REGULAR COUNCIL MEETING
TUESDAY
JUNE 15, 2021

STAFF CONFERENCE ROOM
SECOND FLOOR - CITY HALL
211 WEST ASPEN AVENUE
3:00 P.M.

ATTENTION

IN-PERSON AUDIENCES AT CITY COUNCIL MEETINGS HAVE BEEN SUSPENDED UNTIL FURTHER NOTICE

The meetings will continue to be live streamed on the city's website (https://www.flagstaff.az.gov/1461/Streaming-City-Council-Meetings)

PUBLIC COMMENT PROTOCOL

The process for submitting a public comment has changed and public comments will no longer be read by staff during the Council Meetings.

All public comments will be taken either telephonically or accepted as a written comment.

Public comments may be submitted to publiccomment@flagstaffaz.gov

If you wish to address the City Council with a public comment by phone you must submit the following information:

First and Last Name
Phone Number
Agenda Item number you wish to speak on

If any of this information is missing, you will not be called. We will attempt to call you only one time. We are unable to provide a time when you may be called.

All comments submitted otherwise will be considered written comments and will be documented into the record as such.

If you wish to email Mayor and Council directly you may do so at council@flagstaffaz.gov.

AGENDA

1. CALL TO ORDER

NOTICE OF OPTION TO RECESS INTO EXECUTIVE SESSION

Pursuant to A.R.S. §38-431.02, notice is hereby given to the members of the City Council and to the general public that, at this regular meeting, the City Council may vote to go into executive session, which will not be open to the public, for legal advice and discussion with the City's attorneys for legal advice on any item listed on the following agenda, pursuant to A.R.S. §38-431.03(A)(3).

2. ROLL CALL

NOTE: One or more Councilmembers may be in attendance telephonically or by other technological means.

MAYOR DEASY	
VICE MAYOR DAGGETT	COUNCILMEMBER SALAS
COUNCILMEMBER ASLAN	COUNCILMEMBER SHIMONI
COUNCILMEMBER MCCARTHY	COUNCILMEMBER SWEET

3. PLEDGE OF ALLEGIANCE AND MISSION STATEMENT

MISSION STATEMENT

The mission of the City of Flagstaff is to protect and enhance the quality of life for all.

4. PUBLIC PARTICIPATION

Public Participation enables the public to address the Council about an item that is not on the agenda. Comments relating to items that are on the agenda will be taken at the time that the item is discussed. If you wish to address the Council at tonight's meeting, please complete a comment card and submit it to the recording clerk as soon as possible. Your name will be called when it is your turn to speak. You may address the Council up to three times throughout the meeting, including comments made during Public Participation. Please limit your remarks to three minutes per item to allow everyone an opportunity to speak. At the discretion of the Chair, ten or more persons present at the meeting and wishing to speak may appoint a representative who may have no more than fifteen minutes to speak.

5. PROCLAMATIONS AND RECOGNITIONS

A. Proclamation: Pride Month

6. APPOINTMENTS

Pursuant to A.R.S. §38-431.02, notice is hereby given to the members of the City Council and to the general public that the City Council may vote to go into executive session, which will not be open to the public, for the purpose of discussing or considering employment, assignment, appointment, promotion, demotion, dismissal, salaries, disciplining or resignation of a public officer, appointee, or employee of any public body...., pursuant to A.R.S. §38-431.03(A)(1).

A. Consideration of Appointments: Airport Commission.

STAFF RECOMMENDED ACTION:

Make one appointment to a term expiring October 2021.

7. LIQUOR LICENSE PUBLIC HEARINGS

A. **Consideration and Action on Liquor License Application:** Georgette Hernandez Quintero, "Alejandro's Mexican Food Flagstaff," 6 E. Aspen Avenue #120, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

B. **Consideration and Action on Liquor License Application:** H J Lewkowitz, "Chipotle Mexican Grill #3569," 4409 US Highway 89, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

C. **Consideration and Action on Liquor License Application:** Ricardo Angulo, "VS Arcade and Grill," 409 S. San Francisco Street, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

D. **Consideration and Action on Liquor License Application:** Andrea Dahlman Lewkowitz, "Cracker Barrel #297," 2560 E. Lucky Lane, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

8. CONSENT ITEMS

All matters under Consent Agenda are considered by the City Council to be routine and will be enacted by one motion approving the recommendations listed on the agenda. Unless otherwise indicated, expenditures approved by Council are budgeted items.

A. **Consideration of Appointments:** Presiding Magistrate and On-Call Magistrate for the Flagstaff Municipal Court.

STAFF RECOMMENDED ACTION:

Approve the appointments of Honorable Thomas Chotena as Presiding Magistrate and Honorable Paul Julien as On-Call Magistrate.

B. **Consideration and Approval of Contract:** Purchase of one (1) Bobcat Toolcat Utility Work Machine for Parks trails maintenance and snow operations in the amount of $58,070.72, from Clark Equipment Company, utilizing Sourcewell cooperative purchase contract # 040319-CEC.

STAFF RECOMMENDED ACTION:

1. Approve the purchase of one (1) Bobcat Toolcat Utility Work Machine in the amount of $58,070.72, from Clark Equipment Company, utilizing the Sourcewell cooperative purchase contract # 040319-CEC; and
2. Authorize the City Manager to execute the necessary documents.

C. **Consideration and Approval of Contract:** Construction Manager at Risk Construction Services Contract to Rummel Construction, Inc., for Construction of the Sequence D-Phase I Excavation in the amount of $1,298,649.80.

STAFF RECOMMENDED ACTION:

1. Approve the Construction Manager at Risk Construction Services Contract with Rummel Construction, Inc., for the Construction of Cinder Lake Landfill-Sequence D Phase I Excavation, and execute a Guaranteed Maximum Price (GMP) of $1,298,649.80 (includes an Owner's Contingency of $204,000); and
2. Authorize the City Manager to execute the necessary documents.

D. **Consideration and Approval of Contract:** Professional Engineering Design Services Contract for the Airport Drainage Plan Improvements in the amount of $388,519.

STAFF RECOMMENDED ACTION:

1. Determine Mead & Hunt, Inc, is the most qualified firm based upon responses to the City's Request for Statement of Qualifications (RSOQ), and approve a Professional Engineering Design Services Contract with Mead & Hunt, Inc. for the Airport Drainage Plan Improvements in the amount of $388,519 with a contract time of 365 calendar days; and
2. Authorize the City Manager to execute the necessary documents.

E. **Consideration and Approval of Final Plat**

TLC PC Land Investors LLC requests final plat approval for The Estates at Pine Canyon Pine Run located at 2080 E. Del Rae Dr., a single-family home subdivision on 17.5 acres in the R1 (Single Family Residential) Zone.

STAFF RECOMMENDED ACTION:

Approve the final plat and authorize the Mayor to sign the plat and City Subdivider Agreement when notified by staff that the documents are ready for recording

F. **Consideration and Approval of Final Plat:** Request from JP 325 LLC. for Parcel 1 at Juniper Point Final Plat (PZ-19-00122-03), a 38-unit single-family residential subdivision located at 2000 W. JW Powell Blvd. in the R1 (Single Family Residential) and RR (Rural Residential) zones.

STAFF RECOMMENDED ACTION:

Approve the final plat and authorize the Mayor to sign the plat and City Subdivider Agreement when notified by staff that the documents are ready for recording.

G. **Consideration and Approval of Contract:** Five (5)-year Master Services and Purchasing Agreement with Axon Enterprise, Inc. (formerly known as TASER International) for the Axon Officer Safety Plan, including, the Axon Flex body-worn cameras, Evidence.com License, and TASER 7 equipment in a five (5)-year total amount of $1,003,291.67.

STAFF RECOMMENDED ACTION:

1. Approve the funding of the five (5)-year Master Services and Purchasing Agreement with Axon Enterprise, Inc. for the Axon Officer Safety Plan in the total amount of $1,003,291.67, including, the Axon Flex body-worn cameras, Evidence.com License, and TASER 7 equipment. The first payment, which will be due in FY2021-22, will be in the amount of $124,909.99; the remaining four (4) payments, over the remaining four (4)-years of the contract will be in the amounts of $219,595.42; and
2. Authorize the City Manager to execute all necessary documents.

9. **ROUTINE ITEMS**

A. **Consideration and Adoption of Resolution No. 2021-26 and Ordinance No. 2021-13:** A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the existing Zoning Code provisions to accommodate medical and recreational marijuana and the associated land uses.

STAFF RECOMMENDED ACTION:

1) Adopt Resolution No. 2021-26
2) Read Ordinance No. 2021-13 by title only for the final time
3) City Clerk reads Ordinance No. 2021-13 by title only (if approved above)
4) Adopt Ordinance No. 2021-13

B. **Consideration and Approval of Contract:** Approve the Construction Contract with Jud Co., LLC in the amount of $820,375.50 for the Phoenix Avenue Bridge and Waterline Replacement Project.

STAFF RECOMMENDED ACTION:

1. Approve the Construction Contract with Jud Co., LLC in the amount of $820,375.50, which includes a $57,235.50 Contract Allowance which is 7.5% of the lowest responsive bid, and a contract time of 155-calendar days: and
2. Approve Administrative Change Order Authority to the City Manager in the amount of $76,314.00 (10% of the contract amount, less the Contract Allowances); and
3. Authorize the City Manager to execute the necessary documents.

10. PUBLIC HEARING ITEMS

A. **Consideration and Adoption of Resolution No. 2021-32 and Ordinance No. 2021-16:** A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the existing Accessory Dwelling Unit and Accessory Structure Encroachment Requirements.

STAFF RECOMMENDED ACTION:

At the June 15, 2021, Council Meeting:
1) Read Resolution No. 2021-32 by title only
2) City Clerk reads Resolution No. 2021-32 by title only (if approved above)
3) Read Ordinance No. 2021-16 by title only for the first time
4) City Clerk reads Ordinance No. 2021-16 by title only (if approved above)

At the July 6, 2021, Council Meeting:
5) Adopt Resolution No. 2021-32
6) Read Ordinance No. 2021-16 by title only for the final time
7) City Clerk reads Ordinance No. 2021-16 by title only (if approved above)
8) Adopt Ordinance No. 2021-16

B. **Consideration and Adoption of Resolution No. 2021-33 and Ordinance No. 2021-17**: A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the Zoning Code to include a new zone called Neighborhood Community Commercial (NCC).

STAFF RECOMMENDED ACTION:

At the June 15, 2021 Council Meeting:
1) Read Resolution No. 2021-33 by title only
2) City Clerk reads Resolution No. 2021-33 by title only (if approved above)
3) Read Ordinance No. 2021-17 by title only for the first time
4) City Clerk reads Ordinance No. 2021-17 by title only (if approved above)

At the July 6, 2021, Council Meeting:
5) Adopt Resolution No. 2021-33
6) Read Ordinance No. 2021-17 by title only for the final time

7) City Clerk reads Ordinance No. 2021-17 by title only (if approved above)
8) Adopt Ordinance No. 2021-17

C. **Public Hearing:** Fiscal Year 2021-2022 Budget and Property Tax Levy

STAFF RECOMMENDED ACTION:

1) Open the public hearing
2) Receive citizen input
3) Close the public hearing
4) Convene Special Meeting

11. SPECIAL MEETING

A. **Consideration and Adoption of Resolution No. 2021-28:** A resolution of the Council of the City of Flagstaff, Arizona, adopting the Budget for the City of Flagstaff for Fiscal Year 2021-2022.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-28 by title only
2) City Clerk reads Resolution No. 2021-28 by title only (if approved above)
3) Adopt Resolution No. 2021-28
4) Reconvene Regular Meeting

12. REGULAR AGENDA

A. **Consideration and Adoption of Ordinance No. 2021-14:** An ordinance levying upon the assessed valuation of the property within the City of Flagstaff, Arizona, subject to taxation a certain sum upon each one hundred dollars ($100.00) of valuation sufficient to raise the amount estimated to be required in the Annual Budget, less the amount estimated to be received from other sources of revenue; providing funds for various bond redemptions, for the purpose of paying interest upon bonded indebtedness and providing funds for general municipal expenses, all for the Fiscal Year ending the 30th day of June 2022. **(Primary and secondary property tax levies for FY 2021-2022)**

STAFF RECOMMENDED ACTION:

At the June 15, 2021 Council Meeting:
1) Read Ordinance No. 2021-14 by title only for the first time
2) City Clerk reads Ordinance No. 2021-14 by title only (if approved above)
At the July 6, 2021 Council Meeting:
3) Read Ordinance No. 2021-14 by title only for the final time
4) City Clerk reads Ordinance No. 2021-14 by title only (if approved above)
5) Adopt Ordinance No. 2021-14

B. **Consideration and Adoption of Ordinance No. 2021-15:** An ordinance of the City Council of the City of Flagstaff, authorizing the acquisition of real property for the Lone Tree Overpass Project; providing for delegation of authority, subsequent council approvals, severability, and establishing an effective date

STAFF RECOMMENDED ACTION:

At the June 15th, 2021 Council Meeting:
1) Read Ordinance No. 2021-15 by title only for the first time
2) City Clerk reads Ordinance No. 2021-15 by title only (if approved above)
At the July 6th, 2021 Council Meeting:
3) Read Ordinance No. 2021-15 by title only for the final time
4) City Clerk reads Ordinance No. 2021-15 by title only (if approved above)
5) Adopt Ordinance No. 2021-15

C. **Consideration and Adoption of Resolution No. 2021-31:** Consideration of an Intergovernmental Agreement (IGA) between the City of Flagstaff and the Arizona Board of Regents, for and on behalf of, Northern Arizona University (NAU) to share resources, information, and proportional costs for continued operation of a Public Safety Radio System.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-31 by title only
2) City Clerk reads Resolution No. 2021-31 by title only (if approved above)
3) Adopt Resolution No. 2021-31

D. **Consideration and Adoption of Resolution No. 2021-35:** A resolution approving a Binding Waiver of Enforcement between the City of Flagstaff and Northgate Holdings, LLC related to properties owned by Northgate generally located north of Ellery Avenue and south of Dupont Avenue on South San Francisco Street.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-35 by title only
2) City Clerk reads Resolution No. 2021-35 by title only (if approved above)
3) Adopt Resolution No. 2021-35

E. **Consideration and Adoption of Resolution No. 2021-34:** A resolution adopting the Flagstaff Carbon Neutrality Plan

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-34 by title only
2) City Clerk reads Resolution No. 2021-34 by title only (if approved above)
3) Adopt Resolution No. 2021-34

F. **Consideration and Approval:** Canceling of the August 17, 2021 Regular Meeting and the August 31, 2021 Work Session.

STAFF RECOMMENDED ACTION:

1. Cancel the August 17, 2021 Regular Council Meeting
2. Cancel the August 31, 2021 Work Session

13. **COUNCIL LIAISON REPORTS**

14. FUTURE AGENDA ITEM REQUESTS

After discussion and upon agreement by three members of the Council, an item will be moved to a regularly-scheduled Council meeting.

A. **Future Agenda Item Request (F.A.I.R.)** A Citizens' Petition regarding lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

B. **Future Agenda Item Request (F.A.I.R.):** A request by Councilmember Salas to place on a future agenda a discussion about reviewing and possibly amending the 2021 Commemorative Flag schedule to designate flags for July and August.

C. **Future Agenda Item Request (F.A.I.R.):** A request by Councilmember Aslan to place on a future agenda a discussion about the addition of a "Land Acknowledgement" in the City Council Rules of Procedure, to be read during the agenda's PLEDGE OF ALLEGIANCE AND MISSION STATEMENT section.

15. INFORMATIONAL ITEMS AND REPORTS FROM COUNCIL AND STAFF, FUTURE AGENDA ITEM REQUESTS

16. ADJOURNMENT

CERTIFICATE OF POSTING OF NOTICE

The undersigned hereby certifies that a copy of the foregoing notice was duly posted at Flagstaff City Hall on _____, at _____ a.m./p.m. in accordance with the statement filed by the City Council with the City Clerk.

Dated this _____ day of _____, 2021.

_____
Stacy Saltzburg, MMC, City Clerk

6. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Fobar, Deputy City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration of Appointments: Airport Commission.

STAFF RECOMMENDED ACTION:

Make one appointment to a term expiring October 2021.

Executive Summary:

The Airport Commission consists of seven citizens, and is responsible for reviewing and reporting to the Council on the development of the Airpark and on matters affecting the operation and efficiency of the airport, using the Airport Master Plan as a guide. There is currently one seat available due to a resignation. It is important to fill vacancies on Boards and Commissions quickly so as to allow the Commission to continue meeting on a regular basis.

There are two applications on file and they are as follows:

Gail Jackson (new applicant)
David Zorn (new applicant)

In an effort to reduce exposure to personal information the applicant roster and applications will be submitted to the City Council separately.

COUNCIL APPOINTMENT ASSIGNMENT: Councilmember Sweet

Financial Impact:

These are voluntary positions and there is no budgetary impact to the City of Flagstaff.

Policy Impact:

None.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

- Foster community pride & civic engagement by increasing opportunities for public involvement, in line with best practices & legal requirements
- Enhance community involvement, education & regional partnerships to strengthen the level of public trust

Has There Been Previous Council Decision on This:

None.

Options and Alternatives:

1) Appoint one Commissioner: by appointing a member at this time, the Airport Commission will be at full membership, allowing the group to meet and provide recommendations to the City Council.

2) Table the action to allow for further discussion or expand the list of candidates.

Community Benefits and Considerations:

The City's boards, commissions, and committees were created to foster public participation and input and to encourage Flagstaff citizens to take an active role in city government.

Community Involvement:

INFORM: Board members and City staff have informed the community of these vacancies though word of mouth in addition to the vacancies being posted on the City's website.

Attachments: Airport Commission Authority

CHAPTER 2-11
FLAGSTAFF AIRPORT COMMISSION

SECTIONS:

2-11-001-0001 COMMISSION CREATED:
2-11-001-0002 COMPOSITION; TERMS:
2-11-001-0003 ORGANIZATION:
2-11-001-0004 COMPENSATION:
2-11-001-0005 MEETINGS:
2-11-001-0006 ACTIONS OF THE COMMISSION:

2-11-001-0001 COMMISSION CREATED:

There is hereby established the Flagstaff Airport Commission to be composed of seven (7) members who shall meet as hereinafter provided to consider and deliberate upon matters of concern to the City Council and citizens that affect the operation and efficiency of the airport toward the end of providing an optimum level of services within available resources using the Airport Master Plan as a basic guide. (Ord. 1897, Amended, 11/21/95)

2-11-001-0002 COMPOSITION; TERMS:

The composition of the membership of the Commission shall be as follows:

A. Seven (7) members to be appointed by the City Council who shall serve for three (3) year terms, on a staggered basis.

B. Ex Officio Members: The following persons shall be ex officio members of the Commission, but shall have no vote:

The Mayor;

The City Manager;

The Airport Manager;

The FAA Tower Operator.

C. A quorum shall shall consist of four (4) voting members of the Commission. (Res. 1045, 9-20-77; Ord. 1897, Amended, 11/21/95; Ord. 2007-03, Amended, 02/06/2007; Ord. 2014-28, Amended, 11/18/2014; Ord. 2016-30, Amended, 07/05/2016)

2-11-001-0003 ORGANIZATION:

At the first meeting after appointment and at the first meeting held in any calendar year thereafter, the members of the Commission shall elect a Chairperson and Vice-Chairperson. (Ord. 2007-03, Amended 02/06/2007)

2-11-001-0004 COMPENSATION:

The members of the Commission may be reimbursed by the City for necessary travel and subsistence expenses, but shall not receive compensation for their services. Any such travel must be approved in advance by the City Council or the City Manager with all budgetary considerations taken into account.

2-11-001-0005 MEETINGS:

The Commission shall hold regular monthly meetings, which shall at all times be open to the public, the time and place of said meetings shall be posted in accordance with any currently applicable Arizona State Statutes regulating public meetings and proceedings (open meeting laws). Special meetings may be called by the Chairperson on twenty-four (24) hours' notice.

2-11-001-0006 ACTIONS OF THE COMMISSION:

A. The Commission, with the consent of the City Manager, may call on all City divisions for assistance in the performance of its duties, and it shall be the duty of such divisions to render such assistance to the Commission as may be reasonably required.

B. All discussions, deliberations, actions and recommendations of the Commission shall be advisory to the City Council, and such advisories as the Commission may from time to time make shall be forwarded to the City Council through the City Manager. (Res. 1045, 9-20-77)

7. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Fobar, Deputy City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Action on Liquor License Application: Georgette Hernandez Quintero, "Alejandro's Mexican Food Flagstaff," 6 E. Aspen Avenue #120, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

Executive Summary:

The liquor license process begins at the State level and applications are then forwarded to the respective municipality for posting at the property and holding a public hearing, after which the Council recommendation is forwarded back to the State. A Series 12 license allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food. Alejandro's Meixcan Food Flagstaff is a new business in Flagstaff. If approved it will be the 94th active series 12 license in Flagstaff. Series 12 licenses are non-quota licenses. To view surrounding liquor licenses, please refer to the online interactive Liquor License Map.

The property has been posted as required, and the Police and Community Development divisions have reviewed the application and provided their respective reports.

Financial Impact:

There is no budgetary impact to the City of Flagstaff as this is a recommendation to the State.

Policy Impact:

Not applicable.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Liquor licenses are a regulatory action and there is no Council goal that applies.

Has There Been Previous Council Decision on This:

Not applicable.

Key Considerations:

Because the application is for a new license, consideration may be given to both the location and the applicant's personal qualifications.

The deadline for issuing a recommendation on this application is June 18, 2021.

Community Benefits and Considerations:

This business will contribute to the tax base of the community.

Community Involvement:

The application was properly posted on May 25, 2021. No written protests have been received to date.

Attachments:

Letter to Applicant
Hearing Procedures
Series 12 Description
PD Memo
Zoning Memo
Map

City of Flagstaff

OFFICE OF THE CITY CLERK

5/28/2021

Georgette Hernandez Quintero
PO Box 30006
Flagstaff, AZ 86001

Dear Ms. Hernandez Quintero:

Your application for a new Series 12 Liquor License for Alejandro's Mexican Food Flagstaff located at 6 E. Aspen Ave. Ste 120, Flagstaff, AZ was posted on May 25, 2021. The City Council will consider the application at a public hearing during their regularly scheduled City Council Meeting on **Tuesday, June 15, 2021 which is currently scheduled to begin at 3:00 p.m.**

It is important that you or your representative attend this Council Meeting via video conference (Microsoft Teams Meeting) and be prepared to answer any questions that the City Council may have. The invitation to join the online meeting will be emailed to you prior to the hearing. Failure to be available for questions could result in a recommendation for denial of your application. We suggest that you contact your legal counsel or the Department of Liquor Licenses and Control at 602-542-5141 to determine the criteria for your license. To help you understand how the public hearing process will be conducted, we are enclosing a copy of the City's liquor license application hearing procedures.

The twenty-day posting period for your liquor license application is set to expire on June 14, 2021 and the application may be removed from the premises at that time.

There is an $815 application fee which needs to be received prior to the hearing date. Payment can be made online at https://www.flagstaff.az.gov/2452/E--Services under Business Licensing Payment Online Services by clicking Liquor License Request Payment, in person at the payment window, or you can send a check to my attention at 211 W. Aspen Ave., Flagstaff, AZ 86001.

If you have any questions, please feel free to call me at 928-213-2077 (office) or 928-220-5995 (cell).

Sincerely,

Stacy M. Fobar

Stacy M. Fobar
Deputy City Clerk

Enclosures

City of Flagstaff

Liquor License Application
Hearing Procedures

1. When the matter is reached at the Council meeting, the presiding officer will open the public hearing on the item.

2. The presiding officer will request that the Applicant come forward to address the Council regarding the application in a presentation not exceeding ten (10) minutes. Council may question the Applicant regarding the testimony or other evidence provided by the Applicant.

3. The presiding officer will then ask whether City staff have information to present to the Council regarding the application. Staff should come forward at this point and present information to the Council in a presentation not exceeding ten (10) minutes. Council may question City staff regarding the testimony or other evidence provided by City staff.

4. Other parties, if any, may then testify, limited to three (3) minutes per person. Council may question these parties regarding the testimony they present to the Council.

5. The Applicant may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of the Applicant.

6. City staff may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of City Staff.

7. The presiding officer will then close the public hearing.

8. The Council will then, by motion, vote to forward the application to the State with a recommendation of approval, disapproval, or shall vote to forward with no recommendation.

R19-1-702. Determining Whether to Grant a License for a Certain Location

A. To determine whether public convenience requires and the best interest of the community will be substantially served by issuing or transferring a license at a particular unlicensed location, local governing authorities and the Board may consider the following criteria:

1. Petitions and testimony from individuals who favor or oppose issuance of a license and who reside in, own, or lease property within one mile of the proposed premises;

2. Number and types of licenses within one mile of the proposed premises;

3. Evidence that all necessary licenses and permits for which the applicant is eligible at the time of application have been obtained from the state and all other governing bodies;

4. Residential and commercial population of the community and its likelihood of increasing, decreasing, or remaining static;

5. Residential and commercial population density within one mile of the proposed premises;

6. Evidence concerning the nature of the proposed business, its potential market, and its likely customers;

7. Effect on vehicular traffic within one mile of the proposed premises;

8. Compatibility of the proposed business with other activity within one mile of the proposed premises;

9. Effect or impact on the activities of businesses or the residential neighborhood that might be affected by granting a license at the proposed premises;

10. History for the past five years of liquor violations and reported criminal activity at the proposed premises provided that the applicant received a detailed report of the violations and criminal activity at least 20 days before the hearing by the Board;

11. Comparison of the hours of operation at the proposed premises to the hours of operation of existing businesses within one mile of the proposed premises; and

12. Proximity of the proposed premises to licensed childcare facilities as defined by A.R.S. § 36-881.

B. This Section is authorized by A.R.S. § 4-201(I).

License Types: Series 12 Restaurant License

Non-transferable
On-sale retail privileges
Note: Terms in **BOLD CAPITALS** are defined in the glossary.

PURPOSE:
Allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food.

ADDITIONAL RIGHTS AND RESPONSIBILITIES:
An applicant for a restaurant license must file a copy of its restaurant menu and Restaurant Operation Plan with the application. The Plan must include listings of all restaurant equipment and service items, the restaurant seating capacity, and other information requested by the department to substantiate that the restaurant will operate in compliance with Title 4.

The licensee must notify the Department, in advance, of any proposed changes in the seating capacity of the restaurant or dimensions of a restaurant facility.

A restaurant licensee must maintain complete restaurant services continually during the hours of selling and serving of spirituous liquor, until at least 10:00 p.m. daily, if any spirituous liquor is to be sold and served up to 2:00 a.m.

On any original applications, new managers and/or the person responsible for the day-to-day operations must attend a basic and management training class.

A licensee acting as a **RETAIL AGENT**, authorized to purchase and accept **DELIVERY** of spirituous liquor by other licensees, must receive a certificate of registration from the Department.

A **PREGNANCY WARNING SIGN** for pregnant women consuming spirituous liquor must be posted within twenty (20) feet of the cash register or behind the bar.

A log must be kept by the licensee of all persons employed at the premises including each employee's name, date and place of birth, address and responsibilities.

Bar, beer and wine bar, and restaurant licensees must pay an annual surcharge of $20.00. The money collected from these licensees will be used by the Department for an auditor to review compliance by restaurants with the restaurant licensing provisions of ARS 4-205.02.

FLAGSTAFF POLICE DEPARTMENT
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TDD 1-800-842-4681

Chief of Police
Dan Musselman

MEMORANDUM

Memo #21-38

TO: **Chief Dan Musselman**

FROM: **Sgt. Ryan Turley**

DATE: **May 21st 2021**

RE: **LIQUOR LICENSE APPLICATION – SERIES 12- FOR "Alejandro's"**

On May 21st, 2021, I initiated an investigation into an application for a series 12 (Restaurant) liquor license filed by Georgette Hernandez (Owner / Agent). This is a new license application, and the application number is 148868. It is for Alejandro's which is located at 6 E. Aspen # 120.

I conducted a query through local systems and public access on Georgette and discovered no derogatory records. I conducted a search for any current or previous liquor licenses held by Georgette and did not find any. I did not find any current or historical liquor violations for Georgette. I found evidence that Georgette had taken the mandatory liquor law training. This business is not located within 300 feet of a school or church.

I contacted Georgette over the phone, and she confirmed that she would be attending the council meeting on June 15th. The restaurant's hours will be 10 to 10 seven days a week.

Planning and Development Services Memorandum

To: Stacy Fobar, Deputy City Clerk

From: Reggie Eccleston, Code Compliance Manager

CC: Alaxandra Pucciarelli, Interim Planning Director

Date: May 25, 2021

Re: Application for Liquor License #149004
6 E. Aspen Ave. Ste. 120, Flagstaff, Arizona 86001
Assessor's Parcel Number 101-19-009E
Georgette Hernandez Quintero on behalf of Alejandro's Mexican Food Flagstaff

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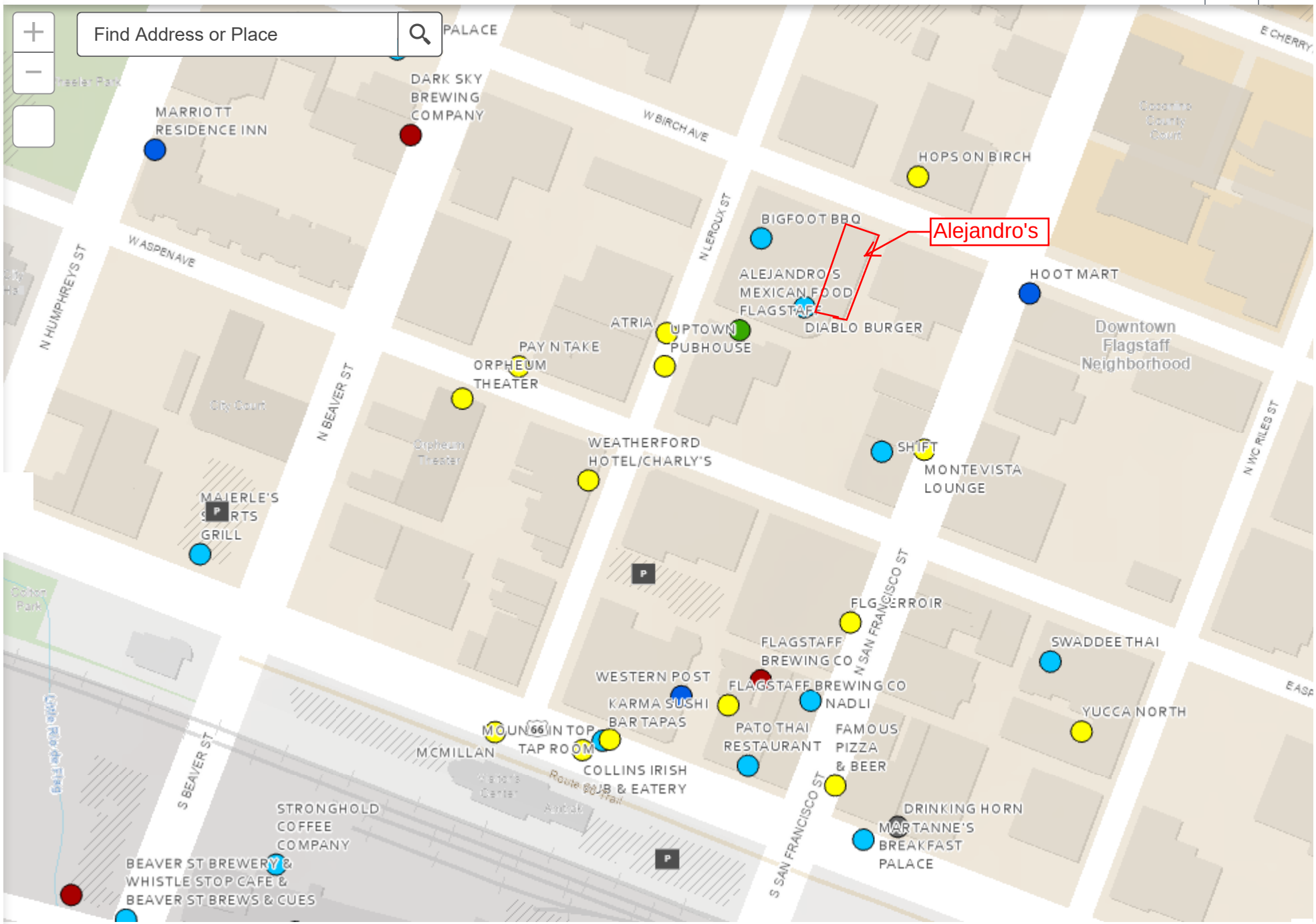
This application is a request for a transfer Series 12 Restaurant liquor license by Georgette Hernandez Quintero on behalf of Alejandro's Mexican Food Flagstaff. This business is located within the Central Business district. This district does allow for this use.

There are no active Zoning Code violations associated with the applicant or the property at this time.

Active Liquor Licenses

City of Flagstaff GIS



7. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Fobar, Deputy City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Action on Liquor License Application: H J Lewkowitz, "Chipotle Mexican Grill #3569," 4409 US Highway 89, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

Executive Summary:

The liquor license process begins at the State level and applications are then forwarded to the respective municipality for posting at the property and holding a public hearing, after which the Council recommendation is forwarded back to the State. A Series 12 license allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food. Chipotle Mexican Grill #3569 is a new business in Flagstaff. If approved it will be the 95th active series 12 license in Flagstaff. Series 12 licenses are non-quota licenses. To view surrounding liquor licenses, please refer to the online interactive Liquor License Map.

The property has been posted as required, and the Police and Community Development divisions have reviewed the application and provided their respective reports.

Financial Impact:

There is no budgetary impact to the City of Flagstaff as this is a recommendation to the State.

Policy Impact:

Not applicable.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Liquor licenses are a regulatory action and there is no Council goal that applies.

Has There Been Previous Council Decision on This:

Not applicable.

Key Considerations:

Because the application is for a new license, consideration may be given to both the location and the applicant's personal qualifications.

The deadline for issuing a recommendation on this application is June 18, 2021.

Community Benefits and Considerations:

This business will contribute to the tax base of the community.

Community Involvement:

The application was properly posted on May 26, 2021. No written protests have been received to date.

Attachments:

Letter to Applicant
Hearing Procedures
Series 12 Description
PD Memo
Zoning Memo
Map

City of Flagstaff

OFFICE OF THE CITY CLERK

5/28/2021

H J Lewkowitz
2600 N Central Avenue #1775
Phoenix, AZ 85004

Dear Mr. Lewkowitz:

Your application for a new Series 12 Liquor License for Chipotle Mexican Grill #3569 located at 4409 US Highway 89, Flagstaff, AZ was posted on May 26, 2021. The City Council will consider the application at a public hearing during their regularly scheduled City Council Meeting on **Tuesday, June 15, 2021 which is currently scheduled to begin at 3:00 p.m.**

It is important that you or your representative attend this Council Meeting via video conference (Microsoft Teams Meeting) and be prepared to answer any questions that the City Council may have. The invitation to join the online meeting will be emailed to you prior to the hearing. Failure to be available for questions could result in a recommendation for denial of your application. We suggest that you contact your legal counsel or the Department of Liquor Licenses and Control at 602-542-5141 to determine the criteria for your license. To help you understand how the public hearing process will be conducted, we are enclosing a copy of the City's liquor license application hearing procedures.

The twenty-day posting period for your liquor license application is set to expire on June 15, 2021 and the application may be removed from the premises at that time.

There is an $815 application fee which needs to be received prior to the hearing date. Payment can be made online at https://www.flagstaff.az.gov/2452/E--Services under Business Licensing Payment Online Services by clicking Liquor License Request Payment, in person at the payment window, or you can send a check to my attention at 211 W. Aspen Ave., Flagstaff, AZ 86001.

If you have any questions, please feel free to call me at 928-213-2077 (office) or 928-220-5995 (cell).

Sincerely,

Stacy M. Fobar

Stacy M. Fobar
Deputy City Clerk

Enclosures

City of Flagstaff

Liquor License Application
Hearing Procedures

1. When the matter is reached at the Council meeting, the presiding officer will open the public hearing on the item.

2. The presiding officer will request that the Applicant come forward to address the Council regarding the application in a presentation not exceeding ten (10) minutes. Council may question the Applicant regarding the testimony or other evidence provided by the Applicant.

3. The presiding officer will then ask whether City staff have information to present to the Council regarding the application. Staff should come forward at this point and present information to the Council in a presentation not exceeding ten (10) minutes. Council may question City staff regarding the testimony or other evidence provided by City staff.

4. Other parties, if any, may then testify, limited to three (3) minutes per person. Council may question these parties regarding the testimony they present to the Council.

5. The Applicant may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of the Applicant.

6. City staff may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of City Staff.

7. The presiding officer will then close the public hearing.

8. The Council will then, by motion, vote to forward the application to the State with a recommendation of approval, disapproval, or shall vote to forward with no recommendation.

R19-1-702. Determining Whether to Grant a License for a Certain Location

A. To determine whether public convenience requires and the best interest of the community will be substantially served by issuing or transferring a license at a particular unlicensed location, local governing authorities and the Board may consider the following criteria:

1. Petitions and testimony from individuals who favor or oppose issuance of a license and who reside in, own, or lease property within one mile of the proposed premises;

2. Number and types of licenses within one mile of the proposed premises;

3. Evidence that all necessary licenses and permits for which the applicant is eligible at the time of application have been obtained from the state and all other governing bodies;

4. Residential and commercial population of the community and its likelihood of increasing, decreasing, or remaining static;

5. Residential and commercial population density within one mile of the proposed premises;

6. Evidence concerning the nature of the proposed business, its potential market, and its likely customers;

7. Effect on vehicular traffic within one mile of the proposed premises;

8. Compatibility of the proposed business with other activity within one mile of the proposed premises;

9. Effect or impact on the activities of businesses or the residential neighborhood that might be affected by granting a license at the proposed premises;

10. History for the past five years of liquor violations and reported criminal activity at the proposed premises provided that the applicant received a detailed report of the violations and criminal activity at least 20 days before the hearing by the Board;

11. Comparison of the hours of operation at the proposed premises to the hours of operation of existing businesses within one mile of the proposed premises; and

12. Proximity of the proposed premises to licensed childcare facilities as defined by A.R.S. § 36-881.

B. This Section is authorized by A.R.S. § 4-201(I).

License Types: Series 12 Restaurant License

Non-transferable
On-sale retail privileges
Note: Terms in **BOLD CAPITALS** are defined in the glossary.

PURPOSE:
Allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food.

ADDITIONAL RIGHTS AND RESPONSIBILITIES:
An applicant for a restaurant license must file a copy of its restaurant menu and Restaurant Operation Plan with the application. The Plan must include listings of all restaurant equipment and service items, the restaurant seating capacity, and other information requested by the department to substantiate that the restaurant will operate in compliance with Title 4.

The licensee must notify the Department, in advance, of any proposed changes in the seating capacity of the restaurant or dimensions of a restaurant facility.

A restaurant licensee must maintain complete restaurant services continually during the hours of selling and serving of spirituous liquor, until at least 10:00 p.m. daily, if any spirituous liquor is to be sold and served up to 2:00 a.m.

On any original applications, new managers and/or the person responsible for the day-to-day operations must attend a basic and management training class.

A licensee acting as a **RETAIL AGENT**, authorized to purchase and accept **DELIVERY** of spirituous liquor by other licensees, must receive a certificate of registration from the Department.

A **PREGNANCY WARNING SIGN** for pregnant women consuming spirituous liquor must be posted within twenty (20) feet of the cash register or behind the bar.

A log must be kept by the licensee of all persons employed at the premises including each employee's name, date and place of birth, address and responsibilities.

Bar, beer and wine bar, and restaurant licensees must pay an annual surcharge of $20.00. The money collected from these licensees will be used by the Department for an auditor to review compliance by restaurants with the restaurant licensing provisions of ARS 4-205.02.

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Chief of Police
Dan Musselman

MEMORANDUM

Memo #21-39

TO: **Chief Dan Musselman**

FROM: **Sgt. Ryan Turley**

DATE: **May 21st 2021**

RE: **LIQUOR LICENSE APPLICATION – SERIES 12- FOR "Chipotle"**

On May 21st, 2021, I initiated an investigation into an application for a series 12 (Restaurant) liquor license filed by H.J. Lewkowitz (Agent), John Hartung (Controlling Person), Brian Niccol (Controlling Person) and Roger Theodoredis (Controlling Person). This is an Owner Transfer application, and the application number is 149260. It is for Chipotle Mexican Grill which is located at 4409 US Highway 89.

I conducted a query through local systems and public access on all applicants and discovered no derogatory records. I conducted a search for any current or previous liquor licenses held by all of the applicants, and I found that H.J. Lewkowitz had several. I did not find any current or historical liquor violations for the applicants. This business is not located within 300 feet of a school or church.

The restaurants hours are usually 10:45 AM to 10:00 PM

Planning and Development Services Memorandum

To: Stacy Fobar, Deputy City Clerk

From: Reggie Eccleston, Code Compliance Manager

CC: Alaxandra Pucciarelli, Interim Planning Director

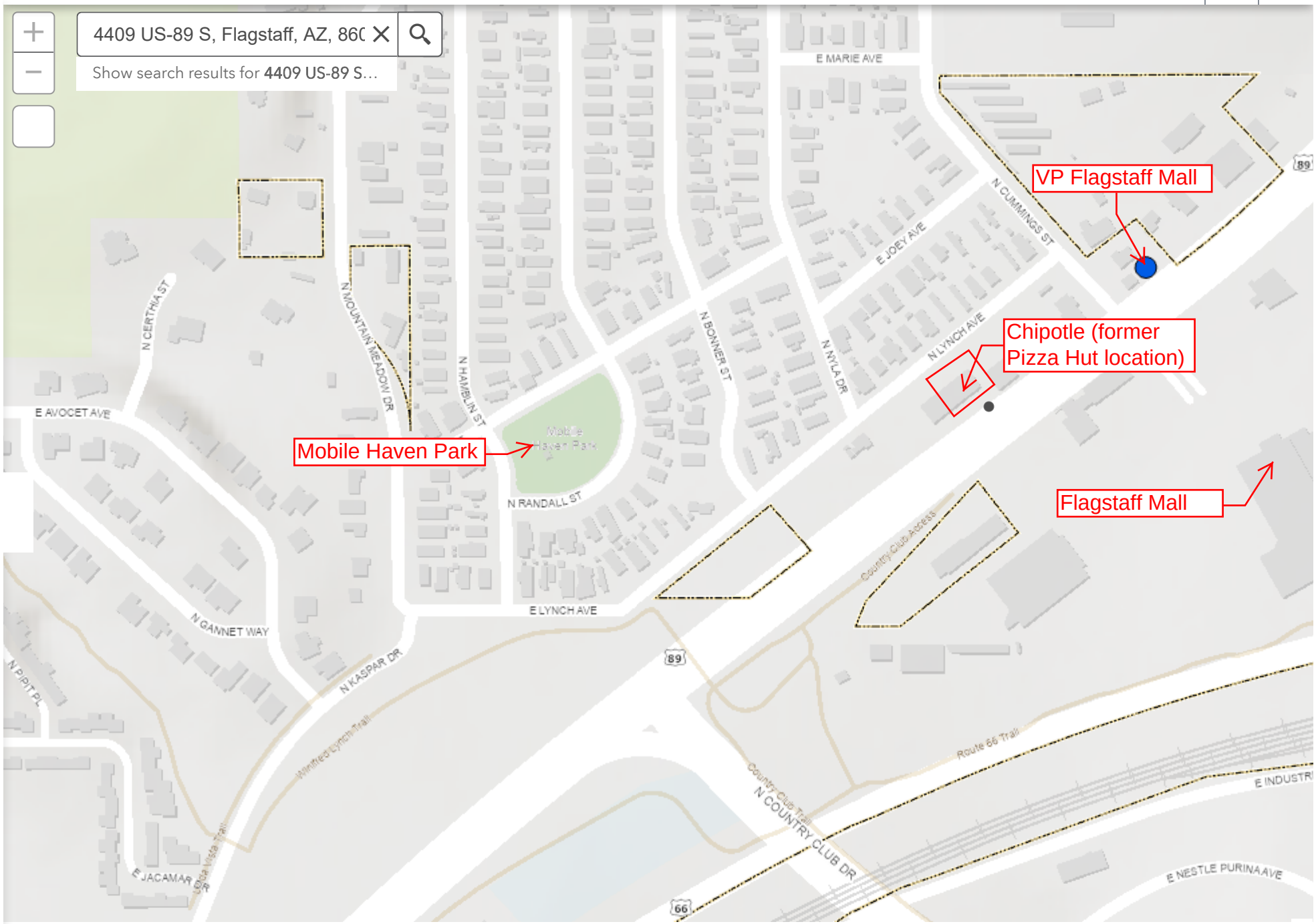
Date: May 25, 2021

Re: Application for Liquor License #149260
4409 N. Highway 89, Flagstaff, Arizona 86004
Assessor's Parcel Number 113-27-927B
H J Lewkowitz on behalf of Chipotle Mexican Grill #3569

This application is a request for a transfer Series 12 Restaurant liquor license by H J Lewkowitz on behalf of Chipotle Mexican Grill #3569. This business is located within the Highway Commercial district. This district does allow for this use.

There are no active Zoning Code violations associated with the applicant or the property at this time.

Active Liquor Licenses City of Flagstaff GIS



7. C.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Fobar, Deputy City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Action on Liquor License Application: Ricardo Angulo, "VS Arcade and Grill," 409 S. San Francisco Street, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

Executive Summary:

The liquor license process begins at the State level and applications are then forwarded to the respective municipality for posting at the property and holding a public hearing, after which the Council recommendation is forwarded back to the State. A Series 12 license allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food. VS Arcade and Grill is a new business in Flagstaff. If approved it will be the 96th active series 12 license in Flagstaff. Series 12 licenses are non-quota licenses. To view surrounding liquor licenses, please refer to the online interactive Liquor License Map.

The property has been posted as required, and the Police and Community Development divisions have reviewed the application and provided their respective reports.

Financial Impact:

There is no budgetary impact to the City of Flagstaff as this is a recommendation to the State.

Policy Impact:

Not applicable.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Liquor licenses are a regulatory action and there is no Council goal that applies.

Has There Been Previous Council Decision on This:

Not applicable.

Key Considerations:

Because the application is for a new license, consideration may be given to both the location and the applicant's personal qualifications.

The deadline for issuing a recommendation on this application is June 18, 2021.

Community Benefits and Considerations:

This business will contribute to the tax base of the community.

Community Involvement:

The application was properly posted on May 25, 2021. No written protests have been received to date.

Attachments:

Letter to Applicant
Hearing Procedures
Series 12 Description
PD Memo
Zoning Memo
Map

City of Flagstaff

OFFICE OF THE CITY CLERK

5/28/2021

Ricardo Angulo
409 S. San Francisco Street
Flagstaff, AZ 86001

Dear Mr. Angulo:

Your application for a new Series 12 Liquor License for VS Arcade and Grill located at 409 S. San Francisco Street, Flagstaff, AZ was posted on May 25, 2021. The City Council will consider the application at a public hearing during their regularly scheduled City Council Meeting on **Tuesday, June 15, 2021 which is currently scheduled to begin at 3:00 p.m.**

It is important that you or your representative attend this Council Meeting via video conference (Microsoft Teams Meeting) and be prepared to answer any questions that the City Council may have. The invitation to join the online meeting will be emailed to you prior to the hearing. Failure to be available for questions could result in a recommendation for denial of your application. We suggest that you contact your legal counsel or the Department of Liquor Licenses and Control at 602-542-5141 to determine the criteria for your license. To help you understand how the public hearing process will be conducted, we are enclosing a copy of the City's liquor license application hearing procedures.

The twenty-day posting period for your liquor license application is set to expire on June 14, 2021 and the application may be removed from the premises at that time.

There is an $815 application fee which needs to be received prior to the hearing date. Payment can be made online at https://www.flagstaff.az.gov/2452/E--Services under Business Licensing Payment Online Services by clicking Liquor License Request Payment, in person at the payment window, or you can send a check to my attention at 211 W. Aspen Ave., Flagstaff, AZ 86001.

If you have any questions, please feel free to call me at 928-213-2077 (office) or 928-220-5995 (cell).

Sincerely,

Stacy M. Fobar

Stacy M. Fobar
Deputy City Clerk

Enclosures

City of Flagstaff

Liquor License Application
Hearing Procedures

1. When the matter is reached at the Council meeting, the presiding officer will open the public hearing on the item.

2. The presiding officer will request that the Applicant come forward to address the Council regarding the application in a presentation not exceeding ten (10) minutes. Council may question the Applicant regarding the testimony or other evidence provided by the Applicant.

3. The presiding officer will then ask whether City staff have information to present to the Council regarding the application. Staff should come forward at this point and present information to the Council in a presentation not exceeding ten (10) minutes. Council may question City staff regarding the testimony or other evidence provided by City staff.

4. Other parties, if any, may then testify, limited to three (3) minutes per person. Council may question these parties regarding the testimony they present to the Council.

5. The Applicant may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of the Applicant.

6. City staff may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of City Staff.

7. The presiding officer will then close the public hearing.

8. The Council will then, by motion, vote to forward the application to the State with a recommendation of approval, disapproval, or shall vote to forward with no recommendation.

R19-1-702. Determining Whether to Grant a License for a Certain Location

A. To determine whether public convenience requires and the best interest of the community will be substantially served by issuing or transferring a license at a particular unlicensed location, local governing authorities and the Board may consider the following criteria:

1. Petitions and testimony from individuals who favor or oppose issuance of a license and who reside in, own, or lease property within one mile of the proposed premises;

2. Number and types of licenses within one mile of the proposed premises;

3. Evidence that all necessary licenses and permits for which the applicant is eligible at the time of application have been obtained from the state and all other governing bodies;

4. Residential and commercial population of the community and its likelihood of increasing, decreasing, or remaining static;

5. Residential and commercial population density within one mile of the proposed premises;

6. Evidence concerning the nature of the proposed business, its potential market, and its likely customers;

7. Effect on vehicular traffic within one mile of the proposed premises;

8. Compatibility of the proposed business with other activity within one mile of the proposed premises;

9. Effect or impact on the activities of businesses or the residential neighborhood that might be affected by granting a license at the proposed premises;

10. History for the past five years of liquor violations and reported criminal activity at the proposed premises provided that the applicant received a detailed report of the violations and criminal activity at least 20 days before the hearing by the Board;

11. Comparison of the hours of operation at the proposed premises to the hours of operation of existing businesses within one mile of the proposed premises; and

12. Proximity of the proposed premises to licensed childcare facilities as defined by A.R.S. § 36-881.

B. This Section is authorized by A.R.S. § 4-201(I).

License Types: Series 12 Restaurant License

Non-transferable
On-sale retail privileges
Note: Terms in **BOLD CAPITALS** are defined in the glossary.

PURPOSE:
Allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food.

ADDITIONAL RIGHTS AND RESPONSIBILITIES:
An applicant for a restaurant license must file a copy of its restaurant menu and Restaurant Operation Plan with the application. The Plan must include listings of all restaurant equipment and service items, the restaurant seating capacity, and other information requested by the department to substantiate that the restaurant will operate in compliance with Title 4.

The licensee must notify the Department, in advance, of any proposed changes in the seating capacity of the restaurant or dimensions of a restaurant facility.

A restaurant licensee must maintain complete restaurant services continually during the hours of selling and serving of spirituous liquor, until at least 10:00 p.m. daily, if any spirituous liquor is to be sold and served up to 2:00 a.m.

On any original applications, new managers and/or the person responsible for the day-to-day operations must attend a basic and management training class.

A licensee acting as a **RETAIL AGENT**, authorized to purchase and accept **DELIVERY** of spirituous liquor by other licensees, must receive a certificate of registration from the Department.

A **PREGNANCY WARNING SIGN** for pregnant women consuming spirituous liquor must be posted within twenty (20) feet of the cash register or behind the bar.

A log must be kept by the licensee of all persons employed at the premises including each employee's name, date and place of birth, address and responsibilities.

Bar, beer and wine bar, and restaurant licensees must pay an annual surcharge of $20.00. The money collected from these licensees will be used by the Department for an auditor to review compliance by restaurants with the restaurant licensing provisions of ARS 4-205.02.

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TDD 1-800-842-4681

Chief of Police
Dan Musselman

MEMORANDUM

Memo #21-41

TO: **Chief Dan Musselman**

FROM: **Sgt. Ryan Turley**

DATE: **May 21st 2021**

RE: **LIQUOR LICENSE APPLICATION – SERIES 12- FOR "VS Arcade and Grill"**

On May 21st, 2021, I initiated an investigation into an application for a series 12 (Restaurant) liquor license filed by Hector Gonzalez (Controlling Person) and Ricardo Angulo (controlling Person). This is a new application, and the application number is 150170. It is for VS Arcade and Grill which is located at 409 S. San Francisco

I conducted a query through local systems and public access on all applicants and discovered no derogatory records. I conducted a search for any current or previous liquor licenses held by all of the applicants and found none. I did not find any current or historical liquor violations for the applicants. This business is not located within 300 feet of a school or church.

The restaurants hours are usually 11:00 AM to 2:00 AM. I spoke to Ricardo who advised that he would be present for the council meeting on June 15th, 2021

Planning and Development Services Memorandum

To: Stacy Fobar, Deputy City Clerk

From: Reggie Eccleston, Code Compliance Manager

CC: Alaxandra Pucciarelli, Interim Planning Director

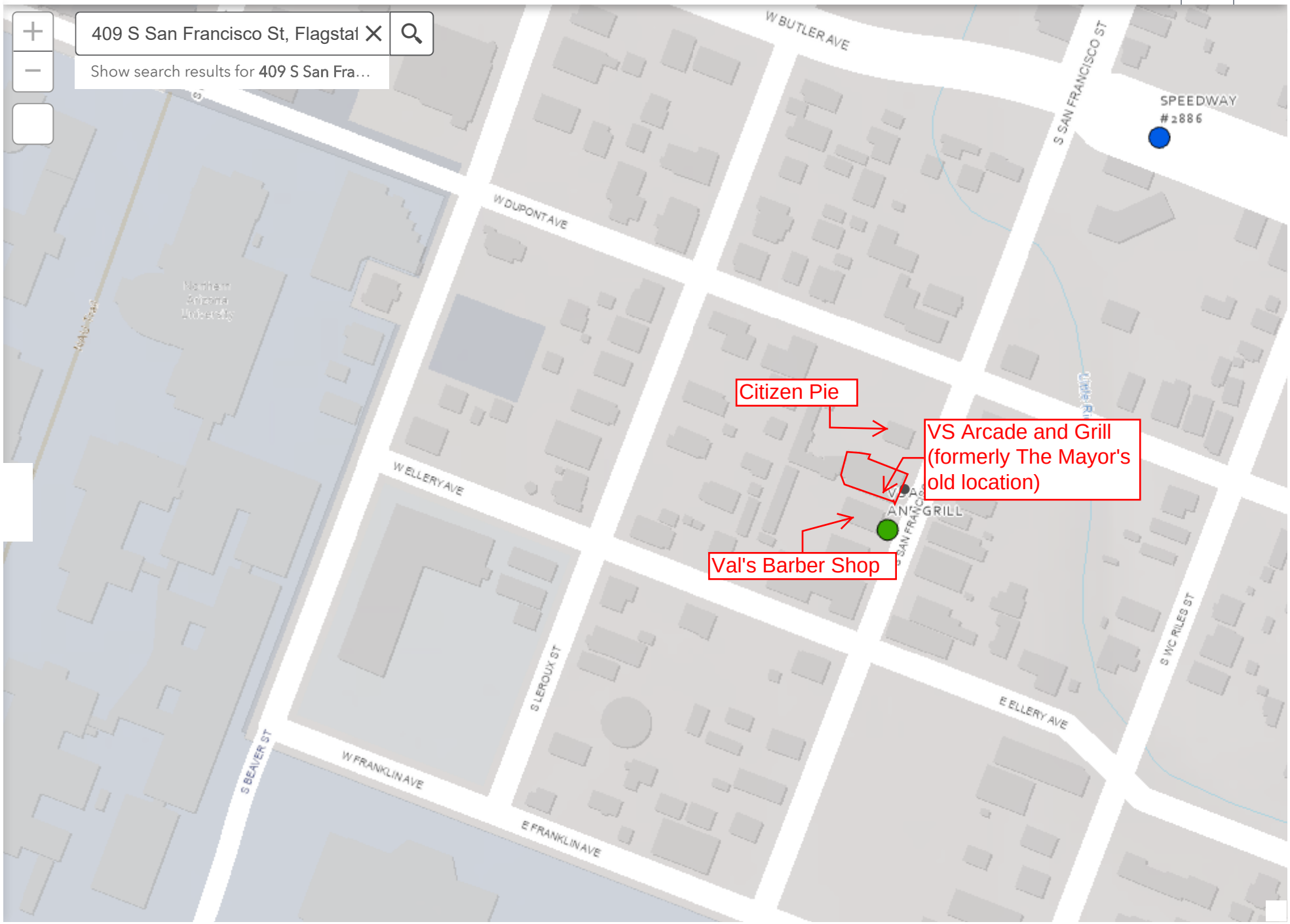
Date: May 25, 2021

Re: Application for Liquor License #150170
409 S. San Francisco St., Flagstaff, Arizona 86001
Assessor's Parcel Number 103-15-025
Ricardo Angulo on behalf of VS Arcade and Grill

This application is a request for a new Series 12 Restaurant liquor license by Ricardo Angulo on behalf of VS Arcade and Grill. This business is located within the Community Commercial district. This district does allow for this use.

There are no active Zoning Code violations associated with the applicant or the property at this time.

Active Liquor Licenses City of Flagstaff GIS



7. D.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Fobar, Deputy City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Action on Liquor License Application: Andrea Dahlman Lewkowitz, "Cracker Barrel #297," 2560 E. Lucky Lane, Series 12, New Application.

STAFF RECOMMENDED ACTION:

Hold the public hearing.

The City Council has the option to:
1) Forward the application to the State with a recommendation for approval;
2) Forward the application to the State with a recommendation for denial based on the testimony received at the public hearing and/or other factors.

Executive Summary:

The liquor license process begins at the State level and applications are then forwarded to the respective municipality for posting at the property and holding a public hearing, after which the Council recommendation is forwarded back to the State. A Series 12 license allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food. Cracker Barrel #297 is an existing business in Flagstaff. If approved it will be the 97th active series 12 license in Flagstaff. Series 12 licenses are non-quota licenses. To view surrounding liquor licenses, please refer to the online interactive Liquor License Map.

The property has been posted as required, and the Police and Community Development divisions have reviewed the application and provided their respective reports.

Financial Impact:

There is no budgetary impact to the City of Flagstaff as this is a recommendation to the State.

Policy Impact:

Not applicable.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Liquor licenses are a regulatory action and there is no Council goal that applies.

Has There Been Previous Council Decision on This:

Not applicable.

Key Considerations:

Because the application is for a new license, consideration may be given to both the location and the applicant's personal qualifications.

The deadline for issuing a recommendation on this application is June 18, 2021.

Community Benefits and Considerations:

This business will contribute to the tax base of the community.

Community Involvement:

The application was properly posted on May 25, 2021. No written protests have been received to date.

Attachments:

Letter to Applicant
Hearing Procedures
Series 12 Description
PD Memo
Zoning Memo
Map

City of Flagstaff

OFFICE OF THE CITY CLERK

5/28/2021

Andrea Lewkowitz
2600 N Central Avenue #1775
Phoenix, AZ 85004

Dear Ms. Lewkowitz:

Your application for a new Series 12 Liquor License for Cracker Barrel #297 located at 2560 E. Lucky Lane, Flagstaff, AZ was posted on May 25, 2021. The City Council will consider the application at a public hearing during their regularly scheduled City Council Meeting on **Tuesday, June 15, 2021 which is currently scheduled to begin at 3:00 p.m.**

It is important that you or your representative attend this Council Meeting via video conference (Microsoft Teams Meeting) and be prepared to answer any questions that the City Council may have. The invitation to join the online meeting will be emailed to you prior to the hearing. Failure to be available for questions could result in a recommendation for denial of your application. We suggest that you contact your legal counsel or the Department of Liquor Licenses and Control at 602-542-5141 to determine the criteria for your license. To help you understand how the public hearing process will be conducted, we are enclosing a copy of the City's liquor license application hearing procedures.

The twenty-day posting period for your liquor license application is set to expire on June 14, 2021 and the application may be removed from the premises at that time.

There is an $815 application fee which needs to be received prior to the hearing date. Payment can be made online at https://www.flagstaff.az.gov/2452/E--Services under Business Licensing Payment Online Services by clicking Liquor License Request Payment, in person at the payment window, or you can send a check to my attention at 211 W. Aspen Ave., Flagstaff, AZ 86001.

If you have any questions, please feel free to call me at 928-213-2077 (office) or 928-220-5995 (cell).

Sincerely,

Stacy M. Fobar

Stacy M. Fobar
Deputy City Clerk

Enclosures

City of Flagstaff

Liquor License Application
Hearing Procedures

1. When the matter is reached at the Council meeting, the presiding officer will open the public hearing on the item.

2. The presiding officer will request that the Applicant come forward to address the Council regarding the application in a presentation not exceeding ten (10) minutes. Council may question the Applicant regarding the testimony or other evidence provided by the Applicant.

3. The presiding officer will then ask whether City staff have information to present to the Council regarding the application. Staff should come forward at this point and present information to the Council in a presentation not exceeding ten (10) minutes. Council may question City staff regarding the testimony or other evidence provided by City staff.

4. Other parties, if any, may then testify, limited to three (3) minutes per person. Council may question these parties regarding the testimony they present to the Council.

5. The Applicant may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of the Applicant.

6. City staff may make a concise closing statement to the Council, limited to five (5) minutes. During this statement, Council may ask additional questions of City Staff.

7. The presiding officer will then close the public hearing.

8. The Council will then, by motion, vote to forward the application to the State with a recommendation of approval, disapproval, or shall vote to forward with no recommendation.

R19-1-702. Determining Whether to Grant a License for a Certain Location

A. To determine whether public convenience requires and the best interest of the community will be substantially served by issuing or transferring a license at a particular unlicensed location, local governing authorities and the Board may consider the following criteria:

1. Petitions and testimony from individuals who favor or oppose issuance of a license and who reside in, own, or lease property within one mile of the proposed premises;

2. Number and types of licenses within one mile of the proposed premises;

3. Evidence that all necessary licenses and permits for which the applicant is eligible at the time of application have been obtained from the state and all other governing bodies;

4. Residential and commercial population of the community and its likelihood of increasing, decreasing, or remaining static;

5. Residential and commercial population density within one mile of the proposed premises;

6. Evidence concerning the nature of the proposed business, its potential market, and its likely customers;

7. Effect on vehicular traffic within one mile of the proposed premises;

8. Compatibility of the proposed business with other activity within one mile of the proposed premises;

9. Effect or impact on the activities of businesses or the residential neighborhood that might be affected by granting a license at the proposed premises;

10. History for the past five years of liquor violations and reported criminal activity at the proposed premises provided that the applicant received a detailed report of the violations and criminal activity at least 20 days before the hearing by the Board;

11. Comparison of the hours of operation at the proposed premises to the hours of operation of existing businesses within one mile of the proposed premises; and

12. Proximity of the proposed premises to licensed childcare facilities as defined by A.R.S. § 36-881.

B. This Section is authorized by A.R.S. § 4-201(I).

License Types: Series 12 Restaurant License

Non-transferable
On-sale retail privileges
Note: Terms in **BOLD CAPITALS** are defined in the glossary.

PURPOSE:
Allows the holder of a restaurant license to sell and serve spirituous liquor solely for consumption on the premises of an establishment which derives at least forty percent (40%) of its gross revenue from the sale of food.

ADDITIONAL RIGHTS AND RESPONSIBILITIES:
An applicant for a restaurant license must file a copy of its restaurant menu and Restaurant Operation Plan with the application. The Plan must include listings of all restaurant equipment and service items, the restaurant seating capacity, and other information requested by the department to substantiate that the restaurant will operate in compliance with Title 4.

The licensee must notify the Department, in advance, of any proposed changes in the seating capacity of the restaurant or dimensions of a restaurant facility.

A restaurant licensee must maintain complete restaurant services continually during the hours of selling and serving of spirituous liquor, until at least 10:00 p.m. daily, if any spirituous liquor is to be sold and served up to 2:00 a.m.

On any original applications, new managers and/or the person responsible for the day-to-day operations must attend a basic and management training class.

A licensee acting as a **RETAIL AGENT**, authorized to purchase and accept **DELIVERY** of spirituous liquor by other licensees, must receive a certificate of registration from the Department.

A **PREGNANCY WARNING SIGN** for pregnant women consuming spirituous liquor must be posted within twenty (20) feet of the cash register or behind the bar.

A log must be kept by the licensee of all persons employed at the premises including each employee's name, date and place of birth, address and responsibilities.

Bar, beer and wine bar, and restaurant licensees must pay an annual surcharge of $20.00. The money collected from these licensees will be used by the Department for an auditor to review compliance by restaurants with the restaurant licensing provisions of ARS 4-205.02.

FLAGSTAFF POLICE DEPARTMENT
911 SAWMILL RD • FLAGSTAFF, ARIZONA 86001• (928) 779-3646
ADMIN FAX (928)213-3372
TDD 1-800-842-4681

Chief of Police
Dan Musselman

MEMORANDUM

Memo #21-40

TO: **Chief Dan Musselman**

FROM: **Sgt. Ryan Turley**

DATE: **May 21st 2021**

RE: **LIQUOR LICENSE APPLICATION – SERIES 12- FOR "Cracker Barrel"**

On May 21st, 2021, I initiated an investigation into an application for a series 12 (Restaurant) liquor license filed by Andrea Lewkowitz (Agent), Paul Couvillion (Controlling Person), Sandra Cochran (Controlling Person), Richard Wolfson (controlling Person) and Kara Jacobs (Controlling Person). This is a new application, and the application number is 148454. It is for Cracker Barrel which is located a 2560 E. Lucky Lane.

I conducted a query through local systems and public access on all applicants and discovered no derogatory records. I conducted a search for any current or previous liquor licenses held by all of the applicants, and I found that Andrea Lewkowitz had several. I did not find any current or historical liquor violations for the applicants. This business is not located within 300 feet of a school or church.

The restaurants hours are usually 7:00 AM to 10:00 PM. I spoke to Andrea who advised that she would be present for the council meeting on June 15th, 2021

Planning and Development Services Memorandum

To: Stacy Fobar, Deputy City Clerk

From: Reggie Eccleston, Code Compliance Manager

CC: Alaxandra Pucciarelli, Interim Planning Director

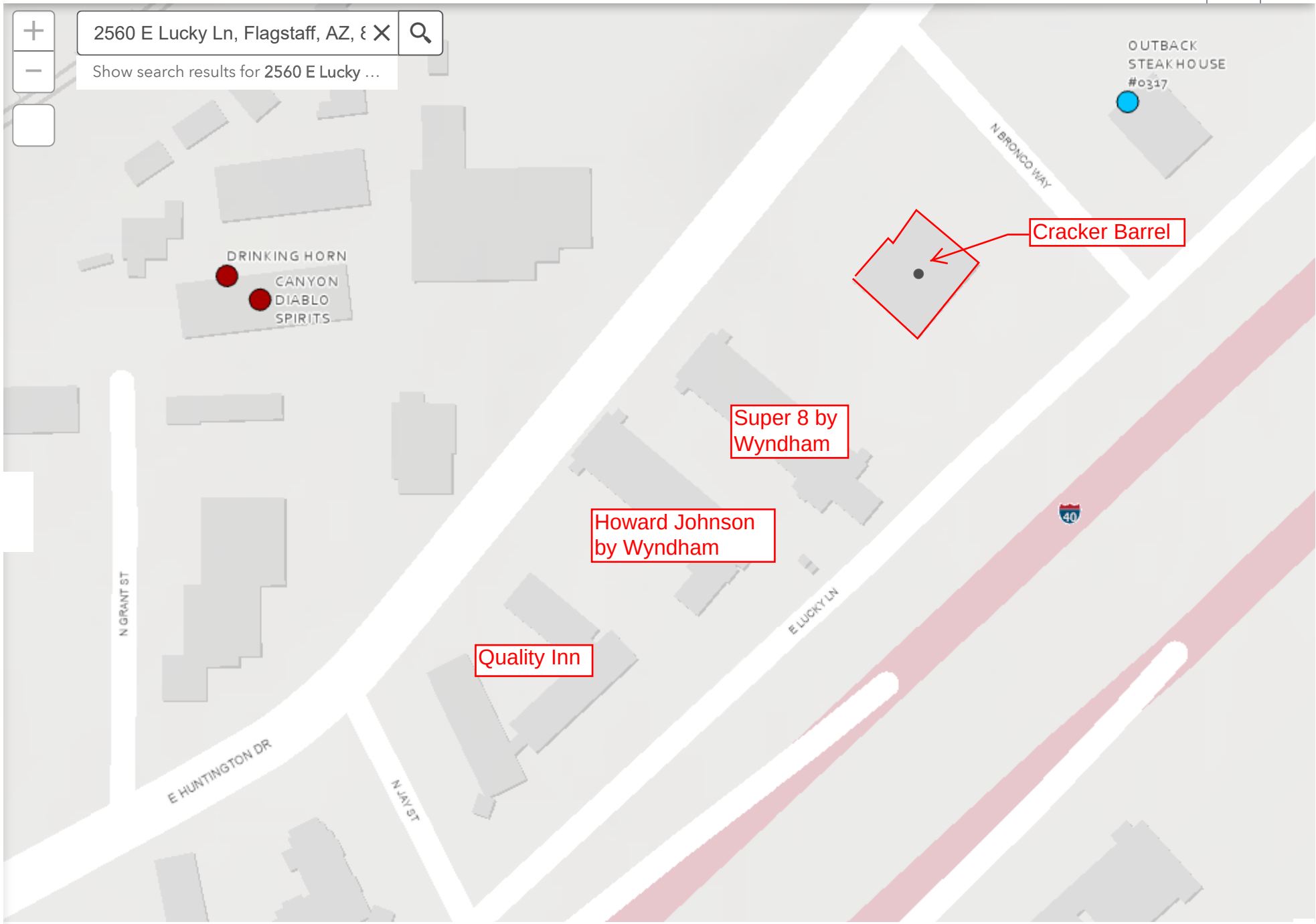
Date: May 25, 2021

Re: Application for Liquor License #148454
2560 E. Lucky Lane, Flagstaff, Arizona 86004
Assessor's Parcel Number 107-11-002
Andrea Dahlman Lewkowitz on behalf of Cracker Barrel #297

This application is a request for a new Series 12 Restaurant liquor license by Andrea Dahlman Lewkowitz on behalf of Cracker Barrel #297. This business is located within the Highway Commercial district. This district does allow for this use.

There are no active Zoning Code violations associated with the applicant or the property at this time.

Active Liquor Licenses City of Flagstaff GIS



8. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Jessica Cortes, Court Administrator
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration of Appointments: Presiding Magistrate and On-Call Magistrate for the Flagstaff Municipal Court.

STAFF RECOMMENDED ACTION:

Approve the appointments of Honorable Thomas Chotena as Presiding Magistrate and Honorable Paul Julien as On-Call Magistrate.

Executive Summary:

Appointment of all magistrates is required to be completed by the Flagstaff City Council for a two-year term under both the City Charter and Flagstaff City Code (FCC) Section 1-15-001-0002(A). Appointment of Magistrates for the Municipal Court allows for ongoing operations of the court without interruption.

Magistrates hear criminal, civil, traffic and local code violations that are filed in the Flagstaff Municipal Court. They conduct trials, both jury and non-jury, and sentence individuals within the parameters set by law. Magistrates are required for the ongoing operational needs of the Municipal Court. Magistrates are critical to the criminal and civil processes of the judicial branch.

Judge Chotena and Judge Julien have been serving in their respective capacities as Presiding Magistrate and On-Call Magistrate at the Flagstaff Municipal Court and are requesting to continue in their current roles.

Financial Impact:

Funding for all judicial positions are included in the approved budget of the Flagstaff Municipal Court. No additional budgetary impact is anticipated.

Policy Impact:

Magistrates are critical to the criminal and civil processes of the judicial branch. These appointments help maintain an independent judiciary that is necessary for the ongoing operations of our local government. A strong, independent and fair judicial branch provides balance to criminal and civil matters that require resolution within our municipality.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives
Personnel - Attract and retain quality staff.

Has There Been Previous Council Decision on This:

Judge Chotena and Judge Julien have been appointed by previous City Councils and have been serving in the Flagstaff Municipal Court for nineteen years and six years respectively.

Options and Alternatives:

Approve the appointments.
Don't approve the appointments and request alternative candidates for Council consideration.

Attachments:

8. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
:	
Co-Submitter:	Andy Bertelsen
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Contract: Purchase of one (1) Bobcat Toolcat Utility Work Machine for Parks trails maintenance and snow operations in the amount of $58,070.72, from Clark Equipment Company, utilizing Sourcewell cooperative purchase contract # 040319-CEC.

STAFF RECOMMENDED ACTION:

1. Approve the purchase of one (1) Bobcat Toolcat Utility Work Machine in the amount of $58,070.72, from Clark Equipment Company, utilizing the Sourcewell cooperative purchase contract # 040319-CEC; and
2. Authorize the City Manager to execute the necessary documents.

Executive Summary:

The Parks Section maintains 700-acres of park land, 58-miles of Flagstaff Urban Trails System (FUTS), numerous Bed, Board, and Beverage (BBB) tax improved spaces, as well as performing snow operations for the City frequently using utilitarian equipment. Providing the consistent service to the community of trail maintenance, park grounds maintenance and snow operations by adding this utilitarian equipment to the Parks fleet is a key ingredient to the overall success of the Section. The purchase of this equipment has been approved by the Fleet Management Committee and the Section seeks to use a Sourcewell cooperative purchase contract # 040319-CEC in order to provide the City better pricing. This equipment will supplement the older non-utilitarian versions within the Section, yet, provide added features and benefits that surpass existing equipment, such as, superior emissions and fuel efficiency, drivability on the roads and a larger array of attachments that accompany proper grounds maintenance. The equipment warranty and services are supported locally by the City of Flagstaff Fleet Section.

Financial Impact:

The Parks Section has $58,070.72 budget capacity in the Operating Capital line item within the Park Grounds Program for fiscal year 2021-2022 in account 001-06-155-0561-5-4433. The Section is funding the equipment from within the Section's funds rather than Fleet Capital funds.

Policy Impact:

None.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Connection to Current Council Goals: Take meaningful climate change action through the use of utilitarian vehicles with lower emission and greater fuel efficiency than current fleet. Actively manage and protect all environmental and natural resources by maintaining park grounds, the trail system (FUTS) and beautification spaces.

Priority Based Budgeting Council Results and Definitions: Safe and Healthy Community and Sustainable, Innovative Infrastructure by promoting physical health through providing recreational opportunities, parks, open space. Also, providing multiple transportation options (maintenance of the FUTS) and deliver outstanding services to residents through a healthy, well maintained infrastructure system.

Has There Been Previous Council Decision on This:

No.

Options and Alternatives:

1. Approve the cooperative purchase contract for one (1) Bobcat Toolcat Utility Work Machine from Clark Equipment Company in the amount of $58,070.72; or
2. Direct staff to rent a similar piece of equipment for a greater cost of approximately $5,000 per month; or
3. Not approve the purchase.

Background/History:

Parks staff researched available utilitarian equipment, which included speaking with the grounds staff at Northern Arizona University (who uses this equipment exclusively for grounds maintenance and snow operations), as well as maintenance staff with Mountain Line. Staff determined that the Bobcat Toolcat was the perfect machine for the various tasks necessary to be performed. Examples of tasks range from trails maintenance, digging, turf maintenance, and landscape maintenance to snow operations. To perform at a higher level, the Section collectively determined that using Parks' operating capital funds over Fleet capital funds in a future year would bring the equipment into usage sooner during an essential time for the Section. The older, inefficient equipment tends to break frequently based on the large number of hours and uses. Further, the community expectation regarding snow operations has become an impact to resources.

Purchasing this piece of equipment enables the Section to perform maintenance tasks as well as different tasks on trails in a more effective and efficient manner. The equipment also opens up new attachments that could be used on athletic fields, trails, turf spaces and other landscaped areas within the parks system.

Clark Equipment Company has Contract #040319-CEC with Sourcewell to supply materials and/or services, which was awarded through a competitive and open procurement process that the City of Flagstaff reviewed to obtain the cooperative purchase contract. This method allows for competitive pricing and is the best value for the purchase of the Bobcat Toolcat.

Key Considerations:

The City of Flagstaff and Fleet Services have educated backgrounds working with Bobcat equipment and a local provider is available for warranty and post warranty repairs, if needed.

Expanded Financial Considerations:

None.

Community Benefits and Considerations:

The community benefit will include a greater impact to trails maintenance and snow operations with the added equipment.

Attachments:

Coop Contract
Exhibit A Quote
Exhibit B Agency Coop
Exhibit B Agency Coop
Toolcat Front View
Toolcat Trails
Toolcat Snow

COOPERATIVE PURCHASE CONTRACT
Contract No. 2021-113

This Cooperative Purchase Contract is made and entered into this _____ day of _____, 20_____by and between the City of Flagstaff, Arizona, a political subdivision of the State of Arizona ("City") and Clark Equipment Company, DBA Bobcat Company, a North Dakota C Corporation ("Contractor").

RECITALS:

A. The Contractor is a fully authorized dealer of Bobcat products;

B. Contractor has Contract #040319-CEC with Sourcewell to supply materials and/or services ("Agency Contract"), which was awarded through a competitive and open procurement process;

C. Contractor is a dealer as described in the Agency Contract; and

D. The City has authority to enter into a Cooperative Purchase Contract with Contractor utilizing the Agency Contract.

AGREEMENT:

NOW THEREFORE, in consideration for the mutual promises contained herein, the parties agree as follows:

1. Materials and or Services Purchased: Contractor shall provide to City the materials and or services, as specified in the Purchase Order(s) and/or Scope of Work submitted by the City in accordance with the Agency Contract. General description of materials and or services being purchased:

Bobcat 5600

2. Specific Requirements of City: Contractor shall comply with all specific purchase and delivery requirements and/or options of City, as specified in the Purchase Order(s) submitted to Contractor or *Exhibit A* attached hereto and incorporated by reference.

3. Payment: Payment to the Contractor for the materials and or services provided, will not exceed **fifty-eight thousand seventy dollars and seventy-two cents ($58,070.72) including other fees and taxes**; in accordance with the price list and terms set forth in the Agency Contract.

4. Terms and Conditions of Agency Contract Apply: All provisions of the Agency Contract documents, including any amendments, are incorporated in and shall apply to this Contract as though fully set forth herein. The Agency Contract documents are set forth in *Exhibit B* attached hereto and incorporated by reference. Contractor is responsible for promptly notifying City in writing of any changes to the Agency Contract.

5. Certificates of Insurance: All insurance provisions of the Agency Contract shall apply, including any requirement to name the City as an additional insured. Prior to commencing performance under this Contract, Contractor shall furnish City with a copy of the current Certificate of Insurance required by the Agency Contract.

6. Term: This Cooperative Purchase Contract shall commence upon execution by the parties and shall continue until expiration or termination of the underlying Agency Contract, unless sooner terminated by City in writing.

7. Renewal: This Cooperative Purchase Contract shall be automatically renewed if the underlying Agency Contract is renewed, for the same renewal period, unless City provides advance written notice to Contractor of its intention to non-renew.

CLARK EQUIPMENT COMPANY DBA BOBCAT COMPANY:

By:_____

Title:_____

CITY OF FLAGSTAFF

By:_____

Title:_____

ATTEST:

_____
City Clerk

APPROVED AS TO FORM:

_____
City Attorney's Office

EXHIBIT A
SPECIFIC REQUIREMENTS OF CITY

Clark Equipment Company Quote # HMM-24744 (Attached)

EXHIBIT B
AGENCY CONTRACT

Sourcewell Contract #040319-CEC. (Attached)

Product Quotation

Quotation Number: HMM-24744
Date: 2021-05-03

Customer Name/Address:	Bobcat Delivering Dealer	ORDER TO BE PLACED WITH: Contract Holder/Manufacturer
CITY OF FLAGSTAFF PARKS & RECREATION G10439 **600 Thorpe Rd** **Flagstaff, AZ 86001**	**Flagstaff Equipment Co Inc,Flagstaff,AZ** **500 NORTH GRANT ST** **FLAGSTAFF AZ 86004-6010** **Phone: (928) 774-1969** **Fax: (928) 774-7006**	**Clark Equipment Co dba Bobcat Company** **250 E Beaton Dr, PO Box 6000** **West Fargo, ND 58078** **Phone: 701-241-8719** **Fax: 855-608-0681** **Contact: Heather Messmer** **Heather.Messmer@doosan.com**

Description	Part No	Qty	Price Ea.	Total
Bobcat 5600 **Adjustable Vinyl Seats** **All-Wheel Steer** **Automatically Activated Glow Plugs** **Auxiliary Hydraulics** • Variable Flow with dual direction detent Beverage Holders Bob-Tach Boom Float Cargo Box Support Cruise Control Deluxe Operator Canopy includes: • Front Window, Rear Window , • Front Wipers, and Electrical Power Port Lower Engine Guard Limited Slip Transaxle Engine and Hydraulic Monitor with Shutdown Front Work Lights Full-time Four-Wheel Drive Horsepower Management • Roll Over Protective Structure (ROPS) . Meets Requirements of SAE-J1040 & ISO 3471 • Falling Object Protective Structure (FOPS) . Meets Requirements of SAE-J1043 & ISO3449, Level I Dome Light **Hydraulic Dump Box** **Instrumentation:** • Hour meter, Job Hours, Speedometer, • Tachometer, Fuel Gauge, Engine • Temperature Gauge, and Warning Lights Joystick, Manually Controlled with Lift Arm Float Lift Arm Support Parking Brake, automatic Power Steering with Tilt Steering Wheel Radiator Screen Rear Receiver Hitch Seat Belts, Shoulder Harness Spark Arrestor Muffler Suspension, 4-wheel independent Tires: 27 x 10.5-15 (8 ply), Lug Tread Toolcat Interlock Control System (TICS) Two-Speed Transmission Machine Warranty: 12 Months, unlimited hours Bobcat Engine Warranty: Additional 12 Months or total of 2000 hours after initial 12 month warranty	**M1221**	**1**	**$44,859.36**	**$44,859.36**
Deluxe Road Package **Backup Alarm** **Turn Signals** **Flashers** **Tail Lights** **Brake Lights** **Rear View Mirror** **Side Mirrors** **Horn** **Lower Engine Guard** **Rear Work Lights** **Headlights**	**M1221-P01-C01**	**1**	**$1,950.48**	**$1,950.48**
Cab Enclosure with Heater & Air Conditioning	**M1221-R02-C03**	**1**	**$4,085.76**	**$4,085.76**
High Flow Package	**M1221-R03-C02**	**1**	**$1,458.24**	**$1,458.24**
29 X 10.5 Trac Tire	**M1221-R05-C04**	**1**	**$458.64**	**$458.64**
Keyless Ignition	**M1221-R06-C02**	**1**	**$282.24**	**$282.24**
Heavy Duty Battery	**M1221-R07-C02**	**1**	**$81.48**	**$81.48**
Attachment Control	**M1221-R08-C02**	**1**	**$198.24**	**$198.24**
Power Bob-Tach	**M1221-R12-C02**	**1**	**$923.16**	**$923.16**
Radio Option	**M1221-R15-C02**	**1**	**$447.72**	**$447.72**
Traction Control	**M1221-R16-C02**	**1**	**$457.80**	**$457.80**

Engine Block Heater	**M1221-A01-C02**	**1**	**$109.20**	**$109.20**
72" Snow Blade	**6905156**	**1**	**$1,797.40**	**$1,797.40**

Total of Items Quoted	**$57,109.72**
Freight Charges	**$961.00**
Dealer Assembly Charges	**$0.00**
Quote Total - US dollars	**$58,070.72**

Notes:

***Prices per the Sourcewell Contract –040319-CEC**
***Terms Net 30 Days. Credit cards accepted.**
FOB Origin within the 48 Contiguous States.
***Delivery: 60 to 90 days from ARO.**

***State Sales Taxes apply. Must include a Tax Exempt Certificate with order placed.**

***TID# 38-0425350**

***Orders Must be Placed With**: **Clark Equipment dba Bobcat Company, Govt Sales, 250 E Beaton Drive, West Fargo, ND 58078.**

ORDER ACCEPTED BY:

_____ _____
SIGNATURE **DATED**

_____ _____
PRINT NAME AND TITLE **PURCHASE ORDER #**

SHIP TO ADDRESS:_____

BILL TO ADDRESS (if different than Ship To):_____

☐

DocuSign Envelope ID: F118B8F3-F767-41AA-AF63-6D8CAA105036

FORM E

CONTRACT ACCEPTANCE AND AWARD

(Top portion of this form will be completed by Sourcewell if the vendor is awarded a contract. The vendor should complete the vendor authorized signatures as part of the RFP response.)

Sourcewell Contract #: 040319-CEC

Proposer's full legal name: Clark Equipment Company dba Bobcat Company

Based on Sourcewell's evaluation of your proposal, you have been awarded a contract. As an awarded vendor, you agree to provide the products and services contained in your proposal and to meet all the terms and conditions set forth in this RFP, in any amendments to this RFP, and in any exceptions that are accepted by Sourcewell.

The effective date of the Contract will be May 31, 2019 and will expire on May 31, 2023 (no later than the later of four years from the expiration date of the currently awarded contract or four years from the date that the Sourcewell Chief Procurement Officer awards the Contract). This Contract may be extended for a fifth year at Sourcewell's discretion.

Sourcewell Authorized Signatures:

DocuSigned by: Jeremy Schwartz
C0FD2A139D06489...
SOURCEWELL DIRECTOR OF OPERATIONS AND PROCUREMENT/CPO SIGNATURE

Jeremy Schwartz
(NAME PRINTED OR TYPED)

DocuSigned by: Chad Coauette
7E42B8F817A64CC...
SOURCEWELL EXECUTIVE DIRECTOR/CEO SIGNATURE

Chad Coauette
(NAME PRINTED OR TYPED)

Awarded on May 28, 2019

Sourcewell Contract # 040319-CEC

Vendor Authorized Signatures:

The Vendor hereby accepts this Contract award, including all accepted exceptions and amendments.

Vendor Name Clark Equipment Company dba Bobcat Company

Authorized Signatory's Title Director, Government Accounts

VENDOR AUTHORIZED SIGNATURE

Randy L. Fuss
(NAME PRINTED OR TYPED)

Executed on May 30th, 2019

Sourcewell Contract # 040319-CEC

SourcewellSM
Formerly the National Joint Powers Alliance (NJPA)

REQUEST FOR PROPOSAL

for the procurement of

MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES

RFP Opening
April 4, 2019
8:30 a.m. Central Time
At the offices of Sourcewell
202 12th Street Northeast, Staples, MN 56479

RFP #040319

Sourcewell, formerly the National Joint Powers Alliance® (NJPA), on behalf of Sourcewell and its current and potential member agencies, which includes all governmental, higher education, K-12 education, not-for-profit, tribal government, and all other public agencies located in all fifty states, Canada, and internationally, issues this Request For Proposal (RFP) to result in a national contract solution for the procurement of #040319 MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES. Details of this RFP are available beginning February 14, 2019. Details may be obtained by letter of request to James Voelker, Sourcewell, 202 12th Street Northeast, P.O. Box 219, Staples, MN 56479, or by e-mail at RFP@sourcewell-mn.gov. Proposals will be received until April 3, 2019 at 4:30 p.m. Central Time at the above address and opened April 4, 2019 at 8:30 a.m. Central Time.

RFP Timeline

February 14, 2019	**Publication of RFP in the print and online version of *USA Today*, in the print and online version of the *Salt Lake News* within the State of Utah, in the print and online version of the *Daily Journal of Commerce* within the State of Oregon (note: OR entities this pertains to: www.sourcewell-mn.gov/compliance-legal/oregon-advertising and also RFP Appendix B), in the print and online version of *The State* within the State of South Carolina, the Sourcewell website, MERX, PublicPurchase.com, Biddingo, and Onvia.**
March 20, 2019 10:00 a.m. CT	**Pre-Proposal Conference (the webcast/conference call). The connection information will be sent to all inquirers two business days before the conference.**
March 27, 2019	**Deadline for RFP questions.**
April 3, 2019 4:30 p.m. CT	**Deadline for Submission of Proposals. Late responses will be returned unopened.**
April 4, 2019 8:30 a.m. CT	**Public Opening of Proposals.**

Direct questions regarding this RFP to: James Voelker at james.voelker@sourcewell-mn.gov or 218-895-4191.

TABLE OF CONTENTS

1. DEFINITIONS
   - A. Contract
   - B. Proposer
   - C. Sourced Good of Open Market Item
   - D. Vendor
2. ADVERTISEMENT OF RFP
3. INTRODUCTION
   - A. About Sourcewell
   - B. Joint Exercise of Powers Laws
   - C. Why Respond to a National Cooperative Procurement Contract
   - D. The Intent of This RFP
   - E. Scope of This RFP
   - F. Expectations for Equipment/Products and Services Being Proposed
   - G. Solutions Based Solicitation
4. INSTRUCTIONS FOR PREPARING YOUR PROPOSAL
   - A. Inquiry Period
   - B. Pre-Proposal Conference
   - C. Identification of Key Personnel
   - D. Proposer's Exceptions to Terms and Conditions
   - E. Proposal Format
   - F. Questions & Answers About This RFP
   - G. Modification or Withdrawal of a Submitted Proposal
   - H. Proposal Opening Procedure
   - I. Sourcewell's Rights Reserved
5. PRICING
   - A. Line-Item Pricing
   - B. Percentage Discount From Catalog or Category
   - C. Cost Plus a Percentage of Cost
   - D. Hot List Pricing
   - E. Ceiling Price
   - F. Volume Price Discounts/ Additional Quantities
   - G. Total Cost of Acquisition
   - H. Sourced Equipment/Products/ Open Market Items
   - I. Price and Product Changes
   - J. Payment Terms
   - K. Sales Tax
   - L. Shipping
6. EVALUATION OF PROPOSALS
   - A. Proposal Evaluation Process
   - B. Proposer Responsiveness
   - C. Proposal Evaluation Criteria
   - D. Other Consideration
   - E. Cost Comparison
   - F. Marketing Plan
   - G. Certificate Of Insurance
   - H. Order Process and/or Funds Flow
   - I. Administrative Fees
   - J. Value Added
   - K. Waiver of Formalities
7. POST AWARD OPERATING ISSUES
   - A. Subsequent Agreements
   - B. Sourcewell Member Sign-up Procedure
   - C. Reporting of Sales Activity
   - D. Audits
   - E. Hub Partner
   - F. Trade-Ins
   - G. Out of Stock Notification
   - H. Termination of a Contract resulting from this RFP
8. GENERAL TERMS AND CONDIITONS
   - A. Advertising a Contract Resulting From This RFP
   - B. Applicable Law
   - C. Assignment of Contract
   - D. List of Proposers
   - E. Captions, Headings, and Illustrations
   - F. Data Practices
   - G. Entire Agreement
   - H. Force Majeure
   - I. Licenses
   - J. Material Suppliers and Sub-Contractors
   - K. Non-Wavier of Rights
   - L. Protests of Awards Made
   - M. Suspension or Disbarment Status
   - N. Affirmative Action and Immigration Status Certification
   - O. Severability
   - P. Relationship of Parties
   - Q. Provisions for Non-Federal Entity Procurements under Federal Awards or Other Awards
9. FORMS
10. PRE-SUBMISSION CHECKLIST
11. PRICE & PRODUCT CHANGE REQUEST FORM
12. APPENDIX A
13. APPENDIX B – HI, ID, OR, SC, UT, WA Political Subdivisions (SEPARATE ATTACHMENT)
14. APPENDIX C – VA Political Subdivisions (SEPARATE ATTACHMENT)
15. APPENDIX D – FEMA Terms & Conditions (SEPARATE ATTACHMENT)

1 DEFINITIONS

A. CONTRACT

Contract means this RFP, current pricing information, fully executed Forms C, D, F, & P from the Proposer's response pursuant to this RFP, and a fully executed Form E ("Acceptance and Award") with final terms and conditions. Form E will be executed after a formal award and will provide final clarification of terms and conditions of the award.

B. PROPOSER

A Proposer is a company, person, or entity delivering a timely response to this RFP. This RFP may also use the terms "respondent" or "proposed Vendor," which is interchangeable with Proposer as the context allows.

C. SOURCED GOOD or OPEN MARKET ITEM

A Sourced Good or Open Market Item is a product within the RFP's scope 1) that is not currently available under the Vendor's Sourcewell contract, 2) that a member wants to buy under contract from an awarded Vendor, and 3) that is generally deemed incidental to the total transaction or purchase of contract items.

D. VENDOR

A Proposer whose response has been awarded a contract pursuant to this RFP.

2 ADVERTISEMENT OF RFP

2.1 Sourcewell advertises this solicitation: 1) in the hard copy print and online editions of the USA Today; 2) once each in Oregon's Daily Journal of Commerce, South Carolina's The State and Utah's Salt Lake Tribune; 3) on Sourcewell's website; and 4) on other third-party websites deemed appropriate by Sourcewell. Other third-party advertisers may include Onvia, PublicPurchase.com, MERX, and Biddingo.

2.2 Sourcewell also notifies and provides solicitation documentation to each state-level procurement departments for possible re-posting of the solicitation within their systems and at their option for future use and to meet specific state requirements.

3 INTRODUCTION

A. ABOUT SOURCEWELL

3.1 Sourcewell, formerly the National Joint Powers Alliance® (NJPA) is a public agency serving as a national municipal contracting agency established under the Service Cooperative statute by Minnesota Legislative Statute §123A.21 with the authority to develop and offer, among other services, cooperative procurement services to its membership. Eligible membership and participation includes states, cities, counties, all government agencies, both public and non-public educational agencies, colleges, universities and non-profit organizations.

3.2 Under the authority of Minnesota state laws and enabling legislation, Sourcewell facilitates a competitive solicitation and contracting process on behalf of the needs of itself and the needs of current and potential member agencies nationally. This process results in national procurement contracts with various Vendors of products/equipment and services which Sourcewell Member agencies desire to procure. These procurement contracts are created in compliance with applicable Minnesota Municipal Contracting Laws. A complete listing of Sourcewell cooperative procurement contracts can be found at www.sourcewell-mn.gov.

3.3 Sourcewell is a public agency governed by publicly elected officials that serve as the Sourcewell Board of Directors. Sourcewell's Board of Directors oversees and authorizes the calls for all new proposals and holds those resulting Contracts for the benefit of its own and its Members use.

3.4 Sourcewell currently serves over 50,000 member agencies nationally. Both membership and utilization of Sourcewell contracts continue to expand, due in part to the increasing acceptance of Cooperative Purchasing throughout the government and education communities nationally.

B. JOINT EXERCISE OF POWERS LAWS

3.5 Sourcewell cooperatively shares those contracts with its Members nationwide through various Joint Exercise of Powers Laws or Cooperative Purchasing Statutes established in Minnesota, other states and Canadian provinces. The Minnesota Joint Exercise of Powers Law is Minnesota Statute §471.59 which states "Two or more governmental units…may jointly or cooperatively exercise any power common to the contracting parties…" This Minnesota Statute allows Sourcewell to serve Member agencies located in all other states. Municipal agencies nationally can participate in cooperative purchasing activities under their own state law. These laws can be found on our website at www.sourcewell-mn.gov/compliance-legal.

3.5.1 For Members within the Commonwealth of Virginia, this RFP is intended to be a "joint procurement agreement" as described in Vir. Code § 2.2-4304(A), and those Virginia Members identified in Appendix C may agree to be a Joint Purchaser under this RFP.

3.5.2 For Members within Canada, this RFP is intended to include municipalities and publicly-funded academic institutions, schools boards, health authorities, and social services (MASH

sectors). In addition this RFP is intended to include current and potential Members of the Rural Municipalities of Alberta (RMA), and their represented Associations (SARM, SUMA and AMM).

C. WHY RESPOND TO A NATIONAL COOPERATIVE PROCUREMENT CONTRACT

3.6 National Cooperative Procurement Contracts create value for Municipal and Public Agencies, as well as for Vendors of products/equipment and services in a variety of ways:

3.6.1 National cooperative contracts potentially save time and effort for municipal and public agencies, who otherwise would have to solicit vendor responses to individual RFPs, resulting in individual contracts, to meet the procurement needs of their respective agencies. Considerable time and effort is also potentially saved by the Vendors who would have had to otherwise respond to each of those individual RFPs. A single, nationally advertised RFP, resulting in a single, national cooperative contract can potentially replace thousands of individual RFPs for the same equipment/products/services that might have been otherwise advertised by individual Sourcewell member agencies.

3.6.2 Sourcewell contracts offer our Members nationally leveraged volume purchasing discounts. Our contract terms and conditions offer the opportunity for Vendors to recognize individual member procurement volume commitment through additional volume based contract discounts.

3.7 State laws that permit or encourage cooperative purchasing contracts do so with the belief that cooperative efficiencies will result in lower prices, better overall value, and considerable time savings.

3.8 The collective purchasing power of thousands of Sourcewell Member agencies nationwide offers the opportunity for volume pricing discounts. Although no sales or sales volume is guaranteed by a Sourcewell Contract resulting from this RFP, substantial volume is anticipated and volume pricing is requested and justified.

3.9 Sourcewell and its Members desire the best value for their procurement dollar as well as a competitive price. Vendors have the opportunity to display and highlight value-added attributes of their company, equipment/products and services without constraints of a typical individual proposal process.

D. THE INTENT OF THIS RFP

3.10. **National contract awarded by Sourcewell:** Sourcewell seeks the most responsive and responsible Vendor relationship(s) to reflect the best interests of Sourcewell and its Member agencies. Through a competitive proposal and evaluation process, the Sourcewell Proposal Evaluation Committee recommends vendors for a national contract awarded by the action of the Sourcewell Chief Procurement Officer. Sourcewell's primary intent is to establish and provide a national cooperative procurement contract that offer opportunities for Sourcewell and our current and potential Member agencies throughout the United States and Canada to procure quality product/equipment and services as desired and needed. The contracts will be marketed nationally through a cooperative effort between the awarded vendor(s) and Sourcewell. Contracts are expected to offer price levels reflective of the potential and collective volume of Sourcewell and the nationally established Sourcewell membership base.

3.11 Beyond our primary intent, Sourcewell further desires to:

3.11.1 Award a four-year contract with a fifth-year contract option resulting from this RFP. Any fifth-year extension is exercised at Sourcewell's discretion and results from Sourcewell's contracting needs or from Member requests; this extension is not intended merely to accommodate an awarded Vendor's request. If Sourcewell grants a fifth-year extension, it may also terminate the contract (or cause it to expire) within the fifth year if the extended

contract is replaced by a resolicited or newly solicited contract. In exigent circumstances, Sourcewell may petition Sourcewell's Board of Directors to extend the contract term beyond five years. This rarely used procedure should be employed only to avoid a gap in contract coverage while a replacement contract is being solicited;

3.11.2 Offer and apply any applicable technological advances throughout the term of a contract resulting from this RFP;

3.11.3 Deliver "Value Added" aspects of the company, equipment/products and services as defined in the "Proposer's Response";

3.11.4 Deliver a wide spectrum of solutions to meet the needs and requirements of Sourcewell and Sourcewell Member agencies; and

3.11.5 Award an exclusive contract to the most responsive and responsible vendor when it is deemed to be in the best interest of Sourcewell and the Sourcewell Member agencies.

3.12 Exclusive or Multiple Awards: Based on the scope of this RFP and on the responses received, Sourcewell may award either an exclusive contract or multiple contracts. In some circumstances, a single national supplier may best meet the needs of Sourcewell Members; in other situations, multiple vendors may be in the best interests of Sourcewell and the Sourcewell Members and preferred by Sourcewell to provide the widest array of solutions to meet the member agency's needs. Sourcewell retains sole discretion to determine which approach is in the best interests of Sourcewell Member agencies.

3.13 Non-Manufacturer Awards: Sourcewell reserves the right to make an award under this RFP to a non-manufacturer or dealer/distributor if such action is in the best interests of Sourcewell and its Members.

3.14 Manufacturer as a Proposer: If the Proposer is a manufacturer or wholesale distributor, the response received will be evaluated on the basis of a response made in conjunction with that manufacturer's authorized dealer network. Unless stated otherwise, a manufacturer or wholesale distributor Proposer is assumed to have a documented relationship with their dealer network where that dealer network is informed of, and authorized to accept, purchase orders pursuant to any Contract resulting from this RFP on behalf of the manufacturer or wholesale distributor Proposer. Any such dealer will be considered a sub-contractor of the Proposer/Vendor. The relationship between the manufacturer and wholesale distributor Proposer and its dealer network may be proposed at the time of the submission if that fact is properly identified.

3.15 Dealer/Reseller as a Proposer: If the Proposer is a dealer or reseller of the products and/or services being proposed, the response will be evaluated based on the Proposer's authorization to provide those products and services from their manufacturer. When requested by Sourcewell, Proposers must document their authority to offer those products and/or services.

E. SCOPE OF THIS RFP

3.16 Scope: The scope of this RFP is to award a contract to a qualifying vendor defined as a manufacturer, provider, or dealer/distributor, established as a Proposer, and deemed responsive and responsible through our open and competitive proposal process. Vendors will be awarded contracts based on the proposal and responders demonstrated ability to meet the expectations of the RFP and demonstrate the overall highest valued solutions which meet and/or exceed the current and future needs and requirements of Sourcewell and its Member agencies nationally within the scope of MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES.

3.17 Additional Scope Definitions: In addition to MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES, **this solicitation should be read to include, but not to be limited to:**

3.17.1 Wheel, track or backhoe loaders, skid steers, excavators, on-highway telescoping excavators, telehandlers, site-preparation equipment, and rollers.

3.17.2 Sourcewell reserves the right to limit the scope of this solicitation for Sourcewell and current and potential Sourcewell member agencies.

3.17.2.1 This solicitation should **NOT** be construed to include any of the following:

a. Construction services
b. Equipment accessory, attachment and supply only solutions, or
c. Vendors whose primary business is covered under categories included in the following Sourcewell RFPs:
    i. Heavy Construction Equipment With Related Accessories, Attachments, and Supplies (See Sourcewell RFP #032119)
    ii. Trailers with Related Equipment, Accessories, and Services (See Sourcewell RFP #121918)
    iii. Snow and Ice Handling Equipment, Supplies, and Accessories (See Sourcewell RFP #080818)
    iv. Public Utility Equipment with Related Accessories and Supplies (See Sourcewell #012418)
    v. Sewer Vacuum, Hydro-Excavation, and Street Sweeper Equipment with Related Accessories and Supplies (See Sourcewell RFP #122017)
    vi. Grounds Maintenance Equipment, Attachments, Accessories, and Related Services (See Sourcewell RFP #062117)
    vii. Roadway Maintenance Equipment with Related Accessories, Attachments, Materials, and Supplies (See Sourcewell RFP #052417)
    viii. Forklifts, Lift Trucks, and Related Material Handling Equipment, Attachments, Accessories, and Services (See Sourcewell RFP #101816)
    ix. Portable Construction and Maintenance Equipment and Trailers with Related Accessories, Attachments, and Supplies (See Sourcewell RFP #052015)
    x. Agricultural Tractors with Related Equipment and Accessories (See Sourcewell RFP #021815)
    xi. Mobile Refuse Collection Vehicles with Related Equipment, Accessories, and Services (See Sourcewell RFP #112014)

3.18 Overlap of Scope: When considering equipment/products/services, or groups of equipment/ products/services submitted as a part of your response, and whether inclusion of such will fall within a "Scope of Proposal," please consider the validity of an inverse statement.

3.18.1 For example, pencils and post-it-notes can generally be classified as office supplies and office supplies generally include pencils and post-it-notes.

3.18.2 In contrast, computers (PCs and peripherals) can generally be considered office supplies; however, the scope of office supplies does not generally include computer servers and infrastructure.

3.18.3 In conclusion: With this in mind, individual products and services must be examined individually by Sourcewell, from time to time and in its sole discretion, to determine their compliance and fall within the original "Scope" as intended by Sourcewell.

3.19 Best and Most Responsive – Responsible Proposer: It is the intent of Sourcewell to award a Contract to the best and most responsible and responsive Proposer(s) offering the best overall quality and selection

of equipment/products and services meeting the commonly requested specifications of Sourcewell and Sourcewell Members, provided the Proposer's Response has been submitted in accordance with the requirements of this RFP. Qualifying Proposers who are able to anticipate the current and future needs and requirements of Sourcewell and Sourcewell member agencies; demonstrate the knowledge of any and all applicable industry standards, laws and regulations; and possess the willingness and ability to distribute, market to and service Sourcewell Members in all 50 states are preferred. Sourcewell requests proposers submit their entire line of products and services as it applies and relates to the scope of this RFP.

3.20 Sealed Proposals: Sourcewell will receive sealed proposal responses to this RFP in accordance with accepted standards set forth in the Minnesota Procurement Code and Uniform Municipal Contracting Law. Awards may be made to responsible and responsive Proposers whose proposals are determined in writing to be the most advantageous to Sourcewell and its current or qualifying future Sourcewell Member agencies.

3.21 Use of Contract: Any Contract resulting from this solicitation shall be awarded with the understanding that it is for the sole convenience of Sourcewell and its Members. Sourcewell and/or its members reserve the right to obtain like equipment/products and services solely from this contract or from another contract source of their choice or from a contract resulting from their own procurement process.

3.22 Awarded Vendor's interest in a contract resulting from this RFP: Awarded Vendors will be able to offer to Sourcewell, and current and potential Sourcewell Members, only those products/equipment and services specifically awarded on their Sourcewell Awarded Contract(s). Awarded Vendors may not offer as "contract compliant," products/equipment and services which are not specifically identified and priced in their Sourcewell Awarded Contract.

3.23 Sole Source of Responsibility- Sourcewell desires a "Sole Source of Responsibility" Vendor. This means that the Vendor will take sole responsibility for the performance of delivered equipment/products/ services. Sourcewell also desires sole responsibility with regard to:

3.23.1 Scope of Equipment/Products/Services: Sourcewell desires a provider for the broadest possible scope of products/equipment and services being proposed over the largest possible geographic area and to the largest possible cross-section of Sourcewell current and potential Members.

3.23.2 Vendor use of sub-contractors in sourcing or delivering equipment/product/services: Sourcewell desires a single source of responsibility for equipment/products and services proposed. Proposers are assumed to have sub-contractor relationships with all organizations and individuals whom are external to the Proposer and are involved in providing or delivering the equipment/products/services being proposed. Vendor assumes all responsibility for the equipment/products/services and actions of any such Sub-Contractor. Suggested Solutions Options include:

3.23.3 Multiple solutions to the needs of Sourcewell and Sourcewell Members are possible. Examples could include:

3.23.3.1 Equipment/Products Only Solution: Equipment/Products Only Solution may be appropriate for situations where Sourcewell or Sourcewell Members possess the ability, either in-house or through local third party contractors, to properly install and bring to operation those equipment/products being proposed.

3.23.3.2 Turn-Key Solutions: A Turn-Key Solution is a combination of equipment/products and services that provides a single price for equipment/products, delivery, and installation to a properly operating status. Generally this is the most desirable solution because Sourcewell and Sourcewell Members may not possess, or desire to

engage, personnel with the necessary expertise to complete these tasks internally or through other independent contractors.

3.23.3.3 Good, Better, Best: Where appropriate and properly identified, Proposers may offer the choice "of good, better, best" multiple-grade solutions to meet Sourcewell Members' needs.

3.23.3.4 Proven – Accepted – Leading-Edge Technology: Where appropriate and properly identified, Proposers may provide a spectrum of technology solutions to complement or enhance the proposed solutions to meet Sourcewell Members' needs.

3.23.4 If applicable, Contracts will be awarded to Proposer(s) able to deliver a proposal meeting the entire needs of Sourcewell and its Members within the scope of this RFP. Sourcewell prefers Proposers submit their complete product line of products and services described in the scope of this RFP. Sourcewell reserves the right to reject individual, or groupings of specific equipment/products and services proposals as a part of the award.

3.24 Geographic Area to be Proposed: This RFP invites proposals to provide MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES to Sourcewell and Sourcewell Members throughout the entire United States and possibly internationally. Proposers will be expected to express willingness to explore service to Sourcewell Members located abroad; however the lack of ability to serve Members outside of the United States will not be cause for non-award. The ability and willingness to serve Canada, for instance, will be viewed as a value-added attribute.

3.25 Contract Term: At Sourcewell's option, a Contract resulting from this RFP will become effective either on the date awarded by the Sourcewell Executive Director and Chief Procurement Officer or on the day following the expiration date of an existing Sourcewell procurement contract for the same or similar product/equipment and services.

3.25.1 Sourcewell is seeking a Contract base term of four years as allowed by Minnesota Contracting Law. Full term is expected. However, one additional one-year renewal/extension may be offered by Sourcewell to Vendor beyond the original four year term if Sourcewell deems such action to be in the best interests of Sourcewell and its Members. Sourcewell reserves the right to conduct periodic business reviews throughout the term of the contract.

3.26 Minimum Contract Value: Sourcewell anticipates considerable activity resulting from this RFP and subsequent award; however, no commitment of any kind is made concerning actual quantities to be acquired. Sourcewell does not guarantee usage. Usage will depend on the actual needs of the Sourcewell Members and the value of the awarded contract.

3.27 [This section is intentionally blank.]

3.28 Contract Availability: This Contract must be available to all current and potential Sourcewell Members who choose to utilize this Sourcewell Contract to include all governmental and public agencies, public and private primary and secondary education agencies, and all non-profit organizations nationally.

3.28.1 With respect to Members within the Commonwealth of Virginia, this RFP is intended to be a "joint procurement agreement" as described in Vir. Code § 2.2-4304(A), and those Virginia Members identified in Appendix C must be allowed to use this Contract as a Joint Purchaser.

3.28.2 For Members within Canada, this RFP is intended to include municipalities and publicly-funded academic institutions, schools boards, health authorities, and social services (MASH sectors). In addition this RFP is intended to include current and potential Members of the Rural Municipalities of Alberta (RMA), and their represented Associations (SARM, SUMA and AMM).

3.29 Proposer's Commitment Period: In order to allow Sourcewell the opportunity to evaluate each proposal thoroughly, Sourcewell requires any response to this solicitation be valid and irrevocable for ninety (90) days after the date proposals are opened.

F. EXPECTATIONS FOR EQUIPMENT/PRODUCTS AND SERVICES BEING PROPOSED

3.30 Industry Standards: Except as contained herein, the specifications or solutions for this RFP shall be those accepted guidelines set forth by the MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES industry, as they are generally understood and accepted within that industry across the nation. Submitted products/equipment, related services and accessories, and their warranties and assurances are required to meet and/or exceed all current, traditional and anticipated standards, needs, expectations, and requirements of Sourcewell and its Members.

3.30.1 Deviations from industry standards must be identified by the Proposer and explained how, in their opinion, the equipment/products and services they propose will render equivalent functionality, coverage, performance, and/or related services. Failure to detail all such deviations may comprise sufficient grounds for rejection of the entire proposal.

3.30.2 Technical Descriptions/Specifications. Excessive technical descriptions and specifications that unduly enlarge the proposal response may cause Sourcewell to reduce the evaluation points awarded on Form G. Proposers must supply sufficient information to:

3.30.2.1 demonstrate the Proposer's knowledge of industry standards and Member agency needs and expectations;

3.30.2.2 Identify the equipment/products and services being proposed as applicable to the needs and expectations of Sourcewell Member agencies; and

3.30.2.3 differentiate equipment/products and services from other industry manufacturers and providers.

3.31 New Current Model Equipment/Products: Proposals submitted shall be for new, current model equipment/products and services with the exception of certain close-out products allowed to be offered on the Proposer's "Hot List" described herein.

3.32 Compliance with laws and standards: All items supplied on this Contract shall comply with any current applicable safety or regulatory standards or codes.

3.33 Delivered and operational: Products/equipment offered herein are to be proposed based upon being delivered and operational at the Sourcewell Member's site. Exceptions to "delivered and operational" must be clearly disclosed in the "Total Cost of Acquisition" section of the proposal.

3.34 Warranty: The Proposer warrants that all products, equipment, supplies, and services delivered under this Contract shall be covered by the industry standard or better warranty. All products and equipment should carry a minimum industry standard manufacturer's warranty that includes materials and labor. The Proposer has the primary responsibility to submit product specific warranty as required and accepted by industry standards. Dealer/Distributors agree to assist the purchaser in reaching a solution in a dispute over warranty's terms with the manufacturer. Any manufacturer's warranty that is effective past the expiration of the warranty will be passed on to the Sourcewell member. Failure to submit a minimum warranty may result in non-award.

3.35 Additional Warrants: The Proposer warrants that all products/equipment and related services furnished hereunder will be free from liens and encumbrances; defects in design, materials, and

workmanship; and will conform in all respects to the terms of this RFP including any specifications or standards. In addition, Proposer/Vendor warrants the products/equipment and related services are suitable for and will perform in accordance with the ordinary use for which they are intended.

G. SOLUTIONS-BASED SOLICITATION

3.36 The Sourcewell solicitation and contract award process is not based on detailed specifications. Instead, this RFP is a "Solutions-Based Solicitation." Sourcewell expects respondents to understand and anticipate the current and future needs of Sourcewell and its members—within the scope of this RFP—and to propose solutions that are commonly desired or required by law or industry standards. Proposal will be evaluated in part on your demonstrated ability to meet or exceed the needs and requirements of Sourcewell and our member agencies within the defined scope of this RFP.

3.37 While Sourcewell does not typically provide product and service specifications, the RFP may contain scope refinements and industry-specific questions. Where specific items are specified, those items should be considered the minimum required, which the proposal can exceed in order to meet Members' needs. Sourcewell may award all of the respondent's proposal or may limit the award to a subset of the proposal.

3 INSTRUCTIONS FOR PREPARING YOUR PROPOSAL

A. INQUIRY PERIOD

4.1 The inquiry period begins on the date of first advertisement and continues until to the Deadline for Submission." RFP packages will be distributed to potential Vendors during the inquiry period.

B. PRE-PROPOSAL CONFERENCE

4.2 A pre-proposal conference will be held at the date and time specified in the timeline on page one of this RFP. Conference information will be sent to all potential Proposers, and attendance is optional. The purpose of this conference is to allow potential Proposers to ask questions regarding this RFP and Sourcewell's competitive contracting process. Only answers issued by written addendum by Sourcewell to questions asked before the deadline for questions are binding on the parties to an awarded contract.

C. IDENTIFICATION OF KEY PERSONNEL

4.3 Awarded Vendors will designate one senior staff member to represent the Vendor to Sourcewell. This contact person will correspond with members for technical assistance, questions, or concerns that may arise, including instructions regarding different contacts for different geographical areas or product lines.

4.4 These designated individuals should also act as the primary contact for marketing, sales, and any other area deemed essential by the Proposer and Sourcewell.

D. PROPOSER'S EXCEPTIONS TO TERMS AND CONDITIONS

4.5 Any exceptions, deviations, or contingencies regarding this RFP that a Proposer requests must be documented on Form C, Exceptions To Proposal, Terms, Conditions And Solutions Request.

4.6 Exceptions, deviations or contingencies requested in the Proposer's response, while possibly necessary in the view of the Proposer, may result in lower scoring or disqualification of a proposal.

E. PROPOSAL FORMAT

4.7 All Proposers must examine the entire RFP package to seek clarification of any item or requirement that may not be clear and to check all responses for accuracy before submitting a proposal.

4.8 All proposals must be properly labeled and sent to "Sourcewell, 202 12th Street NE Staples, MN 56479."

4.9 All proposals must be physically delivered to Sourcewell at the above address with all required hard copy documents and signature forms/pages inserted as loose pages at the front of the Vendor's response. The proposal must include these items.

4.9.1 Hard copy original of completed, signed, and dated Forms C, D, F; hard copy of the signed signature-page only from Forms A and P from this RFP;

4.9.2 Signed hard copies of all addenda issued for the RFP;

4.9.3 Hard copy of Certificate of Insurance verifying the coverage identified in this RFP; and

4.9.4 A complete copy of your response on a flash drive (or other approved electronic means). The electronic copy must contain completed Forms A, B, C, D, F, and P, your statement of products and pricing (including apparent discount), and all appropriate attachments. In order to ensure that your full response is evaluated, you must provide an electronic version of any material that you provide in a hard copy format.

As a public agency, Sourcewell's proposals, responses, and awarded contracts are a matter of public record, except for such data that is classified as nonpublic. Accordingly, public data is available for review through a properly submitted public records request. To redact nonpublic information from your proposal (under Minnesota Statute §13.37), you must make your request within thirty (30) days of the contract award or non-award date.

4.10 All Proposal forms must be submitted in English and must be legible. All appropriate forms must be executed by an authorized signatory of the Proposer. Blue ink is preferred for signatures.

4.11 Proposal submissions should be submitted using the electronic forms provided. Proposers that use alternative documents are responsible for ensuring that the content is substantially similar to the Sourcewell form and that the document is readable by Sourcewell.

4.12 The Proposer must ensure that the proposal is in the physical possession of Sourcewell before the submission deadline.

4.12.1 Proposals must be submitted in a sealed envelope or box properly addressed to Sourcewell and prominently identifying the proposal number, proposal category name, the message **"Hold for Proposal Opening,"** and the deadline for proposal submission. Sourcewell is not responsible for untimely proposals. Proposals received by the deadline for proposal submission will be opened and the name of each Proposer and other appropriate information will be publicly read.

4.13 Proposers are responsible for checking directly on the Sourcewell website for any addendums to this RFP. Addendums to this RFP can change the terms and conditions of the RFP, including the proposal submission deadline.

F. QUESTIONS AND ANSWERS ABOUT THIS RFP

4.14 Upon examination of this RFP document, Proposers should promptly notify Sourcewell of any ambiguity, inconsistency, or error they may discover. Interpretations, corrections, and changes to this RFP will be considered by Sourcewell through a written addendum. Interpretations, corrections, or changes that are made in any other manner are not binding, and Proposers must not rely on them.

4.15 Submit all questions about this RFP, in writing, referencing MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES to James Voelker at Sourcewell, 202 12th Street NE, Staples, MN 56479 or to RFP@sourcewell-mn.gov. You may also call James Voelker at 218-895-4191. Sourcewell urges potential Proposers to communicate all concerns well in advance of the submission deadline to avoid misunderstandings. Questions received within seven (7) days before the submission deadline generally cannot be answered. Sourcewell may, however, field purely procedural questions, questions about Sourcewell-issued addenda, or questions involving a Proposer withdrawing its response before the RFP submission deadline.

4.16 If Sourcewell deems that its answer to a question has a material impact on other potential Proposers or on the RFP itself, Sourcewell will create an addendum to this RFP.

4.17 If Sourcewell deems that its answer to a question merely clarifies the existing terms and conditions and does not have a material impact on other potential Proposers or the RFP itself, no further documentation of that question is required.

4.18 Addenda are written instruments issued by Sourcewell that modify or interpret the RFP. All addenda issued by Sourcewell become a part of the RFP. Addenda will be delivered to all Potential Proposers using the same method of delivery of the original RFP material. Sourcewell accepts no liability in connection with the delivery of any addenda. Copies of addenda will also be made available on the Sourcewell website at www.sourcewell-mn.gov (under "Solicitations") and from the Sourcewell offices. All Proposers must acknowledge their receipt of all addenda in their proposal response.

4.19 Any amendment to a submitted proposal must be in writing and must be delivered to Sourcewell by the RFP submission deadline.

4.20 through 4.21 [These sections are intentionally blank.]

G. MODIFICATION OR WITHDRAWAL OF A SUBMITTED PROPOSAL

4.22 A submitted proposal must not be modified, withdrawn, or cancelled by the Proposer for a period of ninety (90) days following the date proposals were opened. Before the deadline for submission of proposals, any proposal submitted may be modified or withdrawn by notice to the Sourcewell Procurement Manager. Such notice must be submitted in writing and must include the signature of the Proposer. The notice must be delivered to Sourcewell before the deadline for submission of proposals and must be so worded as not to reveal the content of the original proposal. The original proposal will not be physically returned to the potential Proposer until after the official proposal opening. Withdrawn proposals may be resubmitted up to the time designated for the receipt of the proposals if they fully conform with the proposal instructions.

H. PROPOSAL OPENING PROCEDURE

4.23 Sealed and properly identified responses for this RFP entitled MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES will be received by Chris Robinson, Procurement Manager, at Sourcewell Offices, 202 12th Street NE, Staples, MN 56479 until the deadline identified on page one of this RFP**.** All Proposal responses must be submitted in a sealed package. The outside of the package must plainly identify MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES and the RFP number. To avoid premature opening, the Proposer must label the Proposal response properly. **Sourcewell documents the receipt of proposals by immediately time- and date-stamping them.** At the time of the public opening, the Sourcewell Director of Procurement or a representative from the Sourcewell Proposal Evaluation Committee will read the Proposer's names aloud and will determine whether each submission has met Level-1 responsiveness.

I. SOURCEWELL'S RIGHTS RESERVED

4.24 Sourcewell may exercise the following rights with regard to the RFP.

4.24.1 Reject any and all proposals received in response to this RFP;

4.24.2 Disqualify any Proposer whose conduct or proposal fails to conform to the requirements of this RFP;

4.24.3 Duplicate without limitation all materials submitted for purposes of RFP evaluation, and duplicate all public information in response to data requests regarding the proposal;

4.24.4 Consider and accept for evaluation a late modification of a proposal if 1) the proposal itself was submitted on time, 2) the modifications were requested by Sourcewell, and 3) the modifications make the terms of the proposal more favorable to Sourcewell or its members;

4.24.5 Waive any non-material deviations from the requirements and procedures of this RFP;

4.24.6 Extend the Contract, in increments determined by Sourcewell, not to exceed a total Contract term of five years;

4.24.7 Cancel the Request for Proposal at any time and for any reason with no cost or penalty to Sourcewell;

4.24.8 Correct or amend the RFP at any time with no cost or penalty to Sourcewell. If Sourcewell corrects or amends any segment of the RFP after submission of proposals and before the announcement of the awarded Vendor, all proposers will be afforded a reasonable opportunity to revise their proposals in order to accommodate the RFP amendment and the new submission dates. Sourcewell will not be liable for any errors in the RFP or other responses related to the RFP; and

4.24.9 Extend proposal due dates.

5 PRICING

5.1 Sourcewell requests that potential Proposers respond to this RFP only if they are able to offer a wide array of products and services at lower prices and with better value than what they would ordinarily offer to a single government agency, a school district, or a regional cooperative.

5.2 This RFP requests pricing for an indefinite quantity of products or related services with potential national sales distribution and service. While most RFP categories represent significant sales opportunities, Sourcewell makes no guarantees about the quantity of products or services that members will purchase. **The estimated annual value of this contract is $50 Million.**

Vendors are expected to anticipate additional volume through potential government, educational, and not-for-profit agencies that would find value in a national contract awarded by Sourcewell.

5.3 Regardless of the payment method selected by Sourcewell or an Sourcewell member, the total cost associated with any purchase option of the products and services must always be disclosed in the proposal and at the time of purchase.

5.4 All proposers must submit "Primary Pricing" in the form of either "Line-Item Pricing," or "Percentage Discount from Catalog Pricing," or a combination of these pricing strategies. Proposers are also encouraged to offer optional pricing strategies such as "Hot List," "Sourced Products," and "Volume Discounts," as well as financing options such as leasing. All pricing documents should include a clear effective date.

A. LINE-ITEM PRICING

5.5 Line-item pricing is a pricing format in which individual products or services are offered at specific Contract prices. Products or services are individually priced and described by characteristics such as manufacture name, stock or part number, size, or functionality. This method of pricing may offer the least amount of confusion, but Proposers with a large number of items may find this method cumbersome. In these situations, a percentage discount from catalog or category pricing model may make more sense and may increase the clarity of the contract pricing format.

5.6 All line-item pricing items must be numbered, organized, sectioned (including SKUs, when applicable), and prepared to be easily understood by the Evaluation Committee and members.

5.7 Submit Line-Item Pricing items in an Excel spreadsheet format and include all appropriate identification information necessary to discern the line item from other line items in each Responder's proposal.

5.8 Line-item pricing must be submitted to Sourcewell in a searchable spreadsheet format (e.g., Microsoft® Excel®) in order to facilitate quickly finding any particular item of interest. For that reason, Proposers are responsible for providing the appropriate product and service identification information along with the pricing information that is typically found on an invoice or price quote for such product or services.

5.9 All products or services typically appearing on an invoice or price quote must be individually priced and identified on the line-item price sheet, including any and all ancillary costs.

5.10 Proposers should provide both a published "List Price" as well as a "Proposed Contract Price" in their pricing matrix. Published List Price will be the standard "quantity of one" price currently available to government and educational customers, excluding cooperative and volume discounts.

B. PERCENTAGE DISCOUNT FROM CATALOG OR CATEGORY

5.11 This pricing model involves a specific percentage discount from a catalog or list price, defined as a published Manufacturer's Suggested Retail Price (MSRP) for the products or services being proposed.

5.12 Individualized percentage discounts can be applied to any number of defined product groupings.

5.13 A percentage discount from MSRP may be applied to all elements identified in MSRP, including all manufacturer options applicable to the products or services.

5.14 When a Proposer elects to use "Percentage Discount from Catalog or Category," Proposer will be responsible for providing and maintaining current published MSRP with Sourcewell, and this pricing must be included in its proposal and provided throughout the term of any Contract resulting from this RFP.

C. COST PLUS A PERCENTAGE OF COST

5.15 "Cost plus a percentage of cost" as a primary pricing mechanism is not desirable. It is, however, acceptable for pricing sourced goods or services.

D. HOT LIST PRICING

5.16 Where applicable, a Vendor may opt to offer a specific selection of products or services, defined as "Hot List" pricing, at greater discounts than those listed in the standard Contract pricing. All product and service pricing, including the Hot List Pricing, must be submitted electronically in a format that is acceptable to Sourcewell. Hot List pricing must be submitted in a line-item format. Products and services may be added or removed from the Hot List at any time through an Sourcewell Price and Product Change Form.

5.17 Hot List program and pricing may also be used to discount and liquidate close-out and discontinued products and services as long as those close-out and discontinued items are clearly labeled as such. Current ordering process and administrative fees apply. This option must be published and made available to all Sourcewell Members.

E. CEILING PRICE

5.18 Proposal pricing is to be established as a ceiling price. At no time may the proposed products or services be offered under this Contract at prices above this ceiling price without a specific request and approval by Sourcewell. Contract prices may be reduced at any time, for example, to reflect volume discounts or to meet the needs of an Sourcewell Member.

5.19 [This section is intentionally blank.]

F. VOLUME PRICE DISCOUNTS / ADDITIONAL QUANTITIES

5.20 through 5.23 [These sections are intentionally blank.]

G. TOTAL COST OF ACQUISITION

5.24 The Total Cost of Acquisition for the equipment/products and related services being proposed, including those payable by Sourcewell Members to either the Proposer or a third party, is the cost of the proposed equipment/products product/equipment and related services delivered and operational for its intended purpose in the end-user's location. For example, if you are proposing equipment/products FOB Proposer's dock, your proposal should reflect that the contract pricing does not provide for delivery beyond Proposer's dock, nor any set-up activities or costs associated with those delivery or set-up activities. Any additional costs for delivery and set-up should be clearly disclosed. In contrast, a proposal could state that there are no additional costs of acquisition if the product is delivered to and operational at the end-user's location.

H. SOURCED GOOD or OPEN MARKET ITEM

5.25 A Sourced Good or an Open Market Item is a product that a member wants to buy under contract that is not currently available under the Vendor's Sourcewell contract. This method of procurement can be satisfied through a contract sourcing process. Sourcing options serve to provide a more complete contract solution to meet our members' needs. Sourced items are generally deemed incidental to the total transaction or purchase of contract items.

5.26 Sourcewell or Sourcewell Members may request products, equipment, and related services that are within the related scope of this RFP, even if they are not included in an awarded Vendor's line-item price list or catalog. These items are known as Sourced Goods or Open Market Items.

5.27 An awarded Vendor may source such items to the extent that the items are identified as "Sourced Products/Equipment" or "Open Market Items" on any quotation issued in reference to an Sourcewell awarded contract, and that this information is provided to either Sourcewell or an Sourcewell Member. Sourcewell is not responsible for determining whether a Sourced Good is an incidental portion of the overall purchase or whether a Member is able to consider a Sourced Good a purchase under a Sourcewell contract.

5.28 "Cost plus a percentage" pricing is an acceptable option in pricing of Sourced Goods.

I. PRODUCT & PRICE CHANGES

5.29 Awarded Vendors may request product or service changes, additions, or deletions at any time throughout the contract term. All requests must be made in written format by completing the Sourcewell Price and Product Change Request Form (located at the end of this RFP and on the Sourcewell website),

signed by an authorized Vendor representative. All changes are subject to review and approval by Sourcewell. Submit your requests through email to your assigned Contract Manager and to PandP@sourcewell-mn.gov.

5.30 Sourcewell will determine whether the request is both within the scope of the original RFP and in the best interests of Sourcewell and Sourcewell Members. Approved Price and Product Change Request Forms will be returned to the Vendor contact through email.

5.31 The Vendor must 1) complete this change request form and individually list or attach all items subject to change, 2) provide a sufficiently detailed explanation and documentation for the change, and 3) include a compete restatement of pricing document in appropriate format (preferably Excel). The pricing document must identify all products and services being offered and must conform to the following Sourcewell product and price change naming convention: (Vendor Name) (Sourcewell Contract #) (effective pricing date); for example, "COMPANY 012411-CPY effective 02-12-2016."

5.32 The new pricing restatement must include *all* products and services offered, even for those items whose pricing remains unchanged, and must include a new effective date on the pricing documents. This requirement reduces confusion by providing a single, current pricing sheet for each vendor and creates a historical record of pricing.

5.33 ADDITIONS. New products and related services may be added to a Contract resulting from this RFP at any time during that Contract term to the extent that those products and related services are within the scope of this RFP. Allowable new products and related services generally include updated models of products and enhanced services that reflect new technology and improved functionality.

5.34 DELETIONS. New products and related services may be deleted from a contract if an item is no longer available.

5.35 PRICE CHANGES. A Vendor may request pricing changes by providing reasonable justification for the change. For example, a request for a 3% increase in a product line that relies heavily on petroleum products may be reasonable if the raw cost of required petroleum products has increased substantially. Conversely, a request for a 3% increase in prices based only on a 3% increase in a cost-of-living index may be considered unreasonable. Although Sourcewell is sensitive to the possibility of fluctuations in raw material costs, prospective Vendors should make every reasonable attempt to account for normal cost changes by proposing pricing that will be effective throughout the duration of the four-year Contract.

5.35.1 *Price decreases:* Sourcewell expects Vendors to propose their very best prices and anticipates price reductions that are due to advancement in technology and marketplace efficiencies.

5.35.2 *Price increases:* A Vendor must include reasonable documentation for price-increase requests, along with both current and proposed pricing. Appropriate documentation should be attached to the Price and Product Change Request Form, including letters from suppliers announcing price increases. Price increases must not exceed the industry standard.

5.36 through 5.37 [These sections are intentionally blank.]

5.38 Proposers representing multiple manufacturers, or carrying multiple related product lines may also request the addition of new manufacturers or product lines to their Contract to the extent they remain within the scope of this RFP.

5.39 through 5.43 [These sections are intentionally blank.]

K. SALES TAX

5.44 Sales and other taxes should not be included in the prices quoted. The Vendor will charge state and local sales and other applicable taxes on items for which a valid tax-exemption certification has not been provided. Each Sourcewell Member is responsible for providing verification of tax-exempt status to the Vendor. When ordering, Sourcewell Members must indicate that they are tax-exempt entities. Except as set forth herein, no party is responsible for taxes imposed on another party as a result of or arising from the transactions under a Contract resulting from this RFP.

L. SHIPPING

5.45 Shipping costs can constitute a significant portion of the overall cost of procurement. Consequently, significant weight will be given to the quality of a prospective Vendor's shipping program. Shipping charges should reasonably reflect the actual cost of shipping. Sourcewell understands that Vendors may use other shipping cost methods for simplicity or for transparency. But to the extent that shipping costs are determined to disproportionately increase a Vendor's profit, Sourcewell may reduce the points awarded in the "Pricing" criteria.

5.46 through 5.47 [These sections are intentionally blank.]

5.48 All shipping and restocking fees must be identified in the price program. Certain industries providing made-to-order products may not allow returns. Proposals will be evaluated not only on the actual costs of shipping, but on the relative flexibility extended to Sourcewell Members relating to restocking fees, shipping errors, customized shipping requirements, the process for rejecting damaged or delayed shipments, and similar subjects.

5.49 through 5.50 [These sections are intentionally blank.]

5.51 Delivered products must be properly packaged. Damaged products may be rejected. If the damage is not readily apparent at the time of delivery, the Vendor must permit the products to be returned within a reasonable time at no cost to Sourcewell or Sourcewell Members. Sourcewell and Sourcewell Members reserve the right to inspect the products at a reasonable time subsequent to delivery where circumstances or conditions prevent effective inspection of the products at the time of delivery.

5.52 The Vendor must deliver Contract-conforming products in each shipment and may not substitute products without the express approval from Sourcewell or the Sourcewell Member.

5.53 Sourcewell reserves the right to declare a breach of Contract if the Vendor intentionally delivers substandard or inferior products that are not under Contract and described in its paper or electronic price lists or sourced upon request of any Member under this Contract. In the event of the delivery of nonconforming products, the Sourcewell Member will notify the Vendor as soon as possible and the Vendor will replace nonconforming products with conforming products that are acceptable to the Sourcewell member.

5.54 Throughout the term of the Contract, Proposer agrees to pay for return shipment on products that arrive in a defective or inoperable condition. Proposer must arrange for the return shipment of the damaged products.

6 EVALUATION OF PROPOSALS

A. PROPOSAL EVALUATION PROCESS

6.1 The Sourcewell proposal evaluation committee will evaluate proposals received based on a 1,000 point evaluation system. The committee establishes both the evaluation criteria and designates the relative weight of each criterion by assigning possible scores for each category on Form G of this RFP. The committee

may adjust the relative weight of the criteria for each RFP. (For example, if the "Warranty" criterion does not apply to a particular RFP, the points normally awarded under "Warranty" may be used to increase the number of potential points in another evaluation category or categories.) The "Pricing" criterion will contain at least a plurality of points for every RFP.

6.2 Sourcewell uses a scoring system that gives primary importance to "Pricing." But pricing includes more than just the absolute lowest initial cost of purchasing, for example, a particular product. Other considerations include the total cost of the acquisition and whether the Proposer's offering represents the best value. The evaluation committee may consider such factors as life-cycle costs, total cost of ownership, quality, and the suitability of an offering in meeting Sourcewell Members' needs. Pricing points may be awarded based on pricing clarity and ease of use. Sourcewell may also award points based on whether a response contains exceptions, exclusions, or limitations of liabilities.

6.3 The Sourcewell Executive Director and Chief Procurement Officer will consider making awards to the selected Proposer(s) based on the recommendations of the proposal evaluation committee. To qualify for the final evaluation, a Proposer must have been deemed responsive as a result of the criteria set forth under "Proposer Responsiveness," found just below.

B. PROPOSER RESPONSIVENESS

6.4 All responses are evaluated for Level-One and Level-Two Responsiveness. If a response does not substantially conform to substantially all of the terms and conditions in the solicitation, or if it requires unreasonable exceptions, it may be considered nonresponsive.

6.5 All proposals must contain suitable responses to the questions in the proposal forms. The following requirements must be satisfied in order to meet Level-One Responsiveness, which is typically ascertained on the proposal opening date. If these standards are not met, your response may be disqualified as nonresponsive.

6.6 Level-One Responsiveness means that the response

6.6.1 is received before the deadline for submission or it will be returned unopened;

6.6.2 is properly addressed and identified as a sealed proposal with a specific RFP number and an opening date and time;

6.6.3 contains a pricing document (with apparent discounts) and all other forms fully completed, even if "not applicable" is the answer;

6.6.4 includes the original (hard copy) completed, dated, and signed RFP forms C, D, and F. In addition, the response must include the hard-copy signed signature page only from RFP Forms A and P and, if applicable, all signed addenda that have been issued in relation to this RFP;

6.6.5 contains an electronic (CD, flash drive, or other suitable) copy of the entire response; and

6.7 Level-Two Responsiveness (including whether the response is within the RFP's scope) is determined while evaluating the remaining items listed under Proposal Evaluation Criteria below. These items are not arranged in order of importance. Each item draws from multiple questions, and a Proposer's responses may affect scoring in multiple evaluation criteria. For example, the answers to Industry-Specific Questions may help determine scoring relative to a Proposer's marketplace success, ability to sell and service nationwide, and financial strength. Any questions not answered without an explanation will likely result in a loss of points and may lead to a nonaward if the proposal evaluation committee cannot effectively review your response.

C. PROPOSAL EVALUATION CRITERIA

6.8 Forms A and P include a series of questions that address the following categories:

- **6.8.1** Company Information and Financial Strength
- **6.8.2** Industry Requirements and Marketplace Success
- **6.8.3** Ability to Sell and Deliver Service Nationwide
- **6.8.4** Marketing Plan
- **6.8.5** Other Cooperative Procurement Contracts
- **6.8.6** Value-Added Attributes
- **6.8.7** Payment Terms and Financing Options
- **6.8.8** Warranty
- **6.8.9** Equipment/Products/Services
- **6.8.10** Pricing and Delivery
- **6.8.11** Industry-Specific Questions

6.9 [This section is intentionally blank.]

D. OTHER CONSIDERATIONS

6.10 In evaluating RFP responses, Sourcewell has no obligation to consider information that is not provided in the Proposer's response. Sourcewell may, however, consider additional information outside the Proposer's response. This research may include such sources as the Proposer's website, industry publications, listed references, and user interviews.

6.11 Sourcewell may organize RFP responses into separate classes or subcategories, depending on the range of responses. For example, Sourcewell might receive numerous submissions for "Widgets and Related Products and Services." Sourcewell may organize these responses into subcategories, such as manufacturers of fully operational Widgets, manufacturers of component parts for Widgets, and providers of parts and service for Widgets. Sourcewell reserves the right to award Proposers in some or all of such subcategories without regard to the evaluation score given to Proposers in another subcategory. This specifically allows Sourcewell to award Vendors that might not have, for instance, the breadth of products of Proposers in another subcategory, but that nonetheless meet a substantial and articulated need of Sourcewell Members.

6.12 [This section is intentionally blank.]

6.13 Sourcewell reserves the right to request and test equipment/products and related services and to seek clarification from Proposers. Before the Contract award, the Proposer must furnish the requested information within three (3) days (or within another agreed-to time frame) or provide an explanation for the delay along with a requested time frame for providing the requested information. Proposers must make reasonable efforts to supply test products promptly. All Proposer products remain the property of the Proposer, and Sourcewell will return such products after the evaluation process. Sourcewell may make provisional contract awards, subject to a Proposer's proper response to a request for information or products.

6.14 A Proposer's past performance under previously awarded contracts to schools, governmental agencies, and not-for-profit entities is relevant in evaluating a Proposer's current response. Past performance includes the Proposer's record of conforming to published specifications and to standards of good workmanship, as well as the Proposer's history for reasonable and cooperative behavior and for commitment to Member

satisfaction. Incumbency as an awarded Vendor does not, by itself, merit positive consideration for a future Contract award.

6.15 Sourcewell reserves the right to reject any or all proposals.

E. COST COMPARISON

6.16 Sourcewell may use a variety of evaluation methods, including cost comparisons of specific products. Sourcewell reserves the right to use this process when the proposal evaluation committee determines that this will help to make a final determination.

6.17 This direct cost comparison process will award points for being low to high Proposer for each cost evaluation item selected. A "Market Basket" of identical (or substantially similar) equipment/products and related services may be selected by the proposal evaluation committee, and the unit cost will be used as a basis for determining the point value. Sourcewell will select the "Market Basket" from all appropriate product categories as determined by Sourcewell.

F. MARKETING PLAN

6.18 A Proposer's marketing plan is a critical component of the RFP response. An awarded Vendor's sales force will likely be the primary source of communication with Sourcewell Members and will directly affect the contract's success. Marketing success depends on communicating the contract's value, knowing the contract thoroughly, and communicating the proper use of contracted products and services to the end user. Much of the success and sales reward is a direct result of the commitment to the contract by the awarded Vendor's sales teams. Sourcewell reserves the right to deem a Proposer Level-Two nonresponsive or not to award a contract based on an unacceptable or incomplete marketing plan.

6.19 Sourcewell marketing expectations include the following components.

6.19.1 An awarded Vendor must demonstrate the ability to deploy a national sales force or dealer network. The best RFP responses demonstrate the ability to sell, deliver, and service products through acceptable distribution channels to Sourcewell members in all 50 states. Proposers' responses should fully demonstrate their sales and service capabilities, should outline their national sales force network (both numerically geographically), and should describe their method of distribution of the offered products and related services. Service may be independent of the product sales pricing, but Sourcewell encourages related services to be a part of Proposers' response. Despite its preference for awarding contracts to Vendors that demonstrate nationwide sales and service, Sourcewell reserves the right to award contracts that meet specific Member needs locally or regionally.

6.19.2 Proposers are invited to demonstrate their ability to successfully market, promote, and communicate the benefits of an Sourcewell contract to current and potential Members nationwide. Sourcewell desires a marketing plan that communicates the value of the contract to as many Members as possible.

6.19.3 Proposers are expected to be receptive to Sourcewell trainings. Awarded Vendors must provide an appropriate training venue for both management and the sales force. Sourcewell commits to providing training on all aspects of communicating the value of the awarded contract, including the authority of Sourcewell to offer the contract to its Members, the value and utility the contract delivers to Sourcewell Members, the scope of Sourcewell Membership, the authority of Members to use Sourcewell procurement contracts, the preferred marketing and sales methods, and the successful use of specific business sector strategies.

6.19.4 Awarded Vendors are expected to demonstrate a commitment to fully embrace the Sourcewell contract. Proposers should identify both the appropriate levels of sales management

and sales force that will need to understand the value of the Sourcewell contract, as well as the internal procedures needed to deliver the appropriate messaging to Sourcewell Members. Sourcewell will provide a general schedule and a variety of methods describing when and how those individuals should be trained.

6.19.5 Proposers should outline their proposed involvement in promoting a Sourcewell contract through applicable industry trade show exhibits and related customer meetings. Proposers are encouraged to consider participation with Sourcewell at Sourcewell-endorsed national trade shows.

6.19.6 Proposers must exhibit the willingness and ability to actively market and develop contract-specific marketing materials including the following items.

6.19.6.1 Complete Marketing Plan. Proposers must submit a marketing plan outlining how they will launch the Sourcewell contract to current and potential Sourcewell Members. Sourcewell requires awarded Vendors to embrace and actively promote the contract in cooperation with Sourcewell.

6.19.6.2 Printed Marketing Materials. Awarded Vendors will produce and maintain full color print advertisements in camera-ready electronic format, including company logos and contact information to be used in the Sourcewell directory and other approved marketing publications.

6.19.6.3 Contract announcements and advertisements. Proposers should outline in the marketing plan their anticipated contract announcements, advertisements in industry periodicals, and other direct or indirect marketing activities promoting the awarded Sourcewell contract.

6.19.6.4 Proposer's Website. Proposers should identify how an awarded Contract will be displayed and linked on the Proposer's website. An online shopping experience for Sourcewell Members is desired whenever possible.

6.19.7 A Sourcewell Vendor contract launch will be scheduled during a reasonable time frame after the award and held at the Sourcewell office in Staples, MN unless the Vendor and Sourcewell agree to a different location.

6.20 Proposer shall identify their commitment to develop a sales/communication process to facilitate Sourcewell membership and establish status of current and potential agencies/members. Proposer should further express their commitment to capturing sufficient member information as is deemed necessary by Sourcewell.

G. CERTIFICATE OF INSURANCE

6.21 Proposers must provide evidence of liability insurance coverage identified below in the form of a Certificate of Insurance (COI) or an ACORD binder form with their proposal. Upon an award issued under this RFP and before the execution of any commerce relating to such award, the awarded Vendor must provide verification, in the form of a Certificate of Insurance, identifying the coverage required below and identifying Sourcewell as a "Certificate Holder." The Vendor must maintain such insurance coverage at its own expense throughout the term of any contract resulting from this solicitation.

6.22 Any exceptions or assumptions to the insurance requirements must be identified on Form C of this RFP**.** Exceptions and assumptions will be considered as part of the evaluation process. Any exceptions or assumptions that Proposers submit must be specific. If a Proposer does not include specific exceptions or assumptions when submitting the proposal, Sourcewell will typically not consider any additional exceptions or assumptions during the evaluation process. Upon contract award, the awarded Vendor must provide the Certificate of Insurance identifying the coverage as specified.

6.23 Insurance Liability Limits. The awarded Vendor must maintain, for the duration of its contract, $1.5 million in general liability insurance coverage or general liability insurance in conjunction with an umbrella for a total combined coverage of $1.5 million. Work on the Contract will not begin until after the awarded Vendor has submitted acceptable evidence of the required insurance coverage. Failure to maintain any required insurance coverage or an acceptable alternative method of insurance will be deemed a breach of contract.

6.23.1 Minimum Scope and Limits of Insurance. An awarded Vendor must provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the minimum liability requirements provided that the coverage is written on a "following form" basis.

6.23.1.1 Commercial General Liability—Occurrence Form
Policy shall include bodily injury, property damage and broad form contractual liability and XCU coverage.

6.23.1.2 Each Occurrence $1,500,000

6.24 Insurance Requirements: The limits listed in this RFP are minimum requirements for this Contract and in no way limit any indemnity covenants contained in this Contract. Sourcewell does not warrant that the minimum limits contained herein are sufficient to protect the Vendor from liabilities that might arise out of the performance of the work under this Contract by the Vendor, its agents, representatives, employees, or subcontractors, and the Vendor is free to purchase additional insurance as may be determined necessary.

6.25 Acceptability of Insurers: Insurance is to be placed with insurers duly licensed or authorized to do business in the State of Minnesota and with an "A.M. Best" rating of not less than A- VII. Sourcewell does not warrant that the above required minimum insurer rating is sufficient to protect the Vendor from potential insurer solvency.

6.26 Subcontractors: Vendors' certificate(s) must include all subcontractors as additional insureds under its policies, or the Vendor must furnish to Sourcewell separate certificates for each subcontractor. All coverage for subcontractors are be subject to the minimum requirements identified above.

H. ORDER PROCESS AND/OR FUNDS FLOW

6.27 Sourcewell Members typically issue a purchase order directly to a Vendor under a Contract resulting from this RFP. Alternatively, a separate contract may be created to facilitate acquiring products or services offered in response to this RFP. Nothing in this Contract restricts the Member and Vendor from agreeing to add terms or conditions to a purchase order or a separate contract provided that such terms or conditions must not be less favorable to Sourcewell's Members.

6.28 [This section is intentionally blank.]

I. ADMINISTRATIVE FEES

6.29 Vendors will pay to Sourcewell an administrative fee in exchange for Sourcewell facilitating this Contract with its current and potential Members. Sourcewell may grant a conditional contract award to a Proposer if the proposed administrative fee is unclear, inadequate, or unduly burdensome for Sourcewell to administer. Sales under this Contract should not be processed until the parties resolve the administrative fee issue.

6.29.1 The administrative fee is typically calculated as a percentage of the dollar volume of all products and services by Sourcewell Members under this Contract, including anything represented to Sourcewell Members as falling under this Contract.

6.29.2 The administrative fee is included in, and not added to, the pricing included in Proposer's response to the RFP. Awarded Vendors must not charge Sourcewell Members more that permitted in the then current price list in order to offset the administrative fee.

6.29.3 The administrative fee is designed to cover the costs of Sourcewell's involvement in contract management, facilitating marketing efforts, Vendor training, and any order processing tasks relating to the Contract. Administrative fees may also be used for other purposes as allowed by Minnesota law.

6.29.4 The typical administrative fee under this Contract is two percent (2%). While Sourcewell does not dictate the particular fee percentage, we require that the Proposer articulate a specific fee in its response. For example, merely stating that "we agree to pay an administrative fee" is considered nonresponsive. Sourcewell acknowledges that the administrative fee percentage may differ between vendors, industries, and responses.

6.29.5 Sourcewell awarded Vendors are responsible for paying the administrative fee at least quarterly and for generating all related reporting. Vendors agree to cooperate with Sourcewell in auditing these reports to ensure that the administrative fee is paid on all items purchased under the Contract.

6.29.6 [This section is intentionally blank.]

6.30 through 6.32 [This section is intentionally blank.]

J. VALUE–ADDED ATTRIBUTES

6.33 Desirability of Value-Added Attributes: Value-added attributes in an RFP response will be given positive consideration in Sourcewell's evaluation process. Such attributes may increase the benefit of a product or service by improving functionality, performance, maintenance, manufacturing, delivery, energy efficiency, ordering, or other items while remaining within the scope of this RFP.

6.34 Women and Minority Business Enterprise (WMBE), Small Business, and Other Favored Businesses: Some Sourcewell Members give formal preference to certain types of vendors or contractors. Proposers should document WMBE (or other) status for both their organization and for any affiliates (e.g., supplier networks) involved in fulfilling the terms of this RFP. The ability of a Proposer to provide preferred business entity "credits" to Sourcewell and Sourcewell Members under a Contract will be evaluated positively by Sourcewell and reflected in the "value added" area of the evaluation.

6.35 Environmentally Preferred Purchasing Opportunities: Many Sourcewell Members consider the environmental impact of the products and services they purchase. "Green" characteristics demonstrated by Proposers will be evaluated positively by Sourcewell and reflected in the "value added" area of the evaluation. Please identify any green characteristics of any offering in your proposal and identify the sanctioning body determining that characteristic. Where appropriate, please indicate which products have been certified as green and by which certifying agency.

6.36 Online Requisitioning Systems: When applicable, online requisitioning systems will be viewed as a value-added characteristic. Proposers should demonstrate how their system makes online ordering easier for Sourcewell Members, including how Members could integrate their current e-Procurement or enterprise resource planning (ERP) systems into the Proposer's ordering process.

6.37 Financing: The ability of the Proposer to provide financing solutions to Members for the products and services being proposed will be viewed as a value-added attribute.

6.38 Technology: Technological advances that appreciably improve the proposed products or services will be considered value-added attributes.

K. WAIVER OF FORMALITIES

6.39 Sourcewell reserves the right to waive minor formalities (or to accept minor irregularities) in any proposal, when it determines that considering the proposal may be in the best interest of its Members.

7 POST-AWARD OPERATING ISSUES

A. SUBSEQUENT AGREEMENTS

7.1 Purchase Order. Purchase orders for products and services may be executed between Sourcewell Members and the awarded Vendor (or Vendor's sub-contractors) under this Contract. Sourcewell Members and Vendors must indicate on the face of such purchase orders that "This purchase order is issued under Sourcewell contract #XXXXXX" (insert the relevant contract number). Purchase order flow and procedure will be developed jointly between Sourcewell and an awarded Vendor after an award is made.

7.2 Governing Law. Purchase orders must be construed in accordance with, and governed by, the laws of a competent jurisdiction with respect to the Member. (See also Section 8.5 of this RFP.) All provisions required by law to be included in the purchase order should be read and enforced as if they were included. If through mistake or otherwise any such provision is not included, then upon application of either party the Contract shall be physically amended to make such inclusion or correction. The venue for any litigation arising out of disputes related to purchase order will be a court of competent jurisdiction with respect to the Member.

7.3 Additional Terms and Conditions. Additional terms and conditions to a purchase order may be proposed by Sourcewell, Sourcewell Members, or Vendors. Acceptance of these additional terms and conditions is optional to all parties to the purchase order. One purpose of these additional terms and conditions is to address job- or industry-specific requirements of law such as prevailing wage legislation. Additional terms and conditions may also include specific local policy requirements and standard business practices of the issuing Member or the Vendor. Such additional terms and conditions are not considered valid to the extent that they interfere with the general purpose, intent, or currently established terms and conditions contain in this RFP document. For example, a Vendor and Member may agree to add a "net 30" payment requirement to the purchase order instead of applying a "net 10" requirement. But the added terms and conditions must not be less favorable to the Member unless Sourcewell, the Member, and the Vendor agree to a Contract amendment or similar modification.

7.4 Specialized Service Requirements. In the event that the Sourcewell Member desires service requirements or specialized performance requirements (such as e-commerce specifications, specialized delivery requirements, or other specifications and requirements) not addressed in the Contract resulting from this RFP, the Sourcewell Member and the Vendor may enter into a separate, standalone agreement, apart from a Contract resulting from this RFP. Any proposed service requirements or specialized performance requirements require pre-approval by the Vendor. Any separate agreement developed to address these specialized service or performance requirements is exclusively between the Sourcewell Member and Vendor. Sourcewell, its agents, and employees shall not be made a party to any claim for breach of such agreement. Product sourcing is not considered a service. Sourcewell Members will need to conduct procurements for any specialized services not identified as a part of or within the scope of the awarded Contract.

7.5 Performance Bond. At the request of the Member, a Vendor will provide all performance bonds typically and customarily required in their industry. These bonds will be issued pursuant to the

requirements of purchase orders for products and services. If a purchase order is cancelled for lack of a required performance bond by the member agency, Sourcewell recommends that the current pending purchase order be canceled. Each Member has the final decision on purchase order continuation. Any performance bonding required by the Member, the Member's state laws, or by local policy is to be mutually agreed upon and secured between the Vendor and the Member.

7.6 Asset Management Contracts: Asset Management-type Contracts can be initiated under a Contract resulting from this RFP at any time during the term of this Contract. Such a contract could involve, for example, picking up, storing, repairing, inventorying, salvaging, and delivery products falling within the scope of this Contract. The intention in using Asset Management Contracts is to promote the long-term efficiency of Sourcewell's contracts by (among other things) extending the use and re-use of products. Asset Management Contracts cannot be created under this Contract unless they are executed within the authorized term of a Contract resulting from this RFP. The actual term of the Asset Management Contract may, however, extend beyond the expiration date of this Contract.

B. SOURCEWELL MEMBER SIGN-UP PROCEDURE

7.7 Awarded Vendors are responsible for familiarizing their sales and service forces with the various forms of Sourcewell membership documentation and will encourage and assist potential Members in establishing membership with Sourcewell. Sourcewell membership is available at no cost, obligation, or liability to the Member or the Vendor.

C. REPORTING OF SALES ACTIVITY

7.8 Awarded Vendors must report at least quarterly the total gross dollar volume of all products and services purchased by Sourcewell Members as it applies to this RFP and Contract. This report must include the name and address of the purchasing agency, Member number, amount of purchase, and a description of the items purchased.

7.8.1 Zero sales reports: Awarded Vendors must provide a quarterly Contract sales report regardless of the amount of sales.

D. AUDITS

7.9 Sourcewell relies substantially on the reasonable auditing efforts of both Members and awarded Vendors to ensure that Members are obtaining the products, services, pricing, and other benefits under all Sourcewell contracts. Nonetheless, the Vendor must retain and make available to Sourcewell all order and invoicing documentation related to purchases that Members make from the Vendor under the awarded Contract. Sourcewell must not request such information more than once per calendar year, and Sourcewell must make such requests in writing with at least fourteen (14) days' notice. Sourcewell may employ an independent auditor at its own expense or conduct an audit on its own. In either event, the Vendor agrees to cooperate fully with Sourcewell or its agents in order to ensure compliance with this Contract.

E. HUB PARTNER

7.10 Hub Partner: Sourcewell Members may request special services through a "Hub Partner" for the purpose of complying with a law, regulation, or rule that an Sourcewell Member deems to apply in its jurisdiction. Hub Partners may bring value to the proposed transactions through consultancy, through qualifying for disadvantaged business entity credits, or through other means.

7.11 Hub Partner Fees: Sourcewell Members are responsible for any transaction fees, costs, or expenses that arise under this Contract for special service provided by the Hub Partner. The fees, costs, or expenses levied by the Hub Vendor must be clearly itemized in the transaction documentation. To the extent that the Vendor stands in the chain of title during a transaction resulting from this RFP, the documentation must clearly indicate that the transaction is "Executed for the Benefit of [Sourcewell Member name]."

F. TRADE-INS

7.12 The value in US Dollars for Trade-ins will be negotiated between Sourcewell or an Sourcewell Member, and an Awarded Vendor. That identified "Trade-In" value shall be viewed as a down payment and credited in full against the Sourcewell purchase price identified in a purchase order issued pursuant to any Awarded Sourcewell procurement contract. The full value of the trade-in will be consideration.

G. OUT OF STOCK NOTIFICATION

7.13 The Vendor must immediately notify Sourcewell Members when they order an out-of-stock item. The Vendor must also tell the Member when the item will be available and whether there are equivalent substitutes. The Member must have the option of accepting the suggested substitute or canceling the item from the order. Under no circumstance may the Vendor make unauthorized substitutions. Unfilled or substituted items must be indicated on the packing list.

H. CONTRACT TERMINATION FOR CAUSE AND WITHOUT CAUSE

7.14 Sourcewell reserves the right to cancel all or any part of this Contract if the Vendor fails to fulfill any material obligation, term, or condition as described in the following procedure. Before any such termination for cause, Sourcewell will provide written notice to the Vendor, an opportunity to respond, and a reasonable opportunity to cure the breach. The following are some examples of material breaches.

7.14.1 The Vendor provides products or services that do not meet reasonable quality standards and that are not remedied under the warranty;

7.14.2 The Vendor fails to ship the products or to provide the services within a reasonable amount of time;

7.14.3 Sourcewell reasonably believes that the Vendor will not or cannot perform to the requirements or expectations of the Contract, Sourcewell issues a request for assurance, and the Vendor fails to respond;

7.14.4 The Vendor fails to fulfill any of the material terms and conditions of the Contract;

7.14.5 The Vendor fails to follow the established procedure for purchase orders, invoices, or receipt of funds as established by Sourcewell and the Vendor;

7.14.6 The Vendor fails to properly report quarterly sales;

7.14.7 The Vendor fails to actively market this Contract within the guidelines provided in this RFP and defined in the Sourcewell contract launch.

7.15 Upon receipt of the written notice of breach, the Vendor will have ten (10) business days to provide a satisfactory response to Sourcewell. If the Vendor fails to reasonably address all issues in the written notice, Sourcewell may terminate the Contract immediately. If Sourcewell allows the Vendor more time to remedy the breach, such forbearance does not limit Sourcewell's authority to immediately terminate the Contract for continued breaches for which notice was given to the Vendor. Termination of the Contract for cause does not relieve either party of the financial, product, or service obligations incurred before the termination.

7.16 Sourcewell may terminate the Contract if the Vendor files for bankruptcy protection or is acquired by an independent third party. The Vendor must disclose to Sourcewell any litigation, bankruptcy, or suspensions/disbarments that occur during the Contract period. Failure to disclose such information authorizes Sourcewell to immediately terminate the Contract.

7.17 Sourcewell may terminate the Contract without cause by giving the Vendor sixty (60) days' written notice of termination. Termination of the Contract without cause does not relieve either party of the financial, product, or service obligations incurred before the termination.

7.18 Sourcewell may immediately terminate any Contract without further obligation if any Sourcewell employee significantly involved in initiating, negotiating, securing, drafting, or creating the Contract on behalf of Sourcewell has colluded with any Proposer for personal gain. Sourcewell may also immediately cancel a Contract if it finds that gratuities, in the form of entertainment, gifts or otherwise, were offered or given by the Vendor or any agent or representative of the Vendor, to any employee of Sourcewell. Such terminations are effective upon written notice from Sourcewell or at a later date designated in the notice. Termination of the Contract does not relieve either party of the financial, product, or service obligations incurred before the termination.

8 GENERAL TERMS AND CONDITIONS

8. ADVERTISING A CONTRACT RESULTING FROM THIS RFP

8.1 Proposer/Vendor must not advertise or publish information concerning this Contract before the award is announced by Sourcewell. Once the award is made, a Vendor is expected to advertise the awarded Contract to both current and potential Sourcewell Members.

B. APPLICABLE LAW

8.2 [This section is intentionally blank.]

8.3 Sourcewell Compliance with Minnesota Procurement Law: Sourcewell has designed its procurement process to comply with best practices in the State of Minnesota. Sourcewell's solicitation methods are also created to comply with many of the various requirements that our Members must satisfy in their own procurement processes. But these requirements may differ considerably and may change from time to time. So each Sourcewell Member must make its own determination whether Sourcewell's solicitation process satisfies the procurement rules in the Member's jurisdiction.

8.4 Governing law with respect to delivery and acceptance: All applicable portions of the Minnesota Uniform Commercial Code, all other applicable Minnesota laws, and the applicable laws and rules of delivery and inspection of the Federal Acquisition Regulations (FAR) laws will govern Sourcewell contracts resulting from this solicitation.

8.5 Jurisdiction: Any claims that arise against Sourcewell pertaining to this RFP, and any resulting contract that develops between Sourcewell and any other party, must be brought only in courts in Todd County in the State of Minnesota unless otherwise agreed to.

8.5.1 Purchase orders or other agreements created pursuant to a contract resulting from this solicitation must be construed in accordance with, and governed by, the laws of the issuing Member. Any claim arising from such a purchase order or agreement must be filed and venued in a court of competent jurisdiction of the Member unless otherwise agreed to.

8.6 through 8.7 [This section is intentionally blank.]

8.8 Indemnification: Each party is responsible for its own acts and is not responsible for the acts of the other party and the results thereof. Sourcewell's liability is governed by the Minnesota Tort Claims Act (Minn. Stat. §3.736) and other applicable law.

8.9 Prevailing wage: The Vendor must comply with applicable prevailing wage legislation in effect in the jurisdiction of the Sourcewell Member. The Vendor must monitor the prevailing wage rates as established

by the appropriate federal governmental entity during the term of this Contract and adjust wage rates accordingly.

8.10 Patent and copyright infringement: The Vendor agrees to indemnify and hold harmless Sourcewell and Sourcewell Members against any and all suits, claims, judgments, and costs instituted or recovered against the Vendor, Sourcewell, or Sourcewell Members by any person on account of the use or sale of any articles by Sourcewell or Sourcewell Members if the Vendor supplied such articles in violation of applicable patent or copyright laws.

C. ASSIGNMENT OF CONTRACT

8.11 No right or interest in this Contract may be assigned or transferred by the Vendor without prior written permission by Sourcewell. No delegation of any duty of the Vendor under this Contract may be made without prior written permission of Sourcewell. Sourcewell will notify Members by posting approved assignments on the Sourcewell website (www.sourcewell-mn.gov).

8.12 If the original Vendor sells or transfers all assets or the entire portion of the assets used to perform this Contract, a successor-in-interest must perform all obligations under this Contract. Sourcewell reserves the right to reject the acquiring entity as a Vendor. A change of name agreement will not change the contractual obligations of the Vendor.

D. LIST OF PROPOSERS

8.13 Sourcewell will not maintain a list of interested proposers, nor will it automatically send RFPs to them. All interested proposers must request the RFP as a result of Sourcewell's national solicitation advertisements. Because of the wide scope of the potential Members and qualified national suppliers, Sourcewell has determined this to be the best method of fairly soliciting proposals.

E. CAPTIONS, HEADINGS, AND ILLUSTRATIONS

8.14 The captions, illustrations, headings, and subheadings in this RFP are for convenience and ease of understanding and in no way define or limit the scope or intent of this request.

F. DATA PRACTICES

8.15 All materials submitted in response to this RFP become Sourcewell's property and become public records (under Minn. Stat. §13.591) after the evaluation process is completed. If the Proposer submits information in response to this RFP that it requests to be classified as nonpublic information (as defined by the Minnesota Government Data Practices Act, Minn. Stat. §13.37), the Proposer must meet the following requirements.

8.15.1 The Proposer must make the request within thirty (30) days of the award/nonaward notification, and include the appropriate statutory justification. Pricing, marketing plans, and financial information is generally not redactable. The Sourcewell Legal Department will review the request to determine whether the information can be withheld or redacted. If Sourcewell determines that it must disclose the information upon a proper request for such information, Sourcewell will inform the Proposer of such determination.

8.15.2 The Proposer must defend any action seeking release of the materials that it believes to be nonpublic information, and it must indemnify and hold harmless Sourcewell, its agents, and employees, from any judgments or damages awarded against Sourcewell in favor of the party requesting the materials, and any and all costs connected with that defense. This indemnification survives the term of any contract awarded under this RFP. In submitting a response to this RFP, the Proposer agrees that this indemnification survives as long as Sourcewell possesses the confidential information.

8.16 [This section is intentionally blank.]

G. ENTIRE AGREEMENT

8.17 This Contract, as defined herein, constitutes the entire agreement between the parties to this Contract. A Contract resulting from this RFP is formed when the vendor, Sourcewell Executive Director and Chief Procurement Officer approves and signs the applicable Contract Award & Acceptance document (Form E).

H. FORCE MAJEURE

8.18 Except for payments of sums due, neither party is liable to the other nor deemed in default under this Contract if and to the extent that such party's performance of this Contract is prevented due to force majeure. The term "force majeure" means an occurrence that is beyond the control of the party affected and occurs without its fault or negligence including, but not limited to, the following: acts of God, acts of the public enemy, war, riots, strikes, mobilization, labor disputes, civil disorders, fire, flood, snow, earthquakes, tornadoes or violent wind, tsunamis, wind shears, squalls, Chinooks, blizzards, hail storms, volcanic eruptions, meteor strikes, famine, sink holes, avalanches, lockouts, injunctions-intervention-acts, terrorist events or failures or refusals to act by government authority and/or other similar occurrences where such party is unable to prevent by exercising reasonable diligence. The force majeure is deemed to commence when the party declaring force majeure notifies the other party of the existence of the force majeure and is deemed to continue as long as the results or effects of the force majeure prevent the party from resuming performance in accordance with a Contract resulting from this RFP. Force majeure does not include late deliveries of products and services caused by congestion at a manufacturer's plant or elsewhere, an oversold condition of the market, inefficiencies, or other similar occurrences. If either party is delayed at any time by force majeure, then the delayed party must (if possible) notify the other party of such delay within forty-eight (48) hours.

8.19 through 8.20 [These sections are intentionally blank.]

I. LICENSES

8.21 The Vendor must maintain a valid status on all required federal, state, and local licenses, bonds, and permits required for the operation of the business that the Vendor conducts with Sourcewell and Sourcewell Members.

8.22 All responding Proposers must be licensed (where required) and must have the authority to sell and distribute the offered products and services to Sourcewell and Sourcewell Members. Documentation of the required licenses and authorities, if applicable, should be included in the Proposer's response to this RFP.

J. MATERIAL SUPPLIERS AND SUB-CONTRACTORS

8.23 The awarded Vendor must supply the names and addresses of sourcing suppliers and sub-contractors as a part of the purchase order when requested by Sourcewell or a Sourcewell Member.

K. NON-WAIVER OF RIGHTS

8.24 No failure of either party to exercise any power given to it hereunder, nor a failure to insist upon strict compliance by the other party with its obligations hereunder, nor a custom or practice of the parties at variance with the terms hereof, nor any payment under a Contract resulting from this RFP constitutes a waiver of either party's right to demand exact compliance with the terms hereof. Failure by Sourcewell to take action or to assert any right hereunder does not constitute a waiver of such right.

L. PROTESTS OF AWARDS MADE

8.25 Any protests must be filed with Sourcewell's Executive Director and must be resolved in accordance with appropriate Minnesota rules. Protests will only be accepted from Proposers. A protest of an award or nonaward must be filed in writing with Sourcewell within ten (10) calendar days after the public notice or announcement of the award or nonaward. A protest must include the following items.

8.25.1 The name, address, and telephone number of the protester;

8.25.2 The original signature of the protester or its representative (you must document the authority of the representative);

8.25.3 Identification of the solicitation by RFP number;

8.25.4 Identification of the statute or procedure that is alleged to have been violated;

8.25.5 A precise statement of the relevant facts;

8.25.6 Identification of the issues to be resolved;

8.25.7 The aggrieved party's argument and supporting documentation;

8.25.8 The aggrieved party's statement of potential financial damages; and

8.25.9 A protest bond in the name of Sourcewell and in the amount of 10% of the aggrieved party's statement of potential financial damages.

M. SUSPENSION OR DISBARMENT STATUS

8.26 If within the past five (5) years, any firm, business, person or Proposer responding to a Sourcewell solicitation has been lawfully terminated, suspended, or precluded from participating in any public procurement activity with a federal, state, or local government or education agency, the Proposer must include a letter with its response setting forth the name and address of the public procurement unit, the effective date of the suspension or debarment, the duration of the suspension or debarment, and the relevant circumstances relating to the suspension or debarment. Any failure to supply such a letter or to disclose pertinent information may result in the termination of a Contract. By signing the proposal affidavit, the Proposer certifies that no current suspension or debarment exists.

N. AFFIRMATIVE ACTION AND IMMIGRATION STATUS CERTIFICATION

8.27 An Affirmative Action Plan, Certificate of Affirmative Action, or other documentation regarding Affirmative Action may be required by Sourcewell or Sourcewell Members relating to a transaction from this RFP. Vendors must comply with any such requirements or requests.

8.28 Immigration Status Certification may be required by Sourcewell or Sourcewell Members relating to a transaction from this RFP. Vendors must comply with any such requirements or requests.

O. SEVERABILITY

8.29 In the event that any of the terms of a Contract resulting from this RFP are in conflict with any rule, law, or statutory provision, or are otherwise unenforceable under the laws or regulations of any government or subdivision thereof, such terms will be deemed stricken from the Contract, but such invalidity or unenforceability shall not invalidate any of the other terms of an awarded Contract resulting from this RFP.

P. RELATIONSHIP OF PARTIES

8.30 No Contract resulting from this RFP may be considered a contract of employment. The relationship between Sourcewell and an awarded Vendor is one of independent contractors, each free to exercise

judgment and discretion with regard to the conduct of their respective businesses. The parties neither intend the proposed Contract to create, nor is to be construed as creating, a partnership, joint venture, master-servant, principal-agent, or any other, relationship. Except as provided elsewhere in this RFP, neither party may be held liable for acts of omission or commission of the other party and neither party is authorized or has the power to obligate the other party by contract, agreement, warranty, representation, or otherwise in any manner whatsoever except as may be expressly provided herein.

Q. PROVISIONS FOR NON-FEDERAL ENTITY PROCUREMENTS UNDER FEDERAL AWARDS OR OTHER AWARDS; AIRPORT IMPROVEMENT PROGRAM PROVISIONS

8.31 Procurements by Sourcewell or Sourcewell Members utilizing funds under a federal grant or contract may be subject to specific federal laws, regulations, and requirements in addition to those under state and local laws. Applicable law may include, but is not limited to, the procurement standards of the Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards, 2 CFR Part 200 (also referred to as the "Uniform Guidance" or "EDGAR"). The terms included in this section express Proposers willingness and ability to comply with certain requirements which may be applicable to specific Sourcewell Member purchases using federal grant or contract dollars. Sourcewell Members may also require Proposers to enter into ancillary agreements, in addition to the Sourcewell contract's general terms and conditions, to address the Member's specific contractual needs, including contract requirements for a procurement using federal grants or contracts. Sourcewell reserves the right at any time within a contract term to require an awarded Vendor to reaffirm or resubmit proper documentation relating to these requirements. The numbering and identification contained within this section is only for reference purposes and does not identify any actual Federal designation or location of the rule. Rules are located in 2 CFR Part 200.

8.32 Contracts for more than the simplified acquisition threshold currently set at $150,000, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

Sourcewell reserves all rights and privileges under the applicable laws and regulations with respect to this procurement process in the event of breach of contract by either party.

8.33 Contracts in excess of $10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.

Sourcewell reserves the right to terminate any agreement resulting from this procurement process pursuant to Sourcewell RFP sections 7.13 and 7.17. Prior to any termination for cause, Sourcewell will provide written notice to the Proposer, opportunity to respond and opportunity to cure. Sourcewell reserves the right to terminate any agreement resulting from this procurement process without cause with a required 60-day written notice of termination. Termination of Contract shall not relieve either party of financial, product or service obligations incurred or accrued prior to termination.

8.34 Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor." This provision is hereby incorporated by reference into all applicable contracts.

The equal opportunity clause is incorporated by reference herein.

8.35 Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

Proposer shall be in compliance with all applicable Davis-Bacon Act provisions.

8.36 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence. This provision is hereby incorporated by reference into all applicable contracts.

Proposer certifies that during the term of an award for all contracts by Sourcewell resulting from this procurement process, Proposer shall comply with applicable requirements as referenced above.

8.37 Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

Proposer certifies that during the term of an award for all contracts by Sourcewell resulting from this procurement process, Proposer shall comply with applicable requirements as referenced above.

8.38 Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387). Contracts and subgrants of amounts in excess of $150,000 require the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401- 7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251- 1387). Violations shall be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

Proposer certifies that during the term of an award for all contracts by Sourcewell resulting from this procurement process, Proposer shall comply with applicable requirements as referenced above.

8.39 Debarment and Suspension (Executive Orders 12549 and 12689). A contract award (see 2 CFR 180.220) must not be made to parties listed on the government wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

Proposer nor its principals shall be presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation by any federal department or agency.

8.40 Byrd Anti-Lobbying Amendment, as amended (31 U.S.C. 1352). Proposers shall file any required certifications. Proposers shall not have used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Proposers shall disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

Proposers shall file all certifications and disclosures required by, and otherwise comply with, the Byrd Anti-Lobbying Amendment (31 USC 1352).

8.41 Record Retention Requirements. To the extent applicable, Proposer shall comply with the record retention requirements detailed in 2 CFR § 200.333. The Vendor further certifies that Vendor will retain all records as required by 2 CFR § 200.333 for a period of three years after grantees or subgrantees submit final expenditure reports or quarterly or annual financial reports, as applicable, and all other pending matters are closed.

8.42 Energy Policy and Conservation Act Compliance. To the extent applicable, Proposer shall comply with the mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

8.43 Buy American Provisions Compliance. To the extent applicable, Proposer agrees to comply with 49 U.S.C. § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP funded projects are produced in the United States, unless the Federal Aviation Administration has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list. Purchases made in accordance with the Buy American Act shall follow the applicable procurement rules calling for free and open competition.

8.44 Title VI Solicitation Notice. Sourcewell, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 USC §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises or airport concession disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

8.45 Trade Restriction Certification. To the extent applicable, Proposer will comply with the provision in 49 U.S.C. § 50104 regarding certification and notice requirements for firm ownership or control by one or more citizens of a foreign county listed by the Office of the United States Trade Representative as discriminating against U.S. firms.

8.46 Procurement of Recovered Materials. To the extent applicable, Proposer agrees to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247.

8.47 Access to Records (2 CFR § 200.336). Proposer agrees that duly authorized representatives of an Agency shall have access to any books, documents, papers and records of Proposer that are directly pertinent to Proposer's discharge of its obligations under the Contract for the purpose of making audits, examinations, excerpts, and transcriptions. The right also includes timely and reasonable access to Proposer's personnel for the purpose of interview and discussion relating to such documents.

9 FORMS

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Form A

PROPOSER QUESTIONNAIRE- General Business Information

*(Products, Pricing, Sector Specific, Services, Terms and Warranty are addressed on **Form P**)*

Proposer Name: _____Questionnaire completed by: _____

Please identify the person Sourcewell should correspond with from now through the Award process:

Name: _____ E-Mail address: _____

Please answer and submit the electronic version of the questions below in Microsoft Word® This allows Sourcewell evaluators to cut and paste your answers into a separate worksheet. Place your answer directly below each question. Sourcewell prefers a brief but thorough response to each question. Please do not merely attach additional documents to your response without also providing a substantive response. Do not leave answers blank; mark "NA" if the question does not apply to you (preferably with an explanation). Please create a response that is easy to read and understand. For example, you may consider using a different font and color to distinguish your answer from the questions.

Company Information & Financial Strength

1) Provide the full legal name, mailing and email addresses, tax identification number, and telephone number for your business.
2) Provide a brief history of your company, including your company's core values, business philosophy, and longevity in the MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES industry.
3) Provide a detailed description of the products and services that you are offering in your proposal.
4) What are your company's expectations in the event of an award?
5) Demonstrate your financial strength and stability with meaningful data. This could include such items as financial statements, SEC filings, credit and bond ratings, letters of credit, and detailed reference letters.
6) What is your US market share for the solutions that you are proposing? What is your Canadian market share, if any?
7) Has your business ever petitioned for bankruptcy protection? Please explain in detail.
8) How is your organization best described: is it a manufacturer, a distributor/dealer/reseller, or a service provider? Answer whichever question (either a) or b) just below) best applies to your organization.
    a) If your company is best described as a distributor/dealer/reseller (or similar entity), please provide your written authorization to act as a distributor/dealer/reseller for the manufacturer of the products proposed in this RFP. If applicable, is your dealer network independent or company owned?
    b) If your company is best described as a manufacturer or service provider, please describe your relationship with your sales and service force and with your dealer network in delivering the products and services proposed in this RFP. Are these individuals your employees, or the employees of a third party?
9) If applicable, provide a detailed explanation outlining the licenses and certifications that are both required to be held, and actually held, by your organization (including third parties and subcontractors that you use) in pursuit of the business contemplated by this RFP.
10) Provide all "Suspension or Disbarment" information that has applied to your organization during the past ten years.
11) Within this RFP category there may be subcategories of solutions. List subcategory titles that best describe your products and services.

Industry Recognition & Marketplace Success

12) Describe any relevant industry awards or recognition that your company has received in the past five years.

13) Supply three references/testimonials from your customers who are eligible for Sourcewell membership. At a minimum, please include the entity's name, contact person, and phone number.

14) Provide a list of your top five governmental or educational customers (entity name is optional), including entity type, the state the entity is located in, scope of the projects, size of transactions, and dollar volumes from the past three years.

15) Indicate separately what percentages of your sales are to the government and education sectors in the past three years?

16) List any state or cooperative purchasing contracts that you hold. What is the annual sales volume for each of these contracts over the past three years?

17) List any GSA contracts that you hold. What is the annual sales volume for each of these contracts over the past three years?

Proposer's Ability to Sell and Deliver Service Nationwide

18) Describe your company's capability to meet Sourcewell Member's needs across the country. Your response should address at least the following areas.

    a) Sales force.

    b) Dealer network or other distribution methods.

    c) Service force.

    Please include details, such as the locations of your network of sales and service providers, the number of workers (full-time equivalents) involved in each sector, whether these workers are your direct employees (or employees of a third party), and any overlap between the sales and service functions.

19) Describe in detail the process and procedure of your customer service program, if applicable. Please include your response-time capabilities and commitments, as well as any incentives that help your providers meet your stated service goals or promises.

20) a) Identify any geographic areas of the United States that you will NOT be fully serving through the proposed contract. b) Identify any Sourcewell Member sectors (i.e., government, education, not-for-profit) that you will NOT be fully serving through the proposed contract. Please explain your answer. For example, does your company have only a regional presence, or do other cooperative purchasing contracts limit your ability to promote another contract?

21) Define any specific contract requirements or restrictions that would apply to our Members in Hawaii and Alaska and in US Territories.

Marketing Plan

22) If you are awarded a contract, how will you train your sales management, dealer network, and direct sales teams (whichever apply) to ensure maximum impact? Please include how you will communicate your Sourcewell pricing and other contract detail to your sales force nationally.

23) Describe your marketing strategy for promoting this contract opportunity. Please include representative samples of your marketing materials in electronic format.

24) Describe your use of technology and digital data (e.g., social media, metadata usage) to enhance marketing effectiveness.

25) In your view, what is Sourcewell's role in promoting contracts arising out of this RFP? How will you integrate a Sourcewell-awarded contract into your sales process?

26) Are your products or services available through an e-procurement ordering process? If so, describe your e-procurement system and how governmental and educational customers have used it.

Value-Added Attributes

27) Describe any product, equipment, maintenance, or operator training programs that you offer to Sourcewell Members. Please include details, such as whether training is standard or optional, who provides training, and any costs that apply.

28) Describe any technological advances that your proposed products or services offer.

29) Describe any "green" initiatives that relate to your company or to your products or services, and include a list of the certifying agency for each.

30) Describe any Women or Minority Business Entity (WMBE) or Small Business Entity (SBE) certifications that your company or hub partners have obtained.

31) What unique attributes does your company, your products, or your services offer to Sourcewell Members? What makes your proposed solutions unique in your industry as it applies to Sourcewell members?

32) Identify your ability and willingness to provide your products and services to Sourcewell member agencies in Canada.

33) Sourcewell Members may intend to use funds from a federal grant or contract under the Federal Emergency Management Agency (FEMA). In that event, state your ability and willingness to complete, execute, and provide the "Required FEMA Terms and Conditions Certification" form attached as Appendix D to the RFP.

NOTE: Questions regarding Payment Terms, Warranty, Products/Equipment/Services, Pricing and Delivery, and Industry Specific Items are addressed on Form P.

Signature: _____ Date: _____

Form B

PROPOSER INFORMATION

Company Name: _____

Address: _____

City/State/Zip: _____

Phone: _____ Fax: _____

Toll-Free Number: _____ E-mail: _____

Website Address: _____

COMPANY PERSONNEL CONTACTS

Authorized signer for your organization

Name: _____

Email: _____Phone: _____

The person identified here must have proper signing authority to sign the "Proposer's Assurance of Compliance" on behalf of the Proposer.

Who prepared your RFP response?

Name:_____Title:_____

Email: _____Phone:_____

Who is your company's primary contact person for this proposal?

Name: _____Title:_____

Email: _____Phone:_____

Other important contact information

Name: _____Title:_____

Email: _____Phone:_____

Name: _____Title:_____

Email: _____Phone:_____

Form C

EXCEPTIONS TO PROPOSAL, TERMS, CONDITIONS, AND SOLUTIONS REQUEST

Company Name: _____

Any exceptions to the terms, conditions, specifications, or proposal forms contained in this RFP must be noted in writing and included with the Proposer's response. The Proposer acknowledges that the exceptions listed may or may not be accepted by Sourcewell or included in the final contract. Sourcewell will make reasonable efforts to accommodate the listed exceptions and may clarify the exceptions in the appropriate section below.

Section/page	Term, Condition, or Specification	Exception	Sourcewell ACCEPTS

Proposer's Signature: _____ **Date:** _____

Sourcewell's clarification on exceptions listed above:

FORM D

Formal Offering of Proposal

(To be completed only by the Proposer)

MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES

In compliance with the Request for Proposal (RFP) for MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES, the undersigned warrants that the Proposer has examined this RFP and, being familiar with all of the instructions, terms and conditions, general and technical specifications, sales and service expectations, and any special terms, agrees to furnish the defined products and related services in full compliance with all terms and conditions of this RFP, any applicable amendments of this RFP, and all Proposer's response documentation. The Proposer further understands that it accepts the full responsibility as the sole source of solutions proposed in this RFP response and that the Proposer accepts responsibility for any subcontractors used to fulfill this proposal.

Company Name: _____ Date: _____

Company Address: _____

City:_____ State: _____ Zip: _____

CAGE Code/DUNS:_____

Contact Person: _____ Title: _____

Authorized Signature: _____

(Name printed or typed)

FORM E

CONTRACT ACCEPTANCE AND AWARD

(Top portion of this form will be completed by Sourcewell if the vendor is awarded a contract. The vendor should complete the vendor authorized signatures as part of the RFP response.)

Sourcewell Contract #: 040319-XXX

Proposer's full legal name: TBD

Based on Sourcewell's evaluation of your proposal, you have been awarded a contract. As an awarded vendor, you agree to provide the products and services contained in your proposal and to meet all of the terms and conditions set forth in this RFP, in any amendments to this RFP, and in any exceptions that are accepted by Sourcewell.

The effective date of the Contract will be MM DD, YYYY and will expire on MM DD, YYYY (no later than the later of four years from the expiration date of the currently awarded contract or four years from the date that the Sourcewell Chief Procurement Officer awards the Contract). This Contract may be extended for a fifth year at Sourcewell's discretion.

Sourcewell Authorized Signatures:

_____ Jeremy Schwartz
SOURCEWELL DIRECTOR OF COOPERATIVE CONTRACTS AND PROCUREMENT/CPO SIGNATURE (NAME PRINTED OR TYPED)

_____ Chad Coauette
SOURCEWELL EXECUTIVE DIRECTOR/CEO SIGNATURE (NAME PRINTED OR TYPED)

Awarded on MM DD, YYYY Sourcewell Contract # 040319-XXX

Vendor Authorized Signatures:

The Vendor hereby accepts this Contract award, including all accepted exceptions and amendments.

Vendor Name _____

Authorized Signatory's Title _____

_____ _____
VENDOR AUTHORIZED SIGNATURE (NAME PRINTED OR TYPED)

Executed on _____, 20___ Sourcewell Contract # 040319-XXX

Form F

PROPOSER ASSURANCE OF COMPLIANCE

Proposal Affidavit Signature Page

PROPOSER'S AFFIDAVIT

The undersigned, authorized representative of the entity submitting the foregoing proposal (the "Proposer"), swears that the following statements are true to the best of his or her knowledge.

1. The Proposer is submitting its proposal under its true and correct name, the Proposer has been properly originated and legally exists in good standing in its state of residence, the Proposer possesses, or will possess before delivering any products and related services, all applicable licenses necessary for such delivery to Sourcewell members agencies. The undersigned affirms that he or she is authorized to act on behalf of, and to legally bind the Proposer to the terms in this Contract.

2. The Proposer, or any person representing the Proposer, has not directly or indirectly entered into any agreement or arrangement with any other vendor or supplier, any official or employee of Sourcewell, or any person, firm, or corporation under contract with Sourcewell, in an effort to influence the pricing, terms, or conditions relating to this RFP in any way that adversely affects the free and open competition for a Contract award under this RFP.

3. The Proposer has examined and understands the terms, conditions, scope, contract opportunity, specifications request, and other documents in this solicitation and affirms that any and all exceptions have been noted in writing and have been included with the Proposer's RFP response.

4. The Proposer will, if awarded a Contract, provide to Sourcewell Members the /products and services in accordance with the terms, conditions, and scope of this RFP, with the Proposer-offered specifications, and with the other documents in this solicitation.

5. The Proposer agrees to deliver products and services through valid contracts, purchase orders, or means that are acceptable to Sourcewell Members. Unless otherwise agreed to, the Proposer must provide only new and first-quality products and related services to Sourcewell Members under an awarded Contract.

6. The Proposer will comply with all applicable provisions of federal, state, and local laws, regulations, rules, and orders.

7. The Proposer understands that Sourcewell will reject RFP proposals that are marked "confidential" (or "nonpublic," etc.), either substantially or in their entirety. Under Minnesota Statute §13.591, Subd. 4, all proposals are considered nonpublic data until the evaluation is complete and a Contract is awarded. At that point, proposals generally become public data. Minnesota Statute §13.37 permits only certain narrowly defined data to be considered a "trade secret," and thus nonpublic data under Minnesota's Data Practices Act.

8. The Proposer understands that it is the Proposer's duty to protect information that it considers nonpublic, and it agrees to defend and indemnify Sourcewell for reasonable measures that Sourcewell takes to uphold such a data designation.

[The rest of this page has been left intentionally blank. Signature page below]

By signing below, Proposer is acknowledging that he or she has read, understands, and agrees to comply with the terms and conditions specified above.

Company Name: _____

Address: _____

City/State/Zip: _____

Telephone Number: _____

E-mail Address:_____

Authorized Signature: _____

Authorized Name (printed): _____

Title: _____

Date: _____

Notarized

Subscribed and sworn to before me this _____ day of _____, 20_____

Notary Public in and for the County of _____ State of _____

My commission expires: _____

Signature: _____

Form G

OVERALL EVALUATION AND CRITERIA

For the Proposed Subject MEDIUM DUTY AND COMPACT CONSTRUCTION EQUIPMENT WITH RELATED ATTACHMENTS, ACCESSORIES, AND SUPPLIES

Conformance to RFP Terms and Conditions	50	
Financial Viability and Marketplace Success	75	
Ability to Sell and Deliver Service Nationwide	100	
Marketing Plan	50	
Value-Added Attributes	75	
Warranty	50	
Depth and Breadth of Offered Products and Related Services	200	
Pricing	400	
TOTAL POINTS	**1000**	

Reviewed by: _____ Its_____

_____Its_____

Form P

PROPOSER QUESTIONNAIRE
Payment Terms, Warranty, Products and Services, Pricing and Delivery, and Industry-Specific Questions

Proposer Name: _____

Questionnaire completed by: _____

Payment Terms and Financing Options

1) What are your payment terms (e.g., net 10, net 30)?

2) Do you provide leasing or financing options, especially those options that schools and governmental entities may need to use in order to make certain acquisitions?

3) Briefly describe your proposed order process. Please include enough detail to support your ability to report quarterly sales to Sourcewell. For example, indicate whether your dealer network is included in your response and whether each dealer (or some other entity) will process the Sourcewell Members' purchase orders.

4) Do you accept the P-card procurement and payment process? If so, is there any additional cost to Sourcewell Members for using this process?

Warranty

5) Describe in detail your manufacturer warranty program, including conditions and requirements to qualify, claims procedure, and overall structure. You may include in your response a copy of your warranties, but at a minimum please also answer the following questions.
   - Do your warranties cover all products, parts, and labor?
   - Do your warranties impose usage restrictions or other limitations that adversely affect coverage?
   - Do your warranties cover the expense of technicians' travel time and mileage to perform warranty repairs?
   - Are there any geographic regions of the United States for which you cannot provide a certified technician to perform warranty repairs? How will Sourcewell Members in these regions be provided service for warranty repair?
   - Will you cover warranty service for items made by other manufacturers that are part of your proposal, or are these warranties issues typically passed on to the original equipment manufacturer?
   - What are your proposed exchange and return programs and policies?

6) Describe any service contract options for the items included in your proposal.

Pricing, Delivery, Audits, and Administrative Fee

7) Provide a general narrative description of the equipment/products and related services you are offering in your proposal.

8) Describe your pricing model (e.g., line-item discounts or product-category discounts). Provide detailed pricing data (including standard or list pricing and the Sourcewell discounted price) on all of the items that you want Sourcewell to consider as part of your RFP response. If applicable, provide a SKU for each item in your proposal. (Keep in mind

that reasonable price and product adjustments can be made during the term of an awarded Contract. See the body of the RFP and the Price and Product Change Request Form for more detail.)

9) Please quantify the discount range presented in this response. For example, indicate that the pricing in your response represents is a 50% percent discount from the MSRP or your published list.

10) The pricing offered in this proposal is

_____a. the same as the Proposer typically offers to an individual municipality, university, or school district.

_____b. the same as the Proposer typically offers to GPOs, cooperative procurement organizations, or state purchasing departments.

_____c. better than the Proposer typically offers to GPOs, cooperative procurement organizations, or state purchasing departments.

_____d. other than what the Proposer typically offers (please describe).

11) Describe any quantity or volume discounts or rebate programs that you offer.

12) Propose a method of facilitating "sourced" products or related services, which may be referred to as "open market" items or "nonstandard options". For example, you may supply such items "at cost" or "at cost plus a percentage," or you may supply a quote for each such request.

13) Identify any total cost of acquisition costs that are **NOT** included in the pricing submitted with your response. This cost includes all additional charges that are not directly identified as freight or shipping charges. For example, list costs for items like installation, set up, mandatory training, or initial/pre-delivery inspection. Identify any parties that impose such costs and their relationship to the Proposer.

14) If travel expense, delivery or shipping is an additional cost to the Sourcewell Member, describe in detail the complete travel expense, shipping and delivery program.

15) Specifically describe those travel expense, shipping and delivery programs for Alaska, Hawaii, Canada, or any offshore delivery.

16) Describe any unique distribution and/or delivery methods or options offered in your proposal.

17) Please specifically describe any self-audit process or program that you plan to employ to verify compliance with your proposed Contract with Sourcewell. This process includes ensuring that Sourcewell Members obtain the proper pricing, that the Vendor reports all sales under the Contract each quarter, and that the Vendor remits the proper administrative fee to Sourcewell.

18) Identify a proposed administrative fee that you will pay to Sourcewell for facilitating, managing, and promoting the Sourcewell Contract in the event that you are awarded a Contract. This fee is typically calculated as a percentage of Vendor's sales under the Contract or as a per-unit fee; it is not a line-item addition to the Member's cost of goods. (See RFP Section 6.29 and following for details.)

Industry-Specific Questions

19) Describe any industry-specific quality management system certifications obtained by your organization.
20) Describe any environmental management system certifications obtained by your organization.
21) Describe any preventive maintenance programs that your organization offers for the solutions you are proposing in your response.

Signature: _____Date: _____

10 PRE-SUBMISSION CHECKLIST

Check when Completed	Contents of Your Bid Proposal	Hard Copy Required Signed and Dated	Electronic Copy Required – Flash Drive or CD
	Form A: Proposer Questionnaire with all questions answered completely	X – signature page only	X
	Form B: Proposer Information		X
	Form C: Exceptions to Proposal, Terms, Conditions, and Solutions Request	X	X
	Form D: Formal Offering of Proposal	X	X
	Form E: Contract Acceptance and Award		X
	Form F: Proposers Assurance of Compliance	X	X
	Form P: Proposer Questionnaire with all questions answered completely	X – signature page only	X
	Certificate of Insurance with $1.5 million coverage	X	X
	Copy of all RFP Addendums issued by Sourcewell	X	X
	Pricing for all Products/Equipment/Services within the RFP being proposed		X
	Entire Proposal submittal including signed documents and forms		X
	All forms in the Hard Copy Required Signed and Dated should be inserted in the front of the submitted response, unbound		
	Package containing your proposal labeled and sealed with the following language: "**Competitive Proposal Enclosed, Hold for Public Opening XX-XX-XXXX**"		
	Response Package mailed and delivered prior to deadline to: Sourcewell, 202 12th St NE, PO Box 219 Staples, MN 56479		

11 SOURCEWELL VENDOR PRICE AND PRODUCT CHANGE REQUEST FORM

Section 1. Instructions for Vendor

Requests for product or service changes, additions, or deletions will be considered at any time throughout the awarded contract term. All requests must be made in writing by completing sections 2, 3, and 4 of this Sourcewell Price and Product Change Request Form and signed by an authorized Vendor representative in section 5. All changes are subject to review by the Sourcewell Procurement Manager and to approval by Sourcewell's Chief Procurement Officer. Submit request through email to your assigned Sourcewell Contract Administrator.

Sourcewell will determine whether the request is 1) within the scope of the original RFP, and 2) in the best interests of Sourcewell and Sourcewell Members. Approved Price and Product Change Request Forms will be signed and emailed to the Vendor contact.

The Vendor must complete this change request form and individually list or attach all items or services subject to change, must provide sufficiently detailed explanation and documentation for the change, and must include a complete restatement of pricing documentation in an appropriate format (preferably Microsoft® Excel®). The pricing document must identify all products and services being offered and must conform to the following Sourcewell product/price change naming convention: (Vendor Name) (Sourcewell Contract #) (effective pricing date); for example, "Acme Widget Company #012416-AWC eff. 01-01-2017."

NOTE: New pricing restatements must include all products and services offered regardless of whether their prices have changed and must include a new "effective date" on the pricing documents. This requirement reduces confusion by providing a single, current pricing sheet for each Vendor and creates a historical record of pricing.

ADDITIONS. New products and related services may be added to a contract if such additions are within the scope of the original RFP.

DELETIONS. New products and related services may be deleted from a contract if, for example, they are no longer available or have been modified to a point where they are outside the scope of the RFP.

PRICE CHANGES: Vendors may request price changes if they provide sufficient rationale for the change. For example, a Vendor that manufactures products that require substantial petroleum-related material might request a 3% price increase because of a 20% increase in petroleum costs.

Price decreases: Sourcewell expects Vendors to propose their very best prices and anticipates that price reductions might occur because of improved technologies or marketplace efficiencies.

Price increases: Acceptable price increases typically result from specific Vendor cost increases. The Vendor must include reasonable justification for the price increase and must not, for example, offer merely generalized statements about an increase in a cost-of-living index. Appropriate documentation should be attached to this form, including such items as letters from suppliers announcing price increases.

Refer to the RFP for complete "Pricing" details.

Section 2. Vendor Name and Type of Change Request

CHECK ALL CHANGES THAT APPLY:

AWARDED VENDOR NAME: _____

SOURCEWELL CONTRACT NUMBER: _____

☐ Adding Products/Services vices

☐ Deleting Products/Services

☐ Price Increase

☐ Price Decrease

Section 3. Detailed Explanation of Need for Changes

List the products and/or services that are changing or being added or deleted from the previous contract price list, along with the percentage change for each item or category. (Attach a separate, detailed document if changing more than 10 items.)

Provide a general statement and documentation explaining the reasons for these price and/or product changes.
EXAMPLES: 1) "All pricing for paper products and services are increased 5% because of increased raw material and transportation costs (see attached documentation of fuel and raw materials increase)." 2) "The 6400 series floor polisher is being added to the product list as a new model, replacing the 5400 series. The 6400 series 3% increase reflects technological changes that improve the polisher's efficiency and useful life. The 5400 series is now included in the "Hot List" at a 20% discount from the previous pricing until the remaining inventory is liquidated."

If adding products, state how these are within the scope of the original RFP.

If changing prices or adding products or services, state how the pricing is consistent with existing Sourcewell contract pricing.

Section 4. Complete Restatement of Pricing Submitted

A COMPLETE restatement of the pricing, including all new and existing products and services is attached and has been emailed to the Vendor's Contract Administrator.

☐ Yes ☐ No

Section 5. Signatures

_____ _____

Vendor Authorized Signature Date

_____

Print Name and Title of Authorized Signer

_____ _____

Jeremy Schwartz Date

Sourcewell Director of Cooperative Contracts and Procurement/CPO

Appendix A

Sourcewell on behalf of itself and its current and potential Member agencies, which includes all governmental, higher education, K-12 education, not-for-profit, tribal governmental, and all other public agencies located in all fifty states, Canada, and internationally, issues this Request For Proposal (RFP) to result in a national contract solution.

For your reference, the links below include some, but not all, of the entities included in this proposal.

http://www.usa.gov/Agencies/Local_Government/Cities.shtml
http://nces.ed.gov/globallocator/
https://www.census.gov/2010census/partners/pdf/FIPS_StateCounty_Code.pdf
http://nccs.urban.org/sites/all/nccs-archive/html//PubApps/search.php
https://www.usa.gov/tribes#item-37647
http://www.usa.gov/Agencies/State-and-Territories.shtml
Oregon
Hawaii
Washington

Appendix B - Political Subdivision List
for HI, ID, OR, SC, UT, WA

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
County	**County**	**County**	**County**	**County**	**County**
Hawaii County	Ada County	Baker County	Abbeville County	Beaver County	Adams County
Kauai County	Adams County	Benton County	Aiken County	Box Elder County	Asotin County
Maui County	Bannock County	Central Oregon Intergovernmental Council	Allendale County	Cache County	Benton County
Municipality	Bear Lake County	Clackamas County	Anderson County	Carbon County	Chelan County
City and County of Honolulu	Benewah County	Clackamas County Service District No. 1	Bamberg County	Daggett County	Clallam County
Higher Education	Bingham County	Clatsop County	Barnwell County	Davis County	Clark County
Hawaii Community College	Blaine County	Columbia County	Beaufort County	Duchesne County	Columbia County
Honolulu Community College	Boise County	Coos County	Berkeley County	Duchesne County Special Service District No. 2	Cowlitz County
University of Hawaii	Bonner County	Crook County	Calhoun County	Emery County	Douglas County
University of Hawaii Research Corporation	Bonneville County	Curry County	Catawba Regional Council of Governments	Five County Association of Governments	Ferry County
Windward Community College	Boundary County	Deschutes County	Central Midlands Council of Governments	Garfield County	Franklin County
Education (K-12)	Butte County	Douglas County	Charleston County	Grand County	Garfield County
Hanalani Schools	Camas County	Gilliam County	Cherokee County	Iron County	Grant County
Kamehameha Schools	Canyon County	Grant County	Chester County	Juab County	Grays Harbor County
Special District	Caribou County	Harney County	Chesterfield County	Kane County	Island County
Hawaii Community Development Authority	Cassia County	Hood River County	Clarendon County	Millard County	Jefferson County
Hawaii Public Housing Authority	Clark County	Jackson County	Colleton County	Morgan County	King County
Hawaii Tourism Authority	Clearwater County	Jefferson County	Darlington County	Piute County	King County Directors' Association
Honolulu Authority for Rapid Transportation	Custer County	Josephine County	Dillon County	Rich County	Kitsap County
Natural Energy Laboratory of Hawaii Authority	Elmore County	Klamath County	Dorchester County	Salt Lake County	Kittitas County
State	Franklin County	Lake County	Edgefield County	San Juan County	Klickitat County
Hawaii Department of Accounting and General Services	Fremont County	Lane Council of Governments	Fairfield County	Sanpete County	Lewis County
Hawaii Department of Finance and Administration	Gem County	Lane County	Florence County	Sevier County	Lincoln County
Hawaii Department of Health	Gooding County	Lincoln County	Georgetown County	Summit County	Mason County
Hawaii Employer-Union Health Benefits Trust Fund	Idaho County	Linn County	Greenville County	Tooele County	Okanogan County
Hawaii Health Systems Corporation	Jefferson County	Malheur County	Greenwood County	Uintah County	Pacific County
State Of Hawaii	Jerome County	Marion County	Hampton County	Utah County	Pend Oreille County
	Kootenai County	Marion County Housing Authority	Horry County	Wasatch County	Pierce County
	Latah County	Morrow County	Jasper County	Washington County	San Juan County
	Lemhi County	Multnomah County	Kershaw County	Wayne County	Skagit County
	Lewis County	Polk County	Lancaster County	Weber County	Skamania County
	Lincoln County	Sherman County	Laurens County	**Municipality**	Snohomish County
	Madison County	Tillamook County	Lee County	Centerfield City	Spokane County
	Minidoka County	Umatilla County	Lexington County	City of Alpine City	Stevens County
	Nez Perce County	Union County	Lower Savannah Council of Governments	City of American Fork	Thurston County
	Oneida County	Wallowa County	Marion County	City of Aurora	Thurston Regional Planning Council
	Owyhee County	Wasco County	Marlboro County	City of Ballard	Wahkiakum County
	Payette County	Washington County	McCormick County	City of Beaver	Walla Walla County
	Power County	Wheeler County	Newberry County	City of Blanding	Whatcom County
	Shoshone County	Yamhill County	Oconee County	City of Bluffdale	Whitman County
	Teton County	**Municipality**	Orangeburg County	City of Bountiful	Yakima County
	Twin Falls County	City of Adair Village	Pickens County	City of Brigham	Yakima County Public Services
	Valley County	City of Adrian	Richland County	City of Castle Dale	Yakima Valley Conference of Governments
	Washington County	City of Albany	Saluda County	City of Cedar City	**Municipality**
	Municipality	City of Amity	Spartanburg County	City of Cedar Hills	City of Aberdeen
	City of Aberdeen	City of Arlington	Sumter County	City of Centerville	City of Airway Heights
	City of Albion	City of Ashland	Union County	City of Clearfield	City of Algona
	City of American Falls	City of Astoria	Williamsburg County	City of Clinton	City of Anacortes
	City of Ammon	City of Athena	York County	City of Coalville	City of Arlington
	City of Arco	City of Aumsville	**Municipality**	City of Colorado City	City of Asotin
	City of Arimo	City of Aurora	City of Abbeville	City of Corinne City	City of Auburn
	City of Ashton	City of Baker City	City of Aiken	City of Cottonwood Heights	City of Bainbridge Island
	City of Athol	City of Bandon	City of Anderson	City of Delta	City of Battle Ground
	City of Atomic City	City of Banks	City of Barnwell	City of Draper	City of Bellevue
	City of Bancroft	City of Bay City	City of Beaufort	City of Duchesne	City of Bellingham
	City of Bellevue	City of Beaverton	City of Belton	City of East Carbon	City of Benton City
	City of Blackfoot	City of Bend	City of Bennettsville	City of Elk Ridge	City of Bingen
	City of Bliss	City of Boardman	City of Bishopville	City of Elmo	City of Black Diamond
	City of Bloomington	City of Brookings	City of Camden	City of Enoch	City of Blaine
	City of Boise	City of Brownsville	City of Cayce	City of Enterprise	City of Bonney Lake
	City of Bonners Ferry	City of Burns	City of Charleston	City of Ephraim	City of Bothell
	City of Bovill	City of Canby	City of Chesnee	City of Escalante	City of Bremerton
	City of Buhl	City of Cannon Beach	City of Chester	City of Eureka	City of Brewster
	City of Burley	City of Canyonville	City of Clemson	City of Fairview	City of Bridgeport
	City of Caldwell	City of Carlton	City of Clinton	City of Farmington	City of Brier
	City of Cambridge	City of Cascade Locks	City of Columbia	City of Farr West	City of Buckley
	City of Carey	City of Cave Junction	City of Conway	City of Ferron	City of Burien
	City of Cascade	City of Central Point	City of Darlington	City of Fillmore	City of Burlington
	City of Castleford	City of Chiloquin	City of Denmark	City of Fountain Green	City of Camas
	City of Challis	City of Clatskanie	City of Dillon	City of Fruit Heights	City of Carnation
	City of Chubbuck	City of Coburg	City of Easley	City of Garland	City of Cashmere
	City of Clayton	City of Columbia City	City of Florence	City of Grantsville	City of Castle Rock
	City of Clifton	City of Condon	City of Folly Beach	City of Green River	City of Centralia
	City of Coeur d'Alene	City of Coos Bay	City of Forest Acres	City of Gunnison	City of Chehalis
	City of Council	City of Coquille	City of Fountain Inn	City of Harrisville	City of Chelan
	City of Craigmont	City of Cornelius	City of Gaffney	City of Heber City	City of Cheney
	City of Crouch	City of Corvallis	City of Georgetown	City of Helper City	City of Chewelah

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
	City of Culdesac	City of Cottage Grove	City of Goose Creek	City of Herriman	City of Clarkston
	City of Dalton Gardens	City of Cove	City of Greenville	City of Highland	City of Cle Elum
	City of Dayton	City of Creswell	City of Greenwood	City of Hildale	City of Clyde Hill
	City of Deary	City of Culver	City of Greer	City of Holladay	City of Colfax
	City of Dietrich	City of Dallas	City of Hanahan	City of Honeyville	City of College Place
	City of Donnelly	City of Damascus	City of Hardeeville	City of Hooper	City of Colville
	City of Dover	City of Dayton	City of Hartsville	City of Huntington	City of Connell
	City of Downey	City of Dayville	City of Inman	City of Hurricane	City of Cosmopolis
	City of Driggs	City of Depoe Bay	City of Isle of Palms	City of Hyde Park	City of Covington
	City of Dubois	City of Detroit	City of Johnsonville	City of Hyrum	City of Davenport
	City of Eagle	City of Donald	City of Lake City	City of Ivins	City of Dayton
	City of Eden	City of Drain	City of Lancaster	City of Kamas	City of Deer Park
	City of Elk River	City of Dundee	City of Landrum	City of Kanab	City of Des Moines
	City of Emmett	City of Dunes City	City of Laurens	City of Kaysville	City of DuPont
	City of Fairfield	City of Durham	City of Liberty	City of La Verkin	City of Duvall
	City of Fernan Lake Village	City of Eagle Point	City of Loris	City of Layton	City of East Wenatchee
	City of Filer	City of Echo	City of Manning	City of Lehi	City of Edgewood
	City of Firth	City of Elgin	City of Marion	City of Lewiston	City of Edmonds
	City of Franklin	City of Enterprise	City of Mauldin	City of Lindon	City of Electric City
	City of Fruitland	City of Estacada	City of Mullins	City of Logan	City of Ellensburg
	City of Garden City	City of Eugene	City of Myrtle Beach	City of Manti	City of Elma
	City of Genesee	City of Fairview	City of New Ellenton	City of Mapleton	City of Entiat
	City of Georgetown	City of Falls City	City of Newberry	City of Marriott-Slaterville	City of Enumclaw
	City of Glenns Ferry	City of Florence	City of North Augusta	City of Mendon	City of Ephrata
	City of Gooding	City of Forest Grove	City of North Charleston	City of Midvale	City of Everett
	City of Grace	City of Fossil	City of North Myrtle Beach	City of Midway	City of Everson
	City of Grand View	City of Garibaldi	City of Orangeburg	City of Milford	City of Federal Way
	City of Grangeville	City of Gaston	City of Pickens	City of Millville	City of Ferndale
	City of Greenleaf	City of Gates	City of Rock Hill	City of Moab	City of Fife
	City of Hagerman	City of Gearhart	City of Seneca	City of Mona	City of Fircrest
	City of Hailey	City of Gervais	City of Simpsonville	City of Monroe	City of Forks
	City of Hansen	City of Gladstone	City of Spartanburg	City of Monticello	City of George
	City of Harrison	City of Glendale	City of Sumter	City of Morgan	City of Gig Harbor
	City of Hayden	City of Gold Beach	City of Tega Cay	City of Moroni	City of Gold Bar
	City of Hazelton	City of Gold Hill	City of Travelers Rest	City of Mt. Pleasant City	City of Goldendale
	City of Heyburn	City of Grants Pass	City of Union	City of Murray	City of Grand Coulee
	City of Hollister	City of Greenhorn	City of Walhalla	City of Myton	City of Grandview
	City of Homedale	City of Gresham	City of Walterboro	City of Naples	City of Granger
	City of Hope	City of Haines	City of Wellford	City of Nephi	City of Granite Falls
	City of Horseshoe Bend	City of Halfway	City of West Columbia	City of Nibley	City of Harrington
	City of Huetter	City of Halsey	City of Westminster	City of North Logan	City of Hoquiam
	City of Idaho City	City of Happy Valley	City of Woodruff	City of North Ogden	City of Ilwaco
	City of Idaho Falls	City of Harrisburg	City of York	City of North Salt Lake	City of Issaquah
	City of Inkom	City of Helix	Town of Allendale	City of Oakley	City of Kahlotus
	City of Island Park	City of Heppner	Town of Andrews	City of Ogden	City of Kalama
	City of Jerome	City of Hermiston	Town of Atlantic Beach	City of Orangeville	City of Kelso
	City of Juliaetta	City of Hillsboro	Town of Awendaw	City of Orem	City of Kenmore
	City of Kamiah	City of Hines	Town of Aynor	City of Panguitch	City of Kennewick
	City of Kellogg	City of Hood River	Town of Batesburg-Leesville	City of Park City	City of Kent
	City of Kendrick	City of Hubbard	Town of Bethune	City of Parowan	City of Kettle Falls
	City of Ketchum	City of Huntington	Town of Blacksburg	City of Payson	City of Kirkland
	City of Kimberly	City of Idanha	Town of Blackville	City of Perry	City of Kittitas
	City of Kooskia	City of Imbler	Town of Blenheim	City of Plain City	City of La Center
	City of Kuna	City of Independence	Town of Bluffton	City of Pleasant Grove	City of Lacey
	City of Lapwai	City of Irrigon	Town of Blythewood	City of Pleasant View	City of Lake Forest Park
	City of Lava Hot Springs	City of Island City	Town of Bowman	City of Price	City of Lake Stevens
	City of Lewiston	City of Jacksonville	Town of Branchville	City of Providence	City of Lakewood
	City of Mackay	City of Jefferson	Town of Briarcliffe Acres	City of Provo	City of Langley
	City of Malad City	City of John Day	Town of Brunson	City of Richfield	City of Leavenworth
	City of Marsing	City of Johnson City	Town of Calhoun Falls	City of Richmond	City of Liberty Lake
	City of McCall	City of Joseph	Town of Cameron	City of River Heights	City of Long Beach
	City of McCammon	City of Junction City	Town of Campobello	City of Riverdale	City of Longview
	City of Melba	City of Keizer	Town of Central	City of Riverton	City of Lynden
	City of Menan	City of King City	Town of Chapin	City of Roosevelt	City of Lynnwood
	City of Meridian	City of Klamath Falls	Town of Cheraw	City of Roy	City of Mabton
	City of Middleton	City of La Grande	Town of Chesterfield	City of Salem	City of Maple Valley
	City of Midvale	City of La Pine	Town of Clio	City of Salina	City of Marysville
	City of Moscow	City of Lafayette	Town of Clover	City of Salt Lake City	City of Mattawa
	City of Mountain Home	City of Lake Oswego	Town of Cottageville	City of Sandy	City of McCleary
	City of Mullan	City of Lakeside	Town of Coward	City of Santa Clara	City of Medical Lake
	City of Murtaugh	City of Lebanon	Town of Cowpens	City of Santaquin	City of Medina
	City of Nampa	City of Lincoln City	Town of Denmark	City of Saratoga Springs	City of Mercer Island
	City of New Meadows	City of Lonerock	Town of Donalds	City of Smithfield City	City of Mesa
	City of New Plymouth	City of Lostine	Town of Due West	City of South Jordan	City of Mill Creek
	City of Newdale	City of Lowell	Town of Duncan	City of South Ogden	City of Milton
	City of Nezperce	City of Lyons	Town of Eastover	City of South Salt Lake City	City of Monroe
	City of Notus	City of Madras	Town of Edgefield	City of South Weber	City of Montesano
	City of Orofino	City of Malin	Town of Edisto Beach	City of Spanish Fork	City of Morton
	City of Osburn	City of Manzanita	Town of Ehrhardt	City of Spring City	City of Moses Lake
	City of Parker	City of Maupin	Town of Elgin	City of Springville	City of Mossyrock
	City of Parma	City of McMinnville	Town of Elloree	City of St. George	City of Mountlake Terrace
	City of Paul	City of Medford	Town of Estill	City of Sunnyside	City of Moxee
	City of Payette	City of Metolius	Town of Eutawville	City of Sunset	City of Mt. Vernon
	City of Pierce	City of Mill City	Town of Fairfax	City of Syracuse	City of Mukilteo
	City of Pinehurst	City of Millersburg	Town of Ft. Mill	City of Taylorsville	City of Napavine
	City of Plummer	City of Milton-Freewater	Town of Furman	City of Tooele	City of Newcastle
	City of Pocatello	City of Milwaukie	Town of Gaston	City of Toquerville	City of Newport
	City of Ponderay	City of Molalla	Town of Gifford	City of Tremonton	City of Nooksack
	City of Post Falls	City of Monmouth	Town of Gilbert	City of Tropic	City of Normandy Park
	City of Potlatch	City of Monroe	Town of Govan	City of Uintah	City of North Bend
	City of Preston	City of Monument	Town of Gray Court	City of Vernal	City of North Bonneville
	City of Priest River	City of Moro	Town of Great Falls	City of Washington	City of Oak Harbor
	City of Rathdrum	City of Mosier	Town of Greeleyville	City of Washington Terrace	City of Oakville
	City of Reubens	City of Mt. Angel	Town of Hampton	City of Wellington	City of Ocean Shores

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
	City of Rexburg	City of Mt. Vernon	Town of Harleyville	City of Wellsville	City of Okanogan
	City of Richfield	City of Myrtle Creek	Town of Heath Springs	City of Wendover	City of Olympia
	City of Rigby	City of Myrtle Point	Town of Hemingway	City of West Bountiful	City of Omak
	City of Riggins	City of Nehalem	Town of Hilda	City of West Haven City	City of Oroville
	City of Ririe	City of Newberg	Town of Hilton Head Island	City of West Jordan	City of Orting
	City of Roberts	City of Newport	Town of Hodges	City of West Point	City of Othello
	City of Rockland	City of North Bend	Town of Holly Hill	City of West Valley City	City of Pacific
	City of Rupert	City of North Plains	Town of Hollywood	City of Willard	City of Palouse
	City of Salmon	City of North Powder	Town of Honea Path	City of Woodland Hills	City of Pasco
	City of Sandpoint	City of Nyssa	Town of Irmo	City of Woods Cross	City of Pateros
	City of Shelley	City of Oakland	Town of Iva	Town of Alta	City of Pomeroy
	City of Shoshone	City of Oakridge	Town of Jackson	Town of Altamont	City of Port Angeles
	City of Smelterville	City of Ontario	Town of James Island	Town of Alton	City of Port Orchard
	City of Soda Springs	City of Oregon City	Town of Jamestown	Town of Amalga	City of Port Townsend
	City of Spirit Lake	City of Paisley	Town of Jefferson	Town of Annabella	City of Poulsbo
	City of St. Anthony	City of Pendleton	Town of Jenkinsville	Town of Antimony	City of Prosser
	City of St. Charles	City of Philomath	Town of Johnston	Town of Apple Valley	City of Pullman
	City of Stanley	City of Phoenix	Town of Jonesville	Town of Ballard	City of Puyallup
	City of Star	City of Pilot Rock	Town of Kershaw	Town of Bear River City	City of Quincy
	City of Stites	City of Port Orford	Town of Kiawah Island	Town of Bicknell	City of Rainier
	City of Sugar City	City of Portland	Town of Kingstree	Town of Big Water	City of Raymond
	City of Sun Valley	City of Powers	Town of Lake View	Town of Boulder	City of Redmond
	City of Tensed	City of Prairie City	Town of Lamar South Carolina	Town of Brian Head	City of Renton
	City of Tetonia	City of Prineville	Town of Lane	Town of Bryce Canyon City	City of Republic
	City of Troy	City of Rainier	Town of Latta	Town of Cannonville	City of Richland
	City of Twin Falls	City of Redmond	Town of Lexington	Town of Castle Valley	City of Ridgefield
	City of Ucon	City of Reedsport	Town of Lincolnville	Town of Cedar Fort	City of Ritzville
	City of Victor	City of Richland	Town of Little Mountain	Town of Centerfield	City of Rock Island
	City of Wallace	City of Riddle	Town of Lockhart	Town of Central Valley	City of Roslyn
	City of Weippe	City of Rockaway Beach	Town of Lyman	Town of Circleville	City of Roy
	City of Weiser	City of Rogue River	Town of Lynchburg	Town of Clarkston	City of Royal City
	City of Wendell	City of Roseburg	Town of Mayesville	Town of Clawson	City of Sammamish
	City of Weston	City of Rufus	Town of McBee	Town of Cleveland	City of SeaTac
	City of White Bird	City of Salem	Town of McClellanville	Town of Cornish	City of Seattle
	City of Wilder	City of Sandy	Town of McColl	Town of Daniel	City of Sedro-Woolley
	City of Winchester	City of Scappoose	Town of McCormick	Town of Deweyville	City of Selah
	Higher Education	City of Scio	Town of Meggett	Town of Eagle Mountain	City of Sequim
	Boise State University	City of Scotts Mills	Town of Moncks Corner	Town of Elmo	City of Shelton
	College of Southern Idaho	City of Seaside	Town of Mt. Pleasant	Town of Elsinore	City of Shoreline
	College of Western Idaho	City of Seneca	Town of Neeses	Town of Elwood	City of Snohomish
	Eastern Idaho Technical College	City of Shady Cove	Town of New Ellenton	Town of Emery	City of Snoqualmie
	Idaho Division of Professional Technical Education	City of Sheridan	Town of Nichols	Town of Fairfield	City of Soap Lake
	Idaho State University	City of Sherwood	Town of Ninety Six	Town of Francis	City of South Bend
	Lewis-Clark State College	City of Siletz	Town of Norris	Town of Garden City	City of Spokane
	North Idaho College	City of Silverton	Town of North	Town of Genola	City of Spokane Valley
	University of Idaho	City of Sisters	Town of Norway	Town of Glendale	City of Sprague
	Education (K-12)	City of Sodaville	Town of Olanta	Town of Glenwood	City of Stanwood
	Aberdeen School District No. 58	City of Spray	Town of Pacolet	Town of Goshen	City of Stevenson
	Arbon Elementary School District No. 383	City of Springfield	Town of Pageland	Town of Hanksville	City of Sultan
	Avery School District	City of St. Helens	Town of Pamplico	Town of Hatch	City of Sumas
	Basin School District No. 72	City of St. Paul	Town of Patrick	Town of Henefer	City of Sumner
	Bear Lake County School District No. 33	City of Stanfield	Town of Pawleys Island	Town of Henrieville	City of Sunnyside
	Bear Lake School District No. 33	City of Stayton	Town of Pelion	Town of Hideout	City of Tacoma
	Blackfoot School District No. 55	City of Sublimity	Town of Pelzer	Town of Hinckley	City of Tekoa
	Blaine County School District No. 61	City of Sumpter	Town of Pendleton	Town of Holden	City of Tenino
	Bliss Joint School District No. 234	City of Sutherlin	Town of Perry	Town of Howell	City of Tieton
	Bonneville Joint School District No. 93	City of Sweet Home	Town of Port Royal	Town of Huntsville	City of Toledo
	Boundary County School District No. 101	City of Talent	Town of Prosperity	Town of Joseph	City of Tonasket
	Bruneau-Grand View Joint School District	City of Tangent	Town of Ravenel	Town of Junction	City of Toppenish
	Buhl Joint School District No. 412	City of The Dalles	Town of Reidville	Town of Kanarraville	City of Tukwila
	Butte County Joint School District No. 111	City of Tigard	Town of Ridge Spring	Town of Kanosh	City of Tumwater
	Caldwell School District No. 132	City of Tillamook	Town of Ridgeland	Town of Kingston	City of Union Gap
	Camas County School District No. 121	City of Toledo	Town of Ridgeville	Town of Koosharem	City of University Place
	Cambridge School District	City of Troutdale	Town of Ridgeway	Town of Leeds	City of Vader
	Cascade School District No. 422	City of Tualatin	Town of Saint Matthews	Town of Levan	City of Vancouver
	Cassia County Joint School District No. 151	City of Turner	Town of Saint Stephen	Town of Loa	City of Waitsburg
	Castleford Joint School District No. 417	City of Ukiah	Town of Salem	Town of Manila	City of Walla Walla
	Challis Joint School District No. 181	City of Umatilla	Town of Salley	Town of Mantua	City of Wapato
	Clark County School District No. 161	City of Union	Town of Saluda	Town of Marysvale	City of Warden
	Coeur d'Alene School District No. 271	City of Unity	Town of Santee	Town of Meadow	City of Washougal
	Cottonwood Joint School District No. 242	City of Vale	Town of Scranton	Town of Minersville	City of Wenatchee
	Council School District No. 13	City of Veneta	Town of Seabrook Island	Town of New Harmony	City of West Richland
	Culdesac Joint School District No. 342	City of Vernonia	Town of Sellers	Town of Newton	City of Westport
	Dietrich School District No. 314	City of Waldport	Town of Sharon	Town of Ophir	City of White Salmon
	Emmett Independent School District No. 221	City of Wallowa	Town of Six Mile	Town of Orderville	City of Winlock
	Filer School District No. 413	City of Warrenton	Town of Snelling	Town of Paradise	City of Woodinville
	Firth School District No. 59	City of Wasco	Town of Society Hill	Town of Paragonah	City of Woodland
	Fremont County School District No. 215	City of West Linn	Town of South Congaree	Town of Portage Utah	City of Yakima/Yakima County
	Fruitland School District No. 373	City of Westfir	Town of Springdale	Town of Randolph	City of Yelm
	Garden Valley School District	City of Weston	Town of St. George	Town of Redmond	City of Zillah
	Genesee Joint School District No. 282	City of Wheeler	Town of St. Matthews	Town of Rockville	Consolidated Borough of Quil Ceda Village
	Glenns Ferry Joint School District No. 192	City of Willamina	Town of Stuckey	Town of Rocky Ridge	Grays Harbor Council of Governments
	Gooding Joint School District No. 231	City of Wilsonville	Town of Sullivans Island	Town of Rush Valley	Town of Almira
	Grace Joint School District No. 148	City of Winston	Town of Summerton	Town of Scipio	Town of Beaux Arts Village
	Hagerman Joint School District No. 233	City of Wood Village	Town of Summerville	Town of Scofield	Town of Bucoda
	Hansen School District No. 415	City of Woodburn	Town of Summit	Town of Sigurd	Town of Carbonado
	Highland Joint School District No. 305	City of Yachats	Town of Surfside Beach	Town of Springdale	Town of Cathlamet
	Homedale School District No. 370	City of Yamhill	Town of Swansea	Town of Stockton	Town of Clyde Hill
	Horseshoe Bend School District No. 73	City of Yoncalla	Town of Timmonsville	Town of Toquerville	Town of Colton
	Idaho Falls School District No. 91	Town of Bonanza	Town of Trenton	Town of Torrey	Town of Conconully
	Independent School District of Boise City	Town of Butte Falls	Town of Turbeville	Town of Trenton	Town of Concrete
	Jefferson County School District No. 251	Town of Canyon City	Town of Ulmer	Town of Tropic	Town of Coulee City
	Jerome Joint School District No. 261	Town of Lakeview	Town of Varnville	Town of Uintah	Town of Coulee Dam
	Joint School District No. 2	Town of Lexington	Town of Wagener	Town of Vernon	Town of Coupeville

Hawaii

Idaho

Kamiah School District No. 304
Kellogg Joint School District 391
Kendrick Joint School District No. 283
Kimberly School District No. 414
Kootenai School District No. 274
Kuna Joint School District No. 3
Lake Pend Oreille School District No. 84
Lakeland School District No. 272
Lapwai School District No. 341
Lewiston Independent School District No. 1
Mackay School District No. 182
Madison School District No. 321
Marsh Valley Joint School District No. 21
Marsing Joint School District No. 363
McCall-Donnelly Joint School District No. 421
Meadows Valley School District No. 11
Melba School District No. 136
Middleton School District No. 134
Midvale School District No. 433
Minidoka County School District No. 331
Moscow School District No. 281
Mountain Home School District No. 193
Mountain View School District No. 244
Mullan School District 392
Murtaugh Joint School District No. 418
Nampa Christian Schools Inc.
Nampa School District No. 131
New Plymouth School District
Nez Perce Joint School District No. 302
North Gem School District No. 149
Notus School District
Oneida County School District No. 351
Orofino Joint School District No. 171
Parma School District No. 137
Payette School District No. 371
Plummer-Worley Joint School District No. 44
Pocatello-Chubbuck School District No. 25
Post Falls School District No. 273
Potlatch School District No. 285
Preston Joint School District No. 201
Richfield School District No. 316
Ririe Joint School District No. 252
Rockland School District No. 382
Salmon River Joint School District No. 243
Salmon School District No. 291
Shelley School District No. 60
Shoshone Joint School District No. 312
Snake River School District
Soda Springs Joint School District No. 150
South Lemhi School District No. 292
St. Maries Joint School District No. 41
Sugar-Salem Joint District No. 322
Swan Valley Elementary School District No. 33
Swan Valley School District No. 92
Teton County School District No. 401
Three Creek Joint School District No. 416
Troy School District No. 287
Twin Falls School District No. 411
Valley School District No. 262
Vallivue School District No. 139
Vision Charter School District # 463
Wallace School District No. 393
Weiser School District No. 431
Wendell School District No. 232
West Bonner County School District No. 83
West Jefferson School District No. 253
West Side School District No. 202
Whitepine Joint School District No. 288
Wilder School District No. 133

Special District

Ada County Emergency Medical Services District
Ada County Highway District
Adams County Recreation District
Ahsahka Water and Sewer District
Albion Highway District
Alpine Meadows Water and Sewer District
American Falls Free Library District
American Falls Housing Authority
Atlanta Highway District
Avery Water and Sewer District
Avondale Irrigation District
Bayview Water and Sewer District
Bear Lake County Library District
Bench Sewer District
Benewah County Free Library District
Big Canyon Fire District
Blaine County Housing Authority
Blaine County Recreation District
Bliss Fire District
Boise Basin Library District
Boise City/Ada County Housing Authority
Boise-Kung Irrigation District
Bonneville County Fire District No. 1
Bruneau Valley District Library

Oregon

Higher Education

Blue Mountain Community College
Central Oregon Community College
Chemeketa Community College
Clackamas Community College
Clatsop Community College
Columbia Gorge Community College
Eastern Oregon University
Klamath Community College District
Lane Community College
Linn-Benton Community College
Mt. Hood Community College
Oregon Coast Community College
Oregon Department of Community Colleges and Workforce Development
Oregon Health and Science University
Oregon Institute of Technology
Oregon State University
Oregon State University, Oregon Agricultural Experiment Station
Oregon University System
Portland Community College
Portland State University
Reed College
Rogue Community College
Southern Oregon University
Southern Oregon University Family Housing
Southwestern Oregon Community College
Tillamook Bay Community College
Treasure Valley Community College
Umpqua Community College
University of Oregon
Western Oregon University

Education (K-12)

Adel School District 21
Adrian School District
Alsea School District No. 7J
Amity School District 4J
Annex School District 29
Arlington School District No. 3
Arock School District No. 81
Ashland School District No. 5
Ashwood School District
Astoria School District No. 1C
Athena-Weston School District No. 29RJ
Baker School District No. 5J
Bandon School District
Banks School District No. 13
Beaverton School District No. 48
Bend-La Pine Public Schools
Bethel School District No. 52
Blachly School District
Blachly School District 90
Brookings Harbor School District
Camas Valley School District
Canby School District No. 86
Cascade School District No. 5
Centennial School District No. 28J
Central Curry School District No. 1
Central Linn School District
Central Point School District No. 6
Central School District No. 13J
Clackamas Education Service District
Clatskanie School District No. 6J
Colton School District No. 53
Columbia Gorge Education Service District
Condon School District No. 25J
Coos Bay School District No. 9
Coquille School District No. 8
Corbett School District No. 39
Corvallis School District No. 509J
Cove School District No. 15
Crane Elementary School District
Creswell School District No. 40
Crook County School District
Crow-Applegate-Lorane School District No. 66
Culver School District No. 4
Dallas School District No. 2
David Douglas School District No. 40
Dayton School District No. 8
Dayville School District No. 16J
Douglas County School District
Douglas County School District No. 4
Douglas Education Service District
Dufur School District No. 29
Eagle Point School District No. 9
Echo School District No. 5
Elgin School District
Elkton School District No. 34
Enterprise School District No. 21
Estacada School District No. 108
Eugene School District No. 4J
Falls City School District
Fern Ridge School District No. 28J
Forest Grove School District
Fossil School District 21J

South Carolina

Town of Ward
Town of Ware Shoals
Town of West Pelzer
Town of West Union
Town of Whitmire
Town of Williamston
Town of Williston
Town of Winnsboro
Town of Yemassee

Higher Education

Aiken Technical College
Beaufort Jasper Higher Education Commission
Central Carolina Technical College
Clemson University
Coastal Carolina University
College of Charleston
Denmark Technical College
Florence-Darlington Technical College
Francis Marion University
Greenville Technical College
Horry-Georgetown Technical College
Lander University
Medical University of South Carolina
Midlands Technical College
Northeastern Technical College
Orangeburg-Calhoun Technical College
Piedmont Technical College
South Carolina State Board for Technical and Comprehensive Education
South Carolina State University
South Carolina Technical College System
Spartanburg Community College
Technical College of the Lowcountry
The Citadel
Tri-County Technical College
Trident Technical College
University of South Carolina
University of South Carolina, Aiken
University of South Carolina, Upstate
Williamsburg Technical College
Winthrop University
York Technical College

Education (K-12)

Abbeville County School District
Aiken County Public Schools
Allendale County School District
Anderson County School Districts 1 and 2 Career and Technology Center
Anderson School District No. 1
Anderson School District No. 2
Anderson School District No. 3
Anderson School District No. 4
Anderson School District No. 5
Bamberg School District No. 1
Bamberg School District No. 2
Barnwell School District No. 45
Beaufort County School District
Berkeley County School District
Blackville-Hilda Public Schools
Calhoun County School District
Charleston County School District
Cherokee County School District
Chester County School District
Chesterfield County School District
Clarendon County School District No. 1
Clarendon County School District No. 2
Clarendon County School District No. 3
Clover School District No. 2
Colleton County School District
Darlington County School District
Delta R-V School District
Dillon County School District No. 1
Dillon County School District No. 2
Dillon County School District No. 3
Dillon County School District No. 4
Diocese Of Charleston Schools
Dorchester School District No. 2
Dorchester School District No. 4
Edgefield County Schools
Fairfield County School District
Florence County School District No. 1
Florence County School District No. 2
Florence County School District No. 3
Florence County School District No. 4
Florence County School District No. 5
Ft. Mill School District No. 4
Georgetown County School District
Greenville County School District
Greenwood School District No. 50
Greenwood School District No. 52
Hampton County School District No. 2
Hampton School District No. 1
Horry County Schools
Jasper County School District
John de la Howe School District
Kershaw County School District

Utah

Town of Vineyard
Town of Virgin
Town of Wales
Town of Wallsburg
Uintah Basin Association of Governments

Higher Education

College of Eastern Utah
Davis Applied Technology College
Dixie Applied Technology College
Dixie State University
Mountainland Applied Technology College
Rocky Mountain University of Health Professions
Salt Lake Community College
Snow College
Southern Utah University
Tooele Applied Technology College
Uintah Basin Applied Technology College
University of Utah
University of Utah Hospitals and Clinics
Utah State University
Utah System of Higher Education
Utah Valley University
Weber State University

Education (K-12)

Alpine School District
Beaver County School District
Box Elder School District
Cache County School District
Canyons School District
Carbon School District
Centro De La Familia De Utah Head Start Program School District
Daggett School District
Davis School District
Duchesne County School District
Emery County School District
Freedom Preparatory Academy School District
Garfield County School District
Grand County School District
Granite School District
Iron County School District
Jordan School District
Juab School District
Kane County School District
Logan City School District
Millard School District
Morgan School District
Mountainland Head Start Program School District Office
Murray City School District
Nebo School District
North Sanpete County School District
North Sanpete School District
North Summit School District
Ogden City School District
Park City School District
Piute County School District
Provo City School District
Rich County School District
Rich School District
Rural Utah Child Development Head Start Program School District Office
Salt Lake City School District
San Juan School District
Sevier School District
South Sanpete School District
South Summit School District
Sus Head Start Program School District
Thomas Edison Charter Schools
Tintic School District
Tooele County School District
Uintah School District
Wasatch County School District
Washington County School District
Wayne County School District
Weber School District

Special District

Ash Creek Special Service District
Ashley Valley Water and Sewer Improvement District
Ballard Water and Sewer Improvement District
Bear Lake Special Service District
Bear River Water Conservancy District
Benchland Water District
Benson Culinary Water Improvement District
Bona Vista Water Improvement District
Cache Mosquito Abatement District
Cache Valley Transit District
Canyonlands Health Care Special Service District
Carbon County Housing Authority
Carbon County Municipal Building Authority
Carbon County Recreation Transportation Special Service District
Carbon Water Conservancy District
Castle Valley Special Service District
Cedar City Housing Authority
Cedar Mountain Fire Protection District
Cedarview-Montwell Special Service District
Central Davis County Sewer District

Washington

Town of Creston
Town of Cusick
Town of Darrington
Town of Eatonville
Town of Elmer City
Town of Endicott
Town of Fairfield
Town of Farmington
Town of Friday Harbor
Town of Garfield
Town of Hamilton
Town of Harrah
Town of Hatton
Town of Hunts Point
Town of Index
Town of Ione
Town of La Conner
Town of LaCrosse
Town of Lamont
Town of Latah
Town of Lind
Town of Lyman
Town of Malden
Town of Mansfield
Town of Marcus
Town of Metaline
Town of Millwood
Town of Naches
Town of Nespelem
Town of Northport
Town of Oakesdale
Town of Odessa
Town of Pe Ell
Town of Prescott
Town of Reardan
Town of Riverside
Town of Rockford
Town of Rosalia
Town of Ruston
Town of Skykomish
Town of South Cle Elum
Town of South Prairie
Town of Spangle
Town of Springdale
Town of St. John
Town of Steilacoom
Town of Twisp
Town of Uniontown
Town of Washtucna
Town of Waterville
Town of Waverly
Town of Wilbur
Town of Wilkeson
Town of Wilson Creek
Town of Winthrop
Town of Woodway
Town of Yacolt
Town of Yarrow Point

Higher Education

Bates Technical College
Bellevue Community College
Bellingham Technical College
Big Bend Community College
Cascadia Community College
Central Washington University
Centralia College
Clark College
Clover Park Technical College
Columbia Basin Community College
Community Colleges of Spokane
Eastern Washington University
Edmonds Community College
Everett Community College
Evergreen State College
Grays Harbor College
Green River Community College
Highline Community College
Lake Washington Institute of Technology
Lower Columbia College
Northwest Indian College
Olympic College
Peninsula College
Pierce College
Renton Technical College
Seattle Community Colleges District VI
Shoreline Community College
Skagit Valley College
South Puget Sound Community College
Tacoma Community College
University of Washington
Walla Walla Community College
Washington State Board for Community and Technical Colleges
Washington State Higher Education Facilities Authority
Washington State Student Achievement Council

Hawaii

Idaho

Bruneau Water and Sewer District
Buhl Highway District
Buhl Rural Fire Protection District
Burley Highway District
Caldwell Housing Authority
Canyon Highway District No. 4
Cascade Rural Fire District
Castleford Rural Fire District
Central Fire District
Central Orchards Sewer District
Central Shoshone County Water District
Clark County District Library
Clarkia Free Library District
Clarkia Highway District
Clearwater Free Library District
Clearwater Highway District
Clearwater Soil and Water Conservation District
Clearwater Water District
Consolidated Free Library District
Cottonwood Highway District
Custer Soil and Water Conservation District
Dietrich Fire District
Dietrich Highway District
Doumecq Highway District
Downey Swan Lake Highway District
Dry Creek Cemetery Maintenance District
Eagle Fire Protection District
Eagle Sewer District
East Bonner County Free Library District
East Bonner County Library District
East Greenacres Irrigation District
Eastern Idaho Public Health District
Eastern Idaho Regional Wastewater Authority
Elk River Free Library District
Elmore Soil and Water Conservation District
Fenn Highway District
Ferdinand Highway District
Fish Haven Mosquito Abatement District
Fremont County District Library
Friedman Memorial Airport Authority
Garden Valley District Library
Garden Valley Fire Protection District
Garden Valley Recreation District
Gateway Fire Protection District
Gem County Fire Protection District
Gem County Mosquito Abatement District
Glenns Ferry Highway District
Golden Gate Highway District No. 3
Gooding County Memorial Hospital District
Grace District Library
Grangeville Highway District
Granite Reeder Water and Sewer District
Greater Boise Auditorium District
Greater Middleton Parks and Recreation District
Greater Swan Valley Fire Protection District No. 2
Groveland Water and Sewer District
Harbor View Estates Water and Sewer District
Hayden Lake Irrigation District
Hayden Lake Recreational Water and Sewer District
Hillsdale Highway District
Homedale Highway District
Hoo Doo Water and Sewer District
Horseshoe Bend Fire Protection District
Idaho Soil and Water Conservation District
Indian Valley Rural Fire District
Iona-Bonneville Sewer District
Island Park Fire District
Jerome Highway District
Jerome Recreation District
Jerome Rural Fire District No. 1
Kamiah Fire Protection District
Kamiah Highway District
Ketchum Rural Fire Protection District
Kidder Harris Highway District
Kingston Water District
Kootenai County Water District No. 1
Kootenai Ponderay Sewer District
Kootenai-Shoshone Soil and Water Conservation District
Kuna Library District
Laclede Water District
Lakes Highway District
Latah County Library District
Latah Soil and Water Conservation District
Lemhi Soil and Water Conservation District
Lewiston Orchards Irrigation District
Lewiston-Nez Perce County Regional Airport Authority
Lincoln County Recreation District
Little Blacktail Ranch Water District
Little Wood River Library District
Lizard Butte Library District
Lost River Highway District
M&T Water and Sewer District
Mackay Free Library District
Madison Library District

Oregon

Gaston School District 511 J
Gervais School District
Gladstone School District
Glendale School District No. 77
Glide School District
Grant County Education Service District
Grant School District No. 3
Grants Pass School District No. 7
Greater Albany Public School District 8J
Gresham-Barlow School District
Harney County School District No. 3
Harney Education Service District
Harper School District No. 66
Harrisburg School District No. 7
Helix School District No. 1-R
Hermiston School District
High Desert Education Service District
Hillsboro School District No. 1J
Hood River County School District
Huntington School District No. 16J
Imbler School District No. 11
InterMountain Education Service District
Ione School District R2
Jackson County School District No. 9
Jackson Education Service District
Jefferson County School District No. 509-J
Jefferson School District
Jewell School District No. 8
John Day School District No. 3
Jordan Valley School District No. 3
Joseph School District No. 6
Junction City School District No. 69
Klamath County School District
Klamath Falls City Schools
Knappa School District
La Grande School District No. 1
Lake County School District No. 7
Lake Ed Service District
Lake Oswego School District No. 7J
Lakeview School District No. 7
Lane Education Service District
Lebanon Community School District No. 9
Lincoln County School District
Linn-Benton-Lincoln Education Service District
Long Creek School District No. 17
Lowell School District No. 71
Mapleton School District No. 32
Marcola School District No. 79J
McKenzie School District
McMinnville School District No. 40
Medford School District No. 549C
Milton-Freewater School District No. 7
Mitchell School District No. 55
Molalla River School District
Monument School District
Morrow County School District
Mt. Angel School District
Multnomah Education Service District Consortium
Myrtle Point School District
Neah-Kah-Nie School District No. 56
Nestucca Valley School District No. 101
New Hope Christian Schools
Newberg School District No. 29J
North Bend School District No. 13
North Central Education Service District
North Clackamas School District No. 12
North Douglas School District No. 22
North Lake School District
North Marion School District No. 15
North Santiam School District No. 29
North Wasco County School District No. 21
Northwest Regional Education Service District
Nyssa School District No. 26
Oakland School District
Oakridge School District No. 76
Ontario School District No. 8C
Oregon City School District No. 62
Oregon Trail School District No. 46
Paisley School District No. 11
Parkrose School District No. 3
Pendleton School District No. 16
Perrydale School District No. 21J
Philomath School District No. 17J
Phoenix-Talent School District
Pilot Rock School District No. 2
Pine Eagle School District No. 61
Pinehurst School District
Pleasant Hill School District
Plush School District 18
Port Orford-Langlois School District No. 2CJ
Portland Public School District No. 1
Powers School District No. 31
Prairie City School District No. 4
Prospect School District

South Carolina

Lancaster County School District
Laurens County School District No. 55
Laurens County School District No. 56
Lee County School District
Legacy Charter Schools
Lexington County School District No. 1
Lexington County School District No. 2
Lexington County School District No. 3
Lexington County School District No. 4
Lexington-Richland Counties School District No. 5
Marion County School District
Marion County School District No. 7
Marlboro County School District
McCormick County School District
Newberry County School District
Oconee County School District
Orangeburg Consolidated School District Four
Orangeburg County Consolidated School District No. 3
Orangeburg County Consolidated School District No. 5
Pickens County School District
Richland County School District No. 1
Richland County School District No. 2
Rock Hill School District No. 3
Saluda School District No. 1
South Carolina Public Charter School District
Spartanburg County School District No. 1
Spartanburg County School District No. 2
Spartanburg County School District No. 3
Spartanburg County School District No. 4
Spartanburg County School District No. 5
Spartanburg County School District No. 6
Spartanburg County School District No. 7
Sumter School District
Sumter School District No. 17
Sumter School District No. 2
Union County School District
Ware Shoals School District No. 51
Williamsburg County Schools
Williston School District No. 29
York School District No. 1

Special District

Abbeville Housing Authority
Aiken Housing Authority
Anderson Housing Authority
Atlantic Beach Housing Authority
Beaufort Housing Authority
Beaufort-Jasper Water and Sewer Authority
Beech Island Rural Community Water District
Belton-Honea Path Water Authority
Bennettsville Housing Authority
Berea Public Service District
Berkeley County Water and Sanitation Authority
Big Creek Water and Sewerage District
Bluffton Township Fire District
Boiling Springs Fire District, Greenville County
Broad Creek Public Service District
Buffalo-Mt. Pisgah Fire Protection District
Burton Fire District
Central Midlands Regional Transit Authority
Charleston Area Regional Transportation Authority
Charleston County Aviation Authority
Charleston County Housing and Redevelopment Authority
Charleston Housing Authority
Charleston Naval Complex Redevelopment Authority
Charleston Soil and Water Conservation District
Cheraw Housing Authority
Chester Housing Authority
Chester Metropolitan District
Chester Sewer District
Coast Regional Transportation Authority
Columbia Housing Authority
Conway Housing Authority
Daniel Morgan Water District
Darlington County Fire District
Darlington County Water and Sewer Authority
Darlington Housing Authority
Donalds-Due West Water and Sewer Authority
Dorchester County Sales Tax Transportation Authority
Dorchester County Water Authority
Duncan Chapel Fire District
Easley Housing Authority
Easley-Central Water District
East Richland County Public Service District
Edgefield County Water and Sewer Authority
Florence Housing Authority
Fort Mill Housing Authority
Fripp Island Public Service District
Gaffney Housing Authority
Gaston Rural Community Water District
Georgetown County Water and Sewer District
Georgetown Housing Authority
Gilbert-Summit Rural Water District
Grand Strand Water and Sewer Authority
Greenville Arena District

Utah

Central Iron County Water Conservancy District
Central Utah Water Conservancy District
Central Weber Sewer Improvement District
Charleston Water Conservancy District
Copperton Improvement District
Cottonwood Improvement District
Davis Community Housing Authority
Davis County Housing Authority
Davis-Salt Lake Aerial Spray Authority
Duchesne County Upper Country Water Improvement District
Duchesne County Water Conservancy District
Emery County Housing Authority
Emery County Municipal Building Authority
Emery County Special Service District No. 1
Emery Water Conservancy District
Emigration Improvement District
Fruitland Special Service District
Garden City Fire District
Grand County Housing Authority
Granger-Hunter Improvement District
Heber Valley Special Service District
Hooper Water Improvement District
Jensen Water Improvement District
Johnson Water Improvement District
Jordan Valley Water Conservancy District
Jordanelle Special Service District
Juab Special Service Fire District
Kane County Water Conservancy District
Kearns Improvement District
Lake Point Improvement District
Logan-Cache Airport Authority
Maeser Water and Sewer Improvement District
Magna Mosquito Abatement District
Magna Water District
Metropolitan Water District of Salt Lake and Sandy
Midvalley Improvement District
Midway Sanitation District
Milford Area Healthcare Service District
Moab Mosquito Abatement District
Moab Valley Fire Protection District
Mountain Green Sewer Improvement District
Mountain Regional Water Special Service District
Mountain View Special Service District
Mt. Olympus Improvement District
North Davis County Sewer District
North Davis Fire District
North Emery Water Users Special Service District
North Fork Special Services District
North Pointe Solid Waste Special Service District
North Summit Fire District
North Tooele County Fire Protection District
North Utah Water Conservancy District
North View Fire District
Ogden Housing Authority
Ouray Park Water Improvement District
Park City Fire Service District
Price River Water Improvement District
Provo Housing Authority
Rockville/Springdale Fire Protection District
Roosevelt City Housing Authority
Salt Lake City Housing Authority
Salt Lake City Mosquito Abatement District
Salt Lake County Housing Authority
Sandy Suburban Improvement District
Scofield Reservoir Special Service District
Sevier County Special Service District No. 1
Skyline Mountain Special Service District
Snyderville Basin Special Recreation District
Snyderville Basin Water Reclamation District
Solid Waste Special Service District No. 1
South Davis Sewer District
South Davis Water District
South Ogden Conservation District
South Salt Lake Valley Mosquito Abatement District
South Summit Fire Protection District
South Utah Valley Solid Waste District
South Valley Sewer District
Southeastern Utah Housing Authority
Spanish Valley Water and Sewer Improvement District
St. George Housing Authority
Stansbury Park Improvement District
Strawberry Electric Service District
Sugar House Park Authority
Tabby Valley Park Special Service District
Taylorsville-Bennion Improvement District
Thompson Special Service District
Timpanogos Special Service District
Tooele County Housing Authority
Tooele County Recreation Special Service District
Tridell-Lapoint Water Improvement District
Uintah Animal Control and Shelter Special Service District
Uintah County Municipal Building Authority
Uintah Fire Suppression Special Service District
Uintah Health Care Special Service District

Washington

Washington State University
Washington State University, Vancouver
Wenatchee Valley College
Western Washington University
Whatcom Community College
Yakima Valley Community College

Education (K-12)

Aberdeen School District No. 5
Adna School District No. 226
Almira School District No. 17
Anacortes School District No. 103
Arlington Public Schools
Asotin-Anatone School District
Auburn School District No. 408
Bainbridge Island School District No. 303
Battle Ground School District No. 119
Bellevue Christian School District
Bellevue School District No. 405
Bellingham School District No. 501
Benge School District No. 122
Bethel School District No. 403
Bickleton School District
Blaine School District No. 503
Boistfort School District No. 234
Bremerton School District
Brewster School District No. 111
Bridgeport School District No. 75
Brinnon School District No. 46
Burlington-Edison School District No. 100
Camas School District
Cape Flattery School District No. 401
Capital Region Educational Service District No. 113
Carbonado Historical School District No. 19
Cascade Christian Schools
Cascade School District No. 228
Cashmere School District No. 222
Castle Rock School District No. 401
Central Kitsap School District No. 401
Central Valley School District No. 356
Centralia School District No. 401
Chehalis School District No. 302
Cheney School District No. 360
Chewelah School District No. 36
Chief Leschi School System
Chimacum School District No. 49
Clarkston School District No. J250-185
Cle Elum-Roslyn School District
Clover Park School District No. 400
Colfax School District No. 300
College Place School District No. 250
Colton School District No. 306
Columbia School District No. 206
Columbia School District No. 206, Stevens County
Columbia School District No. 400
Colville School District No. 115
Concrete School District No. 11
Conway Consolidated School District No. 317
Cosmopolis School District
Coulee-Hartline School District No. 151
Coupeville School District No. 204
Crescent School District
Creston School District No. 73
Curlew School District No- 50
Cusick School District
Darrington School District No. 330
Davenport School District No. 207
Dayton School District No. 2
Deer Park School District No. 414
Dieringer School District
Dixie School District
East Valley School District No. 361
East Valley School District No. 361, Spokane County
East Valley School District No. 90, Yakima County
Eastmont School District No. 206
Eatonville School District No. 404
Edmonds School District No. 15
Educational Service District No. 112
Ellensburg School District No. 401
Elma School District No. 68
Endicott School District No. 308
Entiat School District No. 127
Enumclaw School District No. 216
Ephrata School District No. 165
Evaline School District No. 36
Everett School District No. 2
Evergreen School District No. 114, Clark County
Evergreen School District No. 205
Federal Way Public Schools
Ferndale School District No. 502
Fife School District No. 417
Finley School District
Franklin Pierce School District No. 402
Freeman School District No. 358
Garfield School District No. 302

Hawaii

Idaho

Marsing Rural Fire District
McCall Fire Protection District
McCall Memorial Hospital District
Meridian Cemetery Maintenance District
Meridian Library District
Meridian Rural Fire Protection District
Mica Kidd Island Fire Protection District
Middleton Rural Fire District
Midvale Fire Protection District
Minidoka County Fire Protection District
Minidoka County Highway District
Moreland Water and Sewer District
Mountain Home Highway District
Mountain Rides Transportation Authority
Nampa and Meridian Irrigation District
Nampa Highway District No. 1
Nampa Housing Authority
New Plymouth Fire District
North Bingham County District Library
North Custer Hospital District
North Kootenai Water and Sewer District
North Lake Recreational Sewer and Water District
North Latah County Highway District
Northern Lakes Fire District
Northside Fire District
Notus-Parma Highway District No. 2
Oakley Highway District
Oakley Library District
Ola District Library
Oneida County Fire District
Oregon Trail Recreation District
Outlet Bay Water and Sewer District
Panhandle Health District
Parma Rural Fire Protection District
Pine Ridge Water and Sewer District
Pinehurst Water District
Pioneer Irrigation District
Placerville Fire Protection District
Pocatello Housing Authority
Pocatello-Chubbuck Auditorium District
Portneuf District Library
Post Falls Highway District
Power County Highway District
Prairie Highway District
Prairie-River Library District
Progressive Irrigation District
Raft River Highway District
Rapid River Water and Sewer District
Richfield District Library
Riverside Independent Water District
Rock Creek Fire District
Rockland Rural Fire District
Rogerson Water District
Ross Point Water District
Sagle Fire District
Salmon River Clinic Hospital District
Sam Owen Fire District
Santa-Fernwood Water and Sewer District
Schweitzer Fire-Rescue District
Settlers Irrigation District
Shelley/Firth Fire District
Shoshone City & Rural Fire District
Shoshone County Fire Protection District No. 2
Shoshone Highway District No. 2
South Bannock Library District
South Bingham Soil Conservation District
South Boundary Fire Protection District
South Custer Fire District
South Fork Coeur d'Alene River Sewer District
South Latah Highway District
Southside Water and Sewer District
Southwestern Idaho Cooperative Housing Authority
St. Maries Fire Protection District
Star Joint Fire District
Star Sewer and Water District
Sun Valley Water and Sewer District
Sunset Heights Water District
Targhee Regional Public Transit Authority
Targhee Regional Public Transportation Authority
Teton County Fire Protection District
Three Creek Highway District
Three Mile Water District
Timberlake Fire Protection District
Twin Falls Highway District
Twin Falls Housing Authority
Twin Falls Rural Fire Protection District
Twin Ridge Rural Fire District
Union Independent Highway District
Upper Fords Creek Rural Fire District
Warm Lake Recreational Water District
Wendell Highway District
West Boise Sewer District
West Bonner Library District
West Bonner Water and Sewer District

Oregon

Rainier School District No. 13
Redmond School District No. 2J
Reedsport School District No. 105
Region 9 Education Service District
Reynolds School District No. 7
Riddle School District No. 70
Riverdale School District No. 51J
Rogue River School District No. 35
Roseburg Public Schools
Salem-Keizer Public School District No. 24J
Santiam Canyon School District No. 129J
Santiam Christian Schools
Scappoose School District No. 1J
Scio School District No. 95C
Seaside School District
Sheridan School District No. 48J
Sherman County School District
Sherwood School District No. 88J
Silver Falls School District No. 4J
Sisters School District No. 6
Siuslaw School District No. 97J
South Coast Education Service District, Region No. 7
South Lane School District No. 45J3
South Umpqua School District No. 19
South Wasco County School District No. 1
Southern Oregon Education Service District
Spray School District No. 1
Springfield School District No. 19
St. Helens School District No. 502
St. Paul School District No. 45
Stanfield School District No. 61
Sutherlin School District No. 130
Sweet Home School District No. 55
Three Rivers School District
Tigard-Tualatin School District No. 23J
Tillamook School District No. 9
Ukiah School District 80 R
Umatilla School District No. 6
Union School District 5
Vale School District No. 84
Vernonia School District No. 47J
Wallowa School District No. 12
Warrenton-Hammond School District No. 30
West Linn-Wilsonville School District
Willamette Education Service District
Willamina School District No. 30J
Winston-Dillard School District No. 116
Woodburn School District No. 103
Yamhill-Carlton School District No. 1
Yoncalla School District No. 32

Special District

Adair Rural Fire Protection District
Amity Fire District
Applegate Valley Fire District No. 9
Arch Cape Sanitary District
Arch Cape Water District
Arnold Irrigation District
Aumsville Rural Fire District
Baker County Library District
Baker Rural Fire Protection District
Baker Valley Soil and Water Conservation District
Bandon Rural Fire Protection District
Barlow Water Improvement District
Bay Area Hospital District
Bend Parks and Recreation District
Beverly Beach Water District
Black Butte Ranch Rural Fire Protection District
Blue Mountain Hospital District
Blue River Water District
Boardman Park and Recreation District
Boardman Rural Fire Protection District
Boring Water District No. 24
Boulder Creek Retreat Special Road District
Brownsville Rural Fire District
Buell-Red Prairie Water District
Bunker Hill Sanitary District
Burlington Water District
Camellia Park Sanitary District
Cannon Beach Rural Fire Protection District
Central Lincoln People's Utility District
Central Oregon Irrigation District
Central Oregon Park and Recreation District
Central Oregon Regional Housing Authority
Charleston Fire District
Charleston Sanitary District
Chehalem Park and Recreation District
Chenowith Water Public Utility District
Chiloquin-Agency Lake Rural Fire Protection District
Christmas Valley Domestic Water Supply District
Christmas Valley Park and Recreation District
Clackamas County Fire District No. 1
Clackamas County Housing Authority
Clackamas County Soil and Water Conservation District
Clatskanie Park and Recreation District

South Carolina

Greenville County Recreation District
Greenville County Redevelopment Authority
Greenville Housing Authority
Greenville Transit Authority
Greenwood Metropolitan District
Greer Housing Authority
Hartsville Housing Authority
Hilton Head No. 1 Public Service District
Holly Springs Fire-Rescue District
Homeland Park Water and Sewer District
James Island Public Service District
Kingstree Housing Authority
Lady's Island-St. Helena Fire District
Lake City Housing Authority
Lancaster County Water and Sewer District
Lancaster Housing Authority
Lancaster Soil and Water Conservation District
Laurens Housing Authority
Lexington County Health Services District, Inc.
Liberty-Chesnee-Fingerville Water District
Local Housing Authority
Lowcountry Regional Transportation Authority
Lugoff-Elgin Water Authority
Marion Housing Authority
Marlboro County Housing Authority
McColl Housing Authority
Medical University Hospital Authority
Metropolitan Sewer Sub-District
Mitford Water and Sewer District
Mullins Housing Authority
Murrells Inlet-Garden City Fire District
Myrtle Beach Air Force Base Redevelopment Authority
Myrtle Beach Housing Authority
Newberry County Water and Sewer Authority
Newberry Housing Authority
North Charleston Housing Authority
North Charleston Sewer District
North Greenville Fire District
Oconee County Joint Regional Sewer Authority
Parker Sewer and Fire Subdistrict
Patriots Point Development Authority
Pee Dee Regional Airport District
Pee Dee Regional Transportation Authority
Piedmont Public Service District
Pioneer Rural Water District
Powdersville Water District
Richland-Lexington Airport District
Richland-Lexington Riverbanks Park District
Rock Hill Housing Authority
Saluda County Water and Sewer Authority
Sandy Springs Water District
Santee Fire Service District
Santee Wateree Regional Transportation Authority
Sheldon Township Fire District
Slater-Marietta Fire District
South Carolina Housing Authority Bond Council
South Carolina Public Employee Benefit Authority
South Carolina Regional Housing Authority No. 1
South Carolina Regional Housing Authority No. 3
South Carolina State Education Assistance Authority
South Carolina State Fiscal Accountability Authority
South Carolina State Housing Finance and Development Authority
South Carolina State Ports Authority
South Greenville Fire District
South Island Public Service District
Southside Rural Community Water District
Spartanburg Housing Authority
Spartanburg Regional Health Services District
St. Andrews Public Service District South Carolina
St. John's Fire District
Starr-Iva Water and Sewer District
Startex-Jackson-Wellford-Duncan Water District
Sumter Housing Authority
Talatha Rural Community Water District
Taylors Fire and Sewer District
Three Rivers Solid Waste Authority
Tigerville Fire District
Tri-County Solid Waste Authority
Union Housing Authority
Valley Public Service Authority
Waccamaw Regional Transportation Authority
Wedgefield Stateburg Water District
West Anderson Water District
Westview-Fairforest Fire District
Whitney Fire Protection District
Williamsburg County Transit Authority
Williamsburg County Water and Sewer Authority
Woodruff Housing Authority
Woodruff-Roebuck Water District
York County Natural Gas Authority

State

Santee-Lynches Regional Council of Governments
South Carolina Department of Health and Environmental Control
South Carolina Department of Mental Health

Utah

Uintah Highlands Water and Sewer Improvement District
Uintah Mosquito Abatement District
Uintah Recreation District
Uintah Transportation Special Service District
Uintah Water Conservancy District
Unified Fire Authority
Utah County Housing Authority
Utah Paiute Housing Authority
Utah Transit Authority
Utah Valley Dispatch Special Service District
Wasatch County Fire District
Wasatch Front Waste and Recycling District
Wasatch Integrated Waste Management District
Washington County Water Conservancy District
Waste Management Service District No. 5
Weber Basin Water Conservancy District
Weber Fire District
Weber Mosquito Abatement District
Weber-Box Elder Conservation District
Wellsville-Mendon Conservancy District
White City Water Improvement District
Woodruff Fire District

State

State Of Utah
Utah Department of Administrative Services
Utah Department of Health
Utah State Legislature
Utah State Treasurer

Tribal

Confederated Tribes of the Goshute Reservation
Kanosh Band of the Paiute Indian Tribe of Utah
Koosharem Band of the Paiute Indian Tribe
Northwestern Band of Shoshone Nation
Northwestern Band of the Shoshone Nation Housing Authority
Paiute Indian Tribe of Utah
Skull Valley Band of Goshute Indians
Ute Indian Tribe

Washington

Glenwood School District
Goldendale School District
Grand Coulee Dam School District
Grandview School District No. 200
Granger School District No. 204
Granite Falls School District No. 332
Grapeview School District No. 54
Great Northern School District
Green Mountain School District No. 103
Griffin School District No. 324
Harrington Public Schools
Highland School District No. 203
Highline School District No. 401
Hockinson School District
Hood Canal School District No. 404
Hoquiam School District No. 28
Inchelium School District No. 70
Issaquah School District No. 411
Kahlotus School District No. 56
Kalama School District No. 402
Keller School District No. 3
Kelso School District No. 458
Kennewick School District No. 17
Kent School District No. 415
Kettle Falls School District No. 212
Kiona-Benton City School District No. 52
Kittitas School District
Klickitat School District No. 402
La Center School District
La Conner School District No. 311
LaCrosse School District
Lake Chelan School District No. 129
Lake Quinault School District No. 97
Lake Stevens School District No. 4
Lake Washington School District No. 414
Lakewood School District No. 306
Lamont School District
Liberty School District No. 362
Lind School District
Longview School District No. 122
Loon Lake School District No. 183
Lopez Island School District No. 144
Lyle School District No- 406
Lynden School District No. 504
Mabton School District No. 120
Mansfield School District No. 207
Manson School District
Mary M. Knight School District
Mary Walker School District No. 207
Marysville School District No. 25
McCleary School District No. 65
Mead School District No. 354
Medical Lake School District No. 326
Mercer Island School District No. 400
Meridian School District No. 505
Methow Valley School District
Monroe School District No. 103
Montesano School District No. 66
Morton School District No. 214
Moses Lake School District No. 161
Mossyrock School District No. 206
Mt. Adams School District No. 209
Mt. Baker School District No. 507
Mt. Vernon School District No. 320
Mukilteo School District No. 6
Naches Valley School District No. 3
Napavine School District No. 14
Naselle-Grays River Valley School District No.165
Nespelem School District No. 14
Newport School District No. 56-415
Nine Mile Falls School District No. 325/179
Nooksack Valley School District No. 506
North Beach School District No. 64
North Franklin School District No. 51
North Kitsap School District No. 400
North Mason School District
North Thurston Public Schools
Northport School District No. 211
Northshore School District No. 417
Oak Harbor School District No. 201
Oakesdale School District No. 324
Oakville School District No. 400
Ocean Beach School District No. 101
Ocosta School District No. 172
Odessa School District No. 105
Okanogan School District No. 105
Olympia School District No. 111
Olympic Educational Service District
Omak School District No. 19
Onalaska School District No. 300
Onion Creek School District No. 30
Orcas Island School District No. 137
Orchard Prairie School District No. 123
Orient School District No. 65

Hawaii

Idaho

West Pend Oreille Fire District
Western Ada Recreation District
Western Elmore County Recreation District
Wilder Irrigation District
Wilder Public Library District
Wilder Rural Fire Protection District
Wilderness Ranch Fire Protection District
Winona Highway District
Worley Fire District
Worley Highway District

State

Idaho Department of Administration
Idaho Department of Health and Welfare
State Of Idaho

Tribal

Coeur d'Alene Tribe
Kootenai Tribe of Idaho
Nez Perce Tribal Enterprises
Nez Perce Tribe
Shoshone-Bannock Tribes

Oregon

Clatskanie People's Utility District
Clatskanie Rural Fire Protection District
Clatsop Care Center Health District
Clatsop County Housing Authority
Cloverdale Rural Fire Protection District
Coburg Rural Fire Protection District
Colton Fire District
Colton Water District
Columbia Corridor Drainage Districts Joint Contracting Authority
Columbia Health District
Columbia Improvement District
Columbia River People's Utility District
Columbia Soil and Water Conservation District
Coos County Airport District
Coos County Library Service District
Coquille Indian Housing Authority
Coquille Valley Hospital District
Corbett Water District
Corvallis Rural Fire Protection District
Cove Rural Fire Protection District
Crooked River Ranch Rural Fire Protection District
Crooked River Ranch Special Road District
Curry Health District
Curry Public Library District
Dallas Cemetery District No. 4
Dean Minard Water District
Dee Rural Fire Protection District
Deschutes County 911 Service District
Deschutes County Rural Fire District No. 1
Deschutes Valley Water District
Devils Lake Water Improvement District
Dexter Rural Fire Protection District
Douglas County Fire District No. 2
Douglas County Housing Authority
Douglas Soil and Water Conservation District
Drakes Crossing Rural Fire Protection District
Dufur Recreation District
Eagle Valley Soil and Water Conservation District
East Fork Irrigation District
East Multnomah Soil and Water Conservation District
East Umatilla County Health District
East Valley Water District
Echo Rural Fire District
Elsie-Vinemaple Rural Fire Protection District No. 11
Emerald People's Utility District
Estacada Rural Fire District No. 69
Fairview Water District
Falcon Cove Beach Water District
Farmers Irrigation District
Gardiner Sanitary District
Gaston Rural Fire District
Gates Rural Fire Protection District
Gearhart Rural Fire Protection District
Glendale Rural Fire Protection District
Gleneden Sanitary District
Goshen Fire District
Government Camp Sanitary District
Grand Ronde Sanitary District
Grant County Transportation District
Grant Soil and Water Conservation District
Grants Pass Irrigation District
Green Sanitary District
Hahlen Road Special District
Halsey-Shedd Rural Fire Protection District
Hamlet Rural Fire Protection District
Harbor Sanitary District
Harbor Water Public Utility District
Harney District Hospital
Harney Soil and Water Conservation District
Harriman Rural Fire Protection District
Hazeldell Rural Fire Protection District
Hebo Joint Water and Sewer Authority
Heceta Water District
Hermiston Cemetery District
Hermiston Fire and Emergency Services District
Hermiston Irrigation District
Hood River County Library District
Hood River County Transportation District
Hood River Valley Parks and Recreation District
Hoodland Fire District No. 74
Hubbard Rural Fire Protection District
Ice Fountain Water District
Illinois Valley Rural Fire Protection District
Ione Rural Fire Protection District
Irrigon Community Park and Recreation Maintenance District
Jackson County Airport Authority
Jackson County Fire District No. 3
Jackson County Fire District No. 5
Jackson County Housing Authority
Jackson County Library District
Jackson County Vector Control District
Jackson Soil and Water Conservation District
Jefferson Rural Fire Protection District
John Day/Canyon City Parks and Recreation District

South Carolina

South Carolina Department of Revenue
South Carolina General Services Division
South Carolina Office of Regulatory Staff
South Carolina State Budget and Control Board
South Carolina State Treasurer's Office
State Of South Carolina

Township

Township of Grand Meadow

Tribal

Catawba Indian Nation

Utah

Washington

Oroville School District No. 410
Orting School District No. 344
Othello School District
Palisades School District No. 102
Palouse School District No. 301
Pasco School District No. 1
Pateros School District
Paterson School District No. 50
Pe Ell School District No. 301
Peninsula School District
Pioneer School District No. 402
Pomeroy School District No. 110
Port Angeles School District No. 121
Port Townsend School District No. 50
Prescott School District No. 402-37
Pride Prep Schools
Prosser School District No. 116
Puget Sound Educational Service District
Pullman School District No. 267
Puyallup School District No. 3
Queets-Clearwater School District No. 20
Quilcene School District No. 48
Quillayute Valley School District No. 402
Quincy School District No. 144
Rainier School District No. 307
Raymond School District No. 116
Reardan-Edwall School District
Renton School District No. 403
Republic School District
Richland School District No. 400
Ridgefield School District No. 122
Ritzville School District
Riverside School District
Riverview School District No. 407
Rochester School District
Rosalia School District No. 320
Royal School District
San Juan Island School District No. 149
Satsop School District No. 104
Seattle Public Schools
Sedro-Woolley School District No. 101
Selah School District No. 119
Selkirk School District No. 70
Sequim School District No. 323
Shaw Island School District No. 10
Shelton School District No. 309
Shoreline School District No. 412
Skykomish School District
Snohomish School District No. 201
Snoqualmie Valley School District No. 410
Soap Lake School District No. 156
South Bend School District No. 118
South Kitsap School District No. 402
South Whidbey School District No. 206
Southside School District
Spokane Public Schools
Sprague School District
St. John School District No. 322
Stanwood-Camano School District No. 401
Steilacoom Historical School District No. 1
Steptoe School District No. 304
Stevenson-Carson School District No. 303
Sultan School District No. 311
Summit Valley School District 202
Sumner School District No. 320
Sunnyside School District No. 201
Tacoma School District No. 10
Taholah School District No. 77
Tahoma School District No. 409
Tekoa School District No. 265
Tenino School District No. 402
Thorp School District No. 400
Toledo School District No. 237
Tonasket School District
Toppenish School District No. 202
Touchet School District No. 300
Toutle Lake School District No. 130
Trout Lake School District No. R-400
Tukwila School District No. 406
Tumwater School District No. 33
Union Gap School District No. 2
University Place School District No. 83
Valley School District
Valley School District No. 70
Vancouver School District No. 37
Vashon Island School District No. 402
Wahkiakum School District No. 200
Wahluke School District No. 73
Waitsburg School District
Walla Walla School District No. 140
Wapato School District No. 207
Warden School District No. 146-161
Washington Schools Risk Management Pool
Washington State Educational Service District

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
		Junction City Rural Fire Protection District			Washougal School District
		Juniper Flat Rural Fire Protection District			Washtucna School District
		Keating Soil and Water Conservation District			Waterville School District No. 209
		Keizer Rural Fire Protection District			Wellpinit School District
		Keno Fire Protection District			Wenatchee School District No. 246
		Kernville-Gleneden Beach-Lincoln Beach Water District			West Valley School District No. 208, Yakima County
		Klamath County Fire District No. 1			West Valley School District No. 363, Spokane County
		Klamath County Library Service District			White Pass School District No. 303
		Klamath Housing Authority			White River School District No. 416
		Klamath Irrigation District			White Salmon Valley School District No. 405-17
		Klamath Vector Control District			Wilbur School District No. 200
		La Grande Rural Fire Protection District			Willapa Valley School District No. 160
		La Pine Park and Recreation District			Wilson Creek School District
		La Pine Rural Fire Protection District			Winlock School District No. 232
		La Pine Water District			Wishkah Valley School District No. 117
		Lake District Hospital			Woodland School District No. 404
		Lake Grove Water District			Yakima School District No. 7
		Lakeside Fire District No. 4			Yelm Community School District No. 2
		Lane County Fire District No. 1			Zillah School District No. 205
		Lane Library District			**Special District**
		Lane Transit District			Acme Water District No. 18
		Langlois Water District			Adams County Fire Protection District No. 1
		LaPine Special Sewer District			Adams County Mosquito Control District
		Lebanon Aquatic District			Aeneas Lake Irrigation District
		Lebanon Fire District			Alderwood Water and Wastewater District
		Lewis and Clark Rural Fire Protection District			Alpine Water District
		Libby Drainage District			Anacortes Housing Authority
		Linn Benton Housing Authority			Annapolis Water District
		Lookingglass Rural Fire District			Asotin County Cemetery District No. 1
		Lorane Rural Fire Protection District			Asotin County Conservation District
		Lowell Rural Fire Protection District			Asotin County Fire District No. 1
		Lower Umpqua Hospital District			Asotin County Housing Authority
		Lusted Water District			Asotin County Public Utility District No. 1
		Madras Aquatic Center District			Badger Mountain Irrigation District
		Malheur County Housing Authority			Bainbridge Island Metropolitan Park and Recreation District
		Malin Rural Fire Protection District			Basin City Water/Sewer District
		Mapleton Water District			Bayview Beach Water District
		Marion County Fire District No. 1			Beacon Hill Water and Sewer District
		Marion Soil and Water Conservation District			Beehive Irrigation District
		Medford Irrigation District			Belfair Water District No. 1
		Merrill Rural Fire Protection District			Bellevue Convention Center Authority
		Metro			Bellingham Housing Authority
		McMinnville Water & Light			Bellingham Public Development Authority
		Mid-County Cemetery Maintenance District			Benton County Diking District No. 1
		Middle Fork Irrigation District			Benton County Fire Protection District No. 1
		Miles Crossing Sanitary Sewer District			Benton County Fire Protection District No. 2
		Mill City Rural Fire Protection District			Benton County Fire Protection District No. 4
		Milton-Freewater Water Control District			Benton County Fire Protection District No. 5
		Mist-Birkenfeld Rural Fire Protection District			Benton County Fire Protection District No. 6
		Mohawk Valley Rural Fire District			Benton County Mosquito Control District
		Molalla River Improvement District			Benton County Public Utility District No. 1
		Molalla Rural Fire Protection District No. 73			Benton Irrigation District
		Monroe Rural Fire Protection District			Benton-Franklin Health District
		Morrow County Health District			Beverly Water District
		Mountain View Hospital District			Birch Bay Water and Sewer District
		Mt. Angel Fire District			Black Diamond Water District
		Multnomah County Drainage District No. 1			Bremerton Housing Authority
		Multnomah County Rural Fire Protection District No. 10			Buckhannon-Upshur County Airport Authority
		Multnomah County Rural Fire Protection District No. 14			Burbank Irrigation District No. 4
		Nesika Beach-Ophir Water District			Carnhope Irrigation District No 7
		Neskowin Regional Sanitary Authority			Cascadia Conservation District
		Neskowin Regional Water District			Cedar River Water and Sewer District
		Nestucca Rural Fire Protection District			Central Klickitat County Park and Recreation District
		Netarts Oceanside Sanitary District			Central Pierce Fire and Rescue District No. 6
		Netarts-Oceanside Rural Fire Protection District			Central Puget Sound Regional Transit Authority
		North Bay Rural Protection Fire District			Central Valley Ambulance Authority
		North Bend City/Coos-Curry Housing Authority			Chelan County Fire District No. 1
		North Central Public Health District			Chelan County Fire District No. 3
		North Clackamas Parks and Recreation District			Chelan County Fire District No. 5
		North County Recreation District			Chelan County Fire District No. 6
		North Gilliam Cemetery District			Chelan County Fire District No. 7
		North Gilliam County Rural Fire Protection District			Chelan County Fire District No. 8
		North Lincoln Fire and Rescue District No. 1			Chelan County Fire District No. 9
		North Powder Rural Fire Protection District			Chelan County Public Hospital District No. 1
		North Sherman County Rural Fire Protection District			Chelan County Public Utility District No. 1
		North Unit Irrigation District			Chelan County/Wenatchee Housing Authority
		Northeast Oregon Housing Authority			Chelan-Douglas Health District
		Northern Wasco County Park and Recreation District			Chinook Water District
		Northern Wasco County People's Utility District			Chuckanut Community Forest Park District
		Northwest Oregon Housing Authority			Clallam Conservation District
		Nyssa Road Assessment District No. 2			Clallam County Fire District No. 2
		Nyssa Rural Fire Protection District			Clallam County Fire District No. 5
		Oak Hill Sanitary District			Clallam County Fire District No. 6
		Oak Lodge Sanitary District			Clallam County Fire Protection District No. 1
		Oak Lodge Water District			Clallam County Fire Protection District No. 3
		Oceanside Water District			Clallam County Fire Protection District No. 4
		Ochoco West Sanitary District			Clallam County Hospital District No. 1
		Odell Sanitary District			Clallam County Housing Authority
		Ontario Library District			Clallam County Parks and Recreation District No. 1
		Oregon Fire Districts Association			Clallam County Public Hospital District No. 2
		Oregon Infrastructure Finance Authority			Clallam County Public Utility District No. 1
		Oregon Trail Library District			Clark County Fire District No. 10
		Oregon Water Wonderland Unit II Sanitary District			Clark County Fire District No. 11
		Owyhee Irrigation District			Clark County Fire District No. 13

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
		Pacific City Joint Water Sanitary Authority			Clark County Fire District No. 5
		Pacific Communities Health District			Clark County Fire Protection District No. 3
		Palatine Hill Water District			Clark County Fire Protection District No. 6
		Peninsula Drainage District No. 1			Clark County Public Utility District No. 1
		Peninsula Drainage District No. 2			Clark Regional Wastewater District
		Pilot Rock Fire Protection District			Cline Irrigation District
		Pine Grove Rural Fire Protection District			Clinton Water District
		Pleasant Hill Rural Fire Protection District			Coal Creek Utility District
		Pleasant Home Water District			Columbia Conservation District
		Polk County Fire District No- 1			Columbia County Fire District No. 3
		Polk County Housing Authority			Columbia County Public Hospital District No. 1
		Polk Soil and Water Conservation District			Columbia County Rural Library District
		Portland Metropolitan Area Water District			Columbia Irrigation District
		Public Procurement Authority			Columbia Valley Water District
		Rainbow Water District			Colville Indian Housing Authority
		Raleigh Water District			Consolidated Irrigation District No. 14
		Redmond Area Park and Recreation District			Covington Water District
		Riddle Rural Fire District			Cowiche Sewer District
		River Forest Acres Special Road District			Cowlitz County Cemetery District No. 2
		River Road Park and Recreation District			Cowlitz County Fire District No. 6
		Rivergrove Water District			Cowlitz County Public Utility District No. 1
		Roads End Sanitary District			Cowlitz Transit Authority
		Roberts Creek Water District			Cross Valley Water District
		Rockwood Water People's Utility District			Dallesport Water District
		Rogue River Cemetery Maintenance District			Douglas County Fire District No. 2
		Rogue Valley Transportation District			Douglas County Fire Protection District No. 5
		Roseburg Urban Sanitary Authority			Douglas County Public Utility District No. 1
		Sable Drive Road District			Douglas County Sewer District No. 1
		Salem Area Mass Transit District			Douglas-Okanogan County Fire District No. 15
		Salem Housing Authority			East Columbia Basin Irrigation District
		Salem-Keizer Transit District			East Gig Harbor Water District
		Santa Clara Rural Fire Protection District			East Lewis County Public Development Authority
		Santiam Water Control District			East Pierce Fire and Rescue District No. 22
		Scappoose Rural Fire District			East Spokane Water District No. 1
		Scio Rural Fire District			East Wenatchee Water District
		Scottsburg Rural Fire District			Eastmont Metropolitan Park District
		Seal Rock Fire District			Eastsound Sewer and Water District
		Seal Rock Water District			Edmonds Public Facilities District
		Shangri-La Water District			Ellensburg Business Development Authority
		Shasta View Irrigation District			Enterprise Cemetery District No. 7
		Siletz Rural Fire Protection District			Entiat Irrigation District
		Silverton Fire District			Everett Housing Authority
		Sisters-Camp Sherman Rural Fire Protection District			Everett Public Facilities District
		Siuslaw Public Library District			Evergreen Water-Sewer District No. 19
		South Clackamas Transportation District			Fall City Water District
		South Suburban Sanitary District			Ferry County Public Utility District No. 1
		Southern Curry Cemetery Maintenance District			Ferry/Okanogan County Fire Protection District No. 13
		Southwest Lincoln County Water District			Fisherman Bay Sewer District
		Spring River Special Road District			Foster Creek Conservation District
		Springfield Utility District			Four Lakes Water District No. 10
		Stanfield Fire District No. 7-402			Franklin Conservation District
		Stayton Fire District			Franklin County Cemetery District No. 2
		Suburban East Salem Water District			Franklin County Fire District No. 1
		Sunrise Water Authority			Franklin County Fire Protection District No. 3
		Sunset Empire Transportation District			Franklin County Irrigation District No. 1
		Swalley Irrigation District			Franklin County Public Utility District No. 1
		Sweet Home Fire and Ambulance District			Freeland Water and Sewer District
		Talent Irrigation District			Ft. Worden Public Development Authority
		Terrebonne Domestic Water District			Gardena Farms Irrigation District No. 13
		Three Sisters Irrigation District			Goforth Special Utility District
		Tillamook County Transportation District			Grand Coulee Project Hydroelectric Authority
		Tillamook People's Utility District			Grandview Irrigation District
		Tiller Rural Fire District			Grant County Airport District No. 1
		Toledo Rural Fire Protection District			Grant County Fire District No. 10
		Tri City Rural Fire District No. 4			Grant County Fire District No. 11
		Tri City Water District			Grant County Fire District No. 3
		Tri-City Service District			Grant County Fire District No. 4
		Tri-County Metropolitan Transportation District			Grant County Fire District No. 7
		Tualatan Hills Park and Recreation District			Grant County Fire Protection District No. 5
		Tualatin Hills Park and Recreation District			Grant County Housing Authority
		Tualatin Valley Irrigation District			Grant County Mosquito Control District No. 1
		Tualatin Valley Water District			Grant County Mosquito District No. 2
		Tumalo Irrigation District			Grant County Port District No. 4
		Twin Rocks Sanitary District			Grant County Port District No. 6
		Umatilla County Housing Authority			Grant County Port District No. 7
		Umatilla Hospital District			Grant County Public Hospital District No. 1
		Umatilla Land Redevelopment Authority			Grant County Public Hospital District No. 2
		Umatilla Morrow Radio and Data District			Grant County Public Hospital District No. 3
		Umatilla Reservation Housing Authority			Grant County Public Hospital District No. 4
		Umatilla Rural Fire Protection District			Grant County Public Utility District No. 2
		Union Cemetery District			Grant Transit Authority
		Vale Oregon Irrigation District			Grays Harbor Conservation District
		Valley View Water District			Grays Harbor County Fire Protection District No. 1
		Vandevert Acres Special Road District			Grays Harbor County Fire Protection District No. 12
		Vineyard Mountain Water and Improvement District			Grays Harbor County Fire Protection District No. 14
		Walla Walla River Irrigation District			Grays Harbor County Fire Protection District No. 2
		Wallowa County Health Care District			Grays Harbor County Fire Protection District No. 7
		Wamic Water and Sanitary Authority			Grays Harbor County Housing Authority
		Warm Springs Housing Authority			Grays Harbor County Water District No. 1
		Wasco County Soil and Water Conservation District			Grays Harbor County Water District No. 2
		Washington County Fire District No. 2			Grays Harbor Drainage District No. 1
		Washington County Housing Authority			Grays Harbor Fire District No. 10
		Water Wonderland Improvement District			Grays Harbor Historical Seaport Authority
		Wedderburn Sanitary District			Grays Harbor Public Utility District No. 1

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
		West Slope Water District			Grays Harbor Transportation Authority
		West Valley Housing Authority			Greater Wenatchee Irrigation District
		Western Lane Ambulance District			Greater Wenatchee Regional Events Center Public Facilities District
		Westport Wauna Rural Fire Protection District			Green Tank Irrigation District No. 11
		Westwood Hills Road District			Hartstene Pointe Water-Sewer District
		Wiard Memorial Park District			Highland Water District
		Wickiup Water District			Highlands Sewer District
		Willamalane Park and Recreation District			Highline Water District
		Williams Rural Fire Protection District			Historic Seattle Preservation and Development Authority
		Willow Creek Park District			Holmes Harbor Sewer District
		Winchester Bay Sanitary District			Hunters Water District
		Winston-Dillard Fire District			Hydro Irrigation District No. 9
		Winston-Dillard Water District			Icicle Irrigation District
		Woodburn Rural Fire Protection District			Inchelium Water District
		Yamhill County Housing Authority			Irvin Water District No. 6
		Yamhill Fire Protection District			Island County Fire District No. 3
		Youngs River-Lewis and Clark Water District			Island County Fire Protection District No. 1
		State			Island County Housing Authority
		Oregon Department of Administrative Services			Jefferson County Conservation District
		Oregon Department of Revenue			Jefferson County Fire District No. 5
		Oregon Health Licensing Agency			Jefferson County Fire Protection District No. 1
		Oregon Higher Education Coordinating Commission			Jefferson County Fire Protection District No. 3
		Oregon Secretary of State			Jefferson County Public Utility District No. 1
		Oregon State Board of Nursing			Jefferson County Water District No. 3
		State of Oregon			Jefferson Transit Authority
		Tribal			Juniper Beach Water District
		Burns Paiute Tribe			Kapowsin Water District
		Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians			Kelso Housing Authority
		Confederated Tribes of Grand Ronde Community			Kennewick Housing Authority
		Confederated Tribes of Siletz Indians			Kennewick Irrigation District
		Confederated Tribes of the Umatilla Indian Reservation			Kennewick Public Facilities District
		Confederated Tribes of the Warm Springs			Kennewick Public Hospital District
		Coquille Indian Tribe			Kent Fire Department Regional Fire Authority
		Klamath Tribes			Key Peninsula Metro Parks District
					King County Airport District No. 1
					King County Ferry District
					King County Fire Protection District No. 16
					King County Fire Protection District No. 2
					King County Fire Protection District No. 20
					King County Fire Protection District No. 25
					King County Fire Protection District No. 27
					King County Fire Protection District No. 28
					King County Fire Protection District No. 34
					King County Fire Protection District No. 37
					King County Fire Protection District No. 40
					King County Fire Protection District No. 43
					King County Fire Protection District No. 44
					King County Fire Protection District No. 45
					King County Fire Protection District No. 47
					King County Fire Protection District No. 50
					King County Flood Control District
					King County Hospital District No. 4
					King County Housing Authority
					King County Public Hospital District No. 1
					King County Public Hospital District No. 2
					King County Water District No. 1
					King County Water District No. 111
					King County Water District No. 117
					King County Water District No. 119
					King County Water District No. 125
					King County Water District No. 19
					King County Water District No. 20
					King County Water District No. 45
					King County Water District No. 49
					King County Water District No. 54
					King County Water District No. 90
					Kitsap Conservation District
					Kitsap County Consolidated Housing Authority
					Kitsap County Fire District No. 18
					Kitsap County Public Utility District No. 1
					Kitsap County Rural Library District
					Kitsap Public Health District
					Kittitas County Conservation District
					Kittitas County Fire District No. 2
					Kittitas County Fire Protection District No. 7
					Kittitas County Hospital District No. 2
					Kittitas County Housing Authority
					Kittitas County Public Utility District No. 1
					Kittitas County Water District No. 5
					Kittitas County Water District No. 6
					Kittitas County Water District No. 7
					Klickitat County Fire District No. 14
					Klickitat County Fire District No. 15
					Klickitat County Fire District No.1
					Klickitat County Fire Protection District No. 4
					Klickitat County Fire Protection District No. 5
					Klickitat County Port District No. 1
					Klickitat County Public Hospital District No. 1
					Klickitat County Public Hospital District No. 2
					Klickitat County Public Utility District No. 1
					Lacey Fire District 3
					Lake Chelan Reclamation District
					Lake Chelan Sewer District
					Lake Forest Park Water District

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
					Lake Stevens Sewer District
					Lake Wenatchee Water District
					Lake Whatcom Water and Sewer District
					Lakehaven Utility District
					Lakewood Water District
					Lenora Water and Sewer District
					Lewis County Conservation District
					Lewis County Fire District No. 1
					Lewis County Fire District No. 11
					Lewis County Fire District No. 13
					Lewis County Fire District No. 18
					Lewis County Fire District No. 9
					Lewis County Fire Protection District No. 14
					Lewis County Fire Protection District No. 16
					Lewis County Fire Protection District No. 2
					Lewis County Fire Protection District No. 5
					Lewis County Fire Protection District No. 6
					Lewis County Fire Protection District No. 8
					Lewis County Hospital District No. 1
					Lewis County Public Facilities District
					Lewis County Public Utility District No. 1
					Lewis County Water District No. 1
					Lewis County Water District No. 3
					Lewis Public Transportation Benefit Area Authority
					Liberty Lake Sewer and Water District
					Lincoln County Fire District No. 1
					Lincoln County Fire District No. 4
					Lincoln County Fire Protection District No. 5
					Lincoln County Fire Protection District No. 6
					Lincoln County Fire Protection District No. 8
					Lincoln County Hospital District No. 3
					Lincoln-Adams County Fire Protection District No. 3
					Longview Housing Authority
					Lopez Island Library District
					Lower Elwha Housing Authority
					Lower Squilchuck Irrigation District
					Lummi Housing Authority
					Lummi Tribal Sewer and Water District
					Makah Housing Authority
					Malaga Water District
					Manchester Water District
					Manson Park and Recreation District
					Marshland Flood Control District
					Marysville Fire District
					Mason Conservation District
					Mason County Fire District No. 13
					Mason County Fire District No. 17
					Mason County Fire District No. 2
					Mason County Fire District No. 4
					Mason County Fire Protection District No. 5
					Mason County Fire Protection District No. 8
					Mason County Housing Authority
					Mason County Public Hospital District No. 1
					Mason County Public Utility District No. 1
					Mason County Public Utility District No. 3
					Mason County Transit Authority
					Methow Valley Irrigation District
					Mid-Columbia Library District
					Midway Sewer District
					Moab Irrigation District No. 20
					Moses Lake Irrigation and Rehabilitation District
					Mukilteo Water and Wastewater District
					Naches-Selah Irrigation District
					North Beach Water District
					North Central Washington Economic Development District
					North City Water District
					North County Regional Fire Authority
					North Highline Fire District
					North Perry Avenue Water District
					North Whidbey Park and Recreation District
					Northeast Sammamish Sewer and Water District
					Northshore Utility District
					Northwest Park and Recreation District No. 2
					Okanogan Conservation District
					Okanogan County Cemetery District No. 4
					Okanogan County Fire District No. 6
					Okanogan County Fire Protection District No. 11
					Okanogan County Housing Authority
					Okanogan County Public Hospital District No. 3
					Okanogan County Public Hospital District No. 4
					Okanogan County Public Utility District No. 1
					Okanogan Fire Protection District No. 16
					Okanogan Irrigation District
					Olympic View Water and Sewer District
					Olympus Terrace Sewer District
					Orcas Island Library District
					Orchard Avenue Irrigation District No. 6
					Oroville Housing Authority
					Oroville-Tonasket Irrigation District
					Othello Housing Authority
					Pacific Conservation District
					Pacific County Fire District No. 2
					Pacific County Fire Protection District No. 1
					Pacific County Fire Protection District No. 3

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
					Pacific County Public Healthcare Services District No. 3
					Pacific County Public Utility District No. 2
					Pacific Hospital Preservation and Development Authority
					Palouse Conservation District
					Pasco/Franklin County Housing Authority
					Pend Oreille County Fire District No. 2
					Pend Oreille County Fire District No. 4
					Pend Oreille County Fire District No. 5
					Pend Oreille County Library District
					Pend Oreille County Public Hospital District No. 1
					Pend Oreille County Public Utility District No. 1
					Peninsula Housing Authority
					Peninsula Metropolitan Park District
					Peshastin Irrigation District
					Peshastin Water District
					Pierce Conservation District
					Pierce County Fire District No. 13
					Pierce County Fire District No. 16
					Pierce County Fire District No. 18
					Pierce County Fire District No. 23
					Pierce County Fire District No. 27
					Pierce County Fire District No. 3
					Pierce County Fire District No. 5
					Pierce County Fire District No. 8
					Pierce County Fire Protection District No. 14
					Pierce County Fire Protection District No. 2
					Pierce County Fire Protection District No. 21
					Pierce County Housing Authority
					Pike Place Market Preservation and Development Authority
					Point Roberts Water District No. 4
					Ponderay Shores Water and Sewer District
					Port Ludlow Drainage District
					Prescott Joint Parks and Recreation District
					Prosser Fire District No. 3
					Prosser Public Hospital District
					Public Hospital District No. 1
					Public Hospital District No. 3
					Public Utility District No- 1
					Puyallup Tribal Health Authority
					Quileute Housing Authority
					Quinault Housing Authority
					Quincy-Columbia Basin Irrigation District
					Renton Housing Authority
					Richland Housing Authority
					Richland Public Facilities District
					Ronald Wastewater District
					Roza Irrigation District
					Sacheen Lake Sewer and Water District
					Sammamish Plateau Water and Sewer District
					San Juan Island Library District
					Saratoga Water District
					Scatchet Head Water District
					Seattle Chinatown International District Preservation and Development Authority
					Seattle Housing Authority
					Seattle Southside Regional Tourism Authority
					Selah-Moxee Irrigation District
					Si View Metropolitan Park District
					Silver Lake Flood Control District
					Silver Lake Water And Sewer District
					Silverdale Water District
					Skagit Conservation District
					Skagit County Cemetery District No. 2
					Skagit County Fire District No. 10
					Skagit County Fire District No. 11
					Skagit County Fire District No. 15
					Skagit County Fire District No. 9
					Skagit County Fire Protection District No. 13
					Skagit County Fire Protection District No. 14
					Skagit County Fire Protection District No. 2
					Skagit County Fire Protection District No. 3
					Skagit County Fire Protection District No. 4
					Skagit County Fire Protection District No. 5
					Skagit County Fire Protection District No. 8
					Skagit County Housing Authority
					Skagit County Public Hospital District No. 1
					Skagit County Public Hospital District No. 2
					Skagit County Public Hospital District No. 304
					Skagit County Public Utility District No. 1
					Skagit County Sewer District No. 1
					Skagit County Sewer District No. 2
					Skagit Valley Public Hospital District No. 1
					Skamania County Fire District No. 1
					Skamania County Fire District No. 4
					Skamania County Public Hospital District No. 1
					Skamania County Public Utility District No. 1
					Skamokawa Water and Sewer District
					Skyway Water and Sewer District
					Snohomish County Fire District No. 15
					Snohomish County Fire District No. 16
					Snohomish County Fire District No. 19
					Snohomish County Fire District No. 26
					Snohomish County Fire District No. 5
					Snohomish County Fire Protection District No. 1
					Snohomish County Fire Protection District No. 17

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
					Snohomish County Fire Protection District No. 21
					Snohomish County Fire Protection District No. 22
					Snohomish County Fire Protection District No. 25
					Snohomish County Fire Protection District No. 28
					Snohomish County Fire Protection District No. 3
					Snohomish County Fire Protection District No. 7
					Snohomish County Housing Authority
					Snohomish County Public Hospital District No. 1
					Snohomish County Public Hospital District No. 2
					Snohomish County Public Utility District No. 1
					Snohomish Health District
					Snohomish River Regional Water Authority
					Snoqualmie Valley Hospital District
					South Columbia Basin Irrigation District
					South Correctional Entity Public Development Authority
					South Naches Irrigation District
					South Whatcom Fire Authority
					South Whidbey Parks and Recreation District
					South Yakima Conservation District
					Southwest Suburban Sewer District
					Spokane Conservation District
					Spokane County Fire District No. 12
					Spokane County Fire District No. 2
					Spokane County Fire District No. 4
					Spokane County Fire Protection District No. 10
					Spokane County Fire Protection District No. 11
					Spokane County Fire Protection District No. 13
					Spokane County Fire Protection District No. 3
					Spokane County Fire Protection District No. 5
					Spokane County Fire Protection District No. 8
					Spokane County Fire Protection District No. 9
					Spokane County Library District
					Spokane County Water District No. 3
					Spokane Housing Authority
					Spokane Indian Housing Authority
					Spokane Public Facilities District
					Spokane Regional Health District
					Spokane Transit Authority
					Startup Water District
					Steptoe Sewer District No. 1
					Stevens County Fire District No. 2
					Stevens County Fire District No. 6
					Stevens County Fire Protection District No. 1
					Stevens County Fire Protection District No. 10
					Stevens County Fire Protection District No. 12
					Stevens County Fire Protection District No. 5
					Stevens County Public Utility District No. 1
					Stevens County Rural Library District
					Stevens Pass Sewer District
					Sun Harbor Water District No. 3
					Sunnyside Housing Authority
					Sunnyside Valley Irrigation District
					Sunnyslope Water District
					Swinomish Housing Authority
					Tacoma Community Redevelopment Authority
					Tacoma Housing Authority
					Tacoma Metropolitan Park District
					Terrace Heights Sewer District
					Thea Foss Waterway Development Authority
					Three Rivers Regional Wastewater Authority
					Thurston Conservation District
					Thurston County Fire District No. 12
					Thurston County Fire District No. 4
					Thurston County Fire District No. 9
					Thurston County Fire Protection District No. 3
					Thurston County Fire Protection District No. 5
					Thurston County Fire Protection District No. 6
					Thurston County Fire Protection District No. 8
					Thurston County Housing Authority
					Thurston County Public Utility District No. 1
					Tri-County Economic Development District
					Tukwila Metropolitan Park District
					Underwood Conservation District
					Union Gap Irrigation District
					Val Vue Sewer District
					Valley Regional Fire Authority
					Valley View Sewer District
					Valley Water District
					Vancouver Housing Authority
					Vashon Park District
					Wahkiakum County Public Utility District No. 1
					Wahkiakum Fire Protection District No. 1
					Wahkiakum Port District No. 1
					Walla Walla County Fire Protection District No. 1
					Walla Walla County Fire Protection District No. 3
					Walla Walla County Fire Protection District No. 4
					Walla Walla County Fire Protection District No. 5
					Walla Walla County Fire Protection District No. 8
					Walla Walla County Rural Library District
					Walla Walla Housing Authority
					Wallula Water District No. 1
					Washington State Convention Center Public Facilities District
					Washington State Major League Baseball Stadium Public Facilities District
					Washington State Tobacco Settlement Authority

Hawaii	Idaho	Oregon	South Carolina	Utah	Washington
					Water District 19
					Wells Ranch Irrigation District
					Wenatchee Reclamation District
					Wenatchee-Chiwawa Irrigation District
					West Sound Utility District
					Whatcom Conservation District
					Whatcom County Fire District No. 1
					Whatcom County Fire District No. 11
					Whatcom County Fire District No. 14
					Whatcom County Fire District No. 16
					Whatcom County Fire District No. 17
					Whatcom County Fire District No. 4
					Whatcom County Fire District No. 5
					Whatcom County Fire District No. 7
					Whatcom County Fire District No. 8
					Whatcom County Public Utility District No. 1
					Whatcom County Water District No. 12
					Whatcom County Water District No. 13
					Whatcom County Water District No. 2
					Whatcom County Water District No. 7
					Whatcom Transportation Authority
					Whidbey Island Public Hospital District
					Whitestone Reclamation District
					Whitman County Fire District No. 11
					Whitman County Fire Protection District No. 12
					Whitman County Fire Protection District No. 14
					Whitman County Fire Protection District No. 7
					Whitman County Public Hospital District No. 3
					Whitman County Rural Library District
					Whitworth Water District No. 2
					Willapa Valley Water District
					William Shore Memorial Pool District
					Williams Lake Sewer District No. 2
					Wine Science Center Development Authority
					Wollochet Harbor Sewer District
					Woodinville Water District
					Yakima County Fire District No. 1
					Yakima County Fire District No. 3
					Yakima County Fire District No. 4
					Yakima County Fire District No. 5
					Yakima County Fire District No. 6
					Yakima County Fire Protection District No. 12
					Yakima County Fire Protection District No. 14
					Yakima County Mosquito Control District
					Yakima Housing Authority
					Yakima Regional Clean Air Authority
					Yakima Rural County Library District
					Yakima-Tieton Irrigation District
					State
					North Seattle Community College
					Seattle Colleges
					State Of Washington
					Washington State Department of Enterprise Services
					Washington State Department of Health
					Washington State Department of Social and Health Services
					Washington State Health Care Authority
					Tribal
					Columbia River Inter-Tribal Fish Commission
					Confederated Tribes of the Chehalis Reservation
					Confederated Tribes of the Colville Reservation
					Confederated Tribes of the Yakama Nation
					Cowlitz Indian Tribe
					Hoh Indian Tribe
					Jamestown S'Klallam Tribe
					Kalispel Tribe of Indians
					Lower Elwha Klallam Tribe
					Lummi Indian Nation
					Makah Tribe
					Muckleshoot Indian Tribe
					Nisqually Indian Tribe
					Nooksack Indian Tribe
					Port Gamble S'Klallam Tribe
					Puyallup Tribe of Indians
					Quileute Indian Tribe
					Quinault Indian Nation
					Samish Indian Nation
					Sauk-Suiattle Indian Tribe
					Skokomish Indian Tribe
					Snoqualmie Indian Tribe
					Spokane Tribe
					Squaxin Island Tribe
					Stillaguamish Tribe of Indians
					Suquamish Tribe
					Swinomish Indian Tribal Community
					Tulalip Tribes
					Upper Skagit Indian Tribe
					Yakama Nation Land Enterprise

Appendix C - Political Subdivision List for
Virginia

City/Town	Special Distrricts	Public K-12	County	Public Higher Education	State	Townships
City of Alexandria	Accomack-Northampton Transportation District	Accomack County Public Schools	Accomack County	Blue Ridge Community College	State of Virginia	Township of Green, Ross County
City of Bristol	Albemarle County Service Authority	Albemarle County Public Schools	Albemarle County	Central Virginia Community College	Virginia Department of Behavioral Health and Developmental Services	
City of Buena Vista	Albemarle-Charlottesville Regional Jail Authority	Alexandria City Public Schools	Alleghany County	Christopher Newport University	Virginia Department of General Services	
City of Charlottesville	Alexandria Redevelopment and Housing Authority	Alleghany County Public Schools	Amelia County	College of William and Mary	Virginia Department of Health	
City of Chesapeake	Appomattox River Water Authority	Amelia County Public Schools	Amherst County	Dabney S. Lancaster Community College	Virginia Department of Health Professions	
City of Colonial Heights	Bath County Airport Authority	Amherst County Public Schools	Appomattox County	Danville Community College	Virginia Department of Public Works	
City of Covington	Bedford County Economic Development Authority	Appomattox County Public Schools	Arlington County	Eastern Shore Community College		
City of Danville	Bedford Regional Water Authority	Arlington Public Schools	Augusta County	Eastern Virginia Medical School		
City of Emporia	Big Stone Gap Redevelopment and Housing Authority	Atlantic Shores Christian Schools	Bath County	George Mason University		
City of Fairfax	Blacksburg-Christiansburg-VPI Water Authority	Augusta County Public Schools	Bedford County	Germanna Community College		
City of Falls Church	Blacksburg-Virginia Polytechnic Institute Sanitation Authority	Bath County Public Schools	Bedford County Public Service Authority	J. Sargeant Reynolds Community College		
City of Franklin	Blue Ridge Airport Authority	Bedford County Public Schools	Bland County	James Madison University		
City of Fredericksburg	Blue Ridge Crossroads Economic Development Authority	Bland County Public Schools	Botetourt County	John Tyler Community College		
City of Galax	Blue Ridge Regional Jail Authority	Botetourt County Public Schools	Brunswick County	Longwood University		
City of Hampton	Blue Ridge Soil and Water Conservation District	Bristol Virginia Public Schools	Buchanan County	Lord Fairfax Community College		
City of Harrisonburg	Bristol Redevelopment and Housing Authority	Brunswick County Public Schools	Buchanan County Public Service Authority	Massanutten Technical Center		
City of Hopewell	Brookneal-Campbell County Airport Authority	Buchanan County Schools	Buckingham County	Mountain Empire Community College		
City of Lexington	Brunswick County Industrial Development Authority	Buckingham County Public Schools	Buckingham County Board of Supervisors	New College Institute		
City of Lynchburg	Buchanan County Industrial Development Authority	Buena Vista City Public Schools	Campbell County	New River Community College		
City of Manassas	Buena Vista Public Service Authority	Campbell County Public Schools	Caroline County	Norfolk State University		
City of Manassas Park	Campbell County Utilities and Service Authority	Caroline County Public Schools	Carroll County	Northern Virginia Community College		
City of Martinsville	Carroll County Industrial Development Authority	Carroll County Public Schools	Carroll County Public Service Authority	Old Dominion University		
City of Newport News	Carroll-Grayson-Galax Solid Waste Authority	Charles City County School District	Charles City County	Patrick Henry Community College		
City of Norfolk	Castlewood Water and Sewage Authority	Charlotte County Public Schools	Charlotte County	Paul D. Camp Community College		
City of Norton	Central Shenandoah Planning District Commission	Charlottesville City Schools	Chesterfield County	Piedmont Virginia Community College		
City of Petersburg	Central Virginia Regional Jail Authority	Chesapeake Public Schools	Clarke County	Radford University		
City of Poquoson	Central Virginia Waste Management Authority	Chesterfield County Public Schools	Craig County	Rappahannock Community College		
City of Portsmouth	Charlottesville Redevelopment and Housing Authority	Clarke County School District	Culpeper County	Richard Bland College		
City of Radford	Charlottesville-Albemarle Airport Authority	Colonial Beach Schools	Cumberland County	Rowanty Technical Center		
City of Richmond	Chesapeake Airport Authority	Colonial Heights Public Schools	Dickenson County	Southern Virginia Higher Education Center		
City of Roanoke	Chesapeake Bay Bridge and Tunnel District	Copper River School District	Dinwiddie County	Southside Virginia Community College		
City of Salem	Chesapeake Hospital Authority	Covington City Public Schools	Essex County	Southwest Virginia Community College		
City of Staunton	Chesapeake Redevelopment and Housing Authority	Craig County Public Schools	Fairfax County	State Council of Higher Education for Virginia		
City of Suffolk	Coeburn-Norton-Wise Regional Wastewater Authority	Culpeper County Public Schools	Fauquier County	Thomas Nelson Community College		
City of Virginia Beach	Craig-New Castle Solid Waste Authority	Cumberland County Public Schools	Floyd County	Tidewater Community College		
City of Waynesboro	Crater District Area Agency on Aging/Foster Grandparent Program, Inc.	Danville Public Schools	Fluvanna County	University of Mary Washington		
City of Williamsburg	Culpeper Soil and Water Conservation District	Dickenson County Public Schools	Franklin County	University of Virginia		
City of Winchester	Cumberland Plateau Planning District Commission	Dinwiddie County Public Schools	Frederick County	University of Virginia Foundation		
Town of Abingdon	Cumberland Plateau Regional Housing Authority	Fairfax County Public Schools	Giles County	University of Virginia Health System		
Town of Alberta	Cumberland Plateau Regional Waste Management Authority	Falls Church City Public Schools	Gloucester County	University of Virginia, Wise		
Town of Altavista	Danville Redevelopment and Housing Authority	Fauquier County Public Schools	Goochland County	Virginia College Savings Plan		
Town of Amherst	Danville-Pittsylvania County Regional Industrial Facilities Authority	Floyd County Public Schools	Grayson County	Virginia Commonwealth University		
Town of Appalachia	Dickenson County Industrial Development Authority	Fluvanna County Public Schools	Greene County	Virginia Community College System		
Town of Appomattox	Dickenson County Public Service Authority	Franklin City Schools	Greensville County	Virginia Highlands Community College		
Town of Ashland	Dinwiddie Airport and Industrial Authority	Franklin County Public Schools	Halifax County	Virginia Military Institute		
Town of Bedford	Dinwiddie County Water Authority	Frederick County Public Schools	Hanover County	Virginia Polytechnic Institute and State University		
Town of Berryville	District Three Governmental Cooperative	Fredericksburg City Public Schools	Henrico County	Virginia State University		
Town of Big Stone Gap	Dryden Water Authority	Galax City Public Schools	Henry County	Virginia Western Community College		
Town of Blacksburg	Eastern Shore of Virginia Broadband Authority	Giles County Public Schools	Henry County Public Service Authority	Wytheville Community College		
Town of Bluefield	Essex County Industrial Development Authority	Gloucester County Public Schools	Highland County			
Town of Boones Mill	Fairfax County Economic Development Authority	Goochland County Public Schools	Isle of Wight County			
Town of Bowling Green	Fairfax County Park Authority	Grayson County Public Schools	James City County			
Town of Boyce	Fairfax County Redevelopment and Housing Authority	Greene County Schools	King and Queen County			
Town of Boydton	Fairfax County Water Authority	Greensville County Public Schools	King George County			
Town of Bridgewater	Fauquier County Water and Sanitation Authority	Halifax County Public Schools	King George County Service Authority			
Town of Broadway	Floyd County Economic Development Authority	Hampton City Schools	King William County			
Town of Brodnax	Floyd-Floyd County Public Service Authority	Hanover County Public Schools	Lancaster County			
Town of Brookneal	Franklin Redevelopment and Housing Authority	Harrisonburg City Public Schools	Lee County			
Town of Buchanan	Frederick County Sanitation Authority	Henrico County Public Schools	Loudoun County			
Town of Burkeville	Fredericksburg Stafford Park Authority	Henry County Public Schools	Louisa County			
Town of Cape Charles	Frederick-Winchester Service Authority	Highland County Public Schools	Lunenburg County			
Town of Cedar Bluff	Front Royal-Warren County Economic Development Authority	Hopewell Public Schools	Madison County			
Town of Charlotte Court House	Ft. Monroe Authority	Imagine Schools	Mathews County			
Town of Chase City	Giles County Public Service Authority	Isle of Wight County Schools	Mecklenburg County			
Town of Chatham	Greensville County Water and Sewer Authority	King and Queen County Public Schools	Middlesex County			
Town of Cheriton	Halifax County Industrial Development Authority	King George County Public Schools	Montgomery County			
Town of Chilhowie	Halifax County Service Authority	King William County Public Schools	Nelson County			
Town of Chincoteague	Hampton Redevelopment and Housing Authority	Lancaster County Public School System	New Kent County			
Town of Christiansburg	Hampton Roads Planning District Commission	Lee County Public Schools	Northampton County			
Town of Claremont	Hampton Roads Regional Jail Authority	Lexington City Schools	Northumberland County			
Town of Clarksville	Hampton Roads Sanitation District	Loudoun County Public Schools	Nottoway County			
Town of Clifton	Harrisonburg Redevelopment and Housing Authority	Louisa County Public Schools	Orange County			
Town of Clifton Forge	Harrisonburg-Rockingham Regional Sewer Authority	Lynchburg City Schools	Page County			
Town of Clinchco	Headwaters Soil and Water Conservation District	Madison County Public Schools	Patrick County			
Town of Clintwood	Hopewell Redevelopment and Housing Authority	Manassas City Public Schools	Pittsylvania County			
Town of Coeburn	James River Water Authority	Manassas Park City Schools	Pittsylvania County Service Authority			
Town of Colonial Beach	John Flannagan Water Authority	Martinsville Public Schools	Powhatan County			
Town of Columbia	Joint Public Service Authority	Mathews County School District	Prince Edward County			
Town of Courtland	Lee County Industrial Development Authority	Mecklenburg County Public Schools	Prince George County			
Town of Craigsville	Lee County Public Service Authority	Middlesex County Public Schools	Prince William County			
Town of Crewe	LENOWISCO Planning District Commission	Montgomery County Public Schools	Prince William County Service Authority			
Town of Culpeper	Lord Fairfax Soil and Water Conservation District	Nelson County Public Schools	Pulaski County			
Town of Damascus	Loudoun County Sanitation Authority	New Kent County Schools	Rappahannock County			
Town of Dayton	Louisa County Water Authority	Newport News Public Schools	Richmond County			
Town of Dendron	Lynchburg Redevelopment and Housing Authority	Norfolk Public Schools	Roanoke County			
Town of Dillwyn	Marion Redevelopment and Housing Authority	Northampton County School District	Rockbridge County			
Town of Drakes Branch	Maury Service Authority	Northumberland County Public Schools	Rockbridge County Public Service Authority			
Town of Dublin	Mecklenburg-Brunswick Regional Airport Authority	Norton City Public Schools	Rockingham County			
Town of Dumfries	Meherrin River Regional Jail Authority	Nottoway County Public Schools	Russell County			
Town of Dungannon	Middle Peninsula Regional Airport Authority	Orange County Public Schools	Scott County			

City/Town	Special Distrricts	Public K-12	County	Public Higher Education	State	Townships
Town of Elkton	Montgomery County Public Service Authority	Page County Public Schools	Scott County Public Service Authority			
Town of Exmore	Montgomery Regional Solid Waste Authority	Patrick County Public Schools	Shenandoah County			
Town of Farmville	Mt. Rogers Planning District Commission	Petersburg City Public Schools	Smyth County			
Town of Fincastle	New River Regional Water Authority	Pittsylvania County School District	Southampton County			
Town of Floyd	New River Resource Authority	Poquoson City Public Schools	Spotsylvania County			
Town of Fries	New River Valley Planning District Commission	Portsmouth Public Schools	Stafford County			
Town of Front Royal	New River Valley Regional Jail Authority	Powhatan County Public Schools	Surry County			
Town of Gate City	Newport News Redevelopment and Housing Authority	Prince Edward County Schools	Sussex County			
Town of Glade Spring	Nicholas County Solid Waste Authority	Prince George County Public Schools	Tazewell County			
Town of Glasgow	Norfolk Airport Authority	Prince William County Schools	Tri-County Lake Administrative Commission			
Town of Glen Lyn	Norfolk Economic Development Authority	Pulaski County Public Schools	Warren County			
Town of Gordonsville	Norfolk Redevelopment and Housing Authority	Radford City Schools	Washington County			
Town of Goshen	Northern Neck Planning District Commission	Rappahannock County Public Schools	Westmoreland County			
Town of Gretna	Northern Virginia Regional Park Authority	Richmond City Public Schools	Wise County			
Town of Grottoes	Northern Virginia Transportation Authority	Richmond County Public Schools	Wythe County			
Town of Halifax	Northwestern Regional Jail Authority	Roanoke City Public Schools	York County			
Town of Hamilton	NRV Regional Water Authority	Roanoke County Public Schools				
Town of Haymarket	Pamunkey Regional Jail Authority	Rockbridge County Schools				
Town of Haysi	Patrick County Economic Development Authority	Rockingham County Public Schools				
Town of Herndon	Pepper's Ferry Regional Wastewater Treatment Authority	Russell County Public Schools				
Town of Hillsville	Petersburg Redevelopment and Housing Authority	Salem City Schools				
Town of Honaker	Peumansend Creek Regional Jail Authority	Scott County Public Schools				
Town of Hurt	Piedmont Soil and Water Conservation District	Shenandoah County Public Schools				
Town of Independence	Planning District One Behavioral Health Services	Smyth County Public Schools				
Town of Iron Gate	Portsmouth Redevelopment and Housing Authority	Southampton County Public Schools				
Town of Irvington	Prince William County Park Authority	Spotsylvania County Public Schools				
Town of Jonesville	Pulaski County Public Service Authority	Stafford County Public Schools				
Town of Kenbridge	Pulaski County Sewerage Authority	Staunton City Schools				
Town of Keysville	Radford Industrial Development Authority	Suffolk Public Schools				
Town of Kilmarnock	Randolph County Water, Sewer and Fire Protection Authority	Surry County Public Schools				
Town of La Crosse	Rapidan Service Authority	Sussex County Public Schools				
Town of Lawrenceville	Rappahannock Regional Jail Authority	Tazewell County Public Schools				
Town of Leesburg	Rappahannock-Shenandoah-Warren Regional Jail Authority	Virginia Beach City Public Schools				
Town of Louisa	Region 2000 Services Authority	Warren County Public Schools				
Town of Lovettsville	Richmond Behavioral Health Authority	Washington County School District				
Town of Luray	Richmond Hospital Authority	Waynesboro Public Schools				
Town of Marion	Richmond Metropolitan Authority	West Point Public Schools				
Town of Middleburg	Richmond Redevelopment and Housing Authority	Westmoreland County Public Schools				
Town of Middletown	Richmond Regional Planning District Commission	Williamsburg-James City County Public Schools				
Town of Mineral	Rivanna Solid Waste Authority	Winchester Public Schools				
Town of Monterey	Rivanna Water and Sewer Authority	Wise County Public Schools				
Town of Montross	Riverside Regional Jail Authority	Wythe County Public Schools				
Town of Mt. Jackson	Roanoke Redevelopment and Housing Authority	York County Public Schools				
Town of Narrows	Roanoke River Service Authority					
Town of New Castle	Roanoke Valley Broadband Authority					
Town of New Market	Roanoke Valley Resource Authority					
Town of Nickelsville	Robert E. Lee Soil and Water Conservation District					
Town of Occoquan	Rockbridge Area Network Authority					
Town of Onancock	Rockbridge County Solid Waste Authority					
Town of Orange	Russell County Industrial Development Authority					
Town of Pamplin City	Russell County Public Service Authority					
Town of Parksley	Scott County Economic Development Authority					
Town of Pearisburg	Scott County Redevelopment and Housing Authority					
Town of Pembroke	Shenandoah Valley Soil and Water Conservation District					
Town of Pennington Gap	Smyth County Industrial Development Authority					
Town of Phenix	Smyth Washington Regional Industrial Facilities Authority					
Town of Pocahontas	South Central Wastewater Authority					
Town of Pound	Southeastern Public Service Authority					
Town of Pulaski	Southside Planning District					
Town of Purcellville	Southside Regional Jail Authority					
Town of Quantico	Southwest Regional Recreation Authority					
Town of Remington	Southwest Virginia Regional Jail Authority					
Town of Rich Creek	Suffolk Redevelopment and Housing Authority					
Town of Richlands	Tappahannock-Essex County Airport Authority					
Town of Ridgeway	Tazewell County Airport Authority					
Town of Rocky Mount	Tazewell County Industrial Development Authority					
Town of Round Hill	Tazewell County Public Service Authority					
Town of Rural Retreat	Tazwell County Public Service Authority					
Town of Saltville	Thomas Jefferson Planning District Commission					
Town of Scottsville	Thomas Jefferson Soil and Water Conservation District					
Town of Shenandoah	Toms Brook-Maurertown Sanitary District					
Town of Smithfield	Upper Occoquan Service Authority					
Town of South Boston	Valley Municipal Utility District No. 2					
Town of South Hill	Vint Hill Economic Development Authority					
Town of St. Paul	Virginia Beach Development Authority					
Town of Stanley	Virginia Commercial Space Flight Authority					
Town of Stephens City	Virginia Highlands Airport Authority					
Town of Strasburg	Virginia Housing Development Authority					
Town of Stuart	Virginia Peninsulas Public Service Authority					
Town of Tangier	Virginia Port Authority					
Town of Tappahannock	Virginia Resources Authority					
Town of Tazewell	Virginia Tech/Montgomery Regional Airport Authority					
Town of Timberville	Virginia/Carolina Water Authority					
Town of Troutville	Virginia's First Regional Industrial Facility Authority					
Town of Urbanna	Washington County Industrial Development Authority					
Town of Victoria	Washington County Service Authority					
Town of Vienna	Waynesboro Economic Development Authority					
Town of Vinton	Waynesboro Redevelopment and Housing Authority					
Town of Wakefield	West Piedmont Planning District					
Town of Warrenton	Western Virginia Water Authority					
Town of Warsaw	Williamsburg Area Transit Authority					
Town of Washington	Winchester Regional Airport Authority					
Town of Waverly	Wired Road Authority					
Town of West Point	Wise County Public Service Authority					
Town of White Stone	Wise County Redevelopment and Housing Authority					
Town of Windsor	Woodway Water and Sewer Authority					
Town of Wise	Wytheville Redevelopment and Housing Authority					
Town of Woodstock						
Town of Wytheville						

SOURCEWELL℠ (Formerly NJPA) AWARDED VENDOR

REQUIRED FEMA TERMS AND CONDITIONS CERTIFICATION

Procurements by Sourcewell℠ (Formerly NJPA) or Sourcewell Members utilizing funds under a federal grant or contract funded all or in part by the Federal Emergency Management Agency (FEMA) may be subject to specific federal laws, regulations, and requirements in addition to those under other federal, state and local laws. This may include, but is not limited to, the procurement standards of the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments, Title 44 of the Code of Federal Regulations, Part 13 (44 CFR Part 13).

The terms included in this section express Vendors willingness and ability to comply with certain requirements which may be applicable to specific Sourcewell Member purchases using FEMA grant or contract dollars. Sourcewell Members may also require Proposers to enter into ancillary agreements, in addition to the Sourcewell contract's general terms and conditions, to address a Member's specific contractual needs, including contract requirements for a procurement using FEMA grants or contracts. Sourcewell reserves the right at any time within a contract term to require an awarded Vendor to reaffirm or resubmit proper documentation relating to these requirements.

Note: The numbering and identification contained within this section is only for reference purposes and does not identify any actual Federal designation or location of the rule. Rules are located in 44 CFR Part 13.

(A) Pursuant to 44 CFR 13.36(i)(1), Sourcewell is entitled to exercise all administrative, contractual, or other remedies permitted by law to enforce Vendor's compliance with the terms of the request for proposal and contract award, including but not limited to those remedies set forth at 44 CFR 13.43.

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(B) Pursuant to 44 CFR 13.36(i)(2), Sourcewell may terminate the contract award for cause or convenience in accordance with the procedures set forth in the request for proposal and contract award and those provided by 44 CFR 13.44.

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(C) Pursuant to 44 CFR 13.36(i)(3)-(6)(12), and (13), Vendor shall comply with the following federal laws during the term of an award for this contract by Sourcewell:

a. Executive Order 11246 of September 24, 1965, entitled "Equal Employment Opportunity," as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor ("DOL") regulations (41 CFR Ch. 60);

b. Copeland "Anti-Kickback" Act (18 U.S.C. 874), as supplemented in DOL regulations (29 CFR Part 3);

c. Davis-Bacon Act (40 U.S.C. 276a-276a-7) as supplemented by DOL regulations (29 CFR Part 5);

d. Section 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by DOL regulations (29 CFR Part 5);

e. Section 306 of the Clean Air Act (42 U.S.C. 1857(h), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15); and

f. Mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94-163, 89 Stat. 871).

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(D) Pursuant to 44 CFR 13.36(i)(7), Vendor shall comply with FEMA requirements and regulations pertaining to reporting, including but not limited to those set forth at 44 CFR 40 and 41.

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(E) Pursuant to 44 CFR 13.36(i)(8), Vendor agrees to the following provisions regarding patents:

a. During the term of an award for this contract by Sourcewell, all rights to inventions and/or discoveries that arise or are developed, in the course of or under this request for proposal and contract award, shall belong to the Sourcewell Member and be disposed of in accordance with their policy. Sourcewell and Sourcewell members, at its own discretion, may file for patents in connection with all rights to any such inventions and/or discoveries.

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(F) Pursuant to 44 CFR 13.36(i)(9), Vendor agrees to the following provisions, regarding copyrights:

a. During the term of an award for this contract by Sourcewell, any copyrightable material or inventions, in accordance with 44 CFR 13.34, FEMA reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish or otherwise use, for Federal Government purposes:

(1) The copyright in any work developed under a grant or contract; and
(2) Any rights of copyright to which a grantee or a contactor purchases ownership with grant support.

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(G) Pursuant to 44 CFR 13.36(i)(10), Vendor shall maintain any books, documents, papers, and records of the Vendor which are directly pertinent to this request for proposal and contract award. At any time during normal business hours and as often as Sourcewell or Sourcewell Members deems necessary, Vendor shall permit Sourcewell or Sourcewell Member, FEMA, the Comptroller General of United States, or any of their duly authorized representatives to inspect and photocopy such records for the purpose of making audit, examination, excerpts, and transcriptions

_____

Vendor Agrees (YES or NO) Initials of Authorized Representative

(H) Pursuant to 44 CFR 13.36(i)(11), Vendor shall retain all required records for three years after FEMA or Sourcewell or Sourcewell Members makes final payments and all other pending matters are closed. In addition, Vendor shall comply with record retention requirements set forth in 44 CFR 13.42

Vendor Agrees (YES or NO) Initials of Authorized Representative

Vendor agrees to comply with federal, state, and local laws, rules, regulations and ordinances, as applicable. It is further acknowledged that Vendor certifies compliance with provisions, laws, acts, regulations, etc. as noted above.

This certification shall be effective through the term of the Vendor's Sourcewell awarded contract.

Vendor: _____

Contract number: _____

Category: _____

Maturity date: _____

Address: _____

City, state, zip code: _____

Phone number: _____

Printed name and title of authorized representative: _____

Signature of authorized representative: _____

Date: _____

Bobcat
3400
4x4

5600
4x4
Bobcat

8. C.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
:	
Co-Submitter:	Todd Hanson, Solid Waste Director
Co-Submitter:	Andy Bertelsen
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Contract: Construction Manager at Risk Construction Services Contract to Rummel Construction, Inc., for Construction of the Sequence D-Phase I Excavation in the amount of $1,298,649.80.

STAFF RECOMMENDED ACTION:

1. Approve the Construction Manager at Risk Construction Services Contract with Rummel Construction, Inc., for the Construction of Cinder Lake Landfill-Sequence D Phase I Excavation, and execute a Guaranteed Maximum Price (GMP) of $1,298,649.80 (includes an Owner's Contingency of $204,000); and
2. Authorize the City Manager to execute the necessary documents.

Executive Summary:

Sequence D (also known as a cell) is a 33-acre site located on the southern boundary of Cinder Lake Landfill (Landfill). This Construction Services Contract (Project) initiates the excavation and design of Sequence D in preparation of the future disposal needs for northern Arizona.

In approximately three (3)-years the Landfill will begin closing existing cells (Sequence B and C) while opening Sequence D for trash disposal. Sequence D currently contains approximately 230,000 cubic yards of rock and soil to be excavated and processed (screened and crushed). The scope of work for the Project encompasses the following:

- Phase I includes preliminary construction and installation of necessary infrastructure
  - Construction of on-site infrastructure (haul roads and small on-site water storage pond)
  - Excavation and processing of approximately 35,000 cubic yards of rock

The Construction Manager at Risk (CMAR) delivery method allows the contractor to deliver the Project at a Guaranteed Maximum Price (GMP). The CMAR provides professional services and acts as a consultant to the City in the design development and construction phases. The CMAR will also be a valuable partner with the City, especially when considering the Contractor will be at the table acting as a fiduciary in future phases of this Contract. Rummel Construction, Inc. (Rummel) has committed to self-performing a majority of the tasks identified in Phase I.

Financial Impact:

Phase I was reviewed and approved in the FY 2020-2021 budget. The budgeted cost for Phase I work was $1,300,000.00 in Fiscal Year (FY) 2020-2021 and carried forward into FY 2021-2022 budget. Subsequent budgets will include proposals for additional phases as warranted. This Project is budgeted in the Solid Waste Fund in account 211-06-165-0631-0-4433 (Improvements to Land).

Policy Impact:

No.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

High Performance Governance

- Serve the public by providing high quality customer service
- Enhance the organizations fiscal stability & increase efficiency and effectiveness

Safe & Healthy Community

- Ensure the built environment is safe through the use of consistent standards, rules and regulations, and land use practices.

Sustainable, Innovative Infrastructure

- Utilize existing long-range plan(s) that identify the community's future infrastructure needs and all associated costs.
- Deliver outstanding services to residents through a healthy, well maintained infrastructure system.
- Provide effective management of and infrastructure for all modes of transportation.
- Facilitate and develop carbon-neutral energy opportunities.

Environmental Stewardship

- Promote, protect, & enhance a healthy, sustainable environment & its natural resources.
- Implement, maintain & further the Climate Action & Adaptation Plan (CAAP) with awareness of social inequities.
- Strengthen flagstaff's resilience to climate change impacts on built, natural, economic, health, & social systems.

Regional Plan

- Goal E.2 - Expand production and use of renewable energy.
- Goal PF.1 - Work across all government operations and services to prepare for the impacts of natural and human caused hazards.
- Goal PF.2 - Provide sustainable and equitable public facilities, service, and infrastructure systems in an efficient and effective manner to serve all population areas and demographics.

Has There Been Previous Council Decision on This:

No.

Options and Alternatives:

1. Approve the CMAR Construction Services Contract as recommended; or
2. Approve the CMAR Construction Services Contract with a decreased scope of work; or
3. Reject the CMAR Construction Services Contract and do not re-solicit.

Background/History:

The City of Flagstaff Landfill is a 343-acre site that accepts municipal solid waste from a 70-mile radius surrounding Flagstaff. Future landfill cells are being planned to accommodate future disposal needs. Sequence-D consists of a 33-acre portion of the site, located on the southern portion of the Landfill.

The work to be performed under the proposed Contract consists of furnishing all labor, materials, tools, and equipment necessary for the construction for Phase I. The CMAR delivery method entails a commitment by the Construction Manager (CM) to deliver the project within a GMP which is based on the construction documents and specifications at the time of the GMP, plus any reasonably inferred items or tasks. The CMAR provides professional services and acts as a consultant to the owner in the design development and construction phases. Future Phases will require design development services; staff will submit those contracts for City Council review in the near future.

Often times, the CMAR also provides a portion of construction services during the project, depending on the expertise within the company. In this case, Rummel has the ability to dedicate resources to a majority of the scope. The portions of work expected to be sub-contracted in Phase I include: fencing, installation of liners, and crushing. In addition to acting as a fiduciary, the CMAR must manage and control construction costs to not exceed the GMP because contractually any costs exceeding the GMP that are not change orders are the financial liability of the CMAR.

The CMAR delivery method is of particular benefit to the City for the following reasons:

- A higher level of cost control from the start of the Project;
- The CMAR is an owner advocate and manages the Project with the City's best interests at all times;
- The CMAR allows City Project Managers to facilitate multiple projects at the same time;
- The CMAR provides expertise in Value Engineering at the inception of the Project; and
- The CMAR services are professional services and can be handled like an architect, engineer or surveyor

As previously noted, future Phases of development services and construction services will be submitted to Council for review.

Key Considerations:

This Project begins the excavation and design of Sequence D, a 33-acre site located on the south side of the Landfill. The cell contains approximately 230,000 cubic yards of rock and soil that need to be excavated and processed prior to burying trash. The scope of work encompasses the following:

- Phase I-Preliminary Construction and Infrastructure
    - Clearing and grubbing of an 11-acre portion of the site
    - Construction of a 300,000-gallon lined water storage tank for dust abatement needs
    - Construction of the Sequence D haul road
    - Excavation of the preliminary cell
        - Approximately 35,000 cubic yards of soil to be crushed and screened
        - Where possible, the Rummel will excavate within 6-inches of the design elevations as specified in the plans.
        - Rummel is required to use the minimum machinery specifications of a D10 Dozer to excavate soil and rock. Geologic reports indicate that it will be impractical to excavate all portions of rock. Rummel will work in 25-foot grids and demonstrate what portions of rock they are unable to excavate. Those gridded areas will be inventoried for future phases of drilling and blasting.
        - Rock less than 36-inches in diameter shall be crushed and screened to a maximum diameter of 3-inches.
        - Rock greater than 36-inches shall be broken with a mechanical hammer with a minimum tool energy of 2,900 foot pounds. The rock shall be crushed to a maximum diameter of 30-inches.
        - The processed rock and soil will be stockpiled and used to cover trash within the current

sequences (Sequence B and C).

Landfill geologic reports indicate that it would be impractical to accurately project the volumes of rock that could be excavated from the entire cell. Therefore, Phase I is intended to determine the following:

- Determine the characteristics (size, hardness, quantity) of rock in remaining Phases of work
- Assess the optimal methods of excavation in in remaining Phases of work

On February 24, 2021, Purchasing staff posted a Request for Statement of Qualifications (RSOQ) for Construction Manager at Risk services on the PlanetBids electronic bidding website, and advertised it in the Arizona Daily Sun on February 28 and March 7, 2021. On March 30, 2021, Purchasing received five Statements of Qualifications (SOQs) from contractors wishing to provide CMAR services for the project. An Evaluation Committee of five (5) members, including one member, a licensed contractor, outside of City staff, independently reviewed and evaluated the SOQs in accordance with guidelines established by the enabling legislation. Based upon the numerical scoring of the written SOQs, the Selection Committee identified the most qualified Firm to perform the CMAR services for the Project and recommended to commence negotiations for a scope and fee proposal to be provided by Rummel Construction, Inc.

A. Company Overview, Experience and Personnel
B. Experience and Qualifications of the Firm/Team
C. Experience of Key Personnel to be Assigned to the Project
D. Understanding of the Project and Approach to Performing the Required Services
E. Experience with Anticipated Construction Conditions
F. Value Added Knowledge and Experience

After completing the evaluation process, the Evaluation Committee identified the three (3) top Firms. Final scores from all firms are as follows:

Rummel Construction, Inc.:	592
Banicki-Buesing JV:	568
Fann Contracting, Inc.:	525
Kinney Construction Services, Inc.:	493
Markham Contracting Co.:	488

Expanded Financial Considerations:

Increased efficiency in project delivery will render Project and staff time savings that can be utilized on other valuable projects. Handling this Project in an iterative fashion will also allow Rummel and the design engineer(s) to collaborate on a best-fit approach for the City.

Community Benefits and Considerations:

The City of Flagstaff Cinder Lake Landfill will continue providing affordable means of solid waste disposal for northern Arizona through the life of the Landfill.

Community Involvement:

No.

Expanded Options and Alternatives:

1. Deny the requested action and provide direction on how to best deliver the Project and dedicated funding; or
2. Deny the use of the CMAR process on this Project and request that the contract be procured through an alternate project delivery method; or
3. Approve the CMAR Construction Services Contract as recommended.

Attachments:

CMAR Phase 1 Agreement
Scope of Work
Schedule
GMP-Letter
Landfill Map
Contingency Justification
Presentation

City of Flagstaff, Arizona

LANDFILL SEQUENCE D EXCAVATION PROJECT

CONSTRUCTION MANAGER AT RISK

CONSTRUCTION SERVICES

PROJECT NO. 2021-74

Agreement No. 2021-74

MAYOR
Paul Deasy

CITY COUNCIL

ADAM SHIMONI
AUSTIN ASLIN
REGINA SALAS
JIM MCCARTHY
BECKY DAGGETT
MIRANDA SWEET

CITY MANAGEMENT

City Manager
Greg Clifton

Interim Utilities Director
Erin Young

Community Development Director
Dan Folke

Public Works Director
Andrew Bertelsen

TABLE OF CONTENTS

PAGE

RECITALS 1

ARTICLE 1 - DEFINITIONS 1

ARTICLE 2 – CMAR'S SERVICES AND RESPONSIBILITIES 5

ARTICLE 3 - CITY'S SERVICES AND RESPONSIBILITIES 12

ARTICLE 4 - CONTRACT TIME 14

ARTICLE 5 - CONTRACT PRICE 18

ARTICLE 6 - CHANGES TO THE CONTRACT PRICE AND TIME 19

ARTICLE 7 - PROCEDURE FOR PAYMENT 22

ARTICLE 8 – CLAIMS AND DISPUTES 25

ARTICLE 9 – SUSPENSION AND TERMINATION 27

ARTICLE 10 - INSURANCE AND BONDS 29

ARTICLE 11 - INDEMNIFICATION 32

ARTICLE 12 - GENERAL PROVISIONS 33

SIGNATURE PAGE 39

EXHIBIT A – PROJECT DESCRIPTION

EXHIBIT B – APPROVED GMP PROPOSAL

EXHIBIT C – TECHNICAL SPECIFICATIONS

CITY OF FLAGSTAFF, ARIZONA

LANDFILL SEQUENCE D EXCAVATION PROJECT

CONSTRUCTION MANAGER AT RISK

CONSTRUCTION SERVICES AGREEMENT

PROJECT No#2021-74Agreement No. 2021-74

This Construction Services Agreement ("Agreement"), is made and entered into by and between the City of Flagstaff, an Arizona municipal corporation ("City"), and Rummel Construction, Inc. ("Construction Manager at Risk" or CMAR") on this ___ day of _____, 20__.

RECITALS

A. The City is authorized and empowered by provisions of the City Charter to execute agreements for construction services.

B. The City intends to construct Landfill Sequence D Excavation Project as more fully described in Exhibit "A" attached ("Project").

C. CMAR has represented to the City that it has the ability to provide construction services for the Project, and based on this representation, the City hereby engages CMAR to provide these services and construct the Project.

***NOW THEREFORE*,** for and in consideration of the mutual covenants and considerations hereinafter contained, it is agreed by and between the City and CMAR as follows:

Article 1 - Definitions

"Agreement" - This written document signed by the City and CMAR covering the construction phase of the Project, and including other documents itemized and referenced in, or attached to, and made part of this Agreement.

"Change Directive" - A written order prepared and signed by the City, directing a change in the Work prior to agreement on an adjustment in the Contract Price and the Contract Time.

"Change Order" - A type of Contract amendment issued after execution of the Contract Documents or future GMP Amendments signed by the City and CMAR, agreeing to changes to a GMP, for substantial unanticipated alterations in the character of Work. The Change Order shall state the following: the addition, deletion or revision in the scope of Work; the amount of the adjustment to the Contract Price; and the extent of the adjustment to the Contract Times or other modifications to Agreement terms.

"The City ("Owner" or "OWNER") - The City of Flagstaff, a municipal corporation, with whom CMAR has entered into this Agreement and for whom the services are to be provided pursuant to said Contact. Regulatory activities handled by the City of Flagstaff Community Development, Fire and Planning Departments or any other City Department are not subject to the responsibilities of the City under this Agreement.

"City's Representative" - The person designated in Subsection 8.3.1.2.

"City's Senior Representative" - The person designated in Subsection 8.3.1.1.

"CMAR" - The firm selected by the City to provide construction services as detailed in this Agreement.

"CMAR's Contingency" - A fund to cover cost growth during the Project used at the discretion of CMAR usually for costs that result from Project circumstances. The amount of CMAR's Contingency shall be negotiated as a separate line item in each GMP package. Use and management of CMAR's Contingency is described in Subsection 5.3.1.

"CMAR's Representative" - The person designated in Subsection 8.3.2.2.

"CMAR's Senior Representative" - The person designated in Subsection 8.3.2.1.

"Construction Documents" - Certain plans, specifications and drawings prepared by the Design Professional after correcting for permit review requirements or dated plans and specifications specifically identified as the "Construction Documents" herein or in an Exhibit or Addendum which is attached hereto.

"Construction Fee" - CMAR's administrative costs, home office overhead, and profit as applicable to this Project whether at CMAR's principal or branch offices.

"Contract Documents" - The following items and documents in descending order of precedence executed by the City and CMAR: (i) all written modifications, amendments and Change Orders; (ii) this Agreement, including all exhibits and attachments; (iii) Construction Documents; (iv) GMP Plans and Specifications.

"Contract Price" - The amount or amounts set forth in Article 5.

"Contract Time" - The days, as set forth in Article 4, the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work, subject to Winter Shutdown.

"Cost of the Work" - The direct costs necessarily incurred by CMAR in the proper performance of the Work. The Cost of the Work shall include direct labor costs, subcontract costs, costs of materials and equipment incorporated in the completed construction, costs of other materials and equipment, temporary facilities, permit and license fees, materials testing, and related items. The Cost of the Work shall not include CMAR's Construction Fee, General Conditions Costs, and taxes.

"Critical Path Method" - A scheduling technique used to predict project duration by analyzing which sequence of activities has the least amount of scheduling flexibility thus identifying the path (sequence) of activities which represent the longest total time required to complete the Project. Delay in completion of the identified activities shall cause a delay in achieving Substantial Completion.

"Day(s)" - Calendar days unless otherwise specifically noted in the Contract Documents.

"Design Phase Contract" - The agreement between the City and CMAR for Services provided by CMAR during the design phase which may include the following: design recommendations, Project scheduling, constructability reviews, alternate systems evaluation, cost estimate, Minority Business Enterprise/Woman's Business Enterprise/Small Business Enterprise **("MBE/WBE/SBE")** utilization, subcontractor bid phase services, GMP preparation and other services set forth in this Agreement or reasonably inferable therefrom.

"Design Professional" - A qualified, licensed design professional who furnishes, design**,** construction documents, and/or construction administration services required for the Project.

"Differing Site Conditions" - Concealed or latent physical conditions or subsurface conditions at the Site that, (i) materially differ from the conditions indicated in the Contract Documents or (ii) are of an unusual nature, differing materially from the conditions ordinarily encountered and generally recognized as inherent in the Work.

"Final Completion" - 100% completion of all construction Work noted in or reasonably inferred from the Contract Documents, including but not limited to all Punch Lists work, all record and close-out documents specified in Owner's Project specifications and Owner training/start up activities.

"Float" - The number of Days by which an activity can be delayed without lengthening the Critical Path and extending the Substantial Completion date.

"General Conditions Costs" - Includes, but is not limited to the following types of costs for CMAR during the construction phase: (i) payroll costs for Project manager or CMAR for work conducted at the Site, (ii) payroll costs for the superintendent and full-time general foremen, (iii) payroll costs for other management personnel resident and working at the Site, (iv) workers not included as direct labor costs engaged in support (e.g. loading/unloading, clean-up, etc.), (v) costs of offices and temporary facilities setup solely for this Project including office materials, office supplies, office equipment and minor expenses, (vi) cost of utilities, fuel, sanitary facilities and telephone services at the Site, (vii) costs of liability and other applicable insurance premiums not included in labor burdens for direct labor costs, (viii) costs of bond premiums, (ix) costs of consultants not in the direct employ of CMAR or Subcontractors.

"Guaranteed Maximum Price" or "GMP" - The sum of the maximum Cost of the Work; the Construction Fee; General Conditions Costs, taxes, and CMAR's Contingency.

"GMP Plans and Specifications" - The plans and specifications upon which the Guaranteed Maximum Price proposal is based.

"Legal Requirements" - All applicable federal, state and local laws, codes, ordinances, rules, regulations, orders and decrees of any government or quasi-government entity having jurisdiction over the Project or Site, the practices involved in the Project or Site, or any Work.

"Notice to Proceed" or "NTP" - The directive issued by the City, authorizing CMAR to start Work.

"Opening Physical Conditions" – The current physical conditions present on the Site as jointly documented by an inspection of the Site by City and CMAR at the Pre-construction Conference.

"Owner's Contingency" - A fund to cover cost growth during the project used at the discretion of the Owner usually for costs that result from Owner directed changes or unforeseen Site conditions. The amount of the Owner's contingency shall be set solely by the Owner and shall be in addition to the Project costs included in CMAR's GMP packages. Use and management of the Owner's contingency is described in Section 5.3.2.

"Performance Period" - The period of time allotted in the Contract Documents to complete the Work comprised within a GMP. The Performance Period shall be stated with each GMP and shown on the Project Master Schedule.

"Payment Request" - The City form used by CMAR to request progress payments for Work in accordance with Article 7.

"Pre-construction Conference" – A Conference held between City and CMAR prior to the commencement of any Work, as scheduled by the City's Representative or designee.
"Product Data" - Illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by CMAR to illustrate materials or equipment for some portion of the Work.

"Project" - The work to be completed in the execution of this Agreement as amended and as described in the Recitals above and in Exhibit "A" attached.

"Project Record Documents" - The documents created pursuant to Section 2.10.

"Samples" - Physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work shall be evaluated.

"Schedule of Values" - A statement furnished by CMAR to the City's Representative for approval, reflecting the portions of the GMP allotted for the various parts of the work and used as the basis for evaluating CMAR's applications for progress payments.

"Shop Drawings" - Drawings, diagrams, schedules and other data specially prepared for the Work by CMAR or a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

"Site" - Land or premises on which the Project is located.

"Specifications" - The part(s) of the Contract Documents for the construction phase consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

"Subcontractor" - An individual or firm having a direct Agreement with CMAR or any other individual or firm having an Agreement with the aforesaid Contractors at any tier, who undertakes to perform a part of the construction phase Work for which CMAR is responsible.

"Submittals" - Documents and/or things that may be produced or presented by one party for consideration review or such other actions as may be required by this Agreement by another party, entity or person. Examples of Submittals include, but are not limited to, preliminary or evolving drafts, product data samples, etc.

"Substantial Completion" - The established date when the Work or designated portion thereof is sufficiently complete, in accordance with the Contract Documents so that the Owner may occupy the Work, or designated portion thereof, for the use for which it is intended. This may include, but is not limited to: (i) Approval by the City or State Fire Marshall and/or other state or local authorities having jurisdiction over the Work or a portion thereof (Certificate of Occupancy); (ii) all systems in place, functional, and displayed to, and accepted by, the City or it's representative; (iii) City operation and maintenance training complete; (iv) HVAC test and balance completed with reports provided to the Design Professional for review; (v) Operational and Maintenance manuals and final Project Record Documents delivered to the City or Design Professional for review.

"Supplier" - A manufacturer, fabricator, supplier, distributor, material man or vendor having a direct agreement with CMAR or any Subcontractor to furnish materials or equipment to be incorporated in the construction phase Work by CMAR or any Subcontractor.

"Winter Shutdown" – The period of time typically including December through March during which no Work will be performed by any person or entity (including but not limited to the CMAR) on the Project and CMAR shall shutdown, properly insulate and shelter the Project in a safe and workmanlike manner pursuant to local, state and federal laws. Although December through March is typically the time frame, the City reserves the right to initiate and terminate a Winter Shutdown at the City's sole discretion in the event of adverse weather conditions. A Winter Shutdown may be declared by the City despite delays, *for any reason,* on the Project.

"Work" - The entire completed construction or the various separately identifiable parts thereof, required to be furnished during the construction phase. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials, resources and equipment into the construction, and performing or furnishing services and documents as required by the Contract Documents for the construction phase.

Article 2 - CMAR's Services and Responsibilities

2.0 CMAR shall furnish any and all labor, materials, equipment, transportation, utilities, services and facilities required to perform all Work for the construction of the Project, and to completely and totally construct the same and install the material therein for the City. All Work shall be performed in a good and workmanlike and substantial manner and within the care and skill of a qualified CMAR in Flagstaff, Arizona. The Work shall be to the satisfaction of the City and strictly pursuant to and in conformity with the Project's Contract Documents. It is not required that the services be performed in the sequence in which they are described.

2.1 General Services

2.1.1. CMAR's Representative shall be reasonably available to the City and shall have the necessary expertise and experience required to supervise the Work. CMAR's Representative shall communicate regularly with the City but not less than once a week and shall be vested with the authority to act on behalf of CMAR. CMAR's Representative may be replaced only with the written consent of the City.

2.2 Government Approvals and Permits

2.2.1 Unless otherwise provided, CMAR shall obtain all applicable and/or necessary permits, approvals and licenses required for the prosecution of the Work from any government or quasi-government entity having jurisdiction over the Project. CMAR is specifically reminded of the need to obtain the applicable and/or necessary environmental permits or file the applicable and/or necessary environmental notices.

2.2.2 Copies of the permits and notices listed in Subsection 2.2.1 above must be provided to the City's Representative prior to starting the permitted activity. In the case of Fire Department permits, a copy of the application for permit shall also be provided to the City's Representative. This provision does not constitute an assumption by the City of an obligation of any kind for violation of said permit or notice requirements.

2.2.3 City shall be responsible for City of Flagstaff review and permit(s) fees for building and demolition permits. City shall also pay review fees for grading and drainage, water, sewer, and landscaping. City shall also pay for utility design fees for permanent services.

2.2.4 CMAR shall be responsible for all other permits and review fees not specifically listed in Subsection 2.2.3 above.

2.2.5 CMAR is responsible for the cost of water meter(s), water and sewer taps, fire lines and taps, and all water bills on the project meters until Substantial Completion of the Project. Arrangements for construction water are CMAR's responsibility.

2.3 Pre-construction Conference

2.3.1 Prior to the commencement of any Work, the City's Representative or designee shall schedule and conduct a Preconstruction Conference.

At the Pre-Construction Conference, City and CMAR shall document the Opening Physical

Conditions of the Site as jointly documented by an inspection of the Site by City and CMAR at the Pre-Construction.

2.3.2 The purpose of this conference is to establish a working relationship between CMAR, utility firms, and various City agencies. The agenda shall include critical elements of the work schedule, submittal schedule, cost breakdown of major lump sum items, Payment Requests and processing, coordination with the involved utility firms, the level of Project Record Documents required and emergency telephone numbers for all representatives involved in the course of construction.

2.3.3 The Notice to Proceed date shall be concurred with by the parties or set by the City at the Preconstruction Conference. After the meeting and upon receipt of a signed Agreement and delivery of the required bonds and insurance in a City approved format, a Notice to Proceed letter shall be issued confirming the construction start date, Performance Period and if applicable, the Substantial Completion date. If a Substantial Completion date is established the conditions of the Substantial Completion shall be listed and/or as set forth in Article 1 herein. Failure by CMAR to provide the properly executed bond and insurance forms in a timely manner may delay the construction start date; however, it shall not alter the proposed Substantial Completion date nor be a basis for any time extension request or other claims.

2.3.4 CMAR shall provide a Schedule of Values based on the categories used in the buyout of the Work but not greater than the approved GMP and identifying CMAR's Contingency. The Schedule of Values shall subdivide the Work into all items comprising the Work. The Schedule of Values shall contain sufficient detail to identify each individual element of the Work and shall relate to the approved GMP Schedule. The Schedule of Values shall be subject to approval by the City's representative.

2.3.5 Minimum attendance by CMAR shall be CMAR's Representative, who is authorized to execute and sign documents on behalf of the firm, the job superintendent, and CMAR's safety officer.

2.4 Control of the Work

2.4.1 Unless otherwise provided in the Contract Documents to be the responsibility of the City or a separate Contractor, CMAR shall provide through itself or Subcontractors the necessary supervision, labor, inspection, testing, start-up, material, equipment, machinery, temporary utilities and other temporary facilities to permit CMAR to complete the Work consistent with the Contract Documents.

2.4.2 CMAR shall perform all construction activities efficiently and with the requisite expertise, skill and competence to satisfy the requirements of the Contract Documents. CMAR shall at all times exercise complete and exclusive control over the means, methods, sequences and techniques of construction.

2.4.3 CMAR's Representative or CMAR's Superintendent shall be present at the Site at all times that construction activities are taking place.

2.4.3.1 All elements of the Work shall be under the direct supervision of a foreman or his designated representative on the Site who shall have the authority to take actions required to properly carry out that particular element of the work.

2.4.3.2 In the event of noncompliance with this Section, the City may require CMAR to stop or suspend the Work in whole or in part.

2.4.4 Where the Contract Documents require that a particular product be installed and/or applied by an applicator approved by the manufacturer, it is CMAR's responsibility to ensure the Subcontractor employed for such work is approved by the manufacturer.

2.4.5 Before ordering materials or doing work, CMAR and each Subcontractor shall verify measurements at the Site and shall be responsible for the correctness of such measurements. No extra charge or compensation shall be allowed because of differences between actual dimensions and the dimensions indicated on the drawings; differences which may be found shall be submitted to the City for resolution before proceeding with the Work.

2.4.6 CMAR shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to CMAR with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the City at once.

2.4.7 CMAR shall establish and maintain all building and construction grades, lines, levels, and bench marks, and shall be responsible for accuracy and protection of same. This Work shall be performed or supervised by a civil engineer or surveyor licensed as such in the State of Arizona.

2.4.8 Any person employed by CMAR or any Subcontractor who, in the opinion of the City, does not perform his or her work in a proper, skillful, and safe manner or is intemperate or disorderly shall, at the written request of the City, be removed from the Work by CMAR or Subcontractor employing such person, and shall not be employed again in any portion of Work without the written approval of the City. CMAR or Subcontractor shall hold the City harmless from damages or claims which may occur in the enforcement of this Section.

2.4.9 CMAR assumes responsibility to the City for the proper performance of the work of Subcontractors and any acts and omissions in connection with such performance. Nothing in the Contract Documents is intended or deemed to create any legal or contractual relationship between the City and any Subcontractor or Sub-Subcontractor, including but not limited to any third-party beneficiary rights.

2.4.10 CMAR shall coordinate the activities of all Subcontractors. If the City performs other work on the Project or at the Site with separate contractors under the City's control, CMAR agrees to reasonably cooperate and coordinate its activities with those of such separate contractors so that the Project can be completed in an orderly and coordinated manner without unreasonable disruption.

2.5 Control of the Work Site

2.5.1 Throughout all phases of construction, including suspension of Work, CMAR shall keep the Site reasonably free from debris, trash and construction wastes to permit CMAR to perform its construction services efficiently, safely and without interfering with the use of adjacent land areas. Upon Substantial Completion of the Work, or a portion of the Work, CMAR shall remove all debris, trash, construction wastes, materials, equipment, machinery and tools arising from the Work or applicable portions thereof to permit the City to occupy the Project or a portion of the Project for its intended use.

2.5.2 CMAR shall take whatever steps, procedures or means to prevent any dust nuisance due to construction operations. The dust control measures shall be maintained at all times to the satisfaction of the City and in accordance with the requirements of the Arizona Department of Environmental Quality rules and regulations.

2.5.3 CMAR shall maintain ADA, ADAAG and ANSI accessibility requirements during construction activities in an occupied building or facility. ADA, ADAAG and ANSI accessibility requirements shall include, but not be limited to, parking, building access, entrances, exits, restrooms, areas of refuge, and emergency exit paths of travel. CMAR shall be responsible for the coordination of all work to minimize disruption to building occupants and facilities.

2.5.4 Only materials and equipment which are to be used directly in the Work shall be brought to

and stored on the Site by CMAR. When equipment is no longer required for the Work, it shall be removed promptly from the Site. Protection of construction materials and equipment stored at the Site from weather, theft, damage and all other adversity is solely the responsibility of CMAR.

2.6 Shop Drawings, Product Data and Samples

2.6.1 Shop Drawings, Product Data, Samples and similar Submittals are not Contract Documents. The purpose of their submittal is to demonstrate, for those portions of the Work for which Submittals are required, the way CMAR proposes to conform to the information given and the design concept expressed in the Contract Documents.

2.6.2 CMAR shall review, approve, verify, and submit to the City five copies of each Shop Drawing, Product Data, Sample, and similar Submittals required by the Contract Documents in accordance with the approved GMP schedule as shown in Exhibit "B" as to cause no delay in the Work or in the activities of the City or of separate contractors. Submittals made by CMAR, which are not required by the Contract Documents, may be returned without action.

2.6.3 CMAR shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples, or similar Submittals until the respective submittal has been approved by the City or City's designee. Such Work shall be in accordance with approved Submittals.

2.6.4 By approving, verifying and submitting Shop Drawings, Product Data, Samples and similar Submittals, CMAR represents that CMAR has determined and verified materials, field measurements and field construction criteria related thereto, or shall do so, and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.

2.6.5 CMAR shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the City 's approval of Shop Drawings, Product Data, Samples or similar Submittals unless CMAR has specifically informed the City in writing of such deviation at the time of submittal and the City has given written approval to the specific deviation. CMAR shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar Submittals by the City's approval thereof.

2.6.6 CMAR shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar Submittals, to revisions other than those requested by the City on previous Submittals.

2.6.7 Informational Submittals upon which the City is not expected to take responsive action may be so identified in the Contract Documents.

2.6.8 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the City shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

2.7 Quality Control, Testing and Inspection

2.7.1 All materials used in the Work shall be new and unused, unless otherwise noted, and shall meet all quality requirements of the Contract Documents.

2.7.2 All construction materials to be used on the Work or incorporated into the Work, equipment, plant, tools, appliances or methods to be used in the Work may be subject to the inspection and approval or rejection by the City. Any material rejected by the City shall be removed immediately and replaced in an acceptable manner.

2.7.3 The procedures and methods used to sample and test material shall be determined by the

City. Unless otherwise specified, samples and tests shall be made in accordance with the most recently adopted edition of the City of Flagstaff Engineering Division Design and Construction Standards and Specifications.

2.7.4 The City shall select a City or Independent Testing Laboratory and shall pay for initial City Acceptance Testing.

2.7.4.1 When the first and/or subsequent tests indicate noncompliance with the Contract Documents, the cost associated with that noncompliance and the cost of all tests, except the first test, shall be paid for by CMAR. CMAR's Contingency cannot be utilized for the cost of re-testing.

2.7.4.2 When the first and/or subsequent tests indicate noncompliance with the Contract Documents, all retesting shall be performed by the same testing agency.

2.7.5 CMAR shall cooperate with the selected testing laboratory and all others responsible for testing and inspecting the work and shall provide them access to the Work at all times.

2.7.6 At the option of the City, materials may be approved at the source of supply before delivery is started.

2.7.7 Code compliance testing and inspections required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid by CMAR, unless otherwise provided in the Contract Documents.

2.7.8 CMAR's convenience and quality control testing and inspections shall be the sole responsibility of CMAR and paid by CMAR.

2.8 Trade Names and Substitutions

2.8.1 Unless indicated that no substitutions are permitted, CMAR may request a substitution or alternative to Contract Document references to equipment, materials or patented processes by manufacturer, trade name, make or catalog number, subject to the following:

2.8.2 The substitution shall be submitted by CMAR in writing to the City.

2.8.3 CMAR shall certify that the substitution shall perform the functions and achieve the results called for by the general design, be similar and of equal substance, and be suited to the same use as that specified.

2.8.4 The submittal shall state any required changes in the Contract Documents to adapt the design to the proposed substitution.

2.8.5 The submittal shall contain an itemized estimate of all costs and credits that will result directly and indirectly from the acceptance of such substitution, including cost of design, license fees, royalties, and testing. Also, the submittal shall include any adjustment in the Contract Time created by the substitution.

2.8.6 CMAR if requested by the City shall submit Samples or any additional information that may be necessary to evaluate the acceptability of the substitution.

2.8.7 The City shall make the final decision and shall notify CMAR in writing as to whether the substitution has been accepted or rejected.

2.8.8 If the City does not respond in a timely manner, CMAR shall continue to perform the Work in accordance with the Contract Documents and the substitution shall be considered rejected.

2.9 Project Record Documents

2.9.1 During the construction period, CMAR shall maintain at the Site a set of blueline or blackline prints of the Construction Document drawings and shop drawings for Project Record Document purposes.

2.9.1.1 CMAR shall mark these drawings to indicate the actual installation where the installation varies appreciably from the original Construction Documents. CMAR shall give particular attention to information on concealed elements, which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

- Dimensional changes to the drawings.
- Revisions to details shown on drawings
- Depths of foundations below first floor
- Locations and depths of underground utilities
- Revisions to routing of piping and conduits.
- Revisions to electrical circuitry.
- Actual equipment locations.
- Duct size and routing.
- Locations of concealed internal utilities.
- Changes made by Change Order, Change Order Directive, Field Order, Record of Field Change, ASI's and RFI's.
- Addenda and other details not on original Agreement Drawings.

2.9.1.2 CMAR shall mark completely and accurately Project Record Drawing prints of Construction Documents or Shop Drawings, whichever is the most capable of indicating the actual physical condition. Where Shop Drawings are marked, show cross-reference on the Construction Documents location.

2.9.1.3 CMAR shall mark Project Record Drawings sets with red erasable colored pencil.

2.9.1.4 CMAR shall note RFI Numbers, ASI Numbers and Change Order numbers, etc., as required to identify the source of the change to the Construction Documents.

2.9.1.5 CMAR shall, as a condition of Substantial Completion, submit Project Record Drawing prints and Shop Drawings to the City or its representative for review and comment.

2.9.2 Upon receipt of the reviewed Project Record Drawings from the City, CMAR shall correct any deficiencies and/or omissions to the drawings and prepare the following for submission to the City within 14 Days:

2.9.2.1 CMAR shall provide a complete set of electronic Project Record Drawings prepared in AutoCAD format compatible with City of Flagstaff CADD technology. The Design Professional shall provide files of the original Construction Documents to CMAR for the use of preparing these final Project Record Drawings or CMAR may contract with the Design Professional to revise and update the electronic drawing files. Each drawing shall be clearly marked with "As-Built Document."

2.9.2.2 CMAR shall provide a complete set of reproducible mylars from the final AutoCAD drawings.

2.9.2.3 CMAR shall provide the original copy of the Project Record Drawings (redline mark-ups).

2.10 Project Safety

2.10.1 CMAR recognizes the importance of performing the Work in a safe manner so as to prevent damage, injury or loss to (i) all individuals at the Site, whether working or visiting, (ii) the Work,

including materials and equipment incorporated into the Work or stored on-Site or off-Site, and (iii) all other property at the Site or adjacent thereto.

2.10.2 CMAR assumes responsibility for implementing and monitoring all safety precautions and programs related to the performance of the Work.

2.10.3 CMAR shall, prior to commencing construction, designate a Safety Representative with the necessary qualifications and experience to supervise the implementation and monitoring of all safety precautions and programs related to the Work. Unless otherwise required by the Contract Documents, CMAR's Safety Representative shall be an individual stationed at the Site who may have other responsibilities on the Project in addition to safety.

2.10.4 The Safety Representative shall make routine daily inspections of the Site and shall hold weekly safety meetings with CMAR's personnel, Subcontractors and others as applicable.

2.10.5 CMAR and Subcontractors shall comply with all Legal Requirements relating to safety, as well as any City-specific safety requirements set forth in the Contract Documents, provided that such City-specific requirements do not violate any applicable Legal Requirement.

2.10.6 CMAR shall immediately report in writing any safety-related injury, loss, damage or accident arising from the Work to City's Representative and, to the extent mandated by Legal Requirements, to all government or quasi-government authorities having jurisdiction over safety-related matters involving the Project or the Work.

2.10.7 CMAR's responsibility for safety under this Section is not intended in any way to relieve Subcontractors and Sub-Subcontractors of their own contractual and legal obligations and responsibility for (i) complying with all Legal Requirements, including those related to health and safety matters, and (ii) taking all necessary measures to implement and monitor all safety precautions and programs to guard against injury, losses, damages or accidents resulting from their performance of the Work.

2.11 **Warranty**

2.11.1 CMAR warrants to City that the construction, including all materials and equipment furnished as part of the construction, shall be new unless otherwise specified in the Contract Documents, of good quality, in conformance with the Contract Documents and free of defects in materials and workmanship.

2.11.2 CMAR's warranty obligation shall be for one (1) year, except for such greater period as may be required by the technical specifications.

2.11.3 Nothing in this warranty is intended to limit any manufacturer's warranty which provides The City with greater warranty rights than set forth in this Section or the Contract Documents. CMAR shall provide City with all manufacturers' warranties upon Substantial Completion.

2.11.4 Nothing in this warranty is intended to limit any other remedy at law that may be available to the City.

2.12 Correction of Defective Work

2.13 .1 CMAR agrees to correct any Work that is found to not be in conformance with the Contract Documents, including that part of the Work subject to Section 2.12 above, within a period of one (1) year from the date of Substantial Completion of the Work or any portion of the Work, or within such longer period to the extent required by the Contract Documents, or as may be available to the City by law. A progress payment, or partial or entire use or occupancy of the Project by the City, shall not constitute acceptance of Work not in accordance with the Contract Documents.

2.12.2 During the performance of the Work, CMAR shall take meaningful steps to commence correction of such nonconforming Work as notified by the City or as discovered by CMAR. This includes the correction, removal or replacement of the nonconforming Work and any damage caused to other parts of the Work affected by the nonconforming Work. If CMAR fails to commence the necessary steps during the performance of the Work, City, in addition to any other remedies provided under the Contract Documents, may provide CMAR with written notice that City shall commence correction of such nonconforming Work with its own forces.

2.12.3 CMAR shall, take meaningful steps to commence correction of nonconforming Work subject to Section 2.12 and/or Section 2.13.1 above, within seven (7) days of receipt of written notice from City. This includes the correction, removal or replacement of the nonconforming Work and any damage caused to other parts of the Work affected by the nonconforming Work. If CMAR fails to commence the necessary steps within such seven-day period, City, in addition to any other remedies provided under the Contract Documents, may provide CMAR with written notice that City shall commence correction of such nonconforming Work with its own forces. 2.12.4 If City does perform such corrective Work, CMAR shall be responsible for all reasonable costs incurred by City in performing such correction.

2.12.4 For nonconforming Work that creates an emergency requiring an immediate response, CMAR shall respond and initiate corrections within twenty-four hours.

2.12.5 The one year period referenced in Subsection 2.13.1 above applies only to CMAR's obligation to correct nonconforming Work relative to the warranty set forth in that section and is not intended to constitute a period of limitations for any other rights or remedies the City may have regarding CMAR's other obligations under the Contract Documents or as may be allowed by law.

Article 3 - The City's Services and Responsibilities

3.1 Duty to Cooperate.

3.1.1 City shall, throughout the performance of the Work, cooperate with CMAR and perform its responsibilities, obligations and services in a timely manner to facilitate CMAR's timely and efficient performance of the Work and so as not to delay or interfere with CMAR's performance of its obligations under the Contract Documents.

3.1.2 City shall furnish at CMAR's request, at no cost to CMAR, a CADD file of the Construction Documents in AutoCAD format compatible with the City of Flagstaff CADD technology.

3.2 The City's Representative

3.2.1 City's Representative shall be responsible for providing City (as defined in Article I) supplied information and approvals in a timely manner to permit CMAR to fulfill its obligations under the Contract Documents.

3.2.2 City's Representative shall also provide CMAR with prompt notice if City's Representative observes any failure on the part of CMAR to fulfill its contractual obligations, including any default or defect in the project or non-conformance with the drawings and specifications.

3.2.3 The City may utilize field inspectors to assist the City's Representative during construction in observing performance of CMAR. The inspector is for the purpose of assisting the City's Representative and should not be confused with an inspector with a City regulatory department.

3.2.3.1 The field inspector shall be authorized to inspect all Work and materials furnished. Such inspection may extend to all or part of the Work and to the preparation, fabrication or manufacture of the materials to be used.

3.2.3.2 The field inspector shall not be authorized to issue instructions contrary to the Construction Documents or to act as foreman for CMAR.

3.2.3.3 The field inspector shall have the authority to reject work or materials until any questions at issue can be decided by the City's Representative.

3.2.3.4 The furnishing of such services for the City shall not make the City responsible for or give the City control over construction means, methods, techniques, sequences or procedures or for safety precautions or programs or responsibility for CMAR's failure to perform the work in accordance with Contract Documents.

3.3 Design Professional Services

3.3.1 The City may contract separately with one or more Design Professionals to provide construction administration of the Project. The Design Professional's Agreement as well as other firms hired by the City shall be available for review by CMAR. CMAR shall not have any right however, to limit or restrict any contract provisions and/or modifications that are mutually acceptable to the City and Design Professional.

3.3.2 The City may contract with the Design Professional to provide some or all of the following services during the performance of the Work.

3.3.2.1 Provide oversight of the Work. The City and CMAR shall endeavor to communicate through the Design Professional. Communications by and with the Design Professional's consultants shall be through the Design Professional.

3.3.2.2 Conduct Site visits at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in accordance with the Contract Documents. The Design Professional shall keep the City informed of progress of the Work and any noted defects and deficiencies of the Work, and shall endeavor to guard the City against defects and deficiencies in the Work. The Design Professional may have authority to reject construction, which does not conform to the Construction Documents and to require additional inspection or testing of the construction in accordance with Section 2.7.

3.3.2.3 Review and recommend approval of Payment Requests.

3.3.2.4 Review and approve or take other appropriate action upon CMAR's Submittals such as Shop Drawings, Product Data and Samples in accordance with Section 2.6.

3.3.2.5 Interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the City or CMAR. The Design Professional's response to such requests shall be made with reasonable promptness and within any time limits agreed upon.

3.3.2.6 Prepare Change Orders, and may authorize minor changes in the Work as provided in Section 6.6.1.

3.3.2.7 Conduct inspections to determine Substantial Completion and Final Acceptance.

3.3.2.8 Receive and forward to the City for the City's review and records written warranties and related documents required by the Contract Documents and assembled by CMAR.

3.4 **City's Separate Contractors**. City is responsible for all work performed on the Project or at the Site by separate contractors under City's control. City shall contractually require its separate contractors to cooperate with, and coordinate their activities so as not to interfere with CMAR in order to enable CMAR to timely complete the Work consistent with the Contract Documents.

3.5 Permit Review and Inspections

3.5.1 If requested by CMAR, the City's Representative shall provide assistance and guidance in obtaining necessary reviews, permits and inspections, however, the responsibility for obtaining the necessary reviews, permits and inspections remains with CMAR.

3.5.2 Regulating agencies of the City, such as Community Development, Fire, Planning, Building Inspection, Environmental Services, and Engineering Departments, enforce Legal Requirements. These enforcement activities are not subject to the responsibilities of the City under this Agreement.

Article 4 - Contract Time

4.0 Contract Time.

4.0.1 Contract Time shall start with the Notice to Proceed ("NTP") with construction services and shall end with Substantial Completion.

4.0.2 Where there is more than one GMP, each GMP shall establish a separate NTP date and a Performance Period. The Performance Periods for individual GMPs may be sequential or concurrent as established in the individual Notices to Proceed. The Performance Period for the GMP under this Agreement shall be 90 days starting with the NTP.

4.0.3 CMAR agrees that it shall commence timely performance of the Work and shall achieve substantial completion within the Performance Periods and Contract Time.

4.0.4 All of the times set forth in this Article 4 shall be subject to adjustment in accordance with Article 6.

4.0.5 Time is of the essence, for times and time matters set forth in Article 4 and the rest of this Agreement.

Pursuant to Section 9.3 below, if, in the sole discretion of the Capital Improvements Department of the City of Flagstaff, the Project is not at Substantial Completion prior to the advent of adverse weather conditions, a Winter Shutdown shall occur during which no Work will be performed by any person or entity (including but not limited to the CMAR) on the Project and CMAR shall shutdown, properly insulate and shelter the Project in a safe and workmanlike manner pursuant to local, state and federal laws. Although December through March is typically the time frame, the City reserves the right to initiate and terminate a Winter Shutdown at the City's sole discretion in the event of adverse weather conditions. A Winter Shutdown may be declared by the City despite delays, *for any reason,* on the Project.

4.1 Substantial Completion

4.1.1 Substantial Completion shall be for the entire Project unless a partial Substantial Completion is identified in the approved GMP schedule and stated in the Notice to Proceed letter or as may be mutually agreed by the parties in writing. Substantial Completion shall be in accordance with its definition in Article 1 and with the criteria set forth in the Notice to Proceed.

4.1.2 Prior to notifying the City in accordance to Section 4.1.3 below, CMAR shall inspect the Work and prepare and submit to the City a comprehensive list of items to be completed or corrected. CMAR shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of CMAR to complete all Work in accorda*nce with the Co*ntract Documents**.**

4.1.3 CMAR shall notify City when it believes the Work, or to the extent permitted in the Contract Documents, a portion of the Work, is substantially complete.

4.1.4 Within five (5) days of City's receipt of CMAR's notice, the City and CMAR shall jointly inspect such Work to verify that it is substantially complete in accordance with the requirements of the Contract Documents.

4.1.5 If such Work is substantially complete, City shall prepare and issue a Certificate of Substantial Completion that shall set forth (i) the date of Substantial Completion of the Work or portion thereof, (ii) the remaining items of Work that have to be completed within thirty (30) calendar days before Final Acceptance, (iii) provisions (to the extent not already provided in the Contract Documents) establishing City's and CMAR's responsibility for the Project's security, maintenance, utilities and insurance pending Final Acceptance and (iv) an acknowledgment that warranties commence to run on the date of Substantial Completion, except as may otherwise be noted in the Certificate of Substantial Completion.

4.1.6 City, at its option, may use a portion of the Work which has been determined to be substantially complete, provided, however, that (i) a Certificate of Substantial Completion has been issued for the portion of Work addressing the items set forth in Section 4.1.5 above, (ii) CMAR and City have obtained the consent of their sureties and insurers, and to the extent applicable, the appropriate government authorities having jurisdiction over the Project, and (iii) City and CMAR agree that City's use or occupancy shall not interfere with CMAR's completion of the remaining Work.

4.2 Final Completion. Upon receipt of written notice that the Work or identified portions of the Work is ready for final inspection and acceptance, City and CMAR shall jointly inspect to verify that the remaining items of Work have been completed as set forth in Section 4.1.5. The City shall issue a Final Completion Letter and payment pursuant to Section 7.5.

4.3 Liquidated Damages

4.3.1 CMAR understands that if Substantial Completion is not attained within the Contract Time as adjusted, the City shall suffer damages, which are difficult to determine and accurately specify.

CMAR agrees that if Substantial Completion is not attained within the Contract Time as adjusted, CMAR shall pay the City $710.00 (to be determined on an agreement by agreement basis) per day as liquidated damages for each Day that Substantial Completion extends beyond the date determined by the Contract Time as adjusted and further agrees that such amount is reasonable under the circumstances.

4.3.2 CMAR understands that if Final Completion is not attained within the Contract Time as adjusted, the City shall suffer damages, which are difficult to determine and accurately specify. CMAR agrees that if Final Completion is not attained within the Contract Time as adjusted, CMAR shall pay the City $710.00 (to be determined on an agreement by agreement basis) per day as liquidated damages for each Day that Final Completion extends beyond the date determined by the Contract Time as adjusted and further agrees that such amount is reasonable under the circumstances.

4.4 Project Master Schedule

4.4.1 The Project Master Schedule approved as part of a GMP shall be updated and maintained throughout the Work by CMAR.

4.4.2 The Project Master Schedule shall be revised by CMAR as required by conditions and progress of the Work, but such revisions shall not relieve CMAR of its obligations to complete the Work within the Contract Time, as such dates may be adjusted in accordance with the Contract Documents.

4.4.3 Updated Project Master Schedules shall be submitted monthly by CMAR to the City as part of the Payment Request.

4.4.3.1 CMAR shall provide City with a monthly status report with each Project Master Schedule detailing the progress of the Work, including: (i) if the Work is proceeding according to schedule, (ii) any discrepancies, conflicts, or ambiguities found to exist in the Contract Documents that require resolution, and (iii) other items that require resolution so as not to jeopardize ability to complete the Work as presented in the GMP and within the Contract Time.

4.4.3.2 With each schedule submittal CMAR shall include a transmittal letter including the following:

- Description of problem tasks (referenced to field instructions, requests for information ("RFI's"), as appropriate.
- Current and anticipated delays including:
  - Cause of the delay
  - Corrective action and schedule adjustments to correct the delay
  - Known or potential impact of the delay on other activities, milestones, and/or the date of Substantial Completion
- Changes in construction sequence
- Pending items and status thereof including but not limited to:
  - Time Extension requests
  - Other items
- Substantial Completion date status:
  - If ahead of schedule, the number of calendar days ahead
  - If behind schedule, the number of calendar days behind
- Other project or scheduling concerns

4.4.4 City's review of and response to the Project Master Schedule is only for general conformance with the scheduling requirements of the Contract Documents. The review shall not relieve CMAR from compliance with the requirements of the Contract Documents or be construed as

relieving CMAR of its complete and exclusive control over the means, methods, sequences and techniques for executing the Work.

4.4.5 The Project Master Schedule shall include a Critical Path Method ("CPM") diagram schedule that shall show the sequence of activities, the interdependence of each activity and indicate the Critical Path.

4.4.5.1 The CPM diagram schedule shall be in Days and indicate duration, earliest and latest start and finish dates for all activities, and total Float times for all activities except critical activities. The CPM diagram shall be presented in a time scaled graphical format for the Project as a whole.

4.4.5.2 The CPM diagram schedule shall indicate all relationships between activities.

4.4.5.3 The activities making up the schedule shall be in sufficient detail to assure that adequate planning has been done for proper execution of the Work and such that it provides an appropriate basis for monitoring and evaluating the progress of the Work.

4.4.5.4 The CPM diagram schedule shall be based upon activities, which would coincide with the Schedule of Values.

4.4.5.5 The CPM diagram schedule shall show all Submittals associated with each work activity and the review time for each submittal.

4.4.5.6 The schedule shall show milestones, including milestones for Owner-furnished information, and shall include activities for Owner-furnished equipment and furniture when those activities are interrelated with CMAR activities.

4.4.5.7 The schedule shall include a critical path activity that reflects anticipated weather delay during the performance of the Agreement. The duration shall reflect the average climatic range and usual industrial conditions prevailing in the locality of the Site. Weather data shall be based on the information set forth on the City of Flagstaff's Table of "Monthly Anticipated Adverse Weather Calendar Days" and the explanatory paragraphs attached thereto.

4.4.6 The Project Master Schedule shall consider the City's and the tenants' occupancy requirements showing portions of the Project having occupancy priority, and Contract Time.

4.4.7 Float time shall be as prescribed below:

4.4.7.1 The total Float within the overall schedule, is not for the exclusive use of either the City or CMAR, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet Agreement milestones and the Project completion date.

4.4.7.2 CMAR shall not sequester shared Float through such strategies as extending activity duration estimates to consume available Float, using preferential logic, or using extensive crew/resource sequencing, etc. Since Float time within the schedule is jointly owned, no time extensions shall be granted nor delay damages paid until a delay occurs which extends the Work beyond the Substantial Completion date and then only if any such extensions or damages are shown to be justified under the Contract Documents.

4.4.7.3 Since Float time within the schedule is jointly owned, it is acknowledged that City-caused delays on the Project may be offset by City-caused time savings (i.e., critical path Submittals returned in less time than allowed by the Agreement, approval of substitution requests and credit changes which result in savings of time to CMAR, etc.). In such an event, CMAR shall not be entitled to receive a time extension or delay damages until all City-caused time savings

are exceeded, and the Substantial Completion date is also exceeded.

Article 5- Contract Price

5.0.1 CMAR agrees at his own cost and expense, to completely construct and install all Work and materials as called for by this Agreement, free and clear of all claims, liens and charges whatsoever, in the manner and under the conditions specified in the Contract Documents, within the time or times stated in the approved GMP.

5.1 Contract Price

5.1.1 The Contract Price shall be as approved in the Guaranteed Maximum Price Proposal attached as Exhibit "B" and an amount of $1,094,649.80 with an additional $204,000.00 allowed for Owner's Contingency for a total contract price of $1,298,649.80.

5.1.2 The Cost of the Work is actual costs and is a not-to-exceed reimbursable amount.

5.1.3 The General Conditions Costs will be included in the GMP as a not to exceed amount and paid for on actual costs based on submitted and approved invoices. The Construction Fee will be paid as a firm lump sum.

5.1.4 Taxes are deemed to include all sales, use consumer and other taxes, which are legally enacted when negotiations of the GMP were concluded, whether or not yet effective, or merely scheduled to go into effect. Taxes are actual costs and are a not-to-exceed reimbursable amount.

5.2 Guaranteed Maximum Price

5.2.1 The Guaranteed Maximum Price is composed of the maximum Cost of the Work; the Construction Fee; General Conditions Costs; taxes; and, CMAR's contingency all of which are not-to-exceed cost reimbursable or lump sum amounts defined in Articles 5.1 and 5.3. CMAR is at risk to cover any additional Project costs. If the Cost of Work amount, set forth in the GMP, is in excess of the actual Cost of Work and/or CMAR's Contingency, said amount by which the Cost of Work set forth in the GMP is in excess of the actual Cost of Work and/or CMAR's Contingency, shall revert to the City.

5.2.2 The GMP is subject to adjustments made in accordance with Article 6 and by GMP amendments to this Agreement.

5.2.3 GMP amendments are cumulative except for CMAR's Contingency. The amount of CMAR's Contingency for each GMP shall be negotiated separately.

5.2.4 If the GMP requires an adjustment due to changes in the scope of the Work the cost of such changes is determined subject to Article 6. The markups that may be allowed on such changes shall be no greater than the markups delineated in the approved GMP.

5.3 Contingencies

5.3.1 CMAR's Contingency is an amount CMAR may use at its sole discretion for, an increase in the Cost of Work, and may use for increases in General Conditions Costs with written approval of the City. CMAR's Contingency is assumed to be a direct Project cost and all applicable markups shall be applied at the time of GMP submission.

5.3.2 When CMAR utilizes CMAR's Contingency funds, CMAR shall make the appropriate changes to the Schedule of Values with the next regular progress payment request. CMAR shall deduct the amount of CMAR's Contingency funds used from CMAR's Contingency line item

and add the same amount to the line item on the Schedule of Values where the funds were used. If CMAR's contingency funds are used for a new line item that was not given with the original Schedule of Values, these shall be so indicated.

5.3.3 Owner's Contingency are funds to be used at the sole discretion of the Owner to cover any increases in Project costs that result from Owner directed changes or unforeseen Site conditions. Owner's Contingency shall be added to the GMP amount provided by CMAR, the sum of which shall be the full Contract Price for construction. At the time that Owner's Contingency is used the appropriate markups shall be applied.

5.4 **Open Book.** CMAR shall submit to the City upon request all payrolls, reports, estimates, records and any other data concerning the Work performed or to be performed or concerning materials supplied or to be supplied, as well as Subcontractor or Consultant payment applications or invoices and such Subcontractor's or Consultant progress payment checks. The requirements of this Section shall be included in all Agreements between CMAR and its Subcontractors and Consultants. The City may exercise its rights under this Section as often as reasonably necessary in the City's sole judgment to assure the City has a complete and accurate understanding of all Project costs.

Upon project closeout and immediately prior to the release of final payment, the CMAR shall provide to the City a Final Cost Report detailing all Project costs for each division of work with supporting documentation for materials, labor, equipment and other appurtenant items.

Article 6 - Changes to the Contract Price and Time

6.0 Delays to the Work

6.0.1 If CMAR is delayed in the performance of the Work that shall cause a change in the date of Substantial Completion due to acts, omissions, conditions, events, or circumstances beyond its control and due to no fault of its own, or, those for whom CMAR is responsible, the Contract Times for performance shall be reasonably extended by Change Order. However, the City and the CMAR must agree on the determination of whether acts, omissions, conditions, events, or circumstances are actually beyond the CMARs control and/or whether they are due to no fault of the CMAR, or those for whom CMAR is responsible; if the City and the CMAR do not agree, then an independent third party, selected by both parties, shall make the determination of whether acts, omissions, conditions, events, or circumstances are actually beyond the CMARs control and/or whether they are due to no fault of the CMAR, or those for whom CMAR is responsible.

6.0.2 CMAR shall request an increase in the Contract Time by written notice including an estimate of probable effect of delay on progress of the Work within three (3) days of the occurrence of the delay. In the case of a continuing delay only one request is necessary.

6.0.3 By way of example, events that shall entitle CMAR to an extension of the Contract Time include acts or omissions of City or anyone under City's control (including separate Contractors), changes in the Work, Differing Site Conditions, Hazardous Conditions, delays by regulating agencies, wars, floods, labor disputes, unusual delay in transportation, epidemics abroad, earthquakes, adverse weather conditions not reasonably anticipated, and other acts of God.

6.0.4 If adverse weather conditions are the basis for a request for additional Contract Time, such requests shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather

conditions had an adverse effect on the scheduled Substantial Completion. All terms, conditions and definitions necessary for the application of this paragraph shall be as set forth on the City of Flagstaff's Table of "Monthly Anticipated Adverse Weather Calendar Days" and the explanatory paragraphs attached thereto.

6.0.5 It is understood, however, that permitting CMAR to proceed to complete any Work, or any part of the Work, after the date to which the time of completion may have been extended, shall in no way act as a waiver on the part of the City of any of its legal rights herein.

6.0.6 In addition to CMAR's right to a time extension for those events set forth in this Section, CMAR shall also be entitled to an appropriate adjustment of the Contract Price provided, however, that the Contract Price shall not be adjusted for those events set forth in this Section that are beyond the control of both CMAR and City, including the events of war, floods, labor disputes, earthquakes, epidemics, adverse weather conditions not reasonably anticipated, and other acts of God and shall not be adjusted absent a showing of actual damage.

6.1 Differing Site Conditions

6.1.1 If CMAR encounters a Differing Site Condition, CMAR shall be entitled to an adjustment in the Contract Price and/or Contract Times to the extent CMAR's cost and/or time of performance are actually adversely impacted by the Differing Site Condition.

6.1.2 Upon encountering a Differing Site Condition, CMAR shall provide prompt written notice to City of such condition, which notice shall not be later than seven (7) days after such condition has been encountered. CMAR shall, to the extent reasonably possible, provide such notice before the Differing Site Condition has been substantially disturbed or altered.

6.2 Errors, Discrepancies and Omissions

6.2.1 If CMAR observes errors, discrepancies or omissions in the Contract Documents, CMAR shall promptly notify the Design Professional and request clarification.

6.2.2 If CMAR proceeds with the Work affected by such errors, discrepancies or omissions, without receiving such clarifications, CMAR does so at its own risk. Adjustments involving such circumstances made by CMAR prior to clarification by the Design Professional shall be at CMAR's risk.

6.3 The City Requested Change in Work

6.3.1 The City reserves the right to make, at any time during the progress of the Work, such alterations as may be found necessary or in the City's best interest.

6.3.2 Such alterations and changes shall not invalidate this Agreement nor release the surety and CMAR agrees to perform the Work as altered, the same as if it has been a part of the original Contract Documents.

6.3.3 The City shall request a proposal for a change in Work from CMAR, and an adjustment in the Contract Price and/or Contract Times shall be made based on a mutual agreed upon cost and time.

6.4 Legal Requirements. The Contract Price and/or Contract Times shall be adjusted to compensate CMAR for the effects of any changes in the Legal Requirements enacted after the date of their Agreement or the date of the GMP, affecting the performance of the Work

6.5 Change Directives and Change Orders

6.5.1 City and CMAR shall negotiate in good faith and as expeditiously as possible the appropriate adjustments for a Change Directive if any adjustments are appropriate. Upon reaching an agreement, the parties shall prepare and execute an appropriate Change Order reflecting the terms of the adjustment.

6.5.2 All changes in Work authorized by Change Directives and/or Change Orders shall be performed under the conditions of the Contract Documents.

6.6 Minor Changes in the Work

6.6.1 The City has authority to order minor changes in Work that do not materially and adversely affect the Work, including the design, quality, performance and workmanship required by the Contract Documents. Such changes shall be affected by written order and shall be binding on the City and CMAR. CMAR shall carry out such written orders promptly.

6.6.2 CMAR may make minor changes in Work, provided, however that CMAR shall promptly inform City, in writing, of any such changes and record such changes, if appropriate, on the Project Record Documents maintained by CMAR.

6.6.3 Minor changes in Work shall not involve an adjustment in the Contract Price and/or Contract Times.

6.7 Contract Price Adjustments

6.7.1 The increase or decrease in Contract Price resulting from a change in the Work shall be determined by one or more of the following methods:

6.7.1.1 Unit prices set forth in this Agreement or as subsequently agreed to between the parties;

6.7.1.2 A mutually accepted, lump sum, properly itemized and supported by sufficient substantiating data to permit evaluation by City; and

6.7.1.3 Costs, fees and any other markups.

6.7.2 The markups that shall be allowed on such changes shall be no greater than the markups delineated in the approved GMP as shown on Exhibit “B”.

6.7.3 If an increase or decrease cannot be agreed to as set forth in Sections 6.7.1.1 through 6.7.1.3 above and City issues a Change Directive, the cost of the change of the Work shall be determined by the reasonable expense and savings in the performance of the Work resulting from the change, including a reasonable overhead and profit, as may be set forth in their Agreement. CMAR shall maintain a documented, itemized accounting evidencing the expenses and savings associated with such changes.

6.7.4 If unit prices are set forth in the Contract Documents or are subsequently agreed to by the parties, but application of such unit prices shall cause substantial inequity to City or CMAR because of differences in the character or quantity of such unit items as originally contemplated, such unit prices shall be equitably adjusted.

6.7.5 If City and CMAR disagree upon whether CMAR is entitled to be paid for any services required by City, or if there are any other disagreements over the scope of Work or proposed changes to the Work, City and CMAR shall resolve the disagreement pursuant to Article 8 hereof.

6.7.5.1 As part of the negotiation process, CMAR shall furnish City with a good faith estimate of the costs to perform the disputed services in accordance with City's interpretations.

6.7.5.2 If the parties are unable to agree and City expects CMAR to perform the services in accordance with City's interpretations, CMAR shall proceed to perform the disputed services, conditioned upon City issuing a written order to CMAR (i) directing CMAR to proceed and (ii) specifying City's interpretation of the services that are to be performed.

6.7.6 **Emergencies**. In any emergency affecting the safety of persons and/or property, CMAR shall act, at its discretion, to prevent threatened damage, injury or loss. Any change in the Contract Price and/or Contract Time resulting from emergency work under this Section shall be determined as provided in this Article.

6.7.7 **Force Majeure.** The parties acknowledge that there may be events that occur during the term of this Contract that are beyond the control of both the City and the Contractor, including events of war, floods, labor, disputes, earthquakes, epidemics, pandemics, adverse weather conditions not reasonably anticipated, forest fires, and other acts of God. These events may result in temporary delay or permanent shut down of the work that is the subject of this Contract, as set forth in Exhibit B. This may be caused by such things as stay-at-home orders, loss of labor force, supply chain delays, and other impediments to timely delivery of the Contract.

The parties agree that there will be no claims arising from a temporary delay or permanent shut down caused by the events described above and that the City will pay no additional costs incurred as a result of such events.

The parties agree to act in good faith to extend the Contract completion date without any penalty to the Contractor and that the extension will be in an amount of time equal to any temporary delay. This term supersedes all other terms regarding temporary delay, permanent shut down, or increased costs.

Article 7- Procedure for Payment

7.0 For and in consideration of the faithful performance of the Work herein embraced as set forth in the Contract Documents, which are a part hereof and in accordance with the directions of the City and to the City's satisfaction, the City agrees to pay CMAR the actual Cost of the Work and any applicable General Conditions Costs including, insurance and bonding, taxes and CMAR's Construction Fee, but no more than the GMP as adjusted by any change orders. Payment for the specific Work under this Agreement shall be made in accordance with payment provisions detailed below.

7.1 GMP Payment Request

7.1.1 At the pre-construction conference prescribed in Section 2.4, CMAR shall submit for City's review and approval a Schedule of Values. The Schedule of Values shall serve as the basis for monthly progress payments made to CMAR throughout the Work.

7.1.2 At least five (5) working days prior to the date established for a Payment Request, CMAR shall submit an updated Project Master Schedule and meet with the City's Representative to review the progress of the Work as it shall be reflected on the Payment Request.

7.1.3 The Payment Request shall constitute CMAR's representation that the Work has been performed consistent with the Contract Documents, has progressed to the point indicated in the Payment Request, and that title to all Work shall pass to City free and clear of all claims, liens, encumbrances, and security interests upon the incorporation of the Work into the Project.

The Payment Request shall include, at a minimum:

1. Monthly Executive summary detailing work completed during the pay period, a statement addressing the project budget and schedule and the items of work anticipated for the upcoming pay period
2. Current critical path schedule
3. Pay application cover sheet, detailed schedule of values and conditional lien waivers upon release of progress payment
4. Subcontractor and Supplier invoices and conditional lien waivers for current pay period
5. General Conditions invoices for current pay period
6. Daily Reports for current pay period
7. Weekly reports for current pay period
8. Project meeting minutes for current pay period
9. Certified payroll reports- alphabetical by subcontractor (when required for Davis Bacon projects)

7.1.4 The Payment Request may request payment for stored equipment and materials if construction progress is in reasonable conformance with the approved schedule.

7.1.4.1 For equipment and materials suitably stored at the Site, the equipment and materials shall be protected by suitable insurance and City shall receive the equipment and materials free and clear of all liens and encumbrances.

7.1.4.2 For materials and equipment stored off the Site, the City must approve the storage. The material and equipment must be stored within Coconino County or other Sites as may be approved and be accessible for City's inspection. CMAR must establish City title to such materials and equipment or otherwise protect the City's interest and shall include applicable insurance, bonding, storage and transportation to the Site.

7.1.4.3 All bonds and insurance required for stored materials shall name the City as the loss payee to the extent of its interest in the stored materials.

7.1.5 CMAR shall submit to City on a monthly basis either on the first of the month for payment on the 15th or on the 19th of the month for payment on the 30th or 31st. If the payment date is on a Saturday, payment shall be on Friday. If the payment date is on a Sunday, payment shall be on Monday.

7.2 Payment of GMP

7.2.1 City shall make payment in accordance with A.R.S. §34-607. Payment shall be made no later than fourteen (14) days after the Payment Request is certified and approved, but in each case less the total of payments previously made, and less amounts properly retained under Section 7.3 below.

7.2.2 City shall pay CMAR all amounts properly due. If City determines that CMAR is not entitled to all or part of a Payment Request, it shall notify CMAR in writing within (7) days after the date Payment Request is received by the City. The notice shall indicate the specific amounts City intends to withhold, the reasons and contractual basis for the withholding, and the specific measures CMAR shall take to rectify City's concerns. CMAR and City shall attempt to resolve City's concerns. If the parties cannot resolve such concerns, CMAR may pursue its rights under the Contract Documents, including those under Article 8 hereof.

7.3 Retention of GMP

7.3.1 City shall retain ten percent (10%) of each Payment Request amount provided. When fifty percent (50%) of the Work has been completed by CMAR, upon request of CMAR, City may

reduce the amount retained to five percent (5%) from CMAR's subsequent Payment Requests if CMAR's performance of Work has been satisfactory.

7.3.2 In lieu of retention, CMAR may provide as a substitute, an assignment of time certificates of deposit (CDs) from a bank licensed by the State of Arizona, securities of or guaranteed by the United States of America, securities of counties, municipalities and school districts within the State of Arizona or shares of savings and loan institutions authorized to transact business in Arizona.

7.3.2.1 CDs assigned to the City must be maintained at the City's single servicing bank, in the form of time deposit receipt accounts.

7.3.2.2 Securities deposited in lieu of retention must be deposited into a separate account with a bank within the State of Arizona.

7.3.2.3 CDs and Securities shall be assigned exclusively for the benefit of the City of Flagstaff pursuant to the City's form of Escrow Agreement. Escrow Agreement forms may be obtained from the Purchasing Department by contacting Matt Luhman, Purchasing Manager.

7.4 **Substantial Completion**. Upon Substantial Completion of the entire Work or, if applicable, any portion of the Work, City shall release to CMAR all retained amounts relating, as applicable, to the entire Work or completed portion of the Work, less an amount up to two and one-half (2.5) times the reasonable value of all remaining or incomplete items of Work as noted in the Certificate of Substantial Completion.

7.5

7.6 Final Payment

7.6.1 After receipt of a final Payment Request, City shall make final payment within sixty (60) days after receipt by the City, provided that CMAR has completed all of the Work in conformance with the Contract Documents and a Final Completion Letter has been issued by the City.

7.6.2 At the time of submission of its final Payment Request, CMAR shall provide the following information:

7.6.2.1 An affidavit affirming that there are no claims, obligations or liens outstanding or unsatisfied for labor, services, material, equipment, taxes or other items performed, furnished or incurred for or in connection with the Work which shall in any way affect City's interests;

7.6.2.2 A general release executed by CMAR waiving, upon receipt of final payment by CMAR, all claims, except those claims previously made in writing to City and remaining unsettled at the time of final payment; and

7.6.2.3 Consent of CMAR's surety, if any, to final payment.

7.7 Payments To Subcontractors or Suppliers

7.7.1 CMAR shall pay its Subcontractors or suppliers within seven (7) calendar days of receipt of each progress payment from the City. CMAR shall pay for the amount of Work performed or materials supplied by each Subcontractor or supplier as accepted and approved by the City with each progress payment. In addition, any reduction of retention by the City to CMAR shall result in a corresponding reduction to Subcontractors or suppliers who have performed satisfactory work. CMAR shall pay Subcontractors or suppliers the reduced retention within fourteen (14) calendar days of the payment of the reduction of the retention to CMAR. No agreement between CMAR and its Subcontractors and suppliers may materially alter the rights of any Subcontractor or supplier to receive prompt payment and retention reduction as provided herein.

7.7.2 If CMAR fails to make payments in accordance with these provisions, the City may take any one or more of the following actions and CMAR agrees that the City may take such actions:

7.7.2.1 Hold CMAR in default under this Agreement;

7.7.2.2 Withhold future payments including retention until proper payment has been made to Subcontractors or suppliers in accordance with these provisions;

7.7.2.3 Reject all future offers to perform work for the City from CMAR for a period not to exceed one (1) year from Substantial Completion date of this Project; or

7.7.2.4 Terminate this Agreement.

7.7.3 If CMAR's payment to a Subcontractor or supplier is in dispute, it shall act in compliance with A.R.S. § 32-1129.02(D) and related statutes as amended, and shall further hold the City harmless from any ensuing damages, claims or costs.

7.7.4 Should the City fail or delay in exercising or enforcing any right, power, privilege, or remedy under this Section, such failure or delay shall not be deemed a waiver, release, or modification of the requirements of this Section or of any of the terms or provisions thereof.

7.7.5 CMAR shall include these prompt payment provisions in every subcontract, including procurement of materials and leases of equipment for this Agreement.

7.8 Record Keeping and Finance Controls

7.8.1 Records of CMAR's direct personnel payroll, reimbursable expenses pertaining to this Project and records of accounts between the City and CMAR shall be kept on a generally recognized accounting basis and shall be available for three (3) years after Final Completion of the Project.

7.8.2 The City, its authorized representative, and/or the appropriate federal agency, reserve the right to audit CMAR's records to verify the accuracy and appropriateness of all pricing data, including data used to negotiate Contract Documents and any Change Orders.

7.8.3 The City reserves the right to decrease Contract Price and/or payments made on this Agreement if, upon audit of CMAR's records, the audit discloses CMAR has provided false, misleading, or inaccurate cost and pricing data.

7.8.4 CMAR shall include a similar provision in all of its agreements with Subconsultants and Subcontractors providing services under the Contract Documents to ensure the City, its authorized representative, and/or the appropriate federal agency, has access to the Subconsultants' and Subcontractors' records to verify the accuracy of cost and pricing data.

7.8.5 The City reserves the right to decrease Contract Price and/or payments made on this Agreement if the above provision is not included in Subconsultant's and Subcontractor's Agreements, and one or more Subconsultants and/or Subcontractors do not allow the City to audit their records to verify the accuracy and appropriateness of pricing data.

7.8.6 Records and Retention Requirements: The City and its employees, agents, and authorized representatives shall have the right at all reasonable times and during all business hours to inspect and examine CMAR's records related to this Agreement. CMAR shall comply with the City of Flagstaff's records retention policy. This record retention requirement shall remain in effect following expiration of the Agreement or termination of the Agreement by either Party.

Article 8- Claims and Disputes

8.0 Requests for Agreement Adjustments and Relief.

8.0.1 If either CMAR or City believes that it is entitled to relief against the other for any event arising out of or related to Work, such party shall provide written notice to the other party of the basis for its claim for relief.

8.0.2 Such notice shall, if possible, be made prior to incurring any cost or expense and in accordance with any specific notice requirements contained in applicable sections of the Agreement.

8.0.3 In the absence of any specific notice requirement, written notice shall be given within a reasonable time, not to exceed fourteen (14) days, after the occurrence giving rise to the claim for relief or after the claiming party reasonably should have recognized the event or condition giving rise to the request, whichever is later.

8.0.4 Such notice shall include sufficient information to advise the other party of the circumstances giving rise to the claim for relief, the specific contractual adjustment or relief requested and the basis of such request.

8.1 Dispute Avoidance and Resolution

8.1.1 The parties are fully committed to working with each other throughout the Project and agree to communicate regularly with each other at all times so as to avoid or minimize disputes or disagreements. If disputes or disagreements do arise, CMAR and City each commit to resolving such disputes or disagreements in an amicable, professional and expeditious manner so as to avoid unnecessary losses, delays and disruptions to the Work.

8.1.2 CMAR and City shall first attempt to resolve disputes or disagreements at the field level through discussions between CMAR's Representative and City's Representative.

8.1.3 If a dispute or disagreement cannot be resolved through CMAR's Representative and City's Representative, CMAR's Senior Representative and City's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than thirty (30) days after such a request is made, to attempt to resolve such dispute or disagreement. Prior to any meetings between the Senior Representatives, the parties shall exchange relevant information that shall assist the parties in resolving their dispute or disagreement.

8.1.4 Except as otherwise agreed by the parties, any litigation brought by either party against the other to enforce the provisions of this Agreement shall be filed in the Coconino County Superior Court and Arizona law shall apply and control. In the event any action at law or in equity is instituted between the parties in connection with this Agreement, the prevailing party in the action shall be entitled to its costs including reasonable attorneys' fees and court costs from the non-prevailing party.

8.2 Duty to Continue Performance. Unless provided to the contrary in the Contract Documents, CMAR shall continue to perform the Work and City shall continue to satisfy its payment obligations to CMAR, pending the final resolution of any dispute or disagreement between CMAR and City.

8.3 Representatives of the Parties

8.3.1 The City's Representatives

8.3.1.1 City designates the individual listed below or his designee as its Senior Representative ("City's Senior Representative"), which individual has the authority and responsibility for avoiding and resolving disputes under Section 8.1.3:

Andy Bertelsen, Division/Department Head
211 West Aspen Avenue
Flagstaff, AZ 86001
(928) 213-2105
abertelsen@flagstaffaz.gov

8.3.1.2 City designates the individual listed below as its City's Representative, which individual has the authority and responsibility set forth in Section 8.1.2:

Matt Morales, Project Manager
211 West Aspen Avenue
Flagstaff, AZ 86001
(928) 226-2123
matthew.morales@flagstaffaz.gov

8.3.2 CMAR's Representatives

8.3.2.1 CMAR designates the individual listed below as its Senior Representative ("CMAR's Senior Representative"), which individual has the authority and responsibility for avoiding and resolving disputes under Section 8.1.3:

Mike Claflin, Estimator
7520 E. Adobe Dr.
Scottsdale, AZ 85255
(480) 222-9922

8.3.2.2 CMAR designates the individual listed below as its CMAR's Representative, which individual has the authority and responsibility set forth in Section 8.1.2:

Mike Claflin, Estimator
7520 E. Adobe Dr.
Scottsdale, AZ 85255
(480) 222-9922

Article 9 – Suspension and Termination

9.0 City's Right to Stop Work

9.0.1 City may, at its discretion and without cause, order CMAR in writing to stop and suspend the Work. Such suspension shall not exceed one hundred and eighty (180) consecutive days.

9.0.2 CMAR may seek an adjustment of the Contract Price and/or Contract Time if its cost or time to perform the Work has been adversely impacted by any suspension or stoppage of Work by City.

9.1 Termination for Convenience

9.1.1 The City may terminate this Agreement at any time for any reason by giving at least thirty (30) days written notice to the CMAR. In such event, City shall pay CMAR only the direct value of its completed Work and materials supplied as of the date of termination. CMAR shall be entitled to profit and overhead on completed Work only, but shall not be entitled to anticipated profit or anticipated overhead.

9.1.2 If the City suspends the Work for one hundred eighty-one (181) consecutive days or more, such suspension shall be deemed a termination for convenience.

9.1.3 Upon such notice of termination for convenience, CMAR shall proceed with the following obligations:

9.1.3.1 Stop Work as specified in the notice.

9.1.3.2 Place no further subcontracts or orders.

9.1.3.3 Terminate all subcontracts to the extent they relate to the Work terminated. CMAR shall ensure that all subcontracts contain this same termination for convenience provision set forth in Section 9.1 et seq.

9.1.3.4 At the City's sole discretion and if requested in writing by the City, assign to the City all rights, title and interest of CMAR under the subcontracts subject to termination.

9.1.3.5 Take any action that may be necessary for the protection and preservation of the property related to this Agreement that is in the possession of CMAR and in which the City has or may acquire an interest.

9.1.4 CMAR shall submit complete termination inventory schedules no later than one hundred twenty (120) days from the date of the notice of termination.

9.1.5 The City shall pay CMAR the following:

9.1.5.1 The direct value of its completed Work and materials supplied as of the date of termination.

9.1.5.2 The reasonable and direct, actual costs and expenses attributable to such termination. Reasonable costs and expenses shall not include, among other things, anticipated profit, anticipated overhead, or costs arising from CMAR's failure to perform as required under this Agreement.

9.1.5.3 CMAR shall be entitled to profit and overhead on completed Work only, but shall not be entitled to anticipated profit or anticipated overhead. If it is determined that CMAR would have sustained a loss on the entire Work had they been completed, CMAR shall not be allowed profit and the City shall reduce the settlement to reflect the indicated rate of loss.

9.1.6 CMAR shall maintain all records and documents for three (3) years after final settlement. These records shall be maintained and subject to auditing as prescribed in Section 7.7.

9.2 The City's Right to Perform and Terminate for Cause

9.2.1 If the City provides CMAR with a written order to provide adequate maintenance of traffic, adequate cleanup, adequate dust control or to correct deficiencies or damage resulting from

abnormal weather conditions, and CMAR fails to comply in a time frame specified, the City may have work accomplished by other sources at CMAR's sole expense.

9.2.2 If CMAR persistently fails to (i) provide a sufficient number of skilled workers, (ii) supply the materials required by the Contract Documents, (iii) comply with applicable Legal Requirements, (iv) timely pay, without cause, Subconsultants and/or Subcontractors, (v) prosecute the Work with promptness and diligence to ensure that the Work is completed by the Contract Time, as such times may be adjusted, or (vi) perform material obligations under the Contract Documents, then City, in addition to any other rights and remedies provided in the Contract Documents or by law, shall have the rights set forth in Subsections 9.2.3 and 9.2.4 below.

9.2.3 Upon the occurrence of an event set forth in Subsection 9.2.2 above, City may provide written notice to CMAR that it intends to terminate this Agreement unless the problem cited is cured, or commenced to be cured, within seven (7) days of CMAR's receipt of such notice.

9.2.3.1 If CMAR fails to cure, or reasonably commence to cure, such problem, then City may give a second written notice to CMAR of its intent to terminate within an additional seven (7) day period.

9.2.3.2 If CMAR, within such second seven (7) day period, fails to cure, or reasonably commence to cure, such problem, then City may declare this Agreement terminated for default by providing written notice to CMAR of such declaration.

9.2.4 Upon declaring this Agreement terminated pursuant to Subsection 9.2.3.2 above, City may enter upon the premises and take possession, for the purpose of completing the Work, of all materials, equipment, scaffolds, tools, appliances and other items thereon, which have been purchased or provided for the performance of the Work, all of which CMAR hereby transfers, assigns and conveys to City for such purpose, and to employ any person or persons to complete the Work and provide all of the required labor, services, materials, equipment and other items.

9.2.5 In the event of such termination, CMAR shall not be entitled to receive any further payments under the Contract Documents until the Work shall be finally completed in accordance with the Contract Documents. At such time, CMAR shall only be entitled to be paid for Work performed and accepted by the City prior to its default.

9.2.6 If City's cost and expense of completing the Work exceeds the unpaid balance of the Contract Price, then CMAR shall be obligated to pay the difference to City. Such costs and expenses shall include not only the cost of completing the Work, but also losses, damages, costs and expense, including attorneys' fees and expenses, incurred by City in connection with the reprocurement and defense of claims arising from CMAR's default.

9.2.7 If City improperly terminates the Agreement for cause, the termination for cause shall be converted to a termination for convenience in accordance with the provisions of Section 9.1.

9.3 Maintenance During Winter Shutdown of Work; Snow Removal

9.3.1 **The Capital Improvement Department of the** City of Flagstaff retains the right to declare a Winter Shutdown when, in the opinion of the City, it would be unreasonable to continue Work due to adverse weather conditions. The Winter Shutdown determination is at the sole discretion of the City. If Work has been suspended due to winter weather, the CMAR shall be responsible for maintenance and protection of the improvements and of partially completed portions of the Work until final acceptance of the project. Winter Shutdown shall be by field order, change order or original contract. If repairs and/or maintenance are needed during the Winter Shutdown, the CMAR is required to

perform the repairs and/or maintenance within twenty-four (24) hours of notification from the City. If the needed repairs and/or maintenance are not addressed within the timeframe, the City will accomplish the repairs and/or maintenance and deduct the cost from monies due or become due to the CMAR.

9.3.2 The City shall provide snow removal operations on active traffic lanes only. All other snow removal and maintenance operations shall be the responsibility of the Contractor. All cost associated with snow removal and proper disposal shall be considered incidental to the work including repair of temporary surface improvements due to normal wear and snow removal operations.

9.3.3 Upon termination of the Winter Shutdown by the City, the CMAR shall have the right to complete the Work and the Project.

9.3.4 The CMAR shall be solely responsible for any and all costs incurred either as a direct or indirect result of a Winter Shutdown, and shall hold the City harmless from the same.

Article 10 - Insurance and Bonds

10.0 Insurance Requirements

10.0.1 CMAR and Subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this Agreement are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the Work hereunder by CMAR, its agents, representatives, employees or Subcontractors.

10.0.2 The insurance requirements herein are minimum requirements for this Agreement and in no way limit the indemnity covenants contained in this Agreement.

10.0.3 The City in no way warrants that the minimum limits contained herein are sufficient to protect CMAR from liabilities that might arise out of the performance of the work under this Agreement by CMAR, its agents, representatives, employees, or subcontractors. CMAR is free to purchase such additional insurance as may be determined necessary.

10.1 Minimum Scope and Limits of Insurance. CMAR shall provide coverage with limits of liability not less than those stated below:

10.1.1 Commercial General Liability – Occurrence Form

• General Aggregate/for this Project	$2,000,000/$1,000,000
• Products – Completed Operations Aggregate	$1,000,000
• Each Occurrence	$1,000,000

The policy shall be endorsed to include the following additional insured language: **"The City of Flagstaff shall be named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of CMAR."**

Additional Insured Status. The insurance coverage, except Workers' Compensation, required by this Agreement, shall name the CITY, its agents, representatives, directors, officials, employees, and officers, as additional insured AND be accompanied by the required endorsement. Such evidence of additional insured status shall be subject to the approval of the Risk Management Department of the City of Flagstaff. The absence of acceptable insurance and endorsement shall be deemed a breach of this agreement.

10.1.2 Automobile Liability **-** Bodily injury and property damage for any owned, hired, and non-owned vehicles used in the performance of this Agreement.
Combined Single Limit ("CSL") $1,000,000

The policy shall be endorsed to include the following additional insured language: **"The City of Flagstaff shall be named as an additional insured with respect to liability arising out of the activities performed by, or on behalf of CMAR, including automobiles owned, leased, hired or borrowed by CMAR."**

10.1.3 Worker's Compensation: The CMAR shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes.

10.1.4 **Builders' Risk Insurance or Installation Floater** $_____
In an amount equal to the initial Contract Amount plus additional coverage equal to Contract Amount for all subsequent change orders.

10.1.4.1 The City of Flagstaff, CMAR, Subcontractors, Design Professional and Design Professional's consultant and any others with an insurable interest in the Work shall be **Named Insureds** on the policy**.**

10.1.4.2 Coverage shall be written on an all risk, replacement cost basis and **shall include coverage for soft costs, flood and earth movement**.

10.1.4.3 Coverage shall be maintained until whichever of the following shall first occur: (i) final payment has been made; or, (ii) until no person or entity, other than the City of Flagstaff, has an insurable interest in the property required to be covered.

10.1.4.4 Coverage shall be endorsed such that the insurance shall not be canceled or lapse because of any partial use or occupancy by the City.

10.1.4.5 CMAR shall provide coverage from the time any covered property becomes the responsibility of CMAR, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation Site, or awaiting installation, whether on or off Site.

10.1.4.6 Coverage shall contain a **waiver of subrogation** against the City of Flagstaff.

10.1.4.7 CMAR is responsible for the payment of all policy deductibles.

10.1.5 Umbrella/Excess Liability Insurance not less than $2,000,000 per occurrence combined limit Bodily Injury and Property Damage, that "follows form" and applies in excess of the Commercial General Liability, Automobile Liability as required above.

10.2 **Additional Insurance Requirements.** The policies shall include, or be endorsed to include, the following provisions:

10.2.1 The City, its officers, officials, agents, employees and volunteers shall be additional insured to the full limits of liability purchased by CMAR even if those limits of liability are in excess of those required by this Agreement.

10.2.2 CMAR's insurance coverage shall be primary insurance and non-contributory with respect to all other available sources.

10.2.3 Coverage provided by CMAR shall not be limited to the liability assumed under the indemnification provisions of this Agreement.

10.2.4 The policies shall contain a Waiver of Subrogation against the City, its officers, officials, agents, and employees for losses arising from work performed by the CMAR for the City.

10.3 **Notice of Cancellation.** Each insurance policy required by the insurance provisions of this Agreement shall provide the required coverage and shall not be suspended, voided, canceled, reduced in coverage or endorsed to lower limits except after thirty (30) days prior written notice has been given to the City. Such notice shall be sent directly to the City Purchasing Department, attention Matt Luhman, Purchasing Manager, and shall be sent by certified mail, return receipt requested.

10.4 **Acceptability of Insurers.** Insurance is to be placed with insurers who are duly licensed companies in the State of Arizona with an "A.M. Best" rating of A-7, or as approved by the City and licensed in the State of Arizona with policies and forms satisfactory to the City. The City in no way warrants that the above-required minimum insurer rating is sufficient to protect CMAR from potential insurer insolvency.

10.5 Verification Of Coverage

10.5.1 CMAR shall furnish the City with Certificates of Insurance (ACORD form or equivalent approved by the City) as required by this Agreement. The Certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf.

10.5.2 All Certificates of Insurance and endorsements are to be received and approved by the City before work commences. Each insurance policy required by this Agreement shall be in effect at or prior to commencement of Work under this Agreement and remain in effect for the duration of the Project. Failure to maintain the insurance policies as required by this Agreement or to provide evidence of renewal is a material breach of contract.

10.5.3 All Certificates of Insurance required by this Agreement shall be sent directly to City's Purchasing Department, attention Matt Luhman, Purchasing Manager. The City project/contract number and project description shall be noted on the Certificate of Insurance. The City reserves the right to require complete, certified copies of all insurance policies required by this Agreement at any time.

10.5.4 **If the Certificate of Insurance reflecting policy coverage and cancellation notice does not conform to the City's requirements, the CMAR must:**

- **Submit a current Certificate of Insurance (dated within fifteen (15) days of the payment request submittal) with each payment request form. The payment request shall be rejected if the Certificate of Insurance is not submitted with the payment request.**

10.6 **Subcontractors.** CMAR's Certificate(s) of Insurance shall include all Subcontractors as additional insureds under its policies. All coverages for Subcontractors shall be subject to the minimum requirements identified above.

10.7 **Approval.** Any modification or variation from the insurance requirements in this Agreement shall be made by the City Attorney's Office, whose decision shall be final. Such action shall not require a formal contract amendment, but may be made by administrative action.

10.8 Bonds and Other Performance Security.

10.8.1 Prior to execution of this Agreement, CMAR shall provide a performance bond and a labor and materials bond, each in an amount equal to the full amount of the GMP.

10.8.2 Each such bond shall be executed by a surety company, or companies, holding a Certificate of Authority to transact surety business in the State of Arizona, issued by the Director of the Arizona Department of Insurance. A copy of the Certificate of Authority shall accompany the bonds. The Certificate shall have been issued or updated within two (2) years prior to the execution of this Agreement.

10.8.3 The bonds shall be made payable and acceptable to the City of Flagstaff.

10.8.4 The bonds shall be written or countersigned by an authorized representative of the surety who is either a resident of the State of Arizona or whose principal office is maintained in Arizona, as by law required, and the bonds shall have attached thereto a certified copy of Power of Attorney of the signing official.

10.8.4.1 If one Power of Attorney is submitted, it shall be for twice the total GMP amount.

10.8.4.2 If two Powers of Attorney are submitted, each shall be for the total GMP amount. Personal or individual bonds are not acceptable.

10.8.5 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract Documents, CMAR shall promptly furnish a copy of the bonds or shall permit a copy to be made.

10.8.6 All bonds submitted for this project shall be provided by a company which has been rated AM Best rating of "A-,7, or better for the prior four quarters" by the A.M. Best Company.

Article 11 - Indemnification

11.1 CMAR's Liability and Indemnification.

11.1.1 To the fullest extent permitted by law, CMAR shall defend, indemnify and hold harmless the City, its agents, representatives, officers, directors, officials and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, and the cost of appellate proceedings), relating to, arising out of, or alleged to have resulted from the negligent, reckless, or intentional acts, errors, mistakes, omissions, work or services of CMAR, its employees, agents, or any tier of subcontractors in the performance of this Agreement. CMAR's duty to defend, hold harmless and indemnify the City, its agents, representatives, officers, directors, officials and employees shall arise in connection with the claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property including loss of use resulting therefrom, caused by any acts, errors, mistakes, omissions, work or services in the performance of this Agreement including any employee of CMAR or any tier of subcontractor or any other person for whose acts, errors, mistakes, omissions, work or services CMAR may be legally liable.

The amount and type of insurance coverage requirements set forth herein shall in no way be construed as limiting the scope of the indemnity in this paragraph.

Article 12 – General Provisions

12.1 Contract Documents

12.1.1 Contract Documents are as defined in Article 1. This Agreement, Plans, Standard Specifications and Details, Special Provisions, Addenda (if any) dated _____ and used as the basis for the Guaranteed Maximum Price Proposal and Guaranteed Maximum Price Proposal, as accepted by the Mayor and Council per Council Minutes 6th day of June 2021, Performance Bond, Payment Bond, Certificates of Insurance, Construction Documents and Change Orders (if any) are by this reference made a part of this Agreement to the same extent

as if set forth herein in full.

12.1.2 The Contract Documents are intended to permit the parties to complete the Work and all obligations required by the Contract Documents within the Contract Times for the Contract Price. The Contract Documents are intended to be complementary and interpreted in harmony so as to avoid conflict, with words and phrases interpreted in a manner consistent with construction and design industry standards.

12.1.3 In the event of any inconsistency, conflict, or ambiguity between or among the Contract Documents, the Contract Documents shall take precedence in the order in which they are listed in the definition of Contract Documents in Article 1.

12.1.3.1 On the drawings, given dimensions shall take precedence over scaled measurements, and large-scale drawings over small-scale drawings.

12.1.3.2 Specifications take precedence over Plans.

12.1.3.3 In the event of any inconsistency, conflict, or ambiguity between the Contract Documents and the Design Phase Agreement, the Contract Documents take precedence over the Design Phase Agreement

12.1.4 The headings used in this Agreement, or any other Contract Documents, are for ease of reference only and shall not in any way be construed to limit or alter the meaning of any provision.

12.1.5 The Contract Documents form the entire agreement between City and CMAR and by incorporation herein are as fully binding on the parties as if repeated herein. No oral representations or other agreements have been made by the parties except as specifically stated in the Contract Documents.

12.2 **Amendments.** The Contract Documents may not be changed, altered, or amended in any way except in writing signed by a duly authorized representative of each party.

12.3 **Time is of the Essence.** City and CMAR mutually agree that time is of the essence with respect to the dates and times set forth in the Contract Documents.

12.4 **Mutual Obligations.** City and CMAR commit at all times to cooperate fully with each other, and proceed on the basis of trust and good faith, to permit each party to realize the benefits afforded under the Contract Documents.

12.5 **Cooperation and Further Documentation.** CMAR agrees to provide the City such other duly executed documents as shall be reasonably requested by the City to implement the intent of the Contract Documents.

12.6 **Assignment.** CMAR shall not, without the written consent of the City, assign, transfer or sublet any portion of this Agreement or part of the Work or the obligations required by the Contract Documents. Notwithstanding the City's consent to assignment, CMAR as Assignor, and the Assignee shall both remain liable under all rights, obligations, terms, and conditions of this Agreement.

12.7 **Successorship.** CMAR and City intend that the provisions of the Contract Documents are binding upon the parties, their employees, agents, heirs, successors and assigns.

12.8 **Third Party Beneficiary.** Nothing under the Contract Documents shall be construed to give any rights or benefits in the Contract Documents to anyone other than the City and CMAR, and all duties and responsibilities undertaken pursuant to the Contract Documents shall be for the sole and exclusive benefit of City and CMAR and not for the benefit of any other party.

12.9 **Governing Law.** This Agreement and all Contract Documents shall be deemed to be made under, and shall be construed, in accordance with and governed by the laws of the State of Arizona without regard to the conflicts or choice of law provisions thereof. Any action to enforce any provision of this Agreement or to obtain any remedy with respect hereto shall be brought in the Superior Court, Coconino County, Arizona, and for this purpose, each party hereby expressly and irrevocably consents to the jurisdiction and venue of such Court.

12.10 **Severability.** If any provision of the Contract Documents or the application thereof to any person or circumstance shall be invalid, illegal or unenforceable to any extent, the remainder of the Contract Documents and the application thereof shall not be affected and shall be enforceable to the fullest extent permitted by law.

12.11 **Compliance with All Laws.** CMAR will comply with all applicable Federal, State, County and City laws, regulations and policies, including but not limited to the mandatory statutory provisions in Exhibit __, attached and made a part of this Agreement. CMAR understands and acknowledges the applicability of the Americans with Disabilities Act, the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act of 1989. CMAR agrees to comply with these laws in performing the Contract Documents and to permit the City to verify such compliance.

12.12 **Legal Requirements.** CMAR shall perform all Work in accordance with all Legal Requirements and shall provide all notices applicable to the Work as required by the Legal Requirements.

12.13 **Construction Documents.** It is not CMAR's responsibility to ascertain that the Construction Documents are in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations. However, if CMAR recognizes that portions of the Construction Documents are at variance therewith, CMAR shall promptly notify the Design Professional and City in writing, describing the apparent variance or deficiency.

12.14 **Independent Contractor.** CMAR is and shall be an independent contractor. Any provisions in the Contract Documents that may appear to give the City the right to direct CMAR as to the details of accomplishing the Work or to exercise a measure of control over the Work means that CMAR shall follow the wishes of the City as to the results of the Work only. These results shall comply with all applicable laws and ordinances.

12.15 **The City's Right of Cancellation.** All parties hereto acknowledge that this Agreement is subject to cancellation by the City pursuant to the provisions of Section 38-511, Arizona Revised Statutes.

12.16 **Survival.** All warranties, representations and indemnifications by CMAR shall survive the completion or termination of this Agreement.

12.17 **Covenant against Contingent Fees**. CMAR warrants that no person has been employed or retained to solicit or secure this Agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, and that no member of the City Council, or any employee of City has any interest, financially, or otherwise, in the firm. For breach or violation of this warrant, the City shall have the right to annul this Agreement without liability, or at its discretion to deduct from the Contract Price or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

12.18 **No Waiver.** The failure of either party to enforce any of the provisions of the Contract Documents or to require performance of the other party of any of the provisions hereof shall not be construed to be a waiver of such provisions, nor shall it affect the validity of the Contract Documents or any part thereof, or the right of either party to thereafter enforce each and every provision.

12.19 Notice.

12.19.1 Many notices or demands required to be given, pursuant to the terms of this Agreement, may be given to the other Party in writing, delivered in person, sent by facsimile transmission, emailed, deposited in the United States mail, postage prepaid, or deposited with any commercial air courier or express service at the addresses set forth below, or to such other address as the Parties may substitute by written notice, given in the manner prescribed in this paragraph. However, notices of termination, notices of default and any notice regarding warranties shall be sent via registered or certified mail, return receipt requested at the address set forth below ***and*** to legal counsel for the party to whom the notice is being given.

to CMAR:

Mike Claflin, Estimator
7520 E. Adobe Dr.
Scottsdale, AZ 85255
(480) 222-9922

to City:

City of Flagstaff
211 West Aspen Avenue
Flagstaff, Arizona 86001
Attn: Matt Luhman, Purchasing Manager
Phone: (928) 213-2278
mluhman@flagstaffaz.gov

With a copy to:

City of Flagstaff
211 West Aspen Avenue
Flagstaff, Arizona 86001
Attn: Matt Morales, Project Manager
Phone: (928) 213-2123
matthew.morales@flagstaffaz.gov

Design Professional:

City of Flagstaff
Matt Morales, Project Manager

or to such other place and with such other copies as either Party may designate as to itself by written notice to the other Party. Rejection, any refusal to accept or the inability to deliver because of changed address of which no notice was given shall be deemed to be receipt of the notice as of the date of such rejection, refusal or inability to deliver.

12.19.2 Notices Related to Payment, Securities-in-lieu, Bonds. Any notice, request, instruction or other document to be given under this Agreement by any party to any other party related to payment, securities-in-lieu, bonds or other instrument securing the performance of this Agreement, including but not limited to, bid bonds, performance bonds, payment bonds or letters of credit, shall be in writing and shall be delivered in person or by courier or facsimile transmission or mailed by certified mail, postage prepaid, return receipt requested and shall be deemed given upon (a) confirmation of receipt of a facsimile transmission, (b) confirmed delivery by hand or standard overnight mail or (c) upon the expiration of three (3) business

days after the day mailed by certified mail, as follows:

to Contractor:

Mike Claflin, Estimator
7520 E. Adobe Dr.
Scottsdale, AZ 85255
(480) 222-9922

to City:

City of Flagstaff
211 West Aspen Avenue
Flagstaff, Arizona 86001
Attn: Matt Luhman, Purchasing Manager
Phone: (928) 213-2278
mluhman@flagstaffaz.gov

With copies to:

City of Flagstaff
211 West Aspen Avenue
Flagstaff, Arizona 86001
Attn: Matt Morales, Project Manager
Phone: (928) 213-2123
matthew.morales@flagstaffaz.gov

or to such other place and with such other copies as either Party may designate as to itself by written notice to the other Party. Rejection, any refusal to accept or the inability to deliver because of changed address of which no notice was given shall be deemed to be receipt of the notice as of the date of such rejection, refusal or inability to deliver.

12.20 Confidentiality of Plans and Specifications

12.20.1 Any plans or specifications regarding this Project shall be for official use only. CMAR shall not share them with others except as required to fulfill the obligations of this Agreement with the City.

12.20.2 All Record Documents, Shop Drawings and other plans or drawings prepared or submitted by CMAR shall include the following language: "These plans are for official use only and may not be shared with others except as required to fulfill the obligations of the Street Maintenance Program 2011 Project Agreement with the City of Flagstaff."

12.21 CMAR and Subcontractor Employee Security Inquiries. The parties acknowledge that security measures required in this Section are necessary in order to preserve and protect the public health, safety and welfare. In addition to the specific measures set forth below, CMAR shall take such other measures, as it deems reasonable and necessary to further preserve and protect the public health, safety and welfare.

12.21.1 Security Inquiries. CMAR acknowledges that all of the employees that it provides pursuant to this Agreement shall be subject to background and security checks and screening ("Security Inquiries"). CMAR shall perform all such security inquiries and shall make the results available to City for all employees considered for performing work (including supervision and oversight) under this Agreement. City may make further security inquiries. Whether or not further security inquires are made by City, City may, at its sole, absolute and unfettered discretion, accept or reject any or all of the employees proposed by CMAR for performing work under this Agreement. Employees rejected by City for performing services under this Agreement may still be engaged by CMAR for other work not involving the City. An employee rejected for work under this Agreement shall not

be proposed to perform work under other City Agreements or engagements without City's prior approval.

12.21.2 Criteria for Evaluating Security Inquiries. Once formally adopted by City, criteria for excluding an individual from performing work under this Agreement shall be communicated by City to CMAR and used by CMAR as a factor in making its decision. Prior to such adoption, CMAR shall use its best judgment in making its decision using, among other criteria, applicable law, administrative regulations of federal, state and local agencies concerned with work performed under this Agreement, specific local concerns that deal with the specific work and work location(s) of the Project, and standards used by City in evaluating its own personnel.

12.21.3 Additional City Rights Regarding Security Inquiries. In addition to the foregoing, City reserves the right to: (1) have an employee/prospective employee of CMAR be required to provide fingerprints and execute such other documentation as may be necessary to obtain criminal justice information pursuant to A.R.S. § 41-1750(G)(4); (2) act on newly acquired information whether or not such information should have been previously discovered; (3) unilaterally change its standards and criteria relative to the acceptability of CMAR 's employees and/or prospective employees; and, (4) object, at any time and for any reason, to an employee of CMAR performing work (including supervision and oversight) under this Agreement.

12.21.4 Background and Security-Contracts and Subcontracts. CMAR shall include the security inquiry terms of this Section for employee background and security checks and screening in all contracts and subcontracts for work performed under this Agreement, including supervision and oversight.

12.21.5 Materiality of Security Inquiry Provisions. The security inquiry provisions of this Agreement, as set forth above, are material to City 's entry into this Agreement and any breach thereof by CMAR may, at City's sole and unfettered discretion, be considered to be a breach of contract of sufficient magnitude to terminate this Agreement. Such termination shall subject CMAR to liability for its breach of this Agreement.

12.22 Hazardous Materials

12.22.1 Unless included in the Work, if CMAR encounters material on the Site which it reasonably believes to contain asbestos, polychlorinated biphenyl (PCB), or other hazardous substances or materials regulated by applicable law, it shall immediately stop work and report the condition to the City.

12.22.2 If the material is found to contain asbestos, PCB or other hazardous substances or materials regulated by applicable law, CMAR shall not resume work in the affected area until the material has been abated or rendered harmless. CMAR and the City may agree, in writing, to continue work in non-affected areas on the Site.

12.22.3 An extension of Contract Time may be granted in accordance with Article 6.

12.22.4 CMAR shall comply with all applicable laws/ordinances and regulations and take all appropriate health and safety precautions upon discovery.

12.23 Computer Systems. CMAR shall warrant fault-free performance in the processing of date and date-related data including, but not limited to calculating, comparing, and sequencing by all equipment and software products, individually and in combination, from the commencement of the Work. Fault-free performance shall include the manipulation of data when dates are in the 20th or 21st centuries and shall be transparent to the user. Failure to comply with "Year 2000" requirements shall be considered a breach of this Agreement.

12.24 Traffic Control. CMAR shall comply with all provisions of the latest version of the Manual on Uniform Traffic Control Devices and any other traffic control provisions as may be provided in the technical specifications.

THE CITY OF FLAGSTAFF, ARIZONA

Landfill Sequence D Excavation Project

Project No. 2021-74, Agreement No. 2021-74

IN WITNESS WHEREOF, two (2) identical counterparts of this Agreement each of which shall for all purposes be deemed an original thereof, have been duly executed by the parties herein above named, on the date and year first above written.

CMAR agrees that this Agreement, as awarded, is for the stated Work and understands that payment for the total Work shall be made on the basis of the indicated amount(s), per the terms and conditions of this Agreement.

Guaranteed Maximum Price

One million two hundred ninety-eight thousand six hundred forty-nine dollars and eighty cents

$1,298,649.80

THE CITY OF FLAGSTAFF, ARIZONA

By:_____
Greg Clifton, City Manager

Rummel Construction, Inc.

By:_____

Title:_____

(Corporate Seal)

ATTEST:

_____
City Clerk

_____
ATTEST: (Signature and Title)

APPROVED AS TO FORM:

_____
City Attorney

EXHIBIT A - PROJECT DESCRIPTION

EXHIBIT B – APPROVED GMP PROPOSAL

PROJECT #: **DATE:**
PROJECT NAME:

EXHIBIT C – TECHNICAL SPECIFICATIONS

A. General Statement and Extent of Work- The City of Flagstaff (City) Cinder Lake Landfill (CLL) is a 343-acre site that accepts municipal solid waste from a 70-mile radius surrounding Flagstaff. Future landfill cells are being planned to accommodate future disposal needs. Sequence-D consists of a 33-acre portion of the site, located on the southern portion of the Facility.

The work to be performed under a proposed contract (Contract) with the City of Flagstaff (City) consists of furnishing all labor, materials, tools, and equipment necessary for the construction of the following phases of work:

- Phase I-Preliminary Construction and Infrastructure

Phase I is herein referred to as the Construction Project. The project site is located at 6770 East Landfill Road Flagstaff, AZ 86004. Project location maps and limits of construction are shown on the construction plans (Drawings).

The work shall be performed in a workmanlike manner, complete and usable as required by the Drawings and these specifications:

Phase I-Preliminary Construction and Infrastructure
The general work in Phase I includes the following major items:

Preliminary Construction

- Clearing and Grubbing
  - Sequence D-Approximately 32 acres of mostly rabbit brush and small diameter (less than 9-in at the base) Ponderosa Pine Trees.
  - One large diameter Juniper Tree (36" base)

Infrastructure

- Construction of a 306,000-gallon lined reservoir
  - Sheet 14 of Drawings
  - Construction area and volumes shown on Table 1 below.
  - Install a reservoir with dimension of 139.5-ft by 89.5-ft with 9-ft high berms with a keyed-in 60-mil HDPE impermeable liner.
  - The Contractor shall be responsible for confirming measurements through the City's professional surveyor at his own costs.
  - The remaining balance of soil (468 yd^3) shall be screened and crushed according to the specifications noted above.

Table 1-Phase I-Reservoir Construction Area and Volumes

Soil Type	Excavation (yd^3)	Embankment (yd^3)
0.4 acres	1,175	918

- Construction of the Sequence D haul road-Approximately 3.5 acres
  - Sheets 25 thru 30 of Drawings
  - Construction area and volumes shown in Table 3 below.
  - The haul road is intended to serve as a secondary access to Sequence D
  - Soil shall be excavated from Sequence D (Phase I-Preliminary Cell).
  - Install one 24-in reinforced concrete pipe (approximately 45 ft) with 1

headwall on each end (total 2 headwalls) and approximately 200-ft^2 of 2-ft diameter basalt boulders as rip rap on the downstream end. Sixteen ounce per square yard (16-oz/yd^2) non-woven filter fabric shall be installed, and anchored prior to laying down riprap.

- Inventory all quantities of soil placement with at least one aerial survey subcontracted through the City's professional surveyor at the City's expense.

Table 2-Phase I-Sequence D haul road Construction Area and Volumes

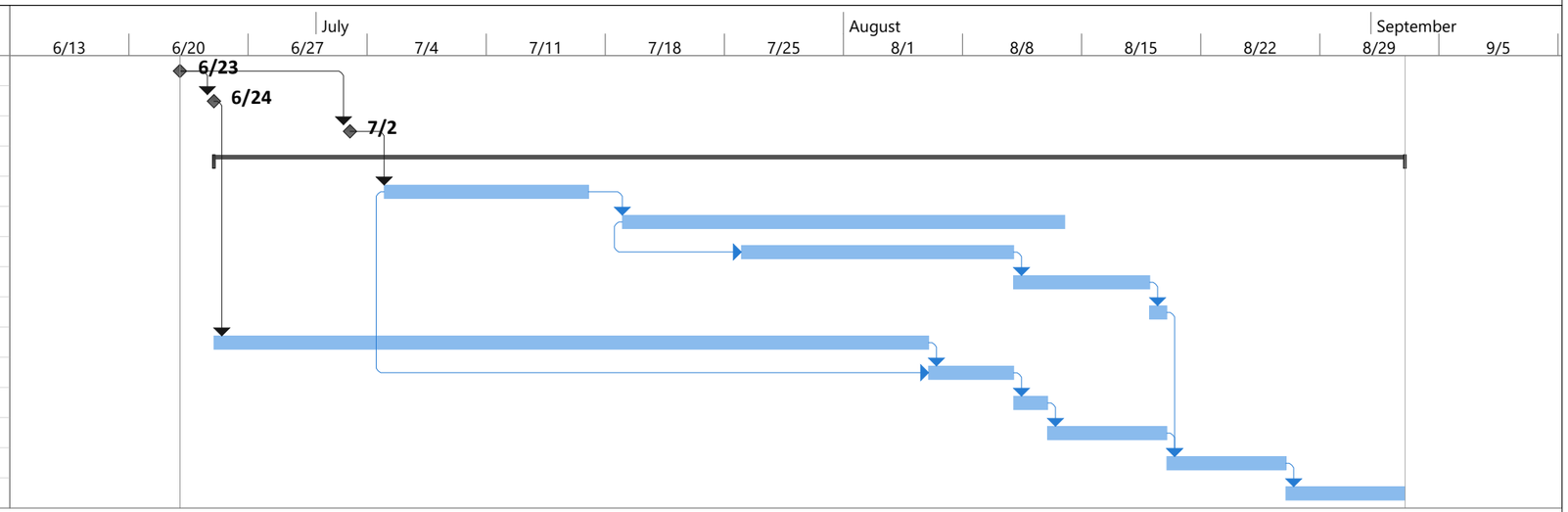
Sequence D haul road Construction Area	Excavation (yd^3)	Embankment (yd^3)
4 acres	175	10,555

The Contractor shall maintain Sequence D and the inbound/outbound haul roads with application and maintenance of dust suppressant (water) per the existing CLL Air Quality Permit. If water proves not to be an effective measure, the Contractor may be required to use an ADEQ approved dust palliative shall applied be in conformance with MAG Section 230 or approved equal.

- Construction of the Preliminary Cell in Sequence D
  - Volume and handling Specifications
    - The total excavation quantity for the Preliminary Cell is 35,000 yd^3.
    - Excavated soil less than 36-in diameter (36-in minus) shall be screened and crushed to a diameter of 3-in minus.
    - The product shall be used primarily for the construction of the Cell D Haul Road (approximately 10,555-yd^3 fill). The remaining balance of 3-in minus soil (approximately 24,445-yd^3) shall be used to fill portions of the Phase I cell to the design elevation(s).
  - Logistics
    - Within Phase I, the Contractor shall excavate to within 6-in of the design elevations on a 25-ft grid. Elevations will be surveyed with regularly scheduled aerial surveys. Subsequently, the Contractor and Project Manager will adjust the volumes accordingly throughout the project.
    - While the Preliminary Cell is being prepared, the crushed soil can be placed in the Phase I Stockpile (northeast of the site). The Phase I Stockpiles can accommodate up to 31,000-yd^3 of crushed material.
    - Subsequent to excavation of the Preliminary cell, the Phase II Stockpiles will be sited in the central portion of Sequence D (Sheet 3 of the Drawings). The potential volumes of the stockpiles are as follows:
      - North Pile-69,000-yd^3
      - South Pile-66,000-yd^3
  - The Contractor shall inventory all quantities of soil placement with at least one aerial survey subcontracted through the City's professional surveyor at the City's expense.

Cinder Lake Landfill Sequence D Phase 1
Preliminary Project Schedule
May 27, 2021
Rummel Construction, Inc.

ID	Task Name	Duration	Start	Finish
1	GMP Purchase Order	0 days	Wed 6/23/21	Wed 6/23/21
2	HDPE Liner Purchase Order	0 days	Thu 6/24/21	Thu 6/24/21
3	NTP	0 days	Fri 7/2/21	Fri 7/2/21
4	**Cinder Lake Sequence D - Phase 1**	**50 days**	**Fri 6/25/21**	**Thu 9/2/21**
5	Mobilization/Setup Crusher	10 days	Mon 7/5/21	Fri 7/16/21
6	Excavate/Process Cell D	20 days	Mon 7/19/21	Fri 8/13/21
7	Place Embankment in Cell	12 days	Mon 7/26/21	Tue 8/10/21
8	Place Embankment Haul Road D	6 days	Wed 8/11/21	Wed 8/18/21
9	Finish Haul Road D	1 day	Thu 8/19/21	Thu 8/19/21
10	Liner Delivery	30 days	Fri 6/25/21	Thu 8/5/21
11	Construct Pond	3 days	Fri 8/6/21	Tue 8/10/21
12	Line Pond	2 days	Wed 8/11/21	Thu 8/12/21
13	Fencing	5 days	Fri 8/13/21	Thu 8/19/21
14	Anticipated Weather Delays	5 days	Fri 8/20/21	Thu 8/26/21
15	Demobe	5 days	Fri 8/27/21	Thu 9/2/21



Project: Cinder Lake Landfill Prelim
Date: Thu 5/27/21

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

RUMCO
Rummel Construction, Inc.

May 26, 2021

Mr. Matt Morales, P.E.
Cinder Lake Landfill Project Manager
6770 E Landfill Road
Flagstaff, AZ 86004

RE: Cinder Lake Landfill Sequence D Phase 1
GMP Proposal

Mr. Morales,

After reviewing the documents, meeting with you to discuss the revised scope, and getting proposal revisions from prospective subcontractors and material suppliers, we present our GMP for the Phase 1 of Sequence D. This GMP is provided based on the following comments, exclusions, and clarifications.

Comments:

The overall cost of this project has increased over the JOC proposal provided last fall. The majority of the cost increases are due to: Fuel increase from $1.60 to $2.75, HDPE liner material increases, Fencing material increases, Grounding material increases, other minor increases (labor and equipment.) In addition, per our discussion we included the cost to fill the new construction water pond, the cost to hammer the anticipated oversize (which also increased the amount of material to crush and associated cost), and added a cost to perform compaction testing within the cell footprint while placing embankment.

Additionally, we included a contingency item as discussed to account for known risks: we pay the subcontractor crushing the material based on tons passing his belt scale and have assumed a conversion factor of 1.8, liner availability and pricing volatility due to current market/Covid conditions, fencing in rock condition (assumed soil/cinder), and lightning – crew standby charges; unknown risks; additional work that may be desired by Cinder Lake Landfill during this phase of construction; and finally any overruns on quantities of work.

Exclusions

- We have excluded quantity surveys, this will be provided by the City's surveyor.
- SWPPP (working under the CLL SWPPP.)
- Permits

Clarifications

- We have assumed this project is taxable. The landfill does not appear to be within the city limits and thus have included Coconino GRT only.
- We anticipate NTP of July 2, 2021 and anticipate overall duration of 10 weeks.
- This project does not appear to impact landfill traffic and thus we have not included costs for traffic

control and have left Bid Item 2 blank.

- Bid item 3 "Clearing & Grubbing" is limited to the new pond area, new access road footprint and the preliminary cell footprint. All debris will be taken to the working face or green waste.
- All quantities will be measured and paid for utilizing the unit pricing provided. City of Flagstaff's surveyor will be responsible for the pre-construction topo and final topo to measure those quantities. Rummel Construction, Inc. will be responsible for all construction related staking & survey.
- The construction water pond construction timing will occur during the construction of the preliminary cell. Timing is dependent upon HDPE liner availability and having crushed material for pond embankments.
- Bid item 5 "Embankment Silty sand" required for the new construction water pond is assumed to be in close proximity to the actual pond – we are utilizing a loader to pack the material to the pond.
- Bid item 8 "Geomembrane" is 60 mil smooth white HDPE. This item includes a flexible ladder similar to attached detail.
- Bid item 9a "Chain-Link Fence and Gates" (2 EA double gates with 6' leafs) are per plan sheets with top and bottom tension wire (not rails). Assumed native soil. If rock encountered, additional costs would be incurred and paid under the contingency item. The plans did not provide a layout for the fence, we have assumed a rectangle with 4 EA corner posts.
- Bid item 15 "Rip Rap with Lined Filter Fabric" assumes that the rock will be sourced from Cinder Lake Landfill – no purchase has been included.
- Bid item 17 "Excavation, Segregation and Crushing of 36" Rock" is the excavation of the preliminary cell to design grades or refusal, crushing the excavated material to a 3" minus specification. This crushed material will be used in the preliminary cell embankments (first priority) and then the access road embankments (second priority.)
- Bid item 19 "Hammer oversize for Crushing" is the cost to hammer any rock larger than 36" diameter to allow for the crushing of this oversize material.

Please contact me with any questions.

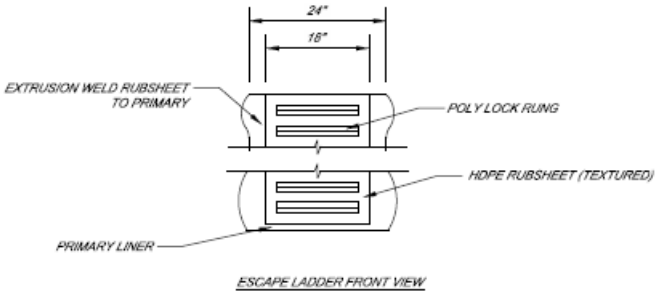
Sincerely,

Mike Claflin
Estimator

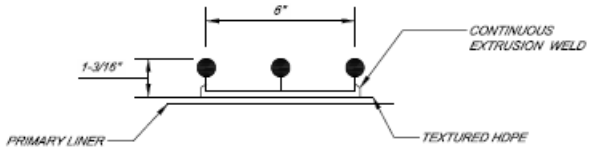
Enclosures: GMP pricing, flexible ladder detail

GMP PROPOSAL

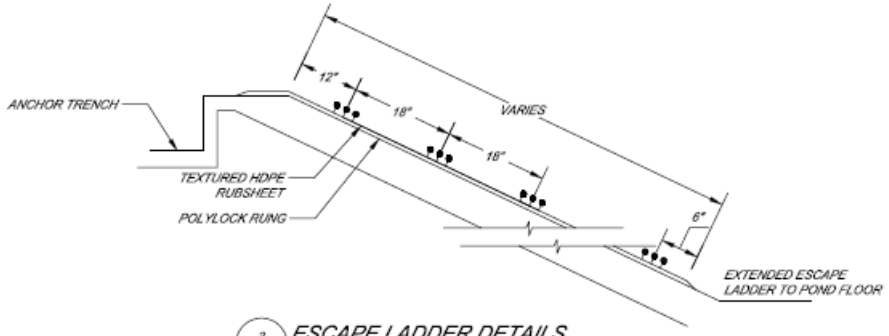
Biditem	Description	Quantity	Units	Unit Price	Bid Total
1	MOBILIZATION	1.000	LS	116,300.00	116,300.00
2	TRAFFIC CONTROL	1.000	LS	0.00	
3	CLEARING AND GRUBBING	1.000	LS	10,000.00	10,000.00
	Subtotal Phase I				**$126,300.00**
4	EXCAVATION	1,175.000	CY	4.00	4,700.00
5	EMBANKMENT - SILTY SAND	653.000	CY	6.60	4,309.80
6	EMBANKMENT - 3" MINUS	165.000	CY	23.50	3,877.50
7	QUALITY CONTROL TESTING OF SOILS	1.000	LS	1,000.00	1,000.00
8	GEOMEMBRANE 80 X 127	10,160.000	SF	5.80	58,928.00
9a	CHAIN-LINK FENCE AND GATES	1.000	LS	32,000.00	32,000.00
9c	FILL POND	318.000	MG	39.00	12,402.00
	Subtotal Reservoir				**$117,217.30**
10	EXCAVATION	175.000	CY	4.50	787.50
11	EMBANKMENT	10,555.000	CY	12.00	126,660.00
12	QUALITY CONTROL TESTING OF SOILS	1.000	LS	10,555.00	10,555.00
13	HEADWALL WITH TRASH RACK	1.000	EA	10,000.00	10,000.00
14	HEADWALL DOWNSTREAM	1.000	EA	7,000.00	7,000.00
15	RIP RAP WITH LINED FILTER FABRIC	1.000	LS	2,850.00	2,850.00
16	24" ID RCP	48.000	LF	210.00	10,080.00
	Subtotal Haul Road				**$167,932.50**
17	EXCAVATION, SEGREGATION AND CRUSHING OF 36"- ROCK	35,000.000	CY	14.00	490,000.00
18	EMBANKMENT	20,000.000	CY	4.75	95,000.00
19	HAMMER OVERSIZE FOR CRUSHING	18.000	DAY	4,900.00	88,200.00
20	QUALITY CONTROL TESTING OF SOILS	1.000	LS	10,000.00	10,000.00
	Subtotal Preliminary Cell				**$683,200.00**
21	OWNER CONTINGENCY	1.000	LS	204,000.00	204,000.00
	Bid Total				**$1,298,649.80**



ESCAPE LADDER FRONT VIEW

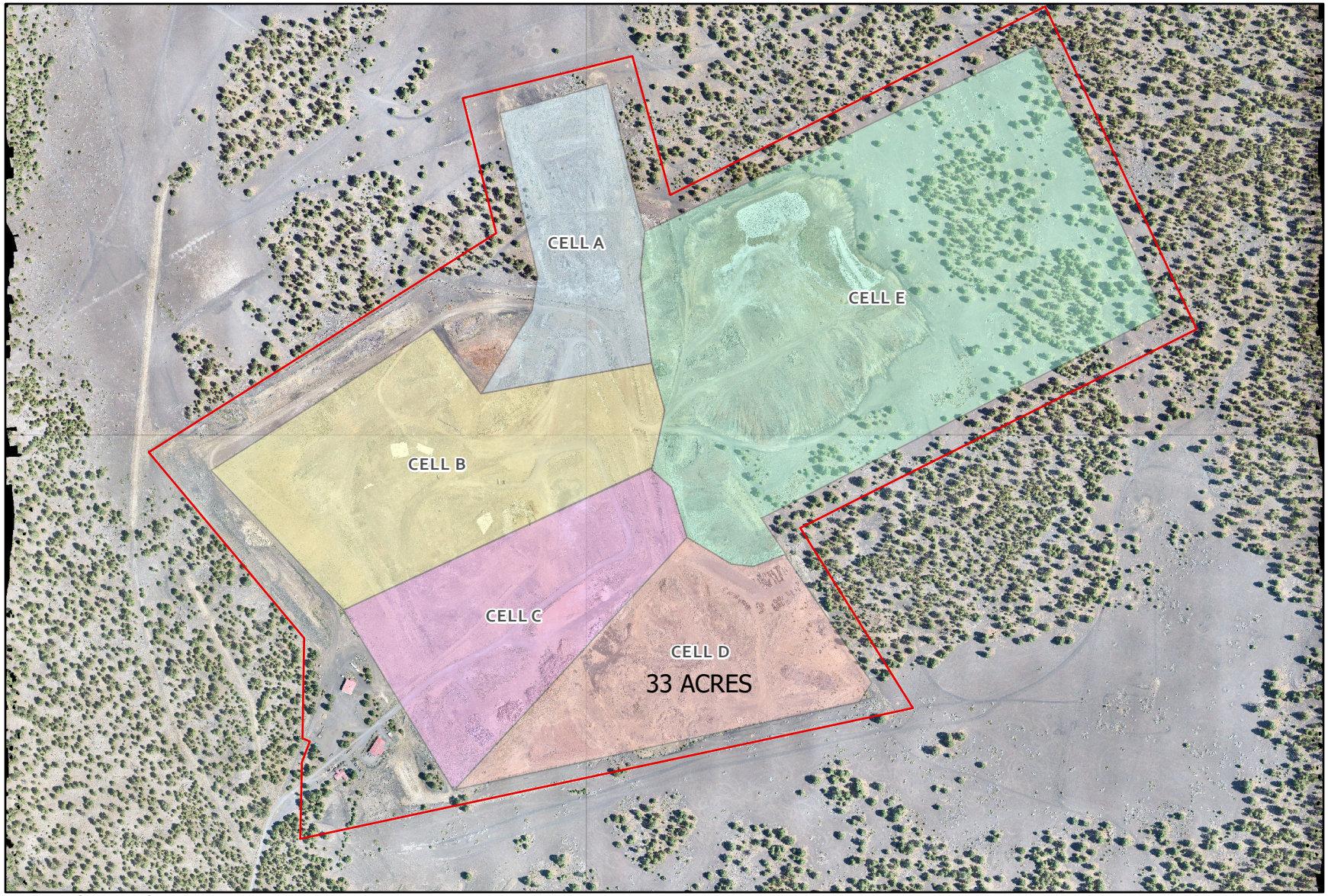


POLY LOCK RUNG



2 / 3GP09 ESCAPE LADDER DETAILS
NOT TO SCALE

CINDER LAKE LANDFILL-SITE PLAN
CELL/SEQUENCE D EXCAVATION



PROPERTY BOUNDARY

CELL NAME

- CELL A
- CELL B
- CELL C
- CELL D
- CELL E

0 0.1 0.2 0.4 Miles

N

CITY OF FLAGSTAFF
CONTRACT SUPPLEMENTARY JUSTIFICATION
Design-Build OR CMAR Contracts

PROJECT NO. SW0631-Q **PROJECT NAME:** PHASE I-SEQUENCE D EXCAVATION

FILE NO. 01-2105OPCON-01 **Project Manager:** Matt Morales

CONTRACTOR/CONSULTANT: Rummel Construction Inc.

PROJECT DESCRIPTION: The Project consists of excavation of 35,000 cubic feet of rock and soil in Cell D (a.k.a Sequence D). Previous geotechnical reports outline a list of variables in soil consistency that will affect excavation and crushing rates. The approved budget for this project is for $1,300,000.00. The proposed Contractor, Rummel Construction Inc. (Rummel) is recommended for approval under a Construction Manager at Risk Contract. City Council will be reviewing this item at their meeting on June 15, 2021.

JUSTIFICATION FOR USE AND AMOUNT:

Contractor's Contingency Justification and Amount:
N/A
Owner's Contingency Justification and Amount:
A $204,000.00 CA recommended to compensate Rummel Inc. (Rummel) for costs associated with potential unforeseen items of work where details could not be determined at the time of contracting such as:

- The volume of rock hammering is greater than originally anticipated
- The volume of soil is less than originally anticipated, hence the amount of boulders are greater than expected and crushing demands increase
- Weather in the fall remains favorable and the contractor can remain on site for additional processing of soil and rock
- Drilling and blasting methods become advantageous to consider in Phase I

The GMP is *$1,094,649.80* plus an owner's contingency of *$204,000* for a total Contract Amount of *$1,298,649.80.*

COST/BUDGET/FUNDING SOURCE ANALYSIS:

Contractor's Contingency:
N/A
Owner's Contingency:
The Owners Contingency is recommended to be included in the Contract Amount and will be funded by the total budget appropriations, $3,357,110.00 remaining in FY 21 account number 211-06-165-0631-0-4433.

APPROVAL:	**Signature**		**Date:**
Project Manager	Matthew Aaron Morales	**Approval Recommended**	5/28/21
Program Manager	Jeff Ely	**Approval Recommended**	6-1-21
Section Head		**Approval Recommended**	6-1-21
Division Head		**Approval Recommended**	6/2/21

Definitions

Owner's Contingency (Design/Build or Construction Manager at Risk)

"Owner's Contingency" means a fund to cover cost growth during the Project used at the discretion of the City usually for costs that result from City's directed changes or Differing Site Conditions, or as the City may otherwise elect. The amount of the Owner's Contingency will be set solely by the City and will be in addition to the Project costs included in the Design-Builder's GMP packages.

The Owner's Contingency are funds to be used at the sole discretion of the City to cover any increases in Project costs that result from City directed changes, Differing Site Conditions, or as the City may otherwise elect. Owner's Contingency will be added to the GMP amount provided by the Design-Builder, the sum of which will be the full Contract Price for construction. Markups for Construction Fee and taxes will be applied by the Design-Builder at the time that Owner's Contingency is used

Contractor's Contingency (Design/Build or Construction Manager at Risk)

"Design-Builder's/CMAR Contingency" means a fund to cover cost growth during the Project used at the discretion of the Design-Builder/CMAR, usually for costs that result from Project circumstances. The amount of the Design-Builder's/CMAR Contingency will be negotiated as a separate line item in each GMP package.

Use and management of the Design-Builder's/CMAR Contingency:

Design-Builder's/CMAR Contingency is an amount the Design-Builder/CMAR may use under the following conditions: (1) at its discretion for increases in the Cost of the Work, or (2) with written approval of the City for increases in General Condition Costs. Design-Builder/CMAR Contingency is assumed to be a direct Project cost so will receive all markups at the time of GMP submission.

When the Design-Builder/CMAR utilizes Design-Builder's/CMAR Contingency funds, the Design-Builder/CMAR shall make the appropriate changes to the Schedule of Values with the next regular progress Payment Request. The Design-Builder/CMAR shall deduct the amount of Design-Builder's/CMAR Contingency funds used from the Design-Builder's/CMAR Contingency line item and add the same amount to the line item on the Schedule of Values where the funds were used. If the Design-Builder's/CMAR Contingency funds are used for a new line item that was not given with the original Schedule of Values, that will be so indicated.

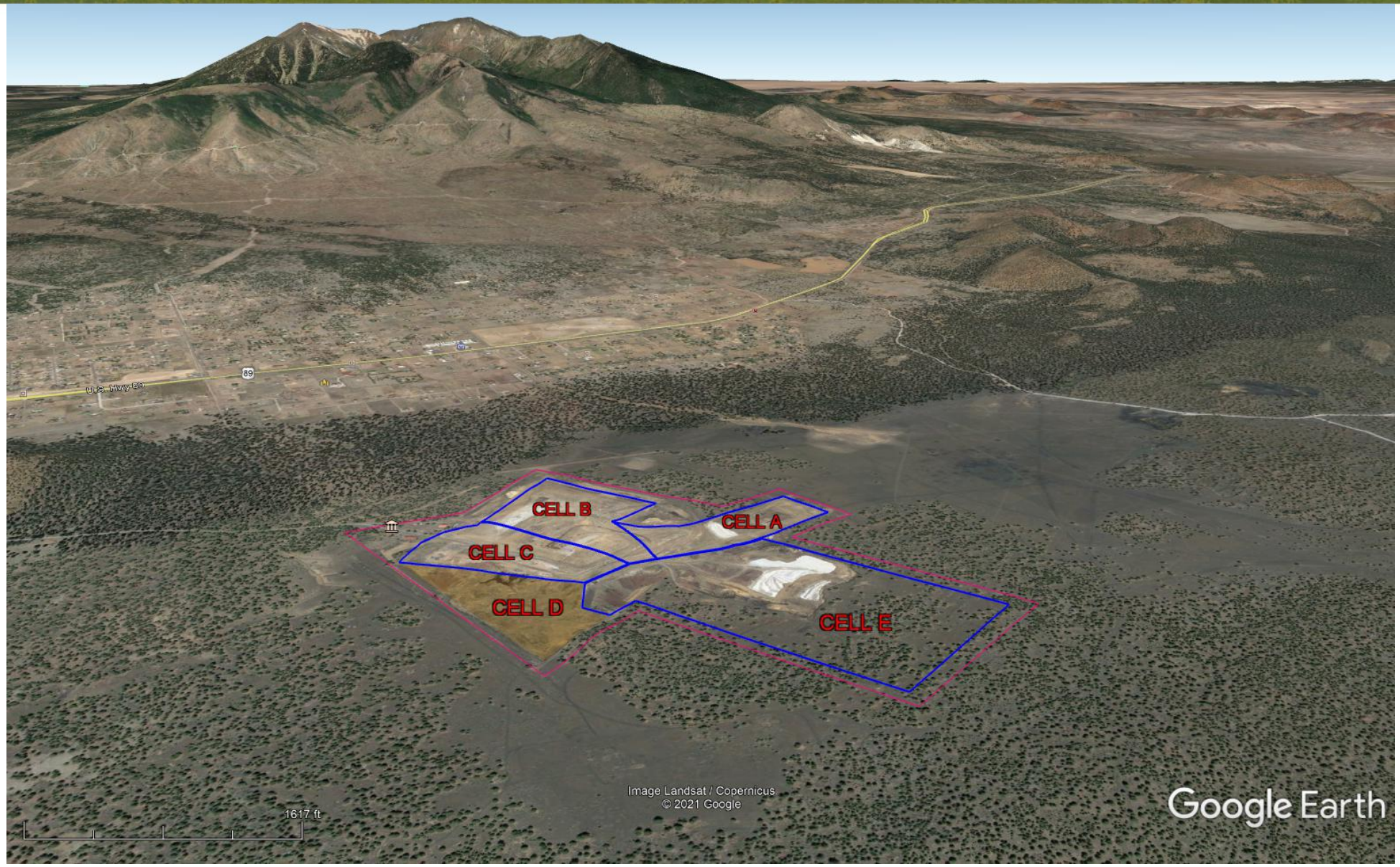
Sequence D Phase-I Excavation

CINDER LAKE LANDFILL

TEAM FLAGSTAFF

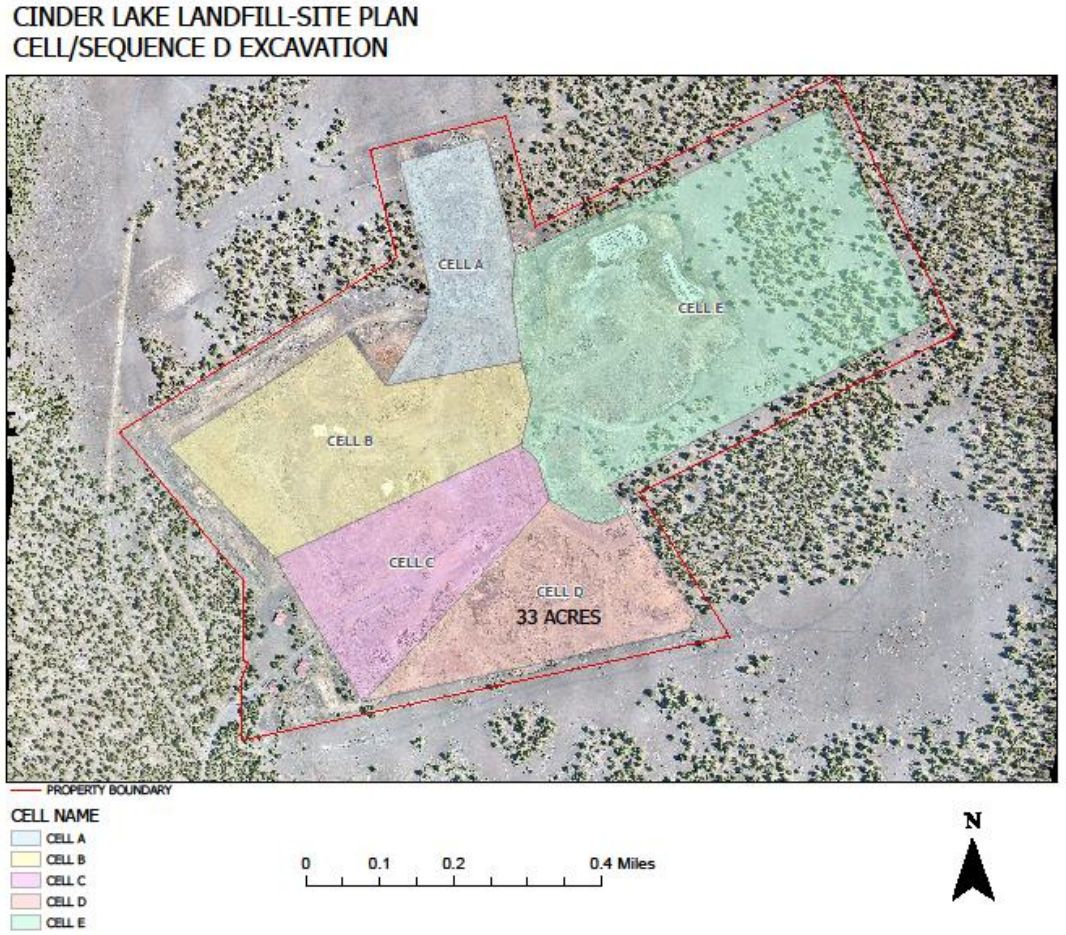
WE MAKE THE CITY BETTER

SEQUENCE D-PHASE I



SEQUENCE D-PHASE I

- Phase I Characteristics
  - Cinder Lake Landfill
    - 343 Acres
    - Cell D
      - 33-ACRES
    - Current Operations
      - CELLS B AND C
    - Future Operations
      - CELL D
      - 3 TO 5 YEARS
      - 230,000 CUBIC YARDS OF SOIL AND ROCK TO EXCAVATE

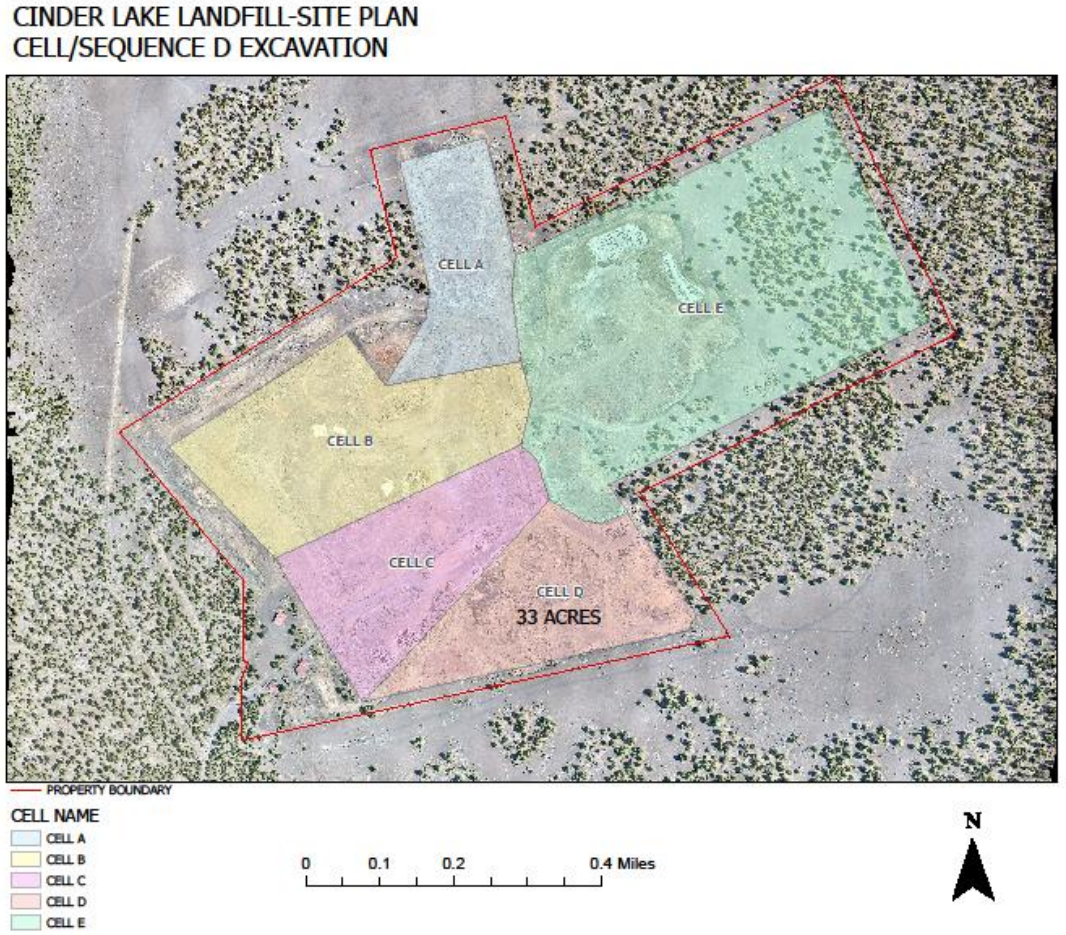


SEQUENCE D-PHASE I

Phase I

- Construction of on-site infrastructure
  - Rough Grading
  - Construction of Haul Roads
  - Construction of Water Storage Pond-Dust Abatement
- Excavation and processing
  - 35,000 cubic yards rock & soil

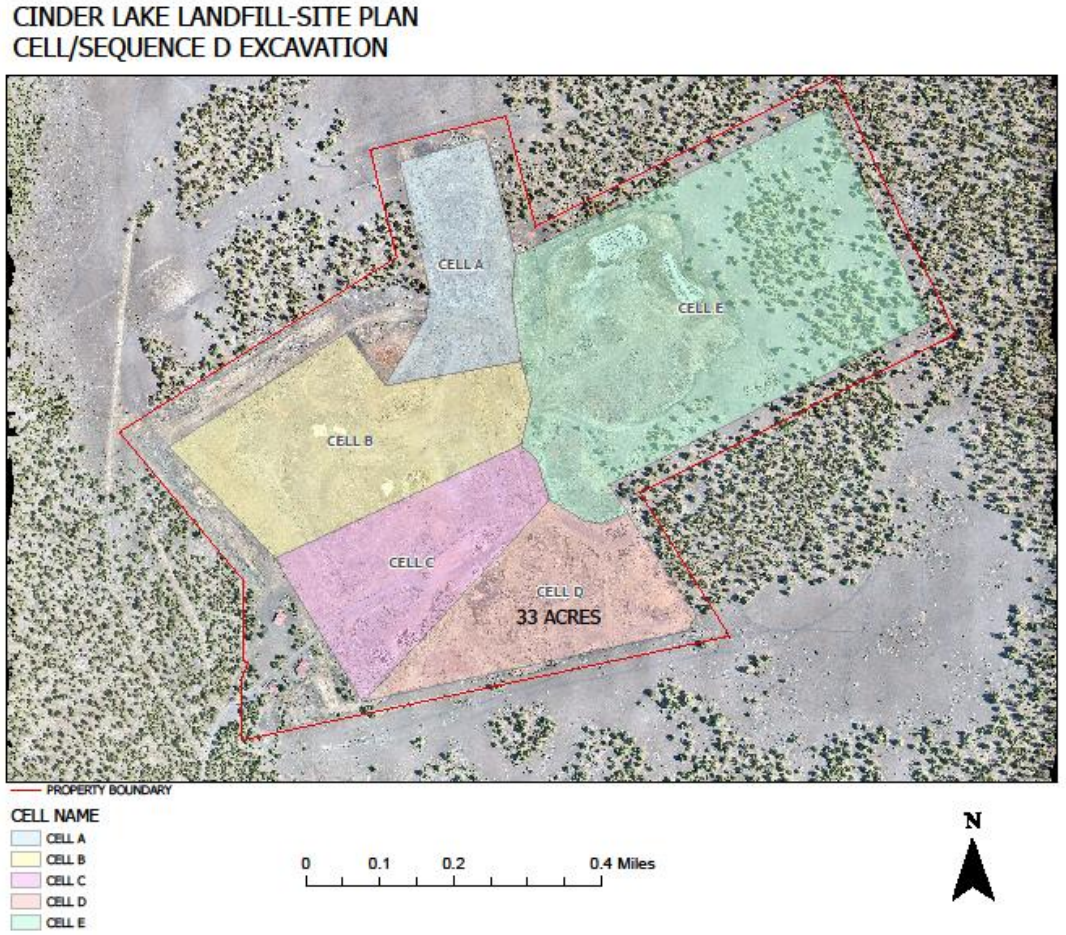
Subsequent Phases will Begin in 2nd Half of this Summer



SEQUENCE D-PHASE I

Construction Manager at Risk (CMAR) Delivery Method

- Advantages
  - Professional Oversight
  - Owner Advocate
  - Value Engineering
  - Allows staff to pursue multiple projects
  - Haul Roads and Water Storage Pond for Dust Abatement



SEQUENCE D-PHASE I

RUMCO Rummel Construction, Inc.

Experience

- Constructed landfills throughout Arizona

Equipment and Manpower

- Owns a fleet of heavy equipment (fleet of dozers, excavators, loaders etc.)

SEQUENCE D-PHASE I

Guaranteed Maximum Price (GMP)

- $1,094,649.80

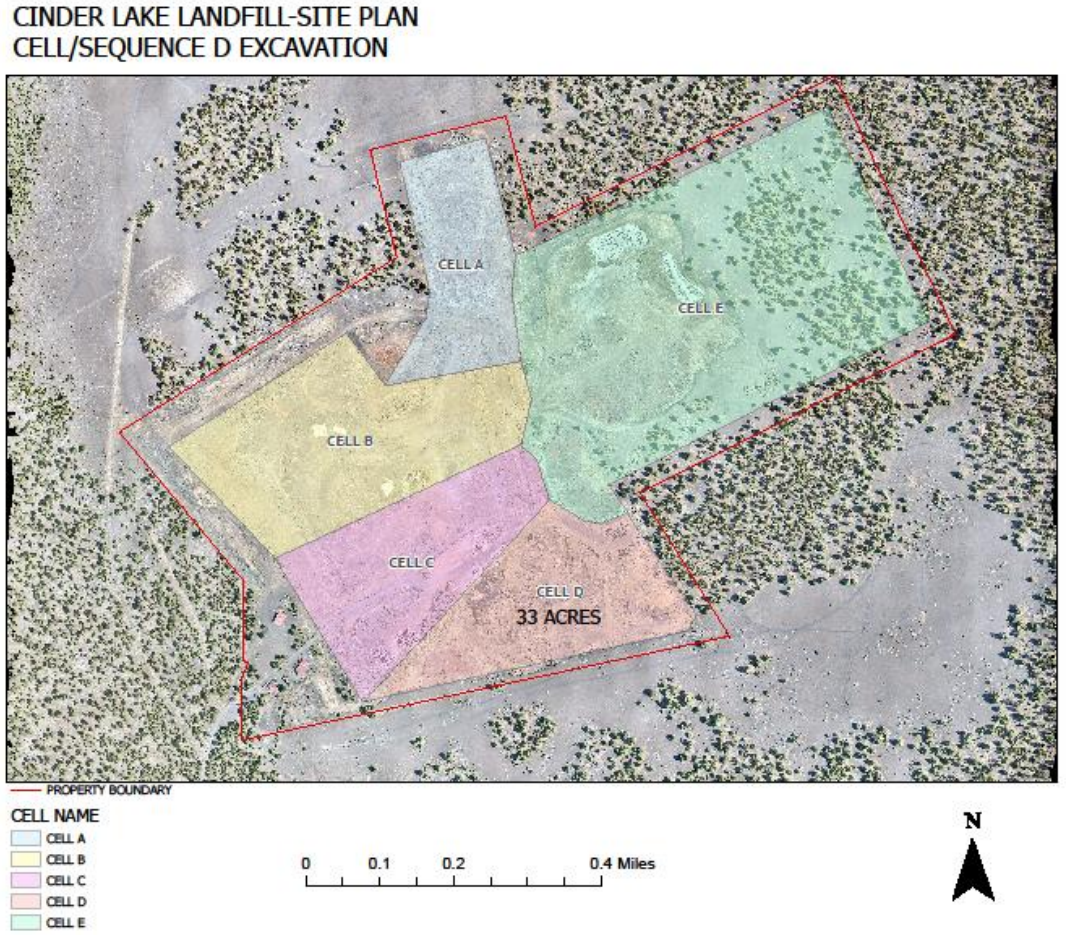
Owner Contingency

- $204,000

Schedule

- 10-weeks

Phase II will be presented to Council in the next 2 months



Questions?

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

8. D.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
:	
Co-Submitter:	Adam Miele
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Contract: Professional Engineering Design Services Contract for the Airport Drainage Plan Improvements in the amount of $388,519.

STAFF RECOMMENDED ACTION:

1. Determine Mead & Hunt, Inc, is the most qualified firm based upon responses to the City's Request for Statement of Qualifications (RSOQ), and approve a Professional Engineering Design Services Contract with Mead & Hunt, Inc. for the Airport Drainage Plan Improvements in the amount of $388,519 with a contract time of 365 calendar days; and
2. Authorize the City Manager to execute the necessary documents.

Executive Summary:

Award of this Professional Engineering Design Services Contract ("Contract") will authorize the Airport Drainage Plan Improvements project to proceed.

The Federal Aviation Administration under Federal Air Regulation Advisory Circular 150/5320-5D gives the following guideline: "Storm drainage design is an integral component in the design of transportation facilities. Drainage design for transportation facilities must strive to maintain compatibility and minimize interference with existing drainage patterns, control flooding of the pavement surface for design flood events and minimize potential environmental impacts from the facility-related storm water runoff."

A drainage system study was done prior to the lengthening of the runway in 2008. There are currently projects planned on airport, such as new hangar tenant projects, and off airport, such as the extension of JW Powell to Lake Mary Road, that could influence the existing storm water runoff from the airport. This drainage improvement plan will assist in preparing for these as well as any changes that may have occurred since the 2008 runway project.

Financial Impact:

The ADOT grant award will provide a grant in the amount of $350,000 (90% State share), the City will provide a match of $38,889 (10% City share) for a total grant award available in the amount of $388,889. This grant is budgeted in FY 2020-21 in account 221-07-222-3352-0 in the amount of $400,000.

Policy Impact:

None

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Goal: Transportation and Other Public Infrastructure: Provide airport infrastructure to enhance tenant and patron experience and secure a second airline.

Has There Been Previous Council Decision on This:

Yes, on January 21, 2020 council approved the grant award agreement, item 7.D.

Options and Alternatives:

1. Authorize the acceptance of the Contract from Mead & Hunt, Inc. for professional services.
2. Reject the acceptance of the Contract from Mead & Hunt, Inc. for professional services and re-solicit for the services.
3. Reject the Contract and continue existing operations in the existing facility.

Background/History:

The Drainage Plan Improvements project will address drainage issues throughout the airport. The last drainage report was completed in 1992. In the event of high intensity rainfall events standing water attracts wildlife which presents hazards to flight operations and is a high concern to the airport.

The routing of JW Powell from Pulliam Drive to Lake Mary Road will run adjacent to the existing airport storm water runoff area. This project can help identify possible needs for the extension of JW Powell. The extension of JW Powell is important to the future of ground transportation for Flagstaff.

Key Considerations:

On August 11, 2020, Purchasing staff posted a Request for Statements of Qualifications (RSOQ 2021-02) for Professional Engineering Services for Airport Drainage Plan Improvements and Other Potential Future Projects. The RSOQ was posted on the PlanetBids electronic bidding website and advertised in the Arizona Daily Sum on August 16 and August 23, 2020.

The solicitation for the contractor was very successful and generated four (4) Statements of Qualifications (SOQs) received by Purchasing staff on September 8, 2020. A Selection Committee of six members, including a licensed engineer, independently reviewed and evaluated the SOQs and a short list of the top three scoring firms were selected for interviews. Based upon the numerical scoring of the written SOQs and the interviews, the Selection Committee identified the most qualified Firm to perform the engineering services for the Project and recommended to commence negotiations for a scope of work and fee proposal to be provided by Mead & Hunt, Inc. Final scores of all firms are as follows:

Mead & Hunt, Inc.:	1,138
Dibble & Associates, Consulting Engineering, Inc.:	1,083
Kimley-Horn & Associates, Inc.:	958
C & S Engineers, Inc. (not interviewed):	534

The highest scored design professional Mead & Hunt, Inc. is very much aware of the preferred design/construction timeline. The contractor is confident the project will be completed on time and on budget.

Community Benefits and Considerations:

This project will identify any needed changes or improvements to control storm water runoff down stream from the Airport.

Community Involvement:

This project will provide information for the Airport and community concerning the safe control of stormwater runoff from the Airport.

Attachments: Contract with all Exhibits

CONTRACT FOR PROFESSIONAL SERVICES
Contract No.: 2021-02

This Contract is entered into this _____ day of _____, 20___ by and between the City of Flagstaff, a political subdivision of the State or Arizona ("Owner"), and Mead & Hunt, Inc., a state of Wisconsin corporation ("Contractor").

WHEREAS, the City of Flagstaff desires to receive and Contractor is able to provide professional services;

NOW THEREFORE, in consideration for the mutual promises contained herein, the City and Contractor (the "parties") agree as follows:

SERVICES

1. Scope of Work: Contractor shall provide the professional services generally described as follows:

PROFESSIONAL ENGINEERING SERVICES
FOR
AIRPORT ENGINEERING DRAINAGE IMPROVEMENT STUDY

and as more specifically described in the scope of work attached hereto as ***Exhibit A.***

2. Schedule of Services: Contractor shall perform all work per the schedule set forth in ***Exhibit A.***

3. Standard Terms and Conditions: The City of Flagstaff Standard Terms and Conditions, attached hereto as ***Exhibit B*** are hereby incorporated by reference by reference and shall apply to performance of this Contract, except to the extent modified in ***Exhibit A.***

4. Key Personnel/Subcontractors: Contractor's Key Personnel, Subcontractors (if any), and contact information are designated in ***Exhibit A.*** Key Personnel are those employees whose license number and signature will be placed on key documents and those employees who have significant responsibilities for completion of the services. The City Representative for this Contract has the right to approve any proposed substitution of Key Personnel or Subcontractors.

5. Grant Provisions: The parties agree to comply to the Grant Provisions attached hereto as ***Exhibit D.***

CITY RESPONSIBILITIES

6. City Representative: The City Representative is Matthew Luhman, Purchasing Manager, or his/her designee. All communications to the City shall be through the City Representative. City Representative is responsible for bringing any request for a Contract amendment or price adjustment to the attention of the City Buyer.

7. City Cooperation: City will cooperate with Contractor by placing at its disposal all available information concerning the City, City property, or the City project reasonably necessary for Contractor's performance of this Contract.

CONTRACT TERM

8. Contract Term: The Contract shall be effective as of the date signed by both parties. Performance shall commence within ten (10) days from the City's issuance of the Notice to Proceed and shall be in force for an initial term of three (3) consecutive years.

9. Renewal: This Contract may be renewed for up to two (2) additional one (1) year terms by mutual written consent of the parties. The City Manager or his designee (the Purchasing Director) shall have authority to approve renewal on behalf of the City.

10. Termination: This Contract may be terminated pursuant to the Standard Terms and Conditions attached hereto.

PAYMENT

11. Compensation: Contractor shall be paid three hundred eighty-eight thousand five hundred nineteen dollars and zero cents ($388,519.00) for satisfactory performance of the work identified in the scope of work attached hereto as *Exhibit A.*

12. Price Adjustment: If price adjustments are permitted (see Exhibit A), any price adjustment must be approved by the City in writing as a formal Contract Amendment. The City Manager or his/her designee (the Purchasing Director) may approve an adjustment if the annual Contract price is less than $49,000; otherwise, if the annual Contract price exceeds $50,000, City Council approval is required.

DATA AND RECORDS

13. City Ownership of Document and Data: Any original documents prepared or collected by Contractor in performance of this Contract such as models, samples, reports, test plans, survey results, graphics, tables, charts, plans, maps, specifications, surveys, computations and other data shall be the property of City ("City's work product"), unless otherwise agreed by the parties in writing. Contractor agrees that all materials prepared under this Contract are "works for hire" within the meaning of the copyright laws of the United States and hereby assigns to the City all rights and interests Contractor may have in the materials it prepares under this Contract, including any right to derivative use of the material.

14. Re-Use: City may use City's work product without further compensation to Contractor; provided, however, City's reuse without written verification or adaption by Contractor for purposes other than contemplated herein is at City's sole risk and without liability to Contractor. Contractor shall not engage in any conflict of interest nor appropriate any portion of City's work product for the benefit of Contractor or any third parties without City's prior written consent.

15. Delivery of Document and Data: Upon termination of this Contract in whole or part, or upon expiration if not previously terminated, Contractor shall immediately deliver to City copies all of City's work product and any other documents and data accumulated by Contractor in performance of this Contract, whether complete or in process.

INSURANCE

16. Insurance: Contractor shall meet insurance requirements of the City, set forth in *Exhibit C.*

MISCELLANEOUS

17. Notice: Any notice concerning this Contract shall be in writing and sent by certified mail and email as follows:

To the City:	To Contractor:
Matthew Luhman, Purchasing Manager City of Flagstaff 211 W. Aspen Flagstaff, Arizona 86001 mluhman@flagstaffaz.gov	Scott Van Gompel, PE Department Manager, Aviation Mead & Hunt, Inc. 2440 Deming Way Middleton, WI 53562 scott.vangompel@meadhunt.com

18. Authority. Each party warrants that it has authority to enter into this Contract and perform its obligations hereunder, and that it has taken all actions necessary to enter into this Contract.

CONTRACTOR

_____

Print name:_____

Title:_____

CITY OF FLAGSTAFF

_____

Print name:_____

Title:_____

Attest:

_____
City Clerk

Approved as to form:

_____
City Attorney's Office

EXHIBIT A

SCOPE OF WORK

Final Negotiated Scope of Work (with any modifications required by City)

(Found on following pages)

Flagstaff Pulliam Airport **Mead & Hunt**

Airport Drainage Plan Improvements 2/1/2021

Fee Estimate

PHASE 1 - PROJECT ADMINISTRATION AND COORDINATION			
1.0	Contract and Subcontracts Preparation	$	2,674
2.0	Project Coordination and Administration	$	29,612
	Expenses and Subconsultants	$	3,474
TOTAL		**$**	**35,760**

PHASE 2 - EXISTING CONDITIONS ASSESSMENTS			
3.0	Stakeholder Group and Key Priorities Identification	$	2,399
4.0	Basis of Design Development	$	3,460
5.0	Baseline Data Development	$	21,384
6.0	Geotechnical Assessment	$	591
7.0	Environmental Conditions Assessment	$	1,182
8.0	Existing Conditions Hydrology and Hydraulic Modeling	$	28,420
	Expenses and Subconsultants	$	77,553
TOTAL		**$**	**134,989**

PHASE 3 - PROPOSED CONDITION ASSESSMENTS			
9.0	Proposed Conditions Hydrology and Hydraulic Modeling	$	19,118
10.0	Alternatives Analysis and Conceptual Designs Development	$	79,662
	Expenses and Subconsultants	$	17,960
TOTAL		**$**	**116,740**

PHASE 4 - AIRPORT DRAINAGE IMPROVEMENTS PLAN AND STAKEHOLDER OUTREACH			
11.0	Existing Conditions Plan Preparation	$	11,171
12.0	City Council Meeting #1	$	6,599
13.0	Proposed Conditions Plan Preparation	$	14,867
14.0	City Council Meeting #2	$	6,599
15.0	Open House	$	8,471
16.0	Final Plan Preparation	$	4,314
17.0	Airport Layout Plan Update	$	1,228
	Expenses and Subconsultants	$	6,647
TOTAL		**$**	**59,896**

PHASE 5 - FEMA MAPPING CORRECTION			
18.0	Obtain Existing FEMA Modeling	$	1,788
19.0	Prepare and Submit LOMR	$	19,868
20.0	Coordinate LOMR Review with FEMA	$	9,704
	Expenses and Subconsultants	$	9,775
TOTAL		**$**	**41,135**

TOTAL Phases 1-4	**$**	**347,384**
TOTAL Phase 5	**$**	**41,135**
TOTAL	**$**	**388,519**

DIRECT SUB CONSULTANTS FEES		
Planning and Environmental Support (Coffman Associates)	$	18,600
Environmental Field verification and Regulatory Support (EPP)	$	13,064
Geotechnical Assessment Support (Western Technologies)	$	4,900
Surveying and Aerial Mapping Support (SWI / ATM)	$	47,595
TOTAL DIRECT SUB CONSULTANTS	**$**	**84,159**

Flagstaff Pulliam Airport
Airport Drainage Plan Improvements
Fee Estimate

Mead & Hunt
2/1/2021

		TOTAL			MEAD & HUNT										EXPENSES							SUBCONSULTANTS					
		Total Labor Costs	Total Expenses	Total Labor Costs and Expenses	Senior Associate $ 308.00	Senior Project Engineer $ 239.00	Project Engineer $ 188.00	Senior Engineer $ 164.00	Engineer II $ 133.00	Engineer I $ 127.00	Technician II $ 119.00	Accounting/Admin Assistant $ 104.00	Total Hours	Total Labor Costs	Mileage $ 0.575	Parking $ 50.00	Travel and Airline Costs	Lodging $ 175.00	Mailing $ 25.00	Copies $ 50.00	Fees 1	Planning and Environmental Support (Cofman Associates) 1	Environmental Field verification and Regulatory Support (EPP) 1	Geotechnical Assessment Support (Western Technologies) 1	Surveying and Aerial Mapping Support (SWI / ATM) 1	Total Expenses
	PHASE 1 - PROJECT ADMINISTRATION AND COORDINATION																										
1.0	**Contract and Subcontracts Preparation**																										
	a. Prepare consultant contract	$ 994	$ -	$ 994	1	2						2	5	$ 994													$ -
	b. Prepare subconsultant contract	$ 1,680	$ -	$ 1,680	1	4						4	9	$ 1,680													$ -
2.0	**Project Coordination and Administration**																										
2.1	Project Coordination																										
	a. Conduct project kickoff meeting with Sponsor	$ 956	$ -	$ 956		4							4	$ 956													$ -
	b. Conduct project kickoff meeting with team	$ 956	$ -	$ 956		4							4	$ 956													$ -
	c. Conduct biweekly progress meetings	$ 8,880	$ -	$ 8,880		16	12	12				8	48	$ 8,880													$ -
	d. Coordinate/conduct in-person meetings (2)	$ 9,384	$ 3,474	$ 12,858		24	8	8				8	48	$ 9,384	210	4	4	4									$ 3,474
2.2	General Administration (Project Manager)																										
	a. Define tasks, schedules, and costs	$ 1,434	$ -	$ 1,434		6							6	$ 1,434													$ -
	b. Monitor work progress and schedules	$ 1,434	$ -	$ 1,434		6							6	$ 1,434													$ -
	c. Coordinate and communicate with Sponsor	$ 1,434	$ -	$ 1,434		6							6	$ 1,434													$ -
	d. Implement and monitor Quality Control (QC) and Quality Assurance (QA)	$ 1,642	$ -	$ 1,642		6						2	8	$ 1,642													$ -
	e. Reporting and invoicing	$ 3,492	$ -	$ 3,492		12						6	18	$ 3,492													$ -
	TOTAL	**$ 32,286**	**$ 3,474**	**$ 35,760**																							
				Total Hours	**2**	**90**	**20**	**20**	**0**	**0**	**0**	**30**	**162**	$ 32,286	**210**	**4**	**4**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	$ 3,021
				Total Labor Costs	**$ 616**	**$ 21,510**	**$ 3,760**	**$ 3,280**	**$ -**	**$ -**	**$ -**	**$ 3,120**		**$ 32,286**	**$ 121**	**$ 200**	**$ 2,000**	**$ 700**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,021**
	PHASE 2 - EXISTING CONDITIONS ASSESSMENTS																										
3.0	**Stakeholder Group and Key Priorities Identification**																										
	a. Identify stakeholders	$ 615	$ -	$ 615		1	2						3	$ 615													$ -
	b. Develop list of key priorities and weight	$ 376	$ -	$ 376			2						2	$ 376													$ -
	c. Confirm scope of proposed projects	$ 1,408	$ -	$ 1,408			4	4					8	$ 1,408													$ -
4.0	**Basis of Design Development**																										
	a. Review applicable code requirements	$ 1,564	$ -	$ 1,564			2	4	4				10	$ 1,564													$ -
	b. Summarize drainage design criteria in technical memo to serve as Basis of Design; submit tech memo	$ 1,896	$ -	$ 1,896			2	8				2	12	$ 1,896													$ -
5.0	**Baseline Data Development**																										
5.1	Existing Data Collection and Review																										
	a. Obtain and review existing data for use in calibration of existing conditions hydrology and hydraulics model	$ 9,064	$ 1,495	$ 10,559			8	16	8	8	24		64	$ 9,064							$ 1,300						$ 1,495
	b. Review limits of topographic survey with Sponsor	$ 704	$ -	$ 704			2	2					4	$ 704													$ -
5.2	Site Reconnaissance																										
	a. Conduct site visit three (3) team members	$ 4,728	$ 1,668	$ 6,396	8		8	8					24	$ 4,728	2	2	2										$ 1,668
5.3	Aerial Survey Data																										
	a. Analyze aerial survey data completed with Master Plan	$ 3,016	$ -	$ 3,016			4	8			8		20	$ 3,016													$ -
	b. Conduct aerial survey and data processing	$ -	$ 33,287	$ 33,287									0	$ -												$ 28,945	$ 33,287
5.4	Topographical Surveying																										
	a. Establish and verify survey control	$ -	$ 10,408	$ 10,408									0	$ -												$ 9,050	$ 10,408
	b. Conduct topographic survey	$ -	$ 9,660	$ 9,660									0	$ -												$ 8,400	$ 9,660
	c Prepare topographic survey deliverables	$ -	$ 1,380	$ 1,380									0	$ -												$ 1,200	$ 1,380
5.5	Survey Data Processing																										
	a. Analyze topographical surveying data	$ 2,560	$ -	$ 2,560				4			16		20	$ 2,560													$ -
	b. Prepare data for use with computer modeling software	$ 1,312	$ -	$ 1,312				8					8	$ 1,312													$ -
6.0	**Geotechnical Assessment**																										
	a. Develop a technical memorandum describing geotechnical conditions	$ 591	$ 3,450	$ 4,041	1		1	1					3	$ 591												$ 3,000	$ 3,450
7.0	**Environmental Conditions Assessment**																										
7.1	Environmental Constraints Analysis																										
	a. Identify potential environmental constraints impacting drainage strategy development	$ -	$ 2,714	$ 2,714									0	$ -							$ 2,360						$ 2,714
	b. Develop a technical memorandum updating the previous Environmental Inventory prepared with the Master Plan	$ 591	$ 3,620	$ 4,211	1		1	1					3	$ 591							$ 3,148						$ 3,620
7.2	Field Verification of Potential Jurisdictional Waters																										
	a. Prepare data in ArcGIS Collector	$ -	$ 2,438	$ 2,438									0	$ -									$ 2,120				$ 2,438
	b. Conduct field verification of potential jurisdictional waters	$ -	$ 3,110	$ 3,110									0										$ 2,704				$ 3,110
	c. Evaluate site for hydric soils, hydrology and vegetation using the regional supplement to the USACE Wetland Delineation Manual	$ -	$ 920	$ 920									0	$ -									$ 800				$ 920
	d. Develop field report	$ 591	$ 3,404	$ 3,995	1		1	1					3	$ 591									$ 2,960				$ 3,404

Flagstaff Pulliam Airport
Airport Drainage Plan Improvements
Fee Estimate

Mead & Hunt
2/1/2021

		TOTAL			MEAD & HUNT										EXPENSES							SUBCONSULTANTS					
		Total Labor Costs	Total Expenses	Total Labor Costs and Expenses	Senior Associate $ 308.00	Senior Project Engineer $ 239.00	Project Engineer $ 188.00	Senior Engineer $ 164.00	Engineer II $ 133.00	Engineer I $ 127.00	Technician II $ 119.00	Accounting/Admin Assistant $ 104.00	Total Hours	Total Labor Costs	Mileage $ 0.575	Parking $ 50.00	Travel and Airline Costs	Lodging $ 175.00	Mailing $ 25.00	Copies $ 50.00	Fees 1	Planning and Environmental Support (Cofman Associates) 1	Environmental Field verification and Regulatory Support (EPP) 1	Geotechnical Assessment Support (Western Technologies) 1	Surveying and Aerial Mapping Support (SWI / ATM) 1	Total Expenses
8.0	**Existing Conditions Hydrology and Hydraulic Modeling**																										
8.1	Subbasin Delineations																										
	a. Utilize baseline data to delineate subbasins within each watershed intersecting the airport	$ 594	$ -	$ 594				2	2				4	$ 594												$ -
8.2	Model Parameters																										
	a. Obtain applicable model parameters	$ 4,408	$ -	$ 4,408				8	8	16			32	$ 4,408												$ -
8.3	Model Development																										
	a. Utilize FLO-2D Pro to model four watershed areas	$ 656	$ -	$ 656				4					4	$ 656												$ -
	b. Incorporate existing stormwater management features into model	$ 6,534	$ -	$ 6,534				22	22				44	$ 6,534												$ -
	c. Calibrate model based on historic flood data	$ 1,688	$ -	$ 1,688			2	8					10	$ 1,688												$ -
8.4	Model Evaluations and Output																										
	a. Evaluate areas of known flooding in existing model and summarize potential causes	$ 6,622	$ -	$ 6,622		2	8	16	8		8		42	$ 6,622												$ -
	b. Conduct work session with sponsor via teleconference to review findings	$ 1,182	$ -	$ 1,182		2	2	2					6	$ 1,182												$ -
	c. Finalize existing conditions model with input from work session	$ 4,640	$ -	$ 4,640				16	8		8		32	$ 4,640												$ -
	d. Document output from model for comparison to the proposed condition in the Plan	$ 2,096	$ -	$ 2,096			2	4	8				14	$ 2,096												$ -
	TOTAL	**$ 57,436**	**$ 77,553**	**$ 134,989**																							
				Total Hours	0	16	51	147	68	24	64	2	372	$ 57,436	**0**	**2**	**2**	**2**	**0**	**0**	**0**	**6808**	**8584**	**3000**	**47595**	$ 67,437
				Total Labor Costs	**$ -**	**$ 3,824**	**$ 9,588**	**$ 24,108**	**$ 9,044**	**$ 3,048**	**$ 7,616**	**$ 208**		**$ 57,436**	**$ -**	**$ 100**	**$ 1,000**	**$ 350**	**$ -**	**$ -**	**$ -**	**$ 6,808**	**$ 8,584**	**$ 3,000**	**$ 47,595**	**$ 67,437**
	PHASE 3 - PROPOSED CONDITION ASSESSMENTS																										
9.0	**Proposed Conditions Hydrology and Hydraulic Modeling**																										
9.1	Proposed Conditions Basemap																										
	a. Update basemap to include impervious areas	$ 3,592	$ -	$ 3,592			2	8			16		26	$ 3,592												$ -
	b. Establish assumptions about grading and drainage patterns for the proposed improvements	$ 4,656	$ -	$ 4,656			2	8	8		16		34	$ 4,656												$ -
9.2	Subbasin Delineations																										
	a. Revise existing condition subbasins to reflect proposed condition subbasins	$ 582	$ -	$ 582				2		2			4	$ 582												$ -
9.3	Model Parameters																										
	a. Update applicable model parameters	$ 1,176	$ -	$ 1,176				4	2	2			8	$ 1,176												$ -
9.4	Model Development																										
	a. Update model to reflect proposed condition improvements	$ 7,016	$ -	$ 7,016			2	18	22	6			48	$ 7,016												$ -
9.5	Model Evaluations and Output																										
	a. Document output from proposed condition model for comparison to existing conditions	$ 2,096	$ -	$ 2,096			2	4	8				14	$ 2,096												$ -
		$ -	$ -	$ -									0	$ -												$ -
10.0	**Alternatives Analysis and Conceptual Designs Development**																										
10.1	Known Flooding Areas and Short-term Projects																										
	a. Evaluate alternatives for mitigations measures	$ 8,912	$ -	$ 8,912			12	16	16		16		60	$ 8,912												$ -
	b. Utilize proposed condition model to evaluate effectiveness of mitigation alternative strategies	$ 4,704	$ -	$ 4,704				16	8	8			32	$ 4,704												$ -
	c. Develop an exhibit and matrix summarizing alternatives with ratings for key priorities	$ 6,526	$ -	$ 6,526	2	4	8	8	8	16			46	$ 6,526												$ -
	d. Present preferred alternatives to Sponsor in work session with Sponsor via teleconference	$ 1,182	$ -	$ 1,182	2	2	2						6	$ 1,182												$ -
	e. Finalize proposed conditions model with preferred alternatives after input from work session	$ 7,408	$ -	$ 7,408		4	16	16		16			52	$ 7,408												$ -
	f. Document preferred alternatives for reporting in Plan	$ 1,720	$ -	$ 1,720			4	8					12	$ 1,720												$ -
	g. Develop a narrative description of the scope for the selected preferred alternatives for the project data sheet	$ 3,440	$ -	$ 3,440			8	16					24	$ 3,440												$ -
	h. Develop a schematic drawing of the concept-level design for the selected preferred alternatives for the project data sheet	$ 11,622	$ -	$ 11,622	2	8	16	16	16	24			82	$ 11,622												$ -
	i. Develop an estimate of total cost for the selected preferred alternatives for the project data sheet	$ 10,194	$ -	$ 10,194	2	8	16	16	16	12			70	$ 10,194												$ -
	j. Geotechnical review for project data sheet	$ -	$ 2,185	$ 2,185									0	$ -										$ 1,900		$ 2,185
	k. Environmental review for project data sheet	$ -	$ 15,775	$ 15,775									0	$ -								$ 9,237	$ 4,480			$ 15,775
10.2	Intermediate and Long-term Projects																										
	a. Evaluate alternatives for mitigations measures and present one concept to mitigate impacts of each project	$ 4,356	$ -	$ 4,356			8	8	8		4		28	$ 4,356												$ -
	b. Develop an exhibit presenting the recommendations	$ 3,952	$ -	$ 3,952			2	4		8	16		30	$ 3,952												$ -

Flagstaff Pulliam Airport
Airport Drainage Plan Improvements
Fee Estimate

Mead & Hunt
2/1/2021

		TOTAL			MEAD & HUNT										EXPENSES							SUBCONSULTANTS				
		Total Labor Costs	Total Expenses	Total Labor Costs and Expenses	Senior Associate $ 308.00	Senior Project Engineer $ 239.00	Project Engineer $ 188.00	Senior Engineer $ 164.00	Engineer II $ 133.00	Engineer I $ 127.00	Technician II $ 119.00	Accounting/Admin Assistant $ 104.00	Total Hours	Total Labor Costs	Mileage $ 0.575	Parking $ 50.00	Travel and Airline Costs $ 500.00	Lodging $ 175.00	Mailing $ 25.00	Copies $ 50.00	Fees 1	Planning and Environmental Support (Cofman Associates) 1	Environmental Field verification and Regulatory Support (EPP) 1	Geotechnical Assessment Support (Western Technologies) 1	Surveying and Aerial Mapping Support (SWI / ATM) 1	Total Expenses
	c. Conduct a work session with the Sponsor via teleconference to review recommendations	$ 1,182	$ -	$ 1,182		2	2	2					6	$ 1,182												$ -
	d. Finalize proposed conditions model with preferred alternatives after input from work session	$ 4,128	$ -	$ 4,128			8	16					24	$ 4,128												$ -
	e. Document output for reporting in Plan	$ 3,128	$ -	$ 3,128			4	8	8				20	$ 3,128												$ -
	f. Develop a narrative of the preferred alternative scope and a total cost estimate	$ 7,208	$ -	$ 7,208			8	16	16		8		48	$ 7,208												$ -
	TOTAL	**$ 98,780**	**$ 17,960**	**$ 116,740**																						
				Total Hours	0	10	78	200	176	66	144	0	674	$ 98,780	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9237**	**4480**	**1900**	**0**	$ 15,617
				Total Labor Costs	**$ -**	**$ 2,390**	**$ 14,664**	**$ 32,800**	**$ 23,408**	**$ 8,382**	**$ 17,136**	**$ -**		**$ 98,780**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 9,237**	**$ 4,480**	**$ 1,900**	**$ -**	**$ 15,617**
	PHASE 4 - AIRPORT DRAINAGE IMPROVEMENTS PLAN AND STAKEHOLDER OUTREACH																									
11.0	**Existing Conditions Plan Preparation**																									
	a. Prepare Plan components for existing site conditions	$ 6,972	$ -	$ 6,972		4	8	12	16			4	44	$ 6,972												$ -
	b. Prepare exhibit depicting existing site conditions	$ 3,615	$ -	$ 3,615		1	4	4		8	8		25	$ 3,615												$ -
	c. Submit the draft plan to the Sponsor for review and comment	$ 584	$ -	$ 584			2					2	4	$ 584												$ -
12.0	**City Council Meeting #1**																									
	a. Address review comments from draft Plan	$ 1,240	$ -	$ 1,240			2	4				2	8	$ 1,240												$ -
	b. Prepare PowerPoint presentation to City Council on overall existing conditions and Plan goals/objectives	$ 2,543	$ -	$ 2,543		1	2	4	8			2	17	$ 2,543												$ -
	c. Present the project to City council with two (2) staff members	$ 2,816	$ 1,668	$ 4,484			8	8					16	$ 2,816		2	2	2								$ 1,668
13.0	**Proposed Conditions Plan Preparation**																									
	a. Prepare Plan components for proposed drainage improvements, alternatives analysis, prioritization of recommended alternatives, and cost estimates	$ 8,044	$ -	$ 8,044		4	8	16	16			8	52	$ 8,044												$ -
	b. Prepare exhibit depicting proposed site conditions	$ 6,239	$ -	$ 6,239		1	4	8		16	16		45	$ 6,239												$ -
	c. Submit the draft plan to the Sponsor for review and comment	$ 584	$ -	$ 584			2					2	4	$ 584												$ -
14.0	**City Council Meeting #2**																									
	a. Address review comments from draft Plan	$ 1,240	$ -	$ 1,240			2	4				2	8	$ 1,240												$ -
	b. Prepare PowerPoint presentation to City Council on proposed conditions and overall Plan recommendations	$ 2,543	$ -	$ 2,543		1	2	4	8			2	17	$ 2,543												$ -
	c. Present the project to City council with two (2) staff members	$ 2,816	$ 1,668	$ 4,484			8	8					16	$ 2,816		2	2	2								$ 1,668
15.0	**Open House**																									
	a. Prepare full-sized exhibits	$ 4,160	$ 173	$ 4,333			2	4		8	16	2	32	$ 4,160						3						$ 173
	b. Prepare PowerPoint presentation	$ 1,495	$ -	$ 1,495		1	1	2	4			2	10	$ 1,495												$ -
	c. Facilitate public open house to present the draft Plan with two (2) staff members [travel expenses included with 14.0.c.]	$ 2,816	$ -	$ 2,816			8	8					16	$ 2,816												$ -
16.0	**Final Plan Preparation**																									
	a. Address review comments from the Sponsor, City Council and ADOT	$ 704	$ -	$ 704			2	2					4	$ 704												$ -
	b. Finalize the Plan	$ 3,194	$ -	$ 3,194		2	4	4			4	8	22	$ 3,194												$ -
	c. Deliver three (3) hard copies with color exhibits and one (1) electronic copy to Sponsor	$ 416	$ 201	$ 617								4	4	$ 416					1	3						$ 201
17.0	**Airport Layout Plan Update**																									
	a. Update Airport Layout Plan (ALP) to incorporate applicable proposed stormwater drainage improvements	$ 1,228	$ 2,938	$ 4,166			4				4		8	$ 1,228							$ 2,555					$ 2,938
	TOTAL	**$ 53,249**	**$ 6,647**	**$ 59,896**																						
				Total Hours	**0**	**15**	**73**	**92**	**52**	**32**	**48**	**40**	**352**	$ 53,249	**0**	**4**	**4**	**4**	**1**	**6**	**0**	**2555**	**0**	**0**	**0**	$ 5,780
				Total Labor Costs	**$ -**	**$ 3,585**	**$ 13,724**	**$ 15,088**	**$ 6,916**	**$ 4,064**	**$ 5,712**	**$ 4,160**		**$ 53,249**	**$ -**	**$ 200**	**$ 2,000**	**$ 700**	**$ 25**	**$ 300**	**$ -**	**$ 2,555**	**$ -**	**$ -**	**$ -**	**$ 5,780**
	PHASE 5 - FEMA MAPPING CORRECTION																									
18.0	**Obtain Existing FEMA Modeling**																									
	a. Initiate data acquisition to obtain FEMA's effective HEC-RAS hydraulic model for Bow & Arrow Wash	$ 1,788	$ 575	$ 2,363				8			4		12	$ 1,788							$ 500					$ 575
19.0	**Prepare and Submit LOMR**																									
	a. Prepare and submit a LOMR application to correct mapping error	$ 8,152	$ -	$ 8,152			8	16	24			8	56	$ 8,152												$ -
	b. Prepare preliminary HEC-RAS model and other administrative LOMR contents	$ 11,716	$ -	$ 11,716		4	8	24	40				76	$ 11,716												$ -
	c. Pay applicable fees to FEMA	$ -	$ 9,200	$ 9,200									0	$ -							$ 8,000					$ 9,200
20.0	**Coordinate LOMR Review with FEMA**																									
	a. Conference call with FEMA with two staff members (2)	$ 1,408	$ -	$ 1,408			4	4					8	$ 1,408												$ -
	b. Address review comments from FEMA (2 rounds)	$ 8,296	$ -	$ 8,296			4	24	24			4	56	$ 8,296												$ -
	TOTAL	**$ 31,360**	**$ 9,775**	**$ 41,135**																						
				Total Hours	**0**	**4**	**24**	**76**	**88**	**0**	**4**	**12**	**208**	$ 31,360	**0**	**0**	**0**	**0**	**0**	**0**	**8500**	**0**	**0**	**0**	**0**	$ 8,500
				Total Labor Costs	**$ -**	**$ 956**	**$ 4,512**	**$ 12,464**	**$ 11,704**	**$ -**	**$ 476**	**$ 1,248**		**$ 31,360**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,500**
	TOTALS			**$ 388,519**										**$ 273,111**								$ 18,600	$ 13,064	$ 4,900	$ 47,595	**$ 100,355**

EXHIBIT B

CITY OF FLAGSTAFF
STANDARD TERMS AND CONDITIONS

IN GENERAL

1. **NOTICE TO PROCEED:** Contractor shall not commence performance until after City has issued a Notice to Proceed.

2. **LICENSES AND PERMITS:** Contractor its expense shall maintain current federal, state, and local licenses, permits and approvals required for performance of the Contract, and provide copies to City upon request.

3. **COMPLIANCE WITH LAWS:** Contractor shall comply with all applicable federal, state and local laws, regulations, standards, codes and ordinances in performance of this Contract.

4. **NON-EXCLUSIVE:** Unless expressly provided otherwise in the Contract, this Contract is non-exclusive and the City reserves the right to contract with others for materials or services.

5. **SAMPLES:** Any sample submitted to the City by the Contractor and relied upon by City as representative of quality and conformity, shall constitute an express warranty that all materials and/or service to be provided to City shall be of the same quality and conformity.

MATERIALS

6. **PURCHASE ORDERS:** The City will issue a purchase order for the materials covered by the Contract, and such order will reference the Contract number.

7. **QUALITY:** Contractor represents that all materials supplied under this Contract will be new and free from defects in material or workmanship. The materials will conform to any statements made on the containers or labels or advertisements for the materials, and will be safe and appropriate for use as normally used. City's inspection, testing, acceptance or use of materials shall not serve to waive these quality requirements. This representation shall survive termination or expiration of the Contract.

8. **ACCEPTANCE:** All materials and services provided by Contract are subject to final inspection and acceptance by the City. Materials and services failing to conform to the Contract specifications may be rejected in whole or part. If rejected, Contractor is responsible for all costs associated arising from rejection.

9. **MANUFACTURER'S WARRANTIES:** Contractor shall deliver all Manufacturer's Warranties to City upon City's acceptance of the materials.

10. **PACKING AND SHIPPING:** Contractor shall be responsible for industry standard packing which conforms to requirements of carrier's tariff and ICC regulations. Containers shall be clearly marked as to lot number, destination, address and purchase order number. All shipments shall be F.O.B. Destination, City of Flagstaff, 211 West Aspen Avenue, Flagstaff, Arizona 86001, unless otherwise specified by the City. C.O.D. shipments will not be accepted.

11. **TITLE AND RISK OF LOSS:** The title and risk of loss of material shall not pass to the City until the City actually receives the material at the point of delivery, and the City has completed inspection and has accepted the material, unless the City has expressly provided otherwise in the Contract.

12. **NO REPLACEMENT OF DEFECTIVE TENDER:** Every tender of materials shall fully comply with all provisions of the Contract. If a tender is made which does not fully conform, this shall constitute a breach and Contractor shall not have the right to substitute a conforming tender without prior written approval from the City.

13. **DEFAULT IN ONE INSTALLMENT TO CONSTITUTE TOTAL BREACH:** Contractor and may not substitute nonconforming materials, or services. Delivery of nonconforming materials, and/or services, or a default of any nature, at the option of the City, shall constitute shall deliver conforming materials, or services, in each installment or lot of the contract a breach of the contract as a whole.

14. **SHIPMENT UNDER RESERVATION PROHIBITED:** Contractor is not authorized to ship materials under reservation and no tender of a bill of lading shall operate as a tender of the materials.

15. **LIENS:** All materials and other deliverables supplied to the City shall be free of all liens other than the security interest held by Contractor until payment in full is made by the City. Upon request of the City, Contractor shall provide a formal release of all liens.

16. **CHANGES IN ORDERS:** The City reserves the right at any time to make changes in any one or more of the following: (a) methods of shipment or packing; (b) place of delivery; and (c) quantities. If any change causes an increase or decrease in the cost of or the time required for performance, an equitable adjustment may be made in the price or delivery schedule, or both. Any claim for adjustment shall be evidenced in writing and approved by the City Purchasing Director prior to the institution of the change.

PAYMENT

17. **INVOICES:** A separate invoice shall be issued for each shipment and each job completed. Invoices shall include the Contract and/or Purchase Order number, and dates when goods were shipped or work performed. Invoices shall be sent within 30 days following performance. Payment will only be made for satisfactory materials and/or services received and accepted by City.

18. **LATE INVOICES:** The City may deduct up to 10% of the payment price for late invoices. The City operates on a fiscal year budget, from July 1 through the following June 30. Except in unusual circumstances, which are not due to the fault of Contractor, City will not honor any invoices or claims submitted after August 15 for materials or services supplied in the prior fiscal year.

19. **TAXES:** Contractor shall be responsible for payment of all taxes including federal, state, and local taxes related to or arising out of Contractor's performance of this Contract. Such taxes include but are not limited to federal and state income tax, social security tax, unemployment insurance taxes, transaction privilege taxes, use taxes, and any other taxes or business license fees as required.

Exception: The City will pay any taxes which are specifically identified as a line item dollar amount in the Contractor's bid, proposal, or quote, and which were considered and approved by the City as part of the Contract award process. In this event, taxes shall be identified as a separate line item in Contractor's invoices.

20. FEDERAL EXCISE TAXES: The City is exempt from paying certain Federal Excise Taxes and will furnish an exemption certificate upon request.

21. FUEL CHARGES: Contractor at its own expense is liable for all fuel costs related to performance. No fuel surcharges will be accepted or paid by City.

22. DISCOUNTS: If the Contract provides for payment discounts, payment discounts will be computed from the later date of the following: (a) when correct invoice is received by the City; or (b) when acceptable materials and/or materials were received by City.

23. AMOUNTS DUE TO THE CITY: Contractor must be current and remain current in all obligations due to the City during performance. Payments to Contractor may be offset by any delinquent amounts due to City or fees and charges owed to City under this Contract.

24. OFAC: No City payments may be made to any person in violation of Office of Foreign Assets Control regulations, 31 C.F.R. Part 501.

SERVICES

25. INDEPENDENT CONTRACTOR: Contractor shall be an independent contractor for purposes of all laws, including but not limited to the Fair Labor Standards Act, Federal Insurance Contribution Act, Social Security Act, Federal Unemployment Tax Act, Internal Revenue Code, Immigration and Naturalization Act; Arizona revenue and taxation, workers' compensation, and unemployment insurance laws.

26. CONTROL: Contractor shall be responsible for the control of the work.

27. WORK SITE: Contractor shall inspect the work site and notify the City in writing of any deficiencies or needs prior to commencing work.

28. SAFEGUARDING PROPERTY: Contractor shall responsible for any damage to real property of the City or adjacent property in performance of the work and safeguard the worksite.

29. QUALITY: All work shall be of good quality and free of defects, performed in a diligent and professional manner.

30. ACCEPTANCE: If work is rejected by the City due to noncompliance with the Contract, The City, after notifying Contractor in writing, may require Contractor to correct the deficiencies at Contractor's expense, or cancel the work order and pay Contractor only for work properly performed.

31. WARRANTY: Contractor warrants all work for a period of one (1) year following final acceptance by the City. Upon receipt of written notice from the City, Contractor at its own expense shall promptly correct work rejected as defective or as failing to conform to the Contract, whether observed before or after acceptance, and whether or not fabricated, installed or completed by Contractor, and shall bear all costs of correction. If Contractor does not correct deficiencies within a reasonable time specified in the written notice from the City, the City may perform the work and Contractor shall be liable for the costs. This

one-year warranty is in addition to, and does not limit Contractor's other obligations herein. This warranty shall survive termination or expiration of the Contract.

For the purposes of this agreement, warranty shall mean performing in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality.

INSPECTION, RECORDS, ADMINISTRATION

32. RECORDS: The City shall have the right to inspect and audit all Contractor books and records related to the Contract for up to five (5) years after completion of the Contract.

33. RIGHT TO INSPECT BUSINESS: The City shall have the right to inspect the place of business of the Contractor or its subcontractor during regular business hours at reasonable times, to the extent necessary to confirm Contract performance.

34. PUBLIC RECORDS: This Contract and any related materials are a matter of public record and subject to disclosure pursuant to Arizona Public Records Law, A.R.S. § 39-121 et seq. If Contractor has clearly marked its proprietary information as "confidential", the City will endeavor to notify Contractor prior to release of such information.

35. CONTRACT ADMINISTRATION: Contractor will be required to participate in the City's Contract Administration Process. Contractor will be closely monitored for contract compliance and will be required to promptly correct any deficiencies.

INDEMNIFICATION, INSURANCE

36. GENERAL INDEMNIFICATION: Contractor shall indemnify, defend and hold harmless the City, its council, boards and commissions, officers, employees from losses, claims, suits, payments and judgments, demands, expenses, reasonable attorney's fees resulting from personal injury to any person, including employees, subcontractors or agents of Contractor or damages to any property but only to the extent caused by the negligent performance of the Contract, except any such injury or damages arising out of the negligence of the City, its officers, agents or employees. This indemnification provision shall survive termination or expiration of the Contract. This indemnification clause shall not apply, if a different indemnification clause is included in the City's Specific Terms and Conditions.

37. INSURANCE: Contractor shall maintain all insurance coverage required by the City, including public liability and worker's compensation.

38. INTELLECTUAL PROPERTY INDEMNIFICATION: Contractor shall indemnify and hold harmless the City against any liability, including costs and expenses, for infringement of any patent, trademark or copyright or other proprietary rights of any third parties arising out of contract performance or use by the City of materials furnished or work performed under this Contract. Contractor shall promptly assume full responsibility for the defense of any suit or proceeding which is, has been, or may be brought against the City for alleged infringement, or alleged unfair competition resulting from similarity in design, trademark or appearance of goods, and indemnify the City against any and all expenses, losses, royalties, profits and damages, attorneys fees and costs resulting from such proceedings or settlement thereof. This indemnification shall survive termination or expiration of the Contract.

CONTRACT CHANGES

39. PRICE INCREASES: Except as expressly provided for in the Contract, no price increases will be approved.

40. COMPLETE AGREEMENT: The Contract is intended to be the complete and final agreement of the parties.

41. AMENDMENTS: This Contract may be amended by written agreement of the parties.

42. SEVERABILITY: If any term or provision of this Contract is found by a court of competent jurisdiction to be illegal or unenforceable, then such term or provision is deemed deleted, and the remainder of this Contract shall remain in full force and effect.

43. NO WAIVER: Each party has the right insist upon strict performance of the Contract, and the prior failure of a party to insist upon strict performance, or a delay in any exercise of any right or remedy, or acceptance of materials or services, shall not be deemed a waiver of any right to insist upon strict performance.

44. ASSIGNMENT: This Contract may be assigned by Contractor with prior written consent of the City, which will not be unreasonably withheld. Any assignment without such consent shall be null and void. Unless expressly provided for in a separately executed Consent to Assignment, no assignment shall relieve Contractor (Assignor) from any of its obligations and liabilities under the Contract with respect to City. The Purchasing Director shall have authority to consent to an assignment on behalf of City.

45. BINDING EFFECT: This Contract shall be binding upon and inure to the benefit of the parties and their successors and assigns.

EMPLOYEES AND SUBCONTRACTORS

46. SUBCONTRACTING: Contractor may subcontract work in whole or in part with the City's advance written consent. City reserves the right to withhold consent if subcontractor is deemed irresponsible and/or subcontracting may negatively affect performance. All subcontracts shall comply with the underlying Contract. Contractor is responsible for Contract performance whether or not subcontractors are used.

47. NONDISCRIMINATION: Contractor warrants that it complies with any state and federal laws, rules and regulations which mandate that all persons, regardless of race, color, pregnancy, religion, sex, sexual orientation, gender identity, genetic information, age, national origin, disability, veteran status, caregiving responsibilities, or familial status shall have equal access to employment opportunities. Contractor shall take affirmative action to ensure that it will not participate either directly or indirectly in the discrimination prohibited by or pursuant to Title VI of the Civil Rights Act of 1964, Pregnancy Discrimination Act of 1978, Americans with Disabilities Act of 2008 as amended, Section 504 of the Rehabilitation Act of 1973, Section 109 of the Housing and Community Development Act of 1974, the Age Discrimination Act of 1975, Age Discrimination and Employment Act of 1967 as amended, Genetic Information Nondiscrimination Act of 2008. In addition, any Contractor shall also comply with City Code, Chapter 14-02, Civil Rights which prohibits discrimination based upon sexual orientation, or gender identity or expression.

48. DRUG FREE WORKPLACE: The City has adopted a Drug Free Workplace policy for itself and those doing business with the City to ensure the safety and health of all persons working on City contracts and projects. Contractor personnel shall abstain from use or possession of illegal drugs while engaged in performance of this Contract.

49. IMMIGRATION LAWS: Pursuant to A.R.S. § 41-4401, Contractor hereby warrants to the City that the Contractor and each of its subcontractors will comply with, and are contractually obligated to comply with, all State and Federal Immigration laws and regulations that relate to its employees and A.R.S. § 23-214(A) (hereinafter "Contractor Immigration Warranty"). A breach of the Contractor Immigration Warranty shall constitute a material breach of this Contract and shall subject the Contractor to penalties up to and including termination of this Contract at the sole discretion of the City. The City retains the legal right to inspect the papers of any Contractor or subcontractor employee who works on this Contract to ensure compliance with the Contractor Immigration Warranty. Contractor agrees to assist the City in regard to any such inspections. The City may, at its sole discretion, conduct random verification of the employment records of the Contractor and any subcontractors to ensure compliance with Contractor's Immigration Warranty. Contractor agrees to assist the City in regard to any random verification performed. Neither Contractor nor any subcontractor shall be deemed to have materially breached the Contractor Immigration Warranty if Contractor or subcontractor if Contractor or subcontractor establishes that it has complied with the employment verification provisions prescribed by sections 274A and 274B of the Federal Immigration and Nationality Act and the E-verify requirements prescribed by A.R.S. § 23-214(A).

50. NO BOYCOTT OF ISRAEL: Pursuant to A.R.S. §§ 35-393 and 35-393.01, the parties certify that they are not currently engaged in and agree, for the duration of the agreement, not to engage in a boycott of Israel.

DEFAULT AND TERMINATION

51. TERMINATION FOR DEFAULT: Prior to terminating this Contract for a material breach, the non-defaulting party shall give the defaulting party written notice and reasonable opportunity to cure the default, not to exceed thirty (30) days unless a longer period of time is granted by the non-defaulting party in writing. In the event the breach is not timely cured, or in the event of a series of repeated breaches the non-defaulting party may elect to terminate Contract by written notice to Contractor, which shall be effective upon receipt. In the event of default, the parties may execute all remedies available at law in addition Contract remedies provided for herein.

52. CITY REMEDIES: In the event of Contractor's default, City may obtain required materials and/or services from a substitute contractor, and Contractor shall be liable to the City to pay for the costs of such substitute service. City may deduct or offset the cost of substitute service from any balance due to Contractor, and/or seek recovery of the costs of substitute service against any performance security, and/or collect any liquidated damages provided for in the Contract. Remedies herein are not exclusive.

53. CONTRACTOR REMEDIES: In the event of City's default, Contractor may pursue all remedies available at law, except as provided for herein.

54. SPECIAL DAMAGES: In the event of default, neither party shall be liable for incidental, special, or consequential damages.

55. TERMINATION FOR NONAPPROPRIATION OF FUNDS: The City may terminate all or a portion of this Contract due to budget constraints and non-appropriation of funds for the following fiscal year, without penalty or liability to Contractor.

56. TERMINATION FOR CONVENIENCE: Unless expressly provided for otherwise in the Contract, this Contract may be terminated in whole or part by the City for convenience upon thirty (30) days written notice, without further penalty or liability to Contractor. If this Contract is terminated, City shall be liable only for payment for satisfactory materials and/or services received and accepted by City before the effective date of termination.

57. TERMINATION DUE TO INSOLVENCY: If Contractor becomes a debtor in a bankruptcy proceeding, or a reorganization, dissolution or liquidation proceeding, or if a trustee or receiver is appointed over all or a substantial portion of the property of Contractor under federal bankruptcy law or any state insolvency law, Contractor shall immediately provide the City with a written notice thereof. The City may terminate this Contract, and Contractor is deemed in default, at any time if the Contractor becomes insolvent, or is a party to any voluntary bankruptcy or receivership proceeding, makes an assignment for a creditor, or there is any similar action that affects Contractor's ability to perform under the Contract.

58. PAYMENT UPON TERMINATION: Upon termination of this Contract, City will pay Contractor for satisfactory performance up until the effective date of termination. City shall make final payment within thirty (30) days from receipt of the Contractor's final invoice.

59. CANCELLATION FOR GRATUITIES: The City may cancel this Contract at any time, without penalty or further liability to Contractor, if City determines that Contractor has given or offered to give any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to a public servant ("Gratuities") in connection with award or performance of the Contract.

60. CANCELLATION FOR CONFLICT OF INTEREST (A.R.S. § 38-511): The City may cancel this Contract within three (3) years after its execution, without penalty or further liability to Contractor.

MISCELLANEOUS

61. ADVERTISING: Contractor shall not advertise or publish information concerning its Contract with City, without the prior written consent of the City.

62. NOTICES: All notices given pursuant to this Contract shall be delivered at the addresses as specified in the Contract, or updated by Notice to the other party. Notices may be: (a) personally delivered, with receipt effective upon personal delivery; (b) sent via certified mail, postage prepaid, with receipt deemed effective four (4) days after being sent; (c) or sent by overnight courier, with receipt deemed effective two (2) days after being sent Notice may be sent by email as a secondary form of notice.

63. THIRD PARTY BENEFICIARIES: This Contract is intended for the exclusive benefit of the parties. Nothing herein is intended to create any rights or responsibilities to third parties.

64. GOVERNING LAW: This Contract shall be construed in accordance with the laws of Arizona.

65. FORUM: In the event of litigation relating to this Contract, any action at law or in equity shall be filed in Coconino County, Arizona.

66. ATTORNEYS' FEES: If any action at law or in equity is necessary to enforce the terms of this Contract, the prevailing party shall be entitled to recover its reasonable attorney's fees, costs, professional fees and expenses.

67. FORCE MAJUERE: There may be events that occur during the term of this Contract that are beyond the control of both the City and the Contractor, including events of war, floods, labor, disputes, earthquakes, epidemics, pandemics, adverse weather conditions not reasonably anticipated, forest fires, and other acts of God. These events may result in a temporary delay of contractual deliverables, or the permanent inability to provide the contractual deliverables that are the subject of this Contract.

There will be no claims arising from a temporary delay of contractual deliverables, or the permanent inability to provide the contractual deliverables caused by the events described above, and the City will pay no additional costs incurred as a result of such events.

The parties agree to act in good faith to extend the Contract completion date without any penalty to the Contractor and that the extension will be in an amount of time equal to any temporary delay. This term supersedes all other terms regarding temporary delay, permanent shut down, or increased costs.

EXHIBIT C

INSURANCE

1. In General. Contractor shall maintain insurance against claims for injury to persons or damage to property, arising from performance of or in connection with this Contract by the Contractor, its agents, representatives, employees or contractors.

2. Requirement to Procure and Maintain. Each insurance policy required by this Contract shall be in effect at, or before, commencement of work under this Contract and shall remain in effect until all Contractor's obligations under this Contract have been met, including any warranty periods. The Contractor's failure to maintain the insurance policies as required by this Contract or to provide timely evidence of renewal will be considered a material breach of this Contract.

3. Minimum Scope and Limits of Insurance. The following insurance requirements are minimum requirements for this Contract and in no way limit the indemnity covenants contained in this Contract. The City does not represent that the minimum limits set forth in this Contract are sufficient to protect the Contractor from liabilities that might arise out of this Contract, and Contractor is free to purchase such additional insurance as Contractor may determine is necessary.

   Contractor shall provide coverage at least as broad and with limits not less than those stated below.

   a. Commercial General Liability - Occurrence Form

General Aggregate	$2,000,000
Products/Completed Operations	$1,000,000
Each Occurrence	$1,000,000

   b. Umbrella Coverage $2,000,000

   c. Automobile Liability – Any Automobile or Owned, Hired and Non-owned Vehicles Combined Single Limit Per Accident for Bodily Injury & Property Damage $1,000,000

   d. Workers' Compensation and Employer's Liability

Workers' Compensation	Statutory
Employer's Liability: Each Accident	$500,000
Disease - Each Employee	$500,000
Disease - Policy Limit	$500,000

   e. Professional Liability $2,000,000

4. Self-Insured Retention. Any self-insured retentions must be declared to and approved by the City. If not approved, the City may require that the insurer reduce or eliminate such self-insured retentions with respect to the City, its officers, agents, employees, and volunteers.

Contractor shall be solely responsible for any self-insured retention amounts. City at its option may require Contractor to secure payment of such self-insured retention by a surety bond or irrevocable and unconditional letter of credit.

5. Other Insurance Requirements. The policies shall contain, or be endorsed to contain, the following provisions:

   a. Additional Insured. In Commercial General Liability and Automobile Liability Coverages, the City of Flagstaff, its officers, officials, agents and employees shall be named and endorsed as additional insureds with respect to liability arising out of this Contract and activities performed by or on behalf of the Contractor, including products and completed operations of the Contractor, and automobiles owned, leased, hired or borrowed by the Contractor.

   b. Broad Form. The Contractor's insurance shall contain broad form contractual liability coverage.

   c. Primary Insurance. The Contractor's insurance coverage shall be primary insurance with respect to the City, its officers, officials, agents, employees and volunteers. Any insurance or self-insurance maintained by the City, its officers, officials, agents and employees, shall be in excess of the coverage of the Contractor's insurance and shall not contribute to it.

   d. Each Insured. The Contractor's insurance shall apply separately to each insured against whom a claim is made or suit is brought, except with respect to the limits of the insurer's liability.

   e. Not Limited. Coverage provided by the Contractor shall not be limited to the liability assumed under the indemnification provisions of this Contract.

   f. Waiver of Subrogation. The policies shall contain a waiver of subrogation against the City, its officers, officials, agents and employees for losses arising from work performed by Contractor for the City.

6. Notice of Cancellation. Each insurance policy required by the insurance provisions of this Contract shall provide the required coverage and shall not be suspended, voided, cancelled, reduced in coverage or in limits unless prior written notice has been given to the City. Notices required by this section shall be sent directly to the Buyer listed in the original Solicitation and shall reference the Contract Number:

   Attention: Matthew Luhman
   Contract No. 2021-02
   Purchasing Section
   City of Flagstaff,
   211 W. Aspen Avenue
   Flagstaff, Arizona 86001.

7. Acceptability of Insurers. Contractor shall place insurance hereunder with insurers duly licensed or approved unlicensed companies in the State of Arizona and with a "Best's" rating of not less than A-: VII. The City does not represent or warrant that the above required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.

8. Certificates of Insurance. The Contractor shall furnish the City with certificates of insurance (ACORD form) as required by this Contract. The certificates for each insurance policy shall be signed by a person authorized by that insurer to bind coverage on its behalf. Any policy endorsements that restrict or limit coverage shall be clearly noted on the certificate of insurance. The City project/contract number and project description shall be noted on the certificates of insurance. The City must receive and approve all certificates of insurance and endorsements before the Contractor commences work.

9. Policies. The City reserves the right to require, and receive within ten (10) days, complete, certified copies of all insurance policies and endorsements required by this Contract at any time. The City shall not be obligated, however, to review any insurance policies or to advise Contractor of any deficiencies in such policies and endorsements. The City's receipt of Contractor's policies or endorsements shall not relieve Contractor from, or be deemed a waiver of, the City's right to insist on strict fulfillment of Contractor's obligations under this Contract.

10. Modifications. Any modification or variation from the insurance requirements in this Contract must have the prior approval of the City's Attorney's Office in consultation with the City's Risk Manager, whose decision shall be final. Such action will not require a formal Contract amendment but may be made by their handwritten revision and notation to the foregoing insurance requirements.

EXHIBIT D

GRANT PROVISIONS

(Found on following pages)

GRANT PROVISIONS

Sponsor: City of Flagstaff

Funding Agency: U.S. Department of Transportation, Federal Aviation Administration

AND

Arizona Department of Transportation, Multimodal Planning Division Aeronautics Group

ARIZONA DEPARTMENT OF TRANSPORTATION (ADOT), MULTIMODAL PLANNING DIVISION, AERONAUTICS GROUP - GRANT PROVISIONS

The Contractor and its Subcontractor shall comply with the following grant provisions;

Applicable Laws
Compliance with all applicable Federal, State, and Local laws and regulations, ordinances, policies, and advisory circulars.

Contractor
a) It is the responsibilities of the contractor to gain authorization for changes on the Project which may have an affect on the contract price, scope, or schedule.
b) All contractors and sub-contractors hired to perform services, shall be in compliance with A.R.S 32, Chapter 10.
c) Any materials, including reports, computer programs or files and other deliverables created under this Agreement are the sole property of the City of Flagstaff. These items shall be made available to the public. The Contractor is not entitled to a patent or copyright on these materials and may not transfer the patent or copyright to anyone else.
d) Any travel shall be reimbursable by the State only within the rules and cost in accordance with the State of Arizona Travel Policy.

Awards to debarred and suspended parties
The City will not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Orders 12549 and 12689, ``Debarment and Suspension.''

Equal Employment Opportunity
Compliance with Executive Order 11246 of September 24, 1965, entitled “Equal Employment Opportunity,” as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR chapter 60). (All construction contracts awarded in excess of $10,000 by grantees and their contractors or subgrantees).

Compliance with the provisions of Arizona Executive Order 75-5 as amended by Arizona Executive Order 2009-9, relating to equal opportunity.

Contracting with small and minority firms, women's business enterprise and labor surplus area firms.
(1) The Contractor will take all necessary affirmative steps to assure that minority firms,women's business enterprises, and labor surplus area firms are used when possible.
(2) Affirmative steps shall include:
(i) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
(ii) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
(iii) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority business, and women's business enterprises;
(iv) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority business, and women's business enterprises;
(v) Using the services and assistance of the Small Business Administration, and the Minority Business Development Agency of the Department of Commerce.

Conflicts of Interest

The City (grantee) and Contractor (subgrantees) will maintain a written code of standards of conduct governing the performance of their employees engaged in the award and administration of contracts. No employee, officer or agent of the grantee or subgrantee shall participate in selection, or in the award or administration of a contract supported by Federal funds if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when:

(i) The employee, officer or agent,

(ii) Any member of his immediate family,

(iii) His or her partner, or

(iv) An organization which employs, or is about to employ, any of the above, has a financial or other interest in the firm selected for award. The grantee's or subgrantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential contractors, or parties to subagreements. Grantee and subgrantees may set minimum rules where the financial interest is not substantial or the gift is an unsolicited item of nominal intrinsic value. To the extent permitted by State or local law or regulations, such standards or conduct will provide for penalties, sanctions, or other disciplinary actions for violations of such standards by the grantee's and subgrantee's officers, employees, or agents, or by contractors or their agents. The awarding agency may in regulation provide additional prohibitions relative to real, apparent, or potential conflicts of interest.

Copyrights

Reports, maps or other documents produced in whole or in part are works for hire and shall not be the subject of any application for copyright by or on behalf of the Contractor or its Subcontractor. The Contractor shall advise the City or its designee at the time of delivery of any copyrighted or copyrightable work furnished under this Agreement, or any adversely held copyrighted or copyrightable material incorporated in any such work and of any invasion of the right of privacy therein contained.

Responsible Contractors

The City will make awards only to responsible contractors possessing the ability to perform successfully under the terms and conditions of the proposed procurement. Consideration will be given to such matters as contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

Access and Retention of Records

Access by the grantee, the subgrantee, the Federal grantor agency, the State grantor agency, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

Retention of all required records for five years, in accordance with A.R.S. 35-214, after grantees or subgrantees make final payments and all other pending matters are closed.

APPENDIX A – CONTRACT PROVISIONS

A1 ACCESS TO RECORDS AND REPORTS

A1.1 SOURCE

2 CFR § 200.333

2 CFR § 200.336

FAA Order 5100.38

A1.2 APPLICABILITY

2 CFR § 200.333 requires a sponsor to retain records pertinent to a Federal award for a period of three years from submission of final closure documents. 2 CFR § 200.336 establishes that sponsors must provide Federal entities the right to access records pertinent to the Federal award. FAA policy extends these requirements to the sponsor's contracts and subcontracts of AIP funded projects.

Contract Types – The sponsor must include this provision in all contracts and subcontracts of AIP funded projects.

Use of Provision – No mandatory language provided. The following language is acceptable to the FAA with meeting the intent of this requirement. If the sponsor prefers to use different language, the sponsor's language must fully satisfy the requirements of §§ 200.333 and 200.336.

A1.3 CONTRACT CLAUSE

ACCESS TO RECORDS AND REPORTS

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Owner, the Federal Aviation Administration and the Comptroller General of the United States or any of their duly authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

A2 AFFIRMATIVE ACTION REQUIREMENT

A2.1 SOURCE

41 CFR part 60-4

Executive Order 11246

A2.2 APPLICABILITY

Minority Participation. Sponsors are required to set goals for minority participation in AIP funded projects exceeding $10,000. The goals for minority participation derive from Economic Area (EA) and Standard Metropolitan Statistical Area (SMSA) as established in Volume 45 of the Federal Register dated 10/3/80. Page 65984 contains a table of all EAs and SMSAs and the associated minority participation goals.

To find the goals for minority participation, a sponsor must either refer to the Federal Register Notice or to the Department of Labor online document, "Participation Goals for Minorities and Females". EAs and SMSAs span state boundaries. A sponsor may have to refer to entries for adjacent states in order to locate the goal for the project location.

Female Participation. Executive Order 11246 has set a goal of 6.9% nationally for female participation for all construction projects. This value remains constant for all counties and states.

Contract Types –

Construction – The sponsor must incorporate this notice in all solicitations for bids or requests for proposals for AIP funded construction work contracts and subcontracts that exceed $10,000. Construction work means construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection and other onsite functions incidental to the actual construction.

Equipment – The sponsor must incorporate this notice in any equipment project exceeding $10,000 that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at a manufacturer's plant (e.g. firefighting and snow removal vehicles).

Professional Services – The sponsor must incorporate this notice in any professional service agreement if the professional services agreement includes tasks that meet the definition of construction work [as defined by the U.S. Department of Labor (DOL)] and exceeds $10,000. Examples include installation of monitoring systems (e.g. noise, environmental, etc.).

Property/Land – The sponsor must incorporate this notice in any agreement associated with land acquisition if the agreement includes construction work (defined above) that exceeds $10,000. Examples include demolition of structures or installation of boundary fencing.

Use of Provision – MANDATORY TEXT. The sponsor must:

(a) Incorporate the text of this provision in its solicitations without modification.
(b) Incorporate the applicable minority participation goal and the covered area by geographic name.
(c) Not simply insert a reference to the 1980 Federal Register Notice.

A2.3 SOLICITATION CLAUSE

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION to ENSURE EQUAL EMPLOYMENT OPPORTUNITY

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for minority participation for each trade:	**[*sponsor must insert established goal*]** Overall Goal 8.05%
Goals for female participation in each trade:	6.9%

These goals are applicable to all of the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a) and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs (OFCCP) within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is **[*sponsor must insert* *state, county, and city*]**. Arizona, Coconino County, and City of Flagstaff.

A3 BREACH OF CONTRACT TERMS

A3.1 SOURCE

2 CFR § 200 Appendix II(A)

A3.2 APPLICABILITY

This provision requires sponsors to incorporate administrative, contractual or legal remedies if contractor violate or breach contract terms. The sponsor must also include appropriate sanctions and penalties.

Contract Types – This provision is required for all contracts that exceed the simplified acquisition threshold as stated in 2 CFR Part 200, Appendix II (A). This threshold is occasionally adjusted for inflation and is now equal to $150,000.

Use of Provision – No mandatory language provided. The following language is acceptable to the FAA as meeting the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of part 200. Select either "contractor" or "consultant" as applicable.

A3.3 CONTRACT CLAUSE

BREACH OF CONTRACT TERMS

Any violation or breach of terms of this contract on the part of the [*Contractor | Consultant*] or its subcontractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement.

Owner will provide [*Contractor | Consultant*] written notice that describes the nature of the breach and corrective actions the [*Contractor | Consultant*] must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the [*Contractor | Consultant*] must correct the breach. Owner may proceed with termination of the contract if the [*Contractor | Consultant*] fails to correct the breach by the deadline indicated in the Owner's notice.

The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

A4 BUY AMERICAN PREFERENCE

A4.1 SOURCE

Title 49 USC § 50101

A4.2 APPLICABILITY

The Buy American Preference requirement in 49 USC § 50101 requires that all steel and manufactured goods used on AIP projects be produced in the United States. The statute gives the FAA the ability to issue a waiver to a sponsor to use non-domestic material on an AIP funded project subject to meeting certain conditions. A sponsor may request that the FAA issue a waiver from the Buy American Preference requirements if the FAA finds that:

1) Applying the provision is not in the public interest;
2) The steel or manufactured goods are not available in sufficient quantity or quality in the United States;
3) The cost of components and subcomponents produced in the United States is more than 60 percent of the total components of a facility or equipment, and final assembly has taken place in the United States. Items that have an FAA standard specification item number (such as specific airport lighting equipment) are considered the equipment.
4) Applying this provision would increase the cost of the overall project by more than 25 percent.

Timing of Waiver Requests. Sponsors desiring a Type 1 or Type 2 waiver must submit their waiver requests *before* issuing a solicitation for bids or a request for proposal for a project.

The sponsor must submit Type 3 or Type 4 waiver requests *prior* to executing the contract. The FAA will generally not consider waiver requests after execution of the contract except where extraordinary and extenuating circumstances exist. The FAA cannot review waiver requests with incomplete information. Sponsors must assess the adequacy of the waiver request and associated information prior to forwarding a waiver request to the FAA for action.

Buy American Conformance List. The FAA Office of Airports maintains a listing of equipment that has received a nationwide waiver from the Buy American Preference requirements or that fully meet the Buy American requirements. The Nationwide Buy American Waiver List is available online at www.faa.gov/airports/aip/buy_american/. Products listed on the Buy American Conformance list do not require additional submittal of domestic content information under a project specific Buy American Preference waiver.

Facility Waiver Requests. For construction of a facility, the sponsor may submit the waiver request after bid opening, but prior to contract execution. Examples of facility construction include terminal buildings, terminal renovation, and snow removal equipment buildings.

Contract Types –

Construction and Equipment – The sponsor must meet the Buy American Preference requirements of 49 USC § 50101 for all AIP funded projects that require steel or manufactured

goods. The Buy America requirements flow down from the sponsor to first tier contractors, who are responsible for ensuring that lower tier contractors and subcontractors are also in compliance.

Note: The Buy American Preference does not apply to equipment a contractor uses as a tool of its trade and which does not remain as part of the project.

Professional Services – Professional service agreements (PSAs) do not normally result in a deliverable that meets the definition of a manufactured product. However, the emergence of various project delivery methods has created situations where task deliverables under a PSA may include a manufactured product. If a PSA includes providing a manufactured good as a deliverable under the contract, the sponsor must include the Buy American Preference provision in the agreement.

Property – Most land transactions do not involve acquiring a manufactured product. However, under certain circumstances, a property acquisition project could result in the installation of a manufactured product. For example, the installation of property fencing, gates, doors and locks, etc. represent manufactured products acquired under an AIP funded land project that must comply with Buy American Preferences.

Use of Provision – No mandatory language provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully comply with 49 USC § 50101.

There are two types of Buy American certifications. The sponsor must incorporate the appropriate "Certificate of Buy America Compliance" in the solicitation:

- Projects for a facility (buildings such as terminals, snow removal equipment (SRE) buildings, aircraft rescue and firefighting (ARFF) buildings, etc.) – Insert the Certificate of Compliance Based on Total Facility.
- Projects for non-facility development (non-building construction projects such as runway or roadway construction or equipment acquisition projects) – Insert the Certificate of Compliance Based on Equipment and Materials Used on the Project.

A4.3 SOLICITATION CLAUSE

A4.3.1 Buy American Preference Statement

BUY AMERICAN PREFERENCE

The Contractor agrees to comply with 49 USC § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP funded projects are produced in the United States, unless the Federal Aviation Administration has issued a waiver for the product; the product is listed as an Excepted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

A bidder or offeror must complete and submit the Buy America certification included herein with their bid or offer. The Owner will reject as nonresponsive any bid or offer that does not include a completed Certificate of Buy American Compliance.

A4.3.2 Certificate of Buy American Compliance – Total Facility

CERTIFICATE OF BUY AMERICAN COMPLIANCE FOR TOTAL FACILITY

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with its proposal. The bidder or offeror must indicate how it intends to comply with 49 USC § 50101 by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e. not both) by inserting a checkmark (✓) or the letter "X".

☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:

a) Only installing steel and manufactured products produced in the United States; or
b) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

- To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
- To faithfully comply with providing U.S. domestic products.
- To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

a) To the submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
b) That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination that may result in rejection of the proposal.
c) To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
d) To furnish U.S. domestic product for any waiver request that the FAA rejects.
e) To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver – The cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components and subcomponents of the "facility". The required documentation for a Type 3 waiver is:

a) Listing of all manufactured products that are not comprised of 100 percent U.S. domestic content (excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.
c) Percentage of non-domestic component and subcomponent cost as compared to total "facility" component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

Type 4 Waiver – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

a) Detailed cost information for total project using U.S. domestic product
b) Detailed cost information for total project using non-domestic product

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature
Company Name	Title

A4.3.3 Certificate of Buy American Compliance – Manufactured Product

Certificate of Buy American Compliance for Manufactured Products

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter "X".

☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:

a) Only installing steel and manufactured products produced in the United States;
b) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
2. To faithfully comply with providing U.S. domestic product.
3. To furnish U.S. domestic product for any waiver request that the FAA rejects
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

1. To the submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver – The cost of the item components and subcomponents produced in the United States is more that 60 percent of the cost of all components and subcomponents of the "item". The required documentation for a Type 3 waiver is:

a) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).
b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
c) Percentage of non-domestic component and subcomponent cost as compared to total "item" component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

a) Detailed cost information for total project using U.S. domestic product
b) Detailed cost information for total project using non-domestic product

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature
Company Name	Title

A5 CIVIL RIGHTS - GENERAL

A5.1 SOURCE

49 USC § 47123

A5.2 APPLICABILITY

There are two separate civil rights provisions that apply to projects:

1. FAA General Civil Rights Provision and,
2. Title VI provisions, which are addressed in Appendix A6.

Contract Types – The General Civil Rights Provisions found in 49 USC § 47123, derived from the Airport and Airway Improvement Act of 1982, Section 520, apply to all sponsor contracts *regardless* of funding source.

Use of Provision – **MANDATORY TEXT**. There are two separate general civil rights provisions —one that is used for contracts, and one that is used for lease agreements or transfer agreements. The sponsor must incorporate the text of the appropriate provision without modification into the contract, or the lease or transfer agreement.

A5.3 CONTRACT CLAUSE (Use the Correct Clause for the Situation)

A5.3.1 Clause that is used for Contracts

GENERAL CIVIL RIGHTS PROVISIONS

The Contractor agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the Contractor and subcontractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

A5.3.2 Clause that is used for Lease Agreements or Transfer Agreements

GENERAL CIVIL RIGHTS PROVISIONS

The (tenant/concessionaire/lessee) agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance. If the (tenant/concessionaire/lessee) transfers its obligation to another, the transferee is obligated in the same manner as the (tenant/concessionaire/lessor).

This provision obligates the (tenant/concessionaire/lessee) for the period during which the property is owned, used or possessed by the (tenant/concessionaire/lessee) and the airport remains obligated to the

Federal Aviation Administration. This provision is in addition to that required by Title VI of the Civil Rights Act of 1964.

A6 CIVIL RIGHTS – TITLE VI ASSURANCE

A6.1 SOURCE

49 USC § 47123

FAA Order 1400.11

A6.2 APPLICABILITY

Title VI of the Civil Rights Act of 1964, as amended, (Title VI) prohibits discrimination on the grounds of race, color, or national origin under any program or activity receiving Federal financial assistance. Sponsors must include appropriate clauses from the Standard DOT Title VI Assurances in all contracts and solicitations.

The text of each individual clause comes from the U.S. Department of Transportation Order DOT 1050.2, Standard Title VI Assurances and Nondiscrimination Provisions, effective April 24, 2013. These assurances require that the Recipient (the sponsor) insert the appropriate clauses in the form provided by the DOT. Where the clause refers to the applicable activity, project, or program, it means the AIP project.

The clauses are as follows:

A6.2.1 Applicability of Title VI Solicitation Notice

Contract Clause	**The Sponsor must include the contract clause in:**	**Clause Text is Included in Paragraph**
Title VI Solicitation Notice – • Assurance 2 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30d of the Airport Sponsor Assurances	1) All AIP funded solicitations for bids, requests for proposals, or any work subject to Title VI regulations; and 2) All sponsor proposals for negotiated agreements **regardless of funding source.**	A6.3.1
Title VI Clauses for Compliance with Nondiscrimination Requirements • Assurance 3 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30e.1 of the Airport Sponsor Assurances	Every contract or agreement (unless the sponsor has determined, and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities) It has been determined that service contracts with utility companies that are not already subject to nondiscrimination requirements must include this clause.	A6.4.1

Contract Clause	The Sponsor must include the contract clause in:	Clause Text is Included in Paragraph
Title VI Required Clause for Property Interests Transferred from the United States • Assurance 4 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30e.3 of the Airport Sponsor Assurances	As a covenant running with the land, in any deed from the United States effecting or recording a transfer of real property, structures, use, or improvements thereon or interest therein to a sponsor. This is a rare occurrence and it will be the responsibility of the United States government to include the clause in the contract.	A6.4.2
Title VI Required Clause for Transfer of Real Property Acquired or Improved Under the Activity, Facility or Program – • Assurance 5 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30e.4a of the Airport Sponsor Assurances	As a covenant running with the land, in any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for all transfers of real property acquired or improved under Airport Improvement Program This applies to agreements such as leases where a physical portion of the airport is transferred for use, for example a fuel farm, apron space, or a parking facility.	A6.4.3
Clause for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program • Assurance 6 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30e.4b of the Airport Sponsor Assurances	In any future (deeds, leases, licenses, permits, or similar instruments) entered into by the sponsor with other parties for the construction or use of, or access to, space on, over, or under real property acquired or improved under Airport Improvement Program This applies to agreements such as leases of concession space in a terminal.	A6.4.4
Title VI List of Pertinent Nondiscrimination Acts and Authorities • Assurance 3 of the DOT Standard Title VI Assurances and Nondiscrimination Clauses • Assurance 30e.2 of the Airport Sponsor Assurances	Insert this list in every contract or agreement, unless the sponsor has determined, and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities. **This list can be omitted if the FAA has determined that the contractor or company is already subject to nondiscrimination requirements.**	A6.4.5

A6.3 SOLICITATION CLAUSE

The sponsor must include this clause in:

1) All AIP funded solicitations for bids, requests for proposals, or any work subject to Title VI regulations; and
2) All sponsor proposals for negotiated agreements **regardless of funding source.**

A6.3.1 Title VI Solicitation Notice

Title VI Solicitation Notice:

The **(Name of Sponsor)**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 USC §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders or offerors that it will affirmatively ensure that any contract entered into pursuant to this advertisement, [select disadvantaged business enterprises or airport concession disadvantaged business enterprises] will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

A6.4 CONTRACT CLAUSES

A6.4.1 Title VI Clauses for Compliance with Nondiscrimination Requirements

The sponsor must include this contract clause in:

1) Every contract or agreement (unless the sponsor has determined, and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities); and

2) Service contracts with utility companies that are not already subject to nondiscrimination requirements.

Compliance with Nondiscrimination Requirements:

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "Contractor"), agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. **Nondiscrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.
3. **Solicitations for Subcontracts, including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor's obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin.
4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. **Sanctions for Noncompliance:** In the event of a Contractor's noncompliance with the non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or

b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

A6.4.2 Title VI Clauses for Deeds Transferring United States Property

This is a rare occurrence, and it will be the responsibility of the United States government to include the clause in the contract. It will be included as a covenant running with the land, in any deed from the United States effecting or recording a transfer of real property, structures, use, or improvements thereon or interest therein to a sponsor.

CLAUSES FOR DEEDS TRANSFERRING UNITED STATES PROPERTY

The following clauses will be included in deeds effecting or recording the transfer of real property, structures, or improvements thereon, or granting interest therein from the United States pursuant to the provisions of the Airport Improvement Program grant assurances.

NOW, THEREFORE, the Federal Aviation Administration as authorized by law and upon the condition that the (***Title of Sponsor***) will accept title to the lands and maintain the project constructed thereon in accordance with (***Name of Appropriate Legislative Authority***), for the **(Airport Improvement Program or other program for which land is transferred),** and the policies and procedures prescribed by the Federal Aviation Administration of the U.S. Department of Transportation in accordance and in compliance with all requirements imposed by Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation pertaining to and effectuating the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252; 42 USC § 2000d to 2000d-4), does hereby remise, release, quitclaim and convey unto the (***Title of Sponsor***) all the right, title and interest of the U.S. Department of Transportation/Federal Aviation Administration in and to said lands described in (***Exhibit A attached hereto or other exhibit describing the transferred property)*** and made a part hereof.

(HABENDUM CLAUSE)

TO HAVE AND TO HOLD said lands and interests therein unto (***Title of Sponsor***) and its successors forever, subject, however, to the covenants, conditions, restrictions and reservations herein contained as follows, which will remain in effect for the period during which the real property or structures are used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits and will be binding on the (***Title of Sponsor***), its successors and assigns.

The (***Title of Sponsor***), in consideration of the conveyance of said lands and interests in lands, does hereby covenant and agree as a covenant running with the land for itself, its successors and assigns, that (1) no person will on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination with regard to any facility located wholly or in part on, over, or under such lands hereby conveyed [,] [and]* (2) that the (***Title of Sponsor***) will use the lands and interests in lands and interests in lands so conveyed, in compliance with all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Effectuation of Title VI of the Civil Rights Act of 1964, and as said Regulations and Acts may be amended[, and (3) that in the event of breach of any of the above-mentioned nondiscrimination conditions, the Department will have a right to enter or re-enter said lands and facilities on said land, and that above described land and facilities will thereon revert to and vest in and become the absolute property of the Federal Aviation Administration and its assigns as such interest existed prior to this instruction].*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary in order to make clear the purpose of Title VI.)

A6.4.3 Title VI Clauses for Transfer of Real Property Acquired or Improved Under the Activity, Facility, or Program

This applies to agreements such as leases where a physical portion of the airport is transferred for use—for example a fuel farm, apron space, or a parking facility—and will be included as a covenant running with the land, in any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for all transfers of real property acquired or improved under the Airport Improvement Program.

CLAUSES FOR TRANSFER OF REAL PROPERTY ACQUIRED OR IMPROVED UNDER THE AIRPORT IMPROVEMENT PROGRAM

The following clauses will be included in (deeds, licenses, leases, permits, or similar instruments) entered into by the (***Title of Sponsor***) pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, lessee, permittee, etc. as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree [in the case of deeds and leases add "as a covenant running with the land"] that:
    1. In the event facilities are constructed, maintained, or otherwise operated on the property described in this (deed, license, lease, permit, etc.) for a purpose for which a Federal Aviation Administration activity, facility, or program is extended or for another purpose involving the provision of similar services or benefits, the (grantee, licensee, lessee, permittee, etc.) will maintain and operate such facilities and services in compliance with all requirements imposed by the Nondiscrimination Acts and Regulations listed in the Pertinent List of Nondiscrimination Authorities (as may be amended) such that no person on the grounds of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.
B. With respect to licenses, leases, permits, etc., in the event of breach of any of the above Nondiscrimination covenants, (***Title of Sponsor***) will have the right to terminate the (lease,

license, permit, etc.) and to enter, re-enter, and repossess said lands and facilities thereon, and hold the same as if the (lease, license, permit, etc.) had never been made or issued.*

C. With respect to a deed, in the event of breach of any of the above Nondiscrimination covenants, the (***Title of Sponsor***) will have the right to enter or re-enter the lands and facilities thereon, and the above described lands and facilities will there upon revert to and vest in and become the absolute property of the (***Title of Sponsor***) and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

A6.4.4 Title VI Clauses for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program

This applies to agreements such as leases of concession space in a terminal and any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for the construction or use of, or access to, space on, over, or under real property acquired or improved under the Airport Improvement Program.

CLAUSES FOR CONSTRUCTION/USE/ACCESS TO REAL PROPERTY ACQUIRED UNDER THE ACTIVITY, FACILITY OR PROGRAM

The following clauses will be included in deeds, licenses, permits, or similar instruments/agreements entered into by (***Title of Sponsor***) pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, licensee, permittee, etc., as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree (in the case of deeds and leases add, "as a covenant running with the land") that (1) no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities, (2) that in the construction of any improvements on, over, or under such land, and the furnishing of services thereon, no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, (3) that the (grantee, licensee, lessee, permittee, etc.) will use the premises in compliance with all other requirements imposed by or pursuant to the List of discrimination Acts And Authorities.

B. With respect to (licenses, leases, permits, etc.), in the event of breach of any of the above nondiscrimination covenants, (***Title of Sponsor***) will have the right to terminate the (license, permit, etc., as appropriate) and to enter or re-enter and repossess said land and the facilities thereon, and hold the same as if said (license, permit, etc., as appropriate) had never been made or issued.*

C. With respect to deeds, in the event of breach of any of the above nondiscrimination covenants, (***Title of Sponsor***) will there upon revert to and vest in and become the absolute property of (***Title of Sponsor***) and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

A6.4.5 Title VI List of Pertinent Nondiscrimination Acts and Authorities

Insert this list in every contract or agreement, unless the sponsor has determined and the FAA concurs, that the contract or agreement is not subject to the Nondiscrimination Acts and Authorities. This list can be omitted if the FAA has determined that the contractor or company is already subject to nondiscrimination requirements.

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "Contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 USC § 2000d *et seq*., 78 stat. 252) (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination in Federally-assisted programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 USC § 4601) (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973 (29 USC § 794 *et seq*.), as amended (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended (42 USC § 6101 *et seq*.) (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982 (49 USC § 471, Section 47123), as amended (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987 (PL 100-209) (broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, the Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 USC §§ 12131 – 12189) as implemented by U.S. Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration's Nondiscrimination statute (49 USC § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);

- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 USC 1681 et seq).

A7 CLEAN AIR AND WATER POLLUTION CONTROL

A7.1 SOURCE

2 CFR § 200, Appendix II(G)

A7.2 APPLICABILITY

Contract Types – This provision is required for all contracts and lower tier contracts that exceed $150,000.

Use of Provision – No mandatory language provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of Appendix II to 2 CFR §200.

A7.3 CONTRACT CLAUSE

CLEAN AIR AND WATER POLLUTION CONTROL

Contractor agrees to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act (42 USC § 740-7671q) and the Federal Water Pollution Control Act as amended (33 USC § 1251-1387). The Contractor agrees to report any violation to the Owner immediately upon discovery. The Owner assumes responsibility for notifying the Environmental Protection Agency (EPA) and the Federal Aviation Administration.

Contractor must include this requirement in all subcontracts that exceeds $150,000.

A8 CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

A8.1 SOURCE

2 CFR § 200, Appendix II(E)

A8.2 APPLICABILITY

Contract Workhours and Safety Standards Act Requirements (CWHSSA) requires contractors and subcontractors on covered contracts to pay laborers and mechanics employed in the performance of the contracts one and one-half times their basic rate of pay for all hours worked over 40 in a workweek. CWHSSA prohibits unsanitary, hazardous, or dangerous working conditions on federally assisted projects. The Wage and Hour Division (WHD) within the U.S. Department of Labor (DOL) enforces the compensation requirements of this Act, while DOL's Occupational Safety and Health Administration (OSHA) enforces the safety and health requirements

Contract Types –

Construction – This provision applies to all contracts and lower tier contracts that exceed $100,000, and employ laborers, mechanics, watchmen, and guards.

Equipment – This provision applies to any equipment project exceeding $100,000 that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at the vendor plant (e.g. ARFF and SRE vehicles).

Professional Services – This provision applies to professional service agreements that exceed $100,000 and employs laborers, mechanics, watchmen, and guards. This includes members of survey crews and exploratory drilling operations.

Property – While most land transactions do not involve employment of laborers, mechanics, watchmen, and guards, under certain circumstances, a property acquisition project could require such employment. Examples include the installation of property fencing or testing for environmental contamination

Use of Provision – **MANDATORY TEXT.** Sponsors must incorporate this text without modification.

A8.3 CONTRACT CLAUSE

CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

1. Overtime Requirements.

No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a

rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

In the event of any violation of the clause set forth in paragraph (1) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this clause, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this clause.

3. Withholding for Unpaid Wages and Liquidated Damages.

The Federal Aviation Administration (FAA) or the Owner shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this clause.

4. Subcontractors.

The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (1) through (4) and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this clause.

A9 COPELAND "ANTI-KICKBACK" ACT

A9.1 SOURCE

2 CFR § 200, Appendix II(D)

29 CFR Parts 3 and 5

A9.2 APPLICABILITY and PURPOSE

The Copeland (Anti-Kickback) Act (18 USC 874 and 40 USC 3145) makes it unlawful to induce by force, intimidation, threat of dismissal from employment, or by any other manner, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment. The Copeland Act also requires each contractor and subcontractor to furnish weekly a statement of compliance with respect to the wages paid each employee during the preceding week.

Contract Types –

Construction – This provision applies to all construction contracts and subcontracts financed under the AIP that exceed $2,000.

Equipment – This provision applies to all equipment installation projects (e.g. electrical vault improvements) financed under the AIP that exceed $2,000. This provision does not apply to equipment acquisitions where the equipment is manufactured at the vendor's plant (e.g. SRE and ARFF vehicles).

Professional Services –The emergence of different project delivery methods has created situations where Professional Service Agreements (PSAs) include tasks that meet the definition of construction, alteration, or repair as defined in 29 CFR Part 5. If such tasks result in work that qualifies as construction, alteration, or repair and it exceeds $2,000, the PSA must incorporate the Copeland Anti-kickback provision.

Property –Ordinarily, land acquisition projects would not involve employment of laborers or mechanics and thus the Copeland Anti-Kickback provision would not apply. However, land projects that involve installation of boundary fencing and demolition of structures would involve laborers and mechanics. The sponsor must include this provision if the land acquisition project involves employment of laborers or mechanics for a contract exceeding $2,000.

Use of Provision – **MANDATORY TEXT.** 29 CFR Part 5 establishes specific language a sponsor must use in construction contracts. The sponsor may not make any modification to the standard language. Architectural/Engineering (A/E) firms that employ laborers and mechanics on a task that meets the definition of construction, alteration, or repair are acting as a contractor. The sponsor may not substitute the term "contractor" for "consultant" in such instances.

A9.3 CONTRACT CLAUSE

COPELAND "ANTI-KICKBACK" ACT

Contractor must comply with the requirements of the Copeland "Anti-Kickback" Act (18 USC 874 and 40 USC 3145), as supplemented by Department of Labor regulation 29 CFR part 3. Contractor and subcontractors are prohibited from inducing, by any means, any person employed on the project to give up any part of the compensation to which the employee is entitled. The Contractor and each Subcontractor must submit to the Owner, a weekly statement on the wages paid to each employee performing on covered work during the prior week. Owner must report any violations of the Act to the Federal Aviation Administration.

A10 DAVIS-BACON REQUIREMENTS

A10.1 SOURCE

2 CFR § 200, Appendix II(D)

29 CFR Part 5

A10.2 APPLICABILITY

The Davis-Bacon Act ensures that laborers and mechanics employed under the contract receive pay no less than the locally prevailing wages and fringe benefits as determined by the Department of Labor.

Contract Types –

Construction – Incorporate into all construction contracts and subcontracts that exceed $2,000 and include funding from the AIP.

Equipment – This provision applies to all equipment installation projects (e.g. electrical vault improvements) financed under the AIP that exceed $ 2, 000. This provision does not apply to equipment acquisitions where the equipment is manufactured at the vendor's plant (e.g. SRE and ARFF vehicles)

Professional Services – The emergence of different project delivery methods has created situations where Professional Service Agreements (PSAs) includes tasks that meet the definition of construction, alteration, or repair as defined in 29 CFR Part 5. If such tasks result in work that qualifies as construction, alteration, or repair and it exceeds $2,000, the PSA must incorporate this clause.

Property – Ordinarily, land acquisition projects would not involve employment of laborers or mechanics and thus the provision would not apply. However, land projects that involve installation of boundary fencing and demolition of structures would involve laborers and mechanics. The sponsor must include this provision if the land acquisition project involves employment of laborers or mechanics for a contract exceeding $2,000.

Fencing Projects – Fencing projects that exceed $2,000 must include this provision.

Use of Provision – **MANDATORY TEXT.** 29 CFR part 5 establishes specific language a sponsor must use. The sponsor may not make any modification to the standard language. A/E firms that employ laborers and mechanics on a task that meets the definition of construction, alteration, or repair are acting as a contractor. The sponsor may not substitute the term "Contractor" for "Consultant" in such instances.

A10.3 CONTRACT CLAUSE

DAVIS-BACON REQUIREMENTS

1. Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any

account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided* that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the Contractor, the laborers, or mechanics to be employed in the classification, or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits where appropriate), the contracting officer shall

refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program: *Provided* that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding.

The Federal Aviation Administration or the sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the Contractor, Sponsor, Applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker; his or her correct classification; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act); daily and weekly number of hours worked; deductions made; and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records that show that the commitment to provide such benefits is

enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and that show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant, Sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.* the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at *www.dol.gov/whd/forms/wh347instr.htm* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the Contractor will submit them to the applicant, sponsor, or Owner, as the case may be, for transmission to the Federal Aviation Administration, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, Sponsor, or Owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) The payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i), and that such information is correct and complete;

(2) Each laborer and mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;

(3) Each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the sponsor, the Federal Aviation Administration, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the Contractor, Sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau,

withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination that provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees, and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The Contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 USC 1001.

A11 DEBARMENT AND SUSPENSION

A11.1 SOURCE

2 CFR part 180 (Subpart C)

2 CFR part 1200

DOT Order 4200.5

A11.2 APPLICABILITY

The sponsor must verify that the firm or individual that it is entering into a contract with is not presently suspended, excluded, or debarred by any Federal department or agency from participating in federally assisted projects. The sponsor accomplishes this by:

1) Checking the System for Award Management (SAM.gov) to verify that the firm or individual is not listed in SAM.gov as being suspended, debarred, or excluded;
2) Collecting a certification from the firm or individual that it is not suspended, debarred, or excluded; and
3) Incorporating a clause in the contract that requires lower tier contracts to verify that no suspended, debarred, or excluded firm or individual is included in the project.

Contract Types – This requirement applies to *covered transactions*, which are defined in 2 CFR part 180. AIP funded contracts are non-procurement transactions, as defined by §180.970. Covered transactions include any AIP-funded contract, regardless of tier, that is awarded by a contractor, subcontractor, supplier, consultant, or its agent or representative in any transaction, if the amount of the contract is expected to equal or exceed $25,000. This includes contracts associated with land acquisition projects.

Use of Provision – No mandatory language provided. The following language is acceptable to the FAA in meeting the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 2 CFR part 180. For professional service agreements, sponsor may substitute bidder/offeror with consultant.

A11.3 SOLICITATION CLAUSE

A11.3.1 Bidder or Offeror Certification

CERTIFICATION OF OFFERER/BIDDER REGARDING DEBARMENT

By submitting a bid/proposal under this solicitation, the bidder or offeror certifies that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

A11.3.2 Lower Tier Contract Certification

CERTIFICATION OF LOWER TIER CONTRACTORS REGARDING DEBARMENT

The successful bidder, by administering each lower tier subcontract that exceeds $25,000 as a "covered transaction", must verify each lower tier participant of a "covered transaction" under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: http://www.sam.gov.
2. Collecting a certification statement similar to the Certification of Offerer /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

A12 DISADVANTAGED BUSINESS ENTERPRISE

A12.1 SOURCE

49 CFR part 26

A12.2 APPLICABILITY

A sponsor that anticipates awarding $250,000 or more in AIP funded prime contracts in a federal fiscal year must have an approved Disadvantaged Business Enterprise (DBE) program on file with the FAA Office of Civil Rights (§ 26.21). The approved DBE program will identify a 3-year overall program goal that the sponsor bases on the availability of ready, willing, and able DBEs relative to all businesses ready, willing, and able to participate on the project (§ 26.45).

Contract Types – Sponsors with a DBE program on file with the FAA must include the three following provisions, if applicable:

1) Clause in all solicitations for proposals for which a contract goal has been established,
2) Clause in each prime contract, and
3) Clause in solicitations that are obtaining DBE participation through race/gender neutral means.

Use of Provision –

1. *Solicitations with a DBE Project Goal* – No mandatory language provided. 49 CFR §26.53 requires a sponsor's solicitation to address what a contractor must submit on proposed DBE participation. The language of A12.3.1 is acceptable to the FAA in meeting the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully satisfy these requirements. The sponsor may require the contractor's submittal on proposed DBE participation either at bid opening as a matter of responsiveness or within five days of bid opening as a matter of responsibility.

2. *Solicitations Relying on Race-gender Neutral Means* – No mandatory language provided. The language of A12.3.2 is acceptable to the FAA in meeting the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully satisfy requirements for a sponsor that is not applying a project specific contract goal but is covered by a DBE program on file with the FAA.

3. *Contracts Covered by DBE Program* – **MANDATORY TEXT PROVIDED**. Sponsors must incorporate this language if they have a DBE program on file with the FAA. This includes projects where DBE participation is obtained through race-gender neutral means (i.e. no project goal). Sections §26.13 and §26.29 establish mandatory language for contractor assurance and prompt payment. The sponsor must not modify the language.

4. Sponsors that are not required to have a DBE program on file with the FAA are not required to include DBE provisions and clauses.

A12.3 REQUIRED PROVISIONS

A12.3.1 Solicitation Language (Solicitations that include a Project Goal)

Information Submitted as a matter of bidder responsiveness:

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR §26.53.

As a condition of bid responsiveness, the Bidder or Offeror must submit the following information with its proposal on the forms provided herein:

1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
2) A description of the work that each DBE firm will perform;
3) The dollar amount of the participation of each DBE firm listed under (1)
4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal; and
5) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

Information submitted as a matter of bidder responsibility:

The Owner's award of this contract is conditioned upon Bidder or Offeror satisfying the good faith effort requirements of 49 CFR §26.53.

The successful Bidder or Offeror must provide written confirmation of participation from each of the DBE firms the Bidder or Offeror lists in its commitment within five days after bid opening.

1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
2) A description of the work that each DBE firm will perform;
3) The dollar amount of the participation of each DBE firm listed under (1)
4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal; and
5) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

A12.3.2 Solicitation Language (Race/Gender Neutral Means)

The requirements of 49 CFR part 26 apply to this contract. It is the policy of the [Insert Name of Owner] to practice nondiscrimination based on race, color, sex, or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

A12.3.3 Prime Contracts (Projects Covered by a DBE Program)

DISADVANTAGED BUSINESS ENTERPRISES

Contract Assurance (§ 26.13) –

The Contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of Department of Transportation-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Owner deems appropriate, which may include, but is not limited to:

1) Withholding monthly progress payments;
2) Assessing sanctions;
3) Liquidated damages; and/or
4) Disqualifying the Contractor from future bidding as non-responsible.

Prompt Payment (§26.29) – The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than [specify number] days from the receipt of each payment the prime contractor receives from [Name of recipient]. The prime contractor agrees further to return retainage payments to each subcontractor within [specify the same number as above] days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the [Name of Recipient]. This clause applies to both DBE and non-DBE subcontractors.

A13 DISTRACTED DRIVING

A13.1 SOURCE

Executive Order 13513

DOT Order 3902.10

A13.2 APPLICABILITY

The FAA encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

Contract Types – Sponsors must insert this provision in all AIP funded contracts that exceed the micro-purchase threshold of 2 CFR §200.67 (currently set at $3,500).

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA in meeting the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully satisfy these requirements.

A13.3 CONTRACT CLAUSE

TEXTING WHEN DRIVING

In accordance with Executive Order 13513, "Federal Leadership on Reducing Text Messaging While Driving", (10/1/2009) and DOT Order 3902.10, "Text Messaging While Driving", (12/30/2009), the Federal Aviation Administration encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or subgrant.

In support of this initiative, the Owner encourages the Contractor to promote policies and initiatives for its employees and other work personnel that decrease crashes by distracted drivers, including policies that ban text messaging while driving motor vehicles while performing work activities associated with the project. The Contractor must include the substance of this clause in all sub-tier contracts exceeding $3,500 that involve driving a motor vehicle in performance of work activities associated with the project.

A14 ENERGY CONSERVATION REQUIREMENTS

A14.1 SOURCE

2 CFR § 200, Appendix II(H)

A14.2 APPLICABILITY

The Energy Conservation Requirements of 2 CFR § 200 Appendix II(H) requires this provision on energy efficiency.

Contract Types – The sponsor must include this provision in all AIP funded contracts and lower-tier contracts.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's revised language must fully satisfy these requirements. Sponsor may substitute "Contractor and subcontractor" with "Consultant and sub-consultant" for professional service agreements.

A14.3 CONTRACT CLAUSE

ENERGY CONSERVATION REQUIREMENTS

Contractor and Subcontractor agree to comply with mandatory standards and policies relating to energy efficiency as contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 USC 6201*et seq*).

A15 DRUG FREE WORKPLACE REQUIREMENTS

A15.1 SOURCE

49 CFR part 32

Drug-Free Workplace Act of 1988 (41 U.S.C. 701 *et seq.,* as amended)

A15.2 APPLICABILITY

The Drug-Free Workplace Act of 1988 requires some Federal contractors and *all* Federal grantees to agree that they will provide drug-free workplaces as a condition of receiving a contract or grant from a Federal agency. The Act does ***not*** apply to contractors, subcontractors, or subgrantees, although the Federal grantees workplace may be where the contractors, subcontractors, or subgrantees are working.

Contract Types – This provision applies to all AIP funded projects, but not to the contracts between the grantee (the sponsor) and a contractor, subcontractors, suppliers, or subgrantees.

Use of Provision – No mandatory or recommended text provided because the requirements do not extend beyond the sponsor level.

A15.3 CONTRACT CLAUSE

None.

A16 EQUAL EMPLOYEMENT OPPORTUNITY (EEO)

A16.1 SOURCE

2 CFR 200, Appendix II(C)

41 CFR § 60-1.4

41 CFR § 60-4.3

Executive Order 11246

A16.2 APPLICABILITY

The purpose of this provision is to provide equal opportunity for all persons, without regard to race, color, religion, sex, or national origin who are employed or seeking employment with contractors performing under a federally assisted construction contract. There are two provisions — a construction clause and a specification clause.

The equal opportunity contract clause must be included in any contract or subcontract when the amount exceeds $10,000. Once the equal opportunity clause is determined to be applicable, the contract or subcontract must include the clause for the remainder of the year, regardless of the amount or the contract.

Contract Types –

Construction – The sponsor must incorporate contract and specification language in all construction contracts and subcontracts as required above.

Equipment – The sponsor must incorporate contract and specification language into all equipment contracts as required above that involves installation of equipment onsite (e.g. electrical vault equipment). This provision does not apply to equipment acquisition projects where the manufacture of the equipment takes place offsite at the vendor plant (e.g. ARFF and SRE vehicles).

Professional Services – The sponsor must include contract and specification language into all professional service agreements as required above.

Property – The sponsor must include contract and specification language into all land acquisition projects that include work that qualifies as construction work as defined by 41 CFR part 60 as required above. An example is installation of boundary fencing.

Use of Provision – **MANDATORY TEXT.** 41 CFR § 60-1.4 provides the mandatory ***contract*** language. 41 CFR § 60-4.3 provides the mandatory ***specification*** language. The sponsor must incorporate these clauses without modification.

A16.3 MANDATORY CONTRACT CLAUSE

A16.3.1 EEO Contract Clause

EQUAL OPPORTUNITY CLAUSE

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identify, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff, or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as the

administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance*: Provided, however*, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

A16.3.2 EEO Specification

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;

   c. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;

   d. "Minority" includes:

      (1) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (2) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);

      (3) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      (4) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR part 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors shall be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other

contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical area where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees shall be employed by the Contractor during the training period and the Contractor shall have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor

by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or female sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items, with onsite supervisory personnel such superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students; and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations, such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisor's adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (7a through 7p). The efforts of a contractor association, joint contractor union, contractor community, or other similar groups of which the Contractor is a member and participant may be asserted as fulfilling any one or more of its obligations under 7a through 7p of these specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, if the particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally), the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized.

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing

subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR part 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone number, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g. those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

A17 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

A17.1 SOURCE

29 USC § 201, et seq

A17.2 APPLICABILITY

The U.S. Department of Labor (DOL) Wage and Hour Division administers the Fair Labor Standards Act (FLSA). This act prescribes federal standards for basic minimum wage, overtime pay, record keeping, and child labor standards.

Contract Types – Per the Department of Labor, all employees of certain enterprises having workers engaged in interstate commerce; producing goods for interstate commerce; or handling, selling, or otherwise working on goods or materials that have been moved in or produced for such commerce by any person are covered by the FLSA.

All consultants, sub-consultants, contractors, and subcontractors employed under this federally assisted project must comply with the FLSA.

> *Professional Services* – 29 CFR § 213 exempts employees in a bona fide executive, administrative or professional capacity. Because professional firms employ individuals that are not covered by this exemption, the sponsor's agreement with a professional services firm must include the FLSA provision.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 29 USC § 201.The sponsor must select *contractor* or *consultant*, as appropriate for the contract.

A17.3 SOLICITATION CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part-time workers.

The [*Contractor* | *Consultant*] has full responsibility to monitor compliance to the referenced statute or regulation. The [*Contractor* | *Consultant*] must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

A18 LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

A18.1 SOURCE

31 USC § 1352 – Byrd Anti-Lobbying Amendment

2 CFR part 200, Appendix II(J)

49 CFR part 20, Appendix A

A18.2 APPLICABILITY

Consultants and contractors that apply or bid for an award of $100,000 or more must certify that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or another award covered by 31 USC 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award.

Contract Types – The sponsor must incorporate this provision into all contracts exceeding $100,000.

Use of Provision – **MANDATORY TEXT.** Appendix A to 49 CFR Part 20 prescribes language the sponsor must use. The sponsor must incorporate this provision without modification.

A18.3 CONTRACT CLAUSE

CERTIFICATION REGARDING LOBBYING

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under

grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

A19 PROHIBITION of SEGREGATED FACILITIES

A19.1 SOURCE

41 CFR § 60

A19.2 APPLICABILITY

The contractor must comply with the requirements of the EEO clause by ensuring that facilities they provide for employees are free of segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin. This clause must be included in all contracts that include the equal opportunity clause, regardless of the amount of the contract.

Contract Types – AIP sponsors must incorporate the Prohibition of Segregated Facilities clause in any contract containing the Equal Employment Opportunity clause of 41 CFR §60.1. This obligation flows down to subcontract and sub-tier purchase orders containing the Equal Employment Opportunity clause.

Construction – Construction work means construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

Equipment – On site installation of equipment such as airfield lighting control equipment meets the definition of construction and thus this provision would apply. This provision does not apply to equipment projects involving manufacture of the item at a vendor's manufacturing plant. An example would be the manufacture of a SRE or ARFF vehicle.

Professional Services – Professional services that include tasks that qualify as construction work as defined by 41 CFR part 60. Examples include the installation of noise monitoring equipment.

Property/Land – Land acquisition contracts that include tasks that qualify as construction work as defined by 41 CFR part 60. Examples include demolition of structures or installation of boundary fencing.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 41 CFR § 60.

A19.3 CONTRACT CLAUSE

PROHIBITION OF SEGREGATED FACILITIES

(a) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Employment Opportunity clause in this contract.

(b) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Employment Opportunity clause of this contract.

A20 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

A20.1 SOURCE

29 CFR part 1910

A20.2 APPLICABILITY

Contract Types – All contracts and subcontracts must comply with the Occupational Safety and Health Act of 1970 (OSH). The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) oversees the workplace health and safety standards wage provisions from OSH.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 20 CFR part 1910.

A20.3 CONTRACT CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. The employer must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The employer retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). The employer must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

A21 PROCUREMENT OF RECOVERED MATERIALS

A21.1 SOURCE

2 CFR § 200.322

40 CFR part 247

Solid Waste Disposal Act

A21.2 APPLICABILITY

Sponsors of AIP funded development and equipment projects must comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. Section 6002 emphasizes maximizing energy and resource recovery through use of affirmative procurement actions for recovered materials identified in the Environmental Protection Agency (EPA) guidelines codified at 40 CFR part 247. When acquiring items designated in the guidelines, the sponsor must procure items that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition.

Contract Types – This provision applies to any contracts that include procurement of products designated in subpart B of 40 CFR part 247 where the purchase price of the item exceeds $10,000 or the value of the quantity acquired by the preceding fiscal year exceeded $10,000.

Construction and Equipment – Include this provision in all construction and equipment projects.

Professional Services and Property – Include this provision if the agreement includes procurement of a product that exceeds $10,000.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 2 CFR § 200.

A21.3 CONTRACT CLAUSE

PROCUREMENT OF RECOVERED MATERIALS

Contractor and subcontractor agree to comply with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, and the regulatory provisions of 40 CFR Part 247. In the performance of this contract and to the extent practicable, the Contractor and subcontractors are to use products containing the highest percentage of recovered materials for items designated by the Environmental Protection Agency (EPA) under 40 CFR Part 247 whenever:

1) The contract requires procurement of $10,000 or more of a designated item during the fiscal year; or
2) The contractor has procured $10,000 or more of a designated item using Federal funding during the previous fiscal year.

The list of EPA-designated items is available at www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products.

Section 6002(c) establishes exceptions to the preference for recovery of EPA-designated products if the contractor can demonstrate the item is:

a) Not reasonably available within a timeframe providing for compliance with the contract performance schedule;
b) Fails to meet reasonable contract performance requirements; or
c) Is only available at an unreasonable price.

A22 RIGHT TO INVENTIONS

A22.1 SOURCE

2 CFR § 200, Appendix II(F)

37 CFR §401

A22.2 APPLICABILITY

Contract Types – This provision applies to all contracts and subcontracts with small business firms or nonprofit organizations that include performance of *experimental, developmental, or research work*. This clause is not applicable to construction, equipment, or professional service contracts unless the contract includes *experimental, developmental, or research work*.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of Appendix II to 2 CFR part 200.

A22.3 CONTRACT CLAUSE

RIGHTS TO INVENTIONS

Contracts or agreements that include the performance of experimental, developmental, or research work must provide for the rights of the Federal Government and the Owner in any resulting invention as established by 37 CFR part 401, Rights to Inventions Made by Non-profit Organizations and Small Business Firms under Government Grants, Contracts, and Cooperative Agreements. This contract incorporates by reference the patent and inventions rights as specified within 37 CFR §401.14. Contractor must include this requirement in all sub-tier contracts involving experimental, developmental, or research work.

A23 SEISMIC SAFETY

A23.1 SOURCE

49 CFR part 41

A23.2 APPLICABILITY

Contract Types – This provision applies to construction of new buildings and additions to existing buildings financed in whole or in part through the Airport Improvement Program.

Professional Services– Sponsor must incorporate this clause in any contract involved in the construction of new buildings or structural addition to existing buildings.

Construction – Sponsor must incorporate this clause in any contract involved in the construction of new buildings or structural addition to existing buildings.

Equipment – Sponsor must include the construction provision if the project involves construction or structural addition to a building such as an electrical vault project to accommodate or install equipment.

Land – This provision will not typically apply to a property/land project.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 49 CFR part 41.

A23.3 CONTRACT CLAUSE

A23.3.1 Professional Service Agreements for Design

SEISMIC SAFETY

In the performance of design services, the Consultant agrees to furnish a building design and associated construction specification that conform to a building code standard that provides a level of seismic safety substantially equivalent to standards as established by the National Earthquake Hazards Reduction Program (NEHRP). Local building codes that model their building code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety. At the conclusion of the design services, the Consultant agrees to furnish the Owner a "certification of compliance" that attests conformance of the building design and the construction specifications with the seismic standards of NEHRP or an equivalent building code.

A23.3.2 Construction Contracts

SEISMIC SAFETY

The Contractor agrees to ensure that all work performed under this contract, including work performed by subcontractors, conforms to a building code standard that provides a level of seismic safety substantially equivalent to standards established by the National Earthquake Hazards Reduction

Program (NEHRP). Local building codes that model their code after the current version of the International Building Code (IBC) meet the NEHRP equivalency level for seismic safety.

A24 TAX DELINQUENCY AND FELONY CONVICTIONS

A24.1 SOURCE

Sections 415 and 416 of Title IV, Division L of the Consolidated Appropriations Act, 2014 (Pub. L. 113-76), and similar provisions in subsequent appropriations acts.

DOT Order 4200.6 - Requirements for Procurement and Non-Procurement Regarding Tax Delinquency and Felony Convictions

A24.2 APPLICABILITY

The sponsor must ensure that no funding goes to any contractor who:

- Has been convicted of a Federal felony within the last 24 months; or
- Has any outstanding tax liability for which all judicial and administrative remedies have lapsed or been exhausted.

Contract Types – This provision applies to all contracts funded in whole or part with AIP.

Use of Provision – The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of DOT Order 4200.6.

A24.3 CONTRACT CLAUSE

CERTIFICATION OF OFFERER/BIDDER REGARDING TAX DELINQUENCY AND FELONY CONVICTIONS

The applicant must complete the following two certification statements. The applicant must indicate its current status as it relates to tax delinquency and felony conviction by inserting a checkmark (✓) in the space following the applicable response. The applicant agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification in all lower tier subcontracts.

Certifications

1) The applicant represents that it is ( ) is not ( ) a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

2) The applicant represents that it is ( ) is not ( ) is not a corporation that was convicted of a criminal violation under any Federal law within the preceding 24 months.

Note

If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the sponsor has received notification from the agency suspension and debarment official (SDO) that the SDO has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore must provide information to the owner about its tax liability or conviction to the Owner, who will then notify

the FAA Airports District Office, which will then notify the agency's SDO to facilitate completion of the required considerations before award decisions are made.

Term Definitions

> **Felony conviction:** Felony conviction means a conviction within the preceding twentyfour (24) months of a felony criminal violation under any Federal law and includes conviction of an offense defined in a section of the U.S. code that specifically classifies the offense as a felony and conviction of an offense that is classified as a felony under 18 U.S.C. § 3559.
>
> **Tax Delinquency**: A tax delinquency is any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

A25 TERMINATION OF CONTRACT

A25.1 SOURCE

2 CFR § 200 Appendix II(B)

FAA Advisory Circular 150/5370-10, Section 80-09

A25.2 APPLICABILITY

Contract Types – All contracts and subcontracts in excess of $10,000 must address *termination for cause* and *termination for convenience* by the sponsor. The provision must address the manner (i.e. notice, opportunity to cure, and effective date) by which the sponsor's contract will be affected and the basis for settlement (i.e. incurred expenses, completed work, profit, etc.).

Use of Provision –

Termination for Default – **MANDATORY TEXT.** Section 80-09 of FAA Advisory Circular 150/5370-10 establishes standard language for Termination for Default under a construction contract. The sponsor must not make any changes to this standard language.

Termination for Convenience – No mandatory text provided. The sponsor must include a clause for termination for convenience. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of Appendix II to 2 CFR part 200.

Equipment, Professional Services, and Property – No mandatory text provided. The sponsor may use their established clause language provided that it adequately addresses the intent of Appendix II(B) to Part 200, which addresses termination for fault and for convenience.

A25.3 CONTRACT CLAUSE

A25.3.1 Termination for Convenience

TERMINATION FOR CONVENIENCE (CONSTRUCTION & EQUIPMENT CONTRACTS)

The Owner may terminate this contract in whole or in part at any time by providing written notice to the Contractor. Such action may be without cause and without prejudice to any other right or remedy of Owner. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

1. Contractor must immediately discontinue work as specified in the written notice.
2. Terminate all subcontracts to the extent they relate to the work terminated under the notice.
3. Discontinue orders for materials and services except as directed by the written notice.
4. Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed work, supplies, equipment and materials acquired prior to termination of the work, and as directed in the written notice.

5. Complete performance of the work not terminated by the notice.
6. Take action as directed by the Owner to protect and preserve property and work related to this contract that Owner will take possession.

Owner agrees to pay Contractor for:

1) completed and acceptable work executed in accordance with the contract documents prior to the effective date of termination;

2) documented expenses sustained prior to the effective date of termination in performing work and furnishing labor, materials, or equipment as required by the contract documents in connection with uncompleted work;

3) reasonable and substantiated claims, costs, and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and

4) reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this contract.

TERMINATION FOR CONVENIENCE (PROFESSIONAL SERVICES)

The Owner may, by written notice to the Consultant, terminate this Agreement for its convenience and without cause or default on the part of Consultant. Upon receipt of the notice of termination, except as explicitly directed by the Owner, the Contractor must immediately discontinue all services affected.

Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

A25.3.2 Termination for Default

TERMINATION FOR DEFAULT (CONSTRUCTION)

Section 80-09 of FAA Advisory Circular 150/5370-10 establishes conditions, rights, and remedies associated with Owner termination of this contract due to default of the Contractor.

TERMINATION FOR DEFAULT (EQUIPMENT)

The Owner may, by written notice of default to the Contractor, terminate all or part of this Contract if the Contractor:

1. Fails to commence the Work under the Contract within the time specified in the Notice- to-Proceed;
2. Fails to make adequate progress as to endanger performance of this Contract in accordance with its terms;
3. Fails to make delivery of the equipment within the time specified in the Contract, including any Owner approved extensions;
4. Fails to comply with material provisions of the Contract;
5. Submits certifications made under the Contract and as part of their proposal that include false or fraudulent statements; or
6. Becomes insolvent or declares bankruptcy.

If one or more of the stated events occur, the Owner will give notice in writing to the Contractor and Surety of its intent to terminate the contract for cause. At the Owner's discretion, the notice may allow the Contractor and Surety an opportunity to cure the breach or default.

If within [10] days of the receipt of notice, the Contractor or Surety fails to remedy the breach or default to the satisfaction of the Owner, the Owner has authority to acquire equipment by other procurement action. The Contractor will be liable to the Owner for any excess costs the Owner incurs for acquiring such similar equipment.

Payment for completed equipment delivered to and accepted by the Owner shall be at the Contract price. The Owner may withhold from amounts otherwise due the Contractor for such completed equipment, such sum as the Owner determines to be necessary to protect the Owner against loss because of Contractor default.

Owner will not terminate the Contractor's right to proceed with the Work under this clause if the delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such acceptable causes include: acts of God, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, and severe weather events that substantially exceed normal conditions for the location.

If, after termination of the Contractor's right to proceed, the Owner determines that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the Owner issued the termination for the convenience the Owner.

The rights and remedies of the Owner in this clause are in addition to any other rights and remedies provided by law or under this contract.

TERMINATION FOR DEFAULT (PROFESSIONAL SERVICES)

Either party may terminate this Agreement for cause if the other party fails to fulfill its obligations that are essential to the completion of the work per the terms and conditions of the Agreement. The party initiating the termination action must allow the breaching party an opportunity to dispute or cure the breach.

The terminating party must provide the breaching party [7] days advance written notice of its intent to terminate the Agreement. The notice must specify the nature and extent of the breach, the conditions

necessary to cure the breach, and the effective date of the termination action. The rights and remedies in this clause are in addition to any other rights and remedies provided by law or under this agreement.

a) **Termination by Owner**: The Owner may terminate this Agreement in whole or in part, for the failure of the Consultant to:
   1. Perform the services within the time specified in this contract or by Owner approved extension;
   2. Make adequate progress so as to endanger satisfactory performance of the Project; or
   3. Fulfill the obligations of the Agreement that are essential to the completion of the Project.

   Upon receipt of the notice of termination, the Consultant must immediately discontinue all services affected unless the notice directs otherwise. Upon termination of the Agreement, the Consultant must deliver to the Owner all data, surveys, models, drawings, specifications, reports, maps, photographs, estimates, summaries, and other documents and materials prepared by the Engineer under this contract, whether complete or partially complete.

   Owner agrees to make just and equitable compensation to the Consultant for satisfactory work completed up through the date the Consultant receives the termination notice. Compensation will not include anticipated profit on non-performed services.

   Owner further agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

   If, after finalization of the termination action, the Owner determines the Consultant was not in default of the Agreement, the rights and obligations of the parties shall be the same as if the Owner issued the termination for the convenience of the Owner.

b) **Termination by Consultant**: The Consultant may terminate this Agreement in whole or in part, if the Owner:
   1. Defaults on its obligations under this Agreement;
   2. Fails to make payment to the Consultant in accordance with the terms of this Agreement;
   3. Suspends the Project for more than [180] days due to reasons beyond the control of the Consultant.

   Upon receipt of a notice of termination from the Consultant, Owner agrees to cooperate with Consultant for the purpose of terminating the agreement or portion thereof, by mutual consent. If Owner and Consultant cannot reach mutual agreement on the termination settlement, the Consultant may, without prejudice to any rights and remedies it may have, proceed with terminating all or parts of this Agreement based upon the Owner's breach of the contract.

   In the event of termination due to Owner breach, the Engineer is entitled to invoice Owner and to receive full payment for all services performed or furnished in accordance with this Agreement and all justified reimbursable expenses incurred by the Consultant through the effective date of termination action. Owner agrees to hold Consultant harmless for errors or omissions in documents that are incomplete as a result of the termination action under this clause.

A26 TRADE RESTRICTION CERTIFICATION

A26.1 SOURCE

49 USC § 50104

49 CFR part 30

A26.2 APPLICABILITY

Unless waived by the Secretary of Transportation, sponsors may not use AIP funds on a product or service from a foreign country included in the current list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR).

Contract Types – The trade restriction certification and clause applies to all AIP funded projects.

Use of Provision – MANDATORY TEXT. 49 CFR part 30 prescribes the language for this model clause. The sponsor must include this certification language in all contracts and subcontracts without modification.

A26.3 SOLICITATION CLAUSE

TRADE RESTRICTION CERTIFICATION

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);
2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and
3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 USC Section 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to an Offeror or subcontractor:

1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR or
2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list or
3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

A27 VETERAN'S PREFERENCE

A27.1 SOURCE

49 USC § 47112(c)

A27.2 APPLICABILITY

Contract Types – This provision applies to all AIP funded projects that involve labor to carry out the project. This preference, which excludes executive, administrative, and supervisory positions, applies to covered veterans (as defined under § 47112(c)) only when they are readily available and qualified to accomplish the work required by the project.

Use of Provision – No mandatory text provided. The following language is acceptable to the FAA and meets the intent of this requirement. If the sponsor uses different language, the sponsor's language must fully satisfy the requirements of 49 USC § 47112.

A27.3 CONTRACT CLAUSE

VETERAN'S PREFERENCE

In the employment of labor (excluding executive, administrative, and supervisory positions), the Contractor and all sub-tier contractors must give preference to covered veterans as defined within Title 49 United States Code Section 47112. Covered veterans include Vietnam-era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns (as defined by 15 USC 632) owned and controlled by disabled veterans. This preference only applies when there are covered veterans readily available and qualified to perform the work to which the employment relates.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FEDERAL CERTIFICATIONS

- A4 - Buy American Preference - Title 49 U.S.C., § 501101
- A11 - Suspension and Debarment Requirement For All Contracts Over $25,000 – 2 CFR part 180 (Subpart C), 2 CFR part 1200, DOT Order 4200.5
- A12 - Disadvantaged Business Enterprise Participation – 49 CFR part 26
- A18 – Lobbying and Influencing Federal Employees – 31 USC § 1352 Byrd Anti-Lobbying Amendment, 2 CFR part 200, Appendix II(J), 49 CFR part 20, Appendix A
- A26 - Trade Restriction Certification – 49 USC § 50104, 49 CFR part 30

A4 - CERTIFICATE OF BUY AMERNCIAN COMPLIANCE-MANUFACTURED PRODUCTS

PULLIAM AIRPORT
FLAGSTAFF, ARIZONA

AIRPORT DRAINAGE PLAN IMPROVEMENTS

As a matter of bid responsiveness, the bidder or offeror must complete, sign, date, and submit this certification statement with their proposal. The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter "X".

☐ Bidder or offeror hereby certifies that it will comply with 49 USC § 50101 by:

a) Only installing steel and manufactured products produced in the United States;
b) Installing manufactured products for which the Federal Aviation Administration (FAA) has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or offeror agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
2. To faithfully comply with providing U.S. domestic product.
3. To furnish U.S. domestic product for any waiver request that the FAA rejects
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or offeror hereby certifies it cannot comply with the 100 percent Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or offeror with the apparent low bid agrees:

1. To the submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that supports the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing U.S. domestic products at or above the approved U.S. domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver – The cost of the item components and subcomponents produced in the United States is more that 60 percent of the cost of all components and subcomponents of the "item". The required documentation for a Type 3 waiver is:

a) Listing of all product components and subcomponents that are not comprised of 100 percent U.S. domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers

Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety).

b) Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
c) Percentage of non-domestic component and subcomponent cost as compared to total "item" component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.

Type 4 Waiver – Total cost of project using U.S. domestic source product exceeds the total project cost using non-domestic product by 25 percent. The required documentation for a Type 4 of waiver is:

a) Detailed cost information for total project using U.S. domestic product
b) Detailed cost information for total project using non-domestic product

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

Date	Signature
Company Name	Title

NOTE: Failure to complete the blanks may be grounds for rejection of the bid.

A11 - CERTIFICATION OF LOWER TIER CONTRACTORS REGRADING DEBAREMENT

PULLIAM AIRPORT
FLAGSTAFF, ARIZONA

AIRPORT DRAINAGE PLAN IMPROVEMENTS

The successful bidder, by administering each lower tier subcontract that exceeds $25,000 as a “covered transaction”, must verify each lower tier participant of a “covered transaction” under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: http://www.sam.gov.
2. Collecting a certification statement similar to the Certification of Offerer /Bidder Regarding Debarment, above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract.

If the Federal Aviation Administration later determines that a lower tier participant failed to disclose to a higher tier participant that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedies, including suspension and debarment of the non-compliant participant.

_____	_____
Date	Signature
_____	_____
Company Name	Title

NOTE: Failure to complete the blanks may be grounds for rejection of the bid.

A12 - ASSURANCE OF DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION

PULLIAM AIRPORT
FLAGSTAFF, ARIZONA

AIRPORT DRAINAGE PLAN IMPROVEMENTS

To meet the mandated requirements of the United States Department of Transportation, 49 CFR Part 26, the assurance below shall be signed by the bidder and submitted with the bid.

BIDDER'S ASSURANCE OF COMPLIANCE WITH TITLE 49 CFR PART 26 RELATING TO DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION

The successful Bidder or Offeror must provide written confirmation of participation from each of the DBE firms the Bidder or Offeror lists in its commitment **within five days after bid opening**.

1) The names and addresses of Disadvantaged Business Enterprise (DBE) firms that will participate in the contract;
2) A description of the work that each DBE firm will perform;
3) The dollar amount of the participation of each DBE firm listed under (1)
4) Written statement from Bidder or Offeror that attests their commitment to use the DBE firm(s) listed under (1) to meet the Owner's project goal; and
5) If Bidder or Offeror cannot meet the advertised project DBE goal, evidence of good faith efforts undertaken by the Bidder or Offeror as described in appendix A to 49 CFR part 26.

The requirements of 49 CFR part 26 apply to this contract. It is the policy of the City of Flagstaff to practice nondiscrimination based on race, color, sex, or national origin in the award or performance of this contract. The Owner encourages participation by all firms qualifying under this solicitation regardless of business size or ownership.

The Contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of Department of Transportation-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Owner deems appropriate, which may include, but is not limited to:

1) Withholding monthly progress payments;
2) Assessing sanctions;
3) Liquidated damages; and/or
4) Disqualifying the Contractor from future bidding as non-responsible.

Prompt Payment (§26.29) – The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than seven (7) days from the receipt of each payment the prime contractor receives from City of Flagstaff. The prime contractor agrees further to return retainage payments to each subcontractor within seven (7) days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the City of Flagstaff. This clause applies to both DBE and non-DBE subcontractors.

The bidder hereby gives assurance pursuant to the requirements of Title 49 CFR Part 26 that bidder has made a reasonable effort to meet the goals for Disadvantaged Business Enterprise participation specified for the contract for which this proposal is submitted and that bidder, if the contract is awarded to bidder, will have a **DBE participation of _____ percent** of the amount of this bid. Bidder further gives assurance that bidder has submitted the documentation required by said Regulations and the contract specifications, including the Listing of Disadvantaged Business Enterprises with which the bidder will subcontract if the contract is awarded and if bidder is unable to meet the contract goals for DBE participation, and the steps bidder has taken to obtain DBE participation.

The Overall Current DBE Goal is 8.05% **Race Conscious 0% / Race Neutral 8.05%**

Date	Signature
Company Name	Title

NOTE: Bidder shall insert the percentage for DBE participation even if the percentage is less than the contract goal. A bid that fails to meet these requirements may be considered grounds for rejecting the bid.

A18 – LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

PULLIAM AIRPORT
FLAGSTAFF, ARIZONA

AIRPORT DRAINAGE PLAN IMPROVEMENTS

The Bidder or Offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Bidder or Offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Date	Signature
Company Name	Title

NOTE: Failure to complete the blanks may be grounds for rejection of the bid.

A26 - TRADE RESTRICTION CERTIFICATE TO BE INCLUDED IN ALL SOLICITATIONS, CONTRACTS, AND SUBCONTRACTS

PULLIAM AIRPORT
FLAGSTAFF, ARIZONA

D AIRPORT DRAINAGE PLAN IMPROVEMENTS

By submission of an offer, the Offeror certifies that with respect to this solicitation and any resultant contract, the Offeror –

1) is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms as published by the Office of the United States Trade Representative (USTR);
2) has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country included on the list of countries that discriminate against U.S. firms as published by the USTR; and
3) has not entered into any subcontract for any product to be used on the Federal project that is produced in a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18 USC Section 1001.

The Offeror/Contractor must provide immediate written notice to the Owner if the Offeror/Contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Contractor must require subcontractors provide immediate written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to an Offeror or subcontractor:

1) who is owned or controlled by one or more citizens or nationals of a foreign country included on the list of countries that discriminate against U.S. firms published by the USTR or
2) whose subcontractors are owned or controlled by one or more citizens or nationals of a foreign country on such USTR list or
3) who incorporates in the public works project any product of a foreign country on such USTR list.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

The Offeror agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in all lower tier subcontracts. The Contractor may rely on the certification of a prospective subcontractor that it is not a firm from a foreign country included on the list of countries that discriminate against U.S. firms as published by USTR, unless the Offeror has knowledge that the certification is erroneous.

This certification is a material representation of fact upon which reliance was placed when making an award. If it is later determined that the Contractor or subcontractor knowingly rendered an erroneous certification, the

Federal Aviation Administration (FAA) may direct through the Owner cancellation of the contract or subcontract for default at no cost to the Owner or the FAA.

Date	Signature
Company Name	Title

NOTE: Failure to complete the blanks may be grounds for rejection of the bid.

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Airport Drainage Design	**Date:** 8/15/2013	**AC No:** 150/5320-5D
	Initiated by: AAS-100	**Change:**

1. Purpose. This Advisory Circular (AC) provides guidance for engineers, airport managers, and the public about the design and construction of airport surface storm drainage systems; and subsurface drainage systems for paved runways, taxiways, and aprons.

2. Cancellation. This AC cancels AC 150/5320-5C, Surface Drainage Design, dated September 29, 2006.

3. Application. The guidelines and recommendations contained in this AC are recommended by the Federal Aviation Administration (FAA) for the design and construction of airport surface and subsurface drainage systems. This AC offers general guidance for these systems and is neither binding nor regulatory.

4. Department of Defense Unified Facilities Criteria. This AC was developed in collaboration with the Department of Defense (DOD) and incorporates the DOD Unified Facilities Criteria (UFC) draft document, Surface Drainage Design, dated August 1, 2006.

5. Purpose of this Revision. This AC includes additional guidance not included in the DOD document.

a. Wildlife Hazard Attractants and Mitigation: Throughout the planning, design, construction, and maintenance of airport surface storm drainage and subsurface drainage systems the engineer must emphasize and address the elimination and/or mitigation of drainage features in the project(s) that could attract hazardous wildlife on and/or around an airport. The engineer should refer to the following documents and sites for guidance on wildlife hazards at airports for all drainage projects:

(1) AC 150/5200-33, Hazardous Wildlife Attractants on or Near Airports, contains guidance on certain land uses that have the potential to attract hazardous wildlife on or near airports. The AC is available at: http://www.faa.gov/airports/resources/advisory_circulars/.

(2) Wildlife Hazard Management at Airports, A Manual for Airport Personnel, is available at: http://www.faa.gov/airports/airport_safety/wildlife/problem/media/2005_FAA_Manual_complete.pdf.

(3) Additional information on wildlife issues can be found on the FAA Guidance on Wildlife website at: http://www.faa.gov/airports/airport_safety/wildlife/guidance/.

b. Appendix F, FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards. FAA Order 5300.1F has been replaced with the following link directing readers to the website for the current FAA Order:

> Procedures for requests and processing of modifications to FAA standards are detailed in FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards. The current FAA Order is available at the following website: http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.list/parentTopicID/24.

c. The design and location of all drainage structures and/or features must comply with all airport design surface requirements per AC 150/5300-13, Airport Design. AC 150/5300-13 also provides general guidance on drainage considerations. Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports, restricts the height of a structure located in a safety area to 3 inches or less above grade.

d. For FAA projects, add the following to paragraph 9-1.1.3:

> Plastic pipe used under airfield pavements shall comply with Item D-701, Pipe for Storm Drains and Culverts in AC 150/5370-10, Standards for Specifying Construction of Airports.

e. Web addresses and contact information in Chapter 12 and Appendix A have been updated. The programs and software listed in Chapter 12 are only a few of many available for drainage analysis and are not the only programs or software which may be used for analysis. In addition, new or updated drainage analysis programs, web addresses, and software constantly become available. Before using any software, users should verify the software meets the appropriate design criteria. Use the most current version of all AC, UFC, and other standards cited in this AC.

f. Public Law (PL), United States Code (USC), and other citations have been added for consistency and clarification where required.

Michael J. O'Donnell
Director of Airport Safety and Standards

UNIFIED FACILITIES CRITERIA (UFC)

SURFACE DRAINAGE DESIGN

U.S. Department of Transportation
Federal Aviation Administration

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

UNIFIED FACILITIES CRITERIA (UFC)

SURFACE DRAINAGE DESIGN[1]

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U.S. ARMY CORPS OF ENGINEERS (Preparing Activity)

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	Date	Location

[1]This UFC supersedes TM 5-820-1/AFM 88-5, Chap 1, dated August 1987; TM 5-820-2/AFM 88-5, Chap 2, dated March 1979; TM 5-820-3/AFM 88-5, Chap 3, dated June 1991; TM 5-820-4/AFM 88-5, Chap 4, dated October 1983; TM 5-852-7/AFM 88-19, Chap 7, dated April 1981; NAVFAC DM 21.06, dated April 1986; EI 02C202, dated October 1995.

The format of this document does not conform to UFC 1-300-01.

FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by Military Standard (MIL-STD) 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the Department of Defense (DOD) Field Activities in accordance with USD(AT&L) Memorandum dated 29 May 2002. UFC will be used for all DOD projects and work for other customers where appropriate.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Headquarters Air Force Civil Engineer Support Agency (HQ AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DOD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet site listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following sources:

- Whole Building Design Guide web site DOD page: (http://dod.wbdg.org/)

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

AUTHORIZED BY:

.	.
Chief, Engineering and Construction U.S. Army Corps of Engineers	Chief Engineer Naval Facilities Engineering Command
The Deputy Civil Engineer DCS/Installations & Logistics Department of the Air Force	Director, Installations Requirements and Management Office of the Deputy Under Secretary of Defense (Installations and Environment)

UNIFIED FACILITIES CRITERIA (UFC)
NEW DOCUMENT SUMMARY SHEET

Document: UFC draft/AC 150/5320-5D

Description: UFC draft/AC 150/5320-5D provides comprehensive and practical guidance to the Tri-service community and Federal Aviation Administration (FAA) for the design of storm drainage systems associated with transportation facilities. Criteria are provided for the design of storm drainage systems which collect, convey, and discharge stormwater on and around pavements and other transportation facilities.

Reasons for Document:

- Previous criteria associated with this topic were outdated and did not take advantage of recent developments in the field of hydrologic engineering.
- Multiple documents covering various topics on the subject matter were in circulation and this document provides a consolidated and comprehensive guide for all users.
- Many new environmental practices have been developed and were not addressed in previous criteria.
- User feedback indicated that published criteria from multiple documents was often confusing and contradicting.

Impact: There are negligible cost impacts; however, these benefits should be realized:

- Providing one location for criteria associated with storm drainage will allow users to be more efficient and effective when applying the procedures and principles contained in this document.
- The updated criteria in this document are considered standard practice and will allow users to take advantage of concepts and methods which are widely understood and accepted throughout the industry today.

CONTENTS

Page

CHAPTER 1 INTRODUCTION 1

1-1 PURPOSE. 1
1-2 SCOPE. 1
1-3 REFERENCES. 1
1-4 UNITS OF MEASUREMENT. 1
1-5 APPLICABILITY. 1
1-5.1 Previous Standards. 1
1-5.2 Applicability Within DOD 1
1-5.3 Design Objectives 1
1-5.4 Waivers to Criteria. 2
1-6 GENERAL INVESTIGATIONS. 2
1-7 ENVIRONMENTAL CONSIDERATIONS. 2
1-7.1 National Environmental Policy. 2
1-7.2 Federal Guidelines. 3
1-7.3 Regulatory Considerations. 3
1-7.4 Federal Regulations. 3
1-7.5 State Regulations. 5
1-7.6 Local Laws. 7
1-7.7 U.S. Army Environmental Quality Program. 7
1-7.8 U.S. Air Force Environmental Quality Program. 8
1-7.9 U.S. Navy Environmental Quality Program. 8
1-7.10 FAA Environmental Handbook. 8
1-7.11 Environmental Impact Analysis. 8
1-7.12 Environmental Effects of Surface Drainage Systems. 8
1-7.13 Discharge Permits. 9
1-7.14 Effects of Drainage Facilities on Fish. 9

CHAPTER 2 SURFACE HYDROLOGY 10

2-1 PURPOSE AND SCOPE. 10
2-2 HYDROLOGIC CRITERIA. 10
2-2.1 Design Objectives. 10
2-2.2 Degree of Drainage Required. 10
2-2.3 Surface Runoff from Design Storm. 10
2-2.4 Design Storm Frequency 10
2-2.5 Surface Runoff from Storms Exceeding Design Storm. 11
2-2.6 Reliability of Operation. 11
2-2.7 Environmental Impact. 12
2-2.8 Maintenance. 12

2-2.9 Future Expansion. 12
2-3 HYDROLOGIC METHODS AND PROCEDURES. 12
2-3.1 Rainfall (Precipitation). 12
2-3.2 Determination of Peak Flow Rates. 15
2-3.3 USGS Regression Equations. 25
2-3.4 SCS TR-55 Peak Flow Method. 28
2-4 DEVELOPMENT OF DESIGN HYDROGRAPHS. 32
2-4.1 SCS Tabular Hydrograph. 33
2-4.2 SCS Synthetic Unit Hydrograph (UH). 37

CHAPTER 3 PAVEMENT SURFACE DRAINAGE 41

3-1 OVERVIEW. 41
3-2 DESIGN FREQUENCY AND SPREAD. 41
3-2.1 Selection of Design Frequency and Design Spread 41
3-2.2 Selection of Check Storm and Spread 42
3-3 SURFACE DRAINAGE 42
3-3.1 Longitudinal Slope. 42
3-3.2 Cross (Transverse) Slope 43
3-3.3 Curbs and Gutters. 44
3-3.4 Roadside and Median Channels 45
3-4 FLOW IN GUTTERS. 45
3-4.1 Capacity Relationship 46
3-4.2 Conventional Curb and Gutter Sections. 47
3-4.3 Shallow Swale Sections 54
3-4.4 Flow in Sag Vertical Curves. 61
3-4.5 Gutter Flow Time. 61
3-5 DRAINAGE INLET DESIGN. 63
3-5.1 Inlet Types. 63
3-5.2 Characteristics and Uses of Inlets 65
3-5.3 Inlet Capacity. 65
3-5.4 Interception Capacity of Inlets on Grade. 73
3-5.5 Interception Capacity of Inlets in Sag Locations. 87
3-5.6 Inlet Locations. 95
3-5.7 Median, Embankment, and Bridge Inlets. 104
3-6 GRATE TYPE SELECTION CONSIDERATIONS. 113

CHAPTER 4 CULVERT DESIGN 115

4-1 PURPOSE. 115
4-2 FISH PASSAGE CONSIDERATIONS. 117
4-2.1 General. 117
4-2.2 High Inverts. 117
4-2.3 High Velocities in Culverts. 117
4-2.4 Undersized or Failed Culverts. 117
4-2.5 Erosion Along Drainageways or at Outlets. 118

4-2.6 Channel Filling. 118
4-2.7 Culvert Installation. 118
4-2.8 Control of Icing. 118
4-3 DESIGN STORM 118
4-4 DESIGN 118
4-4.1 Hydraulic Design Data for Culverts 119
4-4.2 Headwalls and Endwalls 153
4-4.3 Erosion Control at Outlets. 163
4-4.4 Vehicular Safety and Hydraulically Efficient Drainage Practice 176
4-5 OUTLET PROTECTION DESIGN EXAMPLES. 177

CHAPTER 5 CHANNEL DESIGN 187

5-1 OPEN CHANNEL FLOW. 187
5-1.1 Flow Resistance. 187
5-1.2 Stable Channel Design. 193
5-2 DESIGN PARAMETERS. 198
5-2.1 Discharge Frequency. 198
5-2.2 Channel Geometry. 198
5-2.3 Channel Slope. 198
5-2.4 Freeboard. 198
5-2.5 Shear Stress. 200

CHAPTER 6 STORM DRAIN DESIGN 203

6-1 PURPOSE AND SCOPE. 203
6-2 DESIGN PROCEDURES FOR THE DRAINAGE SYSTEM. 203
6-2.1 Grading 203
6-2.2 Classification of Storm Drains. 203
6-2.3 Hydraulics of Storm Drainage Systems. 204
6-2.4 Design Guidelines and Considerations 213
6-3 PRELIMINARY DESIGN PROCEDURE 217
6-3.1 Step 1. 217
6-3.2 Step 2. 222
6-3.3 Step 3. 222
6-3.4 Step 4. 222
6-3.5 Step 5. 223
6-3.6 Step 6. 223
6-4 ENERGY GRADE LINE EVALUATION PROCEDURE. 223

CHAPTER 7 DRAINAGE STRUCTURES 232

7-1 GENERAL. 232
7-2 INLETS. 232
7-2.1 Configuration. 232
7-2.2 Area Inlets. 233

7-3 MANHOLES. 236
7-3.1 Configuration. 236
7-3.2 Chamber and Access Shaft. 237
7-3.3 Frames and Covers. 237
7-3.4 Channels and Benches. 241
7-3.5 Manhole Depth. 241
7-3.6 Location and Spacing. 242
7-3.7 Settlement of Manholes. 242
7-4 JUNCTION CHAMBERS. 243
7-5 MISCELLANEOUS STRUCTURES. 243
7-5.1 Chutes. 243
7-5.2 Security Fencing. 243
7-5.3 Fuel/Water Separators. 246
7-5.4 Outlet Energy Dissipators. 246
7-5.5 Drop Structures and Check Dams. 248
7-5.6 Transitions. 248
7-5.7 Flow Splitters. 248
7-5.8 Siphons. 249
7-5.9 Flap Gates. 250
7-6 DESIGN FEATURES. 251
7-6.1 Grates. 251
7-6.2 Ladders. 252
7-6.3 Steps. 255
7-7 SPECIAL DESIGN CONSIDERATIONS FOR AIRFIELDS. 255
7-7.1 Overview. 255
7-7.2 Recommended Design Parameters 255

CHAPTER 8 STORM WATER CONTROL FACILITIES 258

8-1 GENERAL. 258
8-1.1 Storage and Detention/Retention Benefits. 258
8-1.2 Design Objectives 259
8-2 ISSUES RELATED TO STORM WATER QUANTITY CONTROL FACILITIES. 259
8-2.1 Release Timing. 259
8-2.2 Safety 260
8-2.3 Maintenance. 261
8-3 STORAGE FACILITY TYPES. 261
8-3.1 Detention Facilities 262
8-3.2 Retention Facilities 263
8-3.3 Wet Pond Facilities 263
8-3.4 Infiltration Facilities 264

CHAPTER 9 PIPE SELECTON, BEDDING AND BACKFILL 265

9-1 GENERAL. 265

9-1.1 Pipe Selection 265
9-1.2 Selection of *n* Values. 265
9-1.3 Restricted Use of Bituminous-Coated Pipe. 265
9-1.4 Classes of Bedding and Installation. 266
9-1.5 Strength of Pipe. 267
9-1.6 Rigid Pipe. 267
9-1.7 Flexible Pipe. 283
9-1.8 Bedding of Pipe (Culverts and Storm Drains). 283
9-2 FROST CONDITION CONSIDERATIONS. 283
9-3 INFILTRATION OF FINE SOILS THROUGH DRAINAGE PIPE JOINTS. 285
9-4 MINIMUM AND MAXIMUM COVER FOR AIRFIELDS. 286
9-5 MINIMUM AND MAXIMUM COVER FOR ROADWAYS. 287

CHAPTER 10 GUIDELINES FOR DESIGN IN THE ARCTIC AND SUBARCTIC 289

10-1 GENERAL. 289
10-2 ICING. 289
10-2.1 Description. 289
10-2.2 Types. 289
10-2.3 Natural Factors Conducive to Icing Formation. 291
10-2.4 Effects of Human Activities on Icing. 291
10-2.5 Methods of Counteracting Icing. 292
10-3 GUIDELINES FOR DESIGN OF STORM DRAINS IN THE ARCTIC AND SUBARCTIC. 298
10-4 GRADING. 300
10-5 TEMPORARY STORAGE. 300
10-6 MATERIALS. 300
10-7 MAINTENANCE. 300
10-8 JOINTING. 300
10-9 END PROTECTION. 300
10-10 ANCHORAGE AND BUOYANCY. 301
10-11 DEBRIS AND ICING CONTROL. 301
10-12 TIDAL AND FLOOD EFFECTS. 301
10-13 INSTALLATION. 301

CHAPTER 11 WATER QUALITY CONSIDERATIONS 302

11-1 GENERAL. 302
11-2 GENERAL BMP SELECTION GUIDANCE 302
11-3 ESTIMATING POLLUTANT LOADS 305
11-4 EXTENDED DETENTION DRY PONDS. 305
11-5 WET PONDS. 305
11-6 INFILTRATION/EXFILTRATION TRENCHES. 305
11-7 INFILTRATION BASINS. 306
11-8 SAND FILTERS. 306

11-9 WATER QUALITY INLETS. 306
11-10 VEGETATIVE PRACTICES. 306
11-11 ULTRA-URBAN BMPs. 306
11-12 TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES. 307

CHAPTER 12 DESIGN COMPUTER PROGRAMS 308

12-1 STORM WATER MANAGEMENT PROGRAMS. 308
12-2 DRIP (Drainage Requirement in Pavements). 308
12-3 CANDE (Culvert Analysis and Design). 308
12-4 MODBERG. 308
12-5 PIPECAR. 308
12-6 ADDITIONAL SOFTWARE. 308
12-6.1 HYDRAIN. 310
12-6.2 HYDRA. 310
12-6.3 WSPRO. 311
12-6.4 HYDRO. 311
12-6.5 HY8. 312
12-6.6 HYCHL. 313
12-6.7 NSS. 313
12-6.8 HYEQT. 313
12-6.9 TR-55. 313
12-6.10 TR-20. 314
12-6.11 HMS. 315
12-6.12 HEC-RAS. 316
12-6.13 SWMM. 317
12-7 HYDRAULIC TOOLBOX (HY-TB). 318
12-7.1 HY12. 318
12-7.2 HY15. 318
12-7.3 BASIN. 318
12-7.4 SCOUR. 318
12-8 URBAN DRAINAGE DESIGN PROGRAMS. 318
12-8.1 Manning's Equation. 319
12-8.2 HEC-22. 319
12-8.3 Stormwater Management. 319
12-9 DR3M. 319
12-9.1 Rainfall-Excess Components. 319
12-9.2 Impervious Surfaces. 319
12-9.3 Routing. 320
12-9.4 Model Versatility. 320
12-9.5 Urban Basin Planning. 320
12-9.6 Usability. 320
12-10 EVALUATION OF WATER QUALITY 320
12-11 SOFTWARE AVAILABILITY. 321

GLOSSARY 323

APPENDIX A REFERENCES 327

APPENDIX B LIST OF CHARTS 334

APPENDIX C LIST OF SYMBOLS 385

APPENDIX D BIBLIOGRAPHY 390

APPENDIX E WAIVER PROCESSING PROCEDURES FOR DOD 398

APPENDIX F FAA ORDER 5300.1, MODIFICATIONS TO AGENCY AIRPORT DESIGN, CONSTRUCTION, AND EQUIPMENT STANDARDS. 401

APPENDIX G (FAA ONLY) DESIGN OF SUBSURFACE PAVEMENT DRAINAGE SYSTEMS. 404

INDEX 446

FIGURES

Figure Title

Figure 2-1. Example IDF Curve 13
Figure 2-2. SCS 24-hour Rainfall Distribution 14
Figure 2-3. Approximate Geographic Areas for SCS Rainfall Distributions 15
Figure 2-4. Dimensionless Curvilinear SCS Synthetic Unit Hydrograph and Equivalent Triangular Hydrograph 38
Figure 2-5. Example: The Triangular Unit Hydrograph 40
Figure 3-1. Typical Gutter Sections 45
Figure 3-2. Conveyance–Spread Curves for a Composite Gutter Section 50
Figure 3-3. Classes of Storm Drain Inlets 64
Figure 3-4. P-1-7/8 and P-1-7/8 x 4 Grates (Same as P-1-7/8 Grate Without 3/8-in. Transverse Rods) 68
Figure 3-5. P-1-1/8 Grate 69
Figure 3-6. Curved Vane Grate 70
Figure 3-7. 45-Degree 2-1/4 and 45-Degree 3-1/4 Tilt-bar Grates 71
Figure 3-8. 30-Degree 3-1/4 Tilt-bar Grates 72
Figure 3-9. Reticuline Grate 73
Figure 3-10. Depressed Curb-opening Inlet 81
Figure 3-11. Definition of Depth 88
Figure 3-12. Curb-opening Inlets 93
Figure 3-13. Inlet Spacing Computation Sheet 99
Figure 3-14. Example of Flanking Inlets 102

Figure 3-15. Median Drop Inlet 105
Figure 3-16. Embankment Inlet and Downdrain 113
Figure 4-1. Inlet Control 120
Figure 4-2. Headwater Depth for Concrete Pipe Culverts with Inlet Control 121
Figure 4-3. Headwater Depth for Oval Concrete Pipe Culverts Long Axis Vertical with Inlet Control 122
Figure 4-5. Headwater Depth for Corrugated Metal Pipe Culverts with Inlet Control .. 124
Figure 4-6. Headwater Depth for Structural Plate and Standard Corrugated Metal Pipe-Arch Culverts with Inlet Control 125
Figure 4-7. Headwater Depth for Box Culverts with Inlet Control 126
Figure 4-8. Headwater Depth for Corrugated Metal Pipe Culverts with Tapered Inlet Control 127
Figure 4-9. Headwater Depth for Circular Pipe Culverts with Beveled Ring Inlet Control128
Figure 4-10. Outlet Control 129
Figure 4-11. Head for Circular Pipe Culverts Flowing Full, *n* = 0.012 132
Figure 4-12. Head for Oval Circular Pipe Culverts Long Axis Horizontal or Vertical Flowing Full, *n* = 0.012 133
Figure 4-13. Head for Circular Pipe Culverts Flowing Full, *n* = 0.024 134
Figure 4-14. Head for Circular Pipe Culverts Flowing Full, *n* = 0.0328 to 0.0302 135
Figure 4-15. Head for Standard Corrugated Metal Pipe-Arch Culverts Flowing Full, *n* = 0.024 136
Figure 4-16. Head for Field-Bolted Structural Plate Pipe-Arch Culverts 18 inch Corner Radius Flowing Full, *n* = 0.0327 to 0.0306 137
Figure 4-17. Head for Concrete Box Culverts Flowing Full, *n* = 0.012 138
Figure 4-18. Tailwater Elevation at or Above the Top of the Culvert 139
Figure 4-19. Tailwater Below the Top of the Culvert 139
Figure 4-20. Circular Pipe Critical Depth 141
Figure 4-21. Oval Concrete Pipe Long Axis Horizontal Critical Depth 142
Figure 4-22. Oval Concrete Pipe Long Axis Vertical Critical Depth 143
Figure 4-23. Standard Corrugated Metal Pipe-Arch Critical Depth 144
Figure 4-24. Structural Plate Pipe-Arch Critical Depth 145
Figure 4-25. Critical Depth Rectangular Section 146
Figure 4-26: Culvert Design Form 148
Figure 4-27. Culvert Headwalls and Wingwalls 154
Figure 4-28. Types of Scour at Storm Drain and Culvert Outlets 156
Figure 4-29. Square Culvert Froude Number 157
Figure 4-30. Predicted Scour Depth vs. Observed Scour Depth 158
Figure 4-31. Predicted Scour Width vs. Observed Scour Width 159
Figure 4-32. Predicted Scour Length vs. Observed Scour Length 160
Figure 4-33. Predicted Scour Volume vs. Observed Scour Volume 161
Figure 4-34. Dimensionless Scour Hole Geometry for Minimum Tailwater 162
Figure 4-35. Dimensionless Scour Hole Geometry for Maximum Tailwater 162
Figure 4-36. Recommended Size of Protective Stone 163
Figure 4-37. Length of Stone Protection, Horizontal Blanket 164
Figure 4-38. Recommended Configuration of Riprap Blanket Subject to Minimum and

Maximum Tailwaters 165
Figure 4-39. Preformed Scour Hole 166
Figure 4-40. Culvert Outlet Erosion Protection, Lined Channel Expansion 167
Figure 4-41. Maximum Permissible Discharge for Lined Channel Expansions 167
Figure 4-42. Flared Outlet Transition 168
Figure 4-43. Stilling Well 170
Figure 4-44. U.S. Bureau of Reclamation Impact Basin 171
Figure 4-45. Saint Anthony Falls Stilling Basin 172
Figure 4-46. Design Chart for SAF Stilling Basin 173
Figure 4-47. Recommended Riprap Sizes 175
Figure 4-48. Scour Hole Riprap Sizes 176
Figure 5-1. Distribution of Shear Stress 194
Figure 5-2. Shear Stress Distribution in Channel Bends 196
Figure 5-3. Channel Geometries 199
Figure 6-1. Storm Drain Capacity Sensitivity 207
Figure 6-2. Hydraulic and Energy Grade Lines in Pipe Flow 211
Figure 6-3. Preliminary Storm Drain Computation Sheet 221
Figure 6-4. Energy and Hydraulic Grade Line Illustration 224
Figure 6-5. Energy Grade Line Computation Sheet - Table A 226
Figure 6-6. Energy Grade Line Computation Sheet - Table B 227
Figure 7-1. Inlet Structures 233
Figure 7-2. Typical Inlet Design for Storm Drainage Systems 234
Figure 7-3. Repair Area Inlets 235
Figure 7-4. Standard Storm Drain Manhole 238
Figure 7-5. Standard Precast Manholes 239
Figure 7-6. Junction Details for Large Pipes 239
Figure 7-7. Typical Manhole Configurations 240
Figure 7-8. "Tee" Manhole for Large Storm Drains 241
Figure 7-9. Efficient Channel and Bench Configurations 244
Figure 7-10. Details of a Typical Drainage Chute 245
Figure 7-11. Outlet Security Barrier 246
Figure 7-12. Transitions to Avoid Obstruction 249
Figure 7-13. Twin-Barrel Siphon 250
Figure 7-14. Examples of Typical Inlet Grates 253
Figure 7-15. Examples of Inlet Design 254
Figure 7-16. Type A – Bicycle Gear Configuration 256
Figure 7-17. Type B – Tricycle Gear Configuration 256
Figure 7-18. Type C – Tricycle Gear Configuration 257
Figure 8-1. Hydrograph Schematic 258
Figure 8-2. Example of a Cumulative Hydrograph with and without Detention 260
Figure 9-1. Three Main Classes of Conduits 267
Figure 9-2. Free-Body Conduit Diagrams 268
Figure 9-3. Trench Beddings for Circular Pipe 269
Figure 9-4. Beddings for Positive Projecting Conduits 270
Figure 9-5. Installation Conditions that Influence Loads on Underground Conduits 270

Figure 10-1. Typical Cross Section of a Frost Belt Installation 297
Figure 10-2. Earth Embankments with Impervious Barriers 298

TABLES

Table Title

Table 2-1. Runoff Coefficients for Rational Formula 17
Table 2-2. Manning's Roughness Coefficient (*n*) for Overland Sheet Flow 19
Table 2-3. Intercept Coefficients for Velocity vs. Slope Relationship of Equation 2-4 ... 21
Table 2-4. Values of Manning's Coefficient (*n*) for Channels and Pipes..... 21
Table 2-5. Nationwide Urban Equations Developed by the USGS 26
Table 2-6. Runoff Curve Numbers for Urban Areas (Average Watershed Condition, I_a = $0.2S_R$) 30
Table 2-7. Adjustment Factor (Fp) for Pond and Swamp Areas that are Spread Throughout the Watershed 31
Table 2-8. Tabular Hydrograph Unit Discharges for Type II Rainfall Distributions (English Units) 34
Table 2-9. Subarea and Composite Hydrographs 37
Table 3-1. Manning's *n* for Street and Pavement Gutters 47
Table 3-2. Spread at Average Velocity in a Reach of Triangular Gutter..... 62
Table 3-3. Average Debris Handling Efficiencies of Grates Tested..... 74
Table 3-4. Grate Efficiency and Capacity Summary..... 80
Table 3-5. Comparison of Inlet Interception Capacities..... 87
Table 3-6. Distance to Flanking Inlets in a Sag Vertical Curve Using Depth at Curb Criteria 104
Table 3-7. Grate Ranking with Respect to Bicycle and Pedestrian Safety 114
Table 4-1. Entrance Loss Coefficients, Outlet Control, Full or Partly Full Entrance Head Loss, $H_e = K_e \frac{V^2}{2g}$* 130
Table 5-1. Manning's *n* for Natural Stream Channels (Surface Width at Flood Stage Less than 100 ft) 188
Table 5-2. Manning's Roughness Coefficients for Lined Channels** 188
Table 5-3. Classification of Vegetal Covers as to Degree of Retardance* 189
Table 5-4. Manning's *n* Relationships for Vegetal Degree of Retardance 190
Table 5-5. Permissible Shear Stresses for Lining Materials** 200
Table 6-1. Manning's Coefficients for Storm Drain Conduits..... 206
Table 6-2. Increase in Capacity of Alternate Conduit Shapes Based on a Circular Pipe with the Same Height..... 208
Table 6-3. Frequencies for Coincidental Occurrence 213
Table 6-4. Minimum Pipe Slopes to Ensure 3.0 ft/s Velocity in Storm Drains Flowing Full217
Table 7-1. Manhole Spacing Criteria..... 242
Table 7-2. Transition Design Criteria..... 249
Table 9-1. Suggested Maximum Cover Requirements for Concrete Pipe, Reinforced

Concrete, H-20 Highway Loading* 271
Table 9-2. Suggested Maximum Cover Requirements for Corrugated Aluminum Alloy Pipe, Riveted, Helical, or Welded Fabrication 2.66-inch Spacing, 0.5-inch-Deep Corrugations, H-20 Highway Loading* 272
Table 9-3. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 2.66-inch Spacing, 0.5-inch-Deep Corrugations* 273
Table 9-4. Suggested Maximum Cover Requirements for Structural Plate Aluminum Alloy Pipe, 9-inch Spacing, 2.5-inch Corrugations* 274
Table 9-5. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 5-inch Span, 1-inch-Deep Corrugations* 275
Table 9-6. Suggested Maximum Cover Requirements for Structural Plate Steel Pipe, 6-inch Span, 2-inch-Deep Corrugations* 276
Table 9-7. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 3-inch Span, 1-inch Corrugations* 278
Table 9-8. Suggested Guidelines for Minimum Cover* 279
Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 1)280
Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 2)281
Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 3)282
Table 11-1. BMP Selection Criteria* 303
Table 11-2. Pollutant Removal Comparison for Various Urban BMP Designs* 304
Table 12-1. Software vs. Capabilities Matrix 309
Table 12-2. Software Program Contact Information 321

CHAPTER 1

INTRODUCTION

1-1 PURPOSE. This document establishes general concepts and procedures for the hydrologic design of surface structures for the U.S. Army, Navy, Air Force, Marine Corps, and Federal Aviation Administration (FAA).

1-2 SCOPE. This manual prescribes the hydrologic design criteria to be used for transportation facilities and other areas.

1-3 REFERENCES. Appendix A contains a list of references used in this UFC. Appendix D is a bibliography that lists publications that are considered relevant to this subject and that offer additional information on various topics.

1-4 UNITS OF MEASUREMENT. The unit of measurement system in this document is the inch-pound (IP). In some cases, International System of Units (SI) measurements may be the governing critical values because of applicable codes, accepted standards, industry practices, or other considerations.

1-5 APPLICABILITY. Criteria in this manual pertain to all Department of Defense (DOD) military facilities in the United States, it territories, trusts, and possessions, and unless otherwise noted, to DOD facilities overseas on which the United States has vested base rights. For DOD facilities overseas, if written agreement exists between host nation and DOD that requires application of either North Atlantic Treaty Organization (NATO), International Civil Aviation Organization (ICAO), or other standards, those standards shall apply as stipulated in the agreement.

1-5.1 Previous Standards. The criteria in this manual are not intended to apply to existing facilities constructed under previous standards; however, when existing facilities are modified or new facilities are constructed, they must conform to the criteria established in this manual unless waived.

1-5.2 Applicability Within DOD. This document covers a wide range of topics in the areas of surface drainage and serves as the standard for several agencies responsible for hydrologic design for transportation facilities and other areas. The intended use of the facility under design may differ between agencies and in some cases dictates the need for separate standards. In special cases in which more than one standard is presented, or the standard does not apply to all agencies, special care has been given to clearly identify the relevant audience. Any user of this manual should pay close attention to the relevance of each topic to the intended agency.

1-5.3 Design Objectives

1-5.3.1 The objective of storm drainage design is to provide for safe passage of vehicles or operation of the facility during the design storm event. The drainage system is designed to collect storm water runoff from the pavement surface and adjacent areas, convey it along and through the adjacent areas, and discharge it to an adequate receiving body without causing adverse on- or off-site impacts.

1-5.3.2 Storm water collection systems must be designed to provide adequate surface drainage. Traffic safety is intimately related to surface drainage. Rapid removal of storm water from the pavement minimizes the conditions which can result in the hazards of hydroplaning. Surface drainage is a function of transverse and longitudinal pavement slope, pavement roughness, inlet spacing, and inlet capacity.

1-5.3.3 The objective of storm water conveyance systems (e.g., storm drain piping, ditches and channels, pumps) is to provide an efficient mechanism for conveying design flows from inlet locations to the discharge point without surcharging inlets or otherwise causing surface flooding. Erosion potential must also be considered in the design of open channels or ditches used for storm water conveyance.

1-5.3.4 The design of appropriate discharge facilities for storm water collection and conveyance systems includes consideration of storm water quantity and quality. Local, state, and/or Federal regulations often control the allowable quantity and quality of storm water discharges. To meet these regulatory requirements, storm drainage systems will usually require detention or retention basins, and/or other best management practices (BMPs) for the control of discharge quantity and quality.

1-5.4 Waivers to Criteria. Each DOD service component is responsible for setting administrative procedures necessary to process and grant formal waivers. Waivers to the criteria contained in this manual shall be in accordance with Appendix E.

1-6 GENERAL INVESTIGATIONS. An on-site investigation of the system site and tributary area is a prerequisite for study of drainage requirements. Information regarding capacity, elevations, and condition of existing drains will be obtained. Topography, size and shape of drainage area, and extent and type of development; profiles, cross sections, and roughness data on pertinent existing streams and watercourses; and location of possible ponding areas will be determined. Thorough knowledge of climatic conditions and precipitation characteristics is essential. Adequate information regarding soil conditions, including types, permeability, vegetative cover, depth to and movement of subsurface water, and depth of frost will be secured. Outfall and downstream flow conditions, including high-water occurrences and frequencies, also must be determined. The effect of base drainage construction on local interests' facilities and local requirements that will affect the design of the drainage works will be evaluated. Where diversion of runoff is proposed, particular effort will be made to avoid resultant downstream conditions leading to unfavorable public relations, costly litigations, or damage claims. Any agreements needed to obtain drainage easements and/or avoid interference with water rights will be determined at the time of design and consummated prior to initiation of construction. Possible adverse effects on water quality due to disposal of drainage in waterways involved in water supply systems will be evaluated.

1-7 ENVIRONMENTAL CONSIDERATIONS.

1-7.1 National Environmental Policy. The National Environmental Policy Act of 1969 (NEPA), approved 1 January 1970, sets forth the policy of the Federal

Government, in cooperation with state and local governments and other concerned public and private organizations, to protect and restore environmental quality. The Act (Public Law [PL] 91-190) states, in part, that Federal agencies have a continuing responsibility to use all practicable means, consistent with other essential considerations of national policy, to create and maintain conditions under which man and nature can exist in productive harmony. Federal plans, functions, and programs are to be improved and coordinated to (1) preserve the environment for future generations, (2) assure safe, healthful, productive, and aesthetically pleasing surroundings for all, (3) attain the widest beneficial uses of the environment without degradation, risk to health or safety or other undesirable consequences, …and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources (Refer to Section 101(b) [42 USC § 4321] for complete text.). All Federal agencies, in response to NEPA, must be concerned not just with the impact of their activities on technical and economic considerations but also on the environment.

1-7.2 Federal Guidelines. Storm drainage design is an integral component in the design of transportation facilities. Drainage design for transportation facilities must strive to maintain compatibility and minimize interference with existing drainage patterns, control flooding of the pavement surface for design flood events, and minimize potential environmental impacts from facility-related storm water runoff. To meet these goals, the planning and coordination of storm drainage systems must begin in the early planning phases of transportation projects. Federal goals for sustainability are outlined in the. Whole Building Design Guide's (WBDG), Federal Green Construction Guide for Specifiers.

System planning, prior to commencement of design, is essential to the successful development of a final storm drainage design. Successful system planning will result in a final system design that evolves smoothly through the preliminary and final design stages of the transportation project.

1-7.3 Regulatory Considerations. The regulatory environment related to drainage design is ever changing and continues to grow in complexity. Engineers responsible for the planning and design of drainage facilities must be familiar with Federal, state, and local regulations, laws, and ordinances that may impact the design of storm drain systems. A detailed discussion of the legal aspects of highway drainage design, including a thorough review of applicable laws and regulations, is included in the American Association of State Highway and Transportation Officials' (AASHTO) *Highway Drainage Guidelines*, Volume V, and *Model Drainage Manual*, Chapter 2. Some of the more significant Federal, state, and local regulations affecting drainage design are summarized in paragraphs 1-7.4 through 1-7.6.

1-7.4 Federal Regulations. The following Federal laws may affect the design of storm drainage systems. The highway drainage engineer should be familiar with these laws and any associated regulatory procedures.

1-7.4.1 The Fish and Wildlife Act of 1956 (*Title 16 United States Code* [USC] Section 742a, et seq.), the Migratory Game-Fish Act (16 USC § 760c-760g), and the Fish and

Wildlife Coordination Act (16 USC § 661-666c) express the concern of Congress with the quality of the aquatic environment as it affects the conservation, improvement and enjoyment of fish and wildlife resources. The Fish and Wildlife Service's role in the permit review process is to review and comment on the effects of a proposal on fish and wildlife resources. Storm drainage design may impact streams or other channels which fall under the authority of these acts.

1-7.4.2 NEPA (42 USC § 4321-4347) declares the national policy to promote efforts which will prevent or eliminate damage to the environment and biosphere, stimulate the health and welfare of man, and to enrich the understanding of the ecological systems and natural resources important to the nation. NEPA and its implementing guidelines from the Council on Environmental Quality and the Federal Highway Administration (FHWA) affect highway drainage design as it relates to impacts on water quality and ecological systems.

1-7.4.3 Section 401 of the Federal Water Pollution Control Act Amendments of 1972 (FWPCA) (PL 92-500, 86 Stat. 816, 33 USC § 1344) prohibits discharges from point sources unless covered by a National Pollutant Discharge Elimination System (NPDES) permit. These permits are issued under authority of Section 402 of the Act, and must include the more stringent of either technology-based standards or water-quality based standards. The NPDES program regulations are found at Title 40, Code of Federal Regulations, Parts 122-125 (40 CFR 122-125). These regulations govern how the EPA and authorized states write NPDES permits by outlining procedures on how permits shall be issued, what conditions are to be included, and how the permits should be enforced.

1-7.4.4 Section 402p of the FWPCA (PL 92-500, 86 Stat. 816, 33 USC § 1344) requires the EPA to establish final regulations governing storm water discharge permit application requirements under the NPDES program. The permit application requirements include storm water discharges associated with industrial activities. Highway construction and maintenance are classified as industrial activities.

1-7.4.5 The Water Quality Act of 1987 (PL 100-4), an amendment of Section 402p of the FWPCA, provides a comprehensive framework for the EPA to develop a phased approach to regulating storm water discharges under the NPDES program for storm water discharges associated with industrial activity (including construction activities). The Act clarified that permits for discharges of storm water associated with industrial activity must meet all of the applicable provisions of Section 402 and Section 301, including technology and water quality-based standards. The classes of diffuse sources of pollution include urban runoff, construction activities, separate storm drains, waste disposal activities, and resource extraction operations, which all correlate well with categories of discharges covered by the NPDES storm water program.

1-7.4.6 Section 404 of the FWPCA (PL 92-500, 86 Stat. 816, 33 USC § 1344) prohibits the unauthorized discharge of dredged or fill material in navigable waters (waters of the United States (Section 502(7), 33 USC 1362). The instrument of authorization is termed a permit, and the Secretary of the Army, acting through the

Chief of Engineers, U.S. Army Corps of Engineers, has responsibility for the administration of the regulatory program. The definition of navigable waters (waters of the United States, 40 CFR 230.3(s)) includes all coastal waters, navigable waters of the United States to their headwaters, streams tributary to navigable waters of the United States to their headwaters, inland lakes used for recreation or other purposes that may be interstate in nature, and wetlands contiguous or adjacent to the above waters. A water quality certification is also required for these activities.

1-7.4.7 The Coastal Zone Management Act of 1972 (PL 92-583, amended by PL 94-310; 86 Stat. 1280, 16 USC § 1451, et seq.) declares a national policy to preserve, protect, develop, and restore or enhance the resources of the nation's coastal zone, and to assist states in establishing management programs to achieve wise use of land and water resources, giving full consideration to ecological, cultural, historic, and aesthetic values as well as to the needs of economic development. The development of highway storm drainage systems in coastal areas must comply with this act in accordance with state coastal zone management programs.

1-7.4.8 The Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) (PL 101-508) specifically charged state coastal programs (administered under Federal authority by the National Oceanic and Atmospheric Administration [NOAA]), and state nonpoint source programs (administered under Federal authority by the EPA), to address nonpoint source pollution issues affecting coastal water quality. The guidance specifies economically achievable management measures to control the addition of pollutants to coastal waters for sources of nonpoint pollution through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives.

1-7.4.9 The Safe Drinking Water Act of 1974 (PL 93-523), as amended, includes provisions for requiring protection of surface water discharges in areas designated as sole or principal source aquifers. Mitigation of activities that may contaminate the aquifer (including highway runoff) are typically required to assure Federal funding of the project, which may be withheld if harm to the aquifer occurs.

1-7.5 State Regulations. In addition to complying with the Federal laws cited in paragraphs 1-7.1 through 1-7.4.9, the design of storm drainage systems must also comply with state laws and regulations. State drainage law is derived from both common and statutory law. A summary of applicable state drainage laws originating from common law, or court-made law, and statutory law follow. Note that this is a generalized summary of common state drainage law. Drainage engineers should become familiar with the application of these legal principles in their states.

1-7.5.1 The civil law rule of natural drainage is based upon the perpetuation of natural drainage. A frequently quoted statement of this law is:

> . . .every landowner must bear the burden of receiving upon his land the surface water naturally falling upon land above it and naturally flowing to it therefrom, and he has the corresponding right to have the

> surface water naturally falling upon his land or naturally coming upon it, flow freely therefrom upon the lower land adjoining, as it would flow under natural conditions. From these rights and burdens, the principle follows that he has a lawful right to complain of others, who, by interfering with natural conditions, cause such surface water to be discharged in greater quantity or in a different manner upon his land, than would occur under natural conditions. . . . (Heier v. Krull. 160 Cal 441 (1911))

This rule is inherently strict, and as a result has been modified to some degree in many states.

1-7.5.2 The reasonable use rule states that the possessor of land incurs liability only when his harmful interference with the flow of surface waters is unreasonable. Under this rule, a possessor of land is legally privileged to make a reasonable use of his land even though the flow of surface waters is altered thereby and causes some harm to others. The possessor of land incurs liability, however, when his harmful interference with the flow of surface waters is unreasonable.

1-7.5.3 Stream water rules are founded on a common law maxim that states that "water runs and ought to run as it is by natural law accustomed to run." Thus, as a general rule, any interference with the flow of a natural watercourse to the damage of another will result in liability. Surface waters from highways are often discharged into the most convenient watercourse. The right is unquestioned if those waters were naturally tributary to the watercourse and unchallenged if the watercourse has adequate capacity; however, if all or part of the surface waters has been diverted from another watershed to a small watercourse, any lower owner may complain and recover for ensuing damage.

1-7.5.4 Eminent domain is a statutory law giving public agencies the right to take private property for public use. This right can be exercised as a means to acquire the right to discharge highway drainage across adjoining lands when this right may otherwise be restricted. Whenever the right of eminent domain is exercised, a requirement of just compensation for property taken or damaged must be met.

1-7.5.5 Agricultural drainage laws have been adopted in some states. These laws provide for the establishment, improvement, and maintenance of ditch systems. Drainage engineers may have to take into consideration agricultural laws that may or may not permit irrigation waste water to drain into the highway right-of-way. If the drainage of irrigated agricultural lands into roadside ditches is permitted, excess irrigation water may have to be provided for in the design of the highway drainage system.

1-7.5.6 Environmental quality acts have been enacted by many states to promote the enhancement and maintenance of the quality of life. Hydraulic engineers should be familiar with these statutes.

1-7.6 Local Laws. Many governmental subdivisions have adopted ordinances and codes that impact drainage design. These include regulations for erosion control, BMPs, and storm water detention.

1-7.6.1 Erosion control regulations set forth practices, procedures, and objectives for controlling erosion from construction sites. Cities, counties, or other government subdivisions commonly have erosion control manuals that provide guidance for meeting local requirements. Erosion control measures are typically installed to control erosion during construction periods, and are often designed to function as a part of the highway drainage system. Additionally, erosion control practices may be required by the regulations governing storm water discharge requirements under the NPDES program. These erosion and sediment control ordinances set forth enforceable practices, procedures, and objectives for developers and contractors to control sedimentation and erosion by setting specific requirements that may include adherence to limits of clearing and grading, time limit or seasonal requirements for construction activities to take place, stabilization of the soil, and structural measures around the perimeter of the construction site.

1-7.6.2 Best managagement practices (BMP) regulations set forth practices, procedures, and objectives for controlling storm water quality in urbanizing areas. Many urban city or county government bodies have implemented BMP design procedures and standards as a part of their land development regulations. The design and implementation of appropriate BMPs for controlling storm water runoff quality in these areas must be a part of the overall design of highway storm drainage systems. Additionally, the NPDES permit program for storm water management addresses construction site runoff by the use of self-designed storm water pollution prevention plans. These plans are based upon three main types of BMPs: those that prevent erosion, others that prevent the mixing of pollutants from the construction site with storm water, and those that trap pollutants before they can be discharged. All three of these BMPs are designed to prevent, or at least control, the pollution of storm water before it has a chance to affect receiving streams.

1-7.6.3 Storm water detention regulations set forth practices, procedures, and objectives for controlling storm water quantity through the use of detention basins or other controlling facilities. The purpose of these facilities is to limit increases in the amount of runoff resulting from land development activities. In some areas, detention facilities may be required as a part of the highway storm drainage system. Detention and retention basins must generally meet design criteria to control the more frequent storms and to safely pass larger storm events. Storm water management may also include other measures to reduce the rate of runoff from a developed site, such as maximizing the amount of runoff that infiltrates back into the ground.

1-7.7 U.S. Army Environmental Quality Program. Army Regulation (AR) 200-1, outlines the Army's fundamental environmental policies, management of its programs, and its various types of activities, one of which, water resources management, includes minimizing soil erosion and attendant pollution caused by rapid runoff into streams and rivers. The overall goal is to "plan, initiate, and carry out all actions and programs in a

manner that will minimize or avoid adverse effects on the quality of the human environment without impairment of the Army mission." A primary objective is to eliminate the discharge of pollutants produced by Army activities. Provision of suitable surface drainage facilities is necessary in meeting this objective.

1-7.8 U.S. Air Force Environmental Quality Program. Air Force policy directive (AFPD) 32-70 enunciates Air Force policy in compliance with NEPA executive orders and DOD directives. Procedures outlined in AFPD 32-70 are similar to those described for Army installations. Air Force instruction (AFI) 32-7061 establishes 32 CFR part 989 as the controlling document on environmental assessments and statements for Air Force facilities.

1-7.9 U.S. Navy Environmental Quality Program. The Navy's Environmental Quality Initiative (EQI) is a comprehensive initiative focused on maximizing the use of pollution prevention to achieve and maintain compliance with environmental regulations. The EQI is a fundamental part of the Navy environmental strategy called AIMM to SCORE – Assess, Implement, Manage and Measure to achieve Sustained Compliance and Operational Readiness through Environmental Excellence.

1-7.10 FAA Environmental Handbook. FAA Order 5050.4 provides instructions and guidance for preparing and processing the environmental assessments, findings of no significant impact (FONSI), and environmental impact statements (EIS) for airport development proposals and other airport actions as required by various laws and regulations.

1-7.11 Environmental Impact Analysis. A comprehensive reference, *Handbook for Environmental Impact Analysis*, was issued in September of 1974. This document, prepared by the U.S. Army Corps of Engineers Construction Engineering Research Laboratory (CERL), presents recommended procedures for use by Army personnel in preparing and processing environmental impact assessments (EIA) and EIS. The procedures list step-by-step actions considered necessary to comply with requirements of NEPA and subsequent guidelines. These require that all Federal agencies use a systematic and disciplinary approach to incorporate environmental considerations into their decision making process.

1-7.12 Environmental Effects of Surface Drainage Systems. Such facilities in the arctic or subarctic could have either beneficial or adverse environmental impacts affecting water, land, ecology, and socioeconomic (human and economic) considerations. Despite low population density and minimal development, the fragile nature of the ecology in the arctic and subarctic has attracted the attention of environmental groups interested in protecting these unique assets. Effects on surrounding land and vegetation may cause changes in various conditions in the existing environment, such as surface water quantity and quality, groundwater levels and quality, drainage areas, animal and aquatic life, and land use. Proposed systems may also have social impacts on the community, requiring relocation of military and public activities, open space, recreational activities, community activities, and quality of life. Environmental attributes related to water could include such items as erosion,

aquifer yield, flood potential, flow or temperature variations (the latter affecting permafrost levels and ice jams), biochemical oxygen demand, and content of dissolved oxygen, dissolved solids, nutrients, and coliform organisms. These are among many possible attributes to be considered in evaluating environmental impacts, both beneficial and adverse, including effects on surface water and groundwater. Various methods are explained for presenting and summing up the impact of these effects on the environment.

1-7.13 Discharge Permits. The Federal pollution abatement program requires regulatory permits for all discharges of pollutants from point sources (such as pipelines, channels, or ditches) into navigable waters or their tributaries. This requirement does *not* extend to discharges from separate storm sewers except where the storm sewers receive industrial, municipal, and agricultural wastes or runoff, or where the storm water discharge has been identified as a significant contributor of pollution by the EPA regional administrator, the state water pollution control agency, or an interstate agency. Federal installations, while cooperating with and furnishing information to state agencies, do not apply for or secure state permits for discharges into navigable waters.

1-7.14 Effects of Drainage Facilities on Fish. In many locations, natural drainage channels are environmentally important to preserve fish resources. Culverts, ditches, and other drainage structures constructed along or tributary to these fish streams must be designed to minimize adverse environmental effects. Culvert hazards to fish include high inverts, excessive velocities, undersized culverts, stream degradation, failed or damaged culverts that create obstructions, erosion and siltation at outlets, blockage by icing, and seasonal timing and methods of drainage construction. Consult Federal and state fish and wildlife agencies for guidance on probable effects and possible expedients to mitigate them. Give special concern to anticipated conditions during fish migration season. More information is located in Chapter 4.

CHAPTER 2

SURFACE HYDROLOGY

2-1 PURPOSE AND SCOPE. This chapter presents explanations and examples to give a better understanding of problems in the design of drainage facilities, and outlines convenient methods of estimating design capacities for drainage facilities.

2-2 HYDROLOGIC CRITERIA. The Rational Method, developed over 100 years ago, is widely used for estimating design runoff from urban areas. The Rational Formula, popular because of its simplicity in application, is suited mainly to sizing culverts, storm drains, or channels to accommodate drainage from small areas, generally less than 200 acres. Selection of appropriate values of runoff coefficients in the formula depends on the experience of the designers and the designers' knowledge of local rainfall-runoff relationships. United States Geological Survey (USGS) regression equations and National Resources Conservation Service (NRCS) techniques appropriate for surface drainage design are also included in this chapter.

2-2.1 Design Objectives. The design capacity of surface drainage systems should economically drain the facilities with due consideration of the mission and importance of the particular facility and environmental impacts.

2-2.2 Degree of Drainage Required. The degree of protection to be provided by the drain system depends largely on the importance of the facility as determined by the type and volume of traffic to be accommodated, the necessity for uninterrupted service, and similar factors. Although the degree of protection should increase with the importance of the facility, minimum requirements must be adequate to avoid hazards to operation. One severe accident chargeable to inadequate drainage can offset any difference between the cost of reasonably adequate and inadequate drainage facilities. In some cases, one can justify use of design storm frequencies appreciably higher than minimum criteria in order to protect important facilities. In some designs, portions of the drainage system have been based on as high as a 50-year (yr) design frequency to reduce likelihood of flooding a facility essential to operations and to prevent loss of life.

2-2.3 Surface Runoff from Design Storm. Surface runoff from the selected design storm will be disposed of without damage to facilities, undue saturation of the subsoil, or significant interruption of normal traffic. In addition, certain facilities may have restrictions on surface storage of water due to the potential attraction of waterfowl. For more information on waterfowl hazards, refer to Air Force pamphlet (AFPAM) 91-212 FAA Advisory Circular (AC) 150/5200-33.

2-2.4 Design Storm Frequency

2-2.4.1 **DOD Airfields and Heliports.** For airfields and heliports, a minimum of a 2-year storm event is required unless a waiver is obtained. This event shall have no encroachment of runoff on taxiway and runway pavements (including paved shoulders). It should be noted that after this design storm frequency is specified, computations must be made to determine the critical duration of rainfall required to produce the maximum

rate of runoff for each area. This will depend primarily on the slope and length of overland flow. Another important aspect of the design is minimizing ponding during rain events. Ponding is the accumulation of water around an inlet structure during a rain event. Typically, ponding will be limited around the apron inlets such that it does not exceed 4 inches.

2-2.4.2 **Federal Aviation Administration.** For airports, it is recommended that the 5-year storm event be used with no encroachment of runoff on taxiway and runway pavements (including paved shoulders). The damage or inconvenience that may be caused by storms greater than the 5-year event may not warrant the increased cost of a drainage system large enough to accommodate that storm. The calculation of and provision for the storage of water or ponding between runways, taxiways, and aprons should usually be considered as a safety factor for temporary accommodation of runoff from storm return periods longer than 5 years. Ponding or storage of water of more than a temporary nature may be acceptable on the airport site other than between runways, taxiways, and aprons. Such temporary storage may indeed be essential because of limitations in offsite outfalls. An additional design consideration is the ponding of water around an inlet structure on an apron during a rain event. Typically, ponding will be limited around an apron inlet such that it does not exceed 4 inches.

2-2.4.3 **Areas Other Than Airfields.** For such developed portions of military installations as roadways, administrative, industrial, and housing areas, the design storm will normally be based on rainfall of 10-year frequency. Potential damage or operational requirements may warrant a more severe criterion; in certain storage and recreational areas, a lesser criterion may be appropriate. (With concurrence of the using service, a lesser criterion may also be employed in regions where storms of an appreciable magnitude are infrequent and either damages or operational capabilities are such that large expenditures for drainage are not justified.)

An additional design consideration is the spread of water around inlets. Spread is the width of water on the paved surface measured perpendicular to the curb face. More information on limitations of spread can be found in Chapter 3.

2-2.5 Surface Runoff from Storms Exceeding Design Storm. The design storm frequency alone is not a reliable criterion of the adequacy of storm drain facilities. It is advisable to investigate the probable consequences of storms more severe and less frequent than the design storm before making final decisions regarding the adequacy of proposed drain-inlet capacities. Surface runoff from storms greater than the design storm will be disposed of with the minimum damage to the airfield or heliport. The center 50 percent of runways; the center 50 percent of taxiways serving these runways; and helipad surfaces along the centerline should be free from ponding resulting from storms of a 10-yr frequency and intensity determined by the geographic location. For areas other than airfields and heliports, check with the appropriate local regulatory agency for guidance on design storm requirements.

2-2.6 Reliability of Operation. The drainage system will have the maximum reliability of operation practicable under all conditions, with due consideration given to

abnormal requirements such as debris and annual periods of snowmelt and ice jam breakup.

2-2.7 Environmental Impact. Drainage facilities will be constructed with minimal impact on the environment.

2-2.8 Maintenance. The drainage system will require minimum maintenance, and that maintenance will be accomplished quickly and economically. Particular reliance will be placed on maintenance of drainage components serving operational facilities.

2-2.9 Future Expansion. Future expansion of drainage facilities will be feasible with the minimum of expense and interruption to normal traffic.

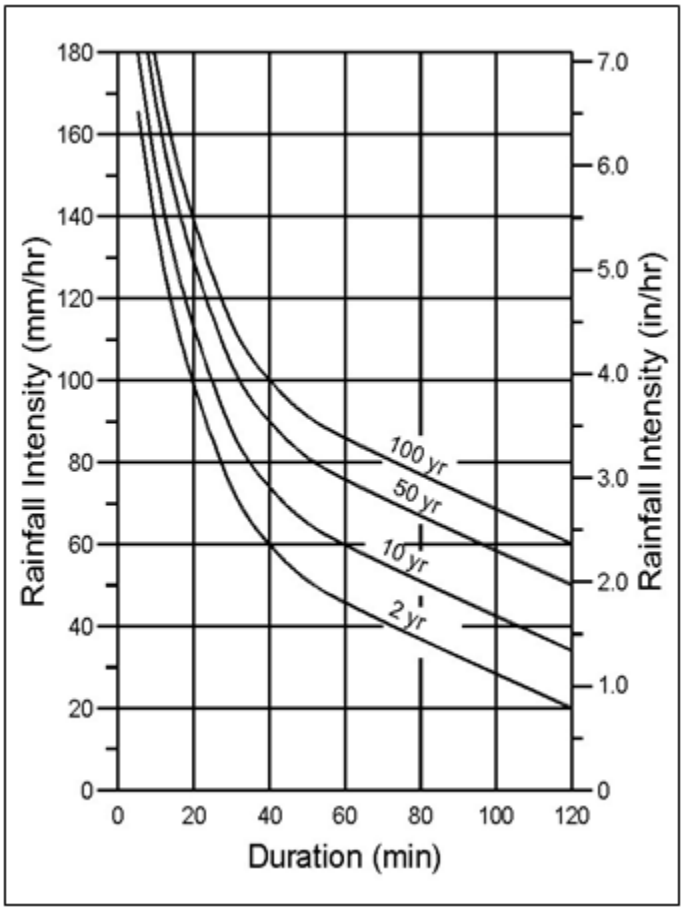
2-3 HYDROLOGIC METHODS AND PROCEDURES. This section provides an overview of hydrologic methods and procedures commonly used in drainage design. These methods include: the Rational Method, the Soil Conservation Service (SCS) Technical Release 55 (TR-55) method, and the United States Geological Survey (USGS) regression equations. Much of the information contained in this section was condensed from the FHWA Hydraulic Engineering Circular No. 22 (HEC-22). The presentation here is intended to provide the reader with an introduction to the methods and procedures, their data requirements, and their limitations. Most of these procedures can be applied using commonly available computer programs. Chapter 12 of this manual contains information on available computer programs.

2-3.1 Rainfall (Precipitation). Rainfall, along with watershed characteristics, determines the flood flows upon which storm drainage design is based. In this section, we will describe the constant rainfall and the synthetic rainfall techniques.

2-3.1.1 **Constant Rainfall Intensity.** Although rainfall intensity varies during precipitation events, many of the procedures used to derive peak flow are based on an assumed constant rainfall intensity. Intensity is defined as the rate of rainfall and is typically given in units of inches per hour (in/hr).

Intensity-duration-frequency curves (IDF curves) have been developed for many jurisdictions throughout the United States through frequency analysis of rainfall events for thousands of rainfall gages. The IDF curve provides a summary of a site's rainfall characteristics by relating storm duration and exceedance probability (frequency) to rainfall intensity (assumed constant over the duration). Figure 2-1 illustrates an example IDF curve. To interpret an IDF curve, find the rainfall duration along the X-axis, go vertically up the graph until reaching the proper return period, then go horizontally to the left and read the intensity off of the Y-axis. Regional IDF curves are available in most state or local highway agency drainage manuals. If the IDF curves are not available, the designer needs to develop them on a project-by-project basis.

Figure 2-1. Example IDF Curve



2-3.1.2 **Synthetic Rainfall Events.** Drainage design is usually based on synthetic rather than actual rainfall events. The SCS 24-hour (hr) rainfall distributions are the most widely used synthetic hyetographs. These rainfall distributions were developed by the U.S. Department of Agriculture SCS, which is now known as Natural Resources Conservation Service (NRCS). The SCS 24-hour distributions incorporate the intensity-duration relationship for the design return period. This approach is based on the assumption that the maximum rainfall for any duration within the 24-hour duration should have the same return period. For example, a 10-year, 24-hour design storm would contain the 10-year rainfall depths for all durations up to 24 hours as derived from IDF curves. SCS developed four synthetic 24-hour rainfall distributions as shown in Figure 2-2; approximate geographic boundaries for each storm distribution are shown in Figure 2-3.

Figure 2-2. SCS 24-hour Rainfall Distribution

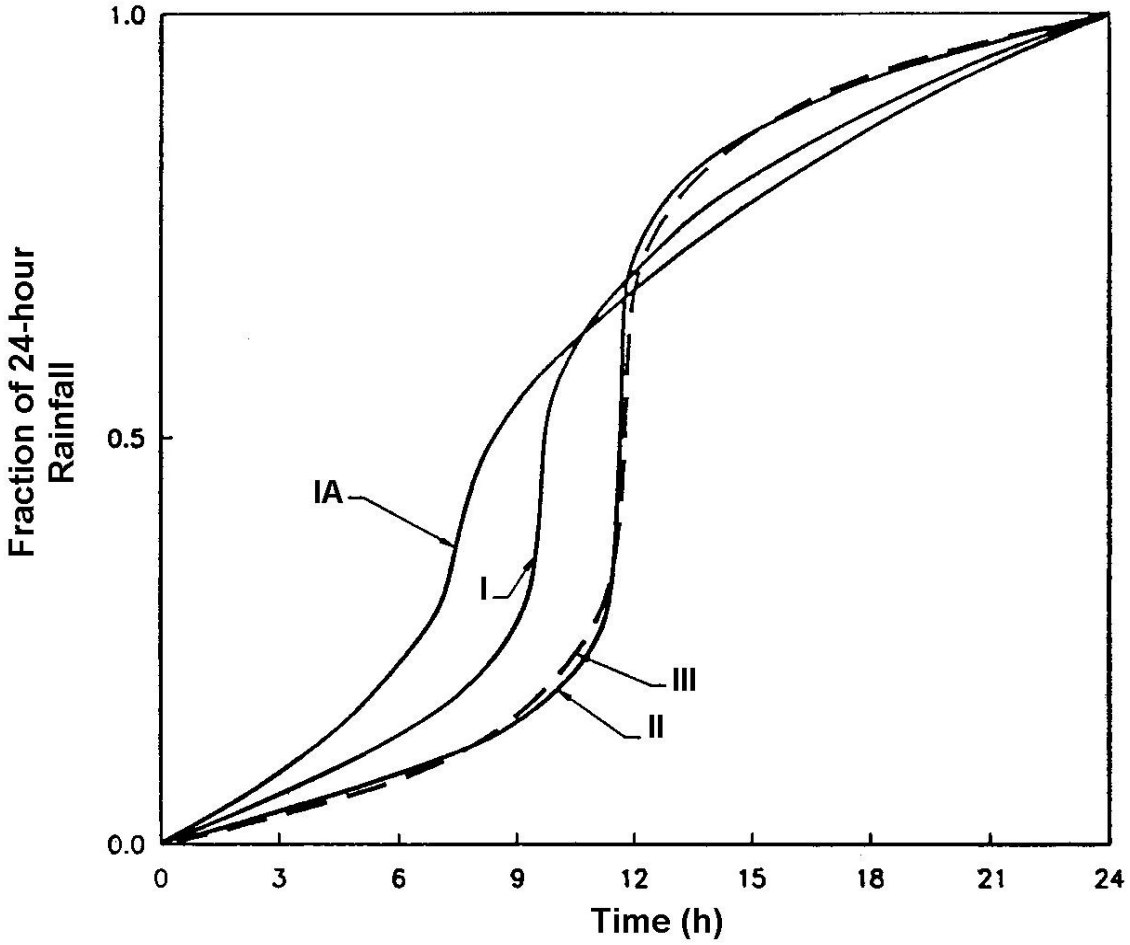


Figure 2-3. Approximate Geographic Areas for SCS Rainfall Distributions

Although the SCS distributions shown do not agree exactly with IDF curves for all locations in the region for which they are intended, the differences are within the accuracy limits of the rainfall depths from the Weather Bureau's rainfall frequency atlases.

2-3.2 Determination of Peak Flow Rates. Peak flows are generally adequate for design and analysis of conveyance systems such as storm drains or open channels; however, if the design or analysis must include flood routing (e.g., storage basins or complex conveyance networks), a flood hydrograph is required. This section discusses three methods, the Rational Method, the SCS TR-55 method, and the USGS regression equations, that are used to derive peak flows for both gaged and ungaged sites. Each method can be used to develop a peak discharge. The drainage area of the project usually dictates which of these methods should be used. The Rational Method is the most commonly used method, but due to its assumptions, it is limited to drainage areas smaller than 200 acres. For drainage areas up to 2000 acres, the SCS TR-55 method is commonly used. Due to the way in which the regression equations were developed, they are usually not appropriate for very small areas, but each set of equations has its own limitations and those should be understood before the equations are applied. The regression equations are often used to compute the discharges for larger areas such as those necessary for culvert design.

2-3.2.1 **Rational Method.** One of the most commonly used equations for the calculation of peak flow from small areas is the Rational Formula, given as Equation 2-1:

$$Q = CIA \quad (2\text{-}1)$$

where:

Q = flow, ft^3/s

C = dimensionless runoff coefficient representing the characteristics of the watershed

I = rainfall intensity, in/hr

A = drainage area, hectares, acres

2-3.2.1.1 **Assumptions**. Assumptions inherent in the Rational Formula are that:

- Peak flow occurs when the entire watershed is contributing to the flow.
- Rainfall intensity is the same over the entire drainage area.
- Rainfall intensity is uniform over a time duration equal to the time of concentration (t_c). The time of concentration is the time required for water to travel from the hydraulically most remote point of the basin to the point of interest.
- The frequency of the computed peak flow is the same as that of the rainfall intensity, i.e., the 10-year rainfall intensity is assumed to produce the 10-year peak flow.
- The coefficient of runoff is the same for all storms of all recurrence probabilities.

2-3.2.1.2 **Limitations**. Because of the inherent assumptions, the Rational Formula should be applied only to drainage areas smaller than 200 acres.

2-3.2.2 **Runoff Coefficient**

2-3.2.2.1 The runoff coefficient, C, in Equation 2-1 is a function of the ground cover and a host of other hydrologic abstractions. It relates the estimated peak discharge to a theoretical maximum of 100 percent runoff. Typical values for C are given in Table 2-1. If the basin contains varying amounts of different land cover or other abstractions, a composite coefficient can be calculated through area weighing using Equation 2-2:

$$\text{weighted } C = \frac{\sum (C_x A_x)}{A_{total}} \quad (2\text{-}2)$$

where:

x = subscript designating values for incremental areas with consistent land cover

Table 2-1. Runoff Coefficients for Rational Formula

Type of Drainage Area	Runoff Coefficient, *C**
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries	0.10 - 0.25
Playgrounds	0.20 - 0.40
Railroad yard areas	0.20 - 0.40
Unimproved areas	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2 percent	0.05 - 0.10
Sandy soil, average, 2 to 7 percent	0.10 - 0.15
Sandy soil, steep, 7 percent	0.15 - 0.20
Heavy soil, flat, 2 percent	0.13 - 0.17
Heavy soil, average, 2 to 7 percent	0.18 - 0.22
Heavy soil, steep, 7 percent	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs	0.75 - 0.95
*Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.	

2-3.2.2.2 Example 2-1 illustrates the calculation of the runoff coefficient, *C*, using area weighing.

Example 2-1

Given: These existing and proposed land uses:

Existing conditions (unimproved):

Land Use	**Area, acres**	**Runoff Coefficient, *C***
Unimproved Grass	22.1	0.25
Grass	21.2	0.22
Total =	43.3	

Proposed conditions (improved):

Land Use	**Area, acres**	**Runoff Coefficient, *C***
Paved	5.4	0.90
Lawn	1.6	0.15
Unimproved Grass	18.6	0.25
Grass	17.7	0.22
Total =	43.3	

Find: Weighted runoff coefficient, *C*, for the existing and proposed conditions.

Solution:

Step 1. Determine weighted *C* for existing (unimproved) conditions using Equation 2-2.

$$\text{weighted } C = \frac{\sum (C_x A_x)}{A}$$

$$\text{weighted } C = \frac{[(22.1)(0.25)+(21.2)(0.22)]}{(43.3)}$$

$$\text{weighted } C = 0.235$$

Step 2. Determine weighted *C* for proposed (improved) conditions using Equation 2-2.

$$\text{weighted } C = \frac{[(5.4)(0.90)+(1.6)(0.15)+(18.6)(0.25)+(17.7)(0.22)]}{(43.3)}$$

$$\text{weighted } C = 0.315$$

2-3.2.3 **Rainfall Intensity.** Rainfall intensity, duration, and frequency curves are necessary to use the Rational Method. Regional IDF curves are available in most state

and local highway agency manuals and are also available from NOAA. If the IDF curves are not available, they should be developed.

2-3.2.4 **Time of Concentration.** A number of methods can be used to estimate time of concentration, t_c, some of which are intended to calculate the flow velocity within individual segments of the flow path (e.g., shallow concentrated flow, open channel flow, etc.). The time of concentration can be calculated as the sum of the travel times within the various consecutive flow segments. For additional discussion on establishing the time of concentration for inlets and drainage systems, see Chapters 3 and 6 of this manual.

2-3.2.4.1 **Sheet Flow Travel Time**. Sheet flow is the shallow mass of runoff on a planar surface with a uniform depth across the sloping surface. This usually occurs at the headwater of streams over relatively short distances, rarely more than about 400 feet (ft), and possibly less than 80 feet. Sheet flow is commonly estimated with a version of the kinematic wave equation, a derivative of Manning's equation, shown as Equation 2-3:

$$T_{ti} = \frac{K_c}{I^{0.4}}\left(\frac{nL}{\sqrt{S}}\right)^{0.6} \quad (2\text{-}3)$$

where:

T_{ti} = sheet flow travel time, minutes (min)

n = roughness coefficient (see Table 2-2)

L = flow length, ft

I = rainfall intensity, in/hr

S = surface slope, feet per feet (ft/ft)

K_c = empirical coefficient equal to 0.933

Table 2-2. Manning's Roughness Coefficient (*n*) for Overland Sheet Flow

Surface Description	*n*
Smooth asphalt	0.011
Smooth concrete	0.012
Ordinary concrete lining	0.013
Good wood	0.014
Brick with cement mortar	0.014
Vitrified clay	0.015
Cast iron	0.015

Surface Description	*n*
Corrugated metal pipe	0.024
Cement rubble surface	0.024
Fallow (no residue)	0.05
Cultivated soils	
Residue cover < 20 percent	0.06
Residue cover > 20 percent	0.17
Range (natural)	0.13
Grass	
Short grass prairie	0.15
Dense grasses	0.24
Bermuda grass	0.41
Woods*	
Light underbrush	0.40
Dense underbrush	0.80
*When selecting *n*, consider cover to a height of about 1.2 inches. This is only part of the plant cover that will obstruct sheet flow.	

Since the rainfall intensity value, *I*, depends on t_{ti} and t_{ti} is not initially known, the computation of t_{ti} is an iterative process. An initial estimate of t_{ti} is assumed and used to obtain *I* from the IDF curve for the locality. The t_{ti} is then computed from Equation 2-3 and used to check the initial value of t_{ti}. If they are not the same, the process is repeated until two successive t_{ti} estimates are the same.

2-3.2.4.2 **Shallow Concentrated Flow Velocity**. After short distances of at most 300 ft, sheet flow tends to concentrate in rills and then gullies of increasing proportions. Such flow is usually referred to as shallow concentrated flow. The velocity of such flow can be estimated using a relationship between velocity and slope as shown in Equation 2-4:

$$V = (3.28)kS_p^{0.5} \quad (2\text{-}4)$$

where:

V = velocity, ft/s

k = intercept coefficient (see Table 2-3)

S_p = slope, percent

Table 2-3. Intercept Coefficients for Velocity vs. Slope Relationship of Equation 2-4

Land Cover/Flow Regime	*k*
Forest with heavy ground litter; hay meadow (overland flow)	0.076
Trash fallow or minimum tillage cultivation; contour or strip cropped; woodland (overland flow)	0.152
Short grass pasture (overland flow)	0.213
Cultivated straight row (overland flow)	0.274
Nearly bare and untilled (overland flow); alluvial fans in western mountain regions	0.305
Grassed waterway (shallow concentrated flow)	0.457
Unpaved (shallow concentrated flow)	0.491
Paved area (shallow concentrated flow); small upland gullies	0.619

2-3.2.4.3 **Open Channel and Pipe Flow Velocity**. Flow in gullies empties into channels or pipes. Open channels are assumed to begin where either the blue stream line shows on USGS quadrangle sheets or the channel is visible on aerial photographs. Cross-section geometry and roughness should be obtained for all channel reaches in the watershed. Manning's equation can be used to estimate average flow velocities in pipes and open channels as follows:

$$V = \frac{1.49}{n} R^{2/3} S^{1/2} \qquad (2\text{-}5)$$

where:

n = roughness coefficient (see Table 2-4)

V = velocity, ft/s

R = hydraulic radius (defined as the flow area divided by the wetted perimeter), ft

S = slope, ft/ft

Table 2-4. Values of Manning's Coefficient (*n*) for Channels and Pipes

Conduit Material	Manning's *n**
Closed Conduits	
Brick	0.013 - 0.017
Cast iron pipe	
Cement-lined and seal coated	0.011 - 0.015

Conduit Material	Manning's *n**
Concrete (monolithic)	0.012 - 0.014
Concrete pipe	0.011 - 0.015
Corrugated-metal pipe – 0.5 inch by 2.5 inch corrugations	
Plain	0.022 - 0.026
Paved invert	0.018 - 0.022
Spun asphalt lines	0.011 - 0.015
Plastic pipe (smooth)	0.011 - 0.015
Vitrified clay	
Pipes	0.011 - 0.015
Liner plates	0.013 - 0.017
Open Channels	
Lined channels	
Asphalt	0.013 - 0.017
Brick	0.012 - 0.018
Concrete	0.011 - 0.020
Rubble or riprap	0.020 - 0.035
Vegetal	0.030 - 0.400
Excavated or dredged	
Earth, straight and uniform	0.020 - 0.030
Earth, winding, fairly uniform	0.025 - 0.040
Rock	0.030 - 0.045
Unmaintained	0.050 - 0.140
Natural channels (minor streams, top width at flood stage < 100 feet)	
Fairly regular section	0.030 - 0.070
Irregular section with pools	0.040 - 0.100
*Lower values are usually for well-constructed and maintained (smoother) pipes and channels.	

For a circular pipe flowing full, the hydraulic radius is one-fourth of the diameter. For a wide rectangular channel ($W > 10\ d$), the hydraulic radius is approximately equal to the depth. The travel time is then calculated as follows:

$$T_{ti} = \frac{L}{60V} \qquad (2\text{-}6)$$

where:

T_{ti} = travel time for segment i, min

L = flow length for segment i, ft

V = velocity for segment i, ft/s

Example 2-2

Given: These flow path characteristics:

Flow Segment	Length (ft)	Slope (ft/ft)	Segment Description
1 (sheet flow)	223	0.005	Bermuda grass
2 (shallow conduit)	259	0.006	Grassed waterway
3 (flow in conduit)	479	0.008	15-in concrete pipe

Find: Time of concentration, t_c, for the area.

Solution:

Step 1. Calculate time of concentration for each segment.

Segment 1

Obtain Manning's n roughness coefficient from Table 2-2: n = 0.41

Determine the sheet flow travel time using Equation 2-3:

$$T_{ti} = \frac{K_c}{I^{0.4}}\left(\frac{nL}{\sqrt{S}}\right)^{0.6}$$

Since the rainfall intensity value, I, is being sought and is also in the equation, an iterative approach must be used. From experience, estimate a time of concentration and read a rainfall intensity from the appropriate IDF curve. In this example, try a time of concentration of 30 min and read from the IDF curve in Figure 2-1 an intensity of 3.4 in/hr. Now use Equation 2-3 to see how good the 30-min estimate was.

First, solve the equation in terms of I.

$$T_{ti1} = \left[\frac{0.933}{(I)^{0.4}}\right]\left[\frac{(0.41)(223)}{(0.005)^{0.5}}\right]^{0.6} = \frac{(68.68)}{I^{0.4}}$$

Inserting 3.4 in/hr for I, the result is 42.1 min. Since 42.1 is greater than the assumed 30 min, try the intensity for 42 min from Figure 2-1, which is 2.8 in/hr.

Using 2.8 in/hr, the result is 45.4 min. Repeat the process with 2.7 in/hr for 45 min and the result is a time of 46.2. This value is close to the 45.2 min.

Use 46 min for segment 1.

Segment 2

Obtain the intercept coefficient, *k*, from Table 2-3: $k = 0.457$ and $K_c = 3.281$

Determine the concentrated flow velocity from Equation 2-4:

$$V = 3.28kS_p^{0.5} = (3.28)(0.457)(0.6)^{0.5} = 116 \text{ ft/s}$$

Determine the travel time from Equation 2-6:

$$T_{ti2} = \frac{L}{(60V)} = \frac{259}{[(60)(1.16)]} = 3.7 \text{ min}$$

Segment 3

Obtain Manning's *n* roughness coefficient from Table 2-4: $n = 0.011$

Determine the pipe flow velocity from Equation 2-5 (assuming full flow)

V = (1.49/0.011)(1.25/4)0.67 (0.008)0.5 = 5.58 ft/s

Determine the travel time from Equation 2-6:

$$T_{ti3} = \frac{L}{(60V)} = \frac{479}{[(60)(5.58)]} = 1.4 \text{ min}$$

Step 2. Determine the total travel time by summing the individual travel times:

$t_c = T_{ti1} + T_{ti2} + T_{ti3}$ = 46.0 + 3.7 + 1.4 = 51.1 min Use 51 min

Example 2-3

Given: Land use conditions from Example 2-1 and the following times of concentration:

Condition	**Time of concentration t_c (min)**	**Weighted *C* (from Example 2-1)**
Existing condition (unimproved)	88	0.235
Proposed condition (improved)	66	0.315

Area = 43.36 acres

Find: The 10-year peak flow using the Rational Formula and the IDF curve shown in Figure 2-1.

Solution:

Step 1. Determine the rainfall intensity, *I*, from the 10-yr IDF curve for each time of concentration.

Existing condition (unimproved) 1.9 in/hr

Proposed condition (improved) 2.3 in/hr

Step 2. Determine peak flow rate, *Q*.

Existing condition (unimproved):

$Q = CIA$

$= (0.235)(1.9)(43.3)$

$= 19.3 \text{ ft}^3/\text{s}$

Proposed condition (improved):

$Q = CIA$

$= (0.315)(2.3)(43.3)$

$= 31.4 \text{ ft}^3/\text{s}$

2-3.3 USGS Regression Equations. Regression equations are commonly used for estimating peak flows at ungaged sites or sites with limited data. The USGS has developed and compiled regional regression equations that are included in a computer program called the National Flood Frequency program (NFF). NFF allows quick and easy estimation of peak flows throughout the United States. All the USGS regression equations were developed using dependent variables in English units. Local equations may be available to provide better correspondence to local hydrology than the regional equations found in NFF. For more information on NFF, refer to paragraph 12-7.7.

2-3.3.1 **Rural Equations.** The rural equations are based on watershed and climatic characteristics within specific regions of each state that can be obtained from topographic maps, rainfall reports, and atlases. These regression equations are generally of the following form:

$$RQ_T = aA^bB^cC^d \quad (2\text{-}7)$$

where:

RQ_T = T-year rural peak flow

a = regression constant

b,c,d = regression coefficients

A,B,C = basin characteristics

Through a series of studies conducted by the USGS, state highway, and other agencies, rural equations have been developed for all states. The NFF program described in Chapter 12 is a companion software package to implement these equations. These equations should not be used where dams and other hydrologic modifications have a significant effect on peak flows. Many other limitations are presented in USGS documents.

2-3.3.2 **Urban Equations.** Rural peak flow can be converted to urban peak flows with the seven-parameter nationwide urban regression equations developed by the USGS. These equations are shown in Table 2-5. A three-parameter equation has also been developed, but the seven-parameter equation is implemented in NFF. The urban equations are based on urban runoff data from 269 basins in 56 cities and 31 states. These equations have been thoroughly tested and proven to give reasonable estimates of peak flows having recurrence intervals between 2 and 500 years. Subsequent testing at 78 additional sites in the southeastern United States verified the adequacy of the equations. While these regression equations have been verified, errors may still be approximately 35 to 50 percent when compared to field measurements. More information can be found in the USGS publication, *Flood Characteristics of Urban Watersheds in the United States, Paper 2207 (1983)*.

Table 2-5. Nationwide Urban Equations Developed by the USGS

Equation	Chapter Equation Number
$UQ2 = 2.35A_s^{.41}SL^{.17}(RI2+3)^{2.04}(ST+8)^{-.65}(13-BDF)^{-.32}IA_s^{.15}RQ2^{.47}$	(2-8)
$UQ5 = 2.70A_s^{.35}SL^{.16}(RI2+3)^{1.86}(ST+8)^{-.59}(13-BDF)^{-.31}IA_s^{.11}RQ5^{.54}$	(2-9)
$UQ10 = 2.99A_s^{.32}SL^{.15}(RI2+3)^{1.75}(ST+8)^{-.57}(13-BDF)^{-.30}IA_s^{.09}RQ10^{.58}$	(2-10)
$UQ25 = 2.78A_s^{.31}SL^{.15}(RI2+3)^{1.76}(ST+8)^{-.55}(13-BDF)^{-.29}IA_s^{.07}RQ25^{.60}$	(2-11)
$UQ50 = 2.67A_s^{.29}SL^{.15}(RI2+3)^{1.74}(ST+8)^{-.53}(13-BDF)^{-.28}IA_s^{.06}RQ50^{.62}$	(2-12)
$UQ100 = 2.50A_s^{.29}SL^{.15}(RI2+3)^{1.76}(ST+8)^{-.52}(13-BDF)^{-.28}IA_s^{.06}RQ100^{.63}$	(2-13)
$UQ500 = 2.27A_s^{.29}SL^{.16}(RI2+3)^{1.86}(ST+8)^{-.54}(13-BDF)^{-.27}IA_s^{.05}RQ500^{.63}$	(2-14)

Equation	Chapter Equation Number

where:

UQ_T = Urban peak discharge for T-year recurrence interval, ft^3/s

A_s = Contributing drainage area, mi^2

SL = Main channel slope (measured between points that are 10 and 85 percent of main channel length upstream of site), ft/mi

RI2 = Rainfall intensity for 2-hour, 2-year recurrence, in/hr

ST = Basin storage (percentage of basin occupied by lakes, reservoirs, swamps, and wetlands), percent

BDF = Basin development factor (provides a measure of the hydraulic efficiency of the basin (see description in paragraph 2-3.3.2)

IA = Percentage of basin occupied by impervious surfaces

RQ_T = T-year rural peak flow

The basin development factor (BDF) is a highly significant parameter in the urban equations and provides a measure of the efficiency of the drainage basin and the extent of urbanization. It can be determined from drainage maps and field inspection of the basin. The basin is first divided into upper, middle, and lower thirds. Within each third of the basin, four characteristics must be evaluated and assigned a code of 0 or 1. The four characteristics are: channel improvements; channel lining (prevalence of impervious surface lining); storm drains or storm sewers; and curb and gutter streets.

With the curb and gutter characteristic, at least 50 percent of the partial basin must be urbanized or improved with respect to an individual characteristic to be assigned a code of 1. With four characteristics being evaluated for each third of the basin, complete development would yield a BDF of 12.

Example 2-4

Given: The following site characteristics:

- The site is located in Tulsa, Oklahoma.
- The drainage area is 3 square miles (mi^2)
- The mean annual precipitation is 38 inch
- Urban parameters (see Table 2-5 for parameter definition):

  SL = 53 ft/mi

  RI2 = 2.2 in/hr (see National Weather Service Technical Paper 40)

ST = 5

BDF = 7

IA = 35

Find: The 2-year urban peak flow.

Solution:

Step 1. Calculate the rural peak flow from the appropriate regional equation.

From Water-Resources Investigations Report 94-4002, the rural regression equation for Tulsa, Oklahoma, is:

$$RQ2 = 0.368A^{.59}P^{1.84} = 0.368(3)^{.59}(38)^{1.84} = 568 ft^3/s$$

Step 2. Calculate the urban peak flow using Equation 2-8.

$$UQ2 = 2.35A_s^{.41}SL^{.17}(RI2+3)^{2.04}(ST+8)^{.65}(13 \quad BDF)^{.32}IA_s^{.15}RQ2^{.47}$$

$$UQ2 = 2.35(3)^{.41}(53)^{.17}(2.2+3)^{2.04}(5+8)^{.65}(13 \quad 7)^{.32}(35)^{.15}(568)^{.47} = 747 ft^3/s$$

2-3.4 SCS TR-55 Peak Flow Method. The SCS (now known as NRCS) peak flow method calculates peak flow as a function of drainage basin area, potential watershed storage, and the time of concentration. An easy to use graphical approach to this method can be found in the TR-55 publication. While some equations are presented in this UFC, graphs, charts, and figures that easily solve the equations are found in TR-55. This rainfall-runoff relationship separates total rainfall into direct runoff, retention, and initial abstraction to yield the following equation for rainfall runoff:

$$Q_D = \frac{(P - 0.2S_R)^2}{P + 0.8S_R} \qquad (2\text{-}15)$$

where:

Q_D = depth of direct runoff, inch

P = depth of 24-hour precipitation, inch This information is available in most highway agency drainage manuals by multiplying the 24-hour rainfall intensity by 24 hour.

S_R = retention, inch

2-3.4.1 Empirical studies found that S_R is related to soil type, land cover, and the antecedent moisture condition of the basin. These are represented by the runoff curve number, CN, which is used to estimate S_R with this equation:

$$S_R = \left[\frac{1000}{CN} - 10 \right] \quad (2\text{-}16)$$

where:

CN = Curve number, listed in Table 2-6 for different land uses and hydrologic soil types. This table assumes average antecedent moisture conditions. For multiple land use/soil type combinations within a basin, use area weighing (see Example 2-1). Soil maps are generally available through the local jurisdiction or the NRCS. Soils are grouped into categories A through D based on soil characteristics. Soil Group A includes pervious sandy soils, while Soil Group D includes non-pervious rocks and clays. A complete description is provided in TR-55.

2-3.4.2 Peak flow is then estimated with Equation 2-17:

$$q_p = q_u A_k Q_D \quad (2\text{-}17)$$

where:

q_p = peak flow, ft^3/s

q_u = unit peak flow, $ft^3/s/mi^2/in.$

A_k = basin area, mi^2

Q_D = runoff depth, in.

The unit peak flow, q_u, is calculated with the equations or graphical methods presented in TR-55.

2-3.4.3 The concept of initial abstraction is important to the TR-55 method and can be calculated with the following equation:

$$I_a = 0.2 S_R \quad (2\text{-}18)$$

I_a = initial abstraction, in.

Table 2-6. Runoff Curve Numbers for Urban Areas
(Average Watershed Condition, $I_a = 0.2S_R$)

Land Use Description		Curve Numbers for Hydrologic Soil Group			
		A	B	C	D
Fully developed urban areas (vegetation established)					
Lawns, open spaces, parks, golf courses, cemeteries, etc.					
Good condition: grass cover on 75 percent or more of the area		39	61	74	80
Fair condition: grass cover on 50 to 75 percent of the area		49	69	79	84
Poor condition: grass cover on 50 percent or less of the area		68	79	86	89
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)					
Streets and roads		98	98	98	98
Paved with curbs and storm sewers (excluding right-of-way)		98	98	98	98
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Paved with open ditches (including right-of-way)		83	89	92	93
	Average % impervious				
Commercial and business areas	85	89	92	94	95
Industrial districts	72	81	88	91	93
Row houses, town houses, and residential with lot sizes 0.125 acre or less	65	77	85	90	92
Residential: average lot size					
0.25 acre	38	61	75	83	87
0.33 acre	30	57	72	81	86
0.50 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas (no vegetation established)					
Newly graded area		77	86	91	94
Western desert urban areas:					
Natural desert landscaping (pervious area only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2 inch sand or gravel mulch and basin borders)		96	96	96	96
Cultivated agricultural land					
Fallow					
Straight row or bare soil		77	86	91	94
Conservation tillage - Poor		76	85	90	93
Conservation tillage - Good		74	83	88	90

2-3.4.4 When ponding or swampy areas occur in a basin, considerable runoff may be retained in temporary storage. The peak flow should be reduced to reflect the storage with Equation 2-19:

$$q_a = q_p F_p \quad (2\text{-}19)$$

where:

q_a = adjusted peak flow, ft^3/s

F_p = adjustment factor, listed in Table 2-7

Table 2-7. Adjustment Factor (Fp) for Pond and Swamp Areas that are Spread Throughout the Watershed

Area of Pond or Swamp (percent)	F_p
0.0	1.00
0.2	0.97
1.0	0.87
3.0	0.75
5.0	0.72

This method has a number of limitations that can have an impact on the accuracy of estimated peak flows:

- The basin should have fairly homogeneous *CN* values.
- The *CN* should be 40 or greater.
- The t_c should be between 0.1 and 10 hour.
- I_a /*P* should be between 0.1 and 0.5.
- The basin should have one main channel or branches with nearly equal times of concentration.
- Neither channel nor reservoir routing can be incorporated.
- F_p is applied only for ponds and swamps that are not in the t_c flow path.

Example 2-5

Given: These physical and hydrologic conditions:

- 1.27 mi^2 of fair condition open space and 1.08 mi^2 of paved surface (airfield)

- Negligible pond and swamp land
- Hydrologic soil type C
- Average antecedent moisture conditions
- Time of concentration is 0.8 hour.
- 24-hour, Type II rainfall distribution, 10-year rainfall of 2.8 inch

Find: The 10-year peak flow using the TR-55 peak flow method.

Solution:

Step 1 Calculate the composite *CN* using Table 2-6 and Equation 2-2.

$$CN = \sum \frac{(CN_x A_x)}{A} = \frac{[1.27(79) + 1.08(98)]}{(1.27 + 1.08)} = 88$$

Step 2. Calculate the retention, S_R, using Equation 2-16.

$$S_R = \left(\frac{1000}{CN} - 10\right) = \left[\left(\frac{1000}{88}\right) - 10\right] = 1.36 \ \textit{in.}$$

Step 3. Calculate the depth of direct runoff, Q_D, using Equation 2-15.

$$Q_D = \frac{(P - 0.2S_R)^2}{(P + 0.8S_R)} = \frac{[2.8 - 0.2(1.36)]^2}{[2.8 + 0.8(1.36)]} = 1.64 \ \textit{in.}$$

$Q_D$is direct runoff, which means the amount of rainfall available for runoff after losses. Using the direct runoff value and the chart for unit peak discharge found in Chapter 4 of TR-55, the peak discharge can be calculated.

Step 4. Determine I_a/P from $I_a = 0.2S_R$.

$$I_a = 0.2(1.36) = 0.272$$

$$\frac{I_a}{P} = \frac{0.272}{2.8} = 0.097 \ \textit{say} \ 0.10$$

Step 5. Calculate peak flow using Equation 2-17.

$$q_p = q_u A_k Q_D \qquad = (410)(2.35)(1.64) = \underline{1580 \ ft^3 / s}$$

2-4 DEVELOPMENT OF DESIGN HYDROGRAPHS. This section discusses methods used to develop a design hydrograph. Hydrograph methods can be computationally involved, so computer programs such as HEC-RAS and HMS (Hydrologic Modeling System), TR-20 (based on SCS Technical Release 20), TR-55,

and HYDRAIN are used almost exclusively to generate runoff hydrographs. Hydrographic analysis is performed when flow routing is important, such as in the design of storm water detention, other water quality facilities, and pump stations. Hydrographs can also be used to evaluate flow routing through large storm drainage systems to more precisely reflect flow peaking conditions in each segment of complex systems. See Chapter 12 of this UFC for more information on computer programs for analysis of urban hydrology and hydraulics. HEC-22 contains additional information on hydrographic methods.

2-4.1 SCS Tabular Hydrograph. The SCS developed a tabular method that is used to estimate partial composite flood hydrographs at any point in a watershed. This method is generally applicable to small, nonhomogeneous areas that may be beyond the limitations of the Rational Method. It is applicable for estimating the effects of land use change in a portion of the watershed as well as estimating the effects of proposed structures.

2-4.1.1 The SCS tabular hydrograph method is based on a series of unit discharge hydrographs expressed in cubic feet of discharge per second per square mile of watershed per inch of runoff. A series of these unit discharge hydrographs are provided in TR-55 for a range of subarea times of concentration (T_c) from 0.1 to 2 hour, and reach travel times (T_{ti}) from 0 to 3 hour. One such tabulation is provided in Table 2-8.

Table 2-8. Tabular Hydrograph Unit Discharges for Type II Rainfall Distributions (English Units)

Tabular hydrograph unit discharges (csm/in) for type II rainfall distributions (Taken from SCS TR-55 Manual)

TRVL TIME (HR)	HYDROGRAPH TIME (HOURS)																														
	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0
IA/P = 0.10	* * * TC =0.5 HR * * *																														
0.0	17	23	32	57	94	170	308	467	529	507	402	297	226	140	96	74	61	53	47	41	36	32	29	26	23	21	20	19	16	14	12	0
.10	16	22	30	51	80	140	252	395	484	499	434	343	265	162	108	80	65	55	49	42	36	33	29	26	23	21	20	19	16	14	12	0
.20	14	19	25	38	47	69	116	207	332	434	477	449	378	238	149	101	77	62	53	45	39	34	30	27	24	22	20	19	17	14	12	0
.30	13	18	24	35	43	60	97	170	278	382	446	448	401	270	171	114	83	66	56	46	40	34	31	27	24	22	20	19	17	15	12	0
.40	12	15	21	29	33	40	53	83	141	233	332	408	434	361	243	157	107	79	64	51	43	36	32	28	25	22	21	20	17	15	12	0
.50	11	15	20	28	31	37	48	71	118	194	286	367	412	378	271	178	119	86	68	53	44	37	32	29	25	23	21	20	17	15	12	0
.75	9	11	14	19	21	24	27	31	37	49	74	118	182	319	374	328	244	169	117	76	56	43	35	31	28	25	22	21	18	16	12	1
1.0	7	9	12	16	17	19	21	24	27	32	40	55	83	188	309	359	322	245	172	102	68	49	38	32	29	26	23	21	19	16	12	1
1.5	5	7	8	11	12	13	14	15	17	19	21	23	27	43	89	175	269	322	309	225	140	77	49	38	32	29	25	23	20	17	13	5
2.0	3	4	6	7	8	8	9	10	10	11	12	14	15	18	23	35	65	123	202	297	280	181	88	52	39	33	29	26	21	19	14	10
2.5	2	3	4	5	5	6	6	7	7	8	9	9	10	12	15	18	24	36	66	150	244	278	171	87	52	39	33	29	23	20	15	11
3.0	1	1	2	3	3	4	4	4	5	5	6	6	7	8	9	11	13	16	20	37	86	198	263	182	96	56	40	33	26	21	16	11
IA/P = 0.30	* * * TC =0.5 HR * * *																														
0.0	0	0	0	1	9	53	157	314	433	439	379	299	237	159	118	95	81	71	65	56	50	46	42	38	34	31	30	28	25	22	19	0
.10	0	0	0	0	1	6	37	117	248	372	416	391	330	218	150	113	92	79	70	60	53	47	43	39	35	32	30	29	26	22	19	0
.20	0	0	0	0	1	4	26	87	194	313	382	388	349	244	167	122	97	82	72	62	54	48	43	39	35	32	30	29	26	22	19	0
.30	0	0	0	0	0	0	3	19	64	151	259	341	372	316	223	156	117	94	80	67	58	50	45	41	36	33	31	29	26	23	19	0
.40	0	0	0	0	0	0	2	13	47	116	211	298	354	328	245	172	127	100	83	69	59	51	45	41	37	33	31	29	26	23	19	0
.50	0	0	0	0	0	0	0	1	9	34	89	170	255	341	303	225	161	120	96	76	64	54	47	42	38	34	31	30	27	24	19	0
.75	0	0	0	0	0	0	0	1	4	14	41	89	152	270	305	268	207	155	118	87	70	57	48	44	39	35	32	30	27	24	19	0
1.0	0	0	0	0	0	0	0	0	0	0	2	7	22	98	212	295	285	237	181	120	88	67	53	46	42	38	34	31	28	25	19	2
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30	95	183	249	265	217	152	96	66	53	46	41	37	34	30	26	20	8
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	18	59	125	221	245	182	105	69	54	47	42	38	32	28	22	16
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	21	84	174	230	172	103	69	54	46	42	34	30	23	18
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	56	157	217	163	101	68	53	46	37	31	25	18
IA/P = 0.50	* * * TC =0.5 HR * * *																														
0.0	0	0	0	0	0	0	2	26	89	170	217	229	200	179	144	119	104	93	85	78	70	64	59	55	51	46	43	41	40	36	32	28	0
.10	0	0	0	0	0	0	0	1	18	65	135	190	216	205	170	137	115	101	91	83	74	67	61	56	52	47	44	42	40	36	32	28	0
.20	0	0	0	0	0	0	0	1	12	47	106	162	198	203	178	145	121	105	94	85	76	68	61	57	52	48	44	42	40	37	32	28	0
.30	0	0	0	0	0	0	0	0	1	8	34	82	135	177	194	168	139	117	102	92	80	71	63	58	54	49	45	43	41	37	33	28	0
.40	0	0	0	0	0	0	0	0	0	6	25	63	111	155	189	174	146	122	106	94	82	73	64	58	54	50	45	43	41	37	33	28	0
.50	0	0	0	0	0	0	0	0	0	4	18	48	90	133	184	177	152	128	110	97	84	74	65	59	55	50	45	43	41	38	33	28	0
.75	0	0	0	0	0	0	0	0	0	1	7	22	47	80	142	169	164	144	124	108	91	79	68	61	56	51	47	44	42	38	34	28	0
1.0	0	0	0	0	0	0	0	0	0	0	0	1	3	11	51	112	155	166	154	134	109	91	76	65	59	54	49	45	43	39	35	28	2
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	50	97	136	154	145	121	95	75	64	58	54	49	45	41	37	29	10
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	18	47	86	134	146	125	94	75	64	58	53	49	42	39	31	21
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	11	44	95	140	127	97	77	65	58	54	45	41	33	26
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	29	86	135	122	95	76	65	58	49	43	35	27
RAINFALL TYPE = II	* * * TC = 0.5 HR * * *																														

Copied from TR-55[13]

2-4.1.2 The hydrograph ordinates for a specific time are determined by multiplying the runoff depth, the subarea, and the tabular hydrograph unit discharge value for that time as determined from the tables. See Equation 2-20:

$$q = q_t A Q_D \quad (2\text{-}20)$$

where:

q = hydrograph ordinate for a specific time, ft^3/s

q_t = tabular hydrograph unit discharge from appropriate table, $ft^3/s/mi^2/in$

A = sub-basin drainage area, mi^2

Q_D = runoff depth, inch

2-4.1.3 The TR-55 publication provides a detailed description of the tabular hydrograph method. In developing the tabular hydrograph, the watershed is divided into homogeneous subareas. Input parameters required for the procedure include: (1) the 24-hour rainfall amount, inch, (2) an appropriate rainfall distribution (I, IA, II, or III), (3) the runoff curve number, CN, (4) the time of concentration, T_c, (5) the travel time, T_{ti}, and (6) the drainage area, mi^2, for each subarea. The 24-hour rainfall amount, rainfall distribution, and the runoff curve number are used in Equations 2-15 and 2-16 to determine the runoff depth in each subarea. The product of the runoff depth times drainage is multiplied times each tabular hydrograph value to determine the final hydrograph ordinate for a particular subarea. Subarea hydrographs are then added to determine the final hydrograph at a particular point in the watershed. Example 2-6 provides an illustration of the use of the tabular hydrograph method.

2-4.1.4 These assumptions and limitations are inherent in the tabular method:

- The total area should be less than 2000 acres. Typically, subareas are far smaller than this because the subareas should have fairly homogeneous land use.
- The travel time, T_{ti}, is less than or equal to 3 hour.
- The time of concentration, t_c, for any given subarea is less than or equal to 2 hour.
- The drainage areas of individual subareas differ by less than a factor of 5.

Example 2-6

Given: A watershed with three subareas. Subareas 1 and 2 both drain into Subarea 3. Consider the basin data for the three subareas:

Subarea	Area (mi^2)	t_c (hr)	T_{ti} (hr)	CN
1	0.386	0.5	---	75
2	0.193	0.5	---	65
3	0.927	0.5	0.20	70

A time of concentration, t_c, of 0.5 hour, an I_a/P value of 0.10, and a Type II storm distribution are assumed for convenience in all three subareas. The travel time applies to the reach for the corresponding area; therefore, the travel time, T_{ti}, in Subarea 3 will apply to the tabular hydrographs routed from Subareas 1 and 2.

Find: The outlet hydrograph for a 5.9-inch storm.

Solution:

Step 1. Calculate the retention for each of the subareas using Equation 2-16.

$$S_R = \left(\frac{1000}{CN} - 10\right)$$

Subarea 1. $$S_R = \left(\frac{1000}{75} - 10\right) = 3.33 \text{ in.}$$

Subarea 2. $$S_R = \left(\frac{1000}{65} - 10\right) = 5.38 \text{ in.}$$

Subarea 3. $$S_R = \left(\frac{1000}{70} - 10\right) = 4.29 \text{ in.}$$

Step 2. Calculate the depth of runoff for each of the subareas using Equation 2-15.

$$Q_D = \frac{(P - 0.2S_R)^2}{P + 0.8S_R}$$

Subarea 1. $$Q_D = \frac{[5.9 - 0.2(85)]^2}{[5.9 + 0.8(85)]} = 3.2 \text{ in.}$$

Subarea 2. $$Q_D = \frac{[5.9 - 0.2(137)]^2}{[5.9 + 0.8(137)]} = 2.28 \text{ in.}$$

Subarea 3. $$Q_D = \frac{[5.9 - 0.2(109)]^2}{[5.9 + 0.8(109)]} = 2.72 \text{ in.}$$

Step 3. Calculate ordinate values using Equation 2-20: $q = q_t A Q_D$.

Multiply the appropriate tabular hydrograph values (q_t) from Table 2-8 by the subarea areas (A) and runoff depths (Q) and sum the values for each time to give the composite hydrograph at the end of Subarea 3. For example, the hydrograph flow contributed from Subarea 1 (t_c = 0.5 hour, T_{ti} = 0.20 hour) at 12.0 hour is calculated as the product of the tabular value, the area, and the runoff depth, or 47 (0.386)3.2 = 58 ft^3/s.

Table 2-9 lists the subarea and composite hydrographs. Please note that this example does not use every hydrograph time ordinate.

Table 2-9. Subarea and Composite Hydrographs

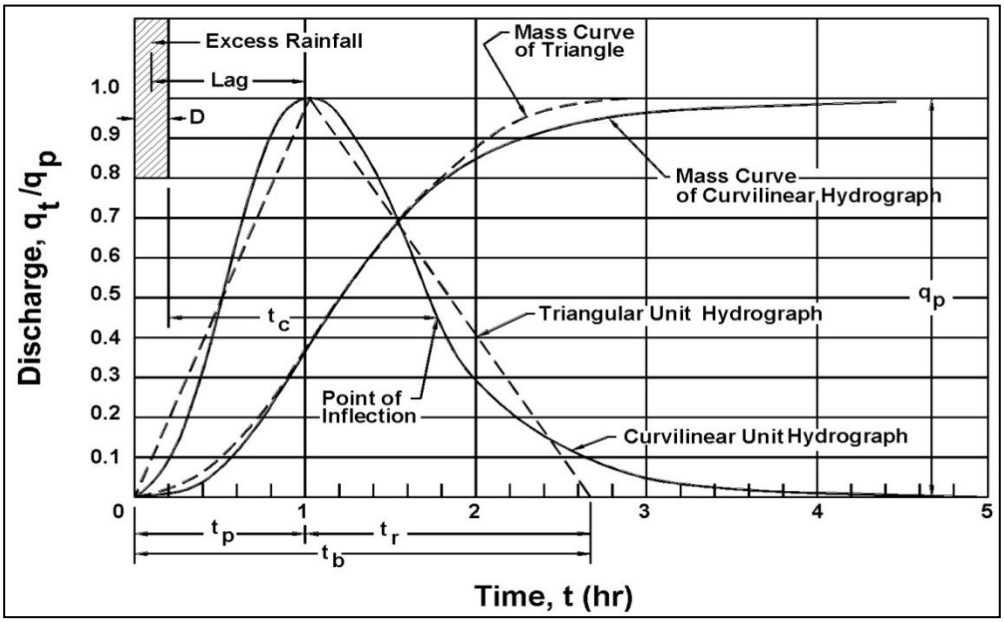
	Flow at Specified Time (ft^3/s)										
Subarea	**11 (hr)**	**12 (hr)**	**12.2 (hr)**	**12.4 (hr)**	**12.5 (hr)**	**12.6 (hr)**	**12.8 (hr)**	**13 (hr)**	**14 (hr)**	**16 (hr)**	**20 (hr)**
1	17	58	143	410	536	584	466	294	65	33	17
2	6	21	51	146	191	210	166	105	23	12	6
3	43	238	778	1337	1281	1016	571	354	119	66	35
Total	66	317	972	1893	2008	1815	1203	753	207	111	58

2-4.2 SCS Synthetic Unit Hydrograph (UH). The SCS developed a synthetic UH procedure that has been widely used in conservation and flood control work. The UH used by this method is based upon an analysis of a large number of natural UHs from a broad cross section of geographic locations and hydrologic regions.

2-4.2.1 This method is easy to apply. The only parameters that need to be determined are the peak discharge and the time to peak (t_p). A standard UH is constructed using these two parameters.

2-4.2.2 For the development of the SCS UH, the curvilinear UH is approximated by a triangular UH that has similar characteristics. Figure 2-4 shows a comparison of the two dimensionless UHs. Even though the time base (t_b) of the triangular UH is 8/3 of the time to peak, t_p, and the t_b of the curvilinear UH is five times the t_p, the area under the two UH types is the same.

Figure 2-4. Dimensionless Curvilinear SCS Synthetic Unit Hydrograph and Equivalent Triangular Hydrograph



2-4.2.3 The area under a hydrograph equals the volume of direct runoff, Q_D, which is 1 inch for a UH. The peak flow is calculated using Equation 2-21:

$$q_p = \frac{K_c A_k Q_D}{t_p} \qquad (2\text{-}21)$$

where:

q_p = peak flow, ft^3/s

A_k = drainage area, mi^2

Q_D = volume of direct runoff (= 1 for unit hydrograph), inch

t_p = time to peak, hour

K_c = 483.5

2-4.2.4 The constant 483.5 reflects a UH that has 3/8 of its area under the rising limb. For mountainous watersheds, the fraction could be expected to be greater than 3/8, and therefore the constant may be near 603.5. For flat, swampy areas, the constant may be on the order of 301.7.

Time to peak, t_p, can be expressed in terms of time of concentration, t_c, as in Equation 2-22:

$$t_p = \frac{2}{3} t_c \tag{2-22}$$

Expressing q_p in terms of t_c rather than t_p yields:

$$q_p = \frac{K_c A_k Q_D}{t_c} \tag{2-23}$$

where K_c = 725.25

Example 2-7

Given: The following watershed conditions:

- The watershed is commercially developed.
- Watershed area = 0.463 mi^2
- Time of concentration, t_c, = 1.34 hour
- Q_D = 1.0 inch

Find: The triangular SCS UH.

Solution:

Step 1. Calculate peak flow using Equation 2-23.

$$q_p = \frac{K_c A_k Q_D}{t_c}$$

$$= \frac{725.25\ (0.463)\ (1.0)}{1.34}$$

$$= 250.59\ ft^3/s$$

Step 2. Calculate the time to peak, t_p, using Equation 2-22.

$$t_p = \frac{2}{3} t_c = \frac{2}{3}(1.34) = 0.893\ \text{hr}$$

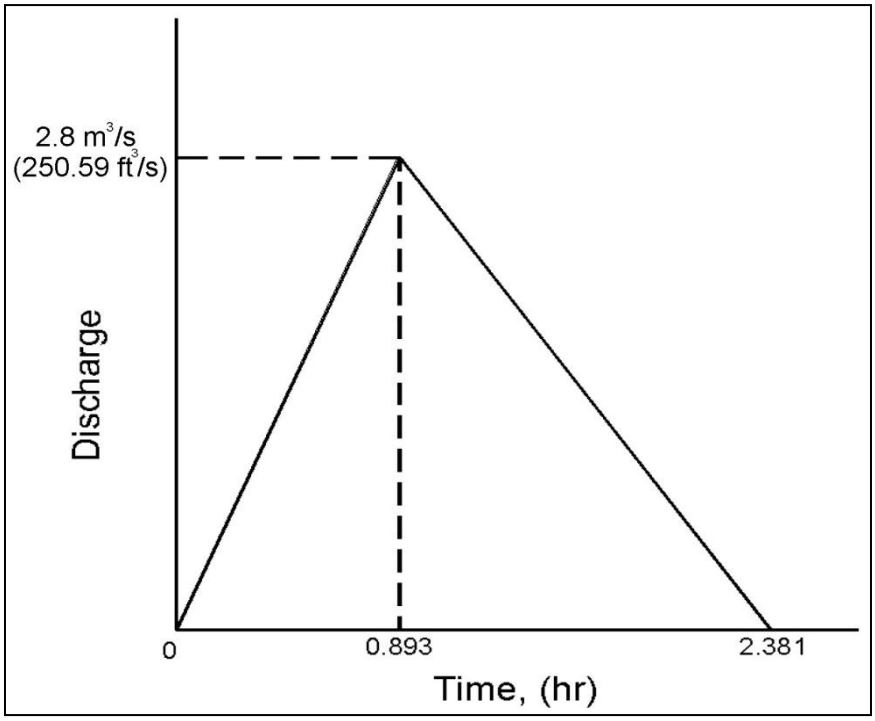
Step 3. Calculate the time base, t_b, of the UH.

Step 4. Draw the resulting triangular UH (see Figure 2-5).

$$t_b = \frac{8}{3}(0.893) = 2.38 \text{ hr}$$

NOTE: The curvilinear SCS UH is more commonly used and is incorporated into many computer programs.

Figure 2-5. Example: The Triangular Unit Hydrograph



CHAPTER 3

PAVEMENT SURFACE DRAINAGE

3-1 OVERVIEW. Effective drainage of pavements is essential to the maintenance of the service level and to traffic safety. Water on the pavement can interrupt traffic, reduce skid resistance, increase potential for hydroplaning, limit visibility due to splash and spray, and cause difficulty in steering a vehicle when the wheels encounter puddles.

Pavement drainage requires consideration of surface drainage, gutter flow, and inlet capacity. The design of these elements is dependent on storm frequency and the allowable spread of storm water on the pavement surface. This chapter presents design guidance for the design of these elements. Most of the information presented here is taken directly from the FHWA's HEC-22 and AASHTO's *Model Drainage Manual*. The charts referenced throughout this chapter can be found in the HEC-22.

3-2 DESIGN FREQUENCY AND SPREAD. Two of the more significant variables considered in the design of pavement drainage are the frequency of the design runoff event and the allowable spread of water on the pavement. A related consideration is the use of an event of lesser frequency to check the drainage design.

Spread and design frequency are not independent. The implications of the use of a criterion for spread of one-half of a traffic lane are considerably different for one design frequency than for a lesser frequency. It also has different implications for a low-traffic, low-speed roadway than for a higher classification roadway or airport runways. These subjects are central to the issue of pavement drainage and important to highway and runway safety.

3-2.1 Selection of Design Frequency and Design Spread

3-2.1.1 The objective of storm drainage design is to provide for safe passage of vehicles during the design storm event. The design of a drainage system for a curbed pavement section is to collect runoff in the gutter and convey it to pavement inlets in a manner that provides reasonable safety for traffic and pedestrians at a reasonable cost. As spread increases, the risks of traffic accidents and delays, and the nuisance and possible hazard to pedestrian traffic increase.

3-2.1.2 The allowable spread for airfields, runways, taxiways, and aprons was defined in Chapter 2, section 2-2.4, Design Storm Frequency.

3-2.1.3 Spread on traffic lanes can be tolerated to greater widths where traffic volumes and speeds are low. Spreads of one-half of a traffic lane are usually considered a minimum type design for DOD roads.

3-2.1.4 The selection of design criteria for intermediate types of facilities may be the most difficult. For example, some arterials with relatively high traffic volumes and speeds may not have shoulders that will convey the design runoff without encroaching

on the traffic lanes. In these instances, an assessment of the relative risks and costs of various design spreads may be helpful in selecting appropriate design criteria.

3-2.1.5 The recommended design frequency for depressed sections and underpasses where ponded water can be removed only through the storm drainage system is a 50-year frequency event. The use of a lesser frequency event, such as a 100-year storm, to assess hazards at critical locations where water can pond to appreciable depths is commonly referred to as a check storm or check event.

3-2.2 Selection of Check Storm and Spread

3-2.2.1 A check storm should be used any time runoff could cause unacceptable flooding during less frequent events. Also, inlets should always be evaluated for a check storm when a series of inlets terminates at a sag vertical curve where ponding to hazardous depths could occur.

3-2.2.2 The frequency selected for the check storm should be based on the same considerations used to select the design storm, i.e., the consequences of spread exceeding that chosen for design and the potential for ponding. Where no significant ponding can occur, check storms are usually unnecessary.

3-2.2.3 Criteria for spread during the check event are: (1) one lane open to traffic during the check storm event, and (2) one lane free of water during the check storm event. These criteria differ substantively, but each sets a standard by which the design can be evaluated.

3-3 SURFACE DRAINAGE. When rain falls on a sloped pavement surface, it forms a thin film of water that increases in thickness as it flows to the edge of the pavement. Factors that influence the depth of water on the pavement include the length of flow path, surface texture, surface slope, and rainfall intensity. As the depth of water on the pavement increases, the potential for vehicular hydroplaning increases. For the purposes of highway drainage, this section provides information on hydroplaning and design guidance for these drainage elements:

- Longitudinal pavement slope
- Cross or transverse pavement slope
- Curb and gutter design
- Roadside and median ditches

Note that the guidance for transverse and longitudinal slopes for military airfields is in UFC 3-260-01 and for FAA facilities, AC 150/5300-13.

3-3.1 Longitudinal Slope. Experience has shown that the recommended minimum values of roadway longitudinal slope given in the AASHTO Green Book, *A Policy on*

Geometric Design of Highways and Streets, will provide safe, acceptable pavement drainage. In addition, follow these general guidelines:

- A minimum longitudinal gradient is more important for a curbed pavement than for an uncurbed pavement since the water is constrained by the curb. However, flat gradients on uncurbed pavements can lead to a spread problem if vegetation is allowed to build up along the pavement edge.

- Desirable gutter grades should not be less than 0.5 percent for curbed pavements, with an absolute minimum of 0.3 percent. Minimum grades can be maintained in very flat terrain by use of a rolling profile, or by warping the cross slope to achieve rolling gutter profiles.

- To provide adequate drainage in sag vertical curves, a minimum slope of 0.3 percent should occur within 50 feet of the low point of the curve. This is accomplished where the length of the curve in feet divided by the algebraic difference in grades in percent (*K*) is equal to or less than 167. This is represented as:

$$K = \frac{L}{G_2 - G_1} \tag{3-1}$$

where:

K = vertical curve constant, ft/percent

L = horizontal length of curve, ft

G_i = grade of roadway, percent

3-3.2 Cross (Transverse) Slope. An acceptable range of roadway cross slopes is specified in UFC 3-250-01FA. These cross slopes are a compromise between the need for reasonably steep cross slopes for drainage and relatively flat cross slopes for driver comfort and safety. These cross slopes represent standard practice.

3-3.2.1 Cross slopes of 2 percent have little effect on driver effort in steering or on friction demand for vehicle stability. Use of a cross slope steeper than 2 percent on pavements with a central crown line is not desirable. In areas of intense rainfall, a somewhat steeper cross slope (2.5 percent) may be used to facilitate drainage.

3-3.2.2 Additional guidelines related to cross slope are:

- Although not widely encouraged, inside lanes can be sloped toward the median if conditions warrant.

- Median areas should not be drained across travel lanes.

- The number and length of flat pavement sections in cross slope transition areas should be minimized. Consideration should be given to increasing cross slopes in sag vertical curves, crest vertical curves, and in sections of flat longitudinal grades.

- Shoulders should be sloped to drain away from the pavement, except with raised, narrow medians and superelevations.

3-3.3 Curbs and Gutters. Curbs are normally used at the outside edge of pavements for low-speed, highway facilities, and in some instances adjacent to shoulders on moderate to high-speed facilities. They serve several purposes:

- They contain the surface runoff within the roadway and away from adjacent properties.

- The prevent erosion on fill slopes.

- They provide pavement delineation.

- The enable the orderly development of property adjacent to the roadway.

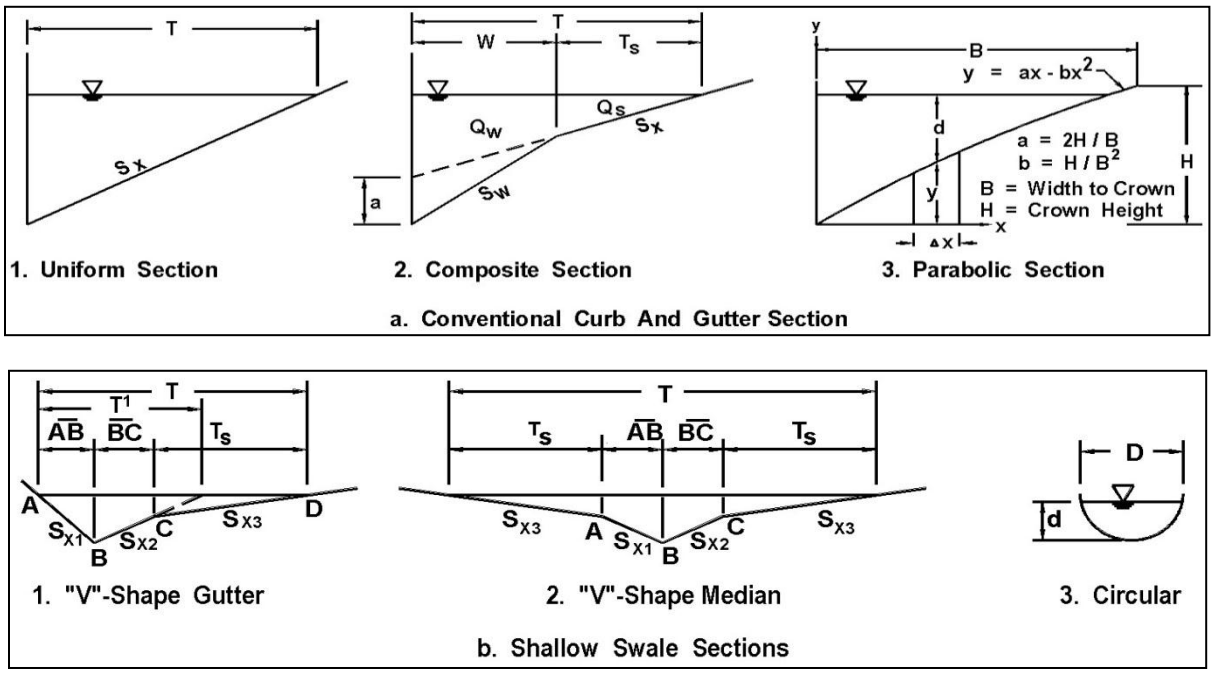
3-3.3.1 Gutters formed in combination with curbs are available in 12- through 39-inch widths. Gutter cross slopes may be the same as that of the pavement or may be designed with a steeper cross slope, usually 1 in/ft steeper than the shoulder or parking lane (if used). AASHTO geometric guidelines state that an 8 percent slope is a common maximum cross slope.

3-3.3.2 A curb and gutter combination forms a triangular channel that can convey runoff equal to or less than the design flow without interruption of the traffic. When a design flow occurs, there is a spread or widening of the conveyed water surface. The water spreads to include not only the gutter width, but also parking lanes or shoulders and portions of the traveled surface.

3-3.3.3 In general, curbs and gutters are not permitted to interrupt surface runoff along a taxiway or runway. The runoff must be allowed unimpeded travel transversely off the runway and then directly by the shortest route across the turf to the area inlets. Inlets spaced throughout the paved apron construction must be placed at proper intervals and in well-drained depressed locations.

3-3.3.4 Spread is what concerns the hydraulic engineer in curb and gutter flow. The distance of the spread, *T*, is measured perpendicular to the curb face to the extent of the water on the roadway and is shown in Figure 3-1. Limiting this width becomes a very important design criterion and will be discussed in detail in section 3-4.

Figure 3-1. Typical Gutter Sections



3-3.3.5 Where practical, runoff from cut slopes and other areas draining toward the roadway should be intercepted before it reaches the highway. By doing so, the deposition of sediment and other debris on the roadway as well as the amount of water that must be carried in the gutter section will be minimized. Where curbs are not needed for traffic control, shallow ditch sections at the edge of the roadway pavement or shoulder offer advantages over curbed sections by providing less of a hazard to traffic than a near-vertical curb and by providing hydraulic capacity that is not dependent on spread on the pavement. These ditch sections are particularly appropriate where curbs have historically been used to prevent water from eroding fill slopes.

3-3.4 Roadside and Median Channels

3-3.4.1 Roadside channels are commonly used with uncurbed roadway sections to convey runoff from the highway pavement and from areas that drain toward the highway. Due to right-of-way limitations, roadside channels cannot be used on most urban arterials.

3-3.4.2 They can be used in cut sections, depressed sections, and other locations where sufficient right-of-way is available and driveways or intersections are infrequent.

3-3.4.3 To prevent drainage from the median areas from running across the travel lanes, slope median areas and inside shoulders to a center swale. This design is particularly important for high speed facilities and for facilities with more than two lanes of traffic in each direction.

3-4 FLOW IN GUTTERS. A pavement gutter is defined as a section of pavement

adjacent to the roadway that conveys water during a storm runoff event. It may include a portion or all of a travel lane. As illustrated in Figure 3-1, gutter sections can be categorized as conventional or shallow swale type. Conventional curb and gutter sections usually have a triangular shape, with the curb forming the near-vertical leg of the triangle. Conventional gutters may have a straight cross slope (Figure 3-1, a.1), a composite cross slope where the gutter slope varies from the pavement cross slope (Figure 3-1, a.2), or a parabolic section (Figure 3-1, a.3). Shallow swale gutters typically have V-shaped or circular sections as illustrated in Figure 3-1, b.1, b.2, and b.3, respectively, and are often used in paved median areas on roadways with inverted crowns.

3-4.1 Capacity Relationship

3-4.1.1 Gutter flow calculations are necessary to establish the spread of water on the shoulder, parking lane, or pavement section. A modification of Manning's equation can be used for computing flow in triangular channels. The modification is necessary because the hydraulic radius in the equation does not adequately describe the gutter cross section, particularly where the top width of the water surface may be more than 40 times the depth at the curb. To compute gutter flow, Manning's equation is integrated for an increment of width across the section. The resulting equation is:

$$Q = \frac{0.56}{n} S_x^{1.67} S_L^{0.5} T^{2.67} \tag{3-2}$$

or in terms of T

$$T = \left(\frac{Qn}{0.56\ S_x^{1.67} S_L^{0.5}} \right)^{0.375} \tag{3-2}$$

where:

n = Manning's coefficient (Table 3-1)

Q = flow rate, ft^3/s

T = width of flow (spread), ft

S_x = cross slope, ft/ft

S_L = longitudinal slope, ft/ft

Equation 3-2 neglects the resistance of the curb face since this resistance is negligible.

Table 3-1. Manning's *n* for Street and Pavement Gutters

Type of Gutter or Pavement	Manning's *n*
Concrete gutter, troweled finish	0.012
Asphalt Pavement: Smooth texture Rough texture	 0.013 0.016
Concrete gutter-asphalt pavement: Smooth Rough	 0.013 0.015
Concrete pavement: Float finish Broom finish	 0.014 0.016
For gutters with small slope, where sediment may accumulate, increase above values of *n* by	0.02
Reference: U.S. Department of Transportation (USDOT), FHWA, Hydraulic Design Series No. 3 (HDS-3)	

3-4.1.2 Spread on the pavement and flow depth at the curb are often used as criteria for spacing pavement drainage inlets. Charts 1A and 1B in Appendix B are nomographs for solving Equation 3-2. These charts can be used for either criterion with the relationship:

$$d = TS_x \tag{3-3}$$

where:

d = depth of flow, ft

Chart 1 can be used for a direct solution of gutter flow where Manning's *n* value is 0.016. For other values of *n*, divide the value of Q_n by *n*. Instructions for use and an example problem solution are provided on the chart.

3-4.2 Conventional Curb and Gutter Sections. Conventional gutters begin at the inside base of the curb and usually extend from the curb face toward the roadway centerline a distance of 1.0 to 3.0 ft. As illustrated in Figure 3-1, gutters can have uniform, composite, or curved sections. Uniform gutter sections have a cross-slope that is equal to the cross-slope of the shoulder or travel lane adjacent to the gutter. Gutters having composite sections are depressed in relation to the adjacent pavement slope. That is, the paved gutter has a cross-slope that is steeper than that of the adjacent pavement. This concept is illustrated in Example 3-1. Curved gutter sections are sometimes found along older city streets or highways with curved pavement sections. Procedures for computing the capacity of curb and gutter sections follow.

3-4.2.1 **Conventional Gutters of Uniform Cross Slope.** The nomograph in Chart 1 solves Equation 3-2 for gutters having triangular cross sections. Example 3-1 illustrates its use for the analysis of conventional gutters with a uniform cross slope.

Example 3-1

Given: Gutter section illustrated in Figure 3-1 a.1.

S_L = 0.010 ft/ft

S_x = 0.020 ft/ft

n = 0.016

Find: (1) Spread at a flow of 1.8 ft^3/s

(2) Gutter flow at a spread of 8.2 ft

Solution (1):

Step 1. *Compute the spread, T, using Equation 3-2 or Chart 1.*

$$T = \left[\frac{(Qn)}{((0.56)S_x^{1.67}S_L^{0.5})}\right]^{0.375}$$

$$T = \left[\frac{(1.8)(0.016)}{\{(0.56)(0.020)^{1.67}(0.010)^{0.5}\}}\right]^{0.375}$$

T = 9.0 ft

Solution (2):

Step 1. *Using Equation 3-2 or Chart 1 with T = 8.2 ft and the information given above, determine Q_n.*

$$Q_n = (0.56)S_x^{1.67}S_L^{0.5}T^{2.67}$$

$$Q_n = (0.56)(0.020)^{1.67}(0.010)^{0.5}(8.2)^{2.67}$$

Q_n = 0.22 ft^3/s

Step 2. *Compute Q from Q_n determined in Step 1.*

$$Q = \frac{Qn}{n}$$

$$Q = \frac{0.22}{.016}$$

$$Q = 1.4 \text{ ft}^3/\text{s}$$

3-4.2.2 **Composite Gutter Sections.** The design of composite gutter sections requires consideration of flow in the depressed segment of the gutter, Q_w. Equation 3-4, displayed graphically as Chart 2 in Appendix B, is provided for use with Equations 3-5 and 3-6 and Chart 1 to determine the flow in a width of gutter in a composite cross section, *W*, less than the total spread, *T*. The procedure for analyzing composite gutter sections is demonstrated in Example 3-2.

$$E_o = \frac{1}{\left\{1+\left[\frac{\left(\frac{S_w}{S_x}\right)}{\left(1+\frac{\left(\frac{S_w}{S_x}\right)}{\left(\frac{T}{W}-1\right)}\right)^{2.67}}-1\right]\right\}} \quad (3\text{-}4)$$

$$Q_w = Q - Q_s \quad (3\text{-}5)$$

$$Q = \frac{Q_s}{(1-E_o)} \quad (3\text{-}6)$$

where:

Q_w = flow rate in the depressed section of the gutter, ft^3/s

Q = gutter flow rate, ft^3/s

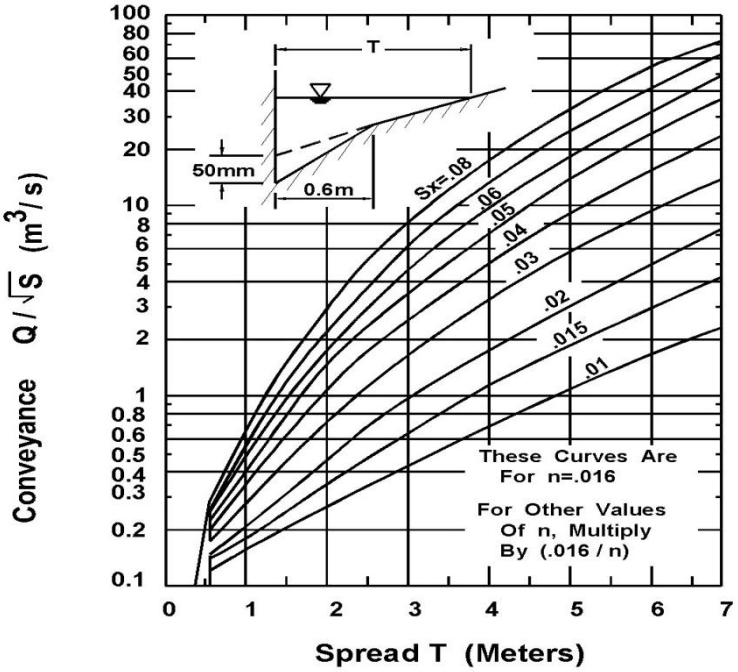
Q_s = flow capacity of the gutter section above the depressed section, ft^3/s

E_o = ratio of flow in a chosen width (usually the width of a grate) to total gutter flow (Q_w/Q)

$S_w = S_x + a/W$ (Figure 3-1 a.2)

Figure 3-2 illustrates a design chart for a composite gutter with a 2-ft wide gutter section with a 2-inch depression at the curb that begins at the projection of the uniform cross slope at the curb face. A series of charts similar to Figure 3-2 for "typical" gutter configurations could be developed.

Figure 3-2. Conveyance–Spread Curves for a Composite Gutter Section



Example 3-2

Given: Gutter section illustrated in Figure 3-1 a.2 with these dimensions:

W = 2 ft

S_L = 0.010 ft/ft

S_x = 0.020 ft/ft

n = 0.016

Gutter depression, a = 2 inch

Find: (1) Gutter flow at a spread of 8.2 ft

(2) Spread at a flow of 4.2 ft^3/s

Solution (1):

Step 1. Compute the cross slope of the depressed gutter, S_w, and the width of spread from the junction of the gutter and the road to the limit of the spread, T_s.

$$S_w = (a/W) + S_x$$

$$S_w = \frac{[(2)/(12)]}{(2)} + (0.020)$$

$$= 0.103 \text{ ft/ft}$$

$$T_s = T - W = 8.2 - 2.0$$

$$T_s = 6.2 \text{ ft}$$

Step 2. From Equation 3-2 or Chart 1 (using T_s.):

$$Q_s n = (0.56) S_x^{1.67} S_L^{0.5} T_s^{2.67}$$

$$Q_s n = (0.56)(0.02)^{1.67} (0.01)^{0.5} (6.2)^{2.67}$$

$$Q_s n = 0.011 \text{ ft}^3\text{/s, and}$$

$$Q_s = \frac{(Q_s n)}{n} = \frac{0.011}{0.016}$$

$$Q_s = 0.69 \text{ ft}^3\text{/s}$$

Step 3. Determine the gutter flow, Q, using Equation 3-4 or Chart 2.

$$\frac{T}{W} = \frac{8.2}{2.0} = 4.10$$

$$\frac{S_w}{S_x} = \frac{0.103}{0.020} = 5.15$$

$$E_o = \frac{1}{\left\{1+\left[\frac{\left(\frac{S_w}{S_x}\right)}{\left(1+\frac{\left(\frac{S_w}{S_x}\right)}{\left(\frac{T}{W}-1\right)}\right)^{2.67}-1}\right]\right\}}$$

$$E_o = \frac{1}{\left\{1+\left[\frac{(5.15)}{\left(1+\frac{(5.15)}{(4.10-1)}\right)^{2.67}-1}\right]\right\}}$$

$$E_o = 0.70$$

or from Chart 2, for $\frac{W}{T}=\frac{2.0}{8.2}=0.24$

$$E_o = \frac{Q_w}{Q} = 0.70$$

$$Q = \frac{Q_s}{(1-E_o)}$$

$$Q = \frac{0.69}{(1-0.70)}$$

$$Q = 2.3 \text{ ft}^3/\text{s}$$

Solution (2):

Since the spread cannot be determined by a direct solution, an iterative approach must be used.

Step 1. Try Q_s = 1.4 ft^3/s.

Step 2. Compute Q_w.

$Q_w = Q - Q_s = 4.2 - 1.4$

$Q_w = 2.8 \text{ ft}^3/\text{s}$

Step 3. Using Equation 3-4 or from Chart 2, determine the *W/T* ratio.

$$E_o = \frac{Q_w}{Q} = \frac{2.8}{4.2} = 0.67$$

$$\frac{S_w}{S_x} = \frac{0.103}{0.020} = 5.15$$

$$\frac{W}{T} = 0.23 \text{ from Chart 2}$$

Step 4. Compute the spread based on the assumed Q_s.

$$T = \frac{W}{\left(\frac{W}{T}\right)} = \frac{2.0}{.23}$$

$T = 8.7$ ft

Step 5. Compute the T_s based on the assumed Q_s.

$T_s = T - W = 8.7 - 2.0 = 6.7$ ft

Step 6. Use Equation 3-2 or Chart 1 to determine the Q_s for the computed T_s.

$$Q_s n = (0.56) S_x^{1.67} S_L^{0.5} T_s^{2.67}$$

$$Q_s n = (0.56)(0.02)^{1.67} (0.01)^{0.5} (6.7)^{2.67}$$

$Q_s n = 0.0131 \text{ ft}^3/\text{s}$

$$Q_s = \frac{Q_s n}{n} = \frac{0.0131}{0.016}$$

$Q_s = 0.82 \text{ ft}^3/\text{s}$

Step 7. Compare the computed Q_s with the assumed Q_s.

Q_s assumed = 1.4 > 0.82 = Q_s computed. Not close, try again.

Step 8. Try a new assumed Q_s and repeat Steps 2 through 7.

Assume Q_s = 1.9 ft^3/s

$$Q_w = 4.2 - 1.9 = 2.3 \text{ ft}^3/\text{s}$$

$$E_o = \frac{Q_w}{Q} = \frac{2.3}{4.2} = 0.55$$

$$\frac{S_w}{S_x} = 5.15$$

$$\frac{W}{T} = 0.18$$

$$T = \frac{2.0}{0.18} = 11.1 \text{ ft}$$

$$T_s = 11.1 - 2.0 = 9.1 \text{ ft}$$

$$Q_s n = 0.30 \text{ ft}^3/\text{s}$$

$$Q_s = \frac{0.30}{0.016} = 1.85 \text{ ft}^3/\text{s}$$

Q_s assumed = 1.9 ft^3/s close to 1.85 ft^3/s = Q_s computed

3-4.3 Shallow Swale Sections

3-4.3.1 **Runoff Control**. Where curbs are not needed for traffic control, a small swale section of circular or V shape may be used to convey runoff from the pavement. As an example, the control of pavement runoff on fills may be needed to protect the embankment from erosion. Small swale sections may have sufficient capacity to convey the flow to a location suitable for interception.

3-4.3.2 **V-sections.** Chart 1 can be used to compute the flow in a shallow V-shaped section. When using Chart 1 for V-shaped channels, the cross slope, S_x, is determined by Equation 3-7:

$$S_x = \frac{S_{x1} S_{x2}}{(S_{x1} + S_{x2})} \qquad (3\text{-}7)$$

Example 3-3 demonstrates the use of Chart 1 to analyze a V-shaped shoulder gutter. Analysis of a V-shaped gutter resulting from a roadway with an inverted crown section is illustrated in Example 3-4.

Example 3-3

Given: V-shaped roadside gutter (Figure 3-1 b.1.) with these characteristics:

S_L = 0.01 S_{x1} = 0.25

n = 0.016 S_{x2} = 0.04

BC = 2.0 ft S_{x3} = 0.02

Find: Spread at a flow of 1.77 ft^3/s

Solution:

Step 1. Calculate S_x using Equation 3-7 assuming all flow is contained entirely in the V-shaped gutter section defined by S_{x1} and S_{x2}.

$$S_x = \frac{S_{x1}S_{x2}}{(S_{x1}+S_{x2})} = \frac{(0.25)(0.04)}{(0.25+0.04)}$$

S_x = 0.0345

Step 2. Using Equation 3-2 or Chart 1, find the hypothetical spread, T', assuming all flow is contained entirely in the V-shaped gutter.

$$T' = \left[\frac{(Qn)}{(0.56S_x^{1.67}S_L^{0.5})}\right]^{0.375}$$

$$T' = \left[\frac{(1.77)(0.016)}{\{(0.56)(0.0345)^{1.67}(0.01)^{0.5}\}}\right]^{0.375}$$

$$T' = 6.4 \ ft$$

Step 3. To determine if T' is within S_{x1} and S_{x2}, compute the depth at point B in the V-shaped gutter knowing $\overline{BC}$ and S_{x2}. Then, knowing the depth at B, compute the distance $\overline{AB}$.

$$d_B = \overline{BC}S_{x2} = (2)(0.04) = 0.08 \ ft$$

$$\overline{AB} = \frac{d_B}{S_{x1}} = \frac{(0.08)}{(0.25)} = 0.32 \ ft$$

$$\overline{AC} = \overline{AB} + \overline{BC} = 0.32 + 2.0 = 2.32 \ ft$$

Because 2.32 ft is less than *T'*, it is clear that the spread falls outside the V-shaped gutter section. An iterative solution technique must be used to solve for the section spread, *T*, as illustrated in the following steps.

Step 4. Solve for the depth at point C, d_c, and compute an initial estimate of the spread.

$T_{\overline{BD}}$ along $\overline{BD}$

$$d_c = d_B - \overline{BC}(S_{x2})$$

From the geometry of the triangle formed by the gutter, an initial estimate for d_B is determined as:

$$\left(\frac{d_B}{0.25}\right)+\left(\frac{d_B}{0.04}\right) = 6.4\ ft$$

d_B = 0.22 ft

d_c = 0.22 - (2.0)(0.04) = 0.14 ft

$$T_s = \frac{d_c}{S_{x3}} = \frac{0.14}{0.02} = 7\ ft$$

$$T_{\overline{BD}} = T_s + \overline{BC} = 7 + 2 = 9\ ft$$

Step 5. Using a spread along $\overline{BD}$ equal to 9.0 ft, develop a weighted slope for S_{x2} and S_{x3}.

2.0 ft at S_{x2} (0.04) and 7.0 ft at S_{x3} (0.02)

$$\frac{(2.0)(0.04)+(7.0)(0.02)}{9.05} = 0.024$$

Using this slope along with S_{x1}, find S_x using Equation 3-7.

$$S_x = \frac{S_{x1}S_{x2}}{(S_{x1}+S_{x2})}$$

$$= \frac{(0.25)(0.024)}{(0.25+0.024)} = 0.022$$

Step 6. Using Equation 3-2 or Chart 1, compute the gutter spread using the composite cross slope, S_x.

$$T = \left[\frac{(Qn)}{(0.56 S_x^{1.67} S_L^{0.5})}\right]^{0.375}$$

$$T = \left[\frac{(1.77)(0.016)}{\{(0.56)(0.022)^{1.67}(0.01)^{0.5}\}}\right]^{0.375}$$

T = 8.5 ft

This 8.5 ft is lower than the assumed value of 9.0 ft. Therefore, assume

$T_{\overline{BD}}$ = 8.3 ft and repeat Step 5 and Step 6.

Step 5. 2.0 ft at S_{x2} (0.04) and 6.3 ft at S_{x3} (0.02)

$$\frac{(2.0)(0.04) + 6.3(0.02)}{(8.30)} = 0.0248$$

Using this slope along with S_{x1}, find S_x using Equation 3-7.

$$S = \frac{(0.25)(0.0248)}{(0.25 + 0.0248)} = 0.0226$$

Step 6. Using Equation 3-2 or Chart 1, compute the spread, T.

$$T = \left[\frac{(Qn)}{(0.56 S_x^{1.67} S_L^{0.5})}\right]^{0.375}$$

$$T = \left[\frac{(1.77)(0.016)}{\{(0.56)(0.0226)^{1.67}(0.01)^{0.5}\}}\right]^{0.375}$$

T = 8.31 ft

This value of T equals 8.31 ft. Because this value is close to the assumed value of 8.3 ft, it is acceptable.

Example 3-4

Given: V-shaped gutter as illustrated in Figure 3-1 b.2 with:

$\overline{AB}$ = 3.28 ft

$\overline{BC}$ = 3.28 ft

S_L = 0.01

n = 0.016

S_{x1} = S_{x2} = 0.25

S_{x3} = 0.04

Find: (1) Spread at a flow of 24.7 ft^3/s

(2) Flow at a spread of 23.0 ft

Solution (1):

Step 1. Assume that the spread remains within middle "V" (A to C) and compute S_x.

$$S_x = \frac{(S_{x1}S_{x2})}{(S_{x1}+S_{x2})}$$

$$S_x = \frac{(0.25)(0.25)}{(0.25+0.25)}$$

$$S_x = 0.125$$

Step 2. From Equation 3-2 or Chart 1:

$$T = \left[\frac{(Qn)}{((0.56)S_x^{1.67}S_L^{0.5})}\right]^{0.375}$$

$$T = \left[\frac{(24.7)(0.016)}{\{(0.56)(0.125)^{1.67}(0.01)^{0.5}\}}\right]^{0.375}$$

$$T = 7.65 \text{ ft}$$

Since T is outside S_{x1} and S_{x2}, an iterative approach (as illustrated in Example 3-3) must be used to compute the spread.

Step 3. Treat one-half of the median gutter as a composite section and solve for T' equal to one-half of the total spread.

Q' for T' = ½ Q = 0.5 (24.7) = 12.4 ft^3/s

Step 4. Try $Q's$ = 1.8 ft^3/s

$Q'_w = Q' - Q'_s = 12.4 - 1.8 = 10.6\ ft^3/s$

Step 5. Using Equation 3-4 or Chart 2, determine the *W/T'* ratio.

$$E'_o = \frac{Q'_w}{Q'} = \frac{10.6}{12.4} = 0.85$$

$$\frac{S_w}{S_x} = \frac{S_{x2}}{S_{x3}} = \frac{0.25}{0.04} = 6.25$$

W/T' = 0.33 from Chart 2

Step 6. Compute the spread based on the assumed *Q'*.

$$T' = \frac{W}{\left(\frac{W}{T'}\right)} = \frac{3.28}{0.22} = 9.94\ ft$$

Step 7. Compute T_s based on the assumed Q'_s.

$T_s = T' - W = 9.94 - 3.28 = 6.66$ ft

Step 8. Use Equation 3-2 or Chart 1 to determine Q'_s for T_s.

$$Q'_s n = (0.56) S_{x3}^{1.67} S_L^{0.5} T_s^{2.67} = (0.56)(0.04)^{1.67}(0.01)^{0.5}(6.66)^{2.67}$$

$$Q'_s n = 0.041$$

$$Q'_s = \frac{0.041}{0.016} = 2.56\ ft^3/s$$

Step 9. Check the computed Q'_s with the assumed Q'_s.

Q'_s assumed = 1.8 < 2.56 = Q'_s computed; therefore, try a new assumed Q'_s and repeat Steps 4 through 9.

Assume Q'_s = 0.04

Q'_w = 12.0 ft^3/s

E'_o = 0.97

$$\frac{S_w}{S_x} = 6.25$$

$\frac{W}{T'}$ = 0.50 from Chart 2

T' = 6.56 ft

T_s = 1.0 ft

$Q_s n$ = 0.0062

Q_s = 0.39 ft^3/s

Q_s computed = 0.39. This is close to 0.40 = Q_s assumed; therefore, the solution is acceptable.

$T = 2\ T' = 2\ (6.56) = 13.12$ ft

Solution (2):

Analyze in half-section using composite section techniques. Double the computed half-width flow rate to get the total discharge:

Step 1. Compute half-section top width

$T' = \frac{T}{2} = \frac{23}{2} = 11.5$ ft

$T_s = T' - 3.28 = 8.22$ ft

Step 2. From Equation 3-2 or Chart 1, determine Q.

$Q_s n = (0.56) S_x^{1.67} S_L^{0.5} T_s^{2.67}$

$Q_s n = (0.56)(0.04)^{1.67} (0.01)^{0.5} (8.22)^{2.67}$

$Q_s n = 0.073$

$Q_s = \frac{0.073}{0.016} = 4.56\ ft^3/s$

Step 3. Determine the flow in half-section using Equation 3-4 or Chart 2.

$\frac{T'}{W} = \frac{11.5}{3.28} = 3.51$

$\frac{S_w}{S_x} = \frac{0.25}{0.04} = 6.25$

$$E_o = \frac{1}{\left\{1+\left[\frac{\left(\frac{S_w}{S_x}\right)}{\left(1+\frac{\left(\frac{S_w}{S_x}\right)}{\left(\frac{T}{W}-1\right)}\right)^{2.67}-1}\right]\right\}}$$

$$E_o = \frac{1}{\left\{1+\left[\frac{(6.25)}{\left(1+\frac{(6.25)}{(3.5-3.28)}\right)^{2.67}-1}\right]\right\}}$$

$$E_o = 0.814 = \frac{Q'_w}{Q} = 1-\frac{Q'_s}{Q'}$$

$$Q' = \frac{Q'_s}{(1-0.814)} = \frac{4.56}{(1-0.814)}$$

$$Q' = 24.5 \text{ ft}^3/\text{s}$$

$$Q = 2\,Q' = 2\,(24.5) = 49 \text{ ft}^3/\text{s}$$

3-4.4 Flow in Sag Vertical Curves. As gutter flow approaches the low point in a sag vertical curve, the flow can exceed the allowable design spread values as a result of the continually decreasing gutter slope. The spread in these areas should be checked to ensure that it remains within allowable limits. If the computed spread exceeds design values, additional inlets should be provided to reduce the flow as it approaches the low point. Sag vertical curves and measures for reducing spread are discussed further in section 3-5.5.

3-4.5 Gutter Flow Time. The flow time in gutters is an important component of the time of concentration for the contributing drainage area to an inlet. To find the gutter flow component of the time of concentration, a method for estimating the average velocity in a reach of gutter is needed. The velocity in a gutter varies with the flow rate, and the flow rate varies with the distance along the gutter, i.e., both the velocity and flow rate in a gutter are spatially varied. The time of flow can be estimated by use of an average velocity obtained by integration of Manning's equation for the gutter section

with respect to time. The derivation of such a relationship for triangular channels is presented in Appendix C of HEC-22.

Table 3-2 and Chart 4 can be used to determine the average velocity in triangular gutter sections. In Table 3-2, T_1 and T_2 are the spread at the upstream and downstream ends of the gutter section, respectively. T_a is the spread at the average velocity. Chart 4 in Appendix B is a nomograph to solve Equation 3-13 for the velocity in a triangular channel with known cross slope, gutter slope, and spread.

Table 3-2. Spread at Average Velocity in a Reach of Triangular Gutter

$\frac{T_1}{T_2}$	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
$\frac{T_a}{T_2}$	0.65	0.66	0.68	0.70	0.74	0.77	0.82	0.86	0.90

$$V = \frac{1.11}{n} S_L^{0.5} S_x^{0.67} T^{0.67} \quad (3\text{-}8)$$

where:

V = velocity in the triangular channel, ft/s

Example 3-5 illustrates the use of Table 3-2 and Chart 4 to determine the average gutter velocity.

Example 3-5

Given: A triangular gutter section with these characteristics:

T_1 = 3.28 ft

T_2 = 9.84 ft

S_L = 0.03 ft/ft

S_x = 0.02 ft/ft

n = 0.016

Inlet spacing is anticipated to be 330 ft.

Find: Time of flow in gutter

Solution:

Step 1. Compute the upstream to downstream spread ratio.

$$\frac{T_1}{T_2} = \frac{3.28}{9.84} = 0.33$$

Step 2. Determine the spread at average velocity, interpolating between values in Table 3-2.

$$\frac{(0.30-0.33)}{(0.3-0.4)} = \frac{X}{(0.74-0.70)}$$

$$X = 0.01$$

$$\frac{T_a}{T2} = 7.65 \text{ ft}$$

$$= 0.71$$

$$T_a = (0.71)(9.84) = 6.99 \text{ ft}$$

Step 3. Using Equation 3-8 or Chart 4, determine the average velocity.

$$V_a = \frac{1.11}{n} S_L^{0.5} S_x^{0.67} T^{0.67}$$

$$V_a = \left[\frac{1.11}{(0.016)}\right](0.03)^{0.5}(0.02)^{0.67}(6.99)^{0.67}$$

$$V_a = 3.21 \text{ ft/s}$$

Step 4. Compute the travel time in the gutter.

$$T_{ti} = L/V = (330)/(3.21/(60) = 1.7 \text{ min}$$

3-5 DRAINAGE INLET DESIGN. The hydraulic capacity of a storm drain inlet depends upon its geometry as well as the characteristics of the gutter flow. Inlet capacity governs both the rate of water removal from the gutter and the amount of water that can enter the storm drainage system. Inadequate inlet capacity or poor inlet location may cause flooding on the roadway resulting in a hazard to the traveling public.

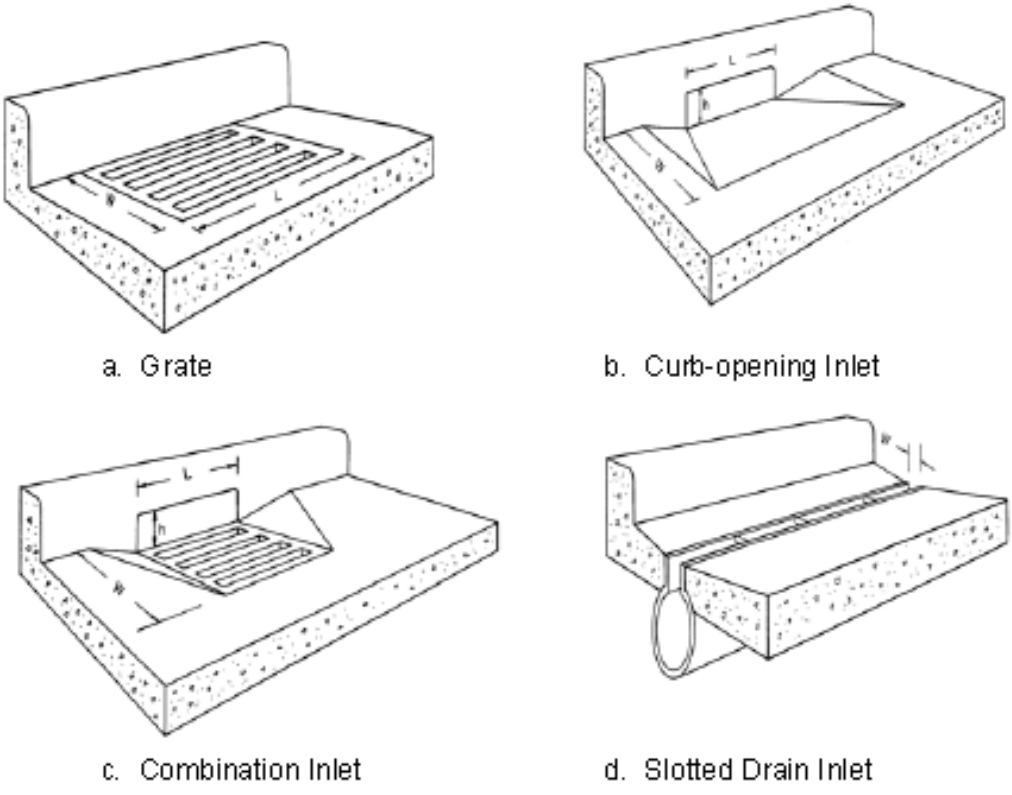
3-5.1 Inlet Types. Storm drain inlets are used to collect runoff and discharge it to an underground storm drainage system. Inlets are typically located in gutter sections,

paved medians, and roadside and median ditches. Inlets used for the drainage of highway surfaces can be divided into four classes:

- Grate inlets
- Curb-opening inlets
- Combination inlets
- Continuous inlets

Grate inlets consist of an opening in the gutter or ditch covered by a grate. Curb-opening inlets are vertical openings in the curb covered by a top slab. Slotted inlets, a form of continuous inlet, consist of a pipe cut along the longitudinal axis with bars perpendicular to the opening to maintain the slotted opening. Combination inlets consist of both a curb-opening inlet and a grate inlet placed in a side-by-side configuration, but the curb opening may be located in part upstream of the grate. Figure 3-3 illustrates each class of inlets. Continuous inlets may also be used with grates, and each type of inlet may be installed with or without a depression of the gutter.

Figure 3-3. Classes of Storm Drain Inlets



3-5.2 Characteristics and Uses of Inlets

3-5.2.1 **Grate Inlets**. As a class, grate inlets perform satisfactorily over a wide range of gutter grades. Grate inlets generally lose capacity with increase in grade, but to a lesser degree than curb-opening inlets. The principal advantage of grate inlets is that they are installed along the roadway where the water is flowing. Their principal disadvantage is that they may be clogged by floating trash or debris. For safety reasons, preference should be given to grate inlets where out-of-control vehicles might be involved. Additionally, where bicycle traffic occurs, grates should be bicycle safe.

3-5.2.2 **Curb-opening Inlets**. Curb-opening inlets are most effective on flatter slopes, in sags, and with flows that typically carry significant amounts of floating debris. The interception capacity of curb-opening inlets decreases as the gutter grade steepens. Consequently, the use of curb-opening inlets is recommended in sags and on grades less than 3 percent. Of course, they are bicycle safe as well.

3-5.2.3 **Combination Inlets**. Combination inlets provide the advantages of both curb-opening and grate inlets. This combination results in a high capacity inlet that offers the advantages of both grate and curb-opening inlets. When the curb-opening precedes the grate in a "sweeper" configuration, the curb-opening inlet acts as a trash interceptor during the initial phases of a storm. Used in a sag configuration, the sweeper inlet can have a curb opening on both sides of the grate. A complete discussion of combination inlets can be found in Chapter 4 of HEC-22.

3-5.2.4 **Continuous Inlets**. Continuous inlets can be used in areas where it is necessary to intercept sheet flow before it crosses onto a section of roadway. Their principal advantage is their ability to intercept flow over a wide section. A form of continuous inlet, slotted inlets are very susceptible to clogging from sediments and debris and are not recommended for use in environments where significant sediment or debris loads may be present. Continuous inlets on a longitudinal grade do have the same hydraulic capacity as curb openings when debris is not a factor. A complete discussion of continuous inlets can be found in Chapter 4 of HEC-22.

3-5.3 Inlet Capacity. Inlet interception capacity has been investigated by several agencies and manufacturers of grates. Hydraulic tests on grate inlets and slotted inlets included in this document were conducted by the Bureau of Reclamation for the FHWA. Four of the grates selected for testing were rated highest in bicycle safety tests, three have designs and bar spacing similar to those proven bicycle safe, and a parallel bar grate was used as a standard with which to compare the performance of others.

Figures 3-4 through 3-9 show the inlet grates for which design procedures were developed. For ease in identification, the following terms have been adopted:

P-1-7/8	Parallel bar grate with bar spacing 1.875 inch on center (Figure 3-4).

P-1-7/8 x 4	Parallel bar grate with bar spacing 1.875 inch on center and 0.375-inch diameter lateral rods spaced at 4 inch on center (Figure 3-4).
P-1-1/8	Parallel bar grate with 1.125 inch on center bar spacing (Figure 3-5)
Curved Vane	Curved vane grate with 3.25 inch longitudinal bar and 4.25 inch transverse bar spacing on center (Figure 3-6).
45°- 2-1/4 Tilt Bar	45-degree tilt-bar grate with 2.25 inch longitudinal bar and 4 inch transverse bar spacing on center (Figure 3-7).
45°- 3-1/4 Tilt Bar	45-degree tilt-bar grate with 3.25 inch longitudinal bar and 4 inch transverse bar spacing on center (Figure 3-7).
30°- 3-1/4 Tilt Bar	30-degree tilt-bar grate with 3.25 inch longitudinal bar and 4 inch transverse bar spacing on center (Figure 3-8).
Reticuline	"Honeycomb" pattern of lateral bars and longitudinal bearing bars (Figure 3-9).

3-5.3.1 **Factors Affecting Inlet Interception Capacity and Efficiency on Continuous Grades.** Inlet interception capacity, Q_i is the flow intercepted by an inlet under a given set of conditions. The efficiency of an inlet, E, is the percent of total flow that the inlet will intercept for those conditions. The efficiency of an inlet changes with changes in cross slope, longitudinal slope, total gutter flow, and, to a lesser extent, pavement roughness. In mathematical form, efficiency, E, is defined by Equation 3-9:

$$E = \frac{Q_i}{Q} \tag{3-9}$$

where:

E = inlet efficiency

Q = total gutter flow, ft^3/s

Q_i = intercepted flow, ft^3/s

Flow that is not intercepted by an inlet is termed carryover or bypass and is defined by Equation 3-10:

$$Q_b = Q - Q_i \tag{3-10}$$

where:

Q_b = bypass flow, ft^3/s

3-5.3.1.1 The interception capacity of all inlet configurations increases with increasing flow rates, and inlet efficiency generally decreases with increasing flow rates. Factors affecting gutter flow also affect inlet interception capacity. The depth of water next to the curb is the major factor in the interception capacity of both grate inlets and curb-opening inlets. The interception capacity of a grate inlet depends on the amount of water flowing over the grate, the size and configuration of the grate, and the velocity of flow in the gutter. The efficiency of a grate is dependent on the same factors and total flow in the gutter.

Figure 3-4. P-1-7/8 and P-1-7/8 x 4 Grates
(Same as P-1-7/8 Grate Without 3/8-in. Transverse Rods)

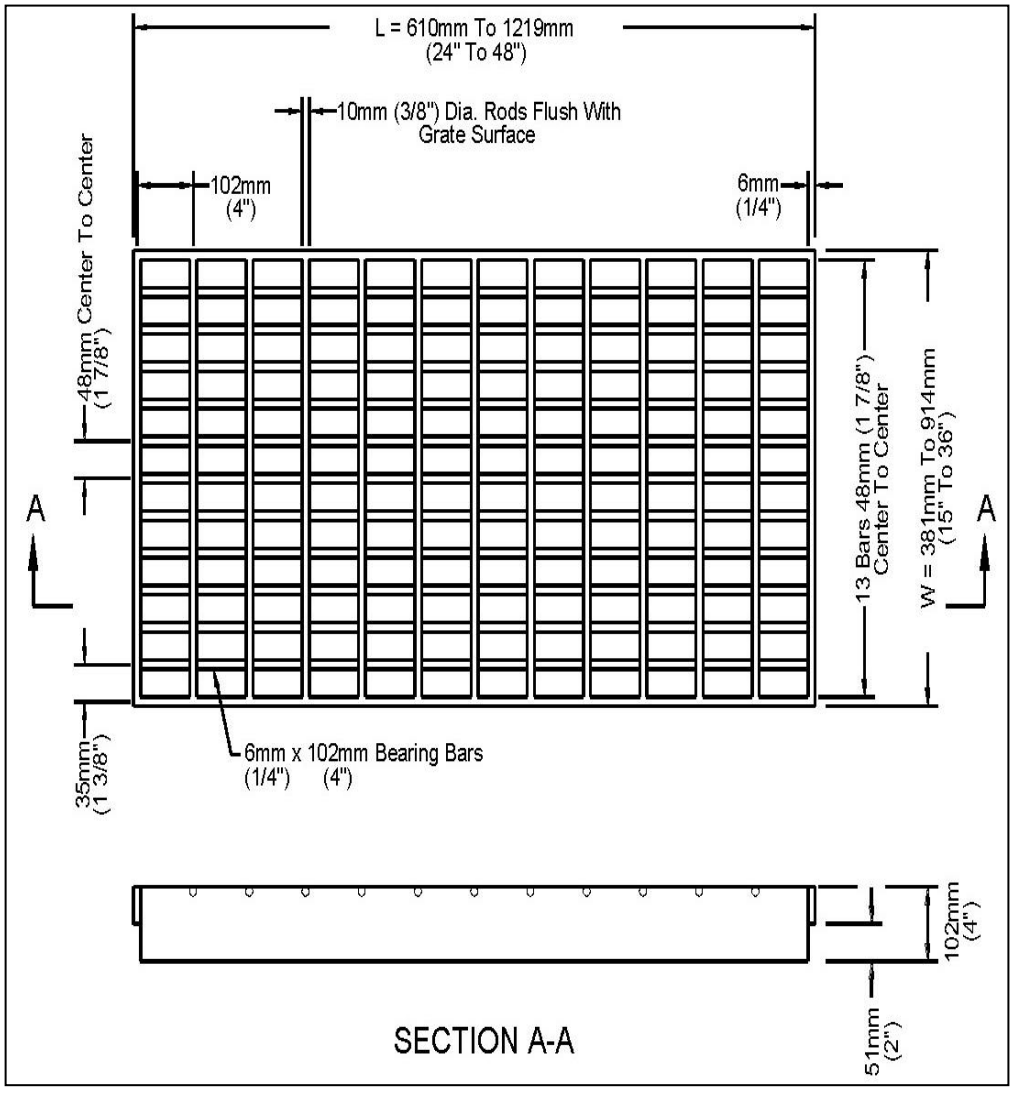


Figure 3-5. P-1-1/8 Grate

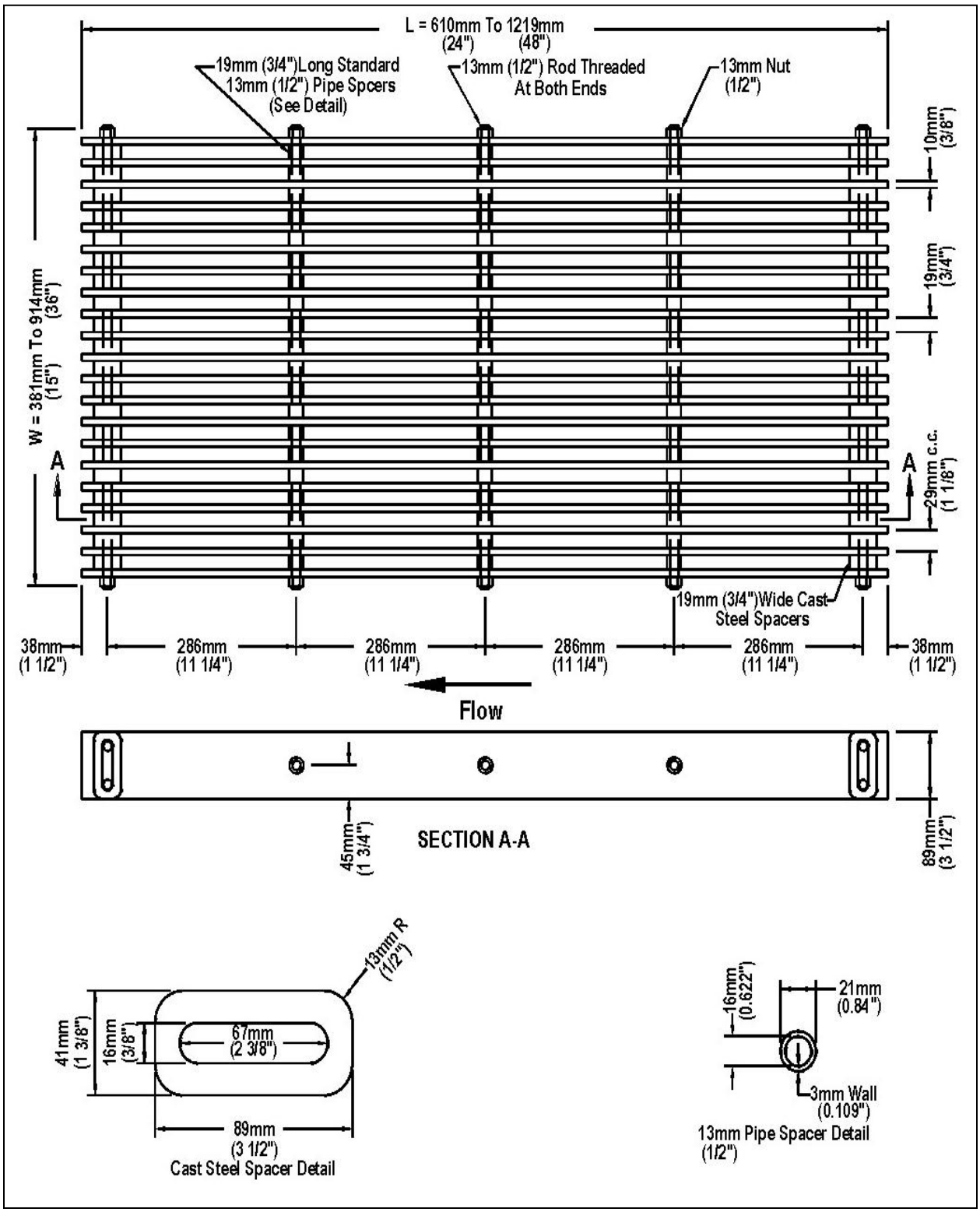


Figure 3-6. Curved Vane Grate

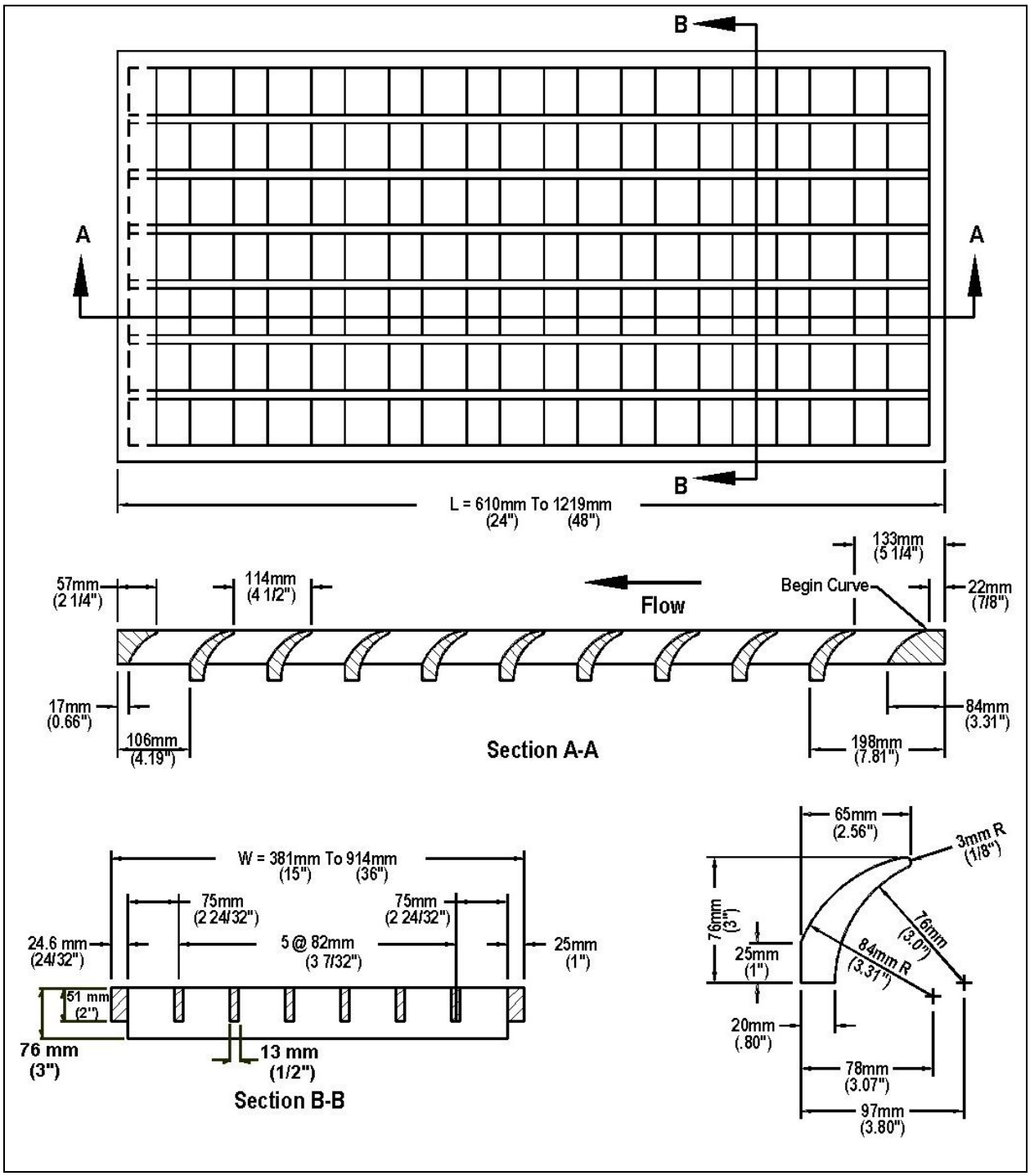


Figure 3-7. 45-Degree 2-1/4 and 45-Degree 3-1/4 Tilt-bar Grates

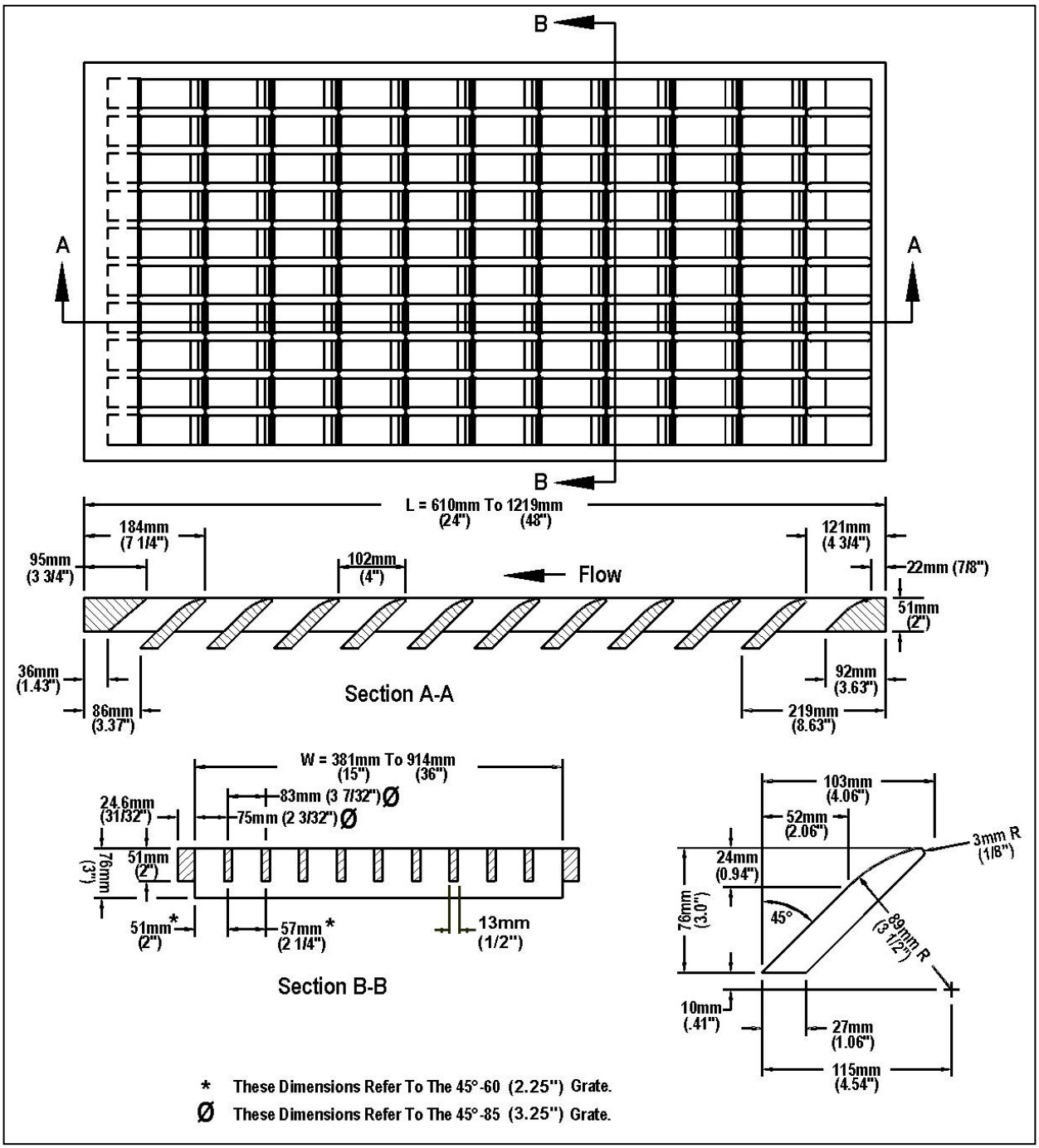
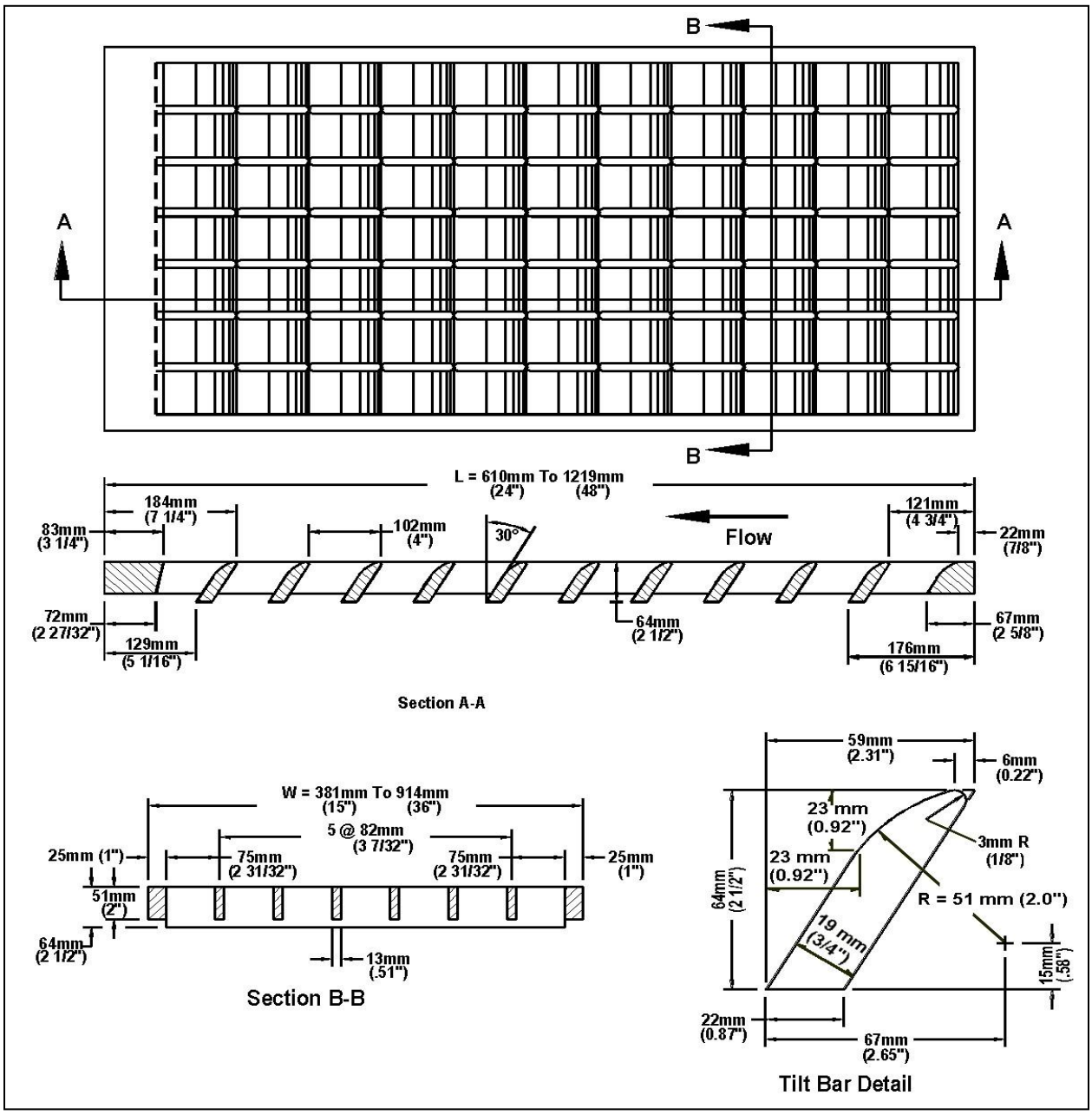


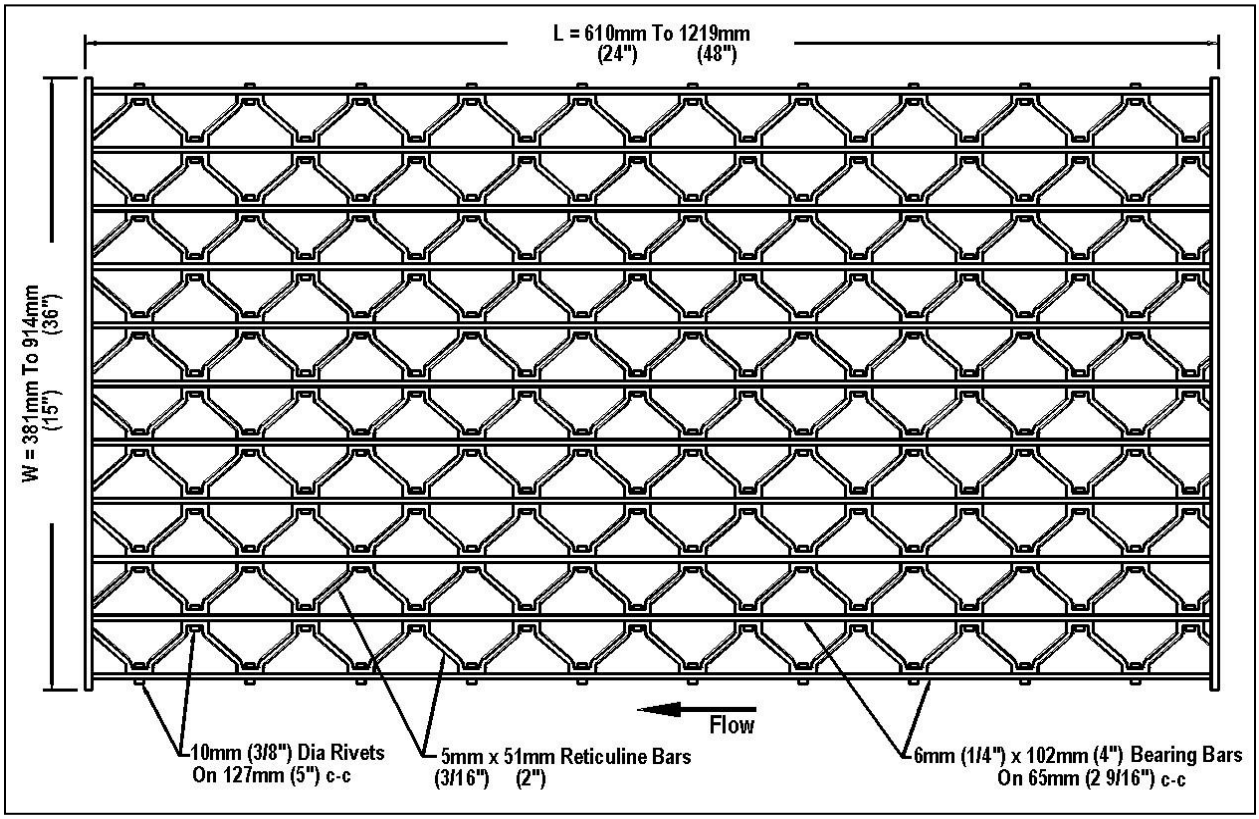
Figure 3-8. 30-Degree 3-1/4 Tilt-bar Grates



3-5.3.1.2 Interception capacity of a curb-opening inlet is largely dependent on flow depth at the curb and curb opening length. Flow depth at the curb and consequently, curb-opening inlet interception capacity and efficiency, is increased by the use of a local gutter depression at the curb opening or a continuously depressed gutter to increase the proportion of the total flow adjacent to the curb. Top slab supports placed flush with the curb line can substantially reduce the interception capacity of curb openings. Tests have shown that such supports reduce the effectiveness of openings downstream of the support by as much as 50 percent and, if debris is caught at the support, interception by the downstream portion of the opening may be reduced to near zero. If intermediate top

slab supports are used, they should be recessed several inches from the curb line and rounded in shape.

Figure 3-9. Reticuline Grate



3-5.3.1.3 Slotted inlets function in essentially the same manner as curb-opening inlets, i.e., as weirs with flow entering from the side. Interception capacity is dependent on flow depth and inlet length. Efficiency is dependent on flow depth, inlet length, and total gutter flow.

3-5.3.1.4 The interception capacity of an equal length combination inlet consisting of a grate placed alongside a curb opening on a grade does not differ materially from that of a grate only. Interception capacity and efficiency are dependent on the same factors that affect grate capacity and efficiency. A combination inlet consisting of a curb-opening inlet placed upstream of a grate inlet has a capacity equal to that of the curb-opening length upstream of the grate plus that of the grate, taking into account the reduced spread and depth of flow over the grate because of the interception by the curb opening. This inlet configuration has the added advantage of intercepting debris that might otherwise clog the grate and deflect water away from the inlet.

3-5.4 Interception Capacity of Inlets on Grade. Section 3-5.3.1 examines the factors that influence the interception capacity of inlets on grade. This section (3-5.4) introduces the design charts for inlets on grade (Appendix B) and procedures for using the charts for the various inlet configurations. Remember that for locally depressed

inlets, the quantity of flow reaching the inlet would be dependent on the upstream gutter section geometry and not the depressed section geometry.

Charts for grate inlet interception are presented in Appendix B. The chart for frontal flow interception is based on test results that show that grates intercept all of the frontal flow until a velocity is reached at which water begins to splash over the grate. At velocities greater than "splash-over" velocity, grate efficiency in intercepting frontal flow is diminished. Grates also intercept a portion of the flow along the length of the grate, or the side flow. A chart is provided to determine side-flow interception.

One set of charts is provided for slotted inlets and curb-opening inlets because these inlets are both side-flow weirs. The equation developed for determining the length of inlet required for total interception fits the test data for both types of inlets.

3-5.4.1 **Grate Inlets.** Grates are effective highway pavement drainage inlets where clogging with debris is not a problem. Where clogging may be a problem, see Table 3-3's ranking of grates for susceptibility to clogging based on laboratory tests using simulated leaves. This table should be used for relative comparisons only.

Table 3-3. Average Debris Handling Efficiencies of Grates Tested

Rank	Grate	Longitudinal Slope	
		0.005	0.04
1	Curved Vane	46	61
2	30°- 85 Tilt Bar	44	55
3	45°- 85 Tilt Bar	43	48
4	P - 50	32	32
5	P - 50xl00	18	28
6	45°- 60 Tilt Bar	16	23
7	Reticuline	12	16
8	P - 30	9	20

When the velocity approaching the grate is less than the "splash-over" velocity, the grate will intercept essentially all of the frontal flow. Conversely, when the gutter flow velocity exceeds the "splash-over" velocity for the grate, only part of the flow will be intercepted. A part of the flow along the side of the grate will be intercepted, dependent on the cross slope of the pavement, the length of the grate, and the flow velocity.

3-5.4.1.1 The ratio of frontal flow to total gutter flow, E_o, for a uniform cross slope is expressed by Equation 3-11:

$$E_o = \frac{Q_w}{Q} = 1 - \left(1 - \frac{W}{T}\right)^{2.67} \quad (3\text{-}11)$$

where:

Q = total gutter flow, ft^3/s

Q_w = flow in width, W, ft^3/s

W = width of depressed gutter or grate, ft

T = total spread of water, ft

Example 3-2 and Chart 2 provide solutions of E_o for either uniform cross slopes or composite gutter sections.

3-5.4.1.2 The ratio of side flow, Q_s, to total gutter flow is:

$$\frac{Q_s}{Q} = 1 - \frac{Q_w}{Q} = 1 - E_o \quad (3\text{-}12)$$

3-5.4.1.3 The ratio of frontal flow intercepted to total frontal flow, R_f, is expressed by Equation 3-13:

$$R_f = 1 - 0.09(V - V_o) \quad (3\text{-}13)$$

where:

V = velocity of flow in the gutter, ft/s

V_o = gutter velocity where splash-over first occurs, ft/s

(***NOTE:*** R_f cannot exceed 1.0.)

This ratio is equivalent to frontal flow interception efficiency. Chart 5 provides a solution for Equation 3-13 that takes into account grate length, bar configuration, and gutter velocity at which splash-over occurs. The average gutter velocity (total gutter flow divided by the area of flow) is needed to use Chart 5. This velocity can also be obtained from Chart 4.

3-5.4.1.4 The ratio of side flow intercepted to total side flow, R_s, or side flow interception efficiency, is expressed by Equation 3-14. Chart 6 in Appendix B provides a solution to Equation 3-14.

$$R_s = \frac{1}{\left(1+\frac{0.15V^{1.8}}{S_x L^{2.3}}\right)} \quad (3\text{-}14)$$

A deficiency in developing empirical equations and charts from experimental data is evident in Chart 6. The fact that a grate will intercept all or almost all of the side flow where the velocity is low and the spread only slightly exceeds the grate width is not reflected in the chart. Error due to this deficiency is very small. In fact, where velocities are high, side flow interception may be neglected without significant error.

3-5.4.1.5 The efficiency, E, of a grate is expressed as in Equation 3-15:

$$E = R_f E_o + R_s(1-E_o) \quad (3\text{-}15)$$

The first term on the right side of Equation 3-15 is the ratio of intercepted frontal flow to total gutter flow, and the second term is the ratio of intercepted side flow to total side flow. The second term is insignificant with high velocities and short grates.

3-5.4.1.6 It is important to recognize that the frontal flow to total gutter flow ratio, E_o, for composite gutter sections assumes by definition a frontal flow width equal to the depressed gutter section width. The use of this ratio when determining a grate's efficiency requires that the grate width be equal to the width of the depressed gutter section, W. If a grate having a width less than W is specified, the gutter flow ratio, E_o, must be modified to accurately evaluate the grate's efficiency. Because an average velocity has been assumed for the entire width of gutter flow, the grate's frontal flow ratio, E_o, can be calculated by multiplying E_o by a flow area ratio. The area ratio is defined as the gutter flow area in a width equal to the grate width divided by the total flow area in the depressed gutter section. This adjustment is represented in Equation 3-15a:

$$E'_o = E_o\left(\frac{A'_w}{A_w}\right) \quad (3\text{-}15a)$$

where:

E'_o = adjusted frontal flow area ratio for grates in composite cross sections

A'_w = gutter flow area in a width equal to the grate width, ft^2

A_w = flow area in depressed gutter width, ft^2

3-5.4.1.7 The interception capacity of a grate inlet on grade is equal to the efficiency of the grate multiplied by the total gutter flow as represented in Equation 3-16. Note that E'_o should be used in place of E_o in Equation 3-16 when appropriate.

$$Q_i = EQ = Q\left[R_f E_o + R_s\left(1 - E_o\right)\right] \quad (3\text{-}16)$$

3-5.4.1.8 The use of Chart 5 and Chart 6 is illustrated in the Examples 3-6 and 3-7.

Example 3-6

Given: The gutter section from Example 3-2 (illustrated in Figure 3-1 a.2) with:

T = 8.2 ft

S_L = 0.010

S_x = 0.020

W = 2.0 ft

n = 0.016

Continuous gutter depression, a = 2 in. or 0.167 ft

Find: The interception capacity of a curved vane grate 2 ft by 2 ft

Solution: From Example 3-2:

S_w = 0.103 ft/ft

E_o = 0.70

Q = 2.3 ft^3/s

Step 1. Compute the average gutter velocity.

$$V = \frac{Q}{A} = \frac{2.3}{A}$$

$A = 0.5\ T^2 S_x + 0.5\ a\ W$

$A = 0.5(8.2)^2(0.2) + 0.5(0.167)(2.0)$

$A = 0.84\ ft^2$

$$V = \frac{2.3}{0.84} = 2.74 \text{ ft/s}$$

Step 2. Determine the frontal flow efficiency using Chart 5.

$R_f = 1.0$

Step 3. Determine the side flow efficiency using Equation 3-14 or Chart 6.

$$R_s = \frac{1}{\left[\frac{1+\left(0.15V^{1.8}\right)}{\left(S_x L^{2.3}\right)}\right]}$$

$$R_s = \frac{1}{\left[\frac{1+(0.15)(2.74)^{1.8}}{(0.02)(2.0)^{2.3}}\right]}$$

$R_s = 0.10$

Step 4. Compute the interception capacity using Equation 3-16.

$Q_i = Q\,[R_f E_o + R_s(1-E_o)]$

$Q_i = (2.3)\,[(1.0(0.70) + (0.10)(1-0.70)]$

$Q_i = 1.68\ ft^3/s$

Example 3-7

Given: The gutter section illustrated in Figure 3-1 a.1 with:

$T = 9.84$ ft

$S_L = 0.04$ ft/ft

$S_x = 0.025$ ft/ft

$n = 0.016$

Bicycle traffic not permitted.

Find: The interception capacity of the following grates:

a. P-50: 2.0 ft x 2.0 ft

b. Reticuline: 2.0 ft x 2.0 ft

c. Grates in a. and b. with a length of 4.0 ft

Solution:

Step 1. Using Equation 3-2 or Chart 1, determine Q.

$$Q = \left(\frac{0.56}{n}\right) S_x^{1.67} S_L^{0.5} T^{2.67}$$

$$Q = \left\{\frac{(.56)}{(0.016)}\right\} (0.025)^{1.67} (0.04)^{0.5} (9.84)^{2.67}$$

$$Q = 6.62 \text{ ft}^3/\text{s}$$

Step 2. Determine E_o from Equation 3-4 or Chart 2.

$$\frac{W}{T} = \frac{2.0}{9.84}$$

$$= 0.2$$

$$E_o = \frac{Q_w}{Q}$$

$$E_o = 1 - \left(1 - \frac{W}{T}\right)^{2.67}$$

$$= 1 - (1-0.2)^{2.67}$$

$$E_o = 0.45$$

Step 3. Using Equation 3-8 or Chart 4, compute the gutter flow velocity.

$$V = \left(\frac{1.11}{n}\right) S_L^{0.5} S_x^{0.67} T^{0.67}$$

$$V = \left\{\frac{(1.11)}{(0.016)}\right\} (0.04)^{0.5} (0.025)^{0.67} (9.84)^{0.67}$$

$$V = 5.4 \text{ ft/s}$$

Step 4. Using Equation 3-13 or Chart 5, determine the frontal flow efficiency for each grate.

Using Equation 3-14 or Chart 6, determine the side flow efficiency for each grate.

Using Equation 3-16, compute the interception capacity of each grate.

Table 3-4 summarizes the results.

Table 3-4. Grate Efficiency and Capacity Summary

Grate	Size (width by length)	Frontal Flow Efficiency, R_f	Side Flow Efficiency, R_s	Interception Capacity, Q_i
P – 1-7/8	2.0 ft by 2.0 ft	1.0	0.036	3.21 ft^3/s
Reticuline	2.0 ft by 2.0 ft	0.9	0.036	2.89 ft^3/s
P – 1-7/8	2.0 ft by 4.0 ft	1.0	0.155	3.63 ft^3/s
Reticuline	2.0 ft by 4.0 ft	1.0	0.155	3.63 ft^3/s
NOTE: The P-1-7/8 parallel bar grate will intercept about 14 percent more flow than the reticuline grate, or 48 percent of the total flow as opposed to 42 percent for the reticuline grate. Increasing the length of the grates would not be cost effective because the increase in side flow interception is small.				

3-5.4.2 **Curb-opening Inlets.** Curb-opening inlets are effective in the drainage of highway pavements where flow depth at the curb is sufficient for the inlet to perform efficiently, as discussed in section 3-5.3.1. Curb openings are less susceptible to clogging and offer little interference to traffic operation. They are a viable alternative to grates on flatter grades where grates would be in traffic lanes or would be hazardous for pedestrians or bicyclists.

3-5.4.2.1 Curb opening heights vary in dimension; however, a typical maximum height is approximately 4 to 6 inches. The length of the curb-opening inlet required for total interception of gutter flow on a pavement section with a uniform cross slope is expressed by Equation 3-17:

$$L_T = (0.6) Q^{0.42} S_L^{0.3} \left(\frac{1}{n S_x} \right)^{0.6} \quad (3\text{-}17)$$

where:

L_T = curb opening length required to intercept 100 percent of the gutter flow, ft

S_L = longitudinal slope

Q = gutter flow, ft^3/s

3-5.4.2.2 The efficiency of curb-opening inlets shorter than the length required for total interception is expressed by Equation 3-18:

$$E = 1 - \left(1 - \frac{L}{L_T} \right)^{1.8} \quad (3\text{-}18)$$

where:

L = curb opening length, ft

Chart 7 is a nomograph for the solution of Equation 3-17, and Chart 8 provides a solution to Equation 3-18.

3-5.4.2.3 The length of inlet required for total interception by depressed curb-opening inlets or curb openings in depressed gutter sections can be found by the use of an equivalent cross slope, S_e, in Equation 3-17 in place of S_x. S_e can be computed using Equation 3-19.

$$S_e = S_x + S'_w E_o \quad (3\text{-}19)$$

where:

S'_w = cross slope of the gutter measured from the cross slope of the pavement, S_x, ft/ft

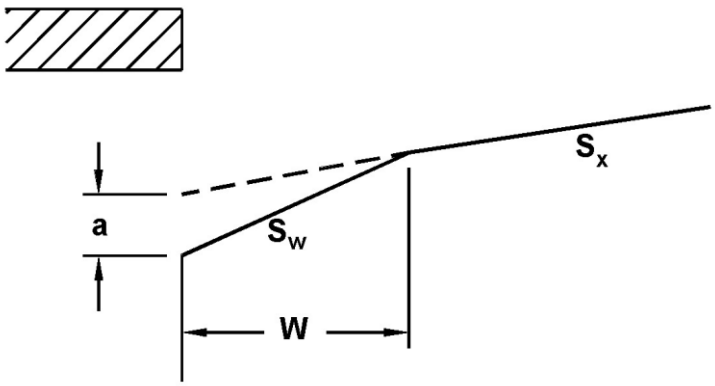
S'_w = $\frac{a}{[12\ W]}$, for W in ft, or = $S_w - S_x$

a = gutter depression, in.

E_o = ratio of flow in the depressed section to total gutter flow determined by the gutter configuration upstream of the inlet

Figure 3-10 shows the depressed curb inlet for Equation 3-19. E_o is the same ratio as used to compute the frontal flow interception of a grate inlet.

Figure 3-10. Depressed Curb-opening Inlet



3-5.4.2.4 As seen from Chart 7, the length of the curb opening required for total interception can be significantly reduced by increasing the cross slope or the equivalent

cross slope. The equivalent cross slope can be increased by use of a continuously depressed gutter section or a locally depressed gutter section.

Using the equivalent cross slope, S_e, Equation 3-17 becomes:

$$L_T = (0.6)Q^{0.42}S_L^{0.3}\left(\frac{1}{nS_e}\right)^{0.6} \quad (3\text{-}20)$$

3-5.4.2.5 Equation 3-18 is applicable with either straight cross slopes or composite cross slopes. Charts 7 and 8 are applicable to depressed curb-opening inlets using S_e rather than S_x.

3-5.4.2.6 Equation 3-19 uses the ratio, E_o, in the computation of the equivalent cross slope, S_e. Example 3-8a demonstrates the procedure to determine spread and then uses Chart 2 to determine E_o. Example 3-8b demonstrates the use of these relationships to design the length of a curb-opening inlet.

Example 3-8a

Given: *A* curb-opening inlet with the following characteristics:

S_L = 0.014 ft/ft

S_x = 0.02 ft/ft

Q = 1.77 ft^3/s

n = 0.016

Find: The interception capacity of the following grates:

(1) Q_i for a 9.84 ft curb opening.

(2) Q_i for a depressed 9.84 ft curb-opening inlet with a continuously depressed curb section.

a = 1 in.

W = 2 ft

Solution (1):

Step 1. Determine the length of curb opening required for total interception of gutter flow using Equation 3-17 or Chart 7.

$$L_T = (0.6)Q^{0.42}S_L^{0.3}\left(\frac{1}{nS_x}\right)^{0.6}$$

$$L_T = (0.6)(1.77)^{0.42}(0.014)^{0.3}\left(\frac{1}{[(0.016)(0.02)]}\right)^{0.6}$$

$$L_T = 23.94 \text{ ft}$$

Step 2. Compute the curb-opening efficiency using Equation 3-18 or Chart 8.

$$\frac{L}{L_T} = \frac{9.84}{23.94} = 0.41$$

$$E = 1-\left(1-\frac{L}{L_T}\right)^{1.8}$$

$$E = 1-(1-0.41)^{1.8}$$

$$E = 0.61$$

Step 3. Compute the interception capacity.

$$Q_i = E\,Q$$

$$= (0.61)(1.77)$$

$$Q_i = 1.08 \text{ ft}^3/\text{s}$$

Solution (2):

Step 1. Use Equation 3-4 (Chart 2) and Equation 3-2 (Chart 1) to determine the *W/T* ratio.

Determine the spread, *T* (procedure from Example 3-2, Solution 2).

Assume $Q_s = 0.64 \text{ ft}^3/\text{s}$

$$Q_w = Q - Q_s$$

$$= 1.77 - 0.64$$

$$= 1.13 \text{ ft}^3/\text{s}$$

$$E_o = \frac{Q_w}{Q}$$

$$= \frac{1.13}{1.77}$$

$= 0.64$

$$S_w = S_x + \frac{a}{W}$$

$$= 0.02 + \frac{0.83}{2.0}$$

$$S_w = 0.062$$

$$\frac{S_w}{S_x} = \frac{0.062}{0.02} = 3.1$$

Use Equation 3-4 or Chart 2 to determine *W/T*.

$$\frac{W}{T} = 0.24$$

$$T = \frac{W}{\left(\frac{W}{T}\right)}$$

$$= \frac{2.0}{0.24}$$

$= 8.33$ ft

$T_s = T - W$

$= 8.3 - 2.0$

$= 6.3$ ft

Use Equation 3-2 or Chart 1 to obtain Q_s.

$$Q_s = \left(\frac{0.56}{n}\right) S_x^{1.67} S_L^{0.5} T_s^{2.67}$$

$$Q_s = \left\{\frac{(0.56)}{(0.016)}\right\} (0.02)^{1.67} (0.01)^{0.5} (6.3)^{2.67}$$

$Q_s = 0.69$ ft^3/s, which is close to the Q_s assumed value

Step 2. Determine the efficiency of the curb opening.

$$S_e = S_x + S'_w E_o = S_x + \left(\frac{a}{W}\right)E_o$$

$$= 0.02 + \left[\frac{(0.083)}{(2.0)}\right](0./64)$$

$$S_e = 0.047$$

Using Equation 3-20 or Chart 7:

$$L_T = (0.6)Q^{0.42}S_L^{0.3}\left(\frac{1}{nS_e}\right)^{0.6}$$

$$L_T = (0.6)(1.77)^{0.42}(0.01)^{0.3}\left[\frac{1}{((0.016)(0.047))}\right]^{0.6}$$

$$L_T = 14.34 \text{ ft}$$

Using Equation 3-18 or Chart 8 to obtain curb inlet efficiency:

$$\frac{L}{L_T} = \frac{9.84}{14.34} = 0.69$$

$$E = 1-\left(1-\frac{L}{L_T}\right)^{1.8}$$

$$E = 1-(1-0.69)^{1.8}$$

$$E = 0.88$$

Step 3. Compute curb opening inflow using Equation 3-9.

$$Q_i = Q\,E$$

$$= (1.77)(0.88)$$

$$Q_i = 1.55 \text{ ft}^3/\text{s}$$

The depressed curb-opening inlet will intercept 1.5 times the flow intercepted by the undepressed curb opening.

Example 3-8b

Given: From Example 3-6:

S_L = 0.01 ft/ft

S_x = 0.02 ft/ft

T = 8.2 ft

Q = 2.26 ft^3/s

n = 0.016

W = 2.0 ft

A = 2.0 in

E_o = 0.70

Find: The minimum length of a locally depressed curb-opening inlet required to intercept 100 percent of the gutter flow.

Solution:

Step 1. Compute the composite cross slope for the gutter section using Equation 3-19.

$$S_e = S_x + S'_w E_o$$

$$S_e = 0.02 + \left(\frac{2/12}{0.6}\right)0.60$$

$$S_e = 0.07$$

Step 2. Compute the length of curb-opening inlet required from Equation 3-20.

$$L_T = (0.6)Q^{0.42}S_L^{0.3}\left(\frac{1}{nS_e}\right)^{0.6}$$

$$L_T = (0.6)(2.26)^{0.42}(0.01)^{0.3}\left[\frac{1}{(0.016)(0.07)}\right]^{0.6}$$

$$L_T = 12.5 \text{ ft}$$

3-5.4.2.7 The use of depressed inlets and combination inlets enhances the interception capacity of the inlet. Example 3-6 determined the interception capacity of a depressed

curved vane grate, 2 ft by 2 ft; Examples 3-8a and 3-8b for an undepressed curb-opening inlet with a length of 9.8 ft and a depressed curb-opening inlet with a length of 9.8 ft; and Example 3-10 for a combination of 2 ft by 2 ft depressed curve vane grate located at the downstream end of a 9.8-ft-long depressed curb-opening inlet. The geometries of the inlets and the gutter slopes were consistent in the examples, and Table 3-5 summarizes a comparison of the intercepted flow of the various configurations.

Table 3-5. Comparison of Inlet Interception Capacities

Inlet Type	Intercepted Flow, Q_i
Curved Vane - Depressed	1.2 ft^3/s (Example 3-6)
Curb-Opening - Undepressed	1.1 ft^3/s (Example 3-8a)
Curb-Opening - Depressed	1.59 ft^3/s (Example 3-8b)
Combination - Depressed	1.76 ft3/s (Example 3-10)

Table 3-5 shows that the combination inlet intercepted approximately 100 percent of the total flow whereas the curved vane grate alone intercepted only 66 percent of the total flow. The depressed curb-opening inlet intercepted 90 percent of the total flow; however, if the curb-opening inlet was undepressed, it would have intercepted only 62 percent of the total flow.

3-5.5 Interception Capacity of Inlets in Sag Locations. Inlets in sag locations operate as weirs under low head conditions and as orifices at greater depths. Orifice flow begins at depths dependent on the grate size, the curb opening height, or the slot width of the inlet. At depths between those at which weir flow definitely prevails and those at which orifice flow prevails, flow is in a transition stage. At these depths, control is ill-defined and flow may fluctuate between weir and orifice control. Design procedures presented here are based on a conservative approach to estimating the capacity of inlets in sump locations.

The efficiency of inlets in passing debris is critical in sag locations because all runoff that enters the sag must be passed through the inlet. Total or partial clogging of inlets in these locations can result in hazardous ponded conditions. When a clogged inlet can lead to a hazardous condition (i.e., abnormally high depths of water such as at an underpass where there is no other avenue for the water to exit), extra precautions are recommended. Some of these include flanking inlets and combination inlets. Grate inlets alone are not recommended for use in sag locations because of the tendency of grates to become clogged. Combination inlets, flanking inlets, or curb-opening inlets are recommended for use in these locations. More information on flanking inlets can be found in section 3-5.6.3. If the depth of ponding is not hazardous even when the inlet is clogged, additional precautions may not be necessary.

3-5.5.1 **Grate Inlets in Sags.** A grate inlet in a sag location operates as a weir to depths dependent on the size of the grate and as an orifice at greater depths. Grates of

larger dimension will operate as weirs to greater depths than smaller grates. The capacity of grate inlets operating as weirs is:

$$Q_i = C_w P d^{1.5} \quad (3\text{-}21)$$

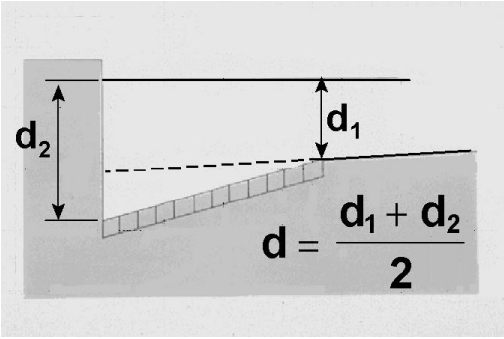
where:

P = perimeter of the grate (ft) disregarding the side against the curb

C_w = weir coefficient, 3.0

d = average depth across the grate; 0.5 (d_1 + d_2), ft (Figure 3-11)

Figure 3-11. Definition of Depth



3-5.5.1.1 The capacity of a grate inlet operating as an orifice is:

$$Q_i = C_o A_g (2gd)^{0.5} \quad (3\text{-}22)$$

where:

C_o = orifice coefficient, 0.67

A_g = clear opening area of the grate, ft^2

g = acceleration due to gravity, 32.16 ft/s^2

Use of Equation 3-22 requires the clear area of opening of the grate. Tests of three grates for the FHWA showed that for flat bar grates, such as the P-1-7/8 x 4 and P-1-1/8 grates, the clear opening is equal to the total area of the grate less the area occupied by longitudinal and lateral bars. The curved vane grate performed about 10 percent better than a grate with a net opening equal to the total area less the area of the bars projected on a horizontal plane. That is, the projected area of the bars in a curved vane grate is 68 percent of the total area of the grate, leaving a net opening of 32 percent; however, the grate performed as a grate with a net opening of 35 percent. Tilt-bar grates were not tested, but analysis of the results would indicate a net opening area of 34 percent for the 30-degree tilt-bar and zero for the 45-degree tilt-bar grate.

Obviously, the 45-degree tilt-bar grate would have greater than zero capacity. Tilt-bar and curved vane grates are not recommended for sump locations where there is a chance that operation would be as an orifice. Opening ratios for the grates are given on Chart 9 in Appendix B.

3-5.5.1.2 Chart 9 is a plot of Equations 3-21 and 3-22 for various grate sizes. The effects of grate size on the depth at which a grate operates as an orifice is apparent from the chart. Transition from weir to orifice flow results in interception capacity less than that computed by either the weir or the orifice equation. This capacity can be approximated by drawing a curve between the lines representing the perimeter and net area of the grate to be used.

Example 3-9 illustrates use of Equations 3-21 and 3-22 and Chart 9.

Example 3-9

Given: Under design storm conditions, a flow to the sag inlet is 6.71 ft^3/s. Also:

S_x = 0.05 ft/ft

n = 0.016

$T_{allowable}$ = 9.84 ft

Find: The grate size required and depth at curb for the sag inlet assuming 50 percent clogging where the width of the grate, W, is 2.0 ft.

Solution:

Step 1. Determine the required grate perimeter.

Depth at curb, d_2:

$d_2 = T\,S_x = (9.84)(0.05)$

d_2 = 0.49 ft

Average depth over grate:

$$d = d_2 - \left(\frac{W}{2}\right)S_w$$

$$d = 0.49 - \left(\frac{2.0}{2}\right)(.05)$$

d = 0.445 ft

From Equation 3-26 or Chart 9:

$$P = \left[\frac{Q_i}{C_w d^{1.5}}\right]$$

$$P = \left[\frac{(6.71)}{(3.0)(0.44)^{1.5}}\right]$$

$$P = 7.66 \text{ ft}$$

Some assumptions must be made regarding the nature of the clogging in order to compute the capacity of a partially clogged grate. If the area of a grate is 50 percent covered by debris so that the debris-covered portion does not contribute to interception, the effective perimeter will be reduced by a lesser amount than 50 percent. For example, if a 2 ft by 4 ft grate is clogged so that the effective width is 1 ft, then the calculation for the perimeter, P, is P = 1 + 4 +1 = 6 ft, rather than 7.66 ft, the total perimeter, or 3.83 ft, half of the total perimeter. The area of the opening would be reduced by 50 percent and the perimeter by 25 percent. Therefore, assuming 50 percent clogging along the length of the grate, a 4 ft by 4 ft, 2 ft by 6 ft, or a 3 ft by 5 ft grate would meet the requirements of a 7.66 ft perimeter 50 percent clogged.

Assuming 50 percent clogging along the grate length,

$P_{effective} = 8.0 = (0.5)(2)\ W + L$

If $W = 2$ ft, then $L > 5$ ft

If $W = 3$ ft, then $L \geq 5$ ft

Select a double 2 ft by 3 ft grate:

$P_{effective} = (0.5)(2)(2.0) + (6)$

$P_{effective} = 8$ ft

Step 2. Check the depth of flow at the curb using Equation 3-21 or Chart 9.

$$d = \left[\frac{Q}{(C_w P)}\right]^{0.67}$$

$$d = \left[\frac{6.71}{(3.0)(8.0)}\right]^{0.67}$$

$$d = 0.43 \text{ ft}$$

Conclusion:

A double 2 ft by 3 ft grate 50 percent clogged is adequate to intercept the design storm flow at a spread that does not exceed design spread; however, the tendency of grate inlets to clog completely warrants consideration of a combination inlet or curb-opening inlet in a sag where ponding can occur, and flanking inlets in long flat vertical curves.

3-5.5.2 **Curb-opening Inlets.** The capacity of a curb-opening inlet in a sag depends on the water depth at the curb, the curb opening length, and the height of the curb opening. The inlet operates as a weir to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage.

3-5.5.2.1 Spread on the pavement is the usual criterion for judging the adequacy of a pavement drainage inlet design. It is also convenient and practical in the laboratory to measure depth at the curb upstream of the inlet at the point of maximum spread on the pavement. Therefore, depth at the curb measurements from experiments coincide with the depth at the curb of interest to designers. The weir coefficient for a curb-opening inlet is less than the usual weir coefficient for several reasons, the most obvious of which is that depth measurements from experimental tests were not taken at the weir, and drawdown occurs between the point where measurements were made and the weir.

3-5.5.2.2 The weir location for a depressed curb-opening inlet is at the edge of the gutter, and the effective weir length is dependent on the width of the depressed gutter and the length of the curb opening. The weir location for a curb-opening inlet that is not depressed is at the lip of the curb opening, and its length is equal to that of the inlet, as shown in Chart 10 of Appendix B.

3-5.5.2.3 The equation for the interception capacity of a depressed curb-opening inlet operating as a weir is:

$$Q_i = C_w \left(L + 1.8\ W\right)\ d^{1.5} \qquad (3\text{-}23)$$

where:

C_w = 2.3

L = length of curb opening, ft

W = lateral width of depression, ft

d = depth at curb measured from the normal cross slope, ft, i.e., $d = T\ S_x$

3-5.5.2.4 The weir equation is applicable to depths at the curb approximately equal to the height of the opening plus the depth of the depression. Thus, the limitation on the use of Equation 3-23 for a depressed curb-opening inlet is:

$$d \le h + \frac{a}{12} \quad (3\text{-}24)$$

where:

h = height of curb-opening inlet, ft

a = depth of depression, in.

3-5.5.2.5 Experiments have not been conducted for curb-opening inlets with a continuously depressed gutter, but it is reasonable to expect that the effective weir length would be as great as that for an inlet in a local depression. Use of Equation 3-23 will yield conservative estimates of the interception capacity.

3-5.5.2.6 The weir equation for curb-opening inlets without depression becomes:

$$Q_i = C_w L\, d^{1.5} \quad (3\text{-}25)$$

Without depression of the gutter section, the weir coefficient, C_w, becomes 3.0. The depth limitation for operation as a weir becomes $d \le h$.

3-5.5.2.7 At curb-opening lengths greater than 12 ft, Equation 3-25 for non-depressed inlets produces intercepted flows that exceed the values for depressed inlets computed using Equation 3-23. Since depressed inlets will perform at least as well as non-depressed inlets of the same length, Equation 3-25 should be used for all curb-opening inlets with lengths greater than 12 ft.

3-5.5.2.8 Curb-opening inlets operate as orifices at depths greater than approximately 1.4 times the opening height. The interception capacity can be computed by Equation 3-26a and Equation 3-26b. These equations are applicable to depressed and undepressed curb-opening inlets. The depth at the inlet includes any gutter depression.

$$Q_i = C_o h\, L\, \left(2\, g\, d_o\right)^{0.5} \quad (3\text{-}26a)$$

or

$$Q_i = C_o A_g \left[2g\left(d_i - \frac{h}{2}\right)\right]^{0.5} \quad (3\text{-}26b)$$

where:

C_o = orifice coefficient (0.67)

d_o = effective head on the center of the orifice throat, ft

L = length of orifice opening, ft

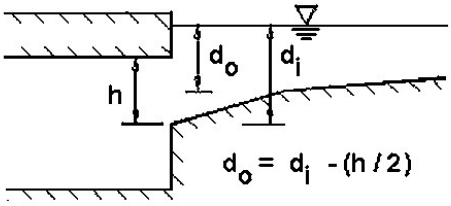
A_g = clear area of opening, ft^2

d_i = depth at lip of curb opening, ft

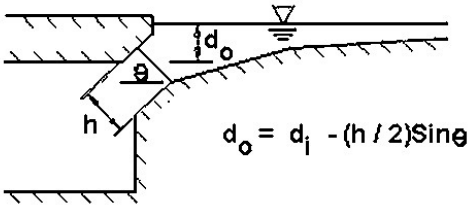
h = height of curb-opening orifice, ft

The height of the orifice in Equation 3-26a and Equation 3-26b assumes a vertical orifice opening. As illustrated in Figure 3-12, other orifice throat locations can change the effective depth on the orifice and the dimension (d_i - $h/2$). A limited throat width could reduce the capacity of the curb-opening inlet by causing the inlet to go into orifice flow at depths less than the height of the opening.

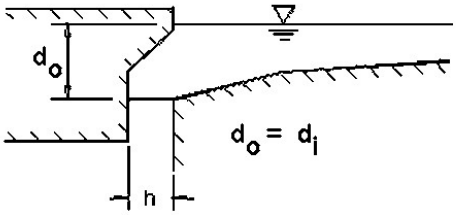
Figure 3-12. Curb-opening Inlets



a. Horizontal Throat



b. Inclined Throat



c. Vertical Throat

3-5.5.2.9 For curb-opening inlets with other than vertical faces (see Figure 3-12), Equation 3-26a can be used with:

h = orifice throat width, ft

d_o = effective head on the center of the orifice throat, ft

Chart 10 provides solutions for Equation 3-23 and Equation 3-26 for depressed curb-opening inlets, and Chart 11 provides solutions for Equation 3-25 and Equation 3-26 for curb-opening inlets without depression. Chart 12 is provided for use for curb openings with other than vertical orifice openings. Example 3-10 illustrates the use of Chart 11 and Chart 12.

Example 3-10

Given: Curb-opening inlet in a sump location with:

L = 8.2 ft

h = 0.432 ft

(1) Undepressed curb opening:

S_x = 0.02

T = 8.2 ft

(2) Depressed curb opening:

S_x = 0.02

a = 1

W = 2 ft

T = 8.2 ft

Find: Q_i

Solution (1): Undepressed

Step 1. Determine the depth at curb.

$d = T\,Sx = (8.2)(0.02)$

d = 0.16 ft

d = 0.16 ft ≤ h = 0.43 ft, therefore weir flow controls

Step 2. Use Equation 3-25 or Chart 11 to find Q_i.

$Q_i = C_w L\, d^{1.5}$

$Q_i = (3.0)(8.2)(0.16)1.5$

$= 1.6\ ft^3/s$

Solution (2): Depressed

Step 1. Determine the depth at curb, d_i.

$d_i = d + a$

$d_i = S_x\, T + a$

$d_i = (0.02)(8.2) + 1/12$

$d_i = 0.25$ ft

$d_i = 0.25$ ft < $h = 0.43$ ft, therefore weir flow controls

Step 2. Determine the efficiency of the curb opening.

$P = L + 1.8\, W$

$P = 8.2 + (1.8)(2.0)$

$P = 11.8$ ft

$Q_i = C_w \left(L + 1.8\ W\right) d^{1.5}$

$Q_i = (2.3)(11.8)(0.16)1.5$

$= 1.7\ ft^3/s$

The depressed curb-opening inlet has 10 percent more capacity than an inlet without depression.

3-5.6 Inlet Locations. The location of inlets is determined by geometric controls that require inlets at specific locations, the use and location of flanking inlets in sag vertical curves, and the criterion of spread on the pavement. In order to adequately design the location of the inlets for a given project, specific information is needed:

- A layout or plan sheet suitable for outlining drainage areas
- Road or runway profiles

- Typical cross sections
- Grading cross sections
- Superelevation diagrams
- Contour maps

3-5.6.1 **Geometric Controls.** In a number of locations, inlets may be necessary with little regard to the contributing drainage area. These locations should be marked on the plans prior to any computations regarding discharge, water spread, inlet capacity, or flow bypass. These are examples of such locations:

- At all low points in the gutter grade
- Immediately upstream of median breaks, entrance/exit ramp gores, cross walks, and street intersections, i.e., at any location where water could flow onto the travelway
- Immediately upgrade of bridges (to prevent pavement drainage from flowing onto bridge decks)
- Immediately downstream of bridges (to intercept bridge deck drainage)
- Immediately upgrade of cross slope reversals
- Immediately upgrade from pedestrian cross walks
- At the end of channels in cut sections
- On side streets immediately upgrade from intersections
- Behind curbs, shoulders, or sidewalks to drain low areas

In addition to these areas, runoff from areas draining towards the pavement should be intercepted by roadside channels or inlets before it reaches the roadway. This applies to drainage from cut slopes, side streets, and other areas alongside the pavement. Curbed pavement sections and pavement drainage inlets are inefficient means for handling extraneous drainage.

3-5.6.2 **Inlet Spacing on Continuous Grades.** Design spread is the criterion used for locating storm drain inlets between those required by geometric or other controls. The interception capacity of the upstream inlet will define the initial spread. As flow is contributed to the gutter section in the downstream direction, spread increases. The next downstream inlet is located at the point where the spread in the gutter reaches the design spread. Therefore, the spacing of inlets on a continuous grade is a function of the amount of upstream bypass flow, the tributary drainage area, and the gutter geometry.

3-5.6.2.1 For a continuous slope, the designer may establish the uniform design spacing between inlets of a given design if the drainage area consists of pavement only or has reasonably uniform runoff characteristics and is rectangular in shape. In this case, the time of concentration is assumed to be the same for all inlets. The following procedure and example illustrate the effects of inlet efficiency on inlet spacing.

3-5.6.2.2 In order to design the location of inlets on a continuous grade, the computation sheet shown in Figure 3-13 may be used to document the analysis. A step-by-step procedure for the use of Figure 3-13 follows.

Step 1. Complete the blanks at the top of the sheet to identify the job by state project number, route, date, and your initials.

Step 2. Mark on a plan the location of inlets that are necessary even without considering any specific drainage area, such as the locations described in section 3-5.6.1.

Step 3. Start at a high point, at one end of the job if possible, and work towards the low point. Then begin at the next high point and work backwards toward the same low point.

Step 4. To begin the process, select a trial drainage area approximately 300 to 500 ft long below the high point and outline the area on the plan. Include any area that may drain over the curb, onto the roadway. However, where practical, drainage from large areas behind the curb should be intercepted before it reaches the roadway or gutter.

Step 5. Col. 1 Describe the location of the proposed inlet by number (col. 1) and station (col. 2) and record this.

Col. 2 Information in columns 1 and 2. Identify the curb and gutter type in Column 19.

Col. 19 Remarks. A sketch of the cross section should be prepared.

Step 6. Col. 3 Compute the drainage area (acres) outlined in Step 4 and record in Column 3.

Step 7. Col. 4 Determine the runoff coefficient, *C*, for the drainage area. Select a *C* value provided in Table 2-1 or determine a weighted *C* value using Equation 3-2 and record the value in Column 4.

Step 8. Col. 5 Compute the time of concentration, t_c, in minutes, for the first inlet and record it in Column 5. The t_c is the amount of time it takes for the water to flow from the most hydraulically remote point

of the drainage area to the inlet, as discussed in Chapter 2. The minimum t_c is 5 minutes.

Figure 3-13. Inlet Spacing Computation Sheet

INLET SPACING COMPUTATION SHEET											Date_____ SP_____ ROUTE_____ Computed By:_____ Sheet __ of____							
INLET		GUTTER DISCHARGE Design Frequency_____					GUTTER DISCHARGE Allowable Spread_____								INLET DISCHARGE			RMK
No.	Stat.	Drain. Area A ( )	Run-off Coeff. C	Time of Conc. t_c	Rain. Inten. I	Q = CIA/K_c	Long. Slope S_L	Cross Slope S_x or S_w	Prev. By-pass Flow	Total Gutter Flow	Depth d	Grate or Gutter Width W	Spread T	W/T	Inlet Type	Inter-cept Flow Q_i	By-pass Flow Q_b	
		( )		(min)	(/hr)	(^{3}/s)	(/)	(/)	(^{3}/s)	(^{3}/s)	( )	( )	( )			(^{3}/s)	(^{3}/s)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)

Step 9. Col. 6 Using the time of concentration, t_c, determine the rainfall intensity from the IDF curve for the design frequency. Enter the value in Column 6.

Step10. Col. 7 Calculate the flow in the gutter using Equation 3-1, $Q = CIA$. The flow is calculated by multiplying Column 3 times Column 4 times Column 6. Enter the flow value in Column 7.

Step 11. Col. 8 From the roadway profile, enter in Column 8 the gutter longitudinal slope, S_L, at the inlet, taking into account any superelevation.

Step12. Col. 9 From the cross section, enter the cross slope, S_x, in Column 9 and the grate or gutter width, W, in Column 13.

Step13. Col. 11 For the first inlet in a series, enter the value from Column 7 into Column 11 since there was no previous bypass flow. Additionally, if the inlet is the first in a series, enter 0 into Column 10.

Step14. Col. 14 Determine the spread, T, by using Equations 3-2 and 3-4 or Chart 1 and Chart 2 and enter the value in Column 14. Also, determine the depth at the curb, d, by multiplying the spread by the appropriate cross slope, and enter the value in Column 12. Compare the calculated spread with the allowable spread as determined by the design criteria outlined in section 3.2. Additionally, compare the depth at the curb with the actual curb height in Column 19. If the calculated spread, Column 14, is near the allowable spread and the depth at the curb is less than the actual curb height, continue on to Step 15. Otherwise, expand or decrease the drainage area up to the first inlet to increase or decrease the spread, respectively. The drainage area can be expanded by increasing the length to the inlet, and it can be decreased by decreasing the distance to the inlet. Then, repeat Steps 6 through 14 until you obtain the appropriate values.

Step 15. Col. 15 Calculate W/T and enter the value in Column 15.

Step 16. Col. 16 Select the inlet type and dimensions and enter the values in Column 16.

Step 17. Col. 17 Calculate the flow intercepted by the grate, Q_i, and enter the value in Column 17. Use Equations 3-11 and 3-8 or Chart 2 and Chart 4 to define the gutter flow. Use Chart 5 and Equation 3-14 or Chart 6 to define the flow intercepted by the grate. Use Equations 3-17 and 3-18 or Chart 7 and Chart 8 for curb-opening inlets. Finally, use Equation 3-16 to determine the intercepted flow.

Step 18. Col. 18 Determine the bypass flow, Q_b, and enter it into Column 18. The bypass flow is Column 11 minus Column 17.

Step 19. Col. 1-4 Proceed to the next inlet down the grade. To begin the procedure, select a drainage area approximately 300 to 400 ft below the previous inlet for a first trial. Repeat Steps 5 through 7 considering only the area between the inlets.

Step 20. Col. 5 Compute the time of concentration, t_c, for the next inlet based upon the area between the consecutive inlets and record this value in Column 5.

Step 21. Col. 6 Determine the rainfall intensity from the IDF curve based on the time of concentration, t_c, determined in Step 20 and record the value in Column 6.

Step 22. Col. 7 Determine the flow in the gutter by using Equation 3-1 and record the value in Column 7.

Step 23. Col. 11 Record the value from Column 18 of the previous line into Column 10 of the current line. Determine the total gutter flow by adding Column 7 and Column 10 and record the value in Column 11.

Step 24. Col. 12 Determine the spread and the depth at the curb as outlined in Step 14. Repeat Steps 18 through 24 until the spread and the depth at the curb are within the design criteria.

Step 25. Col. 16 Select the inlet type and record it in Column 16.

Step 26. Col. 17 Determine the intercepted flow in accordance with Step 17.

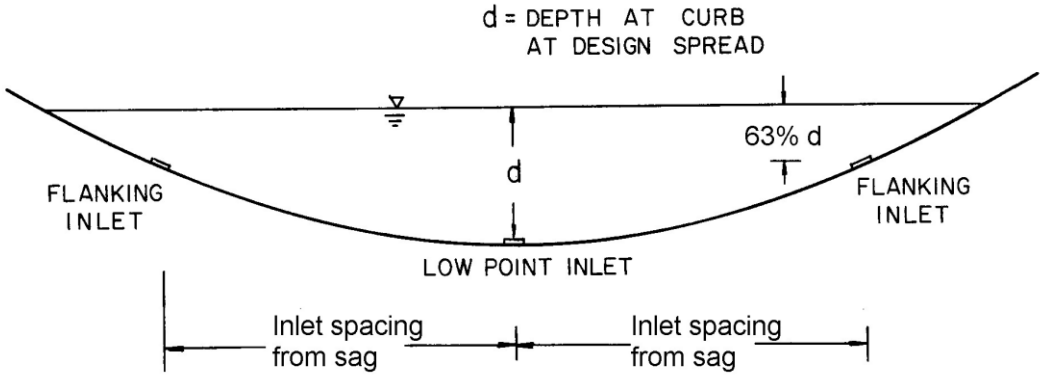
Step 27. Col. 18 Calculate the bypass flow by subtracting Column 17 from Column 11. This completes the spacing design for the inlet.

Step 28. Repeat Steps 19 through 27 for each subsequent inlet down to the low point. HEC-22 provides an example that illustrates the use of this procedure and Figure 3-13.

For inlet spacing in areas with changing grades, the spacing will vary as the grade changes. If the grade becomes flatter, inlets may be spaced at closer intervals because the spread will exceed the allowable spread. Conversely, for an increase in slope, the inlet spacing will become longer because of increased capacity in the gutter sections. Additionally, individual transportation agencies may limit spacing due to maintenance constraints.

3-5.6.3 **Flanking Inlets.** As explained in section 3-5.6.2, inlets should always be located at the low or sag points in the gutter profile. In addition, it is good engineering practice to place flanking inlets on each side of the low point inlet when in a depressed area that has no outlet except through the system. This is illustrated in Figure 3-14. The purpose of the flanking inlets is to act in relief of the inlet at the low point if it should become clogged or if the design spread is exceeded. For a complete explanation of the application of flanking inlets, see section 3-5.5. To summarize, flanking inlets should be used when the runoff entering the sag has only one exit location, i.e., the inlet in the bottom of the sag and the depth of ponding caused by clogging at the low point would cause a hazardous condition. An example would be a sag at an underpass. If the depth of ponding does not become too great and the runoff can exit over the curb, then flanking inlets may not be necessary.

Figure 3-14. Example of Flanking Inlets



Example 3-11

Given: A 500-ft (L) sag vertical curve at an underpass on a 4-lane divided highway with begin and end slopes of -2.5 percent and +2.5 percent respectively. The spread at design *Q* is not to exceed the shoulder width of 9.8 ft.

$S_x = 0.02$

Find: The location of the flanking inlets if located to function in relief of the inlet at the low point when the inlet at the low point is clogged.

Solution:

Step 1. Find the rate of vertical curvatures, *K*.

$$K = \frac{L}{\left(S_{end} - S_{beginning}\right)}$$

$$K = \frac{500ft}{\left(2.5\% - \left(-2.5\%\right)\right)}$$

K = 100 ft

Step 2. Determine the depth at the curb at the design spread.

$d = S_x T = (0.02)(9.84)$

d = 0.2 ft

Step 3. Determine the depth for the flanker locations.

d = 63 percent of depth over the inlet at the bottom of the sag (see Figure 3-14)

= 0.63 (0.2)

= 0.13 ft

Step 4. For use with Table 3-6:

d = 0.20 - 0.13 = 0.07 ft

X = distance from sag point, $(200dK)^{0.5}$

= $\{(200)(0.07)(100)\}^{0.5}$

= 37.4 ft

The inlet spacing is 37.4 ft from the sag point.

3-5.6.3.1 Flanking inlets can be located so they will function before water spread exceeds the allowable spread at the sump location. The flanking inlets should be located so that they will receive all of the flow when the primary inlet at the bottom of the sag is clogged. They should do this without exceeding the allowable spread at the bottom of the sag. If the flanking inlets are the same dimension as the primary inlet, they will each intercept one-half the design flow when they are located so that the depth of ponding at the flanking inlets is 63 percent of the depth of ponding at the low point. If the flanking inlets are not the same size as the primary inlet, it will be necessary to either develop a new factor or do a trial and error solution using assumed depths with the weir equation to determine the capacity of the flanking inlet at the given depths.

3-5.6.3.2 Table 3-6 shows the spacing required for various depth at curb criteria and vertical curve lengths defined by $K = L / (G_2 - G_1)$, where L is the length of the vertical curve in feet and G_1 and G_2 are the approach grades in percent. The AASHTO policy on geometrics specifies maximum K values for various design speeds and a maximum K of 167 considering drainage. The use of Table 3-6 is illustrated in Example 3-11.

Table 3-6. Distance to Flanking Inlets in a Sag Vertical Curve Using Depth at Curb Criteria

d (ft)	*K* (ft/percent)									
	20	**30**	**40**	**50**	**70**	**90**	**110**	**130**	**160**	**167**
0.1	20	24	28	32	37	42	47	51	57	58
0.2	28	35	40	45	53	60	66	72	80	82
0.3	35	42	49	55	65	73	81	88	98	100
0.4	40	49	57	63	75	85	94	102	113	116
0.5	45	55	63	71	84	95	105	114	126	129
0.6	49	60	69	77	92	104	115	125	139	142
0.7	53	65	75	84	99	112	124	135	150	153
0.8	57	69	80	89	106	120	133	144	160	163

NOTES: 1. $X = (200dK)^{0.5}$, where X = distance from sag point
2. $d = Y - Y$, where Y = depth of ponding and Y_f = depth at the flanker inlet
3. Drainage maximum K = 167

3-5.6.3.3 Example problem solutions in section 3-5.5 illustrate the total interception capacity of inlets in sag locations. Except where inlets become clogged, spread on low gradient approaches to the low point is a more stringent criterion for design than the interception capacity of the sag inlet. AASHTO recommends that a gradient of 0.3 percent be maintained within 50 ft of the level point in order to provide for adequate drainage. It is considered advisable to use spread on the pavement at a gradient comparable to that recommended by the AASHTO Committee on Design to evaluate the location and excessive spread in the sag curve. Standard inlet locations may need to be adjusted to avoid excessive spread in the sag curve. Inlets may be needed between the flankers and the ends of the curves also. For major sag points, the flanking inlets are added as a safety factor, and are not considered as intercepting flow to reduce the bypass flow to the sag point. They are installed to assist the sag point inlet in the event of clogging.

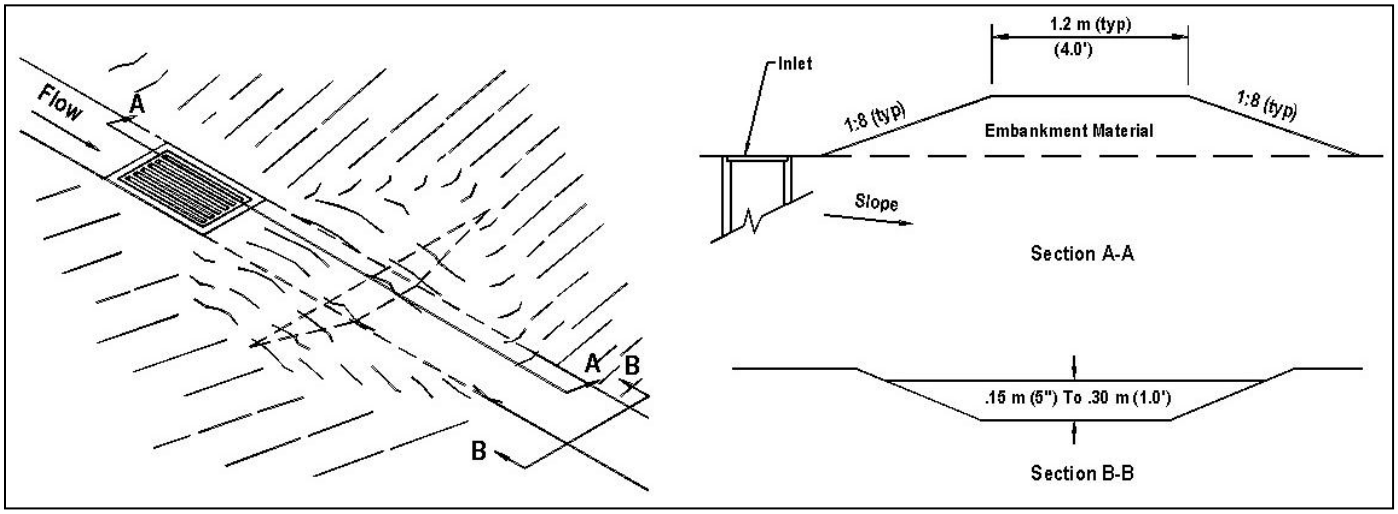
3-5.7 Median, Embankment, and Bridge Inlets. Flow in median and roadside ditches is discussed briefly in Chapter 5 and in the FHWA's HEC-15 and Hydraulic Design Series No. 4 (HDS-4). It is sometimes necessary to place inlets in medians at intervals to remove water that could cause erosion. Inlets are sometimes used in roadside ditches at the intersection of cut and fill slopes to prevent erosion downstream of cut sections.

Where adequate vegetative cover can be established on embankment slopes to prevent erosion, it is preferable to allow storm water to discharge down the slope with as little concentration of flow as practicable. Where storm water must be collected with curbs or swales, inlets are used to receive the water and discharge it through chutes, sod or riprap swales, or pipe downdrains.

Bridge deck drainage is similar to roadway drainage, and deck drainage inlets are similar in purpose to roadway inlets.

3-5.7.1 **Median and Roadside Ditch Inlets.** Median and roadside ditches may be drained by drop inlets similar to those used for pavement drainage, by pipe culverts under one roadway, or by cross drainage culverts that are not continuous across the median. Figure 3-15 illustrates a traffic-safe median inlet. Inlets, pipes, and discontinuous cross drainage culverts should be designed not to detract from a safe roadside. Drop inlets should be flush with the ditch bottom, and traffic-safe bar grates should be placed on the ends of pipes used to drain medians that would be a hazard to errant vehicles, although this may cause a plugging potential. Cross-drainage structures should be continuous across the median unless the median width makes this impractical.

Figure 3-15. Median Drop Inlet



3-5.7.1.1 Ditches tend to erode at drop inlets; paving around the inlets helps to prevent erosion and may increase the interception capacity of the inlet marginally by acceleration of the flow.

3-5.7.1.2 Pipe drains for medians operate as culverts and generally require more water depth to intercept median flow than drop inlets. No test results are available on which to base design procedures for estimating the effects of placing grates on culvert inlets; however, little effect is expected.

3-5.7.1.3 The interception capacity of drop inlets in median ditches on continuous grades can be estimated by use of Chart 14 and Chart 15 in Appendix B to estimate flow depth and the ratio of frontal flow to total flow in the ditch.

3-5.7.1.4 Chart 14 is the solution to Manning's equation for channels of various side slopes. Manning's equation for open channels is:

$$Q = \frac{1.486}{n} A R^{0.67} S_L^{0.5} \quad (3\text{-}27)$$

where:

Q = discharge rate, ft^3/s

n = hydraulic resistance variable

A = cross-sectional area of flow, ft^2

R = hydraulic radius = area/wetted perimeter, ft

S_L = bed slope, ft/ft

3-5.7.1.5 For the trapezoidal channel cross section shown on Chart 14, Manning's equation becomes:

$$Q = \frac{1.486}{n}\left(B + z d^2\right)\left(\frac{B + z d^2}{B + 2d\sqrt{z^2 + 1}}\right)^{0.67} S_L^{0.5} \quad (3\text{-}28)$$

where:

B = bottom width, ft

z = horizontal distance of the side slope to a rise of 1 ft vertical, ft

Equation 3-28 is a trial and error solution to Chart 14.

3-5.7.1.6 Chart 15 is the ratio of frontal flow to total flow in a trapezoidal channel. This is expressed as:

$$E_o \frac{W}{(B + dz)} \quad (3\text{-}29)$$

3-5.7.1.7 Chart 5 and Chart 6 are used to estimate the ratios of frontal and side flow intercepted by the grate-to-total flow.

3-5.7.1.8 Small dikes downstream of drop inlets (Figure 3-15) can be provided to impede bypass flow in an attempt to cause complete interception of the approach flow. The dikes usually need not be more than a few inches high and should have traffic safe slopes. The height of dike required for complete interception on continuous grades or the depth of ponding in sag vertical curves can be computed by use of Chart 9. The effective perimeter of a grate in an open channel with a dike should be taken as

2(L + W) since one side of the grate is not adjacent to a curb. Use of Chart 9 is illustrated in section 3-5.5.1.2.

3-5.7.1.9 The following examples illustrate the use of Chart 14 and Chart 15 for drop inlets in ditches on continuous grade.

Example 3-12

Given: A median ditch with these characteristics:

B = 3.9 ft

n = 0.03

z = 6

S = 0.02

The flow in the median ditch is to be intercepted by a drop inlet with a 2 ft by 2 ft P-50 parallel bar grate; there is no dike downstream of the inlet.

Q = 9.9 ft^3/s

Find: The intercepted and bypassed flows (Q_i and Q_b)

Solution:

Step 1. Compute the ratio of frontal to total flow in a trapezoidal channel.

Q_n = (9.9)(0.03)

Q_n = 0.30 ft^3/s

From Chart 13:

$$\frac{d}{B} = 0.12$$

$$d = (B)\left(\frac{d}{B}\right)$$

$$= (0.12)(3.9)$$

$$= 0.467 \text{ ft}$$

Using Equation 3-29 or Chart 15:

$$E_o = \frac{W}{(B + dz)}$$

$$= \frac{2.0}{[3.9 + (0.47)(6)]}$$

$$= 0.30$$

Step 2. Compute the frontal flow efficiency.

$$V = \frac{Q}{A}$$

$$A = (0.47)[(6)(0.47) + 3.9]$$

$$A = 3.18 \text{ ft}^2$$

$$V = \frac{9.9}{3.18}$$

$$= 3.11 \text{ ft/s}$$

From Chart 5, $R_f = 1.0$

Step 3. Compute the side flow efficiency.

Since the ditch bottom is wider than the grate and has no cross slope, use the least cross slope available on Chart 6 or use Equation 3-14 to solve for R_s.

Using Equation 3-14 or Chart 6:

$$R_s = \frac{1}{\left(1 + \frac{0.15V^{1.8}}{S_x L^{2.3}}\right)}$$

$$R_s = \frac{1}{\left(1 + \frac{(0.15)(3.11)^{1.8}}{\{(0.01)(2.0)^{2.3}\}}\right)}$$

$$= 0.04$$

Step 4. Compute the total efficiency.

$E = E_o R_f + R_s(1 - E_o)$

$E = (0.30)(1.0) + (0.04)(1 - 0.30)$

$= 0.33$

Step 5. Compute the interception and bypass flow.

$Q_i = E\,Q$

$Q_i = (0.33)(9.9)$

$Q_i = 3.27\ ft^3/s$

$Q_b = Q - Qi$

$Q_b = (9.9) - (3.27)$

$Q_b = 6.63\ ft^3/s$

In the above example, a P-1-7/8 inlet would intercept about 33 percent of the flow in a 3.9-ft bottom ditch on a continuous grade.

For grate widths equal to the bottom width of the ditch, use Chart 6 by substituting ditch side slopes for values of S_x, as illustrated in Example 3-13.

Example 3-13

Given: A median ditch with these characteristics:

$Q = 9.9\ ft^3/s$

$W = 2$ ft

$z = 6$

$S = 0.03$ ft/ft

$B = 2$ ft

$n = 0.03$

$S_x = 0.17$ ft/ft

The flow in the median ditch is to be intercepted by a drop inlet with a 2 ft by 2 ft P-1-7/8 parallel bar grate. There is no dike downstream of the inlet.

Find: The intercepted and bypassed flows (Q_i and Q_b).

Solution:

Step 1. Compute the ratio of frontal to total flow in a trapezoidal channel.

$Q_n = (9.9)(0.03)$

$Q_n = 0.30 \text{ ft}^3/\text{s}$

From Chart 14:

$\frac{d}{B} = 0.25$

$d = (0.25)(2.0)$

$= 0.50 \text{ ft}$

Using Equation 3-29 or Chart 15:

$$E_o = \frac{W}{(B + dz)}$$

$$= \frac{2.0}{[2.0 + (0.5)(6)]}$$

$= 0.40$

Step 2. Compute the frontal flow efficiency.

$$V = \frac{Q}{A}$$

$A = (0.5)[(6)(0.5) + 2.0]$

$A = 2.5 \text{ ft}^2$

$$V = \frac{9.9}{2.5}$$

$= 4.0 \text{ ft/s}$

From Chart 5, $R_f = 1.0$

Step 3. Compute the side flow efficiency.

Using Equation 3-14 or Chart 6:

$$R_s = \frac{1}{\left(1+\frac{0.15V^{1.8}}{S_x L^{2.3}}\right)}$$

$$R_s = \frac{1}{\left(1+\frac{(0.15)(4.0)^{1.8}}{\{(0.17)(2.0)^{2.3}\}}\right)}$$

$$= 0.32$$

Step 4. Compute the total efficiency.

$$E = E_o R_f + R_s(1 - E_o)$$

$$E = (0.40)(1.0) + (0.32)(1 - 0.40)$$

$$= 0.59$$

Step 5. Compute the interception and bypass flow.

$$Q_i = E\,Q$$

$$Q_i = (0.59)(9.9)$$

$$Q_i = 5.83 \text{ ft}^3/\text{s}$$

$$Q_b = Q - Q_i$$

$$Q_b = (9.9) - (5.83)$$

$$Q_b = 4.07 \text{ ft}^3/\text{s}$$

The height of dike downstream of a drop inlet required for total interception is illustrated by Example 3-14.

Example 3-14

Given: Data from Example 3-13.

Find: The required height of a berm to be located downstream of the grate inlet to cause total interception of the ditch flow.

Solution:

$P = 2(L + W)$

$P = 2(2.0 + 2.0)$

$= 8.0$ ft

Using Equation 3-21 or Chart 9:

$$d = \left[\frac{Q_i}{(C_w P)}\right]^{0.67}$$

$$d = \left[\frac{(9.9)}{\{(3.0)(8.0)\}}\right]^{0.67}$$

$d = 0.55$ ft

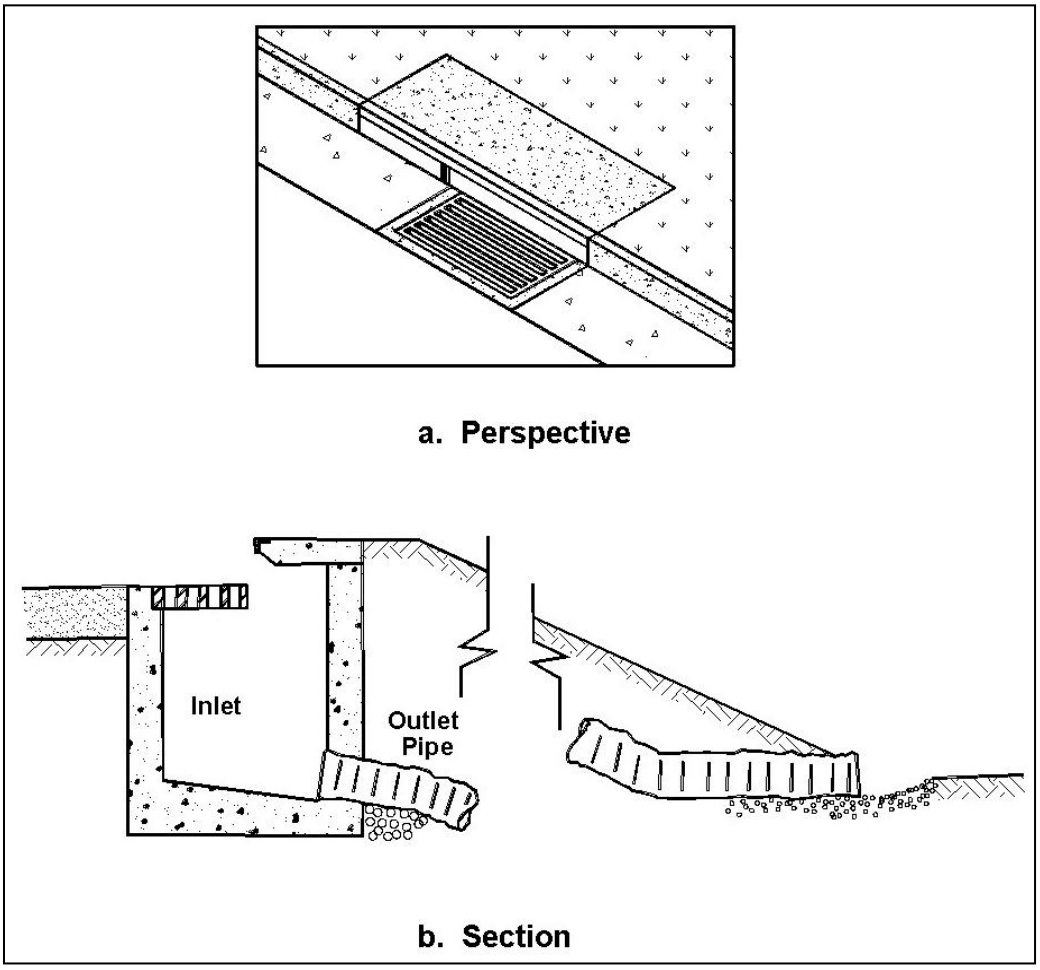
A dike will need to have a minimum height of 0.55 foot for total interception. Due to the initial velocity of the water that may provide adequate momentum to carry the flow over the dike, an additional 0.5 foot may be added to the height of the dike to ensure complete interception of the flow.

3-5.7.2 **Embankment Inlets.** Drainage inlets are often needed to collect runoff from pavements in order to prevent erosion of fill slopes or to intercept water upgrade or downgrade of bridges. Inlets used at these locations differ from other pavement drainage inlets in three respects. First, the economies that can be achieved by system design are often not possible because a series of inlets is not used; second, total or near total interception is sometimes necessary in order to limit the bypass flow from running onto a bridge deck; and third, a closed storm drainage system is often not available to dispose of the intercepted flow, and the means for disposal must be provided at each inlet. Intercepted flow is usually discharged into open chutes or pipe downdrains that terminate at the toe of the fill slope.

3-5.7.2.1 Example problem solutions in other sections of this UFC illustrate by inference the difficulty in providing for near total interception on grade. Grate inlets intercept little more than the flow conveyed by the gutter width occupied by the grate. Combination curb-opening and grate inlets can be designed to intercept total flow if the length of curb opening upstream of the grate is sufficient to reduce spread in the gutter to the width of the grate used. Depressing the curb opening would significantly reduce the length of inlet required. Perhaps the most practical inlets or procedure for use where near total interception is necessary are sweeper inlets, increase in grate width, and slotted inlets of sufficient length to intercept 85 to 100 percent of the gutter flow. Design charts and procedures in section 3-5.4 are applicable to the design of inlets on embankments. Figure 3-16 illustrates a combination inlet and downdrain.

3-5.7.2.2 Downdrains or chutes used to convey intercepted flow from inlets to the toe of the fill slope may be open or closed chutes. Pipe downdrains are preferable because the flow is confined and cannot cause erosion along the sides. Pipes can be covered to reduce or eliminate interference with maintenance operations on the fill slopes. Open chutes are often damaged by erosion from water splashing over the sides of the chute due to oscillation in the flow and from spill over the sides at bends in the chute. Erosion at the ends of downdrains or chutes can be a problem if not anticipated. The end of the device may be placed low enough to prevent damage by undercutting due to erosion. Well-graded gravel or rock can be used to control the potential for erosion at the outlet of the structure; however, some transportation agencies install an elbow or a "tee" at the end of the downdrains to redirect the flow and prevent erosion. See the FHWA's HEC-14 for additional information on energy dissipator designs.

Figure 3-16. Embankment Inlet and Downdrain



3-6 GRATE TYPE SELECTION CONSIDERATIONS. Grate type selection should consider such factors as hydraulic efficiency, debris handling characteristics, pedestrian and bicycle safety, and loading conditions. Relative costs will also influence grate type

selection.

3-6.1 Charts 5, 6, and 9 illustrate the relative hydraulic efficiencies of the various grate types explained here. The parallel bar grate (P-1-7/8) is hydraulically superior to all others but is not considered bicycle safe. The curved vane and the P-1-1/8 grates have good hydraulic characteristics with high velocity flows. The other grates tested are hydraulically effective at lower velocities.

3-6.2 Debris-handling capabilities of various grates are reflected in Table 3-3. The table shows a clear difference in efficiency between the grates with the 3.25-inch longitudinal bar spacing and those with smaller spacings. The efficiencies shown in the table are suitable for comparisons between the grate designs tested, but should not be taken as an indication of field performance since the testing procedure used did not simulate actual field conditions. Some local transportation agencies have developed factors for use of debris-handling characteristics with specific inlet configurations.

3-6.3 Table 3-7 ranks grate styles according to relative bicycle and pedestrian safety. The bicycle safety ratings were based on a subjective test program performed by the FHWA; however, all the grates are considered bicycle and pedestrian safe except the P-1-7/8. In recent years with the introduction of very narrow racing bicycle tires, some concern has been expressed about the P-1-1/8 grate. Exercise caution when using it in bicycle areas.

3-6.4 Grate loading conditions must also be considered when determining an appropriate grate type. Grates in traffic areas must be able to withstand traffic loads; conversely, grates draining yard areas usually do not need to be as rigid.

Table 3-7. Grate Ranking with Respect to Bicycle and Pedestrian Safety

Rank	Grate Style
1	P-1-7/8 x 4
2	Reticuline
3	P-1-1/8
4	45° - 3-1/4 Tilt Bar
5	45° - 2-1/4 Tilt Bar
6	Curved Vane
7	30° - 3-1/4 Tilt Bar

CHAPTER 4

CULVERT DESIGN

4-1 PURPOSE. This chapter discusses the hydraulic design of culverts. Though it is fairly easy to perform culvert design using the charts and nomographs from this chapter, it is still highly recommended that the designer obtain a copy of the FHWA's HY-8 culvert analysis software from the FHWA Web site. The HY-8 program is easy and quick to use and provides accurate answers using the equations shown on the charts and nomographs.

A drainage culvert is defined as any structure under a pavement with a clear opening of 20 feet or less measured along the center of the pavement. Culverts are used to convey flow through an embankment or past some other type of flow obstruction. Culverts are constructed from a variety of materials and are available in many different shapes and configurations. Culvert hydraulics and diagrams, charts, coefficients, and related information useful in the design of culverts are shown later in this chapter.

4-1.1 Culverts are generally of circular, oval, elliptical, arch, or box cross section and may be of single or multiple construction, the choice depending on available headroom and economy. Culvert materials for permanent-type installations include plain concrete, reinforced concrete, corrugated metal, and plastic. Concrete culverts may be either precast or cast in place, and corrugated metal culverts may have either annular or helical corrugations and be constructed of steel or aluminum. For the metal culverts, different kinds of coatings and linings are available for improvement of durability and hydraulic characteristics. The design of economical culverts involves consideration of many factors relating to requirements of hydrology, hydraulics, physical environment, imposed exterior loads, construction, and maintenance. With the design discharge and general layout determined, the design requires detailed consideration of such hydraulic factors as shape and slope of approach and exit channels, allowable head at entrance (and ponding capacity, if appreciable), tailwater levels, hydraulic and energy grade lines, and erosion potential. A selection from possible alternative designs may depend on practical considerations such as minimum acceptable size, available materials, local experience concerning corrosion and erosion, and construction and maintenance aspects. If two or more alternative designs involving competitive materials of equivalent merit appear to be about equal in estimated cost, plans will be developed to permit contractor’s options or alternate bids, so that the least construction cost will result.

4-1.2 Culvert pipe is available in many sizes depending on the material type and configuration. Pipe manufacturers provide pipe and culvert manuals and handbooks that describe their products. See Chapter 9 of this UFC for allowable pipe sizes and fill heights. Designs for extra large sizes or for special shapes or structural requirements may be submitted by manufacturers for approval and fabrication. Short culverts under sidewalks (not entrances or driveways) may be as small as 8 inch in diameter if placed to be comparatively free from accumulation of debris or ice. In general, pipe diameters or pipe-arch rises should be not less than 18 inches. A diameter or pipe-arch of not less than 24 inch should be used in areas where windblown materials such as weeds and

sand may tend to block the waterway. Within these ranges of sizes, structural requirements may limit the maximum size that can be used for a specific installation.

4-1.3 The capacity of a culvert is determined by its ability to admit, convey, and discharge water under specified conditions of potential and kinetic energy upstream and downstream. The hydraulic design of a culvert for a specified design discharge involves selection of a type and size, determination of the position of hydraulic control, and hydraulic computations to determine whether acceptable headwater depths (HW/D) and outfall conditions will result. In considering what degree of detailed refinement is appropriate in selecting culvert sizes, the relative accuracy of the estimated design discharge should be taken into account. Hydraulic computations will be carried out by standard methods based on pressure, energy, momentum, and loss considerations. Appropriate formulas, coefficients, and charts for culvert design are provided later in this chapter. The FHWA's HDS-5 should be consulted for detailed information regarding culvert design practice.

4-1.4 Rounding or beveling the entrance in any way will increase the capacity of a culvert for every design condition. Some degree of entrance improvement should always be considered for incorporation in design. A headwall will improve entrance flow over that of a projecting culvert. A headwall is particularly desirable as a cutoff to prevent saturation, sloughing, and/or erosion of the embankment. Provisions for drainage should be made over the center of the headwall to prevent scouring along the sides of the walls. A mitered entrance conforming to the fill slope produces a little improvement in efficiency over that of the straight, sharp-edged, projecting inlet, but may be structurally unsafe due to uplift forces. Both types of inlets tend to inhibit the culvert from flowing full when the inlet is submerged. The most efficient entrances incorporate such geometric features as elliptical arcs, circular arcs, tapers, and parabolic drop-down curves. In general, elaborate inlet designs for culverts are justifiable only in unusual circumstances.

4-1.5 Outlets and endwalls must be protected against undermining, bottom scour, damaging lateral erosion, and degradation of the downstream channel. The presence of tailwater higher than the culvert crown will affect culvert performance and may require protection of the adjacent embankment against wave or eddy scour. Endwalls (outfall headwalls) and wingwalls should be used where practical, and wingwalls should flare 1 on 8 from 1 diameter width to that required for the formation of a hydraulic jump and the establishment of a Froude number in the exit channel that will ensure stability. Two general types of channel instability can develop downstream of a culvert: gully scour or a localized erosion referred to as a scour hole. Gully scour is to be expected when the Froude number of flow in the channel exceeds that required for stability. Erosion of this type may be considerable depending upon the location of the stable channel section relative to that of the outlet in both the vertical and downstream directions. A scour hole can be expected downstream of an outlet even if the downstream channel is stable. The severity of damage depends upon the conditions existing or created at the outlet. More information on erosion protection is provided at the end of this chapter. In addition, the FHWA's HEC-14 is highly recommended for this topic.

4-1.6 In the design and construction of any drainage system it is necessary to consider the minimum and maximum earth cover allowable in the underground conduits to be placed under both flexible and rigid pavements. Minimum-maximum cover requirements for various pipe and culverts is provided in Chapter 9 of this UFC. The cover depths recommended are valid for average bedding and backfill conditions. Deviations from these conditions may result in significant minimum cover requirements.

4-1.7 Infiltration of fine-grained soils into drainage pipelines through joint openings is one of the major causes of ineffective drainage facilities. This is particularly a problem along pipes on relatively steep slopes such as those encountered with broken-back culverts. Infiltration of backfill and subgrade material can be controlled by watertight flexible joint materials in rigid pipe and with watertight coupling bands in flexible pipe. The results of laboratory research concerning soil infiltration through pipe joints and the effectiveness of gasketing tapes for waterproofing joints and seams are available. More information on watertight joints can be found in Chapter 9.

4-2 FISH PASSAGE CONSIDERATIONS. While the need for fish passage rarely occurs on DOD projects, this section provides some general fish passage guidance.

4-2.1 General. When it is determined that fish are present and fish passage must be accommodated, several design items must be considered. Consult a local fisheries biologist prior to making any of the design accommodations noted in paragraphs 4-2.2 through 4-2.8.

4-2.2 High Inverts. Fish passage is impossible when the culvert outlet is set too high, exceeding jumping ability of the fish and creating a spill velocity exceeding the swimming capability of the fish. Causes can be survey or design error, improper installation, or unexpected degradation of the downstream channel after culvert installation.

4-2.3 High Velocities in Culverts. These prevent fish from swimming upstream. Factors affecting velocity include the culvert's area, shape, slope, and internal roughness, and inlet and outlet conditions. Some increases in velocity result from the increased slope due to the culvert alignment being straight in lieu of the natural stream's meander, reduced surface roughness of the pipe, and a reduction in the cross-sectional area due to the pipe. Tailwater elevation, the water level in the downstream channel at the culvert outlet, should be based on the type of fish present. This minimum should be set with due consideration to recommendations of local fishery biologists.

Countersinking or partially burying a culvert will allow the natural stream material to be sustained throughout the length of the culvert. Enlarged, countersunk pipes have been effective for passing fish through a culvert.

4-2.4 Undersized or Failed Culverts. These can cause overtopping and washout of an embankment and destroy a fish resource by release of large amounts of sediment and debris.

4-2.5 Erosion Along Drainageways or at Outlets. Additional sediment from uncontrolled erosion can adversely affect fish. Causes can be high velocities, high inverts, undersized culverts, inadequate bank protection, and lack of suitable culvert endwalls.

4-2.6 Channel Filling. Covering an extensive reach of stream bottom decreases the area most suitable for spawning, depleting renewal of stocks. Proper biological input in siting and designing drainageways will avoid this problem.

4-2.7 Culvert Installation. Scheduling culvert excavation, channel diversion, and channel crossings by equipment should avoid times of the year that are critical to the fish cycle.

4-2.8 Control of Icing. Thawing devices such as electrical cables or steam lines, essential to any design where there is ice buildup, should be in operation to assure freedom from ice blockages during the spring migration period.

4-3 DESIGN STORM

4-3.1 The design of culverts will be based on the design storm frequencies defined in Chapter 2, section 2-2.5. The headwater depth for the design storm shall not exceed 1.25 or the local requirement. Examples of conditions where greater than the design storm frequency may be used are areas of steep slope in which overflows would cause severe erosion damage; high road fills that impound large quantities of water; and primary diversion structures, important bridges, and critical facilities where uninterrupted operation is imperative.

4-3.2 Protection of facilities against flood flows originating from areas exterior to the facility will normally be based on local design requirements but not less than the 10-year event. Operational requirements, cost-benefit considerations, and the nature and consequences of flood damage resulting from the failure of protective works shall also be considered. Justification for the selected design storm will be presented, and, if appropriate, comparative costs and damages for alternative designs should be included.

4-4 DESIGN. Improper design and careless construction of various drainage structures may render facilities ineffective and unsafe. Consequently, the necessity of applying basic hydraulic principles to the design of all drainage structures must be emphasized. Care should be given to both preliminary field surveys that establish control elevations and to the construction of the various hydraulic structures in strict accordance with proper and approved design procedures. A successful drainage system requires the coordination of both the field and design engineers.

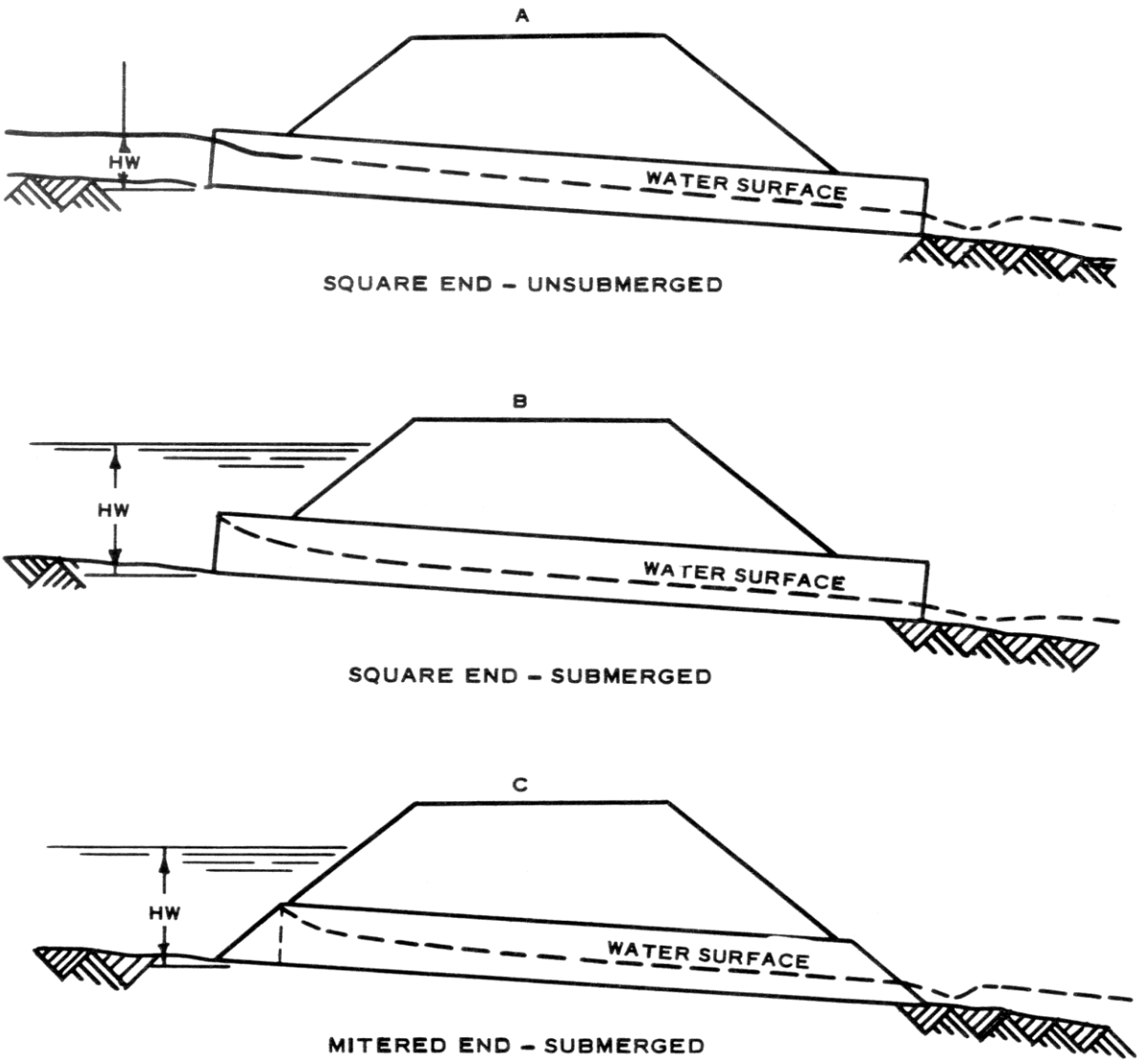
4-4.1 Hydraulic Design Data for Culverts

4-4.1.1 **General**. This section presents diagrams, charts, coefficients, and related information useful in the design of culverts. The information has been obtained largely from the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), and supplemented or modified as appropriate by information from various other sources and as required for consistency with design practice of the U.S. Army Corps of Engineers.

4-4.1.2 **Culvert Flow.** Laboratory tests and field observations show two major types of culvert flow: flow with inlet control and flow with outlet control. Under inlet control, the cross-sectional area of the culvert barrel, the inlet geometry, and the amount of headwater (HW) or ponding at the entrance are of primary importance. Outlet control involves the additional consideration of the elevation of the tailwater in the outlet channel and the slope, roughness, and length of the culvert barrel. The type of flow or the location of the control is dependent on the quantity of flow, roughness of the culvert barrel, type of inlet, flow pattern in the approach channel, and other factors. In some instances, the flow control changes with varying discharges, and occasionally the control fluctuates from inlet control to outlet control and vice versa for the same discharge. Thus, the design of culverts should consider both types of flow and should be based on the more adverse flow condition anticipated.

4-4.1.3 **Inlet Control**. The discharge capacity of a culvert is controlled at the culvert entrance by the depth of headwater and the entrance geometry, including the area, slope, and type of inlet edge. Types of inlet-controlled flow for unsubmerged and submerged entrances are shown at A and B in Figure 4-1. A mitered entrance (C, Figure 4-1) produces little improvement in efficiency over that of the straight, sharp-edged, projecting inlet. Both types of inlets tend to inhibit the culvert from flowing full when the inlet is submerged. With inlet control, the roughness and length of the culvert barrel and outlet conditions (including depths of tailwater) are not factors in determining culvert capacity. The effect of the barrel slope on inlet-control flow in conventional culverts is negligible. Nomographs for determining culvert capacity for inlet control were developed by the Division of Hydraulic Research, Bureau of Public Roads (see the FHWA's HDS-1). These nomographs (Figures 4-2 through 4-9) give headwater-discharge relations for most conventional culverts flowing with inlet control. Nomographs for other culvert shapes are provided in HDS-5.

Figure 4-1. Inlet Control



U. S. Army Corps of Engineers

Figure 4-2. Headwater Depth for Concrete Pipe Culverts with Inlet Control

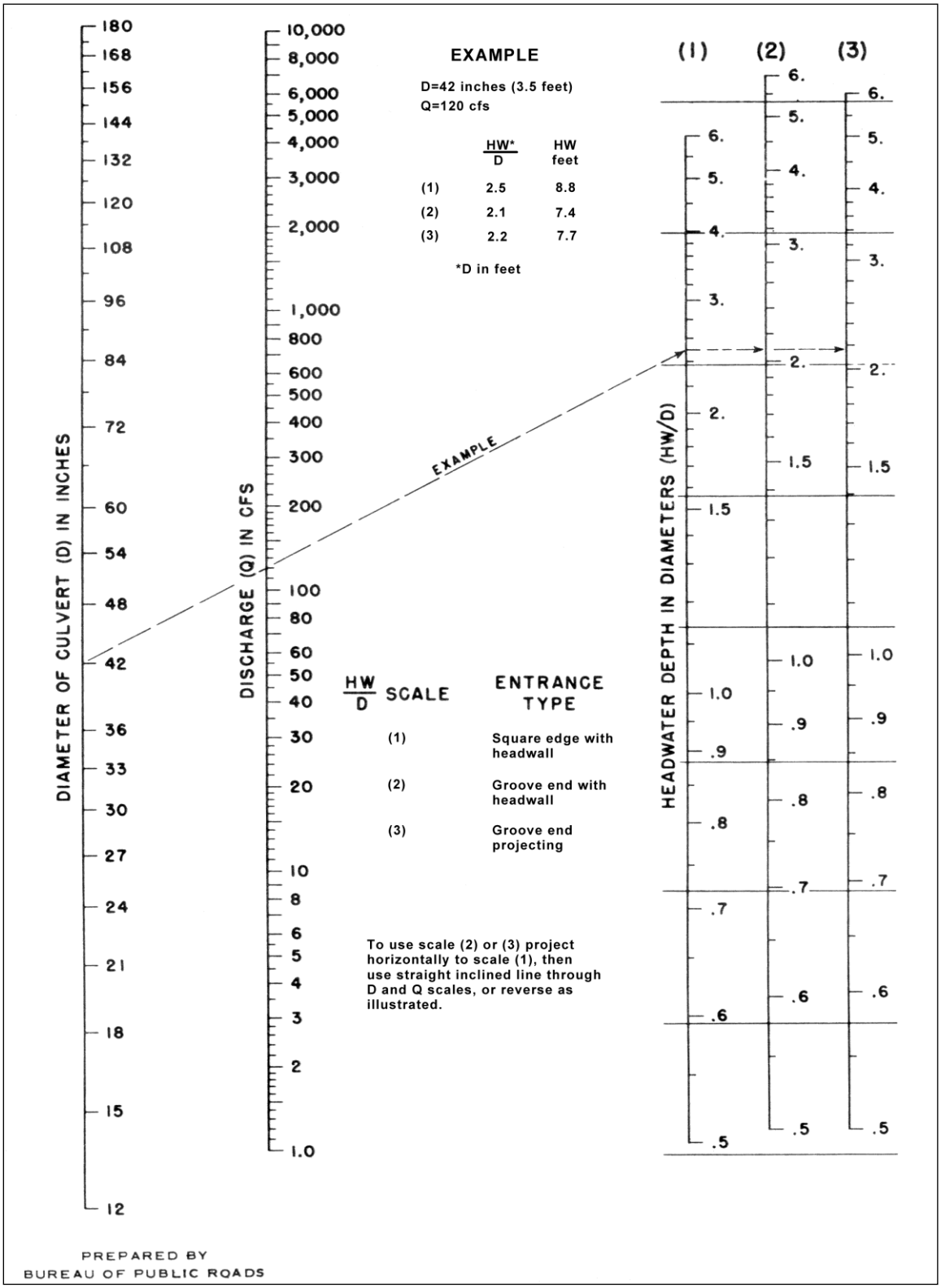


Figure 4-3. Headwater Depth for Oval Concrete Pipe Culverts Long Axis Vertical with Inlet Control

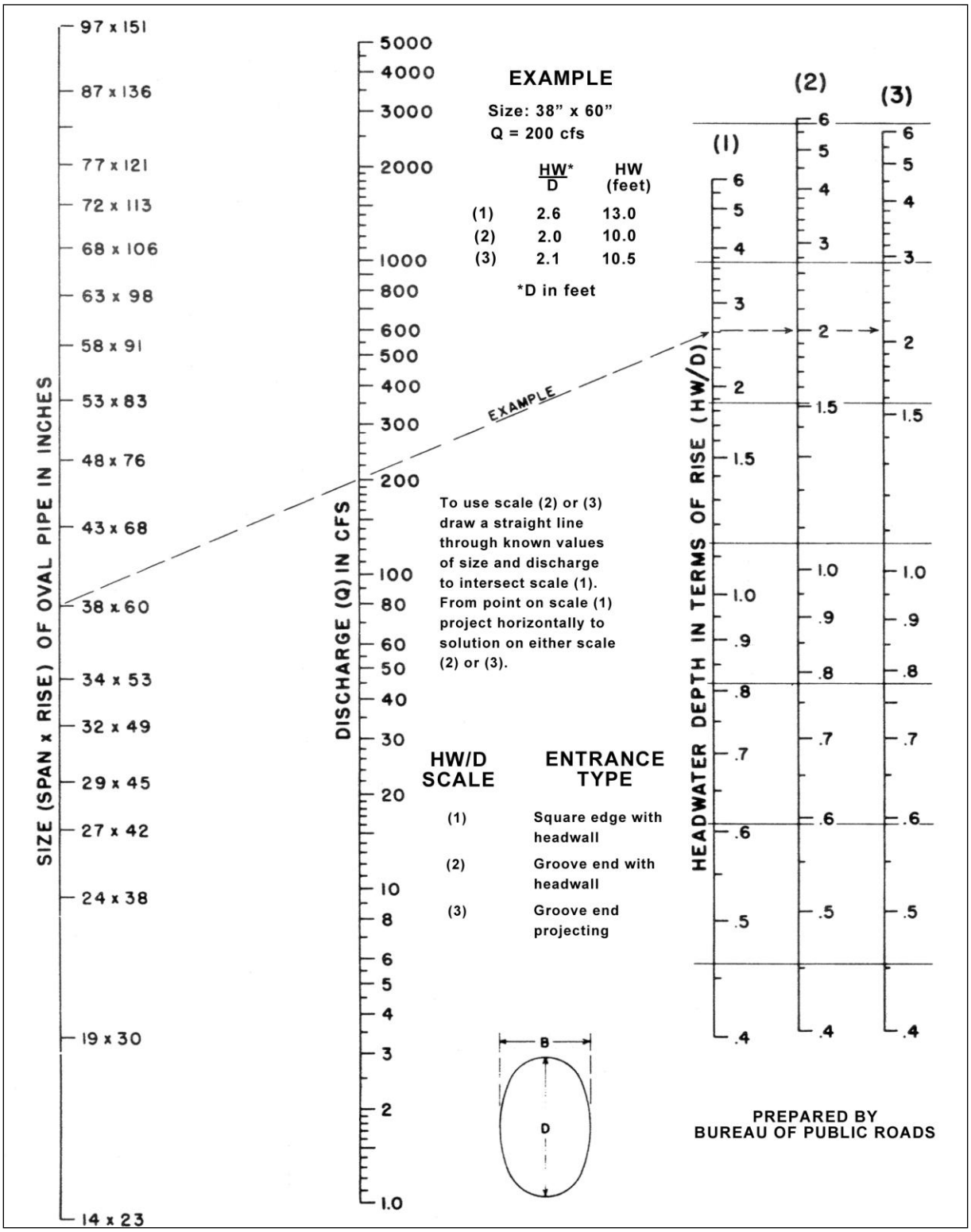


Figure 4-4. Headwater Depth for Oval Concrete Pipe Culverts Long Axis Horizontal with Inlet Control

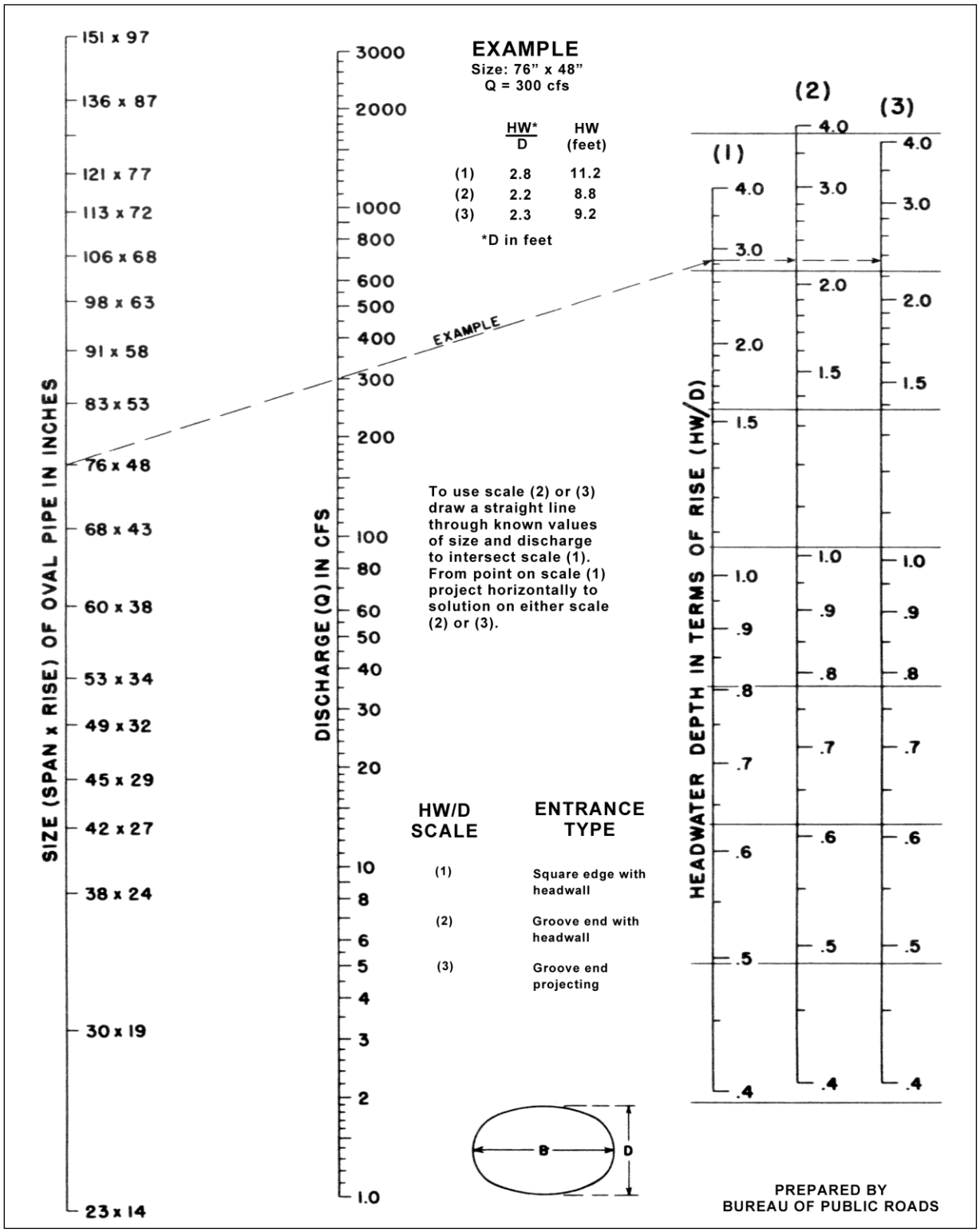


Figure 4-5. Headwater Depth for Corrugated Metal Pipe Culverts with Inlet Control

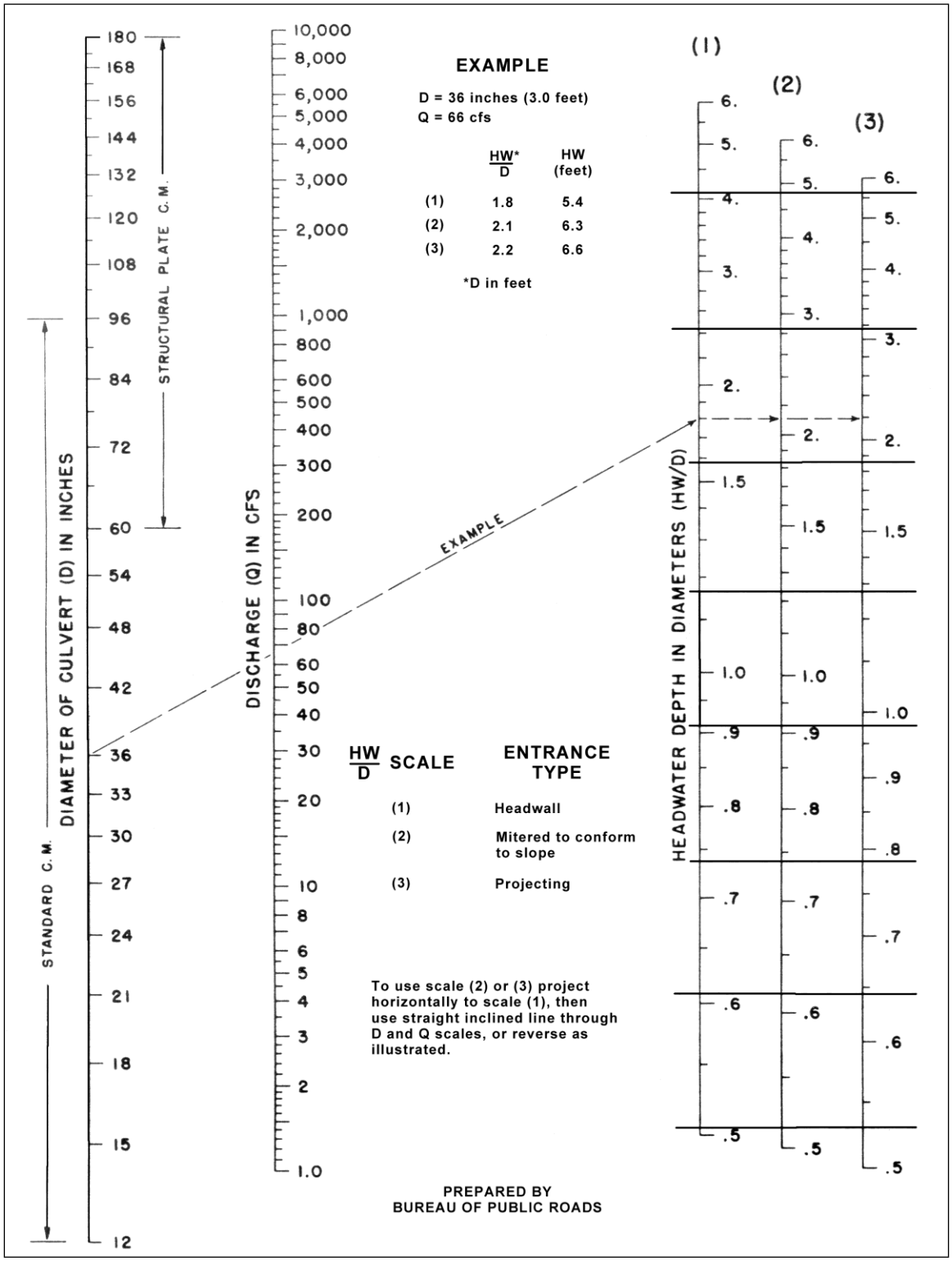


Figure 4-6. Headwater Depth for Structural Plate and Standard Corrugated Metal Pipe-Arch Culverts with Inlet Control

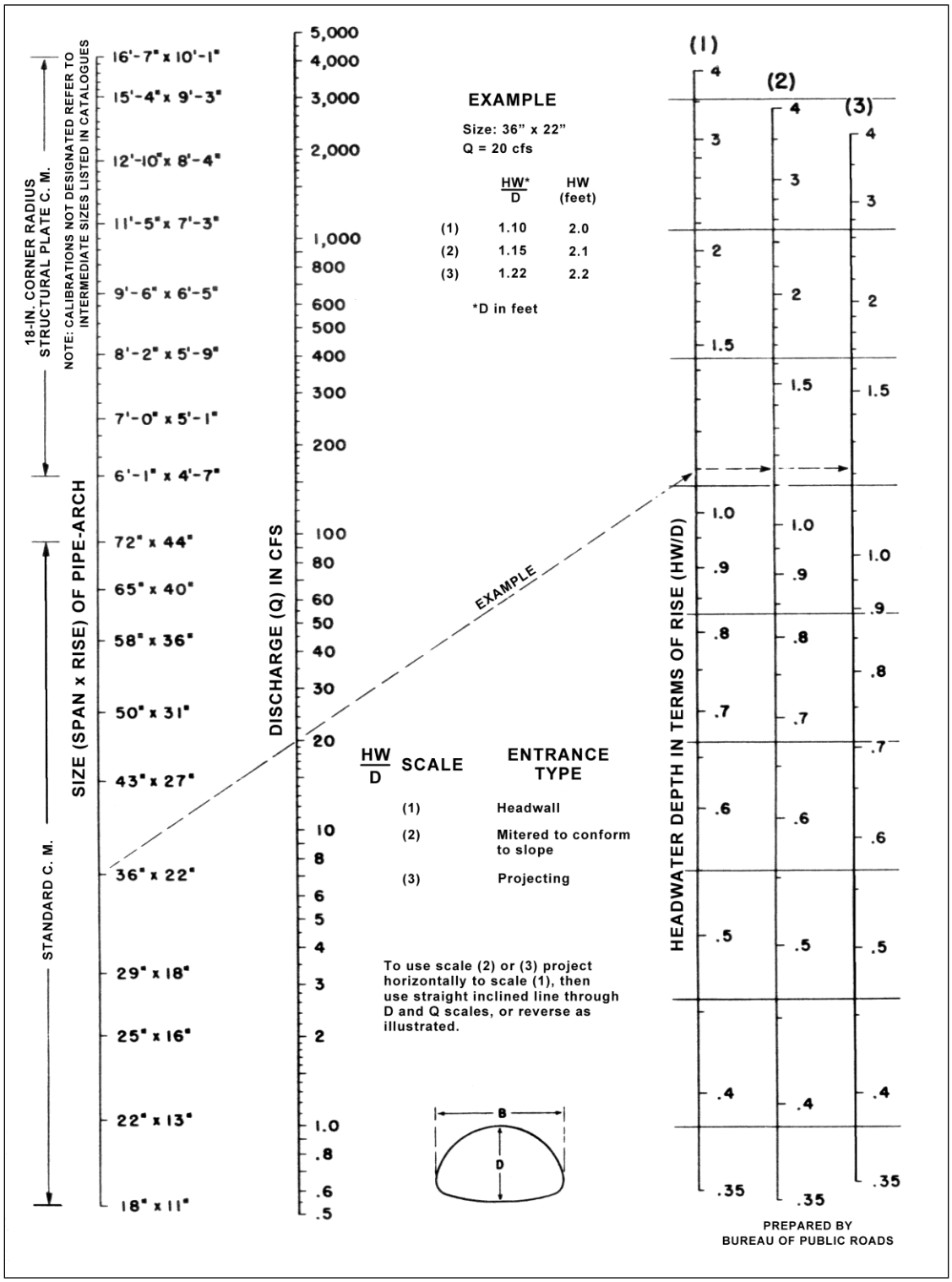


Figure 4-7. Headwater Depth for Box Culverts with Inlet Control

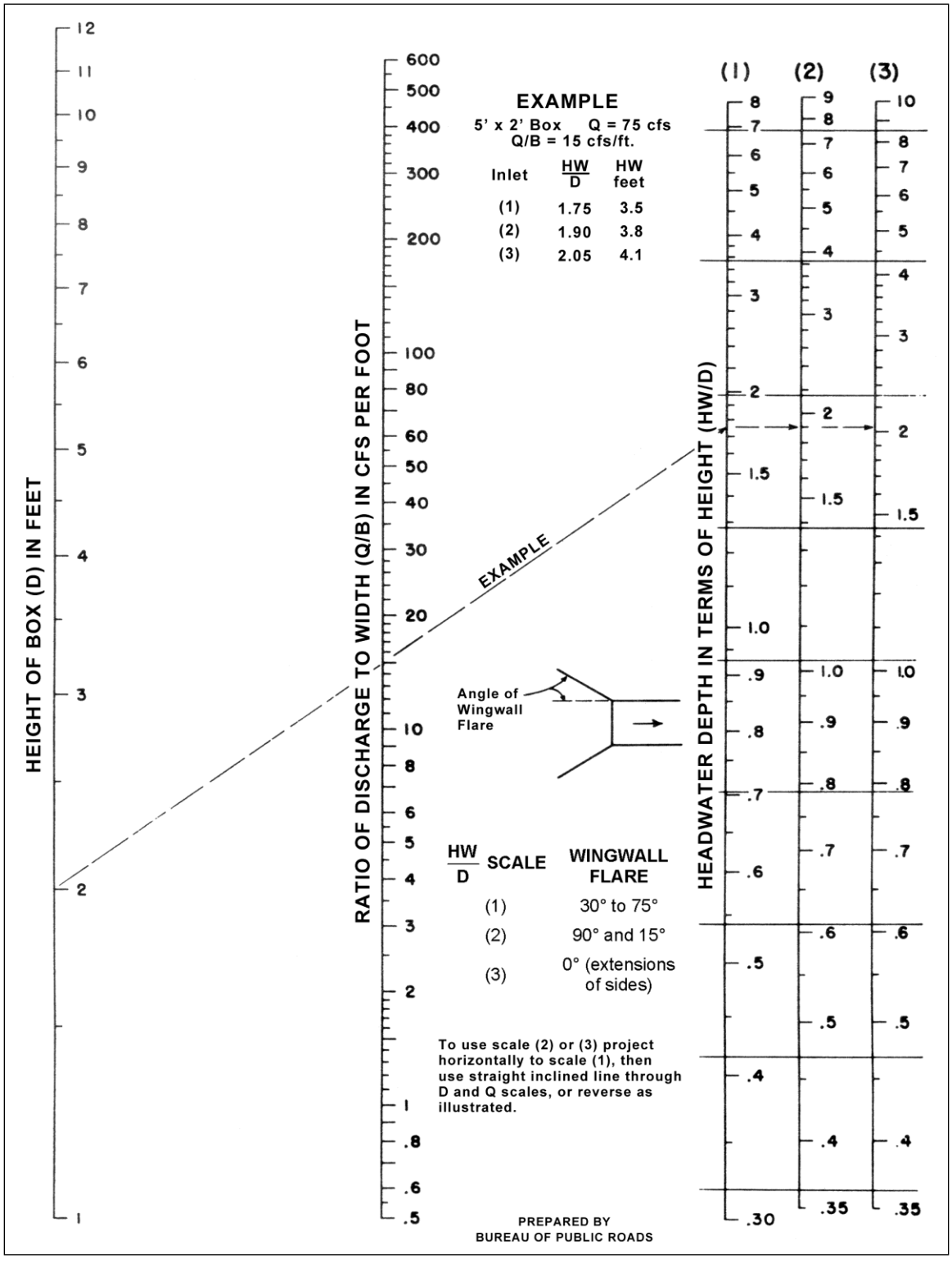


Figure 4-8. Headwater Depth for Corrugated Metal Pipe Culverts with Tapered Inlet Control

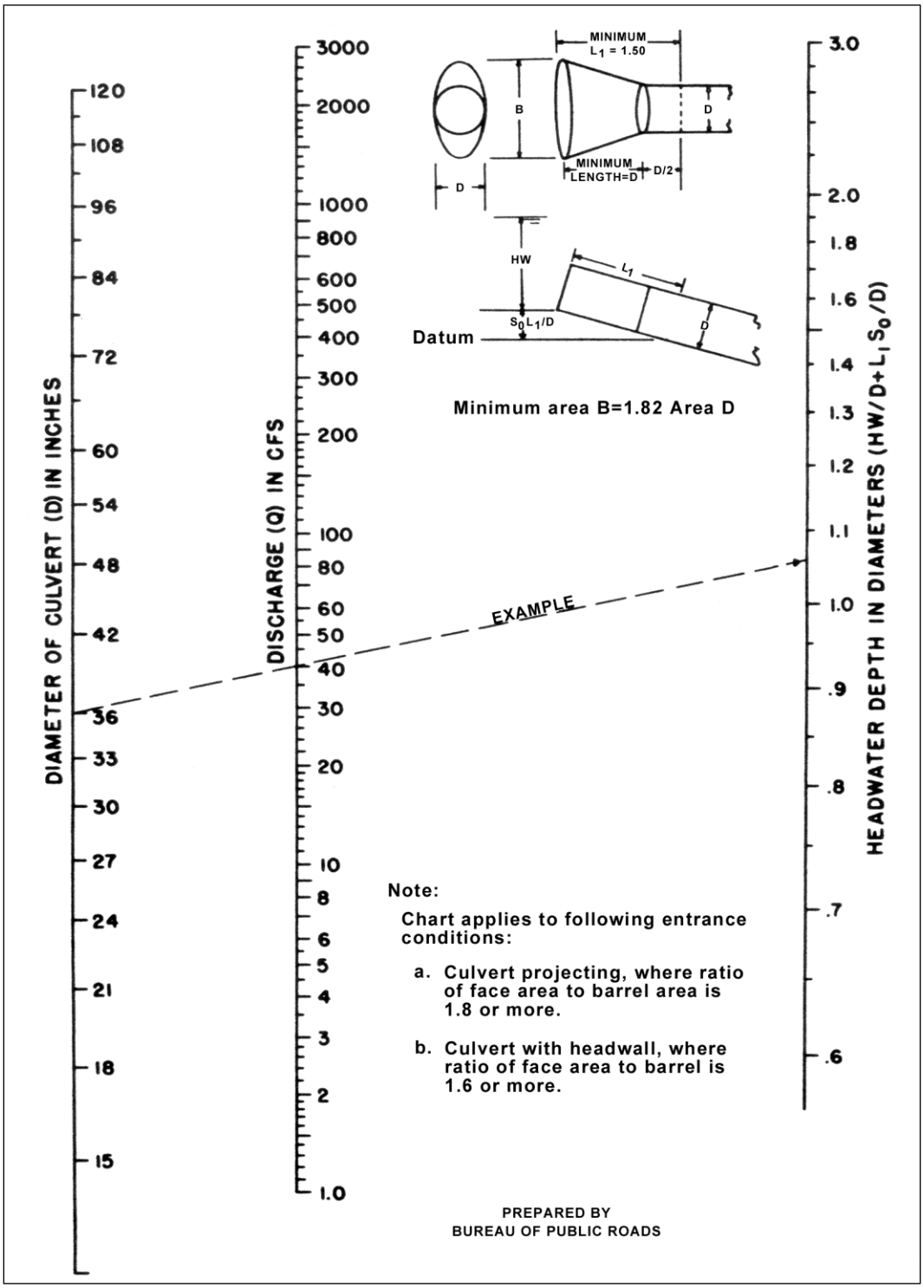
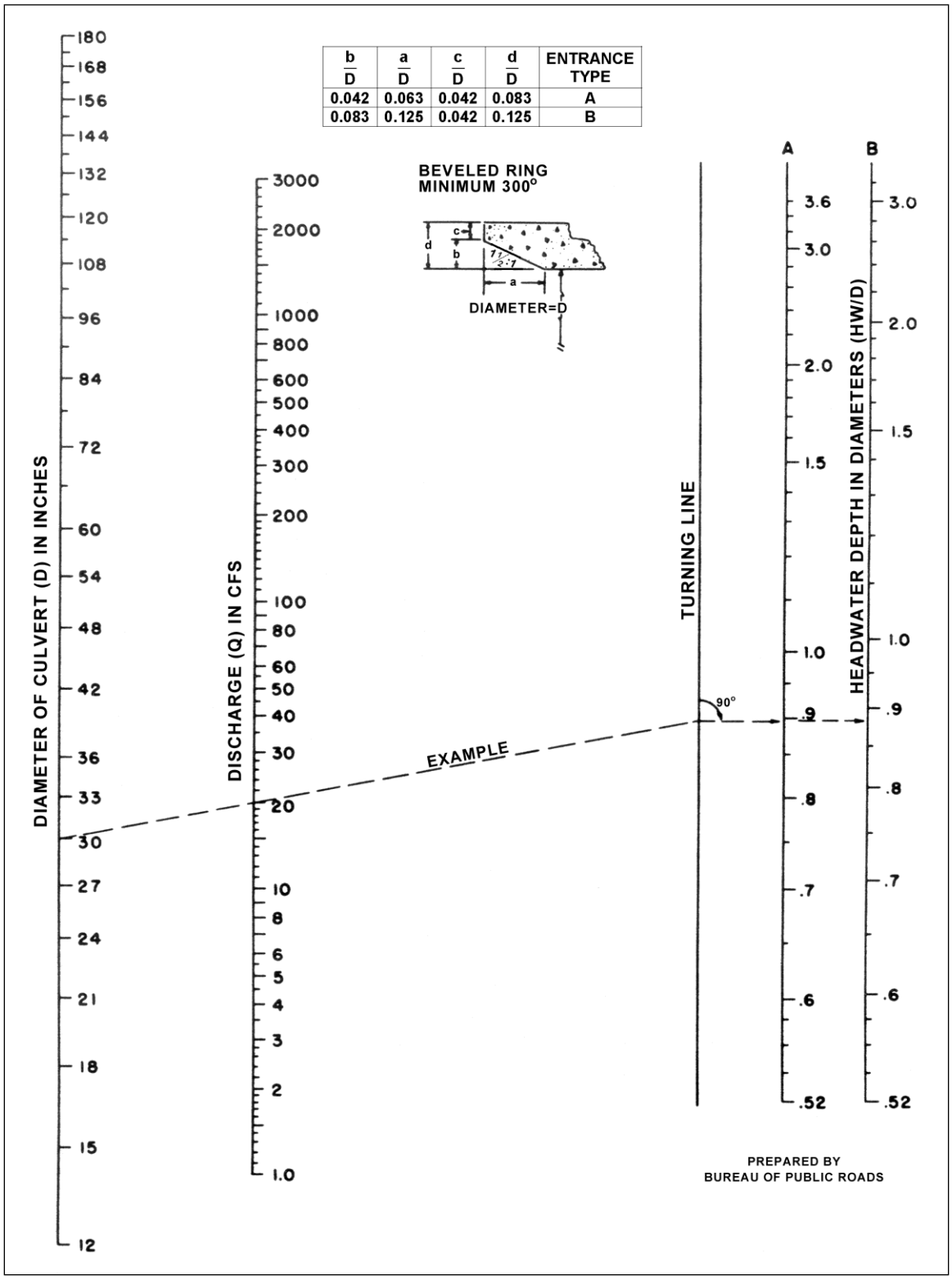
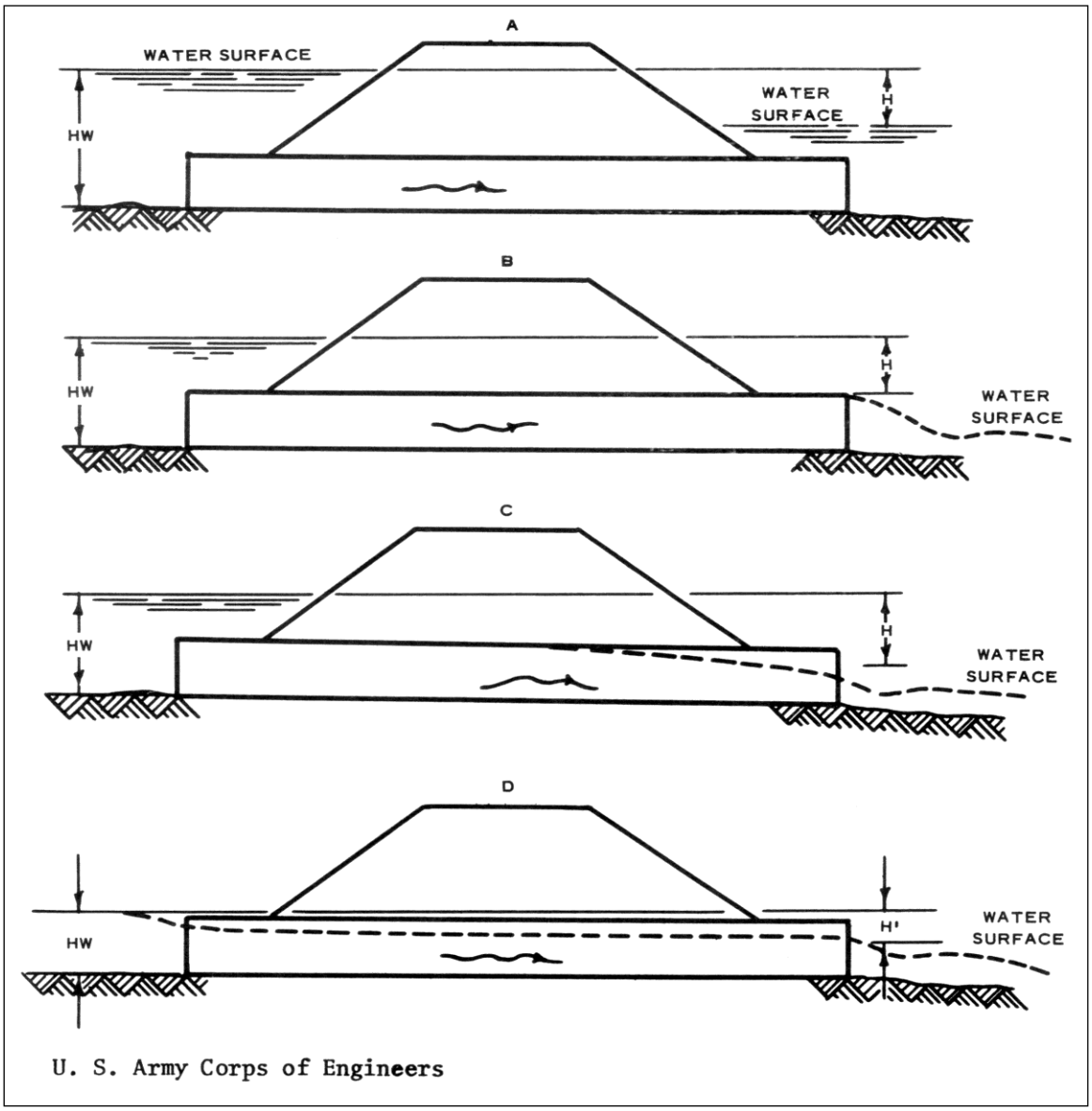


Figure 4-9. Headwater Depth for Circular Pipe Culverts with Beveled Ring Inlet Control



4-4.1.4 **Outlet Control.** Culverts flowing with outlet control can flow with the culvert barrel full or partially full for part of the barrel length or for all of it (Figure 4-10). If the entire barrel is filled (both cross section and length) with water, the culvert is said to be in full flow or flowing full (Figure 4-10, A and B). The other two common types of outlet-control flow are shown in Figure 4-10, C and D. The procedure given for outlet-control flow does not give an exact solution for a free-water-surface condition throughout the barrel length shown in Figure 4-10, D. An approximate solution is given for this case when the headwater, *HW*, is equal to or greater than 0.75*D*, where *D* is the height of the culvert barrel. The head, *H*, required to pass a given quantity of water through a culvert flowing full with control at the outlet is made up of three major parts.

Figure 4-10. Outlet Control



4-4.1.4.1 These three parts are usually expressed in feet of water and include a velocity head, an entrance loss, and a friction loss. The velocity head (the kinetic energy of the water in the culvert barrel) equals $\frac{V^2}{2g}$. The entrance loss varies with the type or design of the culvert inlet and is expressed as a coefficient times the velocity head, or $K_e \frac{V^2}{2g}$. Values of K_e for various types of culvert entrances are given in Table 4-1. The friction loss, H_f, is the energy required to overcome the roughness of the culvert barrel and is usually expressed in terms of Manning's *n* (Table 6-1) and Equation 4-1:

$$H_f = \left(\frac{29n^2L}{R^{1.333}}\right)\left(\frac{V^2}{2g}\right) \quad (4\text{-}1)$$

Table 4-1. Entrance Loss Coefficients, Outlet Control, Full or Partly Full

Entrance Head Loss, $H_e = K_e \frac{V^2}{2g}$ *

Type of Structure and Design of Entrance	Coefficient, K_e
Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, square-cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end)	0.2
Square-edge	0.5
Rounded (radius = 0.083 barrel dimension)	0.2
Mitered to conform to fill slope	0.7
**End section conforming to fill slope	0.5
Beveled edges, 33.7-degree or 45-degree bevels	0.2
Side- or sloped-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls, square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
**End section conforming to fill slope	0.5
Beveled edges, 33.7-degree or 45-degree bevels	0.2
Side- or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 0.083 barrel dimension, or	0.2

Type of Structure and Design of Entrance	Coefficient, K_e
beveled edges on 3 sides	
Wingwalls at 30 degrees to 75 degrees to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 0.083 barrel dimension, or beveled top edge	0.2
Wingwalls at 10 degrees to 25 degrees to barrel	
Square-edged at crown	0.7
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2
* Table developed by the U.S. Army Corps of Engineers ** ***NOTE:*** Made of either metal or concrete, these end sections are commonly available from manufacturers. From limited hydraulic tests, they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design, have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.	

4-4.1.4.2 Adding the three terms and simplifying, yields for full pipe, outlet control flow Equation 4-2:

$$H = \left(1 + K_e + \frac{29n^2L}{R^{1.333}}\right)\left(\frac{V^2}{2g}\right) \quad (4\text{-}2)$$

This equation can be solved readily by the use of the full-flow nomographs, Figures 4-11 through 4-17. The equations shown on these nomographs are the same as Equation 4-1 but expressed in a different form. Each nomograph is drawn for a single value of *n* as noted in the respective figure. These nomographs may be used for other values of *n* by modifying the culvert length as explained later in this chapter in the section describing the use of the outlet-control nomographs. The value of *H* (head, ft) must be measured from some “control” elevation at the outlet that is dependent on the rate of discharge or the elevation of the water surface of the tailwater. For simplicity, a value h_o is used as the distance in feet from the culvert invert (flow line) at the outlet to the control elevation. Equation 4-3 is used to compute headwater in reference to the inlet invert:

$$HW = h_o + H - LS_o \quad (4\text{-}3)$$

Figure 4-11. Head for Circular Pipe Culverts Flowing Full, *n* = 0.012

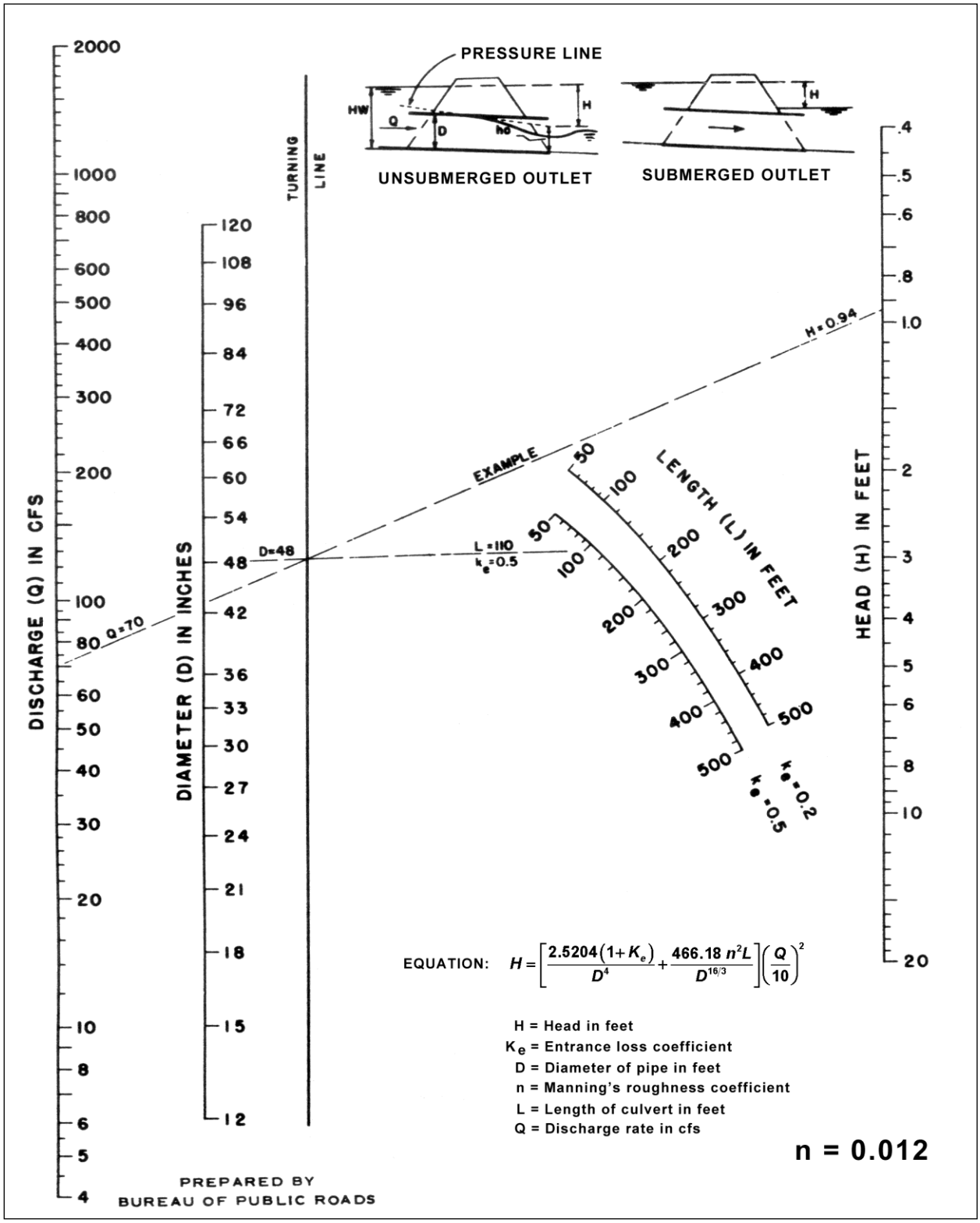


Figure 4-12. Head for Oval Circular Pipe Culverts Long Axis Horizontal or Vertical Flowing Full, *n* = 0.012

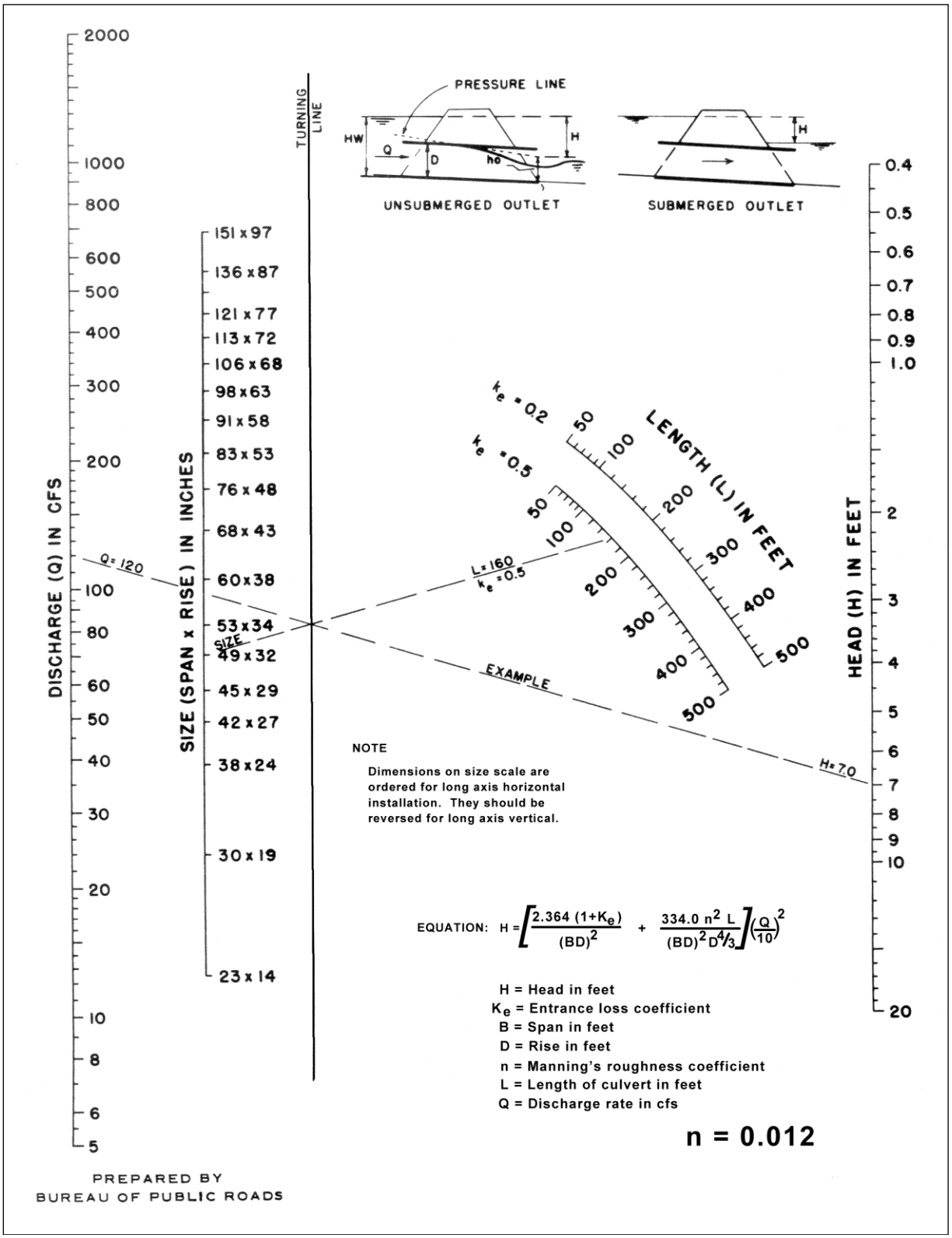


Figure 4-13. Head for Circular Pipe Culverts Flowing Full, *n* = 0.024

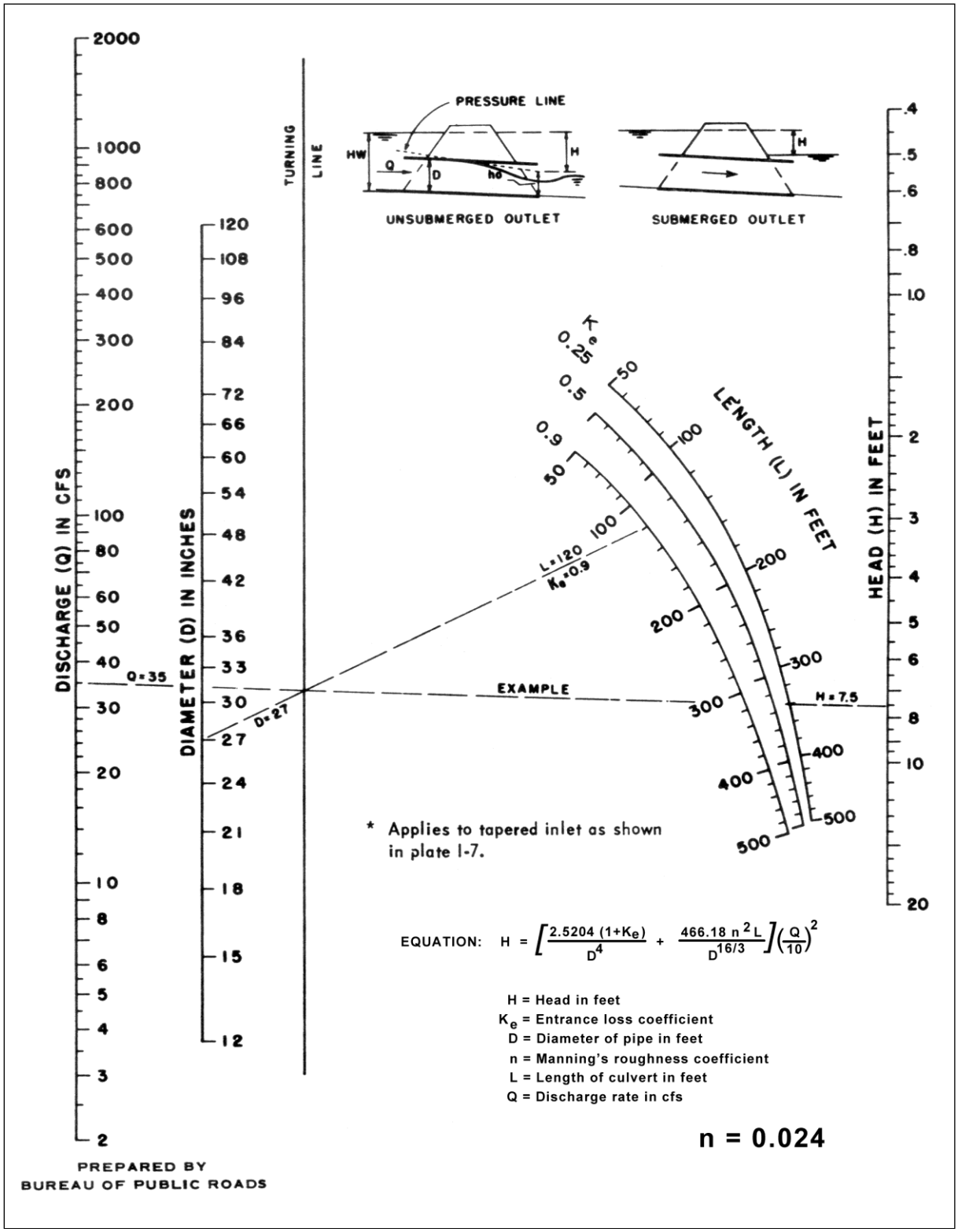


Figure 4-14. Head for Circular Pipe Culverts Flowing Full, *n* = 0.0328 to 0.0302

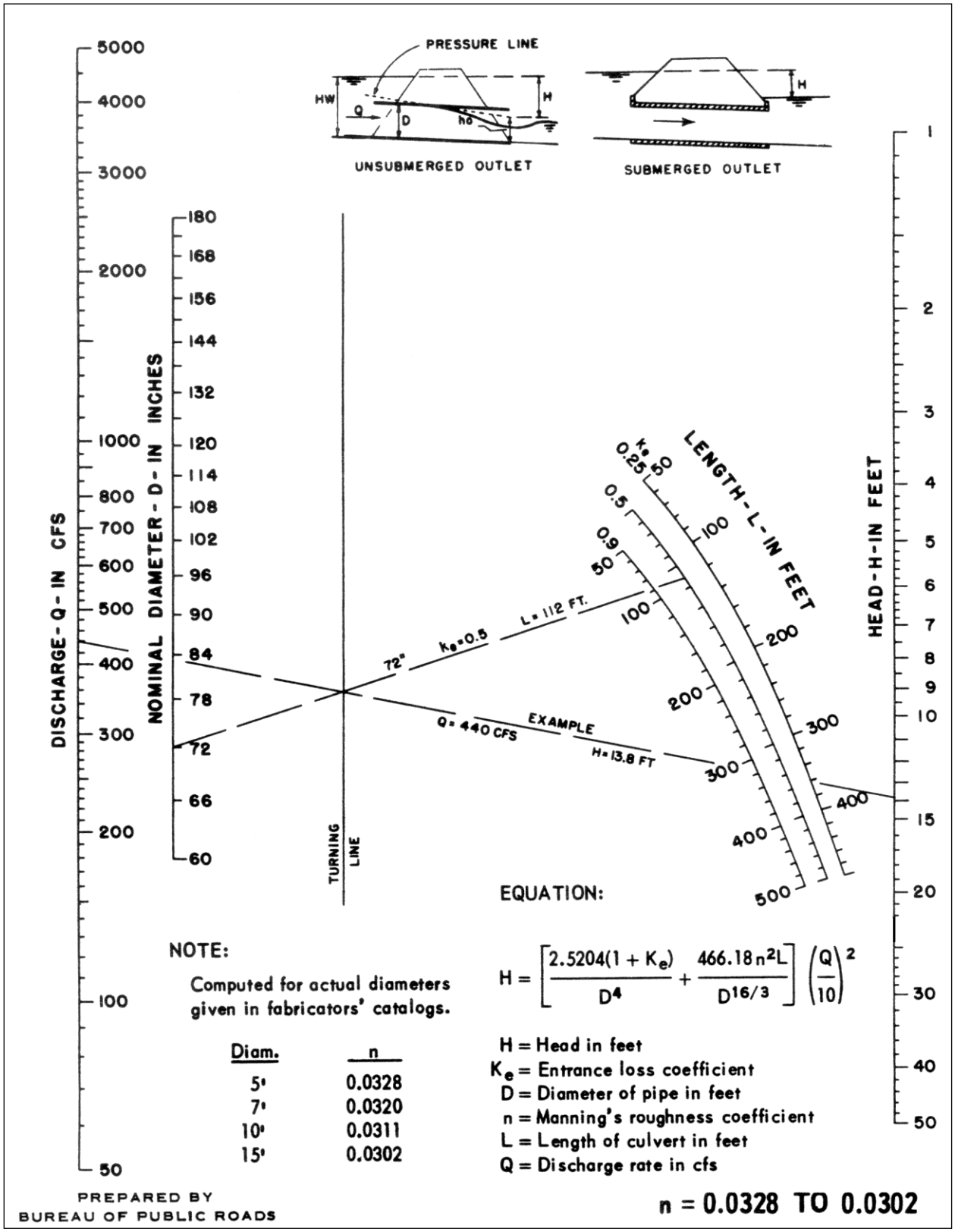


Figure 4-15. Head for Standard Corrugated Metal Pipe-Arch Culverts Flowing Full, *n* = 0.024

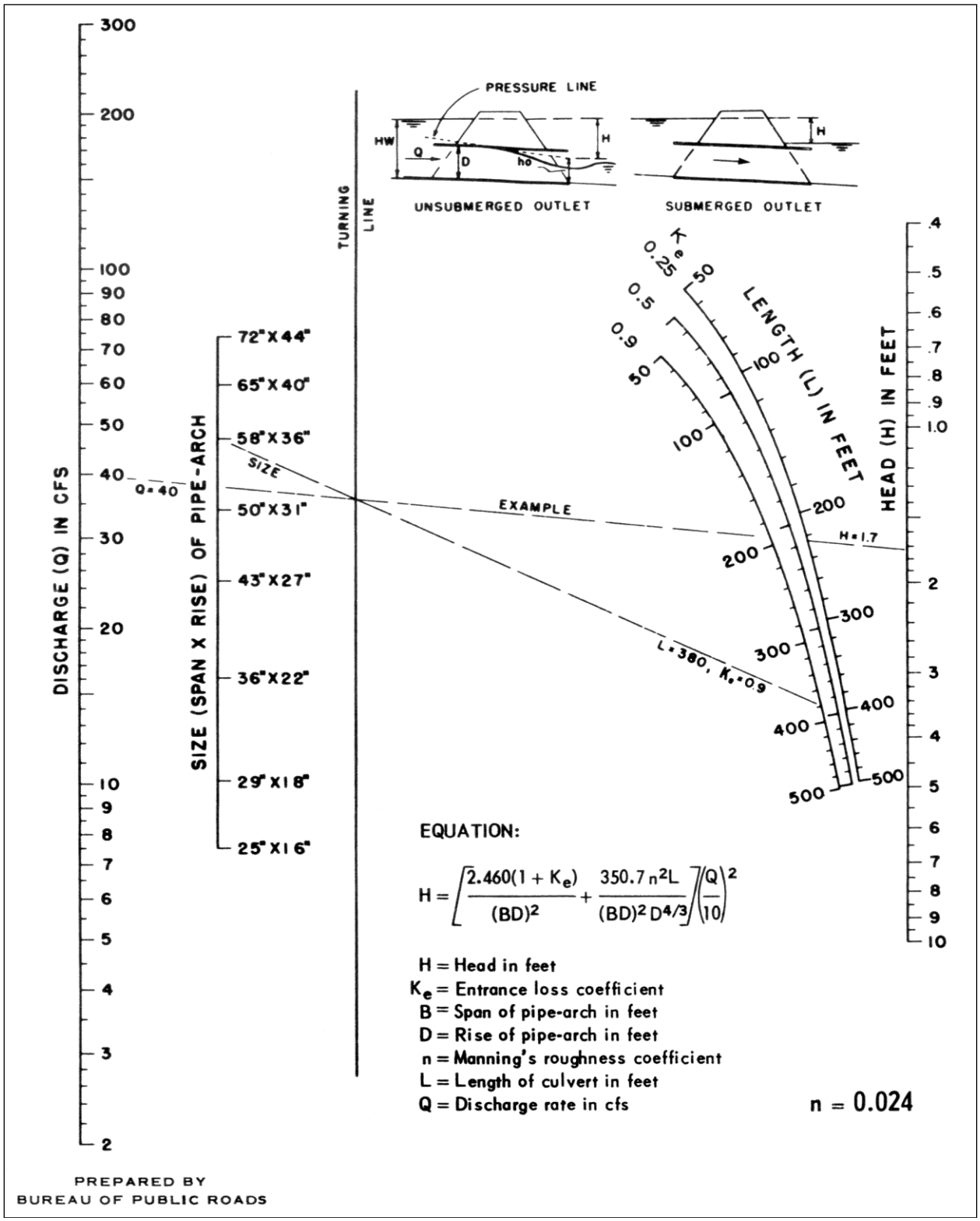


Figure 4-16. Head for Field-Bolted Structural Plate Pipe-Arch Culverts 18 inch Corner Radius Flowing Full, *n* = 0.0327 to 0.0306

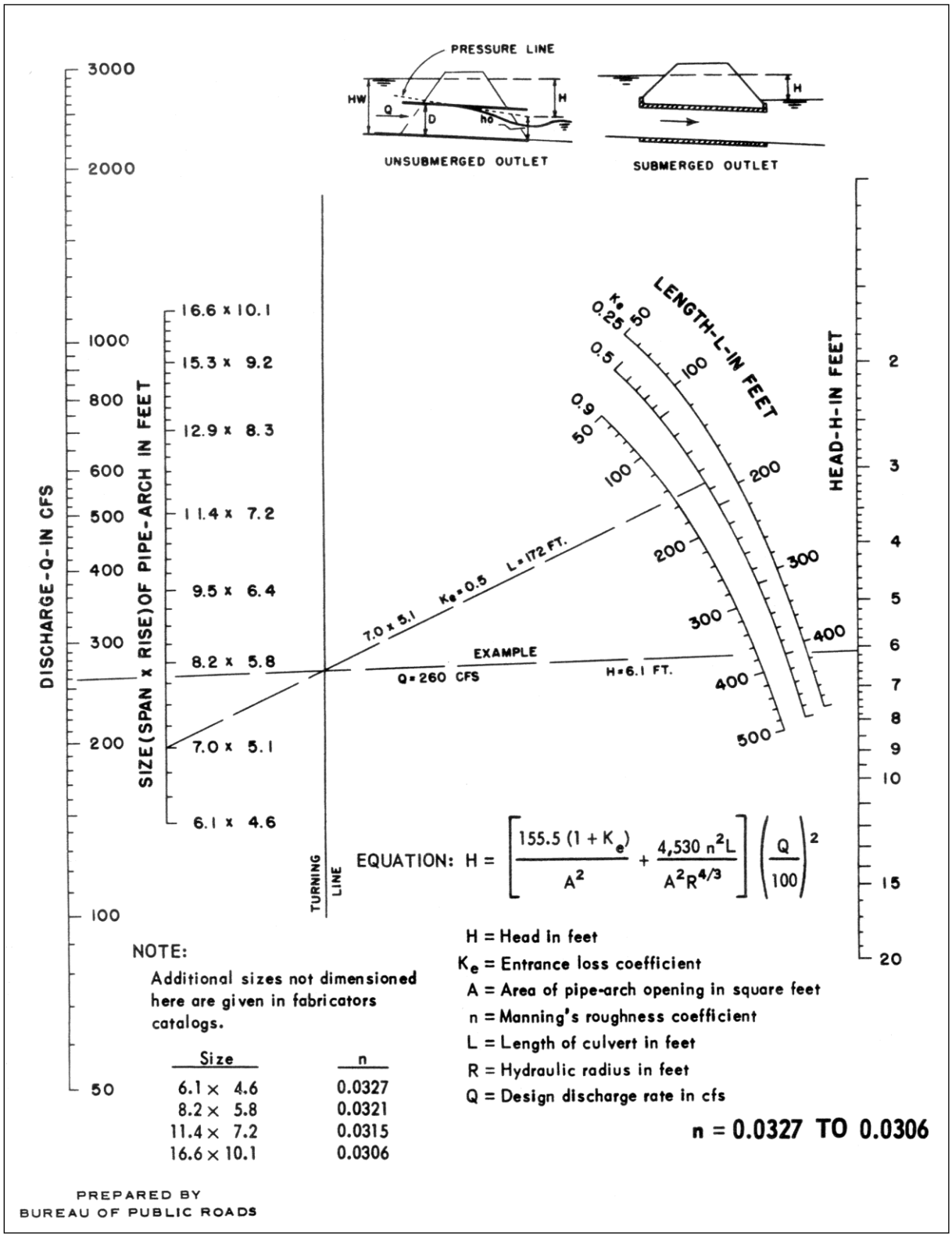
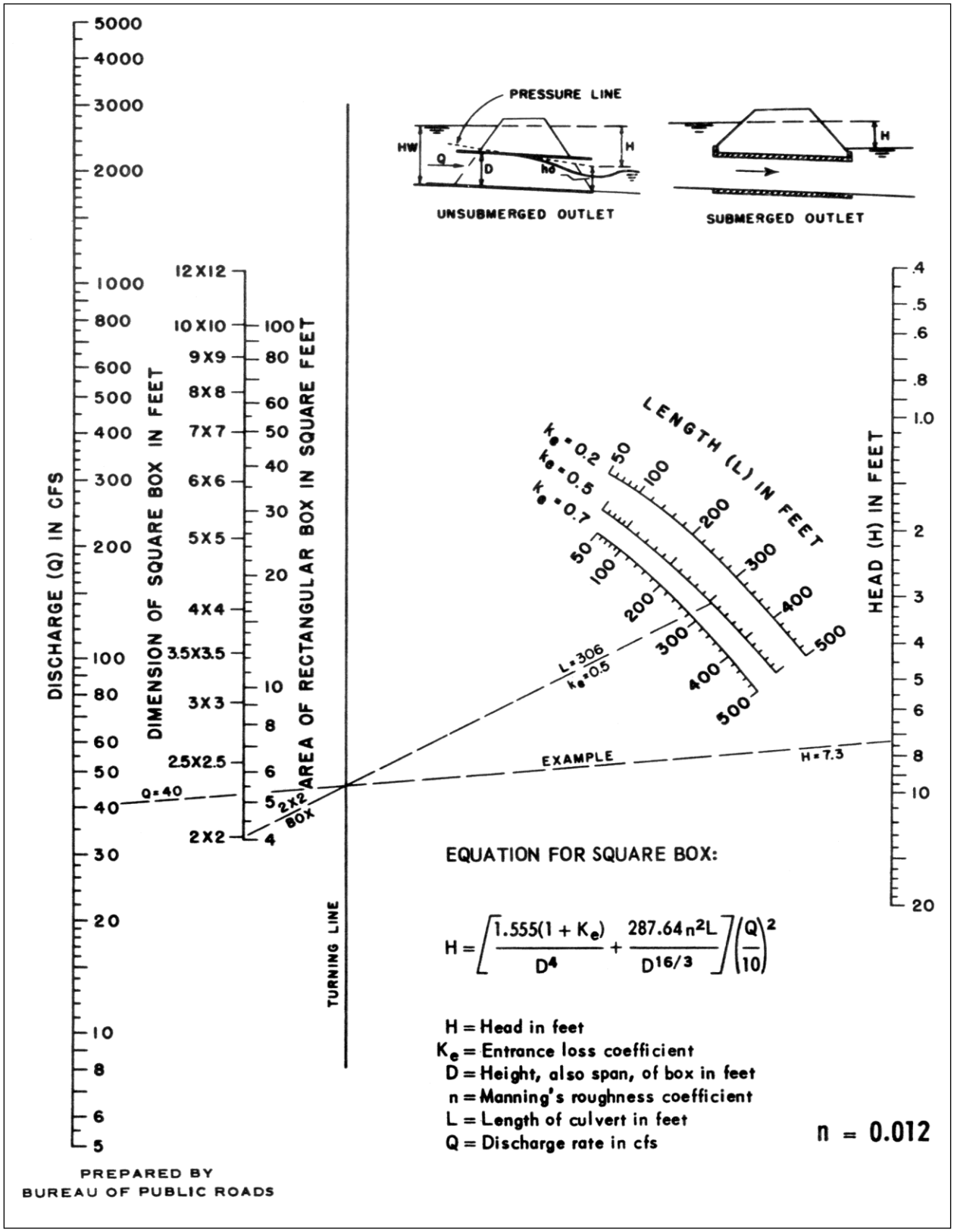


Figure 4-17. Head for Concrete Box Culverts Flowing Full, *n* = 0.012



4-4.1.5 **Tailwater Elevation at or Above the Top of the Culvert Barrel Outlet (Figure 4-10, A)**. The tailwater (TW) depth is equal to h_o, and the relation of headwater to other terms in Equation 4-3 is illustrated in Figure 4-18.

Figure 4-18. Tailwater Elevation at or Above the Top of the Culvert

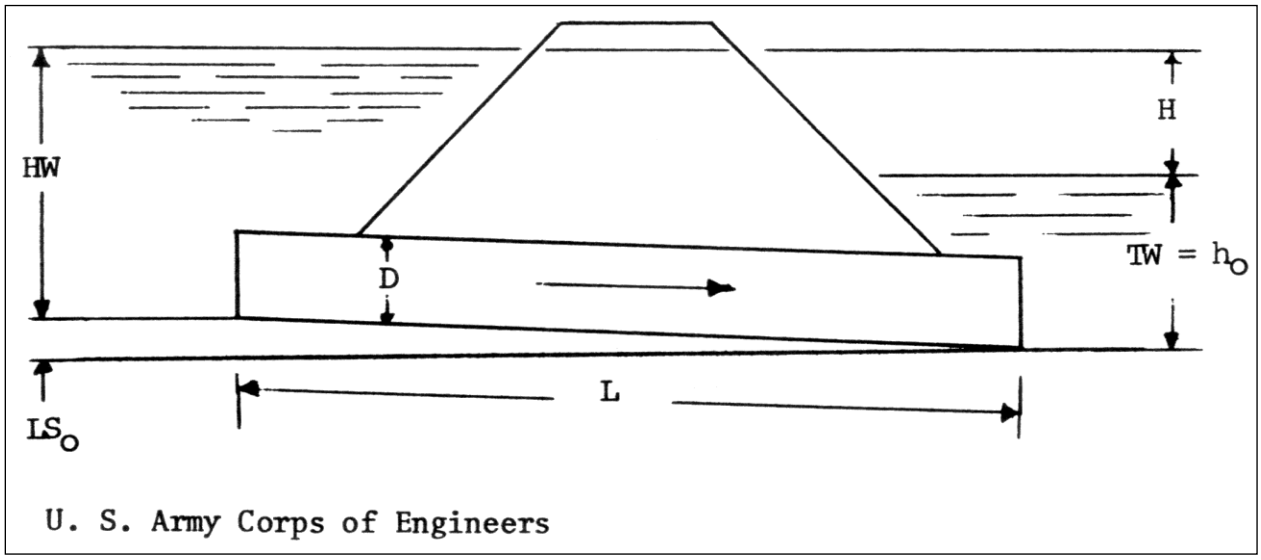
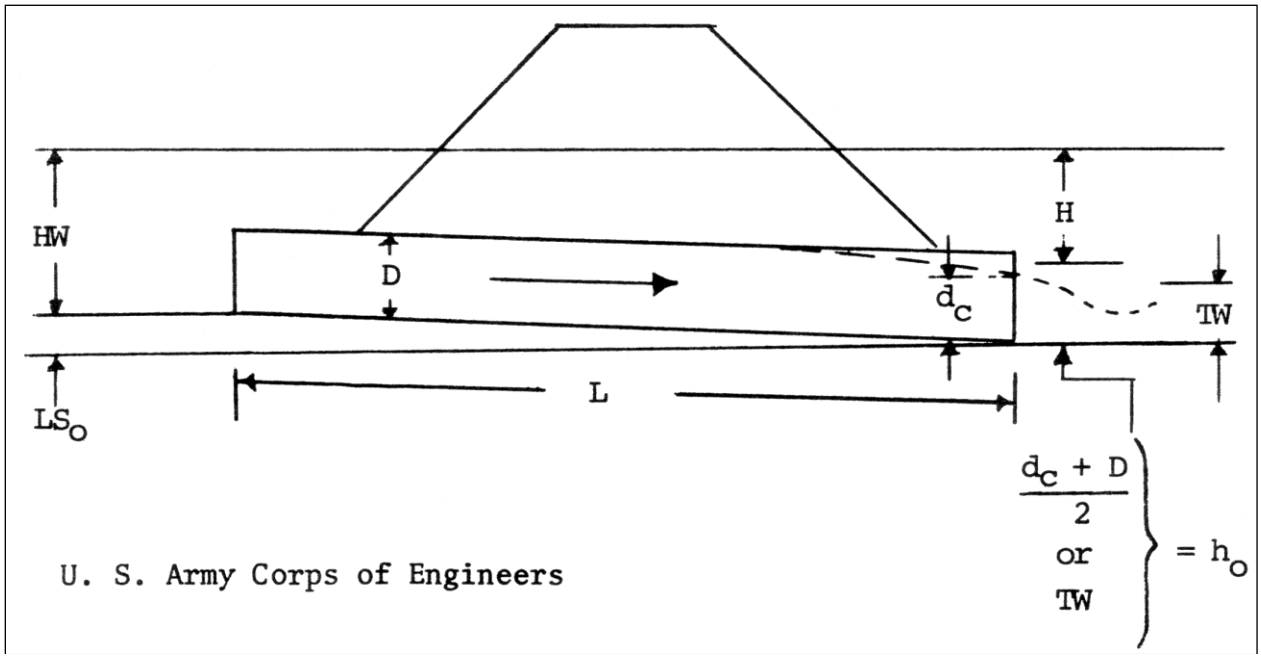


Figure 4-19. Tailwater Below the Top of the Culvert



4-4.1.6 **Tailwater Elevation Below the Top or Crown of the Culvert Barrel Outlet.** Figure 4-10, B, C, and D are three common types of flow for outlet control with this low TW condition (Figure 4-19). In these cases, h_o is found by comparing two values, TW

depth in the outlet channel and $\frac{d_c + D}{2}$, and setting h_o equal to the larger value. The fraction $\frac{d_c + D}{2}$ is a simplified means of computing h_o when the TW is low and the discharge does not fill the culvert barrel at the outlet. In this fraction, d_c is critical depth as determined from Figures 4-20 through 4-25, and D is the culvert height. The value of d_c should never exceed D, making the upper limit of this fraction equal to D. Figure 4-21 shows the terms of Equation 4-3 for the cases discussed above. Equation 4-3 gives accurate answers if the culvert flows full for a part of the barrel length as illustrated by Figure 4-25. This condition of flow will exist if the headwater, as determined by Equation 4-3, is equal to or greater than the quantity:

$$HW \geq D + (1 + K_e)\frac{V^2}{2g} \qquad (4\text{-}4)$$

4-4.1.6.1 If the headwater drops below this point, the water surface will be free throughout the culvert barrel as in Figure 4-10, D, and Equation 4-3 will yield answers with some error since the only correct method of finding headwater in this case is by a backwater computation starting at the culvert outlet. Equation 4-3 will give answers of sufficient accuracy for design purposes, however, if the headwater is limited to values greater than 0.75*D*. For lower headwaters, backwater calculations are required to obtain accurate headwater elevations.

4-4.1.6.2 The depth of TW is important in determining the hydraulic capacity of culverts flowing with outlet control. In many cases, the downstream channel is of considerable width and the depth of water in the natural channel is less than the height of water in the outlet end of the culvert barrel, making the tailwater ineffective as a control. There are instances, however, where the downstream water-surface elevation is controlled by a downstream obstruction or backwater from another stream. A field inspection of all major culvert locations should be made to evaluate downstream controls and determine water stages.

4-4.1.6.3 An approximation of the normal depth of flow in a natural stream (outlet channel) can be made by using Manning's equation, $V = \frac{1.486}{n} R^{2/3} S^{1/2}$, if the channel is reasonably uniform in cross section, slope, and roughness. Values of n for natural streams in Manning's formula are given in Table 5-1. Chart 14 of Appendix B provides the solution to Manning's equation for various channels. This chart could be used to quickly estimate the tailwater depth downstream of the culvert. If the water surface in the outlet channel is established by downstream controls, other means must be found to determine the tailwater elevation. Sometimes this necessitates studying the stage-discharge relation of another stream into which the stream in question flows or securing data on reservoir elevations if a storage dam is involved.

Figure 4-20. Circular Pipe Critical Depth

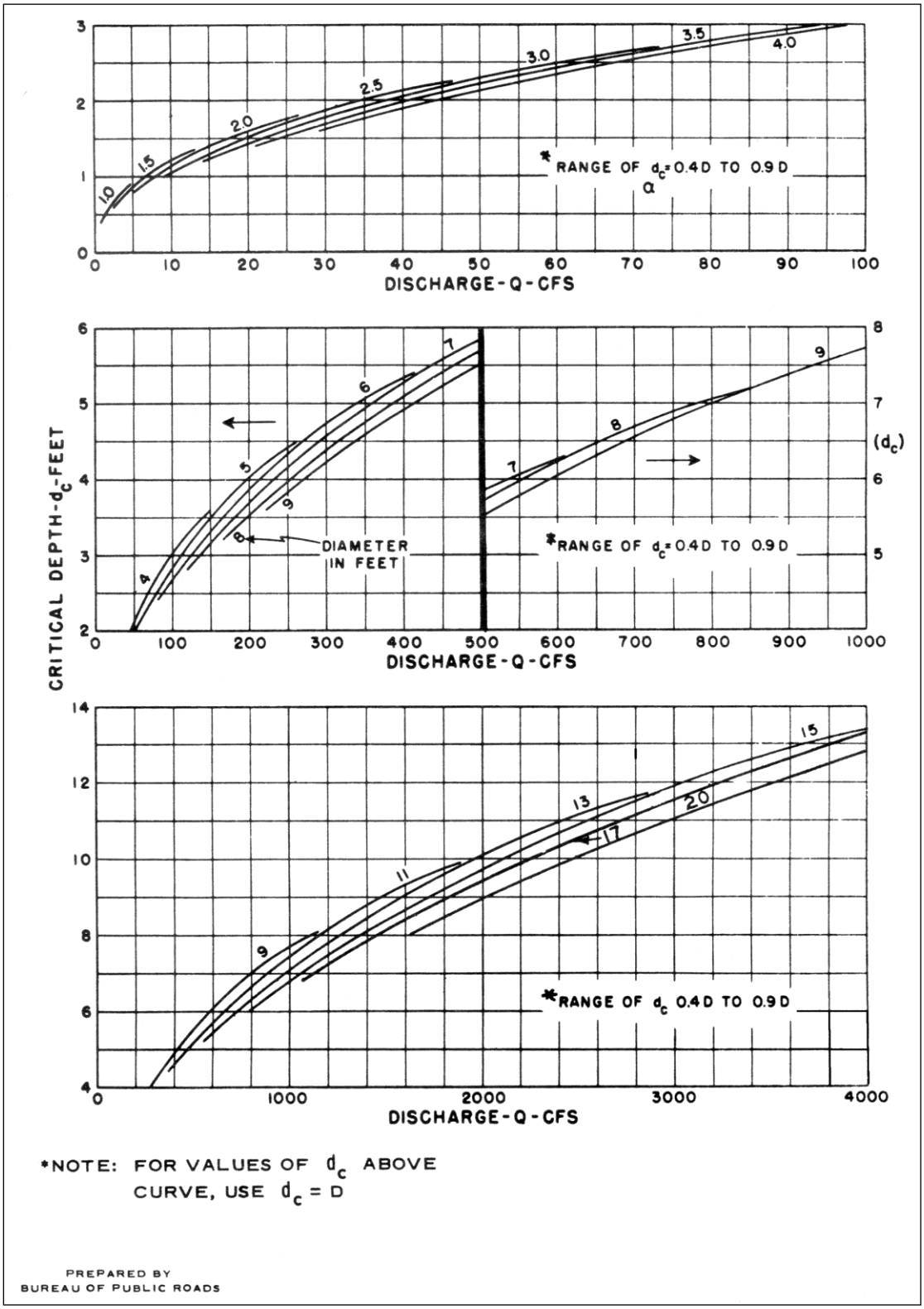


Figure 4-21. Oval Concrete Pipe Long Axis Horizontal Critical Depth

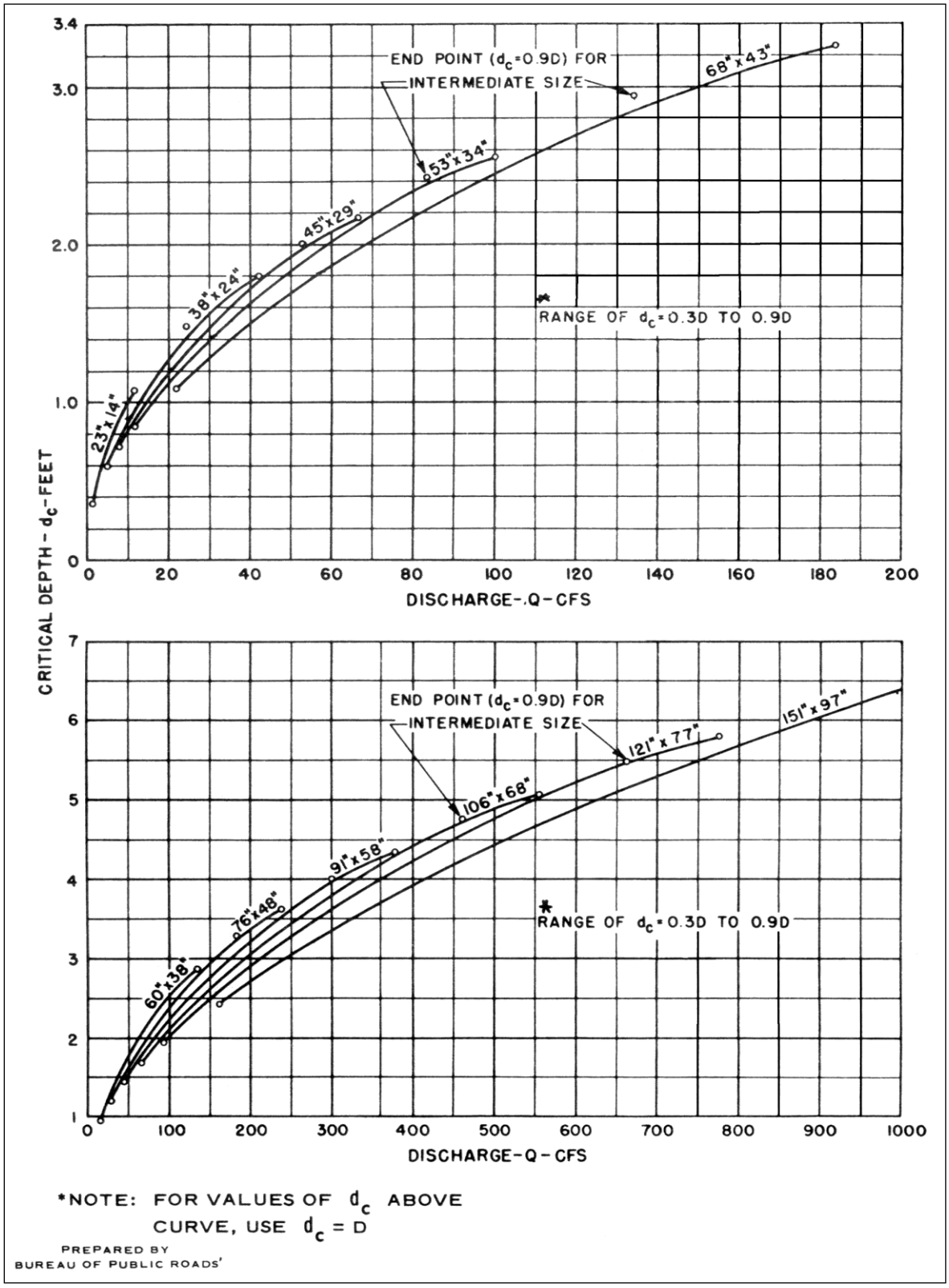


Figure 4-22. Oval Concrete Pipe Long Axis Vertical Critical Depth

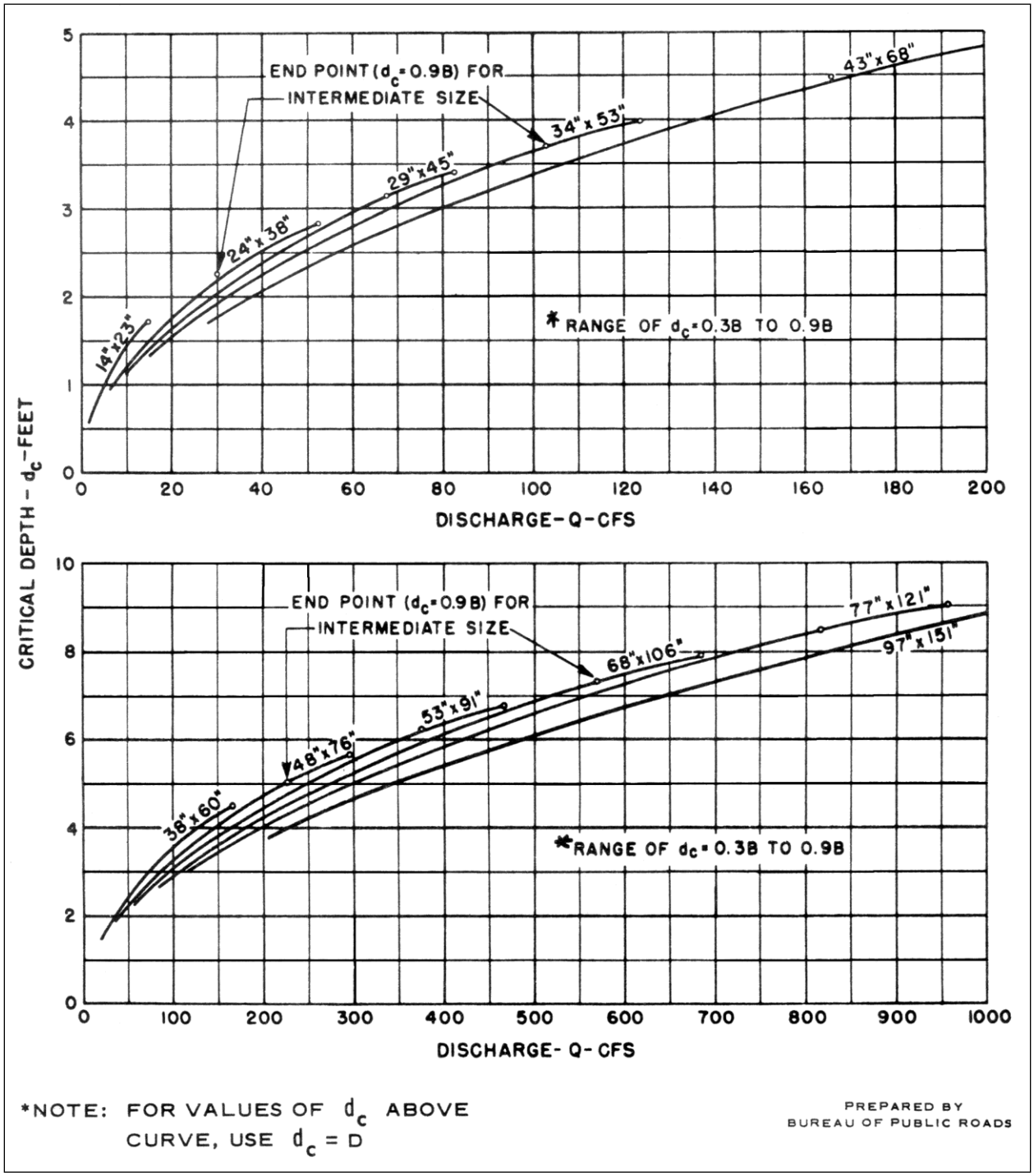


Figure 4-23. Standard Corrugated Metal Pipe-Arch Critical Depth

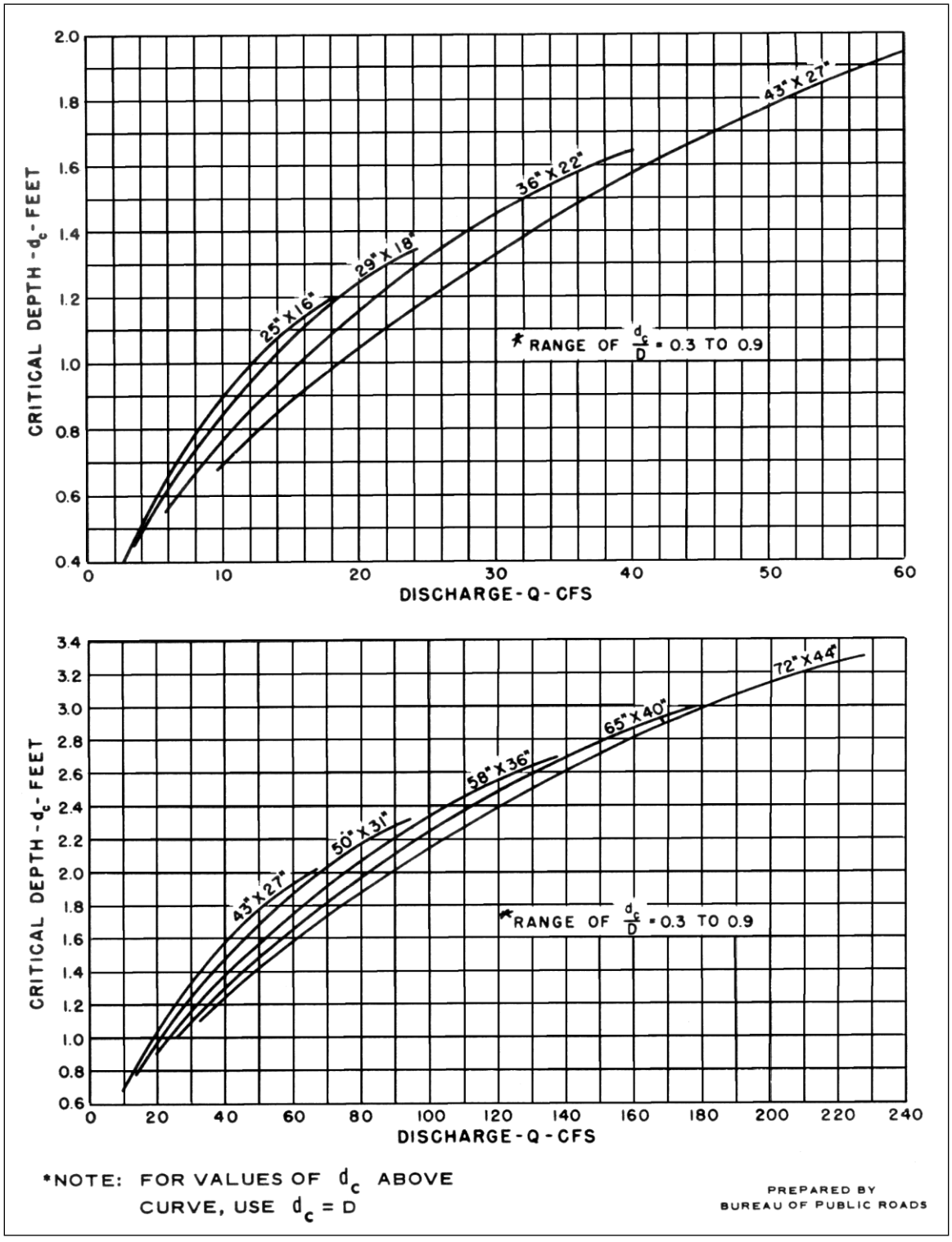


Figure 4-24. Structural Plate Pipe-Arch Critical Depth

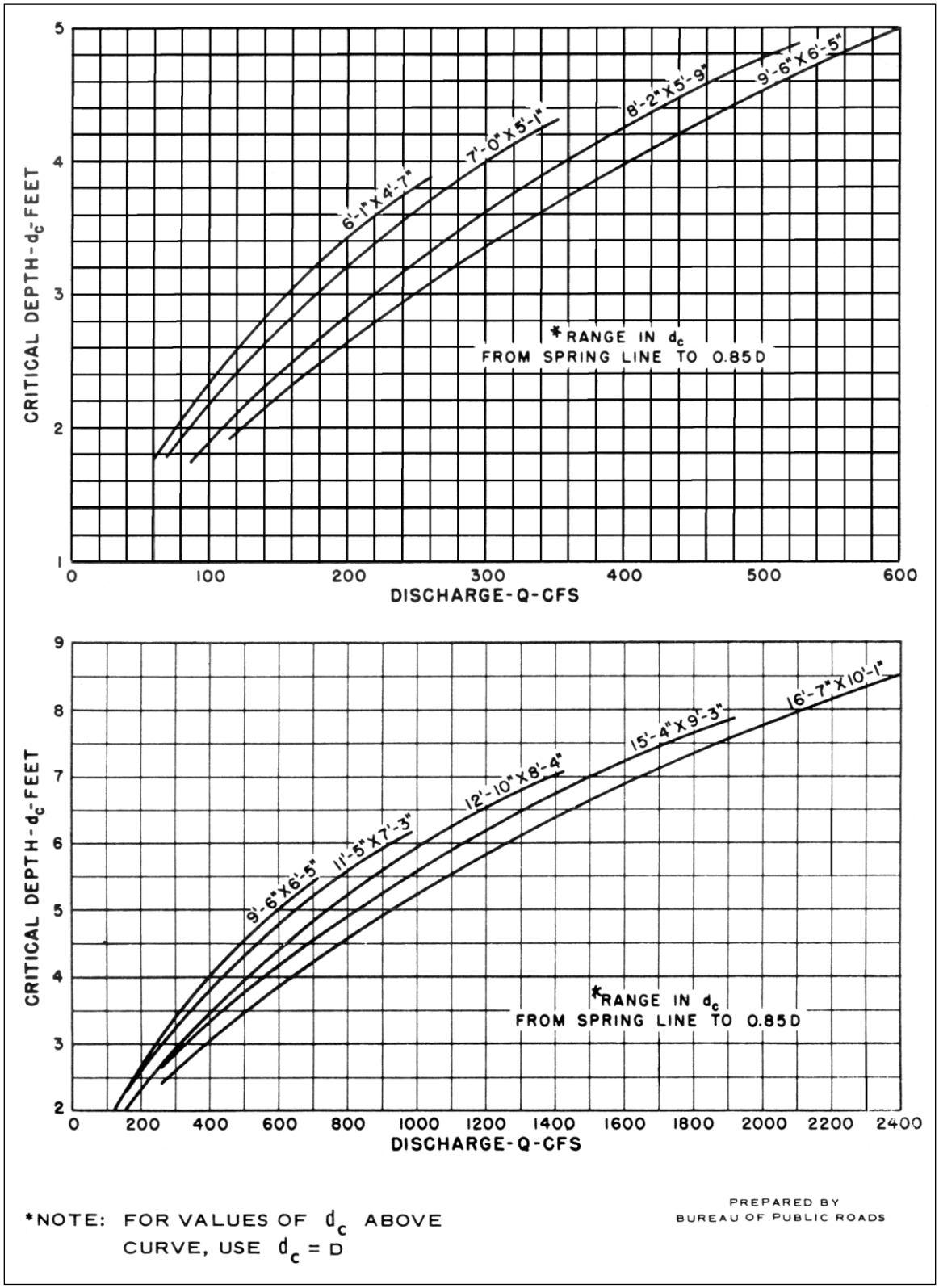
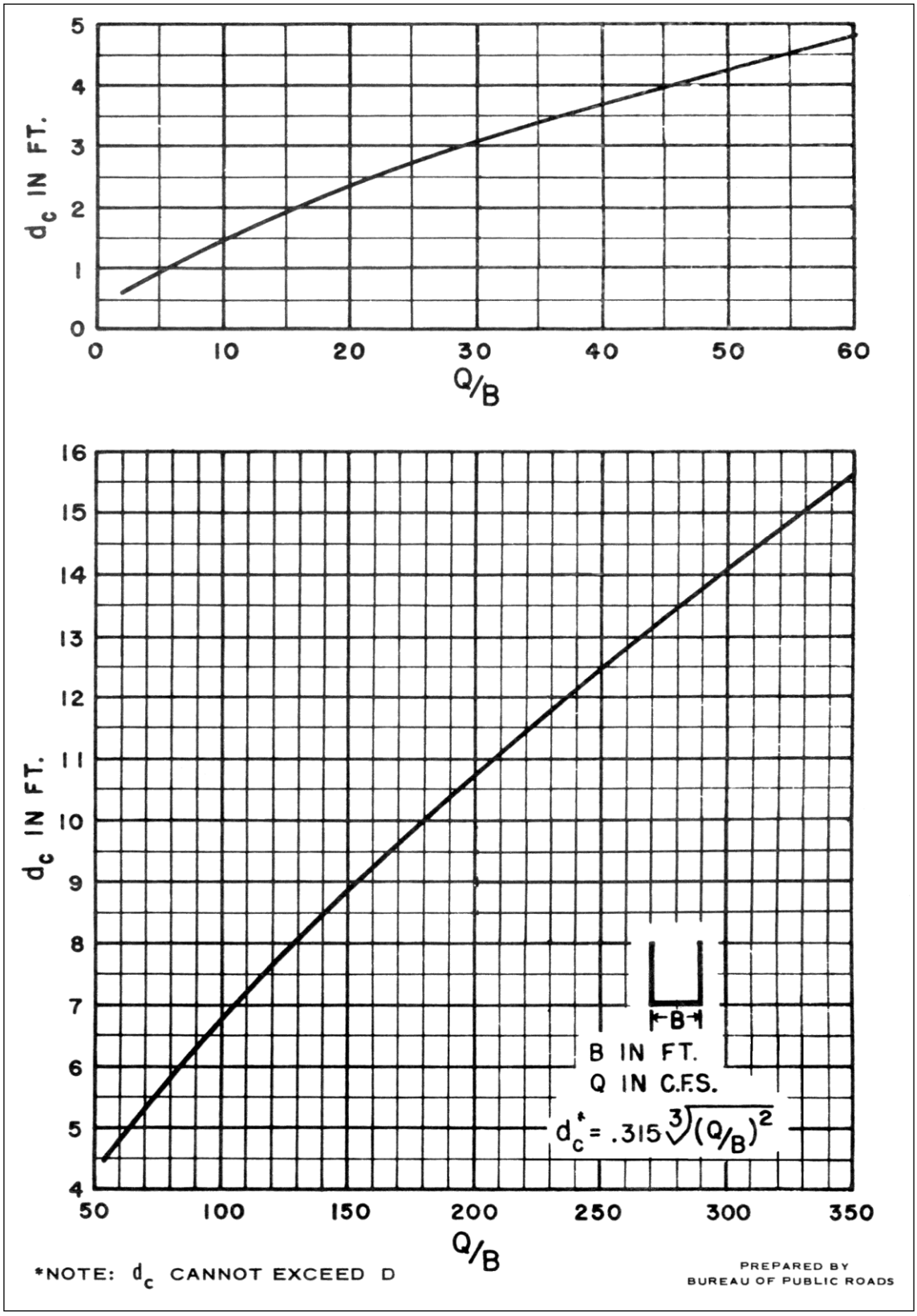


Figure 4-25. Critical Depth Rectangular Section



4-4.1.7 **Procedure for Selection of Culvert Size**

4-4.1.7.1 Using the Culvert Design Form (Figure 4-26) as a guide, perform the steps in paragraph 4-4.1.7.2 to design a culvert. Evaluate both inlet and outlet control conditions.

4-4.1.7.2 Select the culvert size by following these steps:

a. Step 1: List the given data.

(1) Design discharge, Q, in ft^3/s.

(2) Approximate length of the culvert, in feet.

(3) Allowable headwater depth, in feet, which is the vertical distance from the culvert invert (flow line) at entrance to the water-surface elevation permissible in the approach channel upstream from the culvert.

(4) Type of culvert, including barrel material, barrel cross-sectional shape, and entrance type.

(5) Slope of the culvert. (If the grade is given in percent, convert it to slope in feet per foot.)

(6) Allowable outlet velocity (if scour or fish passage are issues).

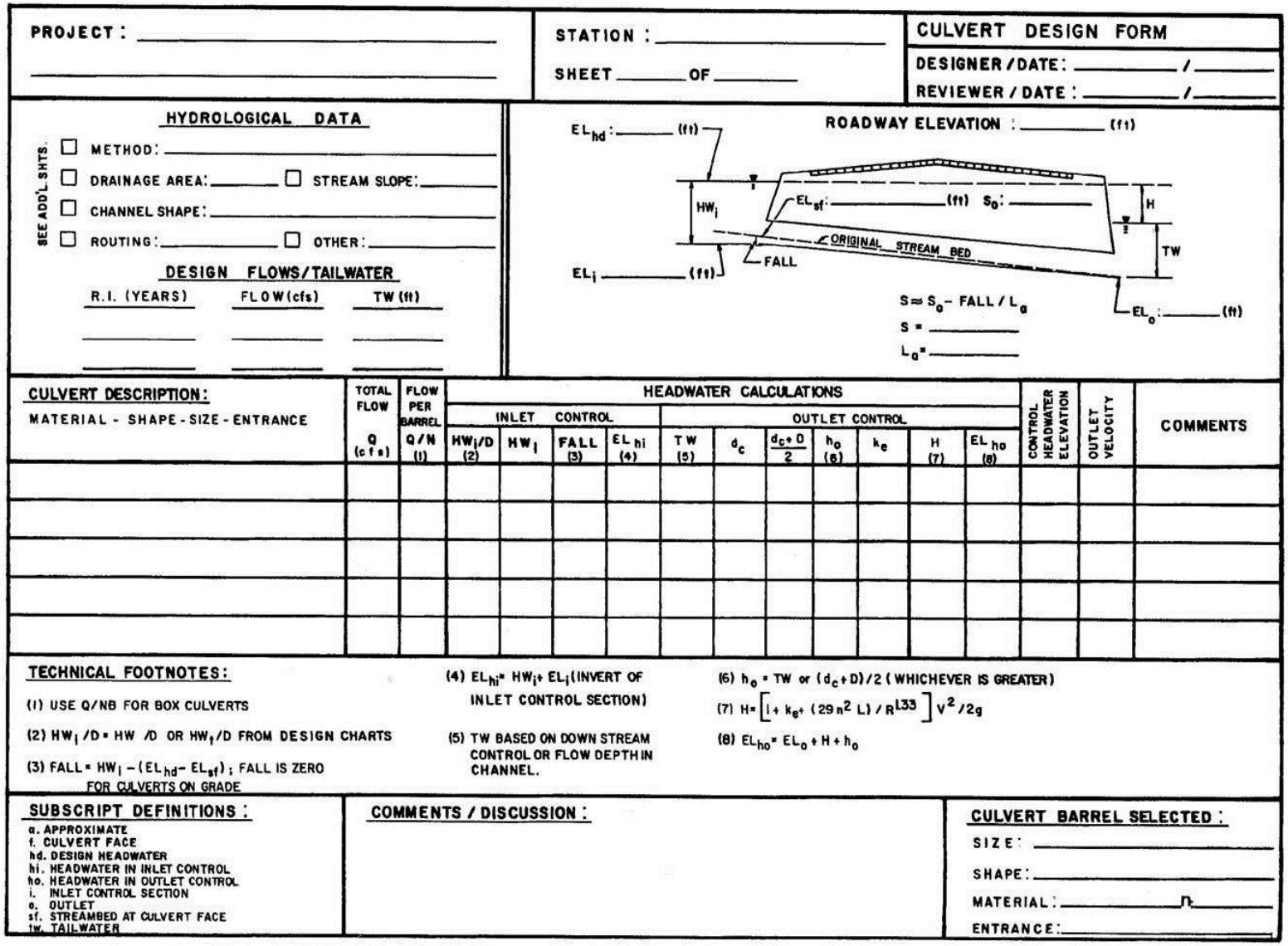
b. Step 2: Determine a trial culvert size.

(1) Refer to the inlet-control nomograph (Figures 4-2 through 4-9) for the selected culvert type.

(2) Using an $\frac{HW}{D}$ of approximately 1.25 and the scale for the entrance type to be used, find a trial-size culvert by following the instructions for the use of these nomographs. If there are reasons for less or greater relative depth of headwater in a particular case, another value of $\frac{HW}{D}$ may be used for this trial selection.

(3) If the trial size for the culverts is obviously too large because of limited height of embankment or availability of size, try a $\frac{HW}{D}$ value or multiple culverts by dividing the discharge equally for the number of culverts used. Raising the embankment height or using pipe-arch and box culverts with width greater than height should be considered. Selection should be based on an economic analysis.

Figure 4-26: Culvert Design Form



PROJECT : _____

STATION : _____

SHEET _____ OF _____

CULVERT DESIGN FORM

DESIGNER / DATE : _____ / _____

REVIEWER / DATE : _____ / _____

HYDROLOGICAL DATA

SEE ADD'L SHTS.

☐ METHOD: _____

☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: _____

☐ CHANNEL SHAPE: _____

☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)

EL_{hd} : _____ (ft)

ROADWAY ELEVATION : _____ (ft)

HW_i

EL_{sf} : _____ (ft) S_o : _____

H

ORIGINAL STREAM BED

TW

FALL

EL_i _____ (ft)

$S \approx S_o - FALL / L_a$

EL_o : _____ (ft)

S = _____

L_a = _____

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW /D OR HW_t/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D)/2$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29 n^2 L) / R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS :

a. APPROXIMATE
f. CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho. HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
sf. STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION :

CULVERT BARREL SELECTED :

SIZE : _____

SHAPE : _____

MATERIAL : _____ n : _____

ENTRANCE : _____

c. Step 3: Find the headwater depth for the trial-size culvert.

(1) Determine and record the headwater depth by use of the appropriate inlet-control nomograph (Figures 4-2 through 4-9). Tailwater conditions are to be neglected in this determination. Headwater in this case is found by simply multiplying $\frac{HW}{D}$ obtained from the nomograph by *D*.

(2) Compute and record the headwater for outlet control using these instructions:

(a) Approximate the depth of the tailwater for the design flood condition in the outlet channel. The tailwater depth may also be due to backwater caused by another stream or some control downstream.

(b) For tailwater depths equal to or above the depth of the culvert at the outlet, set the tailwater equal to h_o and find the headwater by the following equation:

$$HW = h_o + H - S_o L$$

H is estimated from the outlet control nomographs (Figures 4-11 through 4-17).

(c) For tailwater elevations below the crown of the culvert at the outlet, use the following equation to find the headwater:

$$HW = h_o + H - S_o L$$

where $h_o = \frac{d_c + D}{2}$ or TW, whichever is greater. When d_c (Figures 4-20 through 4-25) exceeds the height of the culvert, h_o should be set equal to *D*. Again, *H* is estimated from the outlet control nomographs (Figures 4-11 through 4-17).

(3) Compare the headwater determined from the inlet control and outlet control computations. The higher headwater governs and indicates the flow control existing under the given conditions.

(4) Compare the higher headwater with that allowable at the site. If headwater is greater than allowable, repeat the procedure using a larger culvert. If headwater is less than allowable, repeat the procedure to investigate the possibility of using a smaller size.

d. Step 4: Check the outlet velocities for the selected size.

(1) If outlet control governs in Step 3(2)c, outlet velocity equals $\frac{Q}{A}$, where *A* is the cross-sectional area of flow at the outlet. If d_c or TW is less than the height of the culvert barrel, use a cross-sectional area corresponding to d_c or TW depth, whichever gives the greater area of flow. The total barrel area is used when the tailwater exceeds the top of the barrel.

(2) If inlet control governs in Step 3(2)c, outlet velocity can be assumed to equal normal velocity in open-channel flow as computed by Manning's equation for the barrel size, roughness, and slope of the selected culvert. The FHWA's HDS-3 contains many charts that can be used to estimate the normal depth exiting a culvert. Both circular and box shapes are represented in HDS-3.

e. Step 5: Try a culvert of another type or shape and determine the size and headwater by the same procedure.

f. Step 6: Record the final selection of culvert with size, type, outlet velocity, required headwater, and economic justification on the Culvert Design Form (Figure 4-26).

4-4.1.8 **Instructions for Using the Inlet-Control Nomographs (Figures 4-2 through 4-9)**

4-4.1.8.1 To determine headwater:

a. Connect with a straight edge the given culvert diameter or height, *D*, and the discharge, *Q*, or $\frac{Q}{B}$ for box culverts; mark the intersection of the straight edge on $\frac{HW}{D}$ scale 1.

b. If $\frac{HW}{D}$ scale 1 represents the entrance type used, read $\frac{HW}{D}$ on scale 1. If some other entrance type is used, extend the point of intersection ((a) above) horizontally to scale 2 or 3 and read $\frac{HW}{D}$.

c. Compute the headwater by multiplying $\frac{HW}{D}$ by *D*.

4-4.1.8.2 To determine the culvert size:

a. Given an $\frac{HW}{D}$ value, locate $\frac{HW}{D}$ on the scale for the appropriate entrance type. If scale 2 or 3 is used, extend $\frac{HW}{D}$ point horizontally to scale 1.

b. Connect the point on $\frac{HW}{D}$ scale 1 ((a) above) to the given discharge and read the required diameter, height, or size of the culvert.

4-4.1.8.3 To determine the discharge:

a. Given *HW* and *D*, locate $\frac{HW}{D}$ on the scale for the appropriate entrance type. Continue as in paragraph 4-4.1.8.2, step (a).

b. Connect the point on $\frac{HW}{D}$ scale 1 ((a) above) and the size of the culvert on the left scale and determine *Q* or $\frac{Q}{B}$ on the discharge scale.

c. If $\frac{Q}{B}$ is determined, multiply *B* to find *Q*.

4-4.1.9 **Instructions for Using the Outlet-Control Nomographs.** Figures 4-11 through 4-17 are nomographs to solve for the head when culverts flow full with outlet control. They are also used in approximating the head for some partially full flow conditions with outlet control. These nomographs do not give a complete solution for finding headwater.

a. Locate the appropriate nomograph for the selected type of culvert.

b. Begin finding the nomograph solution by locating a starting point on the length scale. To locate the proper starting point on the length scale, follow these instructions:

(1) If the n value of the nomograph corresponds to that of the culvert being used, find the proper K_e from Table 4-1, and on the appropriate nomograph, locate the starting point on the length curve for the K_e. If a K_e curve is not shown for the selected K_e, go to step 2, below. If the *n* value for the selected culvert differs from that of the nomograph, see step 3, below.

(2) For the *n* of the nomograph and a K_e intermediate between the given scales, connect the given length on adjacent scales by a straight line

and select a point on this line spaced between the two chart scales in proportion to the K_e values.

(3) For a different value of roughness coefficient, n_1, than that of the chart n, use the length scales shown with an adjusted length, L_1, calculated by the formula:

$$L_1 = L\left(\frac{n_1}{n}\right)^2 \qquad (4\text{-}5)$$

where: L_1 = adjusted culvert length

L = actual culvert length

n_1 = desired n value

n = n value from the outlet control chart

c. Using a straight edge, connect the point on the length scale to the size of the culvert barrel and mark the point of crossing on the “turning line.”

d. Pivot the straight edge on this point on the turning line and connect the given discharge rate. Read the head in feet on the head scale. For values beyond the limit of the chart scales, find H by solving the equation given in the nomograph or by using the FHWA’s HY-8 computer program.

4-4.1.9.1 Table 4-1 is used to find the n value for the selected culvert.

4-4.1.9.2 To use the box-culvert nomograph (Figure 4-17) for full flow for other than square boxes:

a. Compute the cross-sectional area of the rectangular box.

NOTE: The area scale on the nomograph is calculated for barrel cross sections with span B twice the height D; its close correspondence with the area of square boxes assures that it may be used for all sections intermediate between square and $B = 2D$ or $B = 2/3D$. For other box proportions, use the equation shown in the nomograph for more accurate results.

b. Connect the proper point on the length scale to the barrel area and mark the point on the turning line.

c. Pivot the straight edge on this point on the turning line and connect the given discharge rate. Read the head in feet on the head scale.

4-4.2 Headwalls and Endwalls

4-4.2.1 The normal functions of a headwall or wingwall are to recess the inflow or outflow end of the culvert barrel into the fill slope to improve entrance flow conditions, to anchor the pipe and to prevent disjointing caused by excessive pressures, to control erosion and scour resulting from excessive velocities and turbulences, and to prevent adjacent soil from sloughing into the waterway opening.

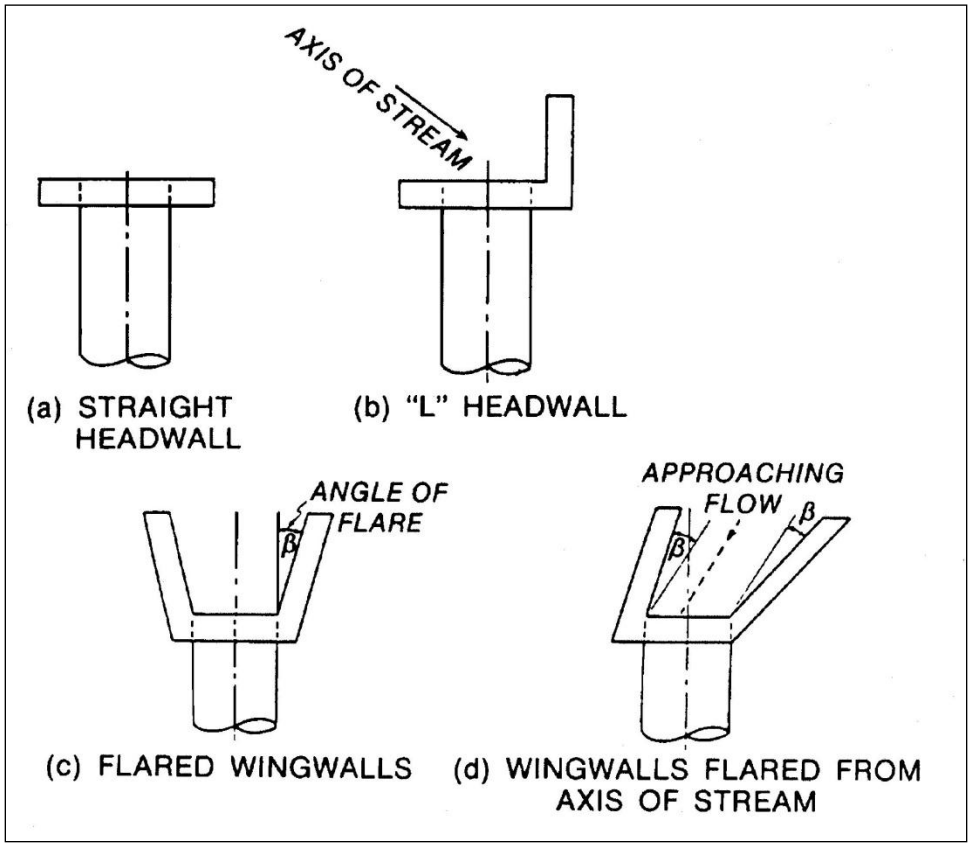
4-4.2.2 Headwalls are particularly desirable as a cutoff to prevent saturation sloughing, piping, and erosion of the embankment. Provisions for drainage should be made over the center of the headwall to prevent scouring along the sides of the walls.

4-4.2.3 Whether or not a headwall is desirable depends on the expected flow conditions and the embankment stability. Erosion protection such as riprap or sacked concrete with a sand-cement ratio of 9:1 may be required around the culvert entrance if a headwall is not used.

4-4.2.4 In the design of headwalls, some degree of entrance improvement should always be considered. The most efficient entrances would incorporate one or more of such geometric features as elliptical arcs, circular arcs, tapers, and parabolic drop-down curves. Elaborate inlet design for a culvert would be justifiable only in unusual circumstances. The rounding or beveling of the entrance in almost any way will increase the culvert capacity for every design condition. These types of improvements provide a reduction in the loss of energy at the entrance for little or no additional cost.

4-4.2.5 Entrance structures (headwalls and wingwalls) protect the embankment from erosion and, if properly designed, may improve the hydraulic characteristics of the culvert. The height of these structures should be kept to the minimum that is consistent with hydraulic, geometric, and structural requirements. Several entrance structures are shown in Figure 4-27. Straight headwalls (Figure 4-27a) are used for low to moderate approach velocity, light drift (small floating debris), broad or undefined approach channels, or small defined channels entering culverts with little change in alignment. The “L” headwall (Figure 4-27b) is used if an abrupt change in flow direction is necessary with low to moderate velocities; however, before an “L” headwall is considered, all efforts should be made to align the culvert with the natural stream. The change in flow direction often causes debris and sediment problems. Winged headwalls or wingwalls (Figure 4-27c) are used for channels with moderate velocity and medium floating debris. Wingwalls are most effective when set flush with the edges of the culvert barrel, aligned with the stream axis (Figure 4-27d), and placed at a flare angle of 18 to 45 degrees. Warped wingwalls (not shown) are used for well-defined channels with high-velocity flow and a free water surface. They are used primarily with box culverts. Warped headwalls are hydraulically efficient because they form a gradual transition from a trapezoidal channel to the barrel. The use of a drop-down apron in conjunction with these wingwalls may be particularly advantageous.

Figure 4-27. Culvert Headwalls and Wingwalls



4-4.2.6 Headwalls are normally constructed of plain or reinforced concrete or of masonry and usually consist of either a straight headwall or a headwall with wingwalls, apron, and cutoff wall, as required by local conditions. Definite design criteria applicable to all conditions cannot be formulated, but certain features require careful consideration to ensure an efficient headwall structure:

- Most culverts outfall into a waterway of relatively large cross section; only moderate tailwater is present, and except for local acceleration, if the culvert effluent freely drops, the downstream velocities gradually diminish. In such situations, the primary problem is usually not one of hydraulics but the protection of the outfall against undermining bottom scour, damaging lateral erosion, and perhaps degrading the downstream channel. The presence of tailwater higher than the culvert crown will affect the culvert performance and may possibly require protection of the adjacent embankment against wave or eddy scour. In any event, a determination must be made about downstream control, its relative permanence, and tailwater conditions likely to result. Endwalls (outfall headwalls) and wingwalls will not be used unless justifiable as an integral part of outfall energy dissipators or erosion protection works, or for reasons such as right-of-way restrictions and occasionally aesthetics.

- The system will fail if there is inadequate endwall protection. Usually the end sections are damaged first, thus causing flow obstruction and progressive undercutting during high runoff periods, which causes washout of the structure. For corrugated metal (pipe or arch) culvert installations, the use of prefabricated end sections may prove desirable and economically feasible. When a metal culvert outfall projects from an embankment fill at a substantial height above natural ground, either a cantilevered free outfall pipe or a pipe downspout will probably be required. In either case, the need for additional erosion protection requires consideration.

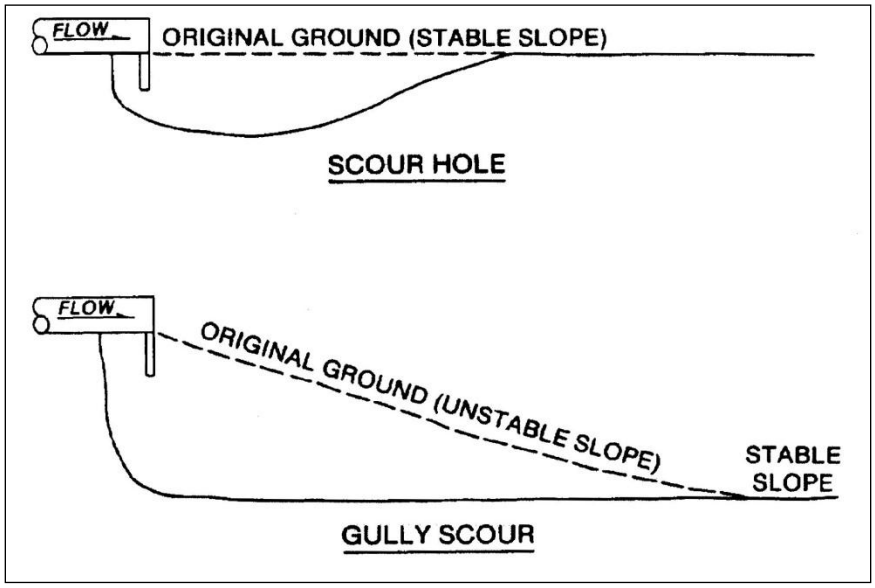
4-4.2.7 Headwalls and endwalls incorporating various designs of energy dissipators, flared transitions, and erosion protection for culvert outfalls are explained in detail in subsequent sections of this chapter.

4-4.2.8 Headwalls or endwalls will be adequate to withstand soil and hydrostatic pressures. In areas of seasonal freezing, the structure will also be designed to preclude detrimental heave or lateral displacement caused by frost action. The most satisfactory method of preventing such damage is to restrict frost penetration beneath and behind the wall to non-frost-susceptible materials. Positive drainage behind the wall is also essential. Criteria for determining the depth of backfill behind walls are given in UFC 3-220-03FA.

4-4.2.9 The headwalls or endwalls will be large enough to preclude the partial or complete stoppage of the drain by sloughing of the adjacent soil. This can best be accomplished by a straight headwall or by wingwalls. Typical erosion problems result from uncontrolled local inflow around the endwalls. The recommended preventive for this type of failure is the construction of a berm behind the endwall (outfall headwall) to intercept local inflow and direct it properly to protected outlets such as field inlets and paved or sodded chutes that will conduct the water into the outfall channel. The proper use of solid sodding will often provide adequate headwall and channel protection.

4-4.2.10 In general, two types of channel instability can develop downstream from storm sewer and culvert outlets: gully scour or a localized erosion termed a scour hole. Distinction between the two conditions can be made by comparing the original or existing slope of the channel or drainage basin downstream of the outlet relative to that required for stability as illustrated in Figure 4-28.

Figure 4-28. Types of Scour at Storm Drain and Culvert Outlets



4-4.2.10.1 Gully scour is to be expected when the Froude number of flow ($F= V/(gy)^{0.5}$ where F is the Froude Number, g is 32.3 ft/s^2, and y is the depth of water in the channel) in the channel exceeds that required for stability. It begins at a control point downstream where the channel is stable and it progresses upstream. If sufficient differential in elevation exists between the outlet and the section of stable channel, the outlet structure will be completely undermined. The primary cause of gully scour is the practice of siting outlets high, with or without energy dissipators relative to a stable downstream grade in order to reduce quantities of pipe and excavation. Erosion of this type may be extensive, depending upon the location of the stable channel section relative to that of the outlet in both the vertical and downstream directions. To prevent gully erosion, outlets and energy dissipators should be located at sites where the slope of the downstream channel or drainage basin is naturally moderate enough to remain stable under the anticipated conditions, or else it should be controlled by ditch checks, drop structures, and/or other means to a point where a naturally stable slope and cross section exist. Design of stable open channels is discussed later in this UFC.

4-4.2.10.2 A scour hole or localized erosion can occur downstream of an outlet even if the downstream channel is stable. The severity of damage to be anticipated depends upon the conditions existing or created at the outlet. In many situations, flow conditions can produce scour resulting in embankment erosion as well as structural damage to the apron, endwall, and culvert.

4-4.2.10.3 Empirical equations have been developed for estimating the extent of the anticipated scour hole in sand. These equations are based on knowledge of the design discharge, the culvert diameter, and the duration and Froude number of the design flow at the culvert outlet; however, the relationship between the Froude number of flow at the culvert outlet and a discharge parameter, or $Q/D_o^{5/2}$, can be calculated for any shape of

outlet, and this discharge parameter is just as representative of flow conditions as is the Froude number. The relationship between the two parameters for partial and full pipe flow in square culverts is shown in Figure 4-29. Since the discharge parameter is easier to calculate and is suitable for application purposes, the original data were reanalyzed in terms of discharge parameter for estimating the extent of localized scour to be anticipated downstream of culvert and storm drain outlets. The equations for the maximum depth, width, length, and volume of scour and comparisons of predicted and observed values are shown in Figures 4-30 through 4-33. Minimum and maximum tailwater depths are defined as those less than $0.5D_o$ and equal to or greater than $0.5D_o$, respectively. Dimensionless profiles along the center lines of the scour holes to be anticipated with minimum and maximum tailwaters are presented in Figure 4-34 and Figure 4-35. Dimensionless cross sections of the scour hole at a distance of 0.4 of the maximum length of scour downstream of the culvert outlet for all tailwater conditions are also shown in Figure 4-34 and Figure 4-35.

Figure 4-29. Square Culvert Froude Number

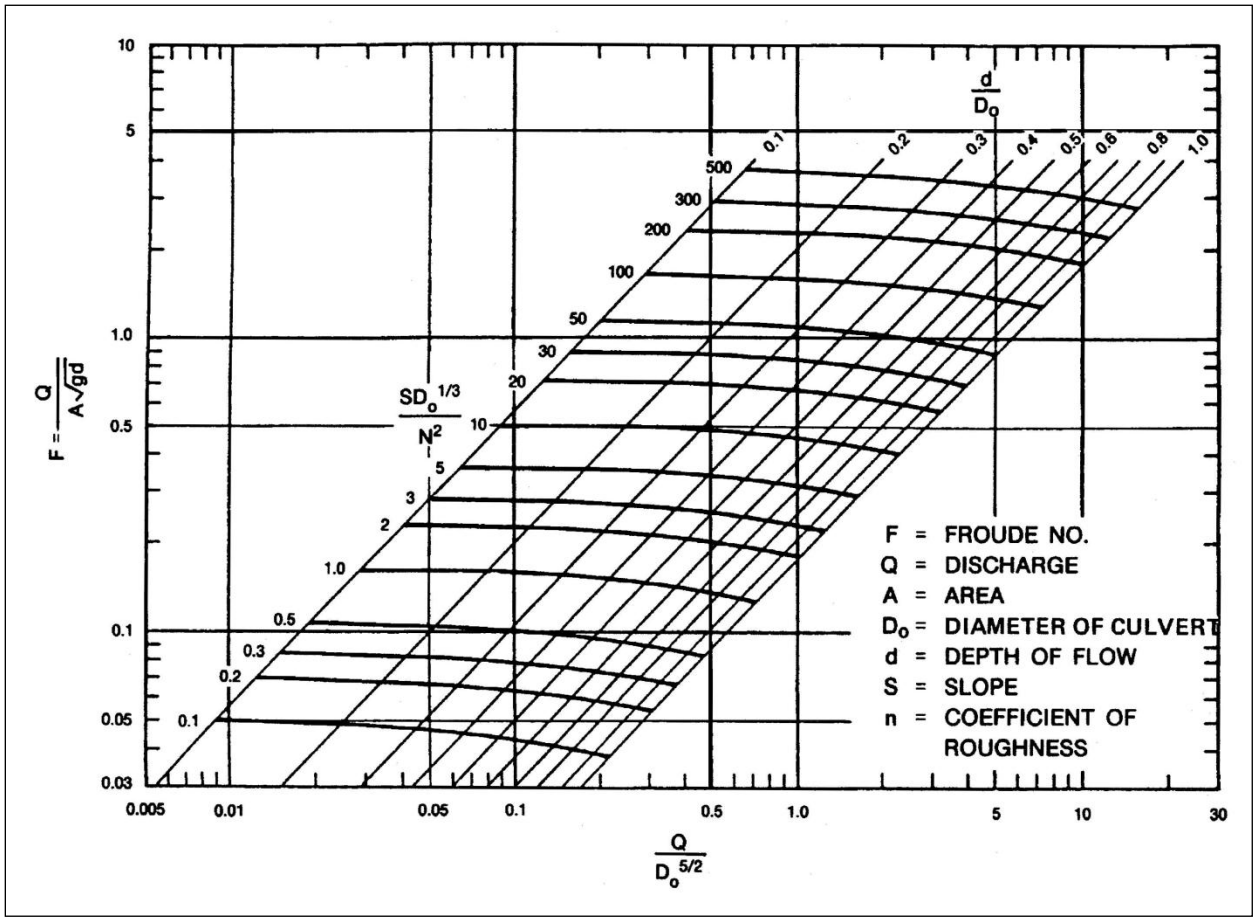


Figure 4-30. Predicted Scour Depth vs. Observed Scour Depth

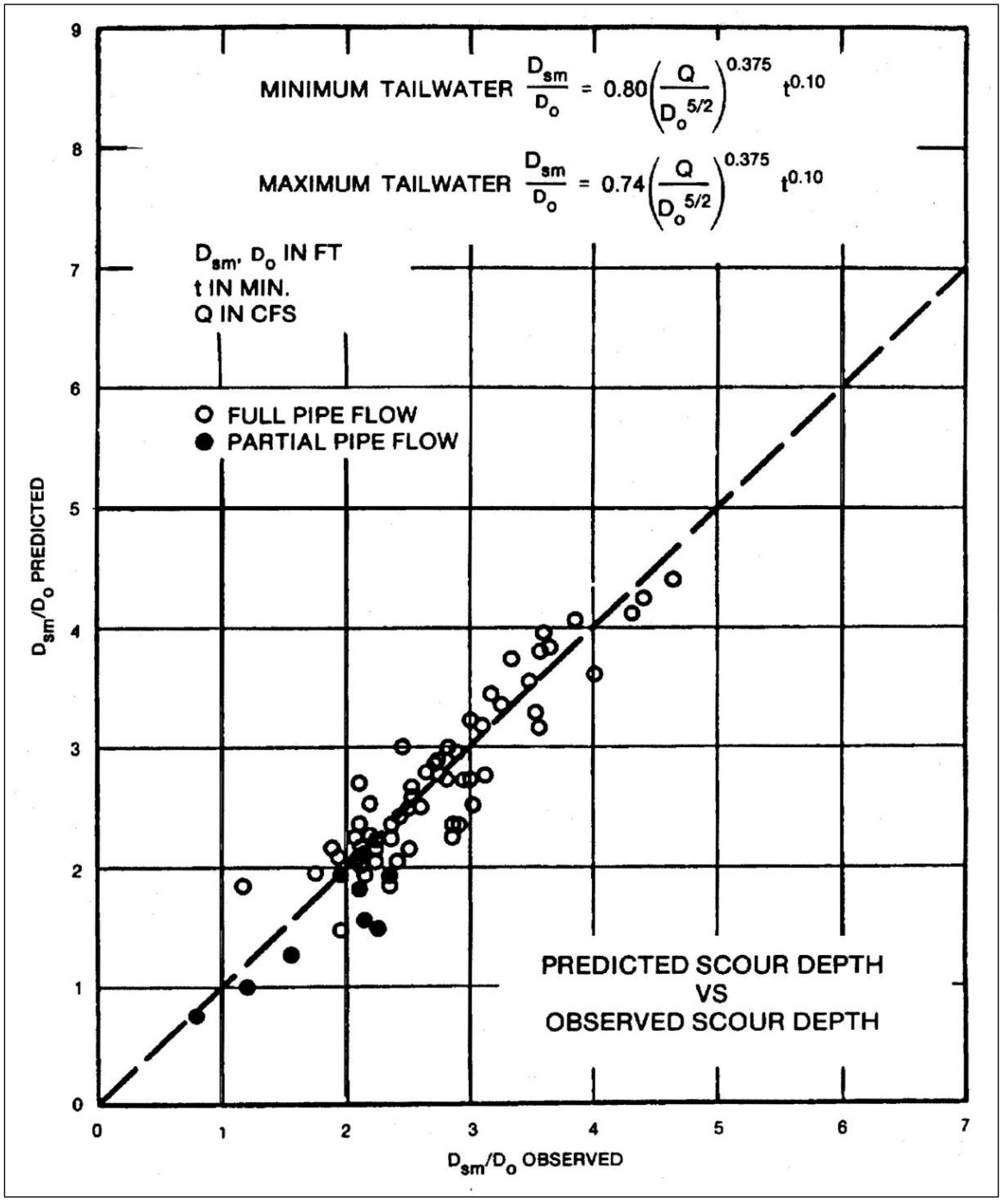


Figure 4-31. Predicted Scour Width vs. Observed Scour Width

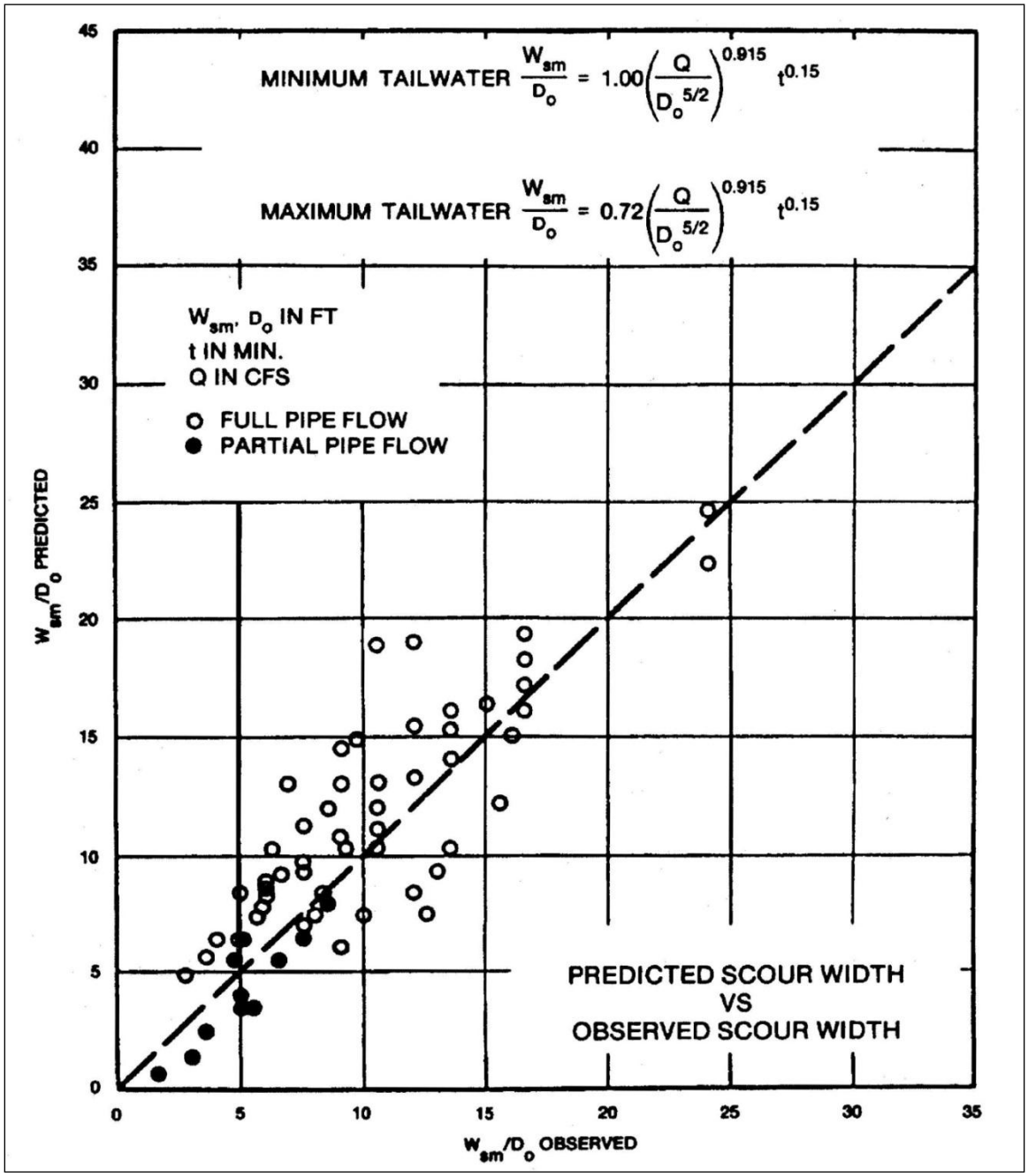


Figure 4-32. Predicted Scour Length vs. Observed Scour Length

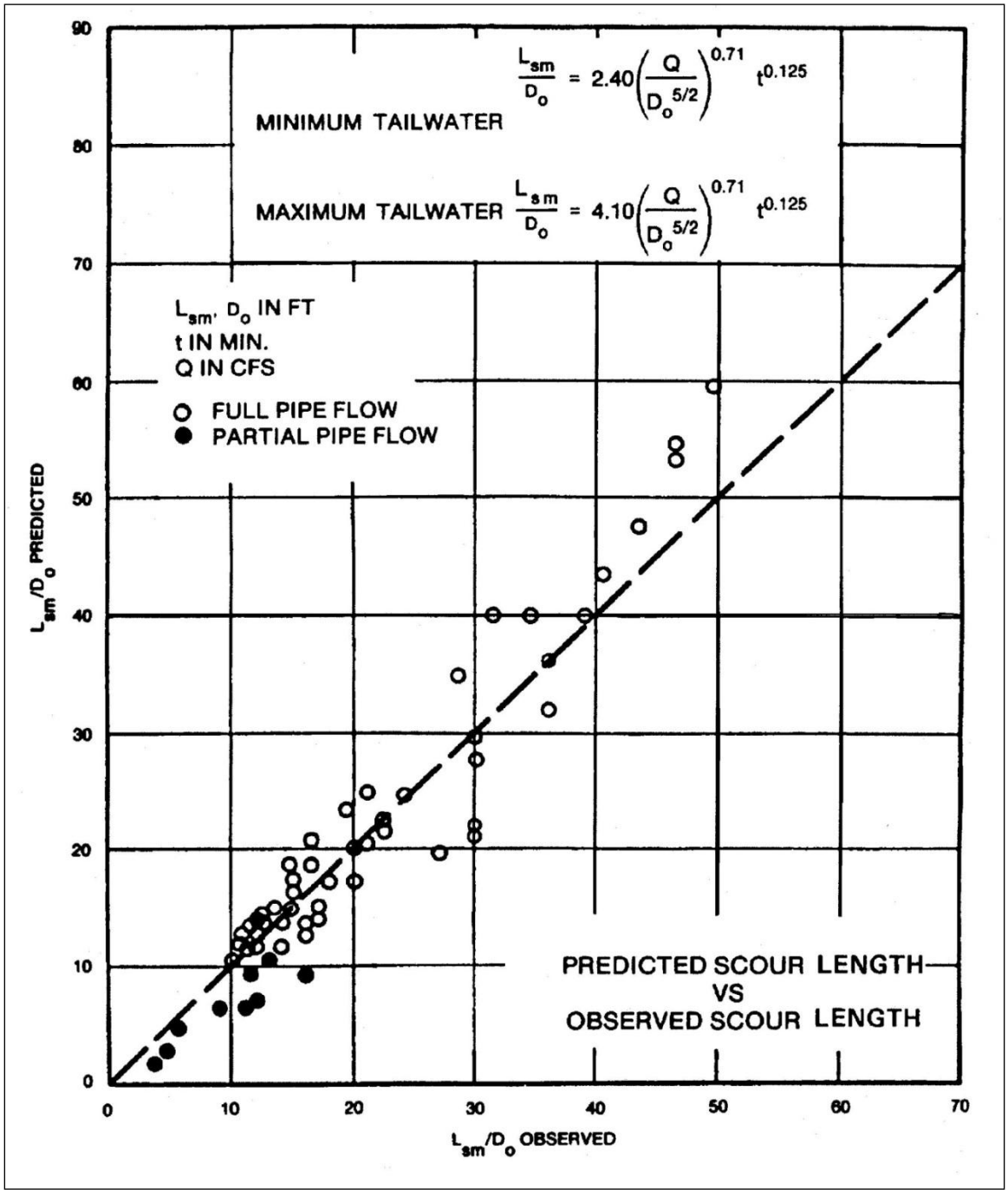


Figure 4-33. Predicted Scour Volume vs. Observed Scour Volume

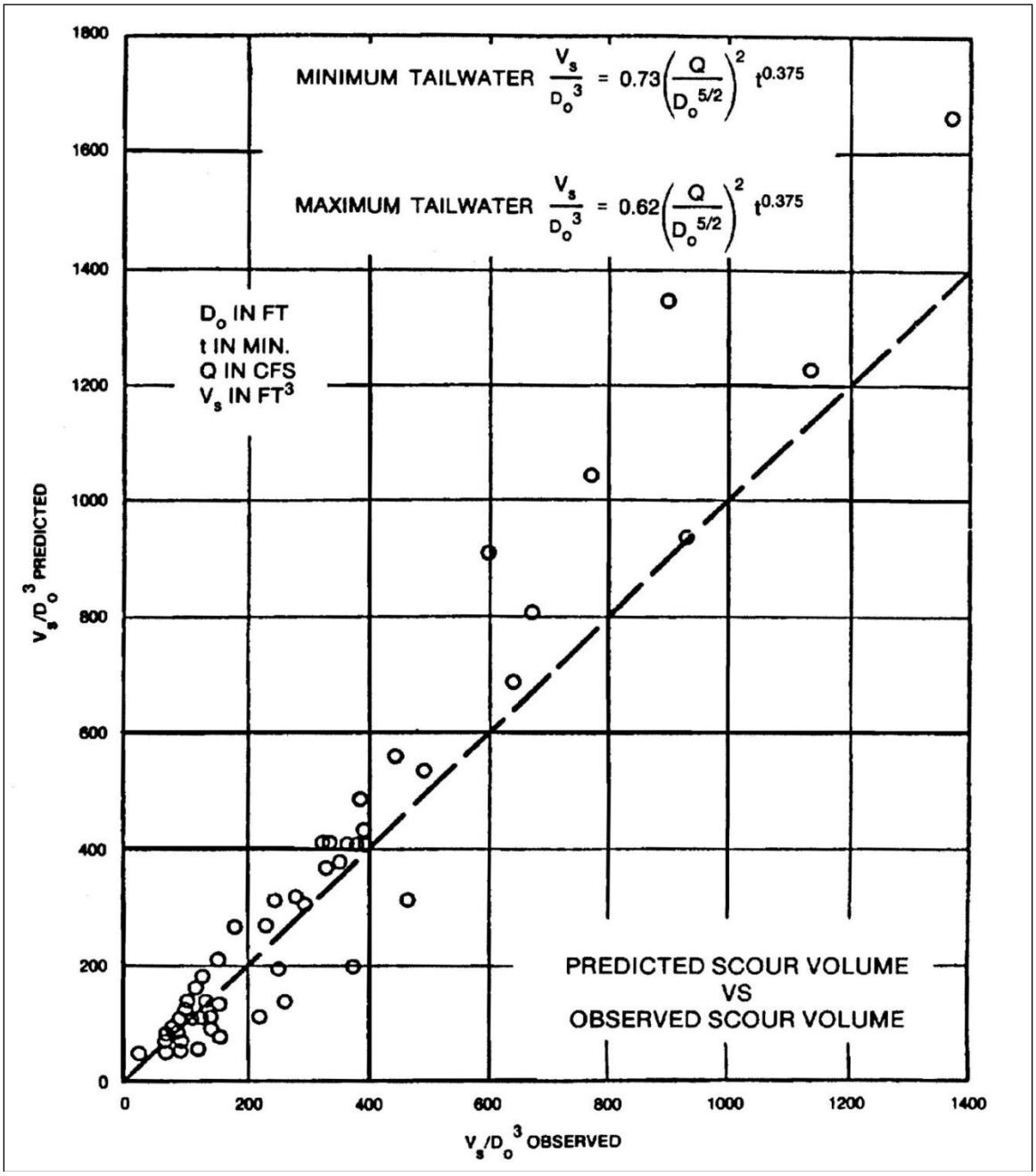


Figure 4-34. Dimensionless Scour Hole Geometry for Minimum Tailwater

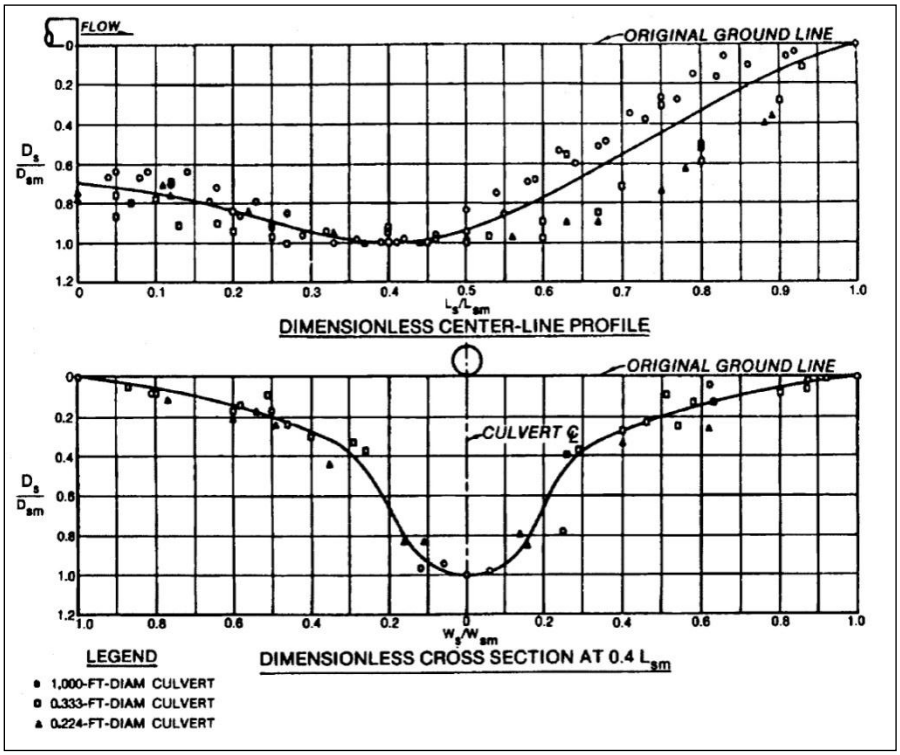
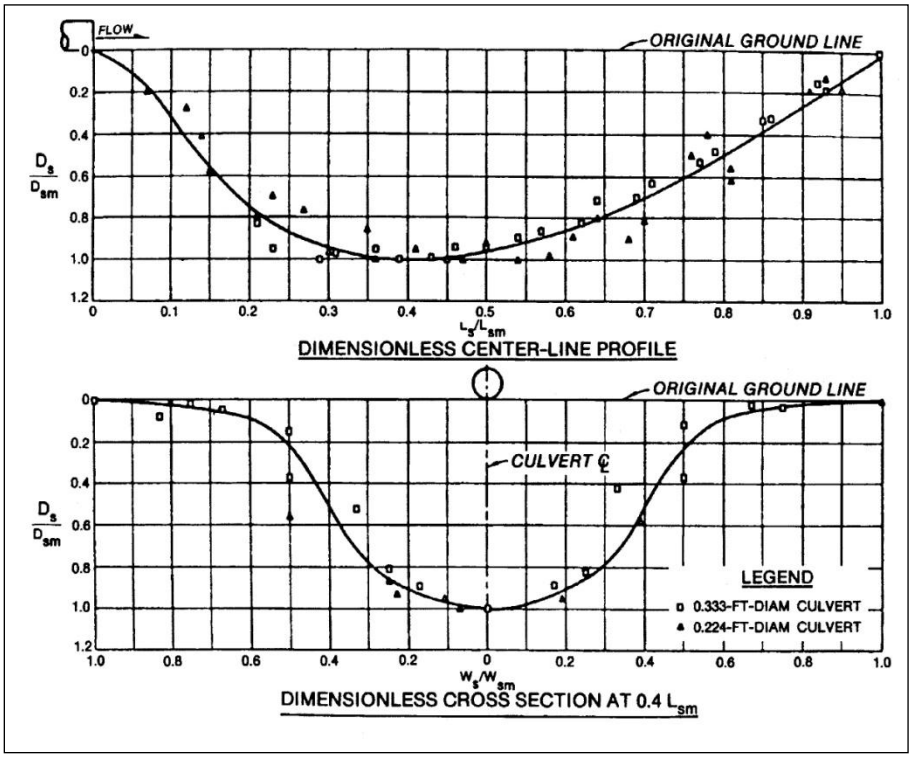


Figure 4-35. Dimensionless Scour Hole Geometry for Maximum Tailwater



4-4.3 Erosion Control at Outlets. There are various methods of preventing scour and erosion at outlets and protecting the structure from undermining. Some of these methods will be explained in subsequent paragraphs. For a complete description of scour at the outlet of culverts and the design of energy dissipators, refer to the FHWA's HEC-14. It has charts, nomographs, and tables necessary for estimating scour holes and the design of energy dissipators. In addition, the HY-8 culvert evaluation software, also available from the FHWA, uses the techniques discussed in HEC-14 to perform scour hole calculations and energy dissipator designs. HEC-14 and HY-8 are highly recommended for energy dissipater design.

4-4.3.1 In some situations, placement of riprap at the end of the outlet may be sufficient to protect the structure. The average size of stone (d_{50}) and configuration of a horizontal blanket of riprap at outlet invert elevation required to control or prevent localized scour downstream of an outlet can be estimated using the information in Figures 4-36 to 4-38. For a given design discharge, culvert dimensions, and tailwater depth relative to the outlet invert, the minimum average size of stone (d_{50}) for a horizontal blanket of protection can be determined using data in Figure 4-36. The length of stone protection (LSP) can be determined by the relations shown in Figure 4-37. The recommended configuration of the blanket is shown in Figure 4-38.

Figure 4-36. Recommended Size of Protective Stone

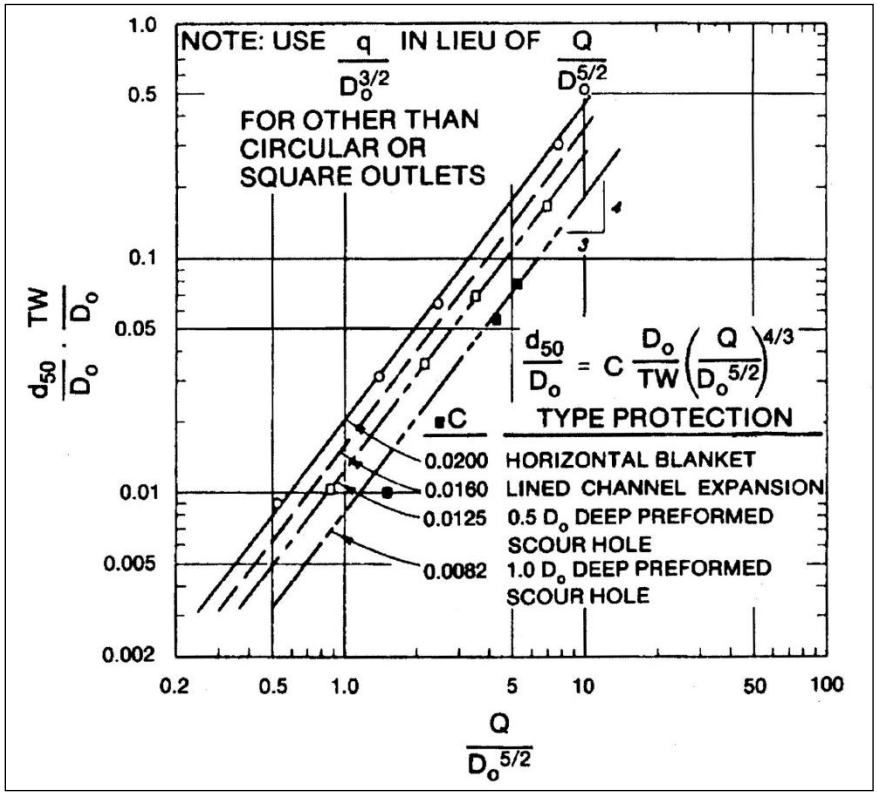


Figure 4-37. Length of Stone Protection, Horizontal Blanket

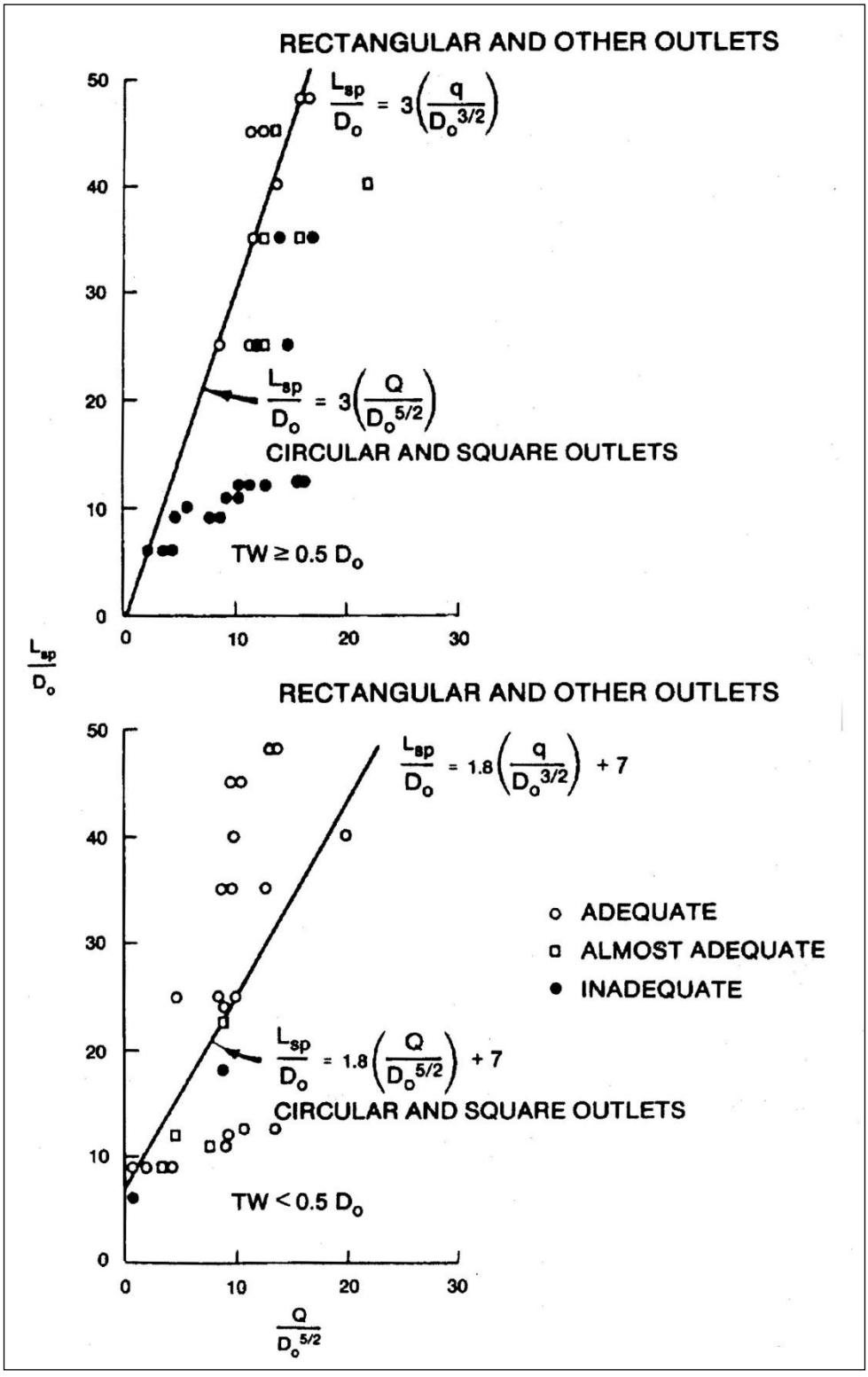
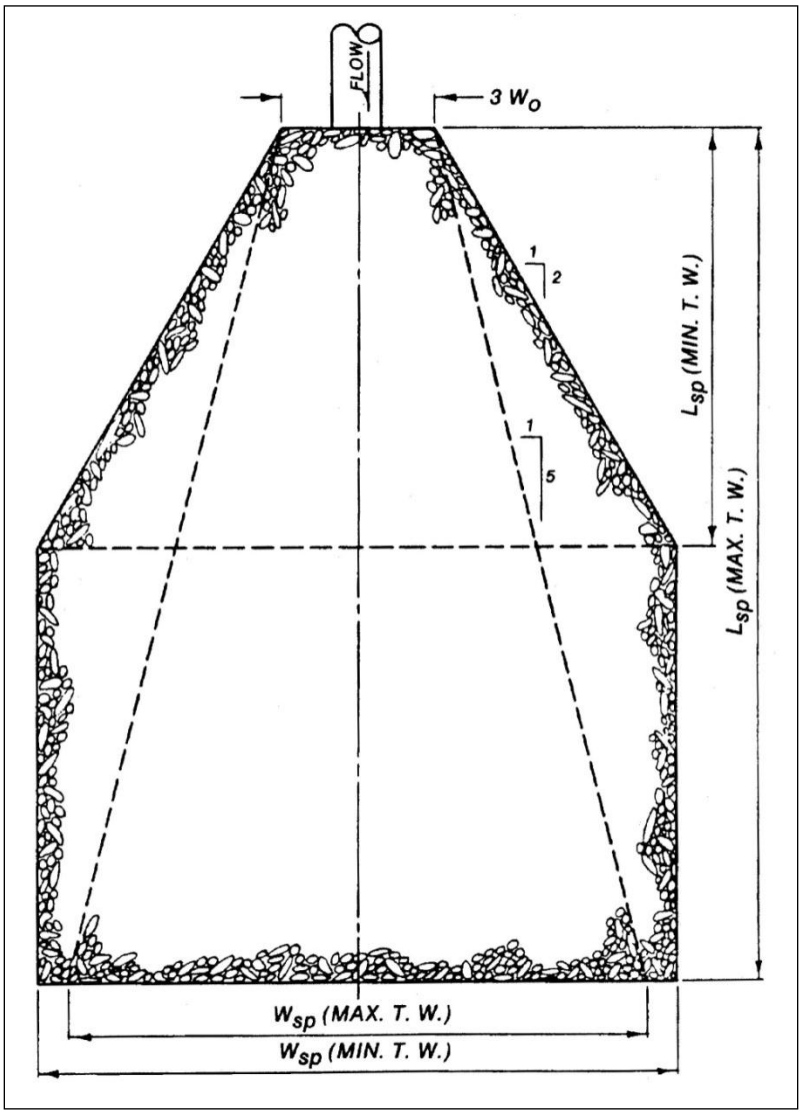
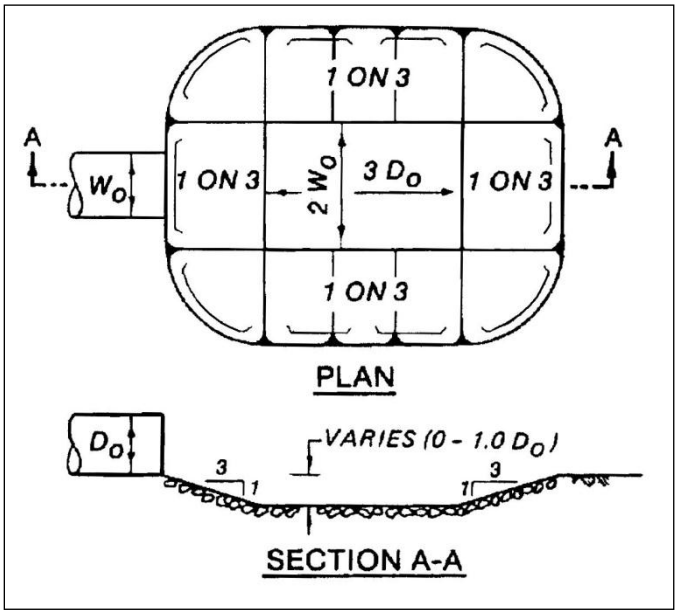


Figure 4-38. Recommended Configuration of Riprap Blanket Subject to Minimum and Maximum Tailwaters



4-4.3.2 The relative advantage of providing both vertical and lateral expansion downstream of an outlet to permit dissipation of excess kinetic energy in turbulence, rather than direct attack of the boundaries, is shown in Figure 4-36. Figure 4-36 indicates that the required size of stone may be reduced considerably if a riprap-lined, preformed scour hole is provided instead of a horizontal blanket at an elevation essentially the same as the outlet invert. Details of a scheme of riprap protection termed "preformed scour hole lined with riprap" are shown in Figure 4-39.

Figure 4-39. Preformed Scour Hole



4-4.3.3 Three ways in which riprap can fail are movement of the individual stones by a combination of velocity and turbulence, movement of the natural bed material through the riprap, resulting in slumping of the blanket, and undercutting and raveling of the riprap by scour at the end of the blanket; therefore, in design, consideration must be given to the selection of adequately sized stone, use of an adequately graded riprap or provision of a filter blanket, and proper treatment of the end of the blanket.

4-4.3.4 Expanding and lining the channel downstream from a square or rectangular outlet for erosion control is usually accomplished using rip rap as shown in Figure 4-40. Figure 4-41 can be used to determine the thickness of the riprap lining. The effectiveness of the lined channel expansion relative to the other schemes of riprap protection described previously is shown in Figure 4-36.

Figure 4-40. Culvert Outlet Erosion Protection, Lined Channel Expansion

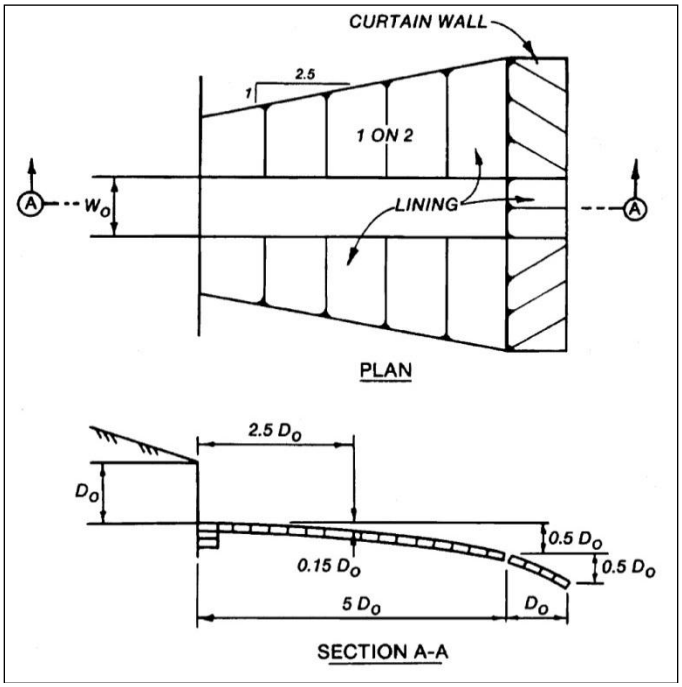
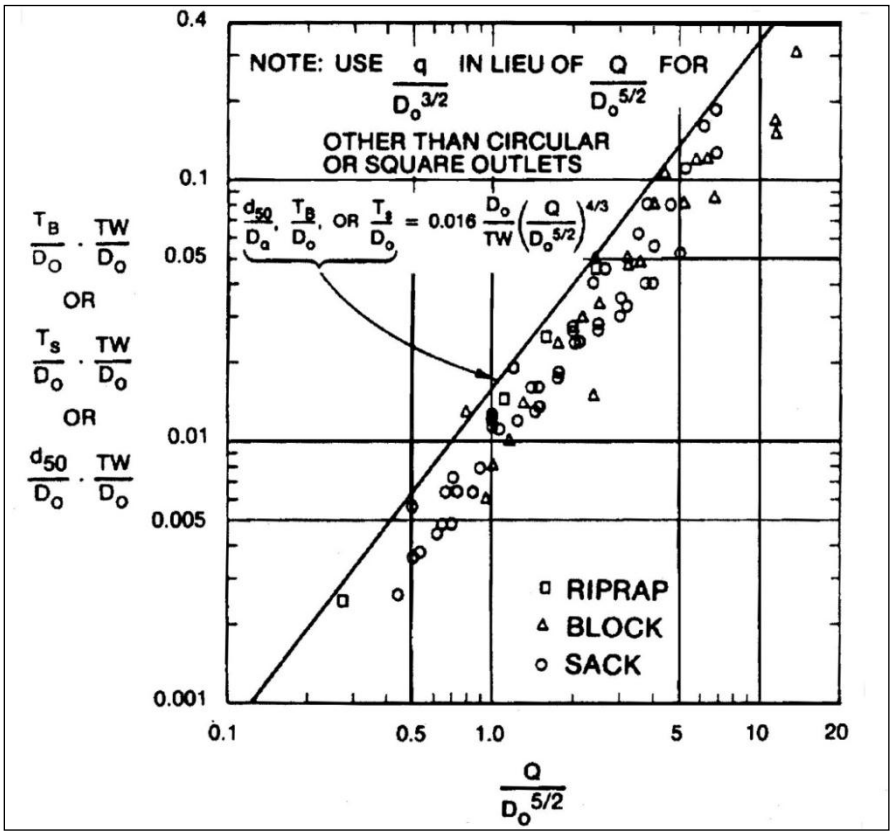


Figure 4-41. Maximum Permissible Discharge for Lined Channel Expansions



4-4.3.5 The maximum discharge parameters, $Q/D_o^{5/2}$ or $q/D_o^{3/2}$, of various schemes of protection can be calculated based on the information in paragraph 4-4.3.4; comparisons relative to the cost of each type of protection can then be made to determine the most practical design for providing effective drainage and erosion control facilities for a given site. In some conditions, the design discharge and economical size of the conduit will result in a value of the discharge parameter greater than the maximum value permissible, thus requiring some form of energy dissipator.

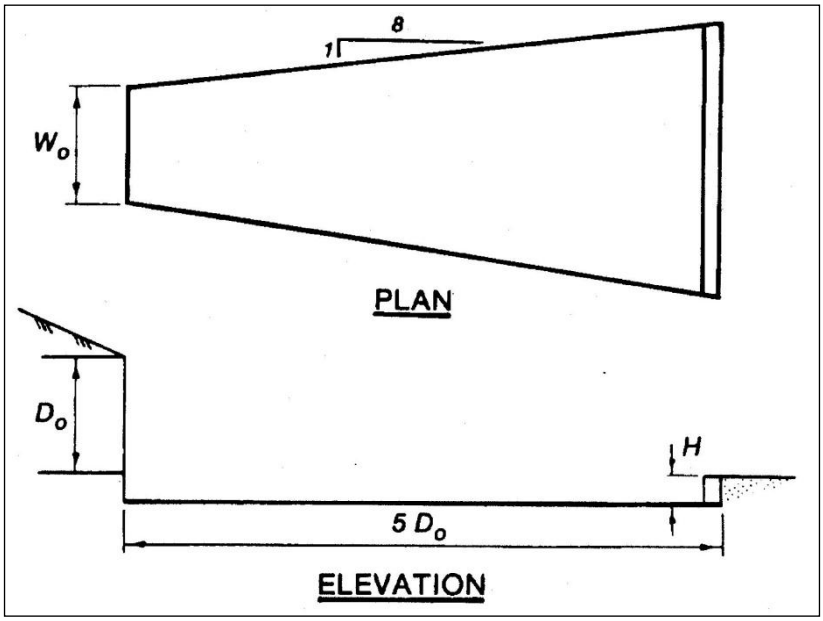
4-4.3.6 The simplest form of energy dissipator is the flared outlet transition. Protection is provided to the local area covered by the apron, and a portion of the kinetic energy of flow is reduced or converted to potential energy by hydraulic resistance provided by the apron. A typical flared outlet transition is shown in Figure 4-42. The flare angle of the walls should be 1 on 8. The length of transition needed for a given discharge conduit size and tailwater situation with the apron at the same elevation as the outlet invert (H = 0) can be calculated by these equations:

$$\frac{L}{D_o} = 0.30\left(\frac{D_o}{TW}\right)^2\left(\frac{Q}{D_0^{5/2}}\right)^{2.5(TW/D_o)^{1/3}} \quad \text{Circular and square outlets} \tag{4-6}$$

$$\frac{L}{D_o} = 0.30\left(\frac{D_o}{TW}\right)^2\left(\frac{q}{D_0^{3/2}}\right)^{2.5(TW/D_o)^{1/3}} \quad \text{Rectangular and other shaped outlets} \tag{4-7}$$

Recessing the apron and providing an end sill will not significantly improve energy dissipation.

Figure 4-42. Flared Outlet Transition



4-4.3.7 The flared transition is satisfactory only for low values of $Q/D_o^{5/2}$ or $q/D_o^{3/2}$, as at culvert outlets. With higher values, however, as at storm drain outlets, other types of energy dissipators will be required. Design criteria for three types of laboratory-tested energy dissipators are presented in Figures 4-43 to 4-45. Each type has advantages and limitations. Selection of the optimum type and size is dependent upon local tailwater conditions, maximum expected discharge, and economic considerations.

4-4.3.8 The stilling well shown in Figure 4-43 consists of a vertical section of circular pipe affixed to the outlet end of a storm sewer. The recommended depth of the well below the invert of the incoming pipe is dependent on the slope and diameter of the incoming pipe and can be determined from the plot in Figure 4-43. The recommended height above the invert of the incoming pipe is two times the diameter of the incoming pipe. The required well diameter can be determined from the equation in Figure 4-43. The top of the well should be located at the elevation of the invert of a stable channel or drainage basin. The area adjacent to the well may be protected by riprap or paving. Energy dissipation does not require maintaining a specified tailwater depth in the vicinity of the outlet. Use of the stilling well is not recommended with $Q/D_o^{5/2}$ greater than 10.

4-4.3.9 The U.S. Bureau of Reclamation (USBR) impact energy dissipator shown in Figure 4-44 is an efficient stilling device even with deficient tailwater. Energy dissipation is accomplished by the impact of the entering jet on the vertically hanging baffle and by the eddies that are formed following impact on the baffle. Excessive tailwater causes flow over the top of the baffle and should be avoided. The basin width required for good energy dissipation for a given storm drain diameter and discharge can be calculated from the information in Figure 4-44. The other dimensions of the energy dissipator are a function of the basin width as shown in Figure 4-44. This basin can be used with $Q/D_o^{5/2}$ ratios up to 21.

4-4.3.10 The Saint Anthony Falls (SAF) stilling basin shown in Figure 4-45 is a hydraulic jump energy dissipator. To function satisfactorily, this basin must have sufficient tailwater to cause a hydraulic jump to form. Design equations for determining the dimensions of the structure in terms of the square of the Froude number of flow entering the dissipator are shown in this figure. Figure 4-46 is a design chart based on these equations. The width of basin required for good energy dissipation can be calculated from the equation in Figure 4-45. Tests used to develop this equation were limited to basin widths of three times the diameter of the outlet, but other model tests indicate that this equation also applies to ratios greater than the maximum shown in Figure 4-45. However, outlet portal velocities exceeding 60 ft/s are not recommended for design containing chute blocks. Parallel basin sidewalls are recommended for best performance. Transition sidewalls from the outlet to the basin should not flare more than 1 on 8.

Figure 4-43. Stilling Well

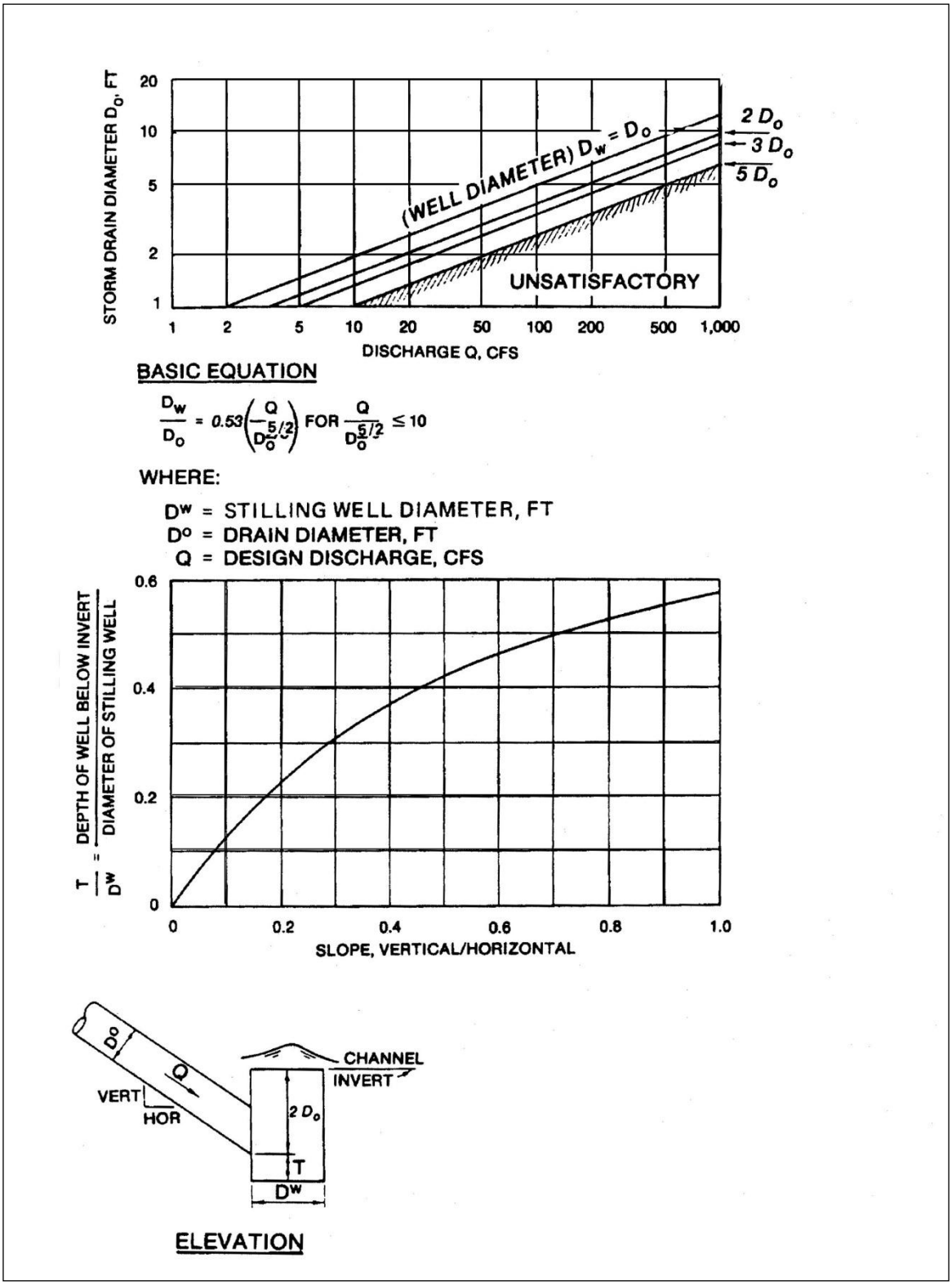


Figure 4-44. U.S. Bureau of Reclamation Impact Basin

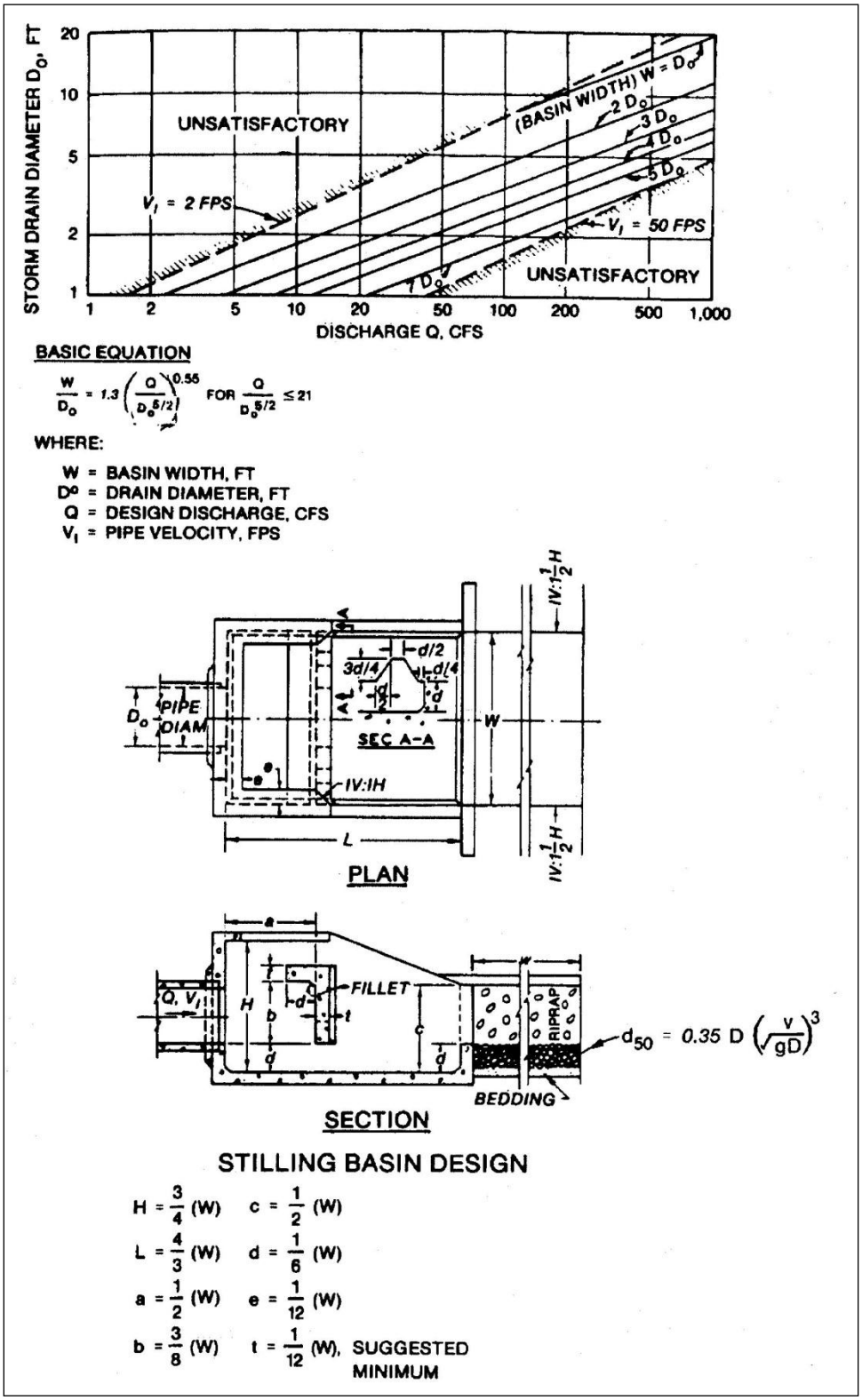


Figure 4-45. Saint Anthony Falls Stilling Basin

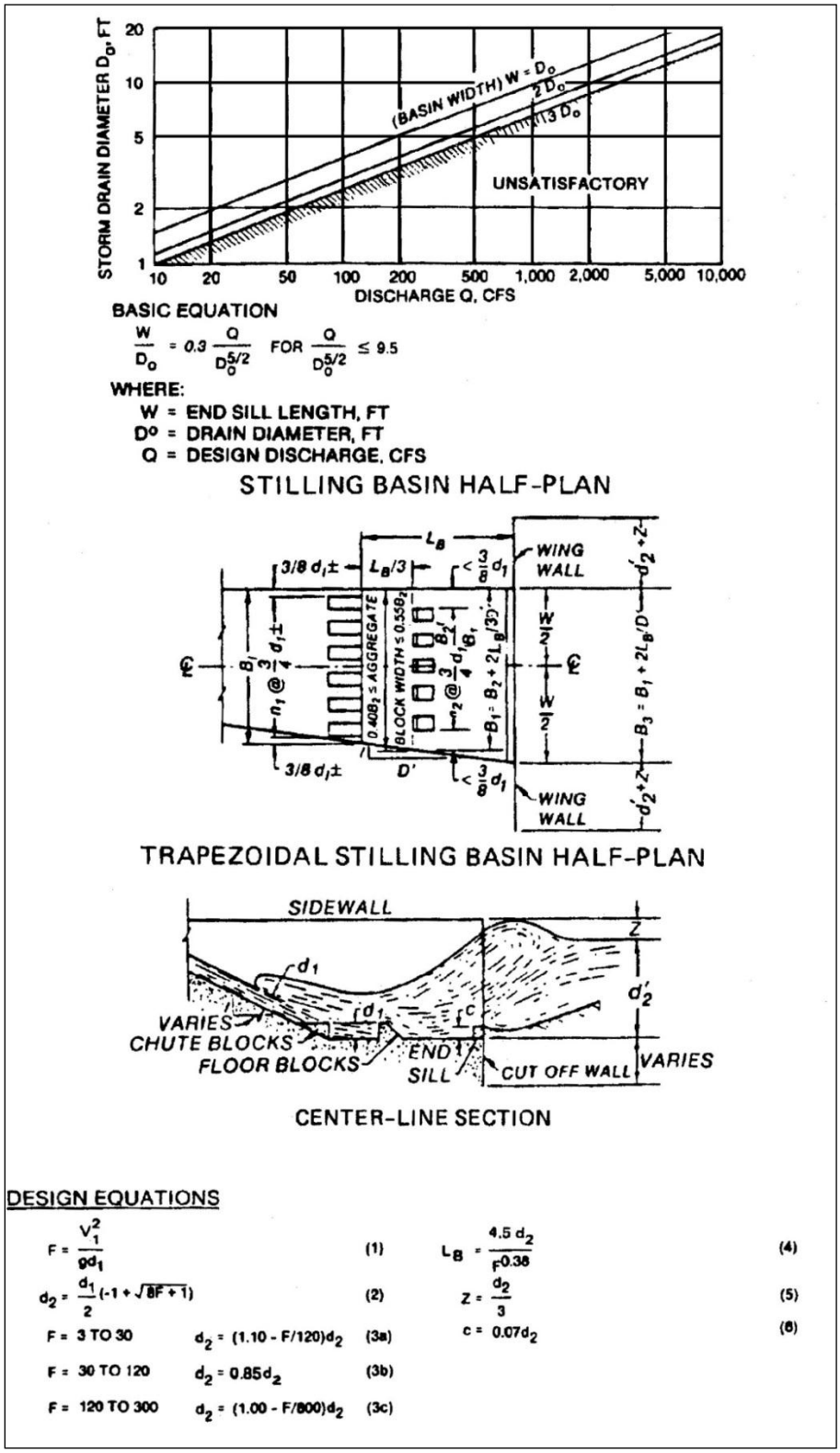
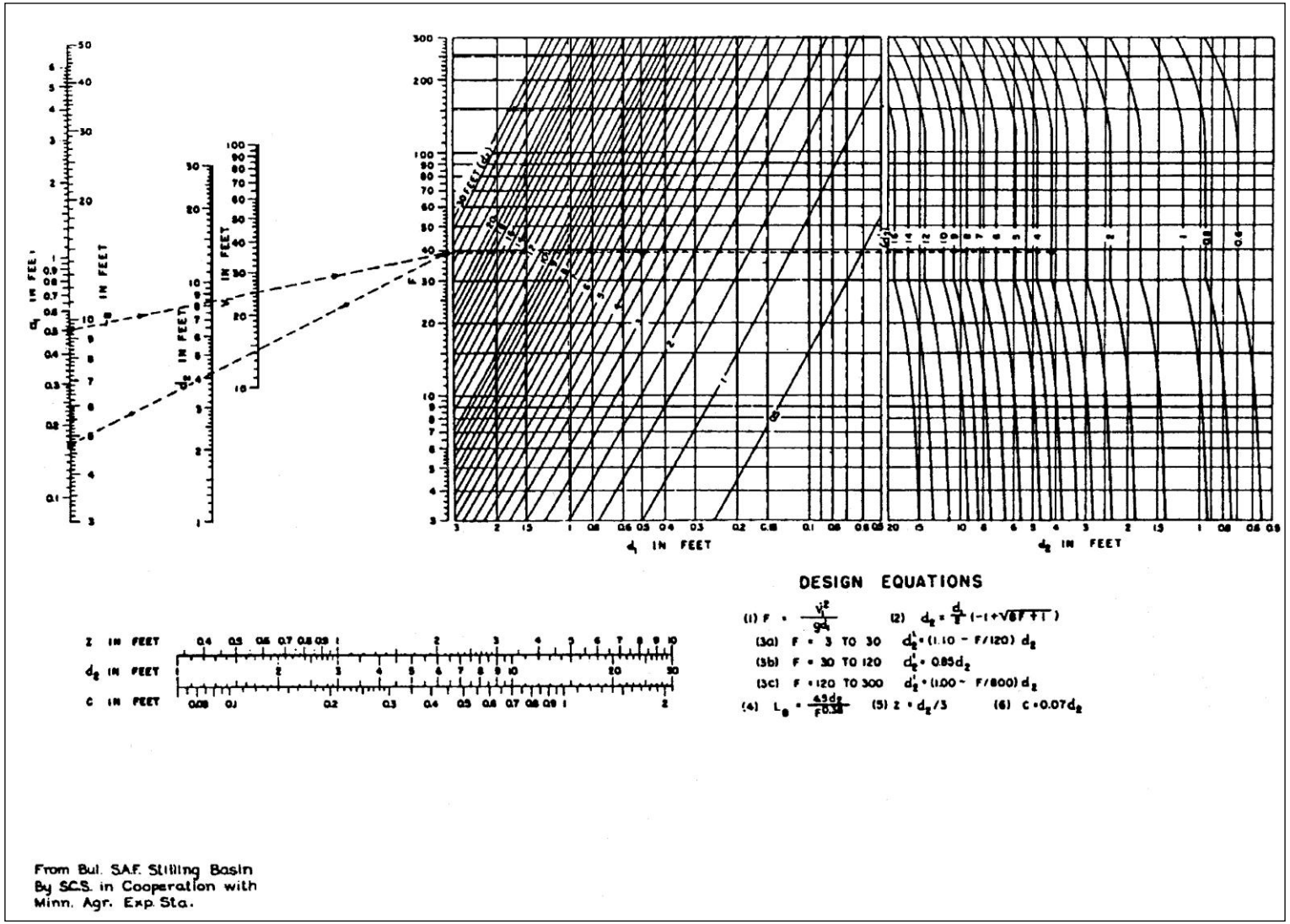


Figure 4-46. Design Chart for SAF Stilling Basin



4-4.3.11 Riprap will be required downstream from the energy dissipators described in this chapter. The size of the stone can be estimated by this equation:

$$d_{50} = D\left(\frac{V}{\sqrt{gD}}\right)^3 \quad \text{or} \quad F = \left(d_{50}/D\right)^{1/3} \tag{4-8}$$

This equation is also to be used for riprap subject to direct attack or adjacent to hydraulic structures such as inlets, confluences, and energy dissipators, where turbulence levels are high. The riprap should extend downstream for a distance approximately 10 times the theoretical depth of flow required for a hydraulic jump.

4-4.3.12 Smaller riprap sizes can be used to control channel erosion. Equation 4-9 is to be used for riprap on the banks of a straight channel where flows are relatively quiet and parallel to the banks.

- Trapezoidal channels

$$d_{50} = .0.35D\left(\frac{V}{\sqrt{gD}}\right)^3 \quad \text{or} \quad F = 1.42\left(d_{50}/D\right)^{1/3} \tag{4-9}$$

- Equation 4-10 is to be used for riprap at the outlets of pipes or culverts where no preformed scour holes are made.

- Wide channel bottom or horizontal scour hole

$$d_{50} = 0.15D\left(\frac{V}{\sqrt{gD}}\right)^3 \quad \text{or} \quad F = 1.88\left(d_{50}/D\right)^{1/3} \tag{4-10}$$

- ½ *D* deep scour hole

$$d_{50} = 0.09D\left(\frac{V}{\sqrt{gD}}\right)^3 \quad \text{or} \quad F = 2.23\left(d_{50}/D\right)^{1/3} \tag{4-11}$$

- *D* deep scour hole

$$d_{50} = 0.055D\left(\frac{V}{\sqrt{gD}}\right)^3 \quad \text{or} \quad F = 2.63\left(d_{50}/D\right)^{1/3} \tag{4-12}$$

- These relationships are shown in Figures 4-47 and 4-48.

Figure 4-47. Recommended Riprap Sizes

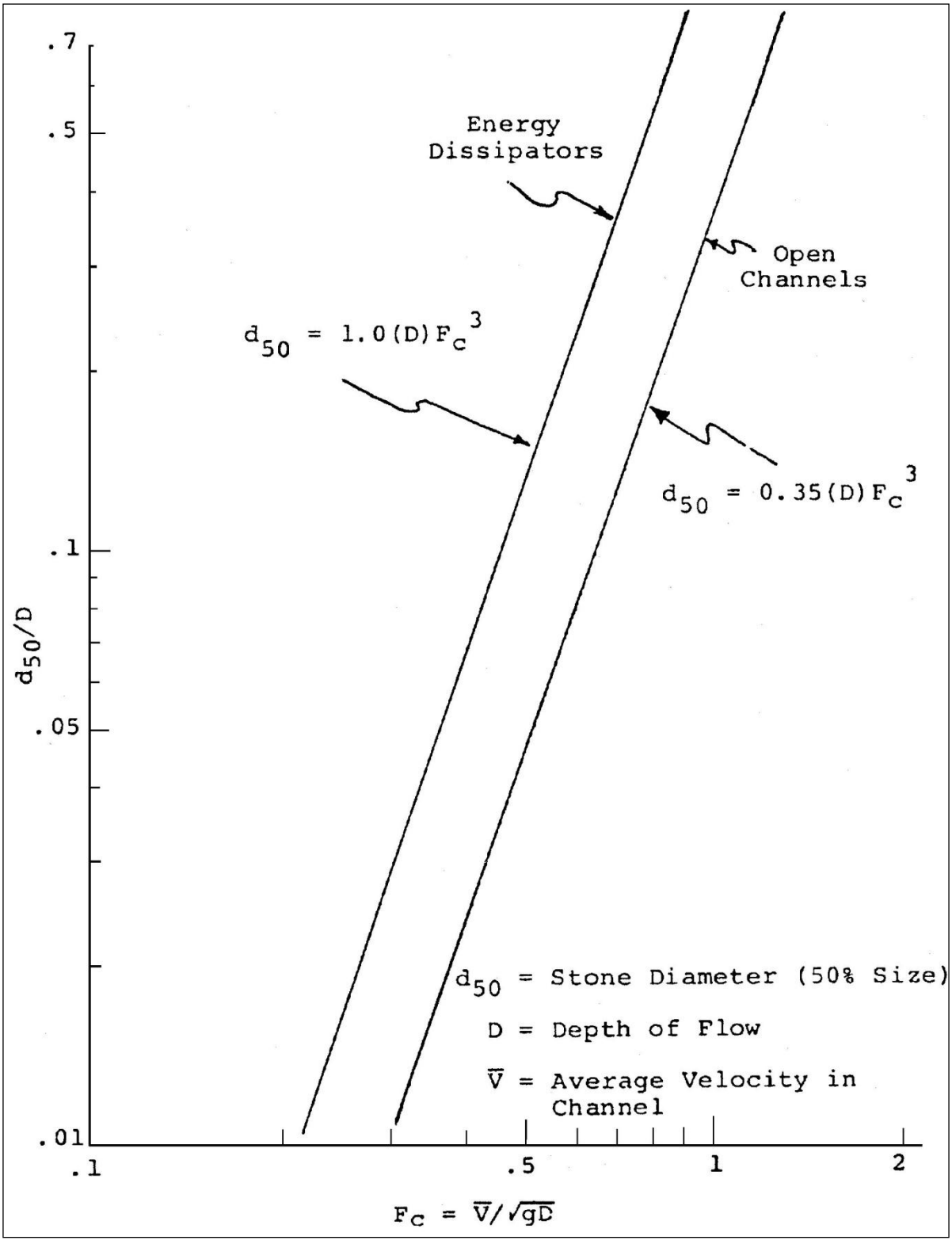
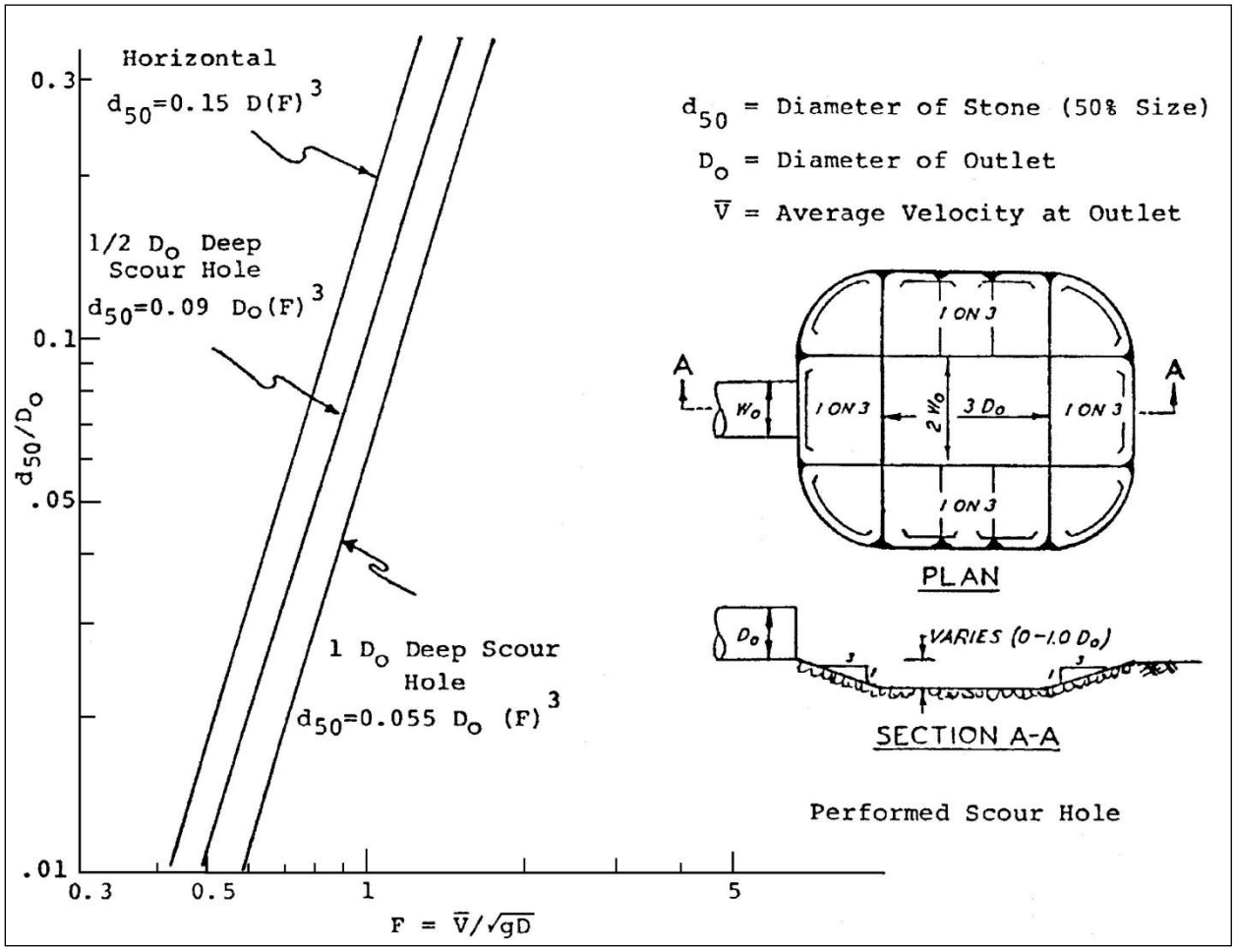


Figure 4-48. Scour Hole Riprap Sizes



4-4.3.13 User-friendly computer programs are available to assist the designer with many of the design problems discussed in this chapter. More information on available computer programs is located in Chapter 12 of this UFC.

4-4.4 Vehicular Safety and Hydraulically Efficient Drainage Practice

4-4.4.1 Some drainage structures are potentially hazardous and, if located in the path of an errant vehicle, can substantially increase the probability of an accident. Inlets should be flush with the ground, or should present no obstacle to a vehicle that is out of control. End structures or culverts should be placed outside the designated recovery area wherever possible. If grates are necessary to cover culvert inlets, take care to design the grate so that the inlet will not clog during periods of high water. Where curb inlet systems are used, setbacks should be minimal and grates should be designed for hydraulic efficiency and safe passage of vehicles. Hazardous channels or energy dissipating devices should be located outside the designated recovery area, or adequate guardrail protection should be provided.

4-4.4.2 It is necessary to emphasize that liberties should not be taken with the hydraulic design of drainage structures to make them safer unless it is clear that their function and efficiency will not be impaired by the changes. Even minor changes at culvert inlets can seriously disrupt hydraulic performance.

4-5 OUTLET PROTECTION DESIGN EXAMPLES.

4-5.1 This section contains examples of recommended application to estimate the extent of scour in a cohesionless soil and alternative schemes of protection required to prevent local scour.

4-5.2 Circular and rectangular outlets with equivalent cross-sectional areas that will be subjected to a range of discharges for a duration of 1 hour are used with these parameters:

- Dimensions of rectangular outlet = W_o = 10 ft, D_o = 5 ft
- Diameter of circular outlet, D_o = 8 ft
- Range of discharge, Q = 362 to 1,086 ft^3/s
- Discharge parameter for rectangular culvert, $q/D_o^{3/2}$ = 3.2 to 9.7
- Discharge parameter for circular culvert, $Q/D_o^{5/2}$ = 2 to 6
- Duration of runoff event, t = 60 min
- Maximum tailwater elevation = 6.4 ft above outlet invert (> 0.5 D_o)
- Minimum tailwater elevation = 2.0 ft above outlet invert (< 0.5 D_o)

4-5.2.1 **Example 4-1**. Determine the maximum depth of scour for minimum and maximum flow conditions for the culverts specified in paragraphs 4-5.2.1.1 and 4-5.2.1.2.

4-5.2.1.1 **Rectangular Culvert**. See Figure 4-30.

- Minimum Tailwater

$$\frac{D_{sm}}{D_o} = 0.80\left(\frac{q}{D_o^{3/2}}\right)^{0.375} t^{0.10}$$

$$D_{sm} = 0.80\,(3.2 \text{ to } 9.7)^{0.375}\ (60)^{0.1}\ (5) = 9.3 \text{ ft to } 14.0 \text{ ft}$$

- Maximum Tailwater

$$\frac{D_{sm}}{D_o} = 0.74\left(\frac{q}{D_o^{3/2}}\right)^{0.375} t^{0.10}$$

$$D_{sm} = 0.74\,(3.2 \text{ to } 9.7)^{0.375}\ (60)^{0.1}\ (5) = 8.6 \text{ ft to } 13.0 \text{ ft}$$

4-5.2.1.2 **Circular Culvert**. See Figure 4-30.

- Minimum Tailwater

$$\frac{D_{sm}}{D_o} = 0.80\left(\frac{Q}{D_o^{5/2}}\right)^{0.375} t^{0.10}$$

$$D_{sm} = 0.80\,(2 \text{ to } 6)^{0.375}\ (60)^{0.1}\ (8) = 12.5 \text{ ft to } 18.9 \text{ ft}$$

- Maximum Tailwater

$$\frac{D_{sm}}{D_o} = 0.74\left(\frac{q}{D_o^{5/2}}\right)^{0.375} t^{0.1}$$

$$D_{sm} = 0.74\,(2 \text{ to } 6)^{0.375}\ (60)^{0.1}\ (8) = 11.6 \text{ ft to } 17.5 \text{ ft}$$

4-5.2.2 **Example 4-2**. Determine the maximum width of scour for minimum and maximum flow conditions for the culverts specified in paragraphs 4-5.2.2.1 and 4-5.2.2.2.

4-5.2.2.1 **Rectangular Culvert**. See Figure 4-31.

- Minimum Tailwater

$$\frac{W_{sm}}{D_o} = 1.00\left(\frac{q}{D_o^{3/2}}\right)^{0.915} t^{0.15}$$

$$W_{sm} = 1.00\,(3.2 \text{ to } 9.7)^{0.915}\ (60)^{0.15}\ (5) = 27 \text{ ft to } 74 \text{ ft}$$

$$W_{sm} = W_{sm} + \frac{W_o}{2} - \frac{D_o}{2} = (27 \text{ to } 74) + \frac{10}{2} - \frac{5}{2} = 29.5 \text{ ft to } 76.5 \text{ ft}$$

- Maximum Tailwater

$$\frac{W_{sm}}{D_o} = 0.72\left(\frac{q}{D_o^{3/2}}\right)^{0.915} t^{0.15}$$

$$W_{sm} = 0.72\,(3.2 \text{ to } 9.7)^{0.915}\ (60)^{0.015} = 19 \text{ ft to } 53 \text{ ft}$$

$$W_{sm} = W_{sm} + \frac{W_o}{2} - \frac{D_o}{2} = (19 \text{ to } 53) + \frac{10}{2} - \frac{5}{2} = 21.5 \text{ ft to } 55.5 \text{ ft}$$

4-5.2.2.2 **Circular Culvert**. See Figure 4-31.

- Minimum Tailwater

$$\frac{W_{sm}}{D_o} = 1.00\left(\frac{Q}{D_o^{5/2}}\right)^{0.915} t^{0.15}$$

$$W_{sm} = 1.00\,(2 \text{ to } 6)^{0.915}\ (60)^{0.15}\ (8) = 28 \text{ ft to } 76 \text{ ft}$$

- Maximum Tailwater

$$\frac{W_{sm}}{D_o} = 0.72\left(\frac{Q}{D_o^{5/2}}\right)^{0.915} t^{0.15}$$

$$W_{sm} = 0.72\,(2 \text{ to } 6)^{0.915}\ (60)^{0.15}\ (8) = 20 \text{ ft to } 55 \text{ ft}$$

4-5.2.3 **Example 4-3**. Determine the maximum length of scour for minimum and maximum flow conditions for the culverts specified in paragraphs 4-5.2.3.1 and 4-5.2.3.2.

4-5.2.3.1 **Rectangular Culvert** (see Figure 4-32)

- Minimum Tailwater

$$\frac{L_{sm}}{D_o} = 2.40\left(\frac{q}{D_o^{3/2}}\right)^{0.71} t^{0.125}$$

$$L_{sm} = 2.4\,(3.2 \text{ to } 9.7)^{0.71}\ (60)^{0.125}\ (5) = 46 \text{ ft to } 101 \text{ ft}$$

- Maximum Tailwater

$$\frac{L_{sm}}{D_o} = 4.10\left(\frac{q}{D_o^{3/2}}\right)^{0.71} t^{0.125}$$

$$L_{sm} = 4.10\,(3.2 \text{ to } 9.7)^{0.71}\ (60)^{0.125}\ (5) = 78 \text{ ft to } 171 \text{ ft}$$

4-5.2.3.2 **Circular Culvert**. See Figure 4-32.

- Minimum Tailwater

$$\frac{L_{sm}}{D_o} = 2.40\left(\frac{Q}{D_o^{5/2}}\right)^{0.71} t^{0.125}$$

$$L_{sm} = 2.4\,(2 \text{ to } 6)^{0.71}\ (60)^{0.125}\ (8) = 52 \text{ ft to } 114 \text{ ft}$$

- Maximum Tailwater

$$\frac{L_{sm}}{D_o} = 4.10\left(\frac{Q}{D_o^{5/2}}\right)^{0.71} t^{0.125}$$

$$L_{sm} = 4.10\,(2 \text{ to } 6)^{0.71}\ (60)^{0.125}\ (8) = 90 \text{ ft to } 195 \text{ ft}$$

4-5.2.4 **Example 4-4**. Determine the profile and cross section of scour for maximum discharge and minimum tailwater conditions (see Figure 4-34):

Circular Culvert For L_{sm} = 114 ft and D_{sm} = 18.9 ft											
L_s/L_{sm}	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
L	0.0	11.4	22.8	34.2	45.6	57.0	68.4	79.8	91.2	102.6	114.0
D_s/D_{sm}	0.7	0.75	0.85	0.95	1.0	0.95	0.75	0.55	0.33	0.15	0.0
D_s	13.2	14.2	16.1	18.0	18.9	18.0	14.2	10.4	6.3	2.9	0.0
For W_{sm} = 76 ft and D_{sm} = 18.9 ft											
W_s/W_{sm}	0.0		0.2		0.4		0.6		0.8		1.0
W_s	0.0		15.2		30.4		45.6		60.8		76.0
D_s/D_{sm}	1.0		0.67		0.27		0.15		0.05		0.0
D_s	18.9		12.6		5.1		2.8		0.95		0.0

Rectangular Culvert For L_{sm} = 101 ft and D_{sm} = 14.0 ft											
L_s/L_{sm}	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
L	0.0	10.1	20.2	30.3	40.4	50.5	60.6	70.7	80.8	90.9	101.0
D_s/D_{sm}	0.7	0.75	0.85	0.95	1.0	0.95	0.75	0.55	0.33	0.15	0.0
D_s	9.8	10.5	11.9	13.3	14.0	13.3	10.5	7.7	4.6	2.1	0.0
For W_{sm} = 74 ft and D_{sm} = 14.0 ft											
W_s/W_{sm}	0.0		0.2		0.4		0.6		0.8		1.0
W_s	0.0		14.8		29.6		44.4		59.2		74.0
D_s/D_{sm}	1.0		0.67		0.27		0.15		0.05		0.0
D_s	14.0		9.38		3.78		2.10		0.70		0.0
$W_{sr} = W_s$ $W_s + \frac{W_o}{2} - \frac{D_o}{2}$	0-2.5		17.3		32.1		46.9		61.7		76.5

4-5.2.5 **Example 4-5**. Determine the depth and width of the cutoff wall for the culverts specified in paragraphs 4-5.2.5.1 and 4-5.2.5.2.

4-5.2.5.1 **Rectangular Culvert**. The maximum depth and width of scour equals 14 ft and 76.5 ft.

- From Figure 4-34, depth of cutoff wall = 0.7 (D_{sm}) = 0.7 (14) = 9.8 ft
- From Figure 4-34, width of cutoff wall = 2 (W_{smr}) = 2 (76.5) = 153 ft

4-5.2.5.2 **Circular Culvert**. The maximum depth and width of scour equals 18.9 ft and 76.0 ft.

- From Figure 4-34, depth of cutoff wall = 0.7 (D_{sm}) = 0.7 (18.9) = 13.2 ft
- From Figure 4-34, width of cutoff wall = 2 (W_{sm}) = 2 (76) = 152 ft

NOTE: The depth of the cutoff wall may be varied with width in accordance with the cross section of the scour hole at the location of the maximum depth of scour. See Figures 4-34 and 4-35.

4-5.2.6 **Example 4-6**. Determine the size and extent of the horizontal blanket of riprap for the culverts specified in paragraphs 4-5.2.6.1 and 4-5.2.6.2.

4-5.2.6.1 **Rectangular Culvert**

- Minimum Tailwater

From Figure 4 - 36, $\frac{d_{50}}{D_o} = 0.020 \left(\frac{D_o}{TW}\right) \left(\frac{q}{D_o^{3/2}}\right)^{4/3}$

$d_{50} = 0.020\,(5/2)\,(3.2 \text{ to } 9.7)^{4/3}\,(5) = 1.2 \text{ ft to } 5.2 \text{ ft}$

From Figure 4 - 37, $\frac{L_{sp}}{D_o} = 1.8 \left(\frac{q}{D_o^{3/2}}\right) + 7$

$L_{sp} = [1.8\,(3.2 \text{ to } 9.7) + 7]\;5 = 64 \text{ ft to } 122 \text{ ft}$

- Maximum Tailwater

$\frac{d_{50}}{D_o} = 0.020 \left(\frac{D_o}{TW}\right) \left(\frac{q}{D_o^{3/2}}\right)^{4/3}$

$d_{50} = 0.020\;(5/6.4)\,(3.2 \text{ to } 9.7)^{4/3}\,(5) = 0.37 \text{ ft to } 0.76 \text{ ft}$

$\frac{L_{sp}}{D_o} = 3 \left(\frac{q}{D_o^{3/2}}\right)$

$L_{sp} = 3\,(3.2 \text{ to } 9.7)\;5 = 48 \text{ ft to } 145 \text{ ft}$

4-5.2.6.2 **Circular Culvert**

- Minimum Tailwater

$\frac{d_{50}}{D_o} = 0.020 \left(\frac{D_o}{TW}\right) \left(\frac{Q}{D_o^{5/2}}\right)^{4/3}$

$\frac{L_{sp}}{D_o} = 1.8 \left(\frac{Q}{D_o^{5/2}}\right) + 7$

$L_{sp} = 1.8\,(2 \text{ to } 6) + 7 \quad 8 = 85 \text{ ft to } 142 \text{ ft}$

- Maximum Tailwater

$$\frac{d_{50}}{D_o} = 0.020 \ \frac{D_o}{TW} \left(\frac{Q}{D_o^{5/2}} \right)^{4/3}$$

$$d_{50} = 0.020 \ (8/6.4)\,(2 \ \text{to} \ 6)^{4/3}\,(8) = 0.50 \text{ ft to } 2.18 \text{ ft}$$

$$\frac{L_{sp}}{D_o} = 3 \left(\frac{Q}{D_o^{5/2}} \right)$$

$$L_{sp} = 3\,(2 \ \text{to} \ 6) \ 8 = 48 \text{ ft to } 144 \text{ ft}$$

Use Figure 4-38 to determine the recommended configuration of a horizontal blanket of riprap subject to minimum and maximum tailwaters.

4-5.2.7 **Example 4-7**. Determine the size and geometry of riprap-lined preformed scour holes 0.5- and 1.0-D_o deep for minimum tailwater conditions for the culverts specified in paragraphs 4-5.2.7.1 and 4-5.2.7.2.

4-5.2.7.1 **Rectangular Culvert**. See Figure 4-36.

- 0.5-D_o-Deep Riprap-Lined Preformed Scour Hole

$$\frac{d_{50}}{D_o} = 0.0125 \ \frac{D_o}{TW} \left(\frac{q}{D_o^{3/2}} \right)^{4/3}$$

$$d_{50} = 0.0125 \ (5/2)\,(3.2 \ \text{to} \ 9.7)^{4/3}\,(5) = 0.73 \text{ ft to } 3.2 \text{ ft}$$

- 1.0-D_o-Deep Riprap-Lined Preformed Scour Hole

$$\frac{d_{50}}{D_o} = 0.0082 \ \frac{D_o}{TW} \left(\frac{q}{D_o^{3/2}} \right)^{4/3}$$

$$d_{50} = 0.0082 \ (5/2)\,(3.2 \ \text{to} \ 9.7)^{4/3} \ (5) = 0.48 \text{ ft to } 2.1 \text{ ft}$$

4-5.2.7.2 **Circular Culvert**

- 0.5-D_o-Deep Riprap-Lined Preformed Scour Hole

$$\frac{d_{50}}{D_o} = 0.0125 \ \frac{D_o}{TW} \left(\frac{Q}{D_o^{5/2}} \right)^{4/3}$$

$$d_{50} = 0.0125\ (8/2)\,(2\ \text{to}\ 6)^{4/3}\ (8) = 1.0\ \text{ft to } 4.4\ \text{ft}$$

- 1.0-D_o-Deep Riprap-Lined Preformed Scour Hole

$$\frac{d_{50}}{D_o} = 0.0082\ \frac{D_o}{TW}\left(\frac{Q}{D_o^{5/2}}\right)^{4/3}$$

$$d_{50} = 0.0082\ (8/2)\,(2\ \text{to}\ 6)^{4/3}\ (8) = 0.66\ \text{ft to } 2.9\ \text{ft}$$

- See Figure 4-24 for geometry.

4-5.2.8 **Example 4-8**. Determine the size and geometry of a riprap-lined channel expansion for minimum tailwaters for the culverts specified in paragraphs 4-5.2.8.1 and 4-5.2.8.2 (see Figure 4-41).

4-5.2.8.1 **Rectangular Culvert**

$$\frac{d_{50}}{D_o} = 0.016\ \frac{D_o}{TW}\left(\frac{q}{D_o^{3/2}}\right)^{4/3}$$

$$d_{50} = 0.016\ (5/2)\,(3.2\ \text{to}\ 9.7)^{4/3}\ (5) = 0.94\ \text{ft to } 4.1\ \text{ft}$$

4-5.2.8.2 **Circular Culvert**

$$\frac{d_{50}}{D_o} = 0.016\ \frac{D_o}{TW}\left(\frac{Q}{D_o^{5/2}}\right)^{4/3}$$

$$d_{50} = 0.016\ (8/2)\,(2\ \text{to}\ 6)^{4/3}\ (8) = 1.29\ \text{ft to } 5.6\ \text{ft}$$

- See Figure 4-40 for geometry.

4-5.2.9 **Example 4-9**. Determine the length and geometry of a flared outlet transition for minimum tailwaters for the culverts specified in paragraphs 4-5.2.9.1 and 4-5.2.9.2.

4-5.2.9.1 **Rectangular Culvert**

$$\frac{L}{D_o} = 0.30\left(\frac{D_o}{TW}\right)^2\left(\frac{q}{D_o^{3/2}}\right)^{2.5(TW/D_o)1/3}$$

$$L = 0.3\,(5/2)^2\ (3.2\ \text{to}\ 9.7)^{2.5(2/5)^{1/3}}\ 5 = 80\ \text{ft to } 616\ \text{ft}$$

4-5.2.9.2 **Circular Culvert**

$$\frac{L}{D_o} = \left[0.30 \left(\frac{D_o}{TW} \right)^2 \left(\frac{Q}{D_o^{5/2}} \right)^{2.5(TW/D_o)^{1/3}} \right]$$

$$L = \left[0.3\,(8/2)^2\ (2\ \text{ to }\ 6)^{2.5(2/8)^{1/3}} \right] 8 = 114 \text{ ft to } 645 \text{ ft}$$

- See Figure 4-42 for geometric details. These equations were developed for H equals 0 or horizontal apron at outlet invert elevation without an end sill.

4-5.2.10 **Example 4-10**. Determine the diameter of the stilling well required downstream of the 8-ft-diameter outlet:

- From Figure 4-43:

$$\frac{D_W}{D_o} = 0.53 \left(\frac{Q}{D_o^{5/2}} \right)^{1.0}$$

$$D_W = 0.53\,(2\ \text{ to }\ 6)\ 8 = 8.5 \text{ ft to } 25.4 \text{ ft}$$

- See Figure 4-43 for additional dimensions.

4-5.2.11 **Example 4-11**. Determine the width of a USBR Type VI basin required downstream of the 8-ft-diameter outlet:

- From Figure 4-44:

$$\frac{W_{VI}}{D_o} = 1.30 \left(\frac{Q}{D_o^{5/2}} \right)^{0.55}$$

$$W_{VI} = \left[1.3\,(2\ \text{ to }\ 6)^{0.55} \right] 8 = 15.2 \text{ ft to } 27.9 \text{ ft}$$

- See Figure 4-44 for additional dimensions.

4-5.2.12 **Example 4-12**. Determine the width of the SAF basin required downstream of the 8-ft-diameter outlet:

- From Figure 4-45:

$$\frac{W_{SAF}}{D_o} = 0.30 \left(\frac{Q}{D_o^{5/2}} \right)^{1.0}$$

$$W_{SAF} = 0.30\,(2 \text{ to } 6)\ 8 = 4.8 \text{ ft to } 14.4 \text{ ft}$$

- See Figure 4-45 for additional dimensions.

4-5.2.13 **Example 4-13**. Determine the size of riprap required downstream of an 8-ft-diameter culvert and a 14.4-ft-wide SAF basin with a discharge of 1,086 ft^3/s:

$$q = \frac{Q}{W_{SAF}} = \frac{1086}{14.4} = 75 \text{ ft}^3/\text{s/ft}$$

$$V_1 = \frac{Q}{A} = \frac{1086}{0.785(8)^2} = 21.6 \text{ ft/s}$$

$$d_1 = \frac{q}{V_1} = \frac{75}{21.6} = 3.5 \text{ ft}$$

d_2 = 8.4 ft (from conjugate depth relations)

- Minimum Tailwater Required For A Hydraulic Jump = 0.90 (8.4) = 7.6 ft

$$d_{50} = D \left(\frac{V}{\sqrt{gD}} \right)^3$$

$$V = \frac{q}{D} = \frac{75}{7.6} = 9.9 \text{ ft/s}$$

$$d_{50} = 1.0 \left[\frac{9.9}{\sqrt{32.2\,(7.6)}} \right]^3 \ 7.6$$

$$d_{50} = 1.9 \text{ ft}$$

CHAPTER 5

CHANNEL DESIGN

5-1 OPEN CHANNEL FLOW. Roadside and median channels are open-channel systems that collect and convey storm water from the pavement surface, roadside, and median areas. These channels may outlet to a storm drain piping system via a drop inlet, to a detention or retention basin or other storage component, or to an outfall channel. Roadside and median channels are normally trapezoidal in cross section and are lined with grass or other protective lining.

The design and analysis of roadside and median channels follow the basic principles of open channel flow. Summaries of several important open channel flow concepts and relationships are presented in many hydraulic engineering texts and in the FHWA's HEC-22 manual.

5-1.1 Flow Resistance. The depth of flow in a channel of given geometry and longitudinal slope is primarily a function of the channel's resistance to flow or roughness. This depth is called the normal depth and is computed from Manning's equation for "V" combined with the continuity equation, $Q = VA$. The combined equation, often referred to as Manning's equation, is:

$$Q = \frac{1.486AR^{0.67}S_o^{0.5}}{n} \qquad (5\text{-}1)$$

where:

Q = discharge rate, ft^3/s

A = cross-sectional flow area, ft^2

R = hydraulic radius, $\frac{A}{P}$, ft

P = wetted perimeter, ft

S_o = energy grade line slope, ft/ft

n = Manning's roughness coefficient

Nomograph solutions to Manning's equation for triangular and trapezoidal channels are presented in Appendix B and are also available in many other texts.

5-1.1.1 The selection of an appropriate Manning's *n* value for design purposes is often based on observation and experience. Manning's *n* values are also known to vary with flow depth. Table 5-1 provides Manning's *n* values for natural channels; Table 5-2 provides a tabulation of Manning's *n* values for various channel lining materials.

Table 5-1. Manning's *n* for Natural Stream Channels (Surface Width at Flood Stage Less than 100 ft)

Stream Channel Characteristics	*n* Value
Fairly regular section:	
Some grass and weeds, little or no brush	0.030-0.035
Dense growth of weeds, depth of flow materially greater than weed height	0.035-0.05
Some weeds, light brush on banks	0.035-0.05
Some weeds, heavy brush on banks	0.05-0.07
Some weeds, dense willows on banks	0.06-0.08
For trees within the channel with branches submerged at high stage, increase all above values by	0.01-0.02
Irregular sections with pools, slight channel meander: increase these values approximately	0.01-0.02
Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stage:	
Bottom of gravel, cobbles, and few boulders	0.04-0.05
Bottom of cobbles, with large boulders	0.05-0.07

Table 5-2. Manning's Roughness Coefficients for Lined Channels**

Lining Category	Lining Type	*n* Value for Given Depth Ranges		
		0 - 0.5 ft	0.5 - 2.0 ft	> 2.0 ft
Rigid	Concrete	0.015	0.013	0.013
	Grouted Riprap	0.040	0.030	0.028
	Stone Masonry	0.042	0.032	0.030
	Soil Element	0.025	0.022	0.020
	Asphalt	0.018	0.016	0.016
Unlined	Bare Soil	0.023	0.020	0.020
	Rock Cut	0.045	0.035	0.025
Temporary*	Woven Paper Net	0.016	0.015	0.015
	Jute Net	0.028	0.022	0.019
	Fiberglass Roving	0.028	0.021	0.019
	Straw with Net	0.065	0.033	0.025
	Curled Wood Mat	0.066	0.035	0.028
	Synthetic Mat	0.036	0.025	0.021
Gravel Riprap	1 inch D_{50}	0.044	0.033	0.030

Lining Category	Lining Type	*n* Value for Given Depth Ranges		
		0 - 0.5 ft	0.5 - 2.0 ft	> 2.0 ft
Rock Riprap	2 inch D_{50}	0.066	0.041	0.034
	6 inch D_{50}	0.104	0.069	0.035
	12 inch D_{50}	--	0.078	0,040

NOTE: Values listed are representative values for the respective depth ranges. Manning's roughness coefficients, *n*, vary with the flow depth.

* Some "temporary" linings become permanent when buried.

** Table reproduced from FHWA HEC-15

5-1.1.2 Manning's roughness coefficient for vegetative and other linings varies significantly depending on the amount of submergence. The classification of vegetal covers by degree of retardance is provided in Table 5-3. Table 5-4 provides a list of Manning's n relationships for five classes of vegetation defined by their degree of retardance.

Table 5-3. Classification of Vegetal Covers as to Degree of Retardance*

Retardance Class	Cover	Condition
A	Weeping lovegrass	Excellent stand, tall, average 2.5 ft
	Yellow bluestem	Excellent stand, tall, average 3.0 ft
	Ischaemum	
B	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall, average 1.0 ft
	Native grass mixture (Little bluestem, bluestem, blue gamma, and other long and short midwest grasses)	Good stand, unmowed
	Weeping lovegrass	Good stand, tall, average 2.0 ft
	Lespedeza sericea	Good stand, not woody, tall, average 1.6 ft
	Alfalfa	Good stand, uncut, average 0.91 ft
	Weeping lovegrass	Good stand, unmowed, average 1.1 ft
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut, average 1.1 ft

Retardance Class	Cover	Condition
C	Crabgrass	Fair stand, uncut, average 0.8 to 4.0 ft
	Bermuda grass	Good stand, mowed, average 0.5 ft
	Common lespedeza	Good stand, uncut, average 0.91 ft
	Grass-legume mixture—summer (orchard grass, redtop Italian ryegrass, and common lespedeza)	Good stand, uncut, average 0.5 to 1.5 ft
	Centipede grass	Very dense cover, average 0.5 ft
	Kentucky bluegrass	Good stand, headed, average. 0.5 to 1.0 ft
D	Bermuda grass	Good stand, cut to 0.2 ft
	Common lespedeza	Excellent stand, uncut, average 0.4 ft
	Buffalo grass	Good stand, uncut, average 0.3 to 0.5 ft
	Grass-legume mixture—fall, spring (orchard grass, redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut, average 0.3 to 0.4 ft
	Lespedeza sericea	After cutting to 0.2-ft height, very good stand before cutting
E	Bermuda grass	Good stand, cut to average 0.1 ft
	Bermuda grass	Burned stubble
NOTE: These covers have been tested in experimental channels. The covers were green and generally uniform. *Table reproduced from FHWA HEC-15		

Table 5-4. Manning's *n* Relationships for Vegetal Degree of Retardance

Retardance Class	Manning's n Equation*	Chapter Equation Number
A	$\frac{R^{1/6}}{\left[15.8+19.97log\left(R^{1.4}S_o^{0.4}\right)\right]}$	5-2
B	$\frac{R^{1/6}}{\left[23.0+19.97log\left(R^{1.4}S_o^{0.4}\right)\right]}$	5-3
C	$\frac{R^{1/6}}{\left[30.2+19.97log\left(R^{1.4}S_o^{0.4}\right)\right]}$	5-4
D	$\frac{R^{1/6}}{\left[34.6+19.97log\left(R^{1.4}S_o^{0.4}\right)\right]}$	5-5
E	$\frac{R^{1/6}}{\left[37.7+19.97log\left(R^{1.4}S_o^{0.4}\right)\right]}$	5-6
* Equations are valid for flows less than 50 ft^3/s. Nomograph solutions for these equations are in FHWA HEC-15.		

5-1.1.3 **Example 5-1**

Given: A trapezoidal channel (as shown in Figure 5-3) with these characteristics:

- S_o = 0.01
- B = 2.62 ft
- z = 3
- d = 1.64 ft

Find: The channel capacity and flow velocity for these channel linings:

(1) Riprap with a median aggregate diameter, d_{50} = 6 in.

(2) A good stand of buffalo grass, uncut, 3 to 6 in.

5-1.1.3.1 ***Solution 1*: Riprap**

Step 1. Determine the channel parameters. From Table 5-1:

n = 0.069

$A = Bd + 2(1/2)(d)(zd)$

$= Bd + zd^2$

$= (2.62)(1.64) + (3)(1.64)2$

$= 12.4\ ft^2$

$P = B + 2[(zd)2 + d2)]1/2$

$= B + 2d(z2 + 1)0.5$

$= (2.62)+ (2)(1.64) + (32 + 1)0.5$

$= 13.0$ ft

$R = \frac{A}{P}$

$= \frac{12.4}{13.0}$

$= 0.95$ ft

Step 2. Compute the flow capacity.

$$Q_n = 1.49AR^{0.67}S_o^{0.5}$$

$$= (1.49)(12.4)(0.95)0.67(0.01)0.5$$

$$= 1.79 \text{ ft}^3/\text{s}$$

$$Q = \frac{Qn}{n}$$

$$= \frac{1.79}{0.069}$$

$$= 25.9 \text{ ft}^3/\text{s}$$

Step 3. Compute the flow velocity.

$$V = \frac{Q}{A}$$

$$= \frac{25.9}{12.4}$$

$$= 2.1 \text{ ft/s}$$

5-1.1.3.2 ***Solution 2*: Buffalo Grass**

Step 1. Determine the roughness. Use these characteristics:

- Degree of retardance from Table 5-3
- Retardance Class D
- From paragraph 5-1.1.3.1, solution 1, step 1: R = 0.95 ft
- Roughness coefficient, n, from Table 5-4

$$n = \frac{R^{0.167}}{34.6 + 19.97 log\left[(R)^{1.4}(S_o)^{0.4}\right]}$$

$$n = \frac{(0.95)^{0.167}}{34.6 + 19.97 log\left[(0.95)^{1.4}(0.01)^{0.4}\right]}$$

$$n = 0.055$$

Step 2. Compute the flow capacity. Use these values from step 1:

$Q_n = 1.79 \text{ ft}^3/\text{s}$

$$Q = \frac{Qn}{n}$$

$$= \frac{1.79}{0.55}$$

$= 32.5 \text{ ft}^3/\text{s}$

Step 3. Compute the flow velocity.

$$V = \frac{Q}{A}$$

$$= \frac{32.5}{12.4}$$

$= 2.62$ ft/s

5-1.2 Stable Channel Design. HEC-15 provides a detailed presentation of stable channel design concepts related to the design of roadside and median channels. This section provides a brief summary of significant concepts.

5-1.2.1 Stable channel design concepts provide a means of evaluating and defining channel configurations that will perform within acceptable limits of stability. For most highway drainage channels, bank instability and lateral migration cannot be tolerated. Stability is achieved when the material forming the channel boundary effectively resists the erosive forces of the flow. Principles of rigid boundary hydraulics can be applied to evaluate this type of system.

5-1.2.2 Both velocity and tractive force methods have been applied to the determination of channel stability. Permissible velocity procedures are empirical in nature, and have been used to design numerous channels in the United States and throughout the world. However, tractive force methods consider actual physical processes occurring at the channel boundary and represent a more realistic model of the detachment and erosion processes.

5-1.2.3 The hydrodynamic force created by water flowing in a channel causes a shear stress on the channel bottom. The bed material, in turn, resists this shear stress by developing a tractive force. Tractive force theory states that the flow-induced shear stress should not produce a force greater than the tractive resisting force of the bed material. This tractive resisting force of the bed material creates the permissible or critical shear stress of the bed material. In a uniform flow, the shear stress is equal to

the effective component of the gravitational force acting on the body of water parallel to the channel bottom. The average shear stress is equal to:

$$\tau = \gamma RS \quad (5\text{-}7)$$

where:

τ = average shear stress, lb/ft^2

γ = unit weight of water, 62.4 lb/ft^3 (at 15.6 °C (60 °F))

R = hydraulic radius, ft

S = average bed slope or energy slope, ft/ft

5-1.2.4 The maximum shear stress for a straight channel occurs on the channel bed and is less than or equal to the shear stress at maximum depth. The maximum shear stress is computed as follows:

$$\tau_d = \gamma dS \quad (5\text{-}8)$$

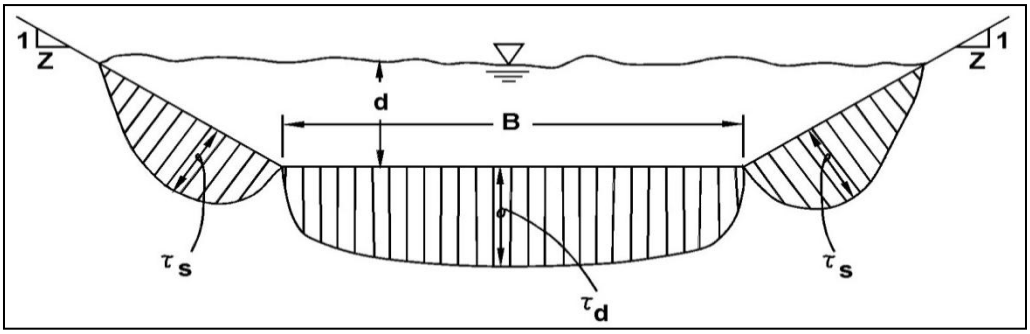
where:

τ_d = maximum shear stress, lb/ft^2

d = maximum depth of flow, ft

5-1.2.5 Shear stress in channels is not uniformly distributed along the wetted perimeter of a channel. A typical distribution of shear stress in a trapezoidal channel tends toward zero at the corners with a maximum on the bed of the channel at its centerline, and the maximum for the side slopes occurs around the lower third of the slope, as illustrated in Figure 5-1.

Figure 5-1. Distribution of Shear Stress



5-1.2.6 For trapezoidal channels lined with gravel or riprap having side slopes steeper than 3:1, side slope stability must also be considered. This analysis is performed by comparing the tractive force ratio between side slopes and channel bottom with the ratio of shear stresses exerted on the channel sides and bottom. The ratio of shear stresses on the sides and bottom of a trapezoidal channel, K_1, is given in Chart 17 of Appendix B and the tractive force ratio, K_2, is given in Chart 18. The angle of repose, θ, for different rock shapes and sizes is provided in Chart 19. The required rock size for the side slopes is found using the following equation:

$$(d_{50})_{sides} = \frac{K_1}{K_2}(d_{50})_{bottom} \quad (5\text{-}9)$$

where:

d_{50} = mean riprap size, ft

K_1 = ratio of shear stresses on the sides and bottom of a trapezoidal channel

K_2 = ratio of tractive force on the sides and bottom of a trapezoidal channel

5-1.2.6.1 Flow around bends also creates secondary currents, which impose higher shear stresses on the channel sides and bottom compared to straight reaches. Areas of high shear stress in bends are illustrated in Figure 5-2. The maximum shear stress in a bend is a function of the ratio of channel curvature to bottom width. This ratio increases as the bend becomes sharper and the maximum shear stress in the bend increases. The bend shear stress can be computed using this relationship:

$$\tau_b = K_b \tau_d \quad (5\text{-}10)$$

where:

τ_b = bend shear stress, lb/ft^2

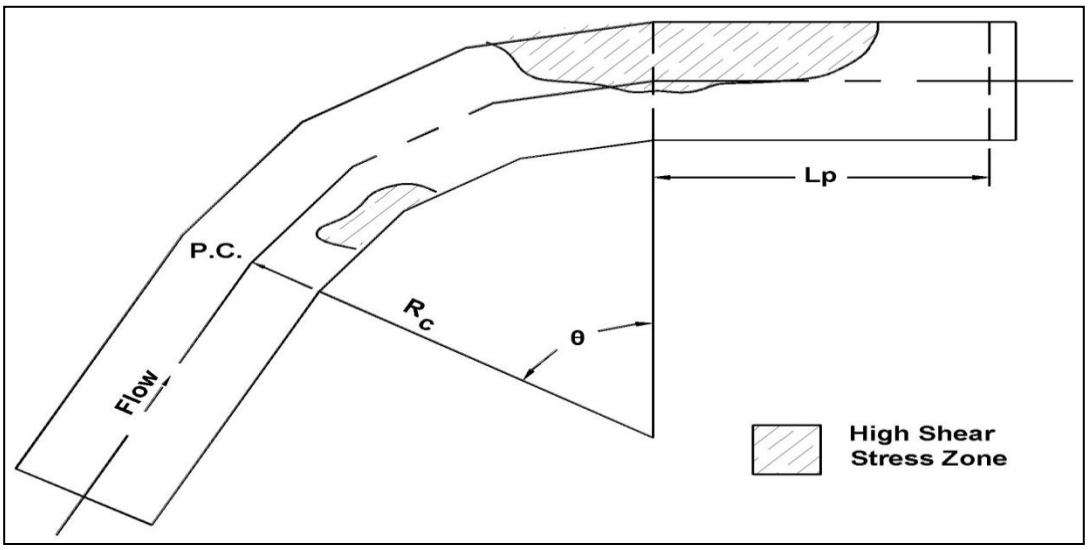
K_b = function of R_c / B (see Chart 21, HEC-22)

R_c = radius to the centerline of the channel, ft

B = bottom width of channel, ft

τ_d = maximum channel shear stress, lb/ft^2

Figure 5-2. Shear Stress Distribution in Channel Bends



5-1.2.6.2 The increased shear stress produced by the bend persists downstream of the bend a distance, *p*, as shown in Figure 5-2. This distance can be computed using this relationship:

$$L_p = \frac{0.604R^{7/6}}{n_b} \qquad (5\text{-}11)$$

where:

L_p = length of protection (length of increased shear stress due to the bend) downstream of the point of tangency, ft

n_b = Manning's roughness in the channel bend

R = hydraulic radius, ft

5-1.2.6.3 **Example 5-2**

Given: A trapezoidal channel with these characteristics:

S_o = 0.01 ft/ft

B = 3.0 ft

z = 3

Lining = A good stand of buffalo grass 3 to 6 inch high. From Example 5-1, Solution 2, n = 0.055.

The channel reach consists of a straight section and a 90-degree bend with a centerline radius of 14.8 ft. The design discharge is 28.2 ft^3/s.

Find: The maximum shear stress in the straight reach and in the bend.

Solution:

Step 1. Compute the channel parameters.

$Q_n = (28.2)(0.055)$

$= 1.555\ ft^3/s$

From (Chart 14A):

$d/B = 0.49$

$d = B\ d/B$

$= (3.0(0.49)$

$= 1.47$ ft

Step 2. Compute the maximum shear stress in the straight reach.

$\tau_d = \gamma dS$

$= (62.5)(1.47)(0.01)$

$= 0.92\ lb/ft^2$

Step 3. Compute the shear stress in the bend.

$$\frac{R_c}{B} = \frac{(14.8)}{(3.0)}$$

$= 4.93$

From Chart 21 (HEC-22):

$K_b = 1.55$

Using Equation 5-10:

$\tau_b = K_b \tau_d$

$= (1.55)(0.92)$

$= 1.43\ lb/ft^2$

5-2 DESIGN PARAMETERS. Parameters required for the design of roadside and median channels include discharge frequency, channel geometry, channel slope, vegetation type, freeboard, and shear stress. This section provides criteria relative to the selection or computation of these design elements.

5-2.1 Discharge Frequency. Roadside and median drainage channels are typically designed to carry 5- to 10-year design flows; however, when designing temporary channel linings, a lower return period can be used. Usually a 2-year return period is appropriate for the design of temporary linings.

5-2.2 Channel Geometry. Most drainage channels are trapezoidal. Several typical shapes with equations for determining channel properties are illustrated in Figure 5-3. The channel depth, bottom width, and top width must be selected to provide the necessary flow area. Chart 22 of Appendix B provides a nomograph solution for determining channel properties for trapezoidal channels.

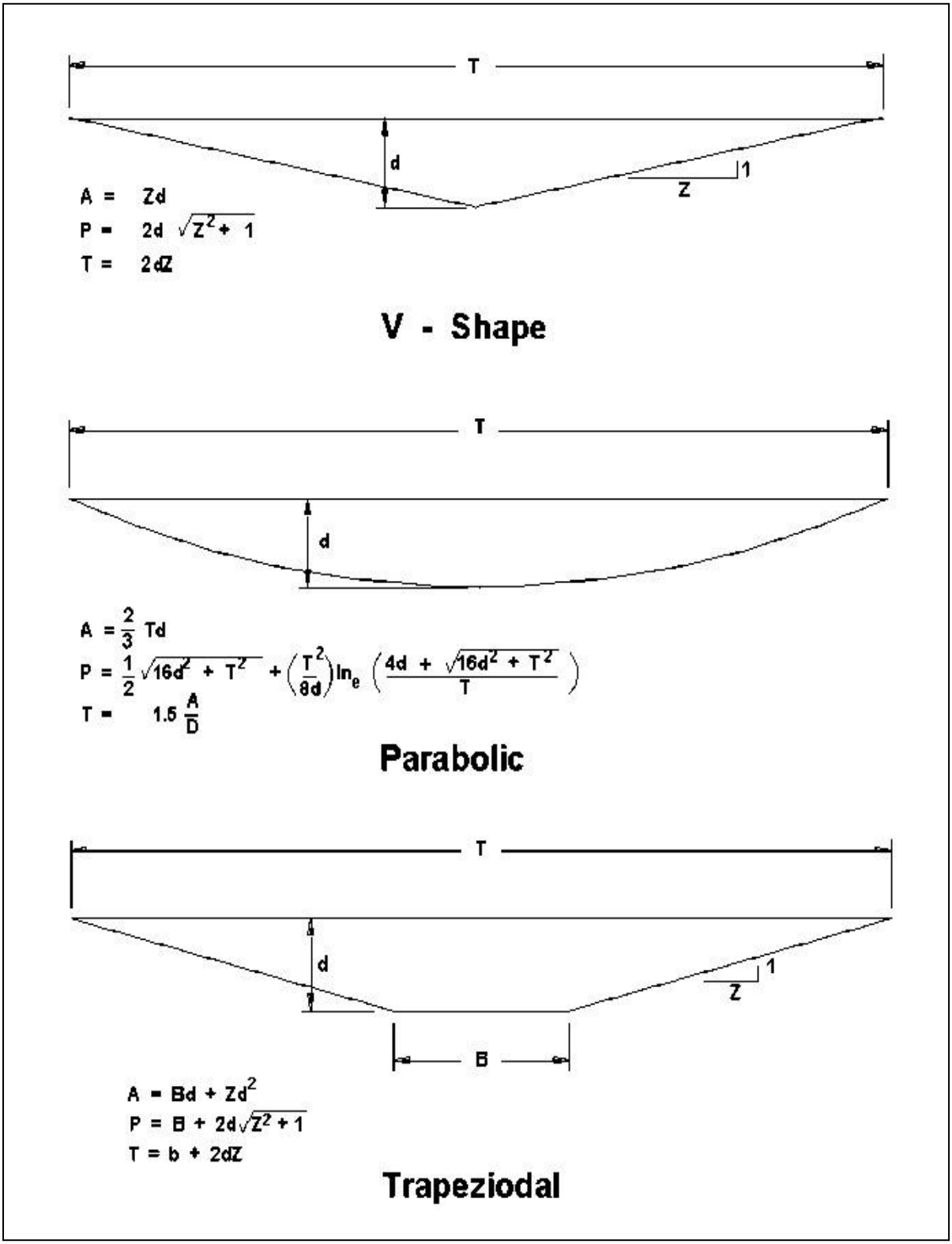
Channel side slopes for triangular or trapezoidal channels should not exceed the angle of repose of the soil and/or lining material, and should generally be 1V:3H or flatter. In areas where traffic safety may be of concern, channel side slopes should be 1V:4H or flatter.

Design of roadside and median channels should be integrated with the geometric and pavement design to ensure proper consideration of safety and pavement drainage needs.

5-2.3 Channel Slope. Channel bottom slopes are generally dictated by the road profile or other constraints. However, if channel stability conditions warrant, it may be feasible to adjust the channel gradient slightly to achieve a more stable condition. Channel gradients greater than 2 percent may require the use of flexible linings to maintain stability. Most flexible lining materials are suitable for protecting channel gradients of up to 10 percent, with the exception of some grasses. Linings such as riprap and wire-enclosed riprap are more suitable for protecting very steep channels with gradients in excess of 10 percent. Rigid linings, such as concrete paving, are highly susceptible to failure from structural instability due to such occurrences as overtopping, freeze thaw cycles, swelling, and excessive soil pore water pressure.

5-2.4 Freeboard. The freeboard of a channel is the vertical distance from the water surface to the top of the channel. The importance of this factor depends on the consequence of overflow of the channel bank. At a minimum the freeboard should be sufficient to prevent waves, superelevation changes, or fluctuations in water surface from overflowing the sides. In a permanent roadside or median channel, about 0.5 ft of freeboard is generally considered adequate. For temporary channels no freeboard is necessary. However, a steep gradient channel should have a freeboard height equal to the flow depth to compensate for the large variations in flow caused by waves, splashing, and surging.

Figure 5-3. Channel Geometries



5-2.5 Shear Stress. The permissible or critical shear stress in a channel defines the force required to initiate movement of the channel bed or lining material. Table 5-5 shows permissible shear stress values for manufactured, vegetative, and riprap channel lining. The permissible shear stress for non-cohesive soils is a function of mean diameter of the channel material as shown in Chart 23 of Appendix B. For larger stone sizes not shown in Chart 23 and rock riprap, the permissible shear stress is given by the following equation:

$$\tau_p = 4.0 D_{50} \tag{5-12}$$

where:

τ_p = permissible shear stress, lb/ft^2

d_{50} = mean riprap size, ft

For cohesive materials, the plasticity index provides a good guide for determining the permissible shear stress as illustrated in Chart 24 of Appendix B.

Table 5-5. Permissible Shear Stresses for Lining Materials**

Lining Category	Lining Type	Permissible Unit Shear Stress, lb/ft^2
Temporary*	Woven Paper Net	0.15
	Jute Net	0.45
	Fiberglass Roving:	
	Single	0.60
	Double	0.85
	Straw with Net	1.45
	Curled Wood Mat	1.55
	Synthetic Mat	2.00
Vegetative	Class A	3.70
	Class B	2.10
	Class C	1.00
	Class D	0.60
	Class E	0.35
Gravel Riprap	1 inch	0.33
	2 inch	0.67
Rock Riprap	6 inch	2.00
	12 inch	4.00

Lining Category	Lining Type	Permissible Unit Shear Stress, lb/ft^2
Bare Soil	Non-cohesive	
	Cohesive	
*Some “temporary” linings become permanent when buried. **Table reproduced from HEC-15		

5-2.5.1 **Example 5-3**

Given: The channel section and flow conditions in Example 5-2, paragraph 5-1.2.6.3.

Find: Determine if a good stand of buffalo grass (Class D degree of retardance) will provide an adequate lining for this channel.

Solution:

Step 1. Determine the permissible shear stress.

From Table 5-4:

τ_p = 0.60 lb/ft^2

Step 2. Compare τ_p with the maximum shear stress in the straight section, τ_d, and with the shear stress in the bend, τ_b.

τ_d = 0.92 lb/ft^2

τ_b = 1.43 lb/ft^2

τ_p = 0.60 < τ_d = 0.92

τ_p = 0.60 < τ_b = 1.43

5-2.5.2 **Example 5-4**

Given: The channel section and flow conditions in Example 5-2 (paragraph 5-1.2.6.3) and Example 5-3 (paragraph 5-2.5.1).

Find: Determine the length of increased shear stress downstream of the point of tangency of the 90-degree bend.

Solution:

Step 1. Determine the flow depth and hydraulic radius.

Assume that the flow depth and hydraulic radius in the bend will be approximately the same as those in the straight reach.

From Example 5-2:

d = 1.47 ft

with d/B = 1.47/3.0

= 0.49

From Chart 22:

R/d = 0.61

R = $d\ R/d$

= (1.47)(0.61)

= 0.90 ft

Step 2. Determine the channel roughness in the bend.

From Example 5-2:

n = 0.055

Step 3. Determine length of increased shear stress.

Using Equation 5-11:

$$L_p = \frac{0.604R^{7/6}}{n_b}$$

$$= \frac{0.604(0.90)^{7/6}}{(0.055)}$$

= 9.7 ft

Since the permissible shear stress, τ_p, was less than the actual shear stress in the bend, τ_b, an adequate lining material would have to be installed throughout the bend plus the length, L_p, downstream of the point of tangency of the curve.

CHAPTER 6

STORM DRAIN DESIGN

6-1 PURPOSE AND SCOPE. A storm drain is that portion of the drainage system that receives surface water through inlets and conveys the water through conduits to an outfall. It is composed of different lengths and sizes of pipe or conduit connected by appurtenant structures. A section of conduit connecting one inlet or appurtenant structure to another is termed a "segment" or "run." The storm drain conduit is most often a circular pipe, but it can also be a box or other enclosed conduit shape. Appurtenant structures include inlet structures (excluding the actual inlet opening), access holes, junction chambers, and other miscellaneous structures. Generalized design considerations for these structures are presented in Chapter 7. The computation of energy losses through these structures is described in detail in HEC-22, Chapter 7.

6-2 DESIGN PROCEDURES FOR THE DRAINAGE SYSTEM. Design storm runoff must be efficiently removed to avoid interruption of operations during or following storms and to prevent temporary or permanent damage to pavement subgrades. Removal is accomplished by a drainage system unique to each site. Drainage systems will vary in design and extent depending upon local soil conditions and topography; size of the physical facility; vegetation cover or its absence; the anticipated presence or absence of ponding; and most importantly, upon local storm intensity and frequency patterns. The drainage system should function with a minimum of maintenance difficulties and expense and should be adaptable to future expansion. Open channels or natural water courses are permitted only at the periphery of an airfield or heliport facility and must be well removed from the landing strips and traffic areas. Provisions for subsurface pavement drainage, the requirements for which are provided in UFC 3-250-01FA or UFC 3-260-01, may necessitate careful consideration. Subdrains are used to drain the base material, lower the water table, or drain perched water tables. Fluctuations of the water table must be considered in the initial design of the facility. A detailed step-by-step design procedure starts in section 6-3.

6-2.1 Grading. Proper grading is the most important single factor contributing to the success of the drainage system. Development of grading and drainage plans must be fully coordinated. Specific grading criteria for airfields can be found in UFC 3-260-01 for DOD and AC 150/5300-13 for FAA.

6-2.2 Classification of Storm Drains. Storm drains may be classified in two groups, primary and auxiliary.

6-2.2.1 **Primary Drains.** Primary drains consist of main drains and laterals that have sufficient capacity to accommodate the project design storm, either with or without supplementary storage in ponding basins above the drain inlets. To lessen construction requirements for drainage facilities, maximum use of ponding consistent with operational and grading requirements will be considered. The location and elevation of the drain inlets are determined in the development of the grading plans.

6-2.2.2 **Auxiliary Drains.** Auxiliary drains normally consist of any type or size drains provided to facilitate the removal of storm runoff but lacking sufficient capacity to remove the project design storm without excessive flooding or overflow. Auxiliary storm drains may be used in certain airfields to provide positive drainage of long flat swales located adjacent to runways or in unpaved adjacent areas. During less frequent storms of high intensity, excess runoff should flow overland to the primary drain system or other suitable outlet with a minimum of erosion. An auxiliary drain may also be installed to convey runoff from pavement gutters wherever a gutter capacity of less than design discharge is provided.

6-2.3 Hydraulics of Storm Drainage Systems. Hydraulic design of storm drainage systems requires an understanding of basic hydrologic and hydraulic concepts and principles. Hydrologic concepts were discussed earlier in this UFC. Important hydraulic principles include flow classification, conservation of mass, conservation of momentum, and conservation of energy. These elements are discussed in hydraulic texts. The following sections assume a basic understanding of these topics.

6-2.3.1 **Flow Type Assumptions.** The design procedures presented here assume that flow within each storm drain segment is steady and uniform. This means that the discharge and flow depth in each segment are assumed to be constant with respect to time and distance. Also, since storm drain conduits are typically prismatic, the average velocity throughout a segment is considered constant.

In actual storm drainage systems, the flow at each inlet is variable, and flow conditions are not truly steady or uniform; however, since the usual hydrologic methods employed in storm drain design are based on computed peak discharges at the beginning of each run, it is conservative to design using the steady uniform flow assumption.

6-2.3.2 **Open Channel vs. Pressure Flow.** Two design philosophies exist for sizing storm drains under the steady uniform flow assumption. The first is referred to as open channel or gravity flow design. To maintain open channel flow, the segment must be sized so that the water surface within the conduit remains open to atmospheric pressure. For open channel flow, flow energy is derived from the flow velocity (kinetic energy), depth (pressure), and elevation (potential energy). If the water surface throughout the conduit is to be maintained at atmospheric pressure, the flow depth must be less than the height of the conduit.

6-2.3.2.1 Pressure flow design requires that the flow in the conduit be at a pressure greater than atmospheric. Under this condition, there is no exposed flow surface within the conduit. In pressure flow, flow energy is again derived from the flow velocity, depth, and elevation. The significant difference here is that the pressure head will be above the top of the conduit, and will not equal the depth of flow in the conduit. In this case, the pressure head rises to a level represented by the hydraulic grade line. A detailed explanation of the hydraulic grade line is presented later in this chapter.

6-2.3.2.2 The question of whether open channel or pressure flow should control design has been debated. For a given flow rate, design based on open channel flow requires larger conduit sizes than those sized based on pressure flow. While it may be more expensive to construct storm drainage systems designed based on open channel flow, this design procedure provides a margin of safety by providing additional headroom in the conduit to accommodate an increase in flow above the design discharge. This factor of safety is often desirable since the methods of runoff estimation are not exact, and once placed, storm drains are difficult and expensive to replace.

6-2.3.2.3 There may be situations in which pressure flow design is desirable, however. For example, on some projects, there may be adequate headroom between the conduit and inlet/access hole elevations to tolerate pressure flow. In such a case, a significant cost savings may be realized over the cost of a system designed to maintain open channel flow. Also, in some cases it may be necessary to use an existing system that must be placed under pressure flow to accommodate the proposed design flow rates. In instances such as these, making a cursory hydraulic and economic analysis of a storm drain using both design methods before making a final selection may be advantageous.

6-2.3.2.4 Under most ordinary conditions, it is recommended that storm drains be sized based on a gravity flow criteria at flow full or near full. Designing for full flow is a conservative assumption since the peak flow actually occurs at 93 percent of full flow. However, the designer should maintain an awareness that pressure flow design may be justified in certain instances. When pressure flow is allowed, special emphasis should be placed on the proper design of the joints so that they are able to withstand the pressure flow.

6-2.3.3 **Hydraulic Capacity**. The hydraulic capacity of a storm drain is controlled by its size, shape, slope, and friction resistance. Several flow friction formulas have been advanced that define the relationship between flow capacity and these parameters. The most widely used formula for gravity and pressure flow in storm drains is Manning's equation.

6-2.3.3.1 Manning’s equation was introduced in Chapter 3 for computing gutter capacity and the capacity for roadside and median channels. For circular storm drains flowing full, Manning's equation becomes:

$$V = \frac{0.59}{n} D^{0.67} S_o^{0.5} \quad Q = \frac{0.46}{n} D^{2.67} S_o^{0.5} \qquad (6\text{-}1)$$

where:

V = mean velocity, ft/s

Q = rate of flow, ft^3/s

n = Manning's coefficient (Table 6-1)

D = storm drain diameter, ft

S_o = slope of the hydraulic grade line, ft/ft

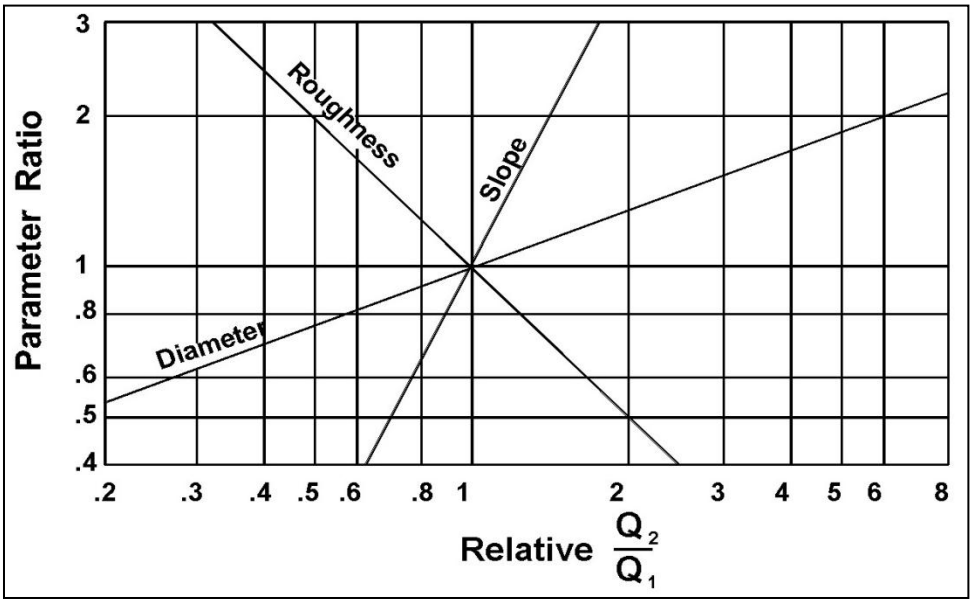
6-2.3.3.2 A nomograph solution of Manning's equation for full flow in circular conduits is presented in Chart 25 of Appendix B. Representative values of the Manning's coefficient for various storm drain materials are provided in Table 6-1. Remember that the values in the table are for new pipe tested in a laboratory. Actual field values for culverts may vary depending on the effect of abrasion, corrosion, deflection, and joint conditions.

Table 6-1. Manning's Coefficients for Storm Drain Conduits

Type of Pipe	Roughness or Corrugation	Manning's *n**
Concrete Pipe	Smooth	0.010-0.011
Concrete Boxes	Smooth	0.012-0.015
Spiral Rib Metal Pipe	Smooth	0.012-0.013
Corrugated Metal Pipe, Pipe-Arch, and Box (Annular or Helical Corrugations — see HDS-5, Manning's *n* varies with barrel size)	2.66 by 0.5 inch Annular	0.022-0.027
	2.66 by 0.5 inch Helical	0.011-0.023
	6 by 1 inch Helical	0.022-0.025
	5 by 1 inch	0.025-0.026
	3 by 1 inch	0.027-0.028
	6 by 2 inch Structural Plate	0.033-0.035
	9 by 2.5 inch Structural Plate	0.033-0.037
Corrugated Polyethylene	Smooth	0.009-0.015
Corrugated Polyethylene	Corrugated	0.018-0.025
Polyvinyl chloride (PVC)	Smooth	0.009-0.011
****NOTE:*** The Manning's *n* values in this table were obtained in the laboratory and are supported by the provided reference. Actual field values for storm drains may vary depending on the effect of abrasion, corrosion, deflection, and joint conditions.		

6-2.3.3.3 Figure 6-1 illustrates storm drain capacity sensitivity to the parameters in Manning's equation. This figure can be used to study the effect changes in individual parameters will have on storm drain capacity. For example, if the diameter of a storm drain is doubled, its capacity will be increased by a factor of 6.0; if the slope is doubled, the capacity is increased by a factor of 1.4; however, if the roughness is doubled, the pipe capacity will be reduced by 50 percent.

Figure 6-1. Storm Drain Capacity Sensitivity



6-2.3.3.4 The hydraulic elements graph in Chart 26 of Appendix B is provided to assist in the solution of the Manning's equation for part-full flow in storm drains. The hydraulic elements chart shows the relative flow conditions at different depths in a circular pipe and illustrates the following important points:

- Peak flow occurs at 93 percent of the height of the pipe. This means that if the pipe is designed for full flow, the design will be slightly conservative.
- The velocity in a pipe flowing half-full is the same as the velocity for full flow.
- Flow velocities for flow depths greater than half-full are greater than velocities at full flow.
- As the depth of flow drops below half-full, the flow velocity drops off rapidly.

6-2.3.3.5 The shape of a storm drain conduit also influences its capacity. Although most storm drain conduits are circular, a significant increase in capacity can be realized by using an alternate shape. Table 6-2 provides a tabular listing of the increase in capacity that can be achieved using alternate conduit shapes that have the same height as the original circular shape, but have a different cross-sectional area. Although these

alternate shapes are generally more expensive then circular shapes, their use can be justified in some instances based on their increased capacity.

Table 6-2. Increase in Capacity of Alternate Conduit Shapes Based on a Circular Pipe with the Same Height

Shape	Area (Percent Increase)	Conveyance (Percent Increase)
Circular		
Oval	63	87
Arch	57	78
Box ($B = D$)	27	27

In addition to the nomograph in Chart 25 of Appendix B, numerous charts have *been developed for conduits with specific shapes, roughness, and sizes.*

6-2.3.3.5 **Example 6-1**

Given: $Q = 17.6\ ft^3/s$

$S_o =$ 0.015 ft/ft

Find: The pipe diameter needed to convey the indicated design flow. Consider use of both concrete and helical corrugated metal pipes.

Solution:

Step 1. Concrete Pipe. Using Equation 6-1 or Chart 25 with $n = 0.013$ for concrete:

$$D = \left[\frac{(Qn)}{(0.46S_o^{0.5})}\right]^{0.375}$$

$$D = \left[\frac{(17.6)(0.013)}{\{(0.46)(0.015)^{0.5}\}}\right]^{0.375}$$

$D =$ 1.69 ft = 20.3 in

Use $D = 21$ in diameter standard pipe size.

Step 2. Helical Corrugated Metal Pipe. Using Equation 6-1 or Chart 25:

Assume $n = 0.017$

$$D = \left[\frac{(Qn)}{(0.46S_o^{0.5})}\right]^{0.375}$$

$$D = \left[\frac{(17.6)(0.017)}{\{(0.46)(0.015)^{0.5}\}}\right]^{0.375}$$

D = 1.87 ft = 20.3 in

Use D = 24 inch diameter standard size. (***NOTE:*** The n value for 24 inch = 0.017. The pipe size and n value must coincide as shown in Table 6-1.)

6-2.3.3.6 **Example 6-2**

Given: The concrete and helical corrugated metal pipes in Example 6-1.

Find: The full flow pipe capacity and velocity.

Solution: Use Equation 6-1 or Chart 25.

Step 1. Concrete pipe:

$$Q = \left(\frac{0.46}{n} D^{2.67} S_o^{0.5}\right)$$

$$Q = \frac{(0.46)}{(0.013)}(1.75)^{2.67}(0.015)^{0.5}$$

Q = 19.3 ft^3/s

Step 2. Helical corrugated metal pipe:

$$Q = \left(\frac{0.46}{n} D^{2.67} S_o^{0.5}\right)$$

$$Q = \frac{(0.46)}{(0.017)}(2.0)^{2.67}(0.015)^{0.5}$$

Q = 21.1 ft^3/s

$$V = \left(\frac{0.59}{n} D^{0.67} S_o^{0.5}\right)$$

$$V = \frac{(0.59)}{(0.017)}(2.05)^{0.67}(0.015)^{0.5}$$

$$V = 6.8 \text{ ft/s}$$

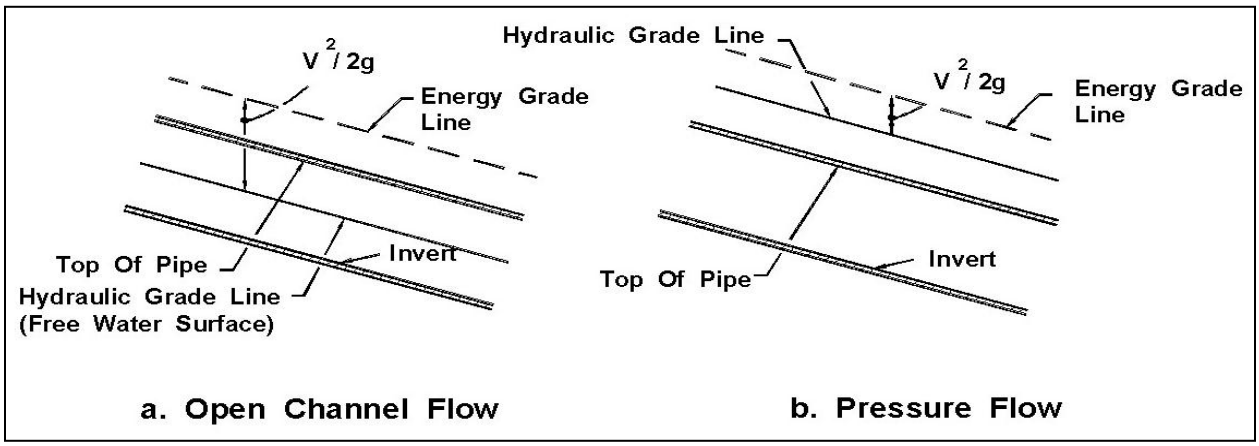
6-2.3.4 **Energy Grade Line/Hydraulic Grade Line**. The energy grade line (EGL) is an imaginary line that represents the total energy along a channel or conduit carrying water. Total energy includes elevation head, velocity head, and pressure head. The calculation of the EGL for the full length of the system is critical to the evaluation of a storm drain. To develop the EGL, it is necessary to calculate all of the losses through the system. The energy equation states that the energy head at any cross section must equal that in any other downstream section plus the intervening losses. The intervening losses are typically classified as either friction losses or form losses. The friction losses can be calculated using Manning's equation. Form losses are typically calculated by multiplying the velocity head by a loss coefficient, *K*. Various tables and calculations exist for developing the value of *K* depending on the structure being evaluated for loss. Knowing the location of the EGL is critical to understanding and estimating the location of the hydraulic grade line (HGL).

6-2.3.4.1 The HGL is a line coinciding with the level of flowing water at any point along an open channel. In closed conduits flowing under pressure, the HGL is the level to which water would rise in a vertical tube at any point along the pipe. The HGL is used to aid the designer in determining the acceptability of a proposed storm drainage system by establishing the elevation to which water will rise when the system is operating under design conditions.

6-2.3.4.2 The HGL, a measure of flow energy, is determined by subtracting the velocity head ($V^2/2g$) from the EGL. Energy concepts can be applied to pipe flow as well as open channel flow. Figure 6-2 illustrates the EGLs and HGLs for open channel and pressure flow in pipes.

6-2.3.4.3 When water is flowing through the pipe and there is a space of air between the top of the water and the inside of the pipe, the flow is considered as open channel flow and the HGL is at the water surface. When the pipe is flowing full under pressure flow, the HGL will be above the crown of the pipe. When the flow in the pipe just reaches the point where the pipe is flowing full, this condition is between open channel flow and pressure flow. At this condition, the pipe is under gravity full flow and the flow is influenced by the resistance of the total circumference of the pipe. Under gravity full flow, the HGL coincides with the crown of the pipe.

Figure 6-2. Hydraulic and Energy Grade Lines in Pipe Flow



6-2.3.4.4 Inlet surcharging and possible access hole lid displacement can occur if the HGL rises above the ground surface. A design based on open channel conditions must be planned carefully as well, including evaluation of the potential for excessive and inadvertent flooding created when a storm event larger than the design storm pressurizes the system. As hydraulic calculations are performed, frequent verification of the existence of the desired flow condition should be made. Often storm drainage systems can alternate between pressure and open channel flow conditions from one section to another.

6-2.3.4.5 A detailed procedure for evaluating the EGL and the HGL for storm drainage systems is presented later in this chapter.

6-2.3.5 **Storm Drain Outfalls.** All storm drains have an outlet where flow from the storm drainage system is discharged. The discharge point can be a natural river or stream, an existing storm drainage system, or a channel that is either existing or proposed for the purpose of conveying the storm water away from the highway. The procedure for calculating the EGL through a storm drainage system begins at the outfall; therefore, consideration of outfall conditions is an important part of storm drain design.

6-2.3.5.1 Several aspects of outfall design must be given serious consideration. These include the flowline or invert (inside bottom) elevation of the proposed storm drain outlet, tailwater elevations, the need for energy dissipation, and the orientation of the outlet structure.

6-2.3.5.2 The flowline or invert elevation of the proposed outlet should be equal to or higher than the flowline of the outfall. If not, the water may need to be pumped or otherwise lifted to the elevation of the outfall.

6-2.3.5.3 The tailwater depth or elevation in the storm drain outfall must be considered carefully. Evaluation of the HGL for a storm drainage system begins at the system

outfall with the tailwater elevation. For most design applications, the tailwater will either be above the crown of the outlet or between the crown and critical depth of the outlet. The tailwater may also occur between the critical depth and the invert of the outlet; however, the starting point for the HGL determination should be either the design tailwater elevation or the average of the critical depth and the height of the storm drain conduit, (*dc* + *D*)/2, whichever is greater.

6-2.3.5.4 An exception to this rule would be for a very large outfall with low tailwater where a water surface profile calculation would be appropriate to determine the location where the water surface will intersect the top of the barrel and full flow calculations can begin. In this case, the downstream water surface elevation would be based on critical depth or the design tailwater elevation, whichever is highest.

6-2.3.5.5 If the outfall channel is a river or stream, it may be necessary to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the elevation of the tailwater in the receiving stream. The relative independence of the discharge from the storm drainage system can be qualitatively evaluated by a comparison of the drainage area of the receiving stream to the area of the storm drainage system. For example, if the storm drainage system has a drainage area much smaller than that of the receiving stream, the peak discharge from the storm drainage system may be out of phase with the peak discharge from the receiving watershed.

Table 6-3 provides a comparison of discharge frequencies for coincidental occurrence for a 10- and 100-year design storm. This table can be used to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. For example, if the receiving stream has a drainage area of 500 acres and the storm drainage system has a drainage area of 5 acres, the ratio of receiving area to storm drainage area is 500 to 5, which equals 100 to 1. From Table 6-3 and considering a 10-year design storm occurring over both areas, the flow rate in the main stream will be equal to that of a 5-year storm when the drainage system flow rate reaches its 10-year peak flow at the outfall. Conversely, when the flow rate in the main channel reaches its 10-year peak flow rate, the flow rate from the storm drainage system will have fallen to the 5-year peak flow rate discharge. This is because the drainage areas are different sizes, and the time to peak for each drainage area is different.

6-2.3.5.6 There may be instances in which an excessive tailwater causes flow to back up the storm drainage system and out of inlets and access holes, creating unexpected and perhaps hazardous flooding conditions. The potential for this should be considered. Flap gates placed at the outlet can sometimes alleviate this condition; otherwise, it may be necessary to isolate the storm drain from the outfall by using a pump station.

6-2.3.5.7 Energy dissipation may be required to protect the storm drain outlet. Protection is usually required at the outlet to prevent erosion of the outfall bed and banks. Riprap aprons or energy dissipators should be provided if high velocities are expected. See HEC-14 for guidance with designing an appropriate dissipator.

Table 6-3. Frequencies for Coincidental Occurrence

Area Ratio	Frequencies for Coincidental Occurrence			
	10-Year Design		100-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000 to 1	1	10	2	100
	10	1	100	2
1,000 to 1	2	10	10	100
	10	2	100	10
100 to 1	5	10	25	100
	10	5	100	25
10 to 1	10	10	50	100
	10	10	100	50
1 to 1	10	10	100	100
	10	10	100	100

6-2.3.5.8 The orientation of the outfall is another important design consideration. Where practical, the outlet of the storm drain should be positioned in the outfall channel so that it is pointed in a downstream direction. This will reduce turbulence and the potential for excessive erosion. If the outfall structure cannot be oriented in a downstream direction, the potential for outlet scour must be considered. For example, where a storm drain outfall discharges perpendicular to the direction of flow of the receiving channel, care must be taken to avoid erosion on the opposite channel bank. If erosion potential exists, a channel bank lining of riprap or other suitable material should be installed on the bank. Alternatively, an energy dissipator structure could be used at the storm drain outlet.

6-2.3.6 **Energy Losses.** Prior to computing the HGL, estimate all energy losses in pipe runs and junctions. In addition to the principal energy involved in overcoming the friction in each conduit run, energy (or head) is required to overcome changes in momentum or turbulence at outlets, inlets, bends, transitions, junctions, and access holes. The calculation of these losses is extremely important when designing the storm drain. If the storm drain design does not account for energy losses, the performance of the storm drain system is uncertain. HEC-22 has a comprehensive description of all of the energy losses and includes an example problem that demonstrates the application of some of these relationships. Refer to Chapter 7 of HEC-22.

6-2.4 Design Guidelines and Considerations. Design criteria and considerations describe the limiting factors that qualify an acceptable design. Several of these factors, including design and check storm frequency, time of concentration and discharge determination, allowable high water at inlets and access holes, minimum flow velocities,

minimum pipe grades, and alignment, are explained in paragraphs 6-2.4.1 through 6-2.4.2.5.

6-2.4.1 **Design Storm Frequency.** The storm drain conduit is one of the most expensive and permanent elements within storm drainage systems. Storm drains normally remain in use longer than any other system elements. Once a storm drain is installed, increasing the capacity or repairing the line is very expensive. Consequently, the design flood frequency for projected hydrologic conditions should be selected to meet the need of the proposed facility both now and well into the future.

6-2.4.1.1 The design storm frequencies for DOD airfields and heliports, areas other than airfields, and FAA facilities are given in Chapter 2 of this UFC; however, exercise caution in selecting an appropriate storm frequency. Consider traffic volume, type and use of roadway, speed limit, flood damage potential, and the needs of the local community.

6-2.4.1.2 The highway community recommends designing storm drains that drain sag points where runoff can be removed only through the storm drainage system for a minimum 50-year frequency storm. The inlet at the sag point as well as the storm drain pipe leading from the sag point must be sized to accommodate this additional runoff. This can be done by computing the bypass occurring at each inlet during a 50-year rainfall and accumulating it at the sag point. Another method would be to design the upstream system for a 50-year design to minimize the bypass to the sag point. Evaluate each case on its own merits and assess the risk and impacts of flooding a sag point.

6-2.4.1.3 Following the initial design of a storm drainage system, it is prudent to evaluate the system using a higher check storm. Check storms are also explained in Chapter 2. Often for roadway design, a 100-year frequency storm is recommended for the check storm. The check storm is used to evaluate the performance of the storm drainage system and determine if the major drainage system is adequate to handle the flooding from a storm of this magnitude. Again, review local criteria.

6-2.4.2 **Time of Concentration and Discharge.** The rate of discharge at any point in the storm drainage system is not the sum of the inlet flow rates of all inlets above the section of interest. It is generally less than this total. The Rational Method is the most common means of determining design discharges for storm drain design. The time of concentration is very influential in determining the design discharge using the Rational Method. The time of concentration is the period required for water to travel from the most hydraulically distant point of the watershed to the point of interest. The designer is usually concerned with two different times of concentration: one for inlet spacing and the other for pipe sizing. The time of concentration for inlet spacing is the time required for water to flow from the hydraulically most distant point of the unique drainage area contributing only to that inlet. Typically, this is the sum of the times required for water to travel overland to the pavement gutter and along the length of the gutter between inlets. If the total time of concentration to the upstream inlet is less than 5 minutes, a minimum time of concentration of 5 minutes is used as the duration of rainfall. The time of

concentration for each successive inlet should be determined independently in the same manner as was used for the first inlet.

6-2.4.2.1 The time of concentration for pipe sizing is the time required for water to travel from the most hydraulically distant point in the total contributing watershed to the design point. Typically, this time consists of two components: (1) the time for overland and gutter flow to reach the first inlet, and (2) the time to flow through the storm drainage system to the point of interest.

6-2.4.2.2 The flow path with the longest time of concentration to the point of interest in the storm drainage system will usually define the duration used in selecting the intensity value in the Rational Method. Exceptions to the general application of the Rational Equation exist. For example, a small, relatively impervious area within a larger drainage area may have an independent discharge higher than that of the total area. This anomaly may occur because of the high runoff coefficient (*C* value) and high intensity resulting from a short time of concentration. If an exception does exist, it can generally be classified as one of two exception scenarios.

6-2.4.2.3 The first exception occurs when a highly impervious section exists at the most downstream area of a watershed and the total upstream area flows through the lower impervious area. When this occurs, two separate calculations should be made.

- First, calculate the runoff from the total drainage area with its weighted *C* value and the intensity associated with the longest time of concentration.

- Second, calculate the runoff using only the smaller, less pervious area. The typical procedure would be followed using the *C* value for the small less pervious area and the intensity associated with the shorter time of concentration.

Compare the results of these two calculations and use the largest value of discharge for design.

6-2.4.2.4 The second exception exists when a smaller, less pervious area is tributary to the larger primary watershed. When this occurs, two sets of calculations should also be made.

- First, calculate the runoff from the total drainage area with its weighted *C* value and the intensity associated with the longest time of concentration.

- Second, calculate the runoff to consider how much discharge from the larger primary area is contributing at the same time as the peak from the smaller, less pervious tributary area. When the small area is discharging, some discharge from the larger primary area is also contributing to the total discharge. In this calculation, use the intensity associated with the time of concentration from the smaller, less pervious area. The portion of the larger primary area to be considered is determined by this equation:

$$A_c = A\frac{t_{c1}}{t_{c2}} \quad (6\text{-}2)$$

A_c is the most downstream part of the larger primary area that will contribute to the discharge during the time of concentration associated with the smaller, less pervious area. A is the area of the larger primary area, t_{c1} is the time of concentration of the smaller, less pervious tributary area, and t_{c2} is the time of concentration associated with the larger primary area as is used in the first calculation. The C value to be used in this computation should be the weighted C value that results from combining C values of the smaller, less pervious tributary area and the area A_c. The area to be used in the Rational Method is the area of the less pervious area plus A_c. This second calculation should be considered only when the less pervious area is tributary to the area with the longer time of concentration and is at or near the downstream end of the total drainage area.

6-2.4.2.5 Finally, compare the results of these calculations and use the largest value of discharge for design.

6-2.4.3 **Maximum Highwater.** Maximum highwater is the maximum allowable elevation of the water surface (HGL) at any given point along a storm drain. These points include inlets, access holes, or any place where there is access from the storm drain to the ground surface. The maximum highwater at any point should not interfere with the intended functioning of an inlet opening or reach an access hole cover. Maximum allowable highwater levels should be established along the storm drainage system prior to initiating hydraulic evaluations.

6-2.4.4 **Minimum Velocity and Grades.** It is desirable to maintain a self-cleaning velocity in the storm drain to prevent deposition of sediments and subsequent loss of capacity. For this reason, storm drains should be designed to maintain full-flow pipe velocities of 3 ft/s or greater. A review of the hydraulic elements in Chart 26 (Appendix B) indicates that this criteria results in a minimum flow velocity of 2 ft/s at a flow depth equal to 25 percent of the pipe diameter. Minimum slopes required for a velocity of 3 ft/s can be computed using the form of Manning's formula in Equation 6-3. Alternately, use values in Table 6-4.

$$S = 2.67\left(\frac{nV}{D^{0.67}}\right)^2 \quad (6\text{-}3)$$

where:

D = in feet when using Equation 6-3

Table 6-4. Minimum Pipe Slopes to Ensure 3.0 ft/s Velocity in Storm Drains Flowing Full

Pipe Size, inch	Full Pipe Flow, ft^3/s	Minimum Slopes, ft/ft		
		***n* = 0.012**	***n* = 0.013**	***n* = 0.024**
8	1.1	0.0064	0.0075	0.0256
10	1.6	0.0048	0.0056	0.0190
12	2.4	0.0037	0.0044	0.0149
15	3.7	0.0028	0.0032	0.0111
18	5.3	0.0022	0.0026	0.0087
21	7.2	0.0018	0.0021	0.0071
24	9.4	0.0015	0.0017	0.0059
27	11.9	0.0013	0.0015	0.0051
30	14.7	0.0011	0.0013	0.0044
33	17.8	0.0010	0.0011	0.0039
36	21.2	0.0009	0.0010	0.0034
42	28.9	0.0007	0.0008	0.0028
48	37.7	0.0006	0.0007	0.0023
54	47.7	0.0005	0.0006	0.0020
60	58.9	0.0004	0.0005	0.0017
66	71.3	0.0004	0.0005	0.0015
72	84.8	0.0003	0.0004	0.0014

6-3 PRELIMINARY DESIGN PROCEDURE. The preliminary design of storm drains can be accomplished by using the following steps and the storm drain computation sheet in Figure 6-3. This procedure assumes that each storm drain will be initially designed to flow full under gravity conditions. The designer must recognize that when the steps in this section are complete, the design is only preliminary. Final design is accomplished after the EGL and HGL computations have been completed.

6-3.1 Step 1. Prepare a working plan layout and profile of the storm drainage system establishing the following design information:

a. Location of Storm Drains

(1) Preliminary Layout**.** Prepare a preliminary map (scale 1 in. = 200 ft or larger) showing the outlines of roadways, runways, taxiways, and parking aprons. Contours should represent approximately the finished grade for the airfield, heliport, or roadway facility. Details of grading, including

ponding basins around primary drain inlets, need not be shown more accurately than with 1-ft contour intervals.

(2) Profiles. Plot profiles of all roadways, or runways, taxiways, and aprons so that elevations controlling the grading of intermediate areas may be determined readily at any point.

b. Direction of Flow. Avoid drainage patterns consisting of closely spaced interior inlets in pavements with intervening ridges for airfields. Such grading may cause taxiing problems, including bumping or scraping of wing tanks. Crowned sections are the standard cross sections for roadways, runways, taxiways, and safety areas. Crowned sections generally slope each way from the center line of the runway on a transverse grade to the pavement. Although crowned grading patterns result in the most economical drainage, adjacent pavements, topographic considerations, or other matters may necessitate other pavement grading.

c. Location of Access Holes and Other Structures

(1) Drain Outlets. Consider the limiting grade elevations and feasible channels for the collection and disposition of the storm runoff. Select the most suitable locations for outlets of drains serving various portions of the field. Then select a tentative layout for primary storm drains. The most economical and most efficient design is generally obtained by maintaining the steepest hydraulic gradient attainable in the main drain and maintaining approximately equal lateral length on each side of the main drain.

(2) Cross-sectional Profiles of Intermediate Areas. Assume the location of cross-sectional profiles of intermediate areas. Plot data showing controlling elevations and indicate the tentatively selected locations for inlets by means of vertical lines. See Chapter 3 for guidance on the preliminary location of inlets. To facilitate a comparison of the elevations of intermediate areas with those of paved areas, projections of roadways, runways, taxiways, or aprons for limited distances should be shown on the profiles. Generally, one cross-sectional profile should follow each line of the underground storm drain system. Other profiles should pass through each of the inlets at approximately right angles to paved roadways, runways, taxiways, or aprons.

(3) Correlation of the Controlling Elevations and Limiting Grades. Begin at points corresponding to the controlling elevations, such as the edges of runways, and sketch the ground profile from the given points to the respective drain inlets. Make the grades conform to the limiting slopes. Review the tentative grading and inlet elevations and make such adjustments in the locations of drain inlets and in grading details as necessary to obtain the most satisfactory general plan.

d. Number or Label Assigned to Each Structure

e. Location of All Existing Utilities (e.g., water, sewer, gas, underground cables)

(1) Trial Drainage Layouts**.** Several trial drainage layouts will be necessary before the most economical system can be selected. The first consideration will be the tentative layout serving all of the depressed areas in which overland flow will accumulate. The inlet structures will be located, during the initial step, at the lowest points within the field areas. The pipelines will be shown next. Each of the inlet structures will be connected to the field pipelines, which in turn will be connected to the major outfalls.

(2) Rechecking of Finished Contours. Before proceeding further, recheck the finished contours to determine whether the surface flow is away from the paved areas, that the flow is not directed across them, that no field structures fall within the paved areas (except in aprons), that possible ponding areas are not adjacent to pavement edges, and that surface water will not have to travel excessively long distances to flow into the inlets. If there is a long, gradually sloping swale between a runway and its parallel taxiway (in which the longitudinal grade, for instance, is all in one direction), additional inlets should be placed at regular intervals down this swale. Should this be required, ridges may be provided to protect the area around the inlet, prevent bypassing, and facilitate the entry of the water into the structure. If the ridge area is within the runway safety area, the grades and grade changes will need to conform to the limitations established for runway safety areas in other pertinent publications.

(3) Maximum Spread and Ponding. Estimate the maximum elevation of storage permissible in the various ponding areas and check the elevations against the profiles. Ponding requirements for airfields and heliports are provided in Chapter 2. Scale the distances from the respective drain inlets to the point where the elevation of maximum permissible ponding intersects the ground line, transfer the scaled distances to the map prepared in (1) above, and sketch a line through the plotted points to represent the boundary of the maximum ponding area during the design storm. Criteria for allowable width of spread for roadways is provided in Chapter 3.

(4) Ditches. A system of extensive peripheral ditches may become an integral part of the drainage system. Ditch size and function are variable. Some ditches carry the outfall away from the pipe system and drainage areas into the natural drainage channels or into existing water courses. Others receive outfall flow from the airport site or adjacent terrain. Open ditches are subject to erosion if their gradients are steep and if the volume of flow is large. When necessary, the ditches may be turfed, sodded, stabilized, or lined to control erosion. A complete explanation of median

drainage can be found in Chapter 3. Stable channel design is detailed in Chapter 5.

(5) Study of the Contiguous Areas. After the storm drain system has been tentatively laid out and before the actual computations have been started, the areas contiguous to the graded portion of the airport that may contribute surface flow upon it should again be studied. A system of open channels, intercepting ditches, or storm drains should be designed where necessary to intercept this storm flow and conduct it away from the facility to convenient outfalls. A study of the soil profiles will assist in locating porous strata that may be conducting subsurface water into the airport. If this condition exists, the subsurface water should be intercepted and diverted.

Figure 6-3. Preliminary Storm Drain Computation Sheet

COMPUTED BY _____ DATE _____
CHECKED BY _____ DATE _____
PAGE _____ OF _____

ROUTE _____
SECTION _____
COUNTY _____

STR. ID		LENGTH	DRAINAGE AREA		RUNOFF COEFF. "C"	"AREA" X "C"		TIME OF CONCENTRATION		RAIN "I"	RUNOFF "Q"	PIPE DIA.	Q FULL	VELOCITY		SEC TIME	INVERT ELEV.		CROWN DROP	SLOPE
FROM	TO	( )	INC ( )	TOTAL ( )		INC. ( )	TOTAL ( )	INLET (min)	SYSTEM (min)	(/hr)	(^{3} /s)	( )	(^{3}/s)	FULL (/s)	DESIGN (/s)	(min)	U/S ( )	D/S ( )	( )	(/)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)

6-3.2 Step 2. Determine the following hydrologic parameters for the drainage areas tributary to each inlet to the storm drainage system. Use the completed grading plan as a guide and sketch the boundaries of specific drainage areas tributary to their respective drain inlets. Compute the area of paved and unpaved areas tributary to the respective inlets.

- Drainage areas
- Runoff coefficients
- Travel time

6-3.3 Step 3. Using the information generated in Steps 1 and 2, complete the following information on the design form for each run of pipe starting with the upstream-most storm drain run:

- FROM and TO stations, Columns 1 and 2.
- LENGTH of run, Column 3.
- INC. drainage area, Column 4. The incremental drainage area tributary to the inlet at the upstream end of the storm drain run under consideration.
- RUNOFF COEFF. "C," Column 6. The runoff coefficient for the drainage area tributary to the inlet at the upstream end of the storm drain run under consideration. In some cases, a composite runoff coefficient will need to be computed.

6-3.4 Step 4. Using the information from Step 3, compute this information:

- TOTAL area, Column 5. Add the incremental area in Column 4 to the previous section's total area and place this value in Column 5.
- INC. "AREA" X "C," Column 7. Multiply the drainage area in Column 4 by the runoff coefficient in Column 6. Put the product, *CA*, in Column 7.
- TOTAL "AREA" X "C," Column 8. Add the value in Column 7 to the value in Column 8 for the previous storm drain run, and put this value in Column 8.
- RAIN "I," Column 11. Using the larger of the two times of concentration in Columns 9 and 10, and an IDF curve, determine the rainfall intensity, *I*, and place this value in Column 11.
- RUNOFF "Q," Column 12. Calculate the discharge as the product of Columns 8 and 11. Place this value in Column 12.

- SLOPE, Column 21. Place the pipe slope value in Column 21. The pipe slope will be approximately the slope of the finished roadway. The slope can be modified as needed.

- PIPE DIA., Column 13. Size the pipe using relationships and charts presented in Chapter 4 to convey the discharge by varying the slope and pipe size as necessary. The storm drain should be sized as close as possible to a full gravity flow. Since most calculated sizes will not be available, a nominal size will be used. The designer will decide whether to go to the next larger size and have part-full flow or whether to go to the next smaller size and have pressure flow.

- Q (CAPACITY) FULL, Column 14. Compute the full flow capacity of the selected pipe using Equation 6-1, and put this information in Column 14.

- VELOCITY, Columns 15 (FULL) and 16 (DESIGN). Compute the full flow and design flow velocities (if different) in the conduit and place these values in Columns 15 and 16. If the pipe is flowing full, the velocities can be determined from $V = Q/A$, Equation 6-1, or Chart 25 (Appendix B). If the pipe is not flowing full, the velocity can be determined from Chart 26.

- SEC (SECTION) TIME, Column 17. Calculate the travel time in the pipe section by dividing the pipe length (Column 3) by the design flow velocity (Column 16). Place this value in Column 17.

- CROWN DROP, Column 20. Calculate an approximate crown drop at the structure to off-set potential structure energy losses using Equation 7-9 of HEC-22.

- INVERT ELEV., Columns 18 and 19. Compute the pipe inverts at the upper (U/S) and lower (D/S) ends of this section of pipe, including any pipe size changes that occurred along the section.

6-3.5 Step 5. Repeat steps 3 and 4 for all pipe runs to the storm drain outlet. Use equations and nomographs to accomplish the design effort.

6-3.6 Step 6. Check the design by calculating the EGL and HGL as described in section 6-4.

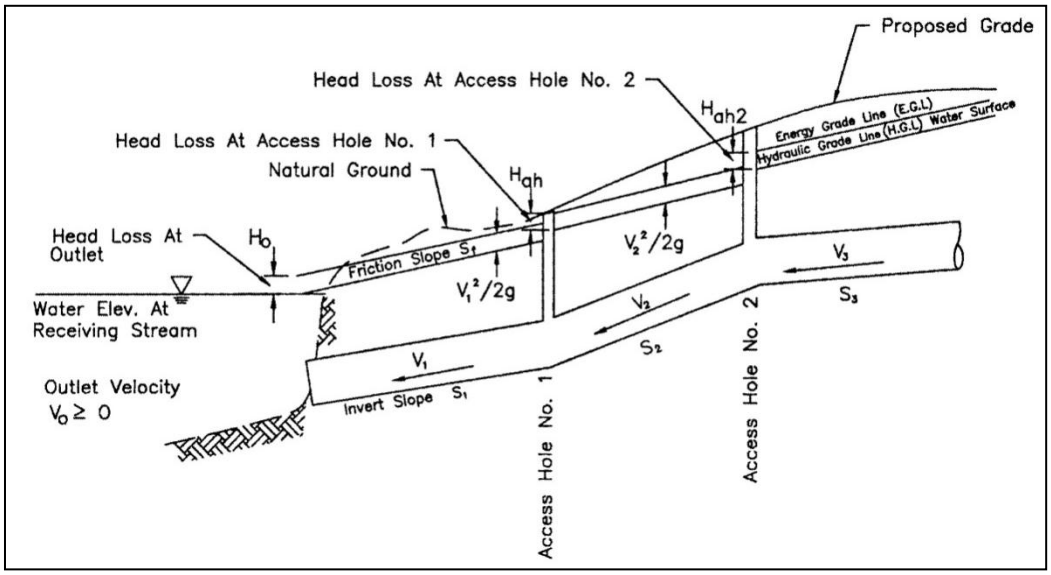
An example of storm drain sizing and layout is provided in Chapter 7 of HEC-22.

6-4 ENERGY GRADE LINE EVALUATION PROCEDURE. This section presents a step-by-step procedure for manual calculation of the EGL and the HGL using the energy loss method. For most storm drainage systems, computer methods such as HYDRA are the most efficient means of evaluating the EGL and HGL; however, it is important that the designer understand the analysis process to better interpret the

output from computer-generated storm drain designs.

6-4.1 Figure 6-4 provides a sketch illustrating the use of the two grade lines in developing a storm drainage system. The step-by-step procedure in paragraph 6-4.3 can be used to manually compute the EGL and HGL. The computation tables in Figure 6-5 and Figure 6-6 can be used to document this procedure.

Figure 6-4. Energy and Hydraulic Grade Line Illustration



6-4.2 Before beginning the computational steps in the procedure, it is important to understand the organization of data on the form. In general, a line will contain the information on a specific structure and the line downstream from the structure. As the table is started, the first two lines may be unique. The first line will contain information about the outlet conditions. This may be a pool elevation or information on a known downstream system. The second line will be used to define the conditions right at the end of the last conduit. Following these first two lines, the procedure becomes more general. A single line on the computation sheet is used for each junction or structure and its associated outlet pipe. For example, data for the first structure immediately upstream of the outflow pipe and the outflow pipe would be tabulated in the third full line of the computation sheet (lines may be skipped on the form for clarity).

Table A (Figure 6-5) is used to calculate the HGL and EGL elevations, while table B (Figure 6-6) is used to calculate the pipe losses and structure losses. Values obtained in Table B are transferred to Table A for use during the design procedure. In the description of the computation procedures, a column number will be followed by a letter A or B to indicate the appropriate table to be used.

6-4.3 EGL computations begin at the outfall and are worked upstream, taking each junction into consideration. Many storm drain systems are designed to function in a subcritical flow regime. In subcritical flow, pipe and access hole losses are summed to determine the upstream EGL levels. If supercritical flow occurs, pipe and access losses

are not carried upstream. When a storm drain section is identified as being supercritical, the designer should advance to the next upstream pipe section to determine its flow regime. This process continues until the storm drain system returns to a subcritical flow regime. Again, HEC-22 includes a complete example that works through these steps.

NOTE: In the EGL computational procedure, values obtained in Table B are transferred to Table A for use during the design procedure. **In the step-by-step description, a column number will be followed by a letter A or B to indicate the appropriate table to be used.**

6-4.3.1 **Step 1**. The first line of Table A includes information on the system beyond the end of the conduit system. Define this as the stream, pool, existing system, etc., in Column 1A. Determine the EGL and HGL for the downstream receiving system. If this is a natural body of water, the HGL will be at the water surface. The EGL will also be at the water surface if no velocity is assumed or will be a velocity head above the HGL if there is a velocity in the water body. If the new system is being connected to an existing storm drain system, the EGL and the HGL will be that of the receiving system. Enter the HGL in Column 14A and the EGL in Column 10A of the first line on the computation sheet.

6-4.3.2 **Step 2**. Identify the structure number at the outfall (this may be just the end of the conduit, but it needs a structure number), the top of conduit (TOC) elevation at the outfall end, and the surface elevation at the outfall end of the conduit. Place these values in Columns 1A, 15A, and 16A, respectively. Also, add the structure number in Column 1B.

6-4.3.3 **Step 3**. Determine the EGL just upstream of the structure identified in Step 2. Two different cases exist when the conduit is flowing full:

- Case 1: If the tailwater at the conduit outlet is greater than $(d_c + D)/2$, the EGL will be the TW elevation plus the velocity head for the conduit flow conditions.

- Case 2: If the tailwater at the conduit outlet is less than $(d_c + D)/2$, the EGL will be the HGL plus the velocity head for the conduit flow conditions. The equivalent HGL, EHGL, will be the invert plus $(d_c + D)/2$.

The velocity head needed in either Case 1 or 2 will be calculated in the next steps, so it may be helpful to complete Step 4 and work Step 5 to the point where velocity head (Column 7A) is determined and then come back and finish this step. Enter the EGL in Column 13A.

NOTE: The values for d_c for circular pipes can be determined from Chart 27. Charts for other conduits or other geometric shapes can be found in HDS-5. Note that the value of d_c cannot be greater than the height of the conduit.

Figure 6-5. Energy Grade Line Computation Sheet - Table A

COMPUTED BY _____ DATE _____
CHECKED BY _____ DATE _____
PAGE _____ OF _____
INITIAL TAILWATER ELEV. _____

ROUTE _____
SECTION _____
COUNTY _____

Str. ID	D	Q	L	V	d	d_c	$V^2/2g$	S_f	Total Pipe Loss (table B)	EGL_o	K (table B)	$K(V^2/2g)$	EGL_i	HGL	U/S TOC	Surf. Elev.
	( )	(^{3}/s)	( )	(/s)	( )	( )	( )	(/)	( )	( )		( )	( )	( )	( )	( )
(1)	(2)	(3)	(4)	(5)	(6a)	(6b)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)

Figure 6-6. Energy Grade Line Computation Sheet - Table B

COMPUTED BY _____ DATE _____
CHECKED BY _____ DATE _____
PAGE _____ OF _____

ROUTE _____
SECTION _____
COUNTY _____

Str. ID (1)	Pipe Losses ( )						Structure Losses ( )							
	H_f (2)	h_b (3)	H_c (4)	H_e (5)	H_j (6)	Total (7)	d_{aho} (8)	K_o (9)	C_D (10)	C_d (11)	C_Q (12)	C_p (13)	C_B (14)	K (15)

6-4.3.4 **Step 4**. Identify the structure for the junction immediately upstream of the outflow conduit (for the first conduit) or immediately upstream of the last structure (if working with subsequent lines) and enter this value in Column 1A and Column 1B of the next line on the computation sheets. Enter the conduit diameter (*D*) in Column 2A, the design discharge (*Q*) in Column 3A, and the conduit length (*L*) in Column 4A.

6-4.3.5 **Step 5**. If the barrel flows full, enter the full flow velocity from continuity in Column 5A and the velocity head ($V^2/2g$) in Column 7A. Put "full" in Column 6a and not applicable (n/a) in Column 6b of Table A. Continue with Step 6. If the barrel flows only partially full, continue with Step 5A.

NOTE: If the pipe is flowing full because of high tailwater or because the pipe has reached its capacity for the existing conditions, the velocity will be computed based on continuity using the design flow and the full cross-sectional area. Do not use the full flow velocity determined in Column 15 of the Preliminary Storm Drain Computation Sheet (Figure 6-3) for part-full flow conditions. For part-full conditions defined in Step 5, the calculations in the preliminary form may be helpful. Actual flow velocities need to be used in the EGL and HGL calculations.

6-4.3.5.1 **Step 5A**. Part-full flow: Using the hydraulic elements graph in Chart 26 with the ratio of part-full to full flow (values from the Preliminary Storm Drain Computation Sheet, Figure 6-3), compute the depth and velocity of flow in the conduit. Enter these values in Column 6a and 5, respectively, of Table A. Compute the velocity head ($V^2/2g$) and place in Column 7A.

6-4.3.5.2 **Step 5B.** Compute the critical depth for the conduit using Chart 27. (If the conduit is not circular, see HDS-5 for additional charts.) Enter this value in Column 6b of Table A.

6-4.3.5.3 **Step 5C**. Compare the flow depth in Column 6a (Table A) with the critical depth in Column 6b (Table A) to determine the flow state in the conduit. If the flow depth in Column 6a is greater than the critical depth in Column 6b, the flow is subcritical; continue with Step 6. If the flow depth in Column 6a is less than or equal to the critical depth in Column 6b, the flow is supercritical; continue with Step 5D. In either case, remember that the EGL must be higher upstream for flow to occur. If after checking for super critical flow in the upstream section of pipe, ensure that the EGL is higher in the pipe than in the structure.

6-4.3.5.4 **Step 5D**. Pipe losses in a supercritical pipe section are not carried upstream. Therefore, enter a zero (0) in Column 7B for this structure.

6-4.3.5.5 **Step 5E**. Enter the structure ID for the next upstream structure on the next line in Column 1A and Column 1B. Enter the pipe diameter (*D*), discharge (*Q*), and conduit length (*L*) in Columns 2A, 3A, and 4A, respectively, of the same line.

NOTE: After a downstream pipe has been determined to flow in supercritical flow, it is necessary to check each succeeding upstream pipe for the type of flow. This is done by calculating normal depth and critical depth for each pipe. If normal depth is less than the

diameter of the pipe, the flow will be open channel flow and the critical depth calculation can be used to determine whether the flow is sub or supercritical. If the flow line elevation through an access hole drops enough that the invert of the upstream pipe is not inundated by the flow in the downstream pipe, the designer goes back to Column 1A and begins a new design as if the downstream section did not exist.

6-4.3.5.6 **Step 5F**. Compute the normal depth for the conduit using Chart 26 and the critical depth using Chart 27. (If the conduit is not circular, see HDS-5 for additional charts.) Enter these values in Columns 6a and 6b of Table A.

6-4.3.5.7 **Step 5G**. If the pipe barrel flows full, enter the full flow velocity from continuity in Column 5A and the velocity head ($V^2/2g$) in Column 7A. Go to Step 3, Case 2 to determine the EGL at the outlet end of the pipe. Put this value in Column 10A and go to Step 6. For part-full flow, continue with Step 5H.

6-4.3.5.8 **Step 5H**. Part-full Flow: Compute the velocity of flow in the conduit and enter this value in Column 5A. Compute the velocity head ($V^2/2g$) and place the value in Column 7A.

6-4.3.5.9 **Step 5I**. Compare the flow depth in Column 6a with the critical depth in Column 6b to determine the flow state in the conduit. If the flow depth in Column 6a is greater than the critical depth in Column 6b, the flow is subcritical; continue with Step 5J. If the flow depth in Column 6a is less than or equal to the critical depth in Column 6b, the flow is supercritical; continue with Step 5K.

6-4.3.5.10 **Step 5J**. Subcritical Flow Upstream: Compute the EGL at the outlet of the structure (EGL_o) at the outlet of the previous structure as the outlet invert plus the sum of the outlet pipe flow depth and the velocity head. Place this value in Column 10A of the appropriate structure and go to Step 9.

6-4.3.5.11 **Step 5K**. Supercritical Flow Upstream: Access hole losses do not apply when the flow in two successive pipes is supercritical. Place zeros (0) in Columns 11A, 12A, and 15B of the intermediate structure (previous line). The HGL at the structure is equal to the pipe invert elevation plus the flow depth. Check the invert elevations and the flow depths both upstream and downstream of the structure to determine where the highest HGL exists. The highest value should be placed in Column 14A of the previous structure line. Perform Steps 20 and 21 and then repeat Steps 5E through 5K until the flow regime returns to subcritical. If the next upstream structure is end-of-line, skip to Step 10B and then perform Steps 20, 21, and 24.

6-4.3.6 **Step 6**. Compute the friction slope (S_f) for the pipe: $S_f = H_f / L = [Q\, n / (0.46\, D^{2.67})]^2$

Enter this value in Column 8A of the current line. This equation assumes full flow in the outlet pipe. If full flow does not exist, set the friction slope equal to the pipe slope.

6-4.3.7 **Step 7**. Compute the friction loss (H_f) by multiplying the length (L) in Column 4A by the friction slope (S_f) in Column 8A and enter this value in Column 2B. Compute other losses along the pipe run such as bend losses (h_o), transition contraction (H_c) and expansion (H_e) losses, and junction losses (H_j) using Equations 7-5 through 7-8 of HEC-22 and place the values in Columns 3B, 4B, 5B, and 6B, respectively. Add the values in 2B, 3B, 4B, 5B, and 6B and place the total in Columns 7B and 9A.

6-4.3.8 **Step 8**. Compute the EGL value at the outlet of the structure (EGL_o) as the EGL for an inflow pipe (EGL_i) elevation from the previous structure (Column 13A) plus the total pipe losses (Column 9A). Enter the EGL_o value in Column 10A.

6-4.3.9 **Step 9**. Estimate the depth of water in the access hole (estimated as the depth from the outlet pipe invert to the HGL in the pipe at the outlet). It is computed as EGL_o (Column 10A) minus the pipe velocity head in Column 7A minus the pipe invert elevation (from the Preliminary Storm Drain Computation Sheet, Figure 6-3). Enter this value in Column 8B. If supercritical flow exists in this structure, leave this value blank and skip to Step 5E.

6-4.3.10 **Step 10**. If the inflow storm drain invert is submerged by the water level in the access hole, compute access hole losses using Equation 7-10 and Equation 7-11 of HEC-22. Start by computing the initial structure head loss coefficient (K_o) based on the relative access hole size. Enter this value in Column 9B. Continue with Step 11. If the inflow storm drain invert is not submerged by the water level in the access hole, compute the head in the access hole using culvert techniques from HDS-5:

6-4.3.10.1 **Step 10A**. If the structure outflow pipe is flowing full or partially full under outlet control, compute the access hole loss by setting K in Equation 7-10 to K_e as reported in Table 7-5b of HEC-22. Enter this value in Columns 15B and 11A and continue with Step 17. Add a note on Table A indicating that this is a drop structure.

6-4.3.10.2 **Step 10B**. If the outflow pipe functions under inlet control, compute the depth in the access hole (HGL) using Chart 28 or 29 (Appendix B). If the storm conduit shape is other than circular, select the appropriate inlet control nomograph from HDS-5. Add these values to the access hole invert to determine the HGL. Since the velocity in the access hole is negligible, the EGL and HGL are the same. Enter the HGL in Column 14A and the EGL in Column 13A. Add a note on Table A indicating that this is a drop structure. Go to Step 20.

6-4.3.11 **Step 11**. Using Equation 7-13 of HEC-22, compute the correction factor for pipe diameter (C_D) and enter this value in Column 10B. Note, this factor is only significant in cases where the d_{aho}/D_o ratio is greater than 3.2.

6-4.3.12 **Step 12**. Using Equation 7-14 of HEC-22, compute the correction factor for flow depth (C_d) and enter this value in Column 11B. Note, this factor is only significant in cases where the d_{aho}/D_o ratio is less than 3.2.

6-4.3.13 **Step 13**. Using Equation 7-15 of HEC-22, compute the correction factor for relative flow (C_Q) and enter this value in Column 12B. This factor equals 1.0 if there are less than 3 pipes at the structure.

6-4.3.14 **Step 14**. Using Equation 7-16 of HEC-22, compute the correction factor for plunging flow (C_P) and enter this value in Column 13B. This factor equals 1.0 if there is no plunging flow. This correction factor is only applied when $h > d_{aho}$.

6-4.3.15 **Step 15**. Enter in Column 14B the correction factor for benching (C_B) as determined from Table 7-6 of HEC-22. Linear interpolation between the two columns of values will most likely be necessary.

6-4.3.16 **Step 16**. Using Equation 7-11 of HEC-22, compute the value of *K* and enter this value in Columns 15B and 11A.

6-4.3.17 **Step 17**. Compute the total access hole loss (H_{ah}) by multiplying the *K* value in Column 11A by the velocity head in Column 7A. Enter this value in Column 12A.

6-4.3.18 **Step 18**. Compute EGL_i at the structure by adding the structure losses in Column 12A to the EGL_o value in Column 10A. Enter this value in Column 13A.

6-4.3.19 **Step 19**. Compute the HGL at the structure by subtracting the velocity head in Column 7A from the EGL_i value in Column 13A. Enter this value in Column 14A.

6-4.3.20 **Step 20**. Determine the top of conduit (TOC) value for the inflow pipe (using information from the Preliminary Storm Drain Computation Sheet, Figure 6-3) and enter this value in Column 15A.

6-4.3.21 **Step 21**. Enter the ground surface, top of grate elevation, or other high water limits at the structure in Column 16A. If the HGL value in Column 14A exceeds the limiting elevation, design modifications will be required.

6-4.3.22 **Step 22**. Enter the structure ID for the next upstream structure in Columns 1A and 1B of the next line. When starting a new branch line, skip to Step 24.

6-4.3.23 **Step 23**. Continue to determine the EGL through the system by repeating Steps 4 through 23. (Begin with Step 2 if working with a drop structure. This begins the design process again as if there were no system downstream from the drop structure.)

6-4.3.24 **Step 24**. When starting a new branch line, enter the structure ID for the branch structure in Columns 1A and 1B of a new line. Transfer the values from Columns 2A through 10A and 2B to 7B associated with this structure on the main branch run to the corresponding columns for the branch line. If flow in the main storm drain at the branch point is subcritical, continue with Step 9; if it is supercritical, continue with Step 5E.

CHAPTER 7

DRAINAGE STRUCTURES

7-1 GENERAL. Certain appurtenant structures are essential to the proper functioning of every storm drainage system. These structures include inlet structures, manholes, and junction chambers. Other miscellaneous appurtenances include transitions, flow splitters, siphons, and flap gates.

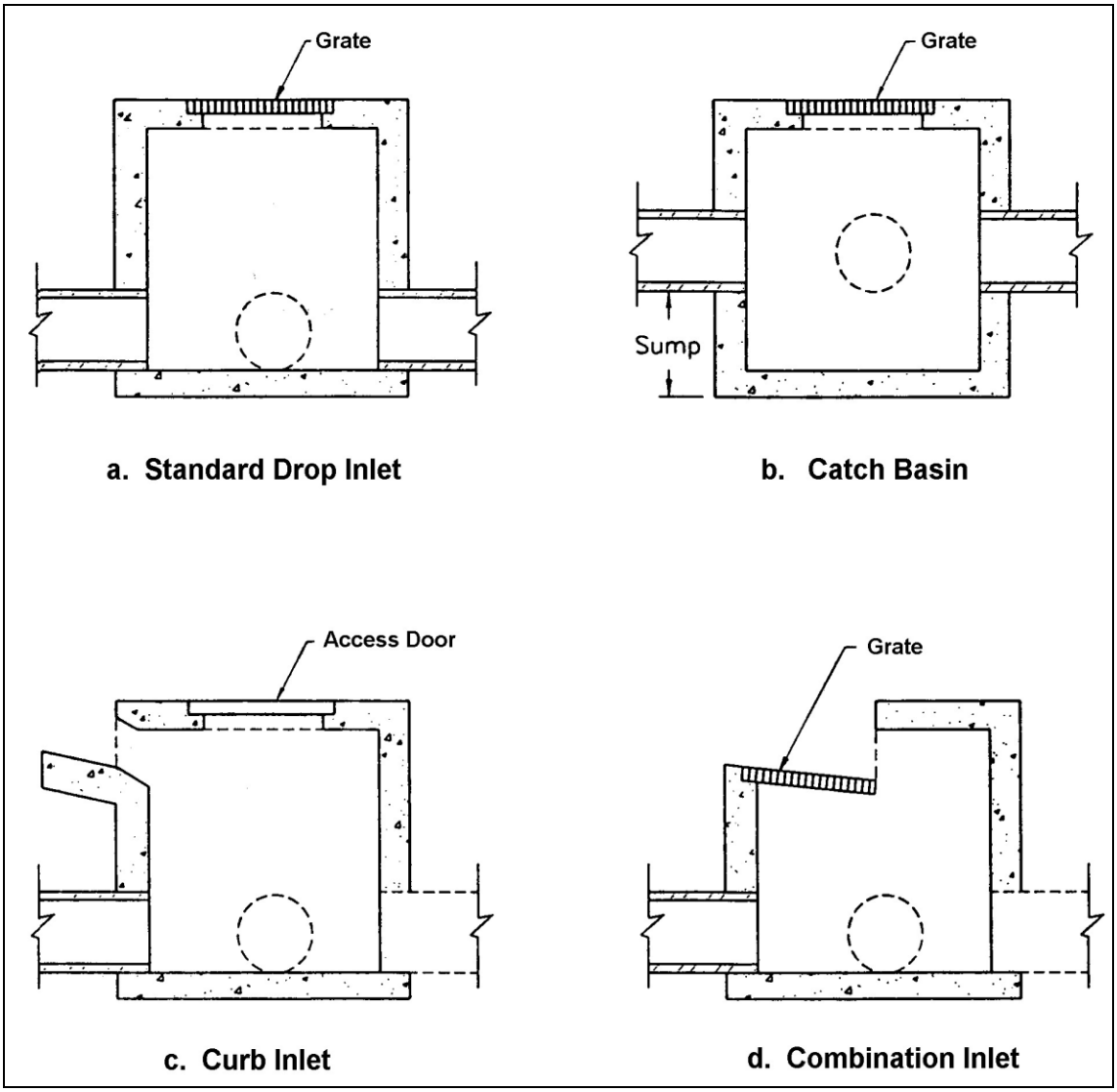
Many agencies have developed their own design standards for commonly used structures; therefore, it is to be expected that many variations will be found in the design of even the simplest structures. The information in this chapter is limited to a general description of these structures with special emphasis on the features considered essential to good design.

7-2 INLETS. The primary function of an inlet structure is to allow surface water to enter the storm drainage system. As a secondary function, inlet structures also serve as access points for cleaning and inspection. The materials most commonly used for inlet construction are cast-in-place concrete and pre-cast concrete. The structures must ensure efficient drainage of design storm runoff to avoid interruption of operations during or following storms and to prevent temporary or permanent damage to pavement subgrades. The material, including the slotted drain corrugated metal pipe to handle surface flow (if employed), should be strong enough to withstand the loads to which it will be subjected.

7-2.1 Configuration. Inlets are structures with inlet openings to receive surface water. Figure 7-1 illustrates several typical inlet structures, including a standard drop inlet (area inlet), catch basin, curb inlet, and combination inlet. The hydraulic design of surface inlets is covered in detail in Chapter 3.

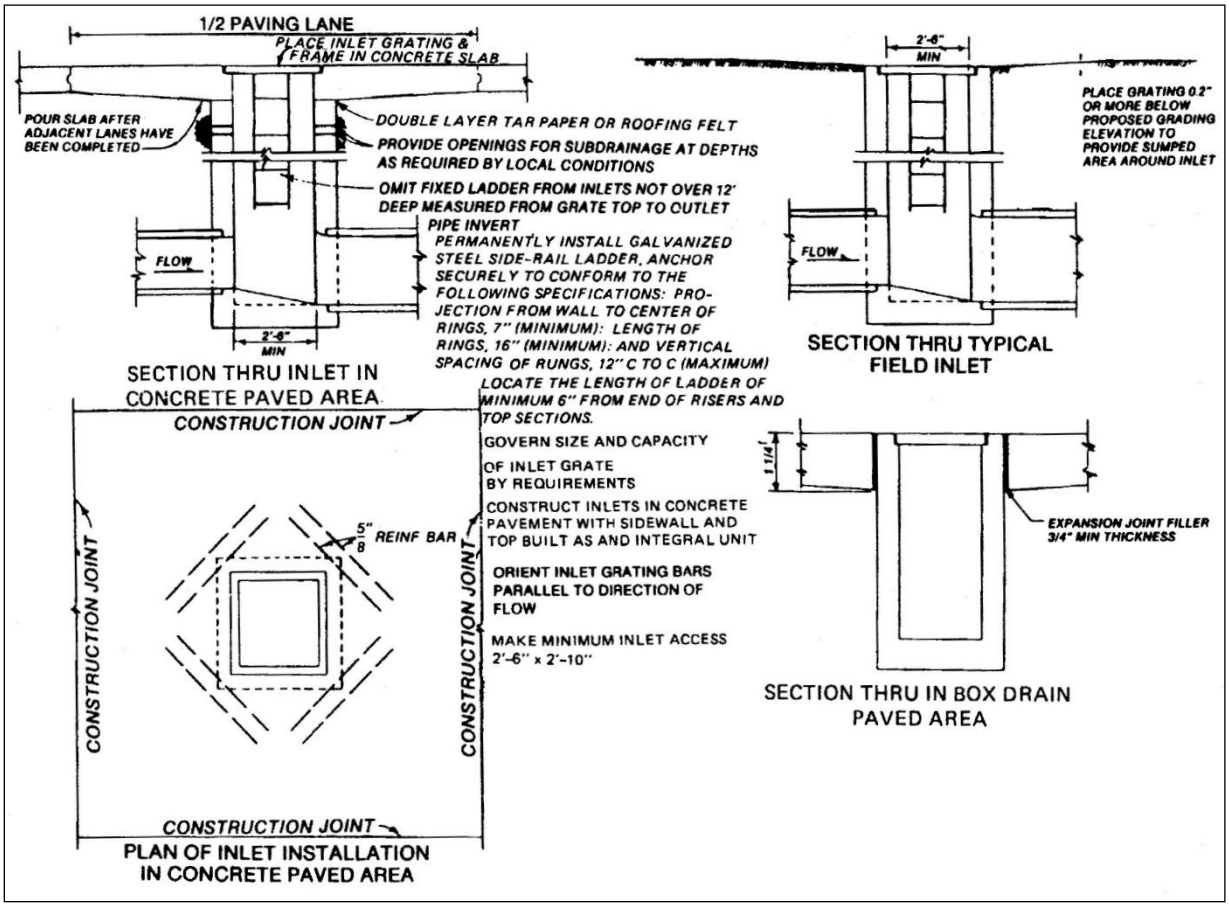
The catch basin, illustrated in Figure 7-1, b, is a special type of inlet structure designed to retain sediment and debris transported by storm water into the storm drainage system. Catch basins include a sump for the collection of sediment and debris. Catch basin sumps require periodic cleaning to be effective and may become an odor and mosquito nuisance if not properly maintained; however, in areas where site constraints dictate that storm drains be placed on relatively flat slopes, and where a strict maintenance plan is followed, catch basins can be used to collect sediment and debris but are ineffective in reducing other pollutant loadings. Additional information regarding the removal of pollutants from storm water can be found in Chapter 11.

Figure 7-1. Inlet Structures



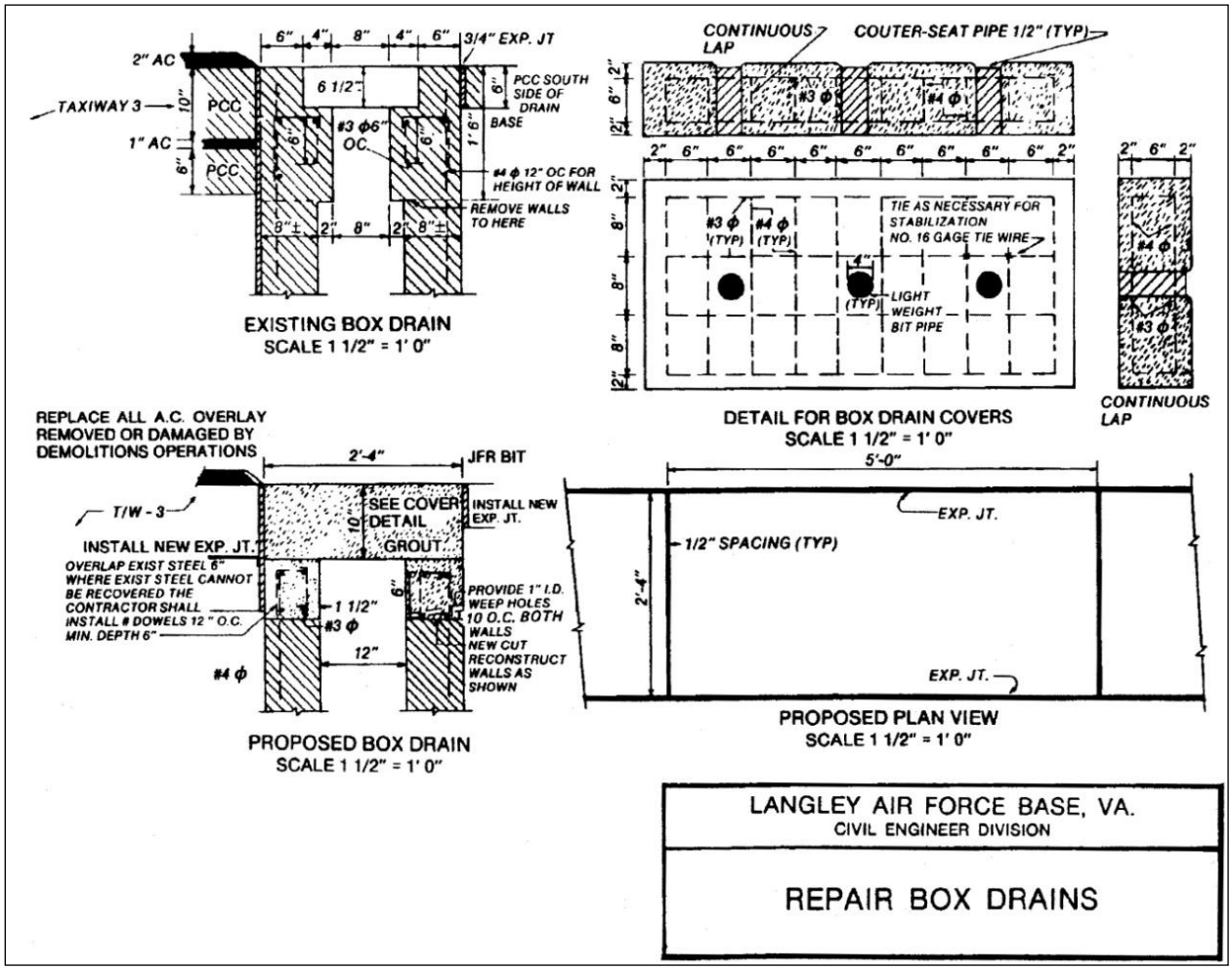
7-2.2 Area Inlets. Where area inlets are used within paved areas to remove surface drainage, a continuous-type grating, generally covering the entire drain, is used to permit water to enter directly into the drain. Certain general requirements are illustrated by the typical section through an area inlet in a paved area shown in Figure 7-2. The walls of the box drain will extend to the surface of the pavement. The pavement will have a free thickened edge at the drain. An approved expansion-joint filler covering the entire surface of the thickened edge of the pavement will be installed at all joints between the pavement and box drain. A 0.75-inch thick filler is usually sufficient, but thicker fillers may be required. Grating for area inlets can be built of steel, cast iron, or reinforced concrete with adequate strength to withstand anticipated loadings. Where two or more area inlets are adjacent, they will be interconnected to provide equalization of flow and optimum hydraulic capacity.

Figure 7-2. Typical Inlet Design for Storm Drainage Systems



7-2.2.1 A number of area inlets similar to those shown in Figure 7-2 have failed structurally at several installations. Causes of failure are the inability of the drain walls to resist the movement of the abutting pavement under seasonal expansion and contraction, the general tendency of the slope pavement to make an expansion movement toward the drain wall while the thickened edge is restrained from moving away from the drain, and the infiltration of detritus into joints. Figure 7-3 indicates a successful box drain in use at Langley Air Force Base. The design provides for the top of the box drain wall to terminate at the bottom of the abutting pavement. A typical drain cover is a 10-inch thick reinforced concrete slab with inserted lightweight circular pipes used for the grating openings. While only 4-inch diameter holes have been indicated in the figure, additional holes may be used to provide egress for the storm runoff. The design may also be used to repair existing area inlets that have failed.

Figure 7-3. Repair Area Inlets



7-2.2.2 Inlet drainage structures, particularly area inlets, have been known to settle at rates different from the adjacent pavement, causing depressions that permit pavement failure should the subgrade deteriorate. Construction specifications requiring careful backfilling around inlets will help prevent the differential settling rates.

7-2.2.3 Inlet structures are located at the upstream end and at intermediate points along a storm drain line. Inlet spacing is controlled by the geometry of the site, inlet opening capacity, and tributary drainage magnitude. Inlet placement is generally a trial and error procedure that attempts to produce the most economical and hydraulically effective system.

Certain general rules apply to inlet placement:

- An inlet is required at the uppermost point in a gutter section where gutter capacity criteria are violated. This point is established by moving the inlet and thus changing the drainage area until the tributary flow equals the gutter capacity. Successive inlets are spaced by locating the point where the sum of

the bypassing flow and the flow from the additional contributing area exceed the gutter capacity. Chapter 3 contains information regarding inlet spacing procedures.

- Inlets are normally used at intersections to prevent street cross flow that could cause pedestrian or vehicular hazards. It is desirable to intercept 100 percent of any potential street cross flow under these conditions. Intersection inlets should be placed on tangent curb sections near corners.

- Inlets are also required where the street cross slope begins to superelevate. The purpose of these inlets is also to reduce the traffic hazard from street cross flow. Sheet flow across the pavement at these locations is particularly susceptible to icing.

- Inlets should also be located at any point where side drainage enters streets and may overload gutter capacity. Where possible, these side drainage inlets should be located to intercept side drainage before it enters the street.

- Inlets should be placed at all low points in the gutter grade and at median breaks.

- Inlets are also used upstream of bridges to prevent pavement drainage from flowing onto the bridge decks, and downstream of bridges to intercept drainage from the bridge.

- As a matter of general practice, inlets should not be located within driveway areas.

7-3 MANHOLES. The primary function of a manhole is to provide convenient access to the storm drainage system for inspection and maintenance. As secondary functions, manholes also serve as flow junctions, and can provide ventilation and pressure relief for storm drainage systems. It is noted that inlet structures can also serve as manholes and should be used in lieu of manholes where possible so that the benefit of extra storm water interception is achieved at minimal additional cost.

Like the materials used for storm drain inlets, the materials most commonly used for manhole construction are pre-cast concrete and cast-in-place concrete. In most areas, pre-cast concrete manhole sections are commonly used due to their availability and competitive cost. They can be obtained with cast-in-place steps at the desired locations, and special transition sections are available to reduce the diameter of the manhole at the top to accommodate the frame and cover. The transition sections are usually eccentric, with one side vertical to accommodate access steps. Pre-cast bottoms are also available in some locations.

7-3.1 Configuration. Typical manhole and junction box construction is shown in Figures 7-4 through 7-7. Where storm drains are too large to reasonably accommodate the typical structure configurations illustrated in Figure 7-7, a vertical riser connected to

the storm drain with a commercial "tee" unit is often used. Such a configuration is illustrated in Figure 7-8. As illustrated in Figure 7-7, the design elements of a manhole include the bottom chamber and access shaft, the ladder, and the manhole bottom. The design elements of a manhole are examined in paragraphs 7-3.2 through 7-3.7.

7-3.2 Chamber and Access Shaft. Most manholes are circular, with the inside dimension of the bottom chamber being sufficient to perform inspection and cleaning operations without difficulty. A minimum inside diameter of 4 ft has been adopted widely, with a 5-ft diameter manhole being used for larger diameter storm drains. The access shaft (cone) tapers to a cast-iron frame that provides a minimum clear opening usually specified as 22 to 24 inches. It is common practice to maintain a constant diameter bottom chamber up to a conical section a short distance below the top, as shown in Figure 7-7, a. It has also become common practice to use eccentric cones for the access shaft, especially in precast manholes. This provides a vertical side for the steps (Figure 7-7, b), which makes the manhole much easier to access.

Another design option maintains the bottom chamber diameter to a height sufficient for a good working space, then tapers to 3 ft as shown in Figure 7-7, c. The cast iron frame in this case has a broad base to rest on the 3-ft diameter access shaft. Still another design uses a removable, flat, reinforced concrete slab instead of a cone, as shown in Figure 7-7, d. As illustrated in Figure 7-7, the access shaft can be centered over the manhole or offset to one side. Certain guidelines apply:

- For manholes with chambers 3 ft or less in diameter, the access shaft can be centered over the axis of the manhole.
- For manholes with chambers 4 ft or greater in diameter, the access shaft should be offset and made tangent to one side of the manhole for better location of the manhole steps.
- For manholes with chambers greater than 4 ft in diameter, where laterals enter from both sides of the manhole, the offset should be toward the side of the smaller lateral.
- The manhole should be oriented so the workers enter it while facing traffic if traffic exists.

7-3.3 Frames and Covers. Manhole frames and covers are designed to provide adequate strength to support superimposed loads, provide a good fit between cover and frame, and maintain provisions for opening while providing resistance to unauthorized opening (primarily from children). Additional information specific to airfields is located at the end of this chapter. In addition, to differentiate storm drain manholes from those on sanitary sewers, communication conduits, or other underground utilities, it is good practice to have the words "STORM DRAIN" or equivalent cast into the top surface of the covers. Most agencies maintain frame and cover standards for their systems. Special considerations for aircraft loading are provided at the end of this chapter.

Figure 7-4. Standard Storm Drain Manhole

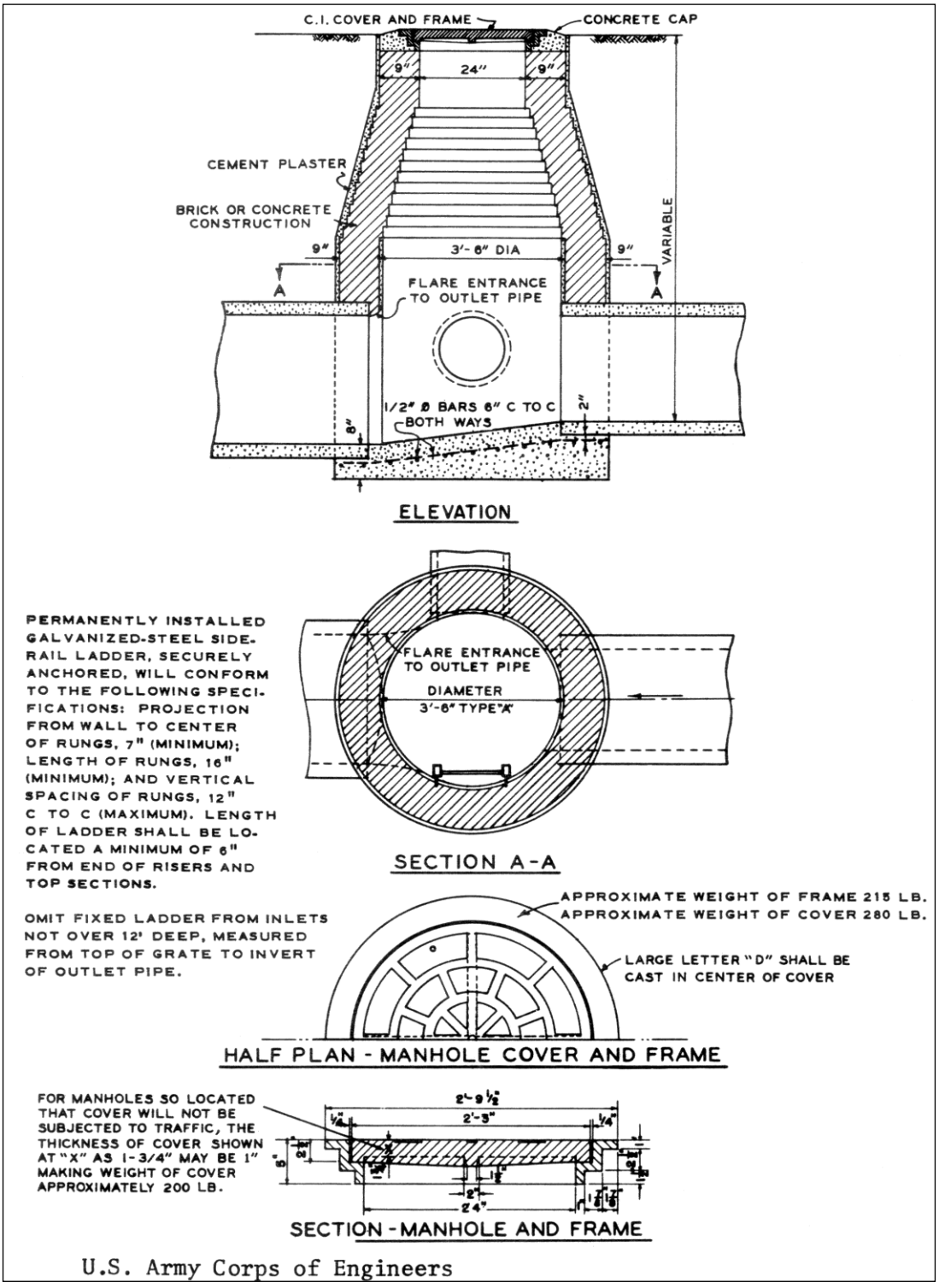


Figure 7-5. Standard Precast Manholes

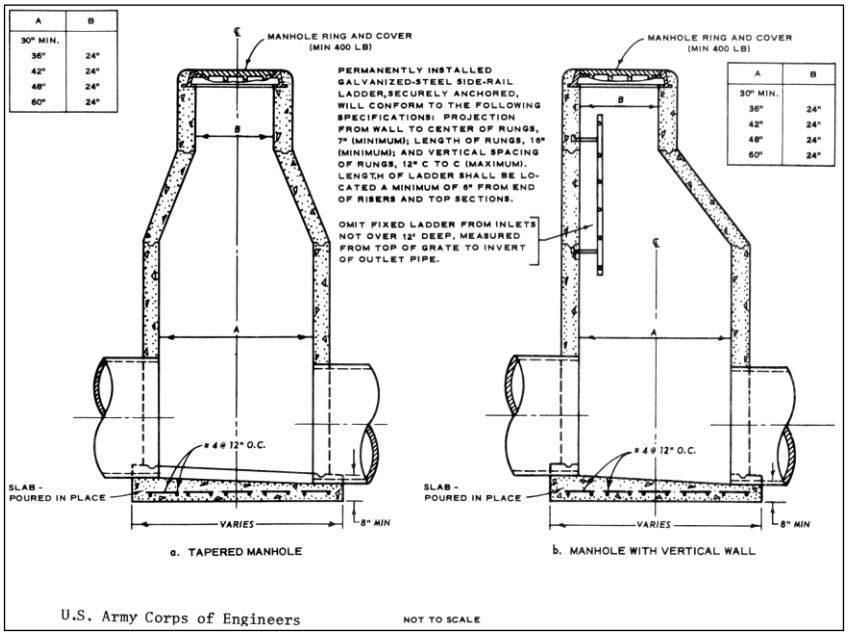


Figure 7-6. Junction Details for Large Pipes

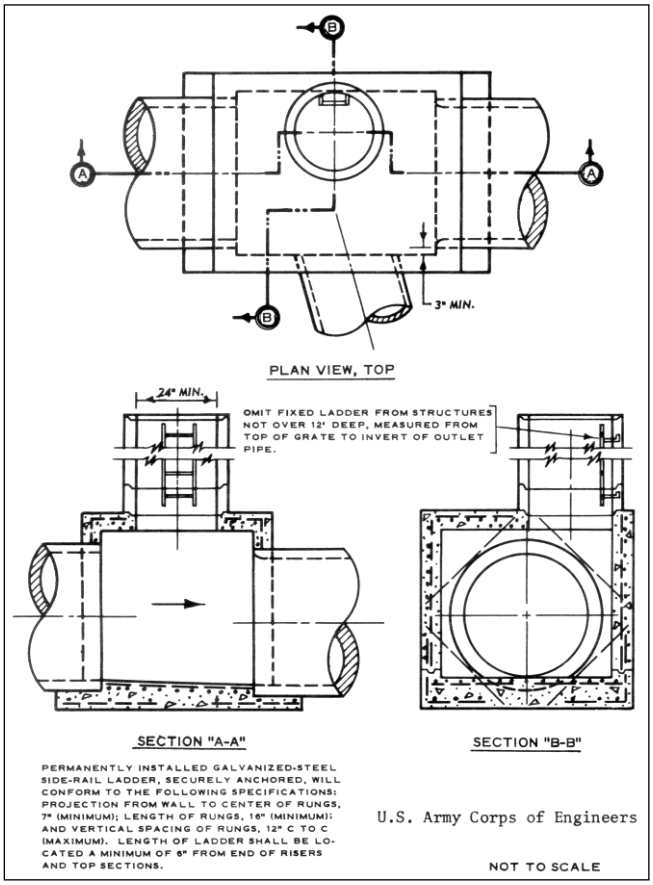


Figure 7-7. Typical Manhole Configurations

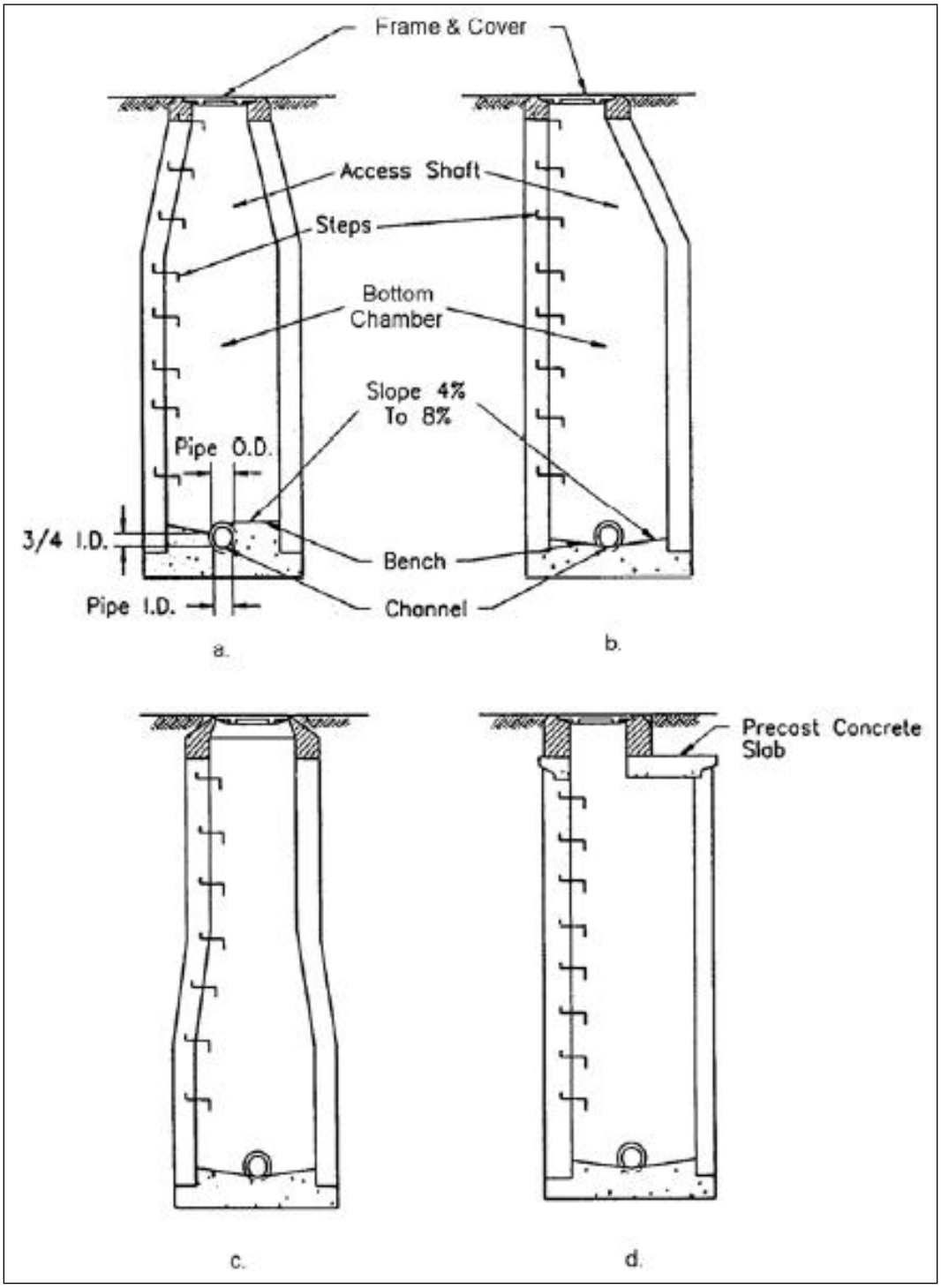
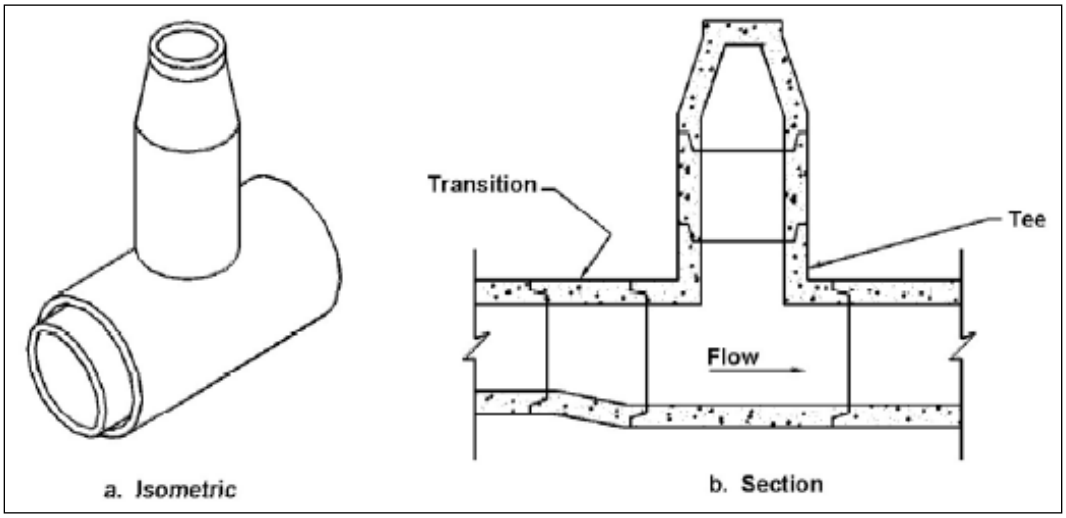


Figure 7-8. "Tee" Manhole for Large Storm Drains



If the HGL could rise above the ground surface at a manhole site, special consideration must be given to the design of the manhole frame and cover. The cover must be secured so that it remains in place during peak flooding periods, avoiding a manhole "blowout." A blowout is caused when the HGL rises in elevation higher than the manhole cover and forces the lid to explode off. Manhole covers should be bolted or secured in place with a locking mechanism if blowout conditions are possible.

7-3.4 Channels and Benches. Flow channels and benches are illustrated in Figure 7-7. The purpose of the flow channel is to provide a smooth, continuous conduit for the flow and to eliminate unnecessary turbulence in the manhole by reducing energy losses. The elevated bottom of the manhole on either side of the flow channel is called the bench. The purpose of a bench is to increase the hydraulic efficiency of the manhole.

In the design of manholes, benched bottoms are not common. Benching is used only when the HGL is relatively flat and there is no appreciable head available. Typically, the slopes of storm drain systems do not require benches to hold the HGL in the correct place. Where the HGL is not of consequence, avoid the extra expense of adding benches.

For the design of the inflow and outflow pipe invert elevations, the pipes should be set so the top of the outlet pipe is below the top of the inlet pipe by the amount of loss in the manhole. This practice is often referred to as "hanging the pipe on the hydraulic grade line."

7-3.5 Manhole Depth. The depth required for a manhole will be dictated by the storm drain profile and surface topography. Common manhole depths range from 5 to 13 ft. Manholes that are shallower or deeper than this may require special consideration.

Irregular surface topography sometimes results in shallow manholes. If the depth to the invert is only 2 to 3 ft, all maintenance operations can be conducted from the surface; however, maintenance activities are not comfortable from the surface, even at shallow depths. It is recommended that the manhole width be of the same size as that for greater depths. Typical manhole widths are 4 to 5 ft. For shallow manholes, use of an extra-large cover with a 30- or 36-inch opening will enable a worker to stand in the manhole for maintenance operations.

Deep manholes must be carefully designed to withstand soil pressure loads. If the manhole is to extend very far below the water table, it must also be designed to withstand the associated hydrostatic pressure or excessive seepage may occur. Since long portable ladders would be cumbersome and dangerous, access must be provided with either steps or built-in ladders.

7-3.6 Location and Spacing. Manhole location and spacing criteria have been developed in response to storm drain maintenance requirements. Spacing criteria are typically established based on a local agency's past experience and maintenance equipment limitations. At a minimum, manholes should be located at specific points:

- Where two or more storm drains converge
- Where pipe sizes change
- Where a change in alignment occurs
- Where a change in grade occurs

In addition, manholes may be located at intermediate points along straight runs of storm drain in accordance with the criteria outlined in Table 7-1; however, individual transportation agencies may have limitations on spacing of manholes due to maintenance constraints.

Table 7-1. Manhole Spacing Criteria

Pipe Size, in.	Suggested Maximum Spacing, ft
12 – 24	300
27 – 36	400
42 – 54	500
60 and up	1000

7-3.7 Settlement of Manholes. Failure of joints between sections of concrete pipe in the vicinity of large concrete manholes indicates that the manhole has settled at a different rate than that of the connecting pipe. Flexible joints should be required for all joints between sections of rigid pipe in the vicinity of large manholes, e.g., 3 to 5 joints along all pipe entering or leaving the manhole.

7-4 JUNCTION CHAMBERS. A junction chamber is a specially designed underground chamber used to join two or more large storm drain conduits. This type of structure is usually required where storm drains are larger than the size that can be accommodated by standard manholes. For smaller diameter storm drains, manholes are typically used instead of junction chambers. Junction chambers by definition do not need to extend to the ground surface and can be completely buried; however, it is recommended that riser structures be used to provide for surface access and/or to intercept surface runoff.

Materials commonly used for junction chamber construction include pre-cast concrete and cast-in-place concrete. On storm drains constructed of corrugated steel, the junction chambers are sometimes made of the same material.

To minimize flow turbulence in junction boxes, flow channels and benches are typically built into the bottom of the chambers. Figure 7-9 illustrates several efficient junction channel and bench geometries. Where junction chambers are used as access points for the storm drain system, their location should adhere to the spacing criteria outlined in section 7-3.6.

7-5 MISCELLANEOUS STRUCTURES.

7-5.1 Chutes. A chute is a steep, open channel that provides a method of discharging accumulated surface runoff over fills and embankments. A typical design is shown in Figure 7-10.

7-5.2 Security Fencing. When a conduit or channel passes through or beneath a security fence and forms an opening greater than 96 square inches (in^2) in area, a security barrier must be installed. Barriers are usually of bars, grillwork, or chain-link screens. Parallel bars used to prevent access will be spaced not more than 6 inch apart and will be of sufficient strength to preclude bending by hand after assembly.

7-5.2.1 Where fences enclose maximum security areas such as exclusion and restricted areas, drainage channels, ditches, and equalizers will, wherever possible, be carried under the fence in one or more pipes having an internal diameter of not more than 10 inch Where the volume of flow is such that the multipipe arrangement is not feasible, the conduit or culvert will be protected by a security grill composed of 0.75-inch diameter rods or 0.50-inch bars spaced not more than 6 inch on center, set and welded in an internal frame. Where rods or bars exceed 18 inch in length, suitable spacer bars will be provided at not more than 18 inch on center, welded at all intersections. Security grills will be located inside the protected area. Where the grill is on the downstream end of the culvert, the grill will be hinged to facilitate cleaning and provided with a latch and padlock, and a debris catcher will be installed in the upstream end of the conduit or culvert. Elsewhere the grill will be permanently attached to the culvert. Security regulations normally require the guard to inspect such grills at least once every shift. For culverts in rough terrain, steps will be provided to the grill to facilitate inspection and cleaning.

Figure 7-9. Efficient Channel and Bench Configurations

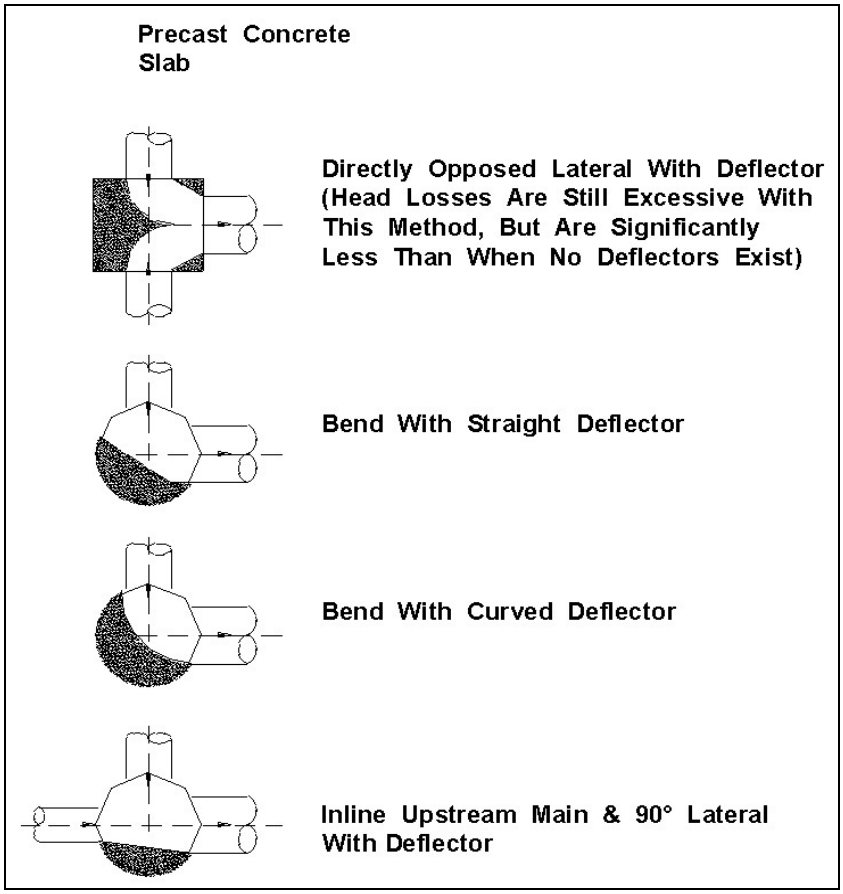
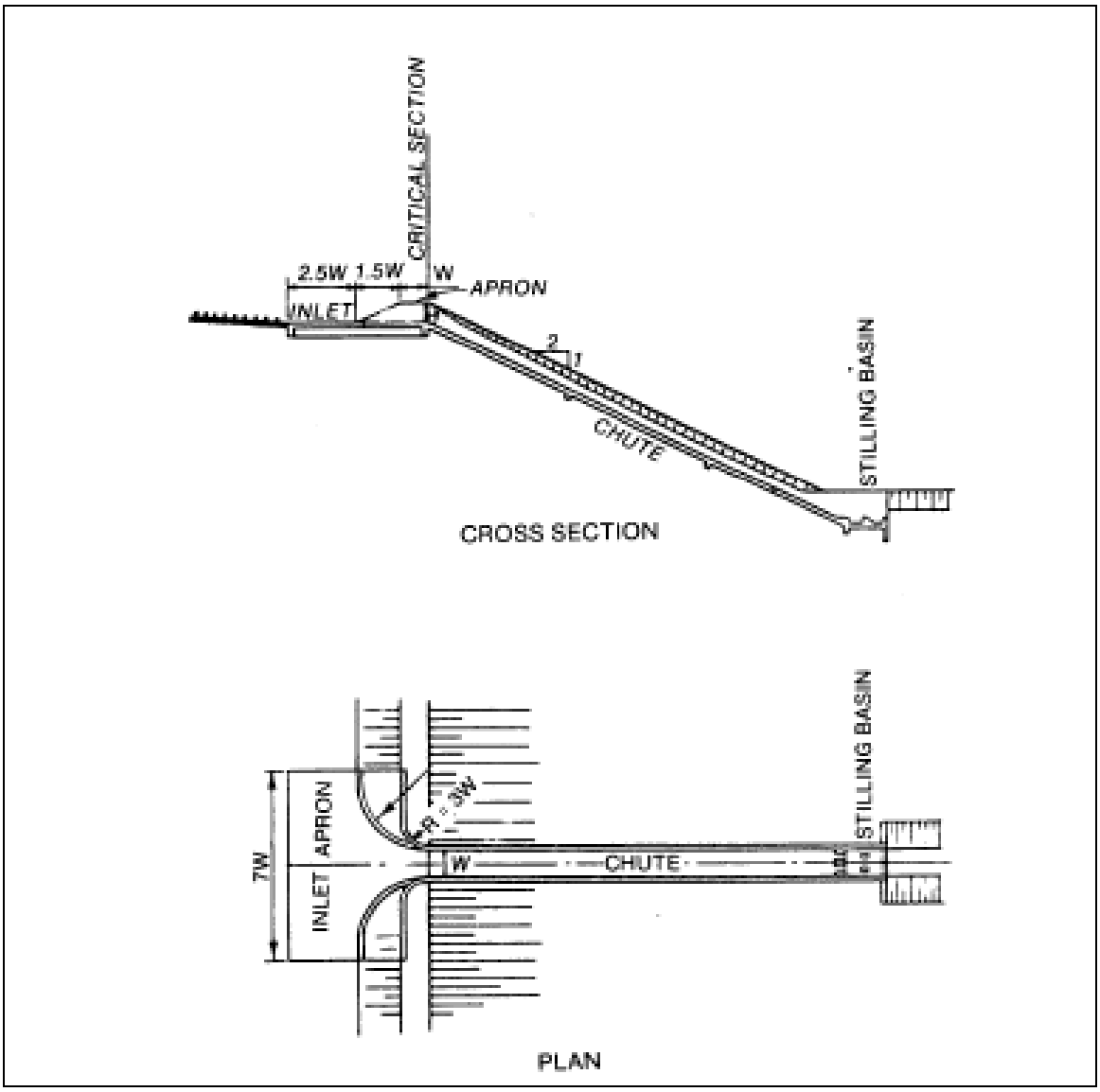


Figure 7-10. Details of a Typical Drainage Chute



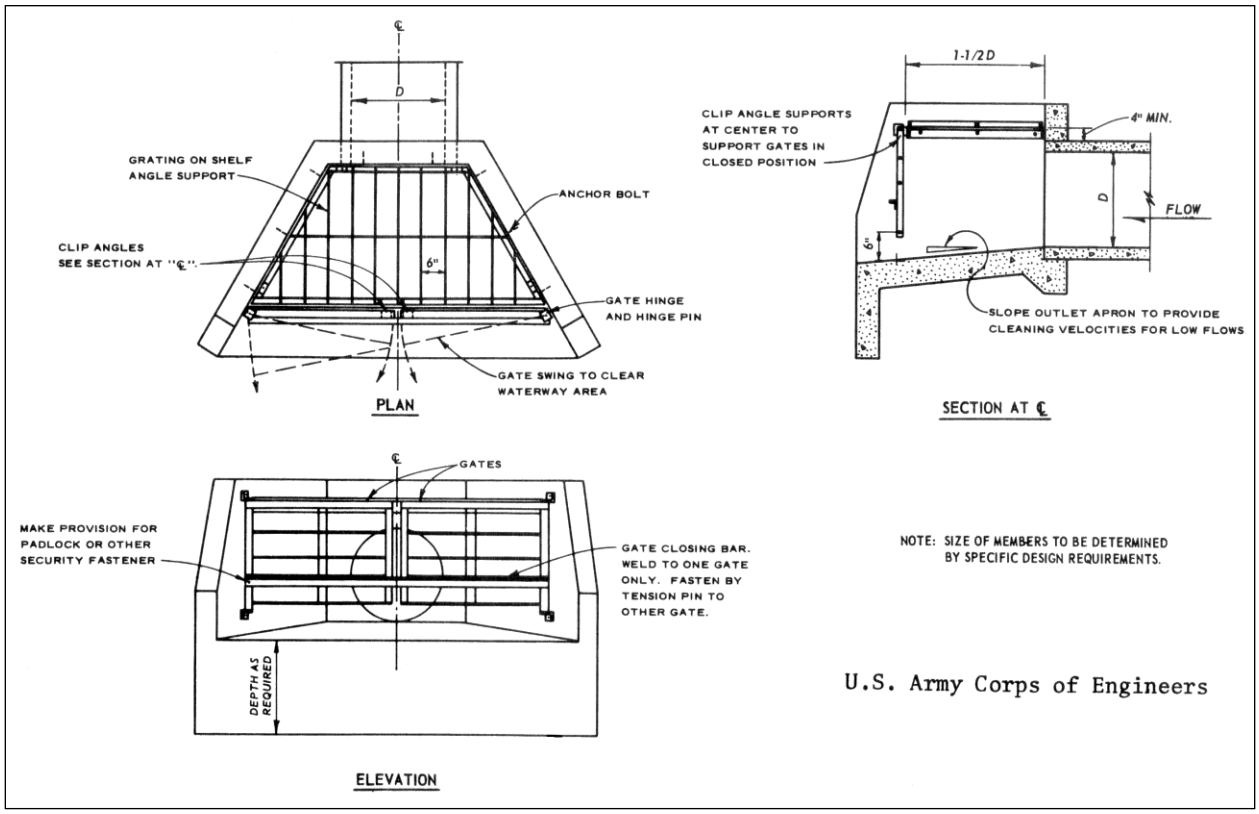
7-5.2.2 For culverts and storm drains, barriers at the intakes would be preferable to barriers at the outlets because of the relative ease of debris removal; however, barriers at the outfalls are usually essential. In these cases, consideration should be given to placing debris interceptors at the inlets. Bars constituting a barrier should be placed in a horizontal position, and the number of vertical members should be limited to minimize clogging; the total clear area should be at least twice the area of the conduit or larger under severe debris conditions. For large conduits, an elaborate cage-like structure may be required. Provisions to facilitate cleaning during or immediately after heavy runoff should be made. Figure 7-11 shows a typical barrier for the outlet of a pipe drain. Note that a 6-inch underclearance is provided to permit passage of normal bedload material, and that the apron between the conduit outlet and the barrier is placed on a slope to

minimize deposition of sediment on the apron during ordinary flow. Erosion protection, where required, is placed immediately downstream from the barrier.

7-5.2.3 If manholes must be located in the immediate vicinity of a security fence, their covers must be fastened to prevent unauthorized opening.

7-5.2.4 Open channels may present special problems due to the relatively large size of the waterway and the possible requirements for passage of large floating debris. For such channels, a barrier should be provided that can be unfastened and opened or lifted during periods of heavy runoff or when clogged. The barrier is hinged at the top and an empty tank is welded to it at the bottom to serve as a float. Open channels or swales that drain relatively small areas and with flows that carry only minor quantities of debris may be secured merely by extending the fence down to a concrete sill set into the sides and across the bottom of the channel.

Figure 7-11. Outlet Security Barrier



7-5.3 Fuel/Water Separators. Fuel/water separators should be installed where there is an oil/water separation problem. The most common location for these units is in areas that contain vehicle washracks. Details on the selection and design of oil/water separators can be found in Army Engineering Technical Letter (ETL) 1110-3-466.

7-5.4 Outlet Energy Dissipators. Most drainage systems are designed to operate under normal free outfall conditions. Tailwater conditions are generally absent; however,

it is possible for a discharge resulting from a drainage system to possess kinetic energy in excess of that which normally occurs in waterways. To reduce the kinetic energy and thereby reduce downstream scour, outfalls may sometimes be required to reduce streambed scour. Scour may occur in the streambed if discharge velocities exceed the critical velocities of the streambed material. Studies of local materials must be made prior to a decision to install energy dissipation devices. Protection against scour may be provided by plain outlets, transitions, and stilling basins. Plain outlets provide no protective works and depend on natural material to resist erosion. Transitions provide little or no dissipation of energy themselves, but by spreading the effluent jet to approximately the flow cross-section of the natural channel, the energy is greatly reduced prior to releasing the effluent into the outlet channel. Stilling basins dissipate the high kinetic energy of flow by a hydraulic jump or other means. Riprap may be required at any of the three types of outfalls.

7-5.4.1 **Plain Type**

- If the discharge channel is in rock or a material highly resistant to erosion, no special erosion protection is required; however, since flow from the culvert will spread with a resultant drop in water surface and increase in velocity, this type of outlet should be used without riprap only if the material in the outlet channel can withstand velocities approximately 1.5 times the velocity in the culvert. At such an outlet, side erosion due to eddy action or turbulence is more likely to prove troublesome than is bottom scour.

- Cantilevered culvert outlets may be used to discharge a free-falling jet onto the bed of the outlet channel. A plunge pool will be developed, the depth and size of which will depend on the energy of the falling jet at the tailwater and the erodibility of the bed material.

7-5.4.2 **Transition Type.** Endwalls (outfall headwalls) serve the dual purpose of retaining the embankment and limiting the outlet transition boundary. Erosion of embankment toes usually can be traced to eddy attack at the ends of such walls. A flared transition is very effective if proportioned so that eddies induced by the effluent jet do not continue beyond the end of the wall or overtop a sloped wall. A guideline is that the product of velocity and flare angle should not exceed 150. That is, if effluent velocity is 5 ft/s, each wingwall may flare 30 degrees; but if velocity is 15 ft/s, the flare should not exceed 10 degrees. Unless wingwalls can be anchored on a stable foundation, a paved apron between the wingwalls is required. Take special care in design of the structure to preclude undermining. A newly excavated channel may be expected to degrade, and proper allowance for this action should be included in establishing the apron elevation and the depth of the cutoff wall. Warped endwalls provide excellent transitions because they result in the release of flow in a trapezoidal section, which generally approximates the cross section of the outlet channel. If a warped transition is placed at the end of a curved section below a culvert, the transition is made at the end of the curved section to minimize the possibility of overtopping due to superelevation of the water surface. A paved apron is required with warped endwalls. Usually riprap is required at the end of a transition-type outlet.

7-5.4.3 **Improved Channels**. Improved channels, especially the paved ones, commonly carry water at velocities higher than those prevailing in the natural channels into which they discharge. Often riprap will suffice for dissipation of excess energy. A cutoff wall may be required at the end of a paved channel to preclude undermining. In extreme cases, a flared transition, stilling basin, or impact device may be required.

7-5.5 Drop Structures and Check Dams. Drop structures and check dams are designed to check channel erosion by controlling the effective gradient and to provide for abrupt changes in channel gradient by means of a vertical drop. These structures also provide satisfactory means for discharging accumulated surface runoff over fills with heights not exceeding approximately 5 ft and over embankments higher than 5 ft, provided the end sill of the drop structure extends beyond the toe of the embankment. The check dam is a modification of the drop structure used for erosion control in small channels where a less elaborate structure is permissible.

7-5.6 Transitions. In storm drainage systems, transitions from one pipe size to another typically occur in manholes or junction chambers; however, there are times when transitions may be required at other locations within the storm drainage system. A typical example is illustrated in Figure 7-12, where a rectangular pipe transition is used to avoid an obstruction. Commercially available transition sections are also available for circular pipes. These transitions can be used upstream of "tee"-type manholes in large storm drains, as illustrated in Figure 7-12. Providing a smooth, gradual transition to minimize head losses is the most significant consideration in the design of transition sections. Table 7-2 provides design criteria for transition sections.

7-5.7 Flow Splitters. A flow splitter is a special structure designed to divide a single flow and divert the parts into two or more downstream channels. Flow splitters are constructed similar to junction boxes except that with flow splitters, flows from a single large storm drain are split into several smaller storm drains.

The design of flow splitters must minimize head loss and potential debris problems. Hydraulic disturbances at the point of flow division result in unavoidable head losses. These losses may be reduced by the inclusion of proper flow deflectors in the design of the structure. Hydraulic disturbances within flow splitters often result in regions of flow velocity reduction. These reductions can cause deposition of material suspended in the storm water flow. In addition, the smaller pipes may not be large enough to carry some of the debris being passed by the large pipe. In some cases, flow splitters can become maintenance intensive; therefore, their use should be judiciously controlled, and when used, positive maintenance access must be provided.

Figure 7-12. Transitions to Avoid Obstruction

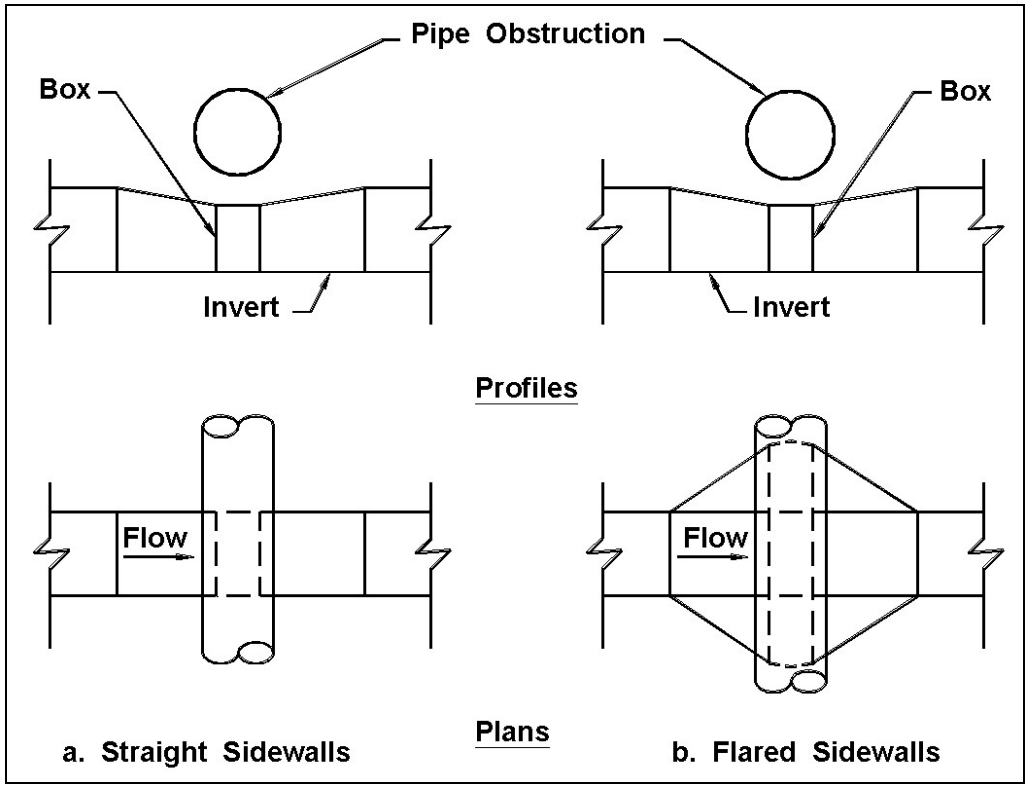
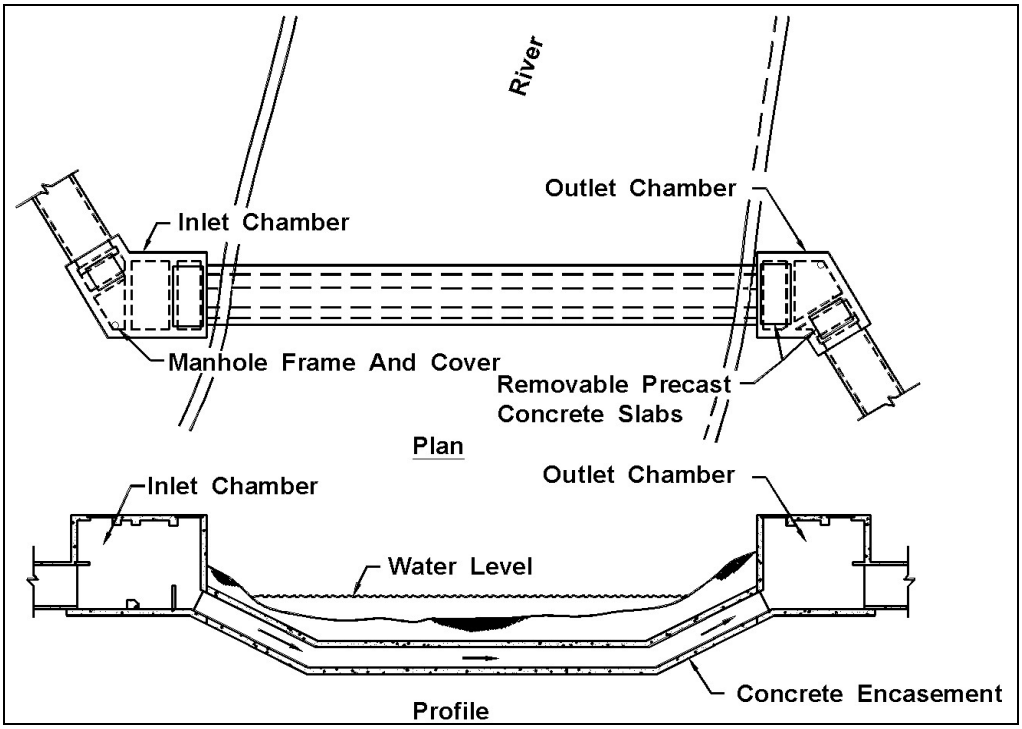


Table 7-2. Transition Design Criteria

Type	Flow Condition	
	***V* < 20 ft/s**	***V* > 20 ft/s**
Expansion	Straight Walls Ratio - 5:1 to 10:1	Straight Walls Ratio - 10:1 to 20:1
Contraction	Straight Walls Ratio - 5:1 to 10:1	Straight Walls Ratio - 10:1 to 20:1

7-5.8 Siphons. In practice, the term "siphon" refers to an inverted siphon or depressed pipe that would stand full even without any flow. Its purpose is to carry the flow under an obstruction such as a stream or depressed highway and to regain as much elevation as possible after the obstruction has been passed. Siphons can consist of single or multiple barrels; however, AASHTO recommends a minimum of two barrels. Figure 7-13 illustrates a twin-barrel siphon.

Figure 7-13. Twin-Barrel Siphon



Certain considerations are important to the efficient design of siphons:

- Self-flushing velocities should be provided under a wide range of flows.
- Hydraulic losses should be minimized.
- Provisions for cleaning should be provided.
- Sharp bends should be avoided.
- The rising portion of the siphon should not be steep enough to make it difficult to flush deposits. (Some agencies limit the rising slope to 15 percent.)
- There should be no change in pipe diameter along the length of the siphon.
- Provisions for drainage should be considered.

7-5.9 Flap Gates. Flap gates are installed at or near storm drain outlets for the purpose of preventing back-flooding of the drainage system at high tides or high stages in the receiving streams. A small differential pressure on the back of the gate will open it, allowing discharge in the desired direction. When water on the front side of the gate rises above that on the back side, the gate closes to prevent backflow. Flap gates are typically made of cast iron, rubber, or steel, and are available for round, square, and rectangular openings and in various designs and sizes.

Maintenance is a necessary consideration with the use of flap gates. In storm drain systems that are known to carry significant volumes of suspended sediment and/or floating debris, flapgates can act as skimmers and cause brush and trash to collect between the flap and seat. The reduction of flow velocity behind a flap gate may also cause sediment deposition in the storm drain near the outlet. Flap gate installations require regular inspection and removal of accumulated sediment and debris.

In addition, for those drainage structures that have a flap gate mounted on a pipe projecting into a stream, the gate must be protected from damage by floating logs or ice during high flows. In these instances, protection must be provided on the upstream side of the gate.

7-6 DESIGN FEATURES.

7-6.1 Grates. Grating elevations for area inlets must be carefully coordinated with the base or airport grading plan. Each inlet must be located at an elevation that will ensure interception of surface runoff. Increased overland velocities immediately adjacent to field inlet openings may result in erosion unless protective measures are taken. A solid sod annular ring varying from 3 to 10 ft around the inlet reduces erosion if suitable turf is established and maintained on the adjacent drainage area. Prior to the establishment of turf on the adjacent area, silt may deposit in a paved apron around the perimeter or deposit in the sod ring, thereby diverting flow from the inlet. In lieu of a sod ring, a paved apron around the perimeter of a grated inlet may be beneficial in preventing erosion and differential settlement of the inlet and the adjacent area as well as facilitating mowing operations.

7-6.1.1 Drainage structures in non-paved areas should be designed so that the grating does not extend above the ground level. The tops of such structures should permit unobstructed use of the area by equipment and facilitate collection of surface runoff.

7-6.1.2 An area inlet in a ponded area operates as a weir under low head situations. At higher heads, however, the grating acts as an orifice. A complete description of grates acting under weir and orifice flow is provided in Chapter 3.

7-6.1.3 Typically a grated inlet in a sloping gutter will intercept all the flow approaching the gross width of the grate opening. The size and spacing of the bars of grated inlets are influenced by the traffic and safety requirements of the local area; nevertheless, in the interest of hydraulic capacity and maintenance requirements, it is desirable that the openings be made as large as traffic and safety requirements will permit. To prevent possible clogging by debris, safety factors are required and are addressed in Chapter 3.

7-6.1.4 Grates may be made of cast iron, steel, or ductile iron; however, cast iron grates may not be used in areas where grates may be subjected to wheel loads. Reinforced concrete grates, with circular openings, may be designed for box drains. Inlet grating and frames must be designed to withstand aircraft wheel loads of the

largest aircraft using or expected to use the facility. As design loads vary, the grates should be carefully checked for load-carrying capacities. Selection of grates and frames will depend upon capacity, strength, anchoring, or the requirement for single or multiple grates. The suggested design of typical metal grates and inlets is shown in Figures 7-14 and 7-15.

7-6.1.5 Commercially manufactured grates and frames for airport loadings have been designed specifically for airport loadings from 50 to 250 lb/in^2. Hold-down devices have also been designed and are manufactured to prevent grate displacement by aircraft traffic. If manufactured grates are used, the vendor must certify the design load capacity. All grates to be used under loaded conditions should be delivered without paintings or coatings to allow for inspection of cracks and other imperfections prior to installation.

7-6.1.6 For rigid concrete pavements, grates may be protected by expansion joints around the inlet frames. Construction joints, which match or are equal to the normal spacing of joints, may be required around the drainage structure. The slab around the drainage structure should include steel reinforcements to control cracking outwardly from each corner of the inlet.

7-6.2 Ladders. Adequate ladders should be provided to assure that rapid entrance and egress may be made by personnel during an inspection of facilities. Ladder rungs should be checked periodically since they are often lost in the course of regular inspection and maintenance work. Fixed ladders will be provided depending on the depth of the structures. DOD projects require ladders on all structures over 12 feet in depth. Access to manhole and junction boxes without fixed ladders will be by portable ladders.

Figure 7-14. Examples of Typical Inlet Grates

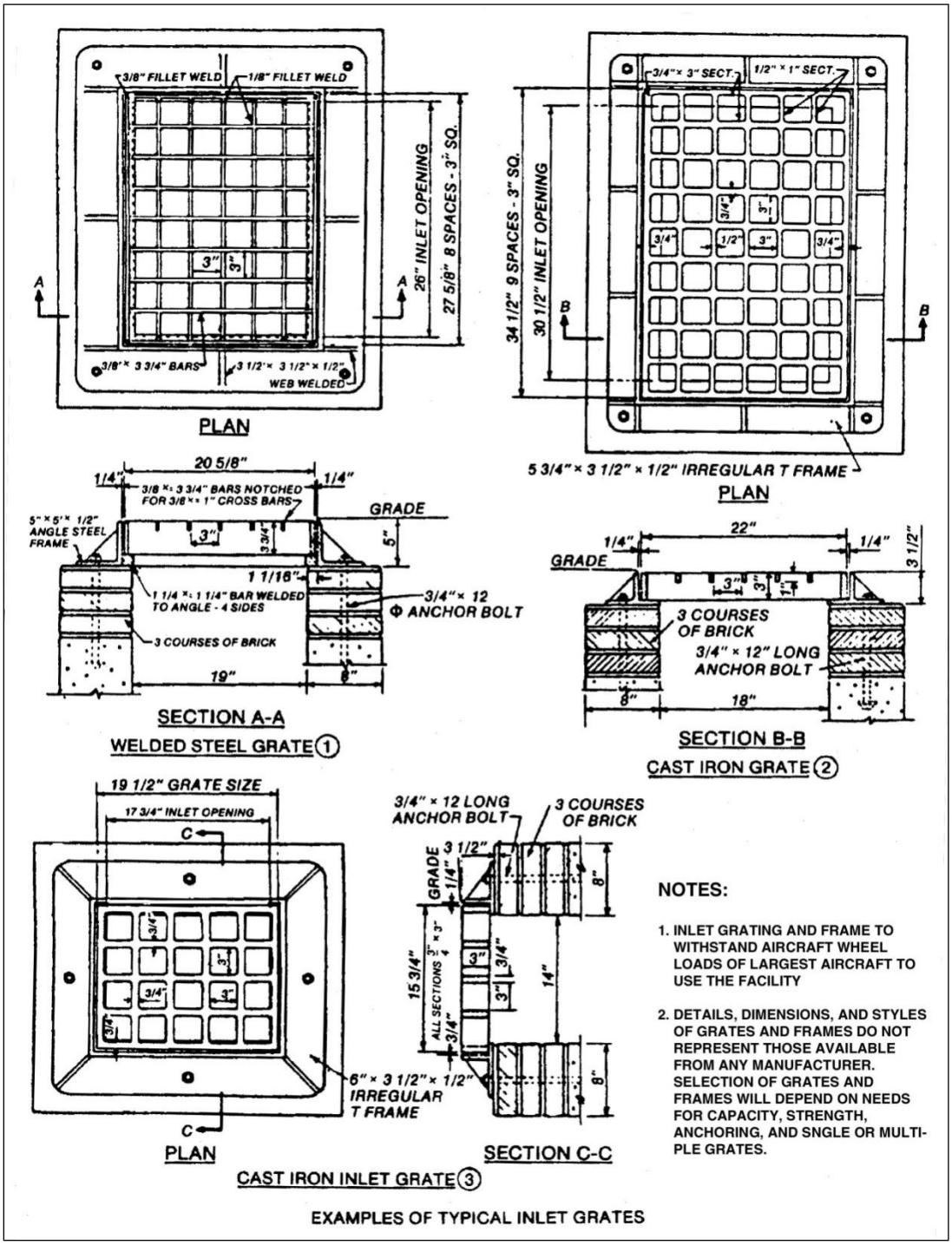
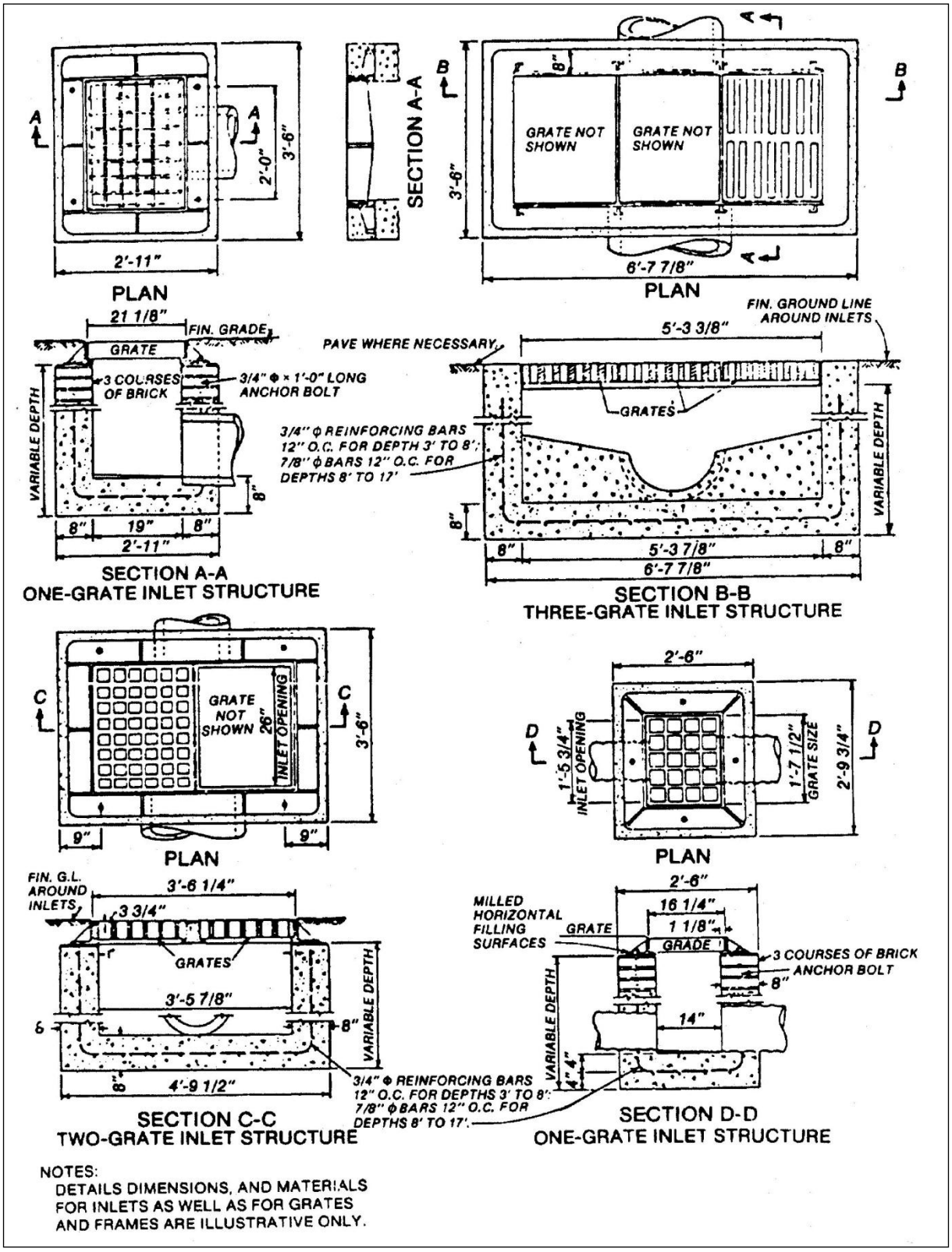


Figure 7-15. Examples of Inlet Design



7-6.3 Steps. Steps are intended to provide a means of convenient access to manholes. Where access steps are provided, each step should be designed to comply with Occupational Safety and Health Administration (OSHA) requirements. The steps should be corrosion resistant. Steps coated with neoprene or epoxy or steps fabricated from rust-resistant material such as stainless steel or aluminum coated with bituminous paint are preferable. Steps made from reinforcing steel are absolutely unacceptable.

Note that some agencies have abandoned the use of manhole steps in favor of having maintenance personnel supply their own ladders. Reasons for this include danger from rust-damaged steps and the desire to restrict access. In addition, DOD does not recommend the use of steps on any structure.

7-7 SPECIAL DESIGN CONSIDERATIONS FOR AIRFIELDS.

7-7.1 Overview. Structures built in connection with airport drainage are similar to those used in conventional construction, but these structures must be capable of supporting the heaviest design aircraft wheel load. Although standard-type structures are usually adequate for roads, special structures will be needed occasionally.

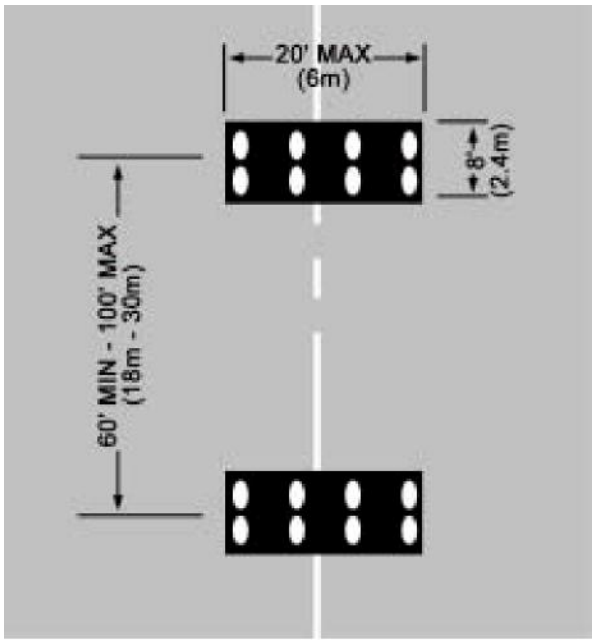
Future heavy aircraft may increase point loadings on some structures (e.g., manhole covers), while on other structures the entire aircraft weight may be imposed on a deck span, pier, or footing (e.g., overpasses). Strengthening of drainage structures after the initial construction may prove extremely difficult, costly, and time consuming.

7-7.2 Recommended Design Parameters

7-7.2.1 **Structural Considerations.** For many drainage structures, the design load is highly dependent upon the aircraft gear configuration. While the exact gear configuration of future heavy aircraft is unknown, three basic gear configurations will be used to design for future heavy loads: Type A – Bicycle; Type B – Tricycle; and Type C – Tricycle. The three basic gear configurations for future heavy aircraft come from FAA AC 150/5320-6*.* For a given aircraft gross weight, each of the three basic gear configurations will be used in the design of each drainage component. Then, for each drainage component, the basic gear configuration that results in the most conservative design will be selected as the design gear configuration for that component. For purposes of design, each of the three basic configurations contains two wheel groups of eight wheels each (sixteen wheels per aircraft). Each wheel group occupies an area of 20 feet by either 6 feet or 8 feet, with each wheel group supporting one-half of the aircraft gross weight. Wheel prints are uniformly spaced within each of the respective wheel groups. Nose gears are not considered in the design, except as they occur in the static load.

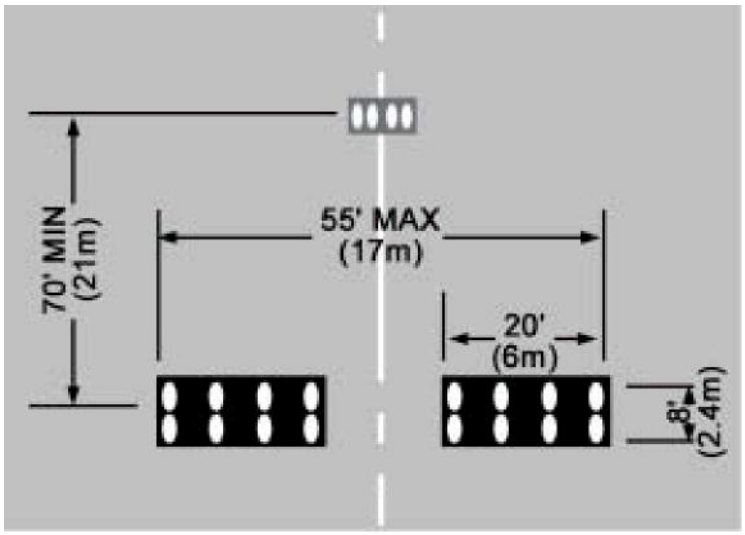
7-7.2.1.1 **Type A – Bicycle.** The Type A – Bicycle configuration (Figure 7-16) consists of two wheel groups located along a single line parallel to the primary aircraft axis (i.e., parallel to the line of travel), but with the major axis of each wheel group oriented perpendicular to the primary aircraft axis.

Figure 7-16. Type A – Bicycle Gear Configuration



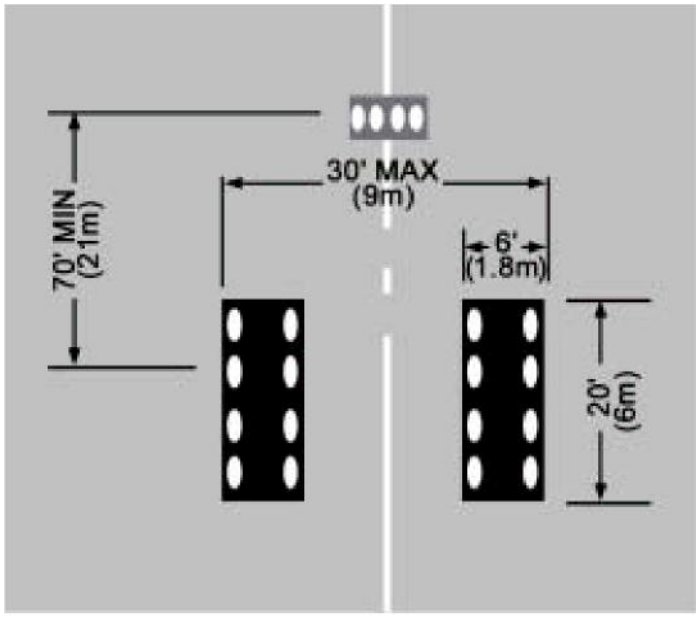
7-7.2.1.2 **Type B – Tricycle.** The Type B – Tricycle configuration (Figure 7-17) includes a nose gear and has wheel groups whose major axes are coincident and perpendicular to the major aircraft axis.

Figure 7-17. Type B – Tricycle Gear Configuration



7-7.2.1.3 **Type C – Tricycle.** The Type C – Tricycle configuration (Figure 7-18) includes a nose gear and has wheel groups whose major axes are parallel to, and equidistant from, the principal aircraft axis.

Figure 7-18. Type C – Tricycle Gear Configuration



7-7.2.2 **Loads.** All loads discussed in this UFC are to be considered as dead load (DL) plus live loads (LL). The design of structures subject to direct wheel loads should also anticipate braking loads as high as 0.7 g (for no-slip brakes).

7-7.2.3 **Direct Loading.** Decks and covers subject to direct heavy aircraft loading, such as manhole covers, inlet grates, utility tunnel roofs, and bridges, should be designed for these loadings:

7-7.2.3.1 Manhole covers for 100-kip wheel loads with tire pressure of 250 lb/in^2.

7-7.2.3.2 For spans of 2 feet or less in the least direction, apply a uniform live load of 250 lb/in^2.

7-7.2.3.3 For spans greater than 2 feet in the least direction, the design will be based on the number of wheels that will fit the span. Wheel loads of 50 to 75 kip should be considered.

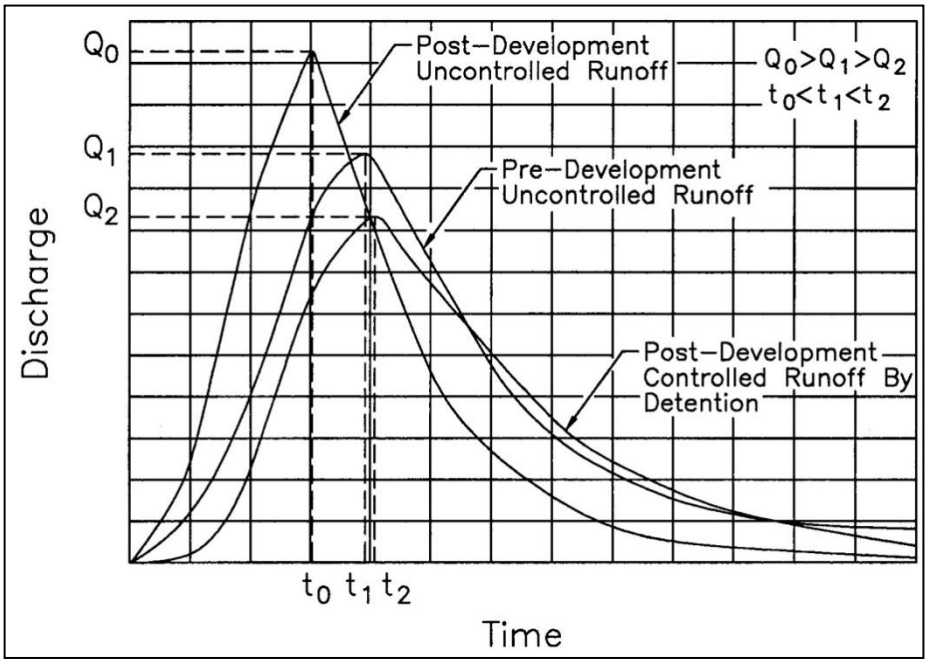
7-7.2.3.4 For structures that will be required to support both in-line and directional traffic lanes such as diagonal taxiways or apron taxi routes, load transfer at expansion joints will not be considered in the design process; however, if specific knowledge about the long-term load transfer characteristics of a particular feature supports the use of load transfer in the design of a particular drainage structure, then an exception is allowed and load transfer will be considered.

CHAPTER 8

STORM WATER CONTROL FACILITIES

8-1 GENERAL. Many land development activities, including the construction of roads and airports, convert natural pervious areas to impervious areas. These activities cause increased runoff because infiltration is reduced, the surface is usually smoother, allowing more rapid drainage, and depression storage is usually reduced. In addition, natural drainage systems are often replaced by lined channels, storm drains, and curb-and-gutter systems. These man-made systems produce an increase in runoff volume and peak discharge as well as a reduction in the time to peak of the runoff hydrograph. This concept is illustrated by the hydrograph in Figure 8-1.

Figure 8-1. Hydrograph Schematic



8-1.1 Storage and Detention/Retention Benefits. The temporary storage or detention/retention of excess storm water runoff as a means of controlling the quantity and quality of storm water releases is a fundamental principle in storm water management and a necessary element of many storm drainage systems. Previous concepts that called for the rapid removal of storm water runoff from developed areas, usually by downstream channelization, are now being combined with methods for storing storm water runoff to prevent overloading of existing downstream drainage systems. The storage of storm water can reduce the frequency and extent of downstream flooding, soil erosion, sedimentation, and water pollution. Detention/retention facilities also have been used to reduce the costs of large storm drainage systems by reducing the required size for downstream storm drain conveyance systems. The use of detention/retention facilities can reduce the peak discharge from a given watershed, as shown in Figure 8-1. The reduced post-development runoff hydrograph is typically designed so that the peak flow is equal

to or less than the pre-developed runoff peak flow rate. Additionally, the volume of the post-development hydrograph is the same as the volume of the reduced post-development runoff hydrograph. Specific design criteria, detailed design guidance, and example problems that address storm water management are provided in Chapter 8 of HEC-22.

8-1.2 Design Objectives

8-1.2.1 One of the fundamental objectives of storm water management is to maintain the peak runoff rate from a developing area at or below the pre-development rate to control flooding, soil erosion, sedimentation, and pollution. Design criteria related to pollution control are presented in Chapter 11.

8-1.2.2 Specific design criteria for peak flow attenuation are typically established by local government bodies. Some jurisdictions also require that flow volume be controlled to pre-development levels as well. Controlling flow volume is only practical when site conditions permit infiltration. To compensate for the increase in flow volume, some jurisdictions require that the peak post-development flow be reduced to below pre-development levels.

8-1.2.3 When storm water management first became common, most detention/ retention facilities were designed for control of runoff from only a single storm frequency. Typically, 2-year, 10-year, or 100-year storms were selected as the controlling criteria. However, single storm criteria have been found rather ineffective since such a design may provide little control of other storms. For example, design for the control of frequent storms (low return periods) provides little attenuation of less frequent but much larger storm events. Similarly, design for less frequent large storms provides little attenuation for the more frequent smaller storms. Some jurisdictions now enforce multiple-storm regulatory criteria that dictate that multiple storm frequencies be attenuated in a single design. A common criteria would be to regulate the 2-year, 10-year, and 100-year events.

8-2 ISSUES RELATED TO STORM WATER QUANTITY CONTROL FACILITIES.

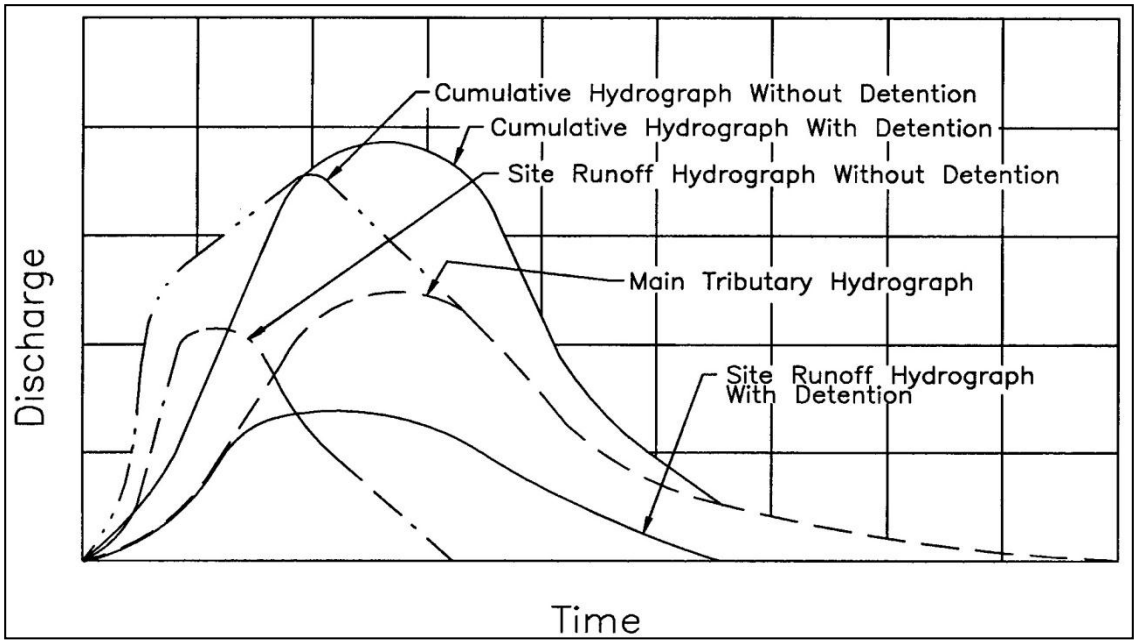
Three potential problem areas are associated with the design of storm water quantity control facilities, and these problem areas must be considered during design. They are release timing, safety, and maintenance.

8-2.1 Release Timing. The timing of releases from storm water control facilities can be critical to the proper functioning of overall storm water systems. As illustrated in Figure 8-1, storm water quantity control structures reduce the peak discharge and increase the duration of flow events. Though this is the desired result for flow tributary to an individual storm water control facility, this shifting of flow peak times and durations in some instances can cause adverse effects downstream.

For example, where the drainage area being controlled is in a downstream portion of a larger watershed, delaying the peak and extending the recession limb of the hydrograph may result in a higher peak on the main channel. As illustrated in

Figure 8-2, this can occur if the reduced peak on the controlled tributary watershed is delayed in such a way that it reaches the main stream at or near the time of its peak. On occasions, it has also been observed that in locations where multiple detention facilities have been installed within developing watersheds, downstream storm flooding problems continue to be noticed. In both of these cases, the natural timing characteristics of the watershed are not being considered, and are not being duplicated by the uncoordinated use of randomly located detention facilities. It is critical that release timing be considered in the analysis of storm water control facilities to ensure the desired result.

Figure 8-2. Example of a Cumulative Hydrograph with and without Detention



8-2.2 Safety

8-2.2.1 In the design of water quantity control facilities, it is important to consider the possibility that people may be attracted to the site, regardless of whether or not the site or structure is intended for their use. It is important to design and construct inflow and outflow structures with safety in mind. Considerations for promoting safety include preventing public trespass, providing emergency escape aids, and eliminating other hazards.

8-2.2.2 Removable, hydraulically-efficient grates and bars may be considered for all inlet and outlet pipes, particularly if they connect with an underground storm drain system and/or they present a safety hazard. Fences may be needed to enclose ponds.

8-2.2.3 Where active recreation areas are incorporated into a detention basin, very mild bottom slopes should be used along the periphery of the storage pond. Ideally, detention basins should be located away from busy streets and intersections. Outflow structures should be designed to limit flow velocities at points where people could be

drawn into the discharge stream. Persons who enter a detention pond or basin during periods when storm water is being discharged may be at risk. The force of the currents may push a person into an outflow structure or may hold a victim under the water where a bottom discharge is used. Several design precautions intended to improve safety are addressed in other storm water publications.

8-2.2.4 In the case of airfields, give special consideration to the attraction of wildlife to the facility. Waterfowl, in particular, create a significant safety hazard to aircraft and therefore must be considered during the design phase. For more information on waterfowl hazards, refer to AFPAM 91-212 or FAA AC 150/5200-33.

8-2.3 Maintenance. Storm water management facilities must be properly maintained if they are to function as intended over a long period of time. Certain types of maintenance tasks should be performed periodically to ensure that storm water management facilities function properly:

- Inspections: Storm water storage facilities should be inspected periodically for the first few months after construction and on an annual basis thereafter. In addition, these facilities should be inspected during and after major storm events to ensure that the inlet and outlet structures are still functioning as designed, and that no damage or clogging has occurred.

- Mowing: Impoundments should be mowed at least twice a year to discourage woody growth and control weeds.

- Sediment, Debris and Litter Control: Accumulated sediment, debris, and litter should be removed from detention facilities at least twice a year. Particular attention should be given to removing sediment, debris, and trash around outlet structures to prevent clogging of the control device.

- Nuisance Control: Standing water or soggy conditions within the lower stage of a storage facility can create nuisance conditions such as odors, insects, and weeds. Allowance for positive drainage during design will minimize these problems. Additional control can be provided by periodic inspection and debris removal, and by ensuring that outlet structures are kept free of debris and trash.

- Structural Repairs and Replacement: Inlet and outlet devices and standpipe or riser structures have been known to deteriorate with time, and may have to be replaced. The actual life of a structural component will depend on individual, site-specific criteria, such as soil conditions.

8-3 STORAGE FACILITY TYPES. Storm water quantity control facilities can be classified by function as either detention or retention facilities. The primary function of detention is to store and gradually release or attenuate storm water runoff by way of a control structure or other release mechanism. True retention facilities provide for storage of storm water runoff, and release via evaporation and infiltration only.

Retention facilities that provide for slow release of storm water over an extended period of several days or more are referred to as extended detention facilities.

8-3.1 Detention Facilities

8-3.1.1 The detention concept is most often employed in highway and municipal storm water management plans to limit the peak outflow rate to that which existed from the same watershed before development for a specific range of flood frequencies. Detention storage may be provided at one or more locations and may be both above or below ground. These locations may exist as impoundments, collection and conveyance facilities, underground tanks, and on-site facilities such as parking lots, pavements, and basins. The facility may have a permanent pool, known as a wet pond. Wet ponds are typically used where pollutant control is important. Detention ponds are the most common type of storage facility used for controlling storm water runoff peak discharges. The majority of these are dry ponds that release all the runoff temporarily detained during a storm.

8-3.1.2 Detention facilities should be provided only where they are shown to be beneficial by hydrologic, hydraulic, and cost analysis. Additionally, some detention facilities may be required by ordinances and should be constructed as deemed appropriate by the governing agency. Specific design guidance and criteria for detention storage apply:

- Design rainfall frequency, intensity, and duration must be consistent with applicable standards and local requirements.

- The facility's outlet structure must limit the maximum outflow to allowable release rates. The maximum release rate may be a function of existing or developed runoff rates, downstream channel capacity, potential flooding conditions, and/or local ordinances.

- The size, shape, and depth of a detention facility must provide sufficient volume to satisfy the project's storage requirements. This is best determined by routing the inflow hydrograph through the facility. HEC-22, Chapter 8, outlines techniques that can be used to estimate an initial storage volume, and provides an explanation of storage routing techniques.

- An auxiliary outlet must be provided to allow overflow that may result from excessive inflow or clogging of the main outlet. This outlet should be positioned such that overflows will follow a predetermined route. Preferably, such outflows should discharge into open channels, swales, or other approved storage or conveyance features.

- The system must be designed to release excess storm water expeditiously to ensure that the entire storage volume is available for subsequent storms and to minimize hazards. A dry pond, which is a facility with no permanent pool,

may need a paved low flow channel to ensure complete removal of water and to aid in nuisance control.

- The facility must satisfy Federal and state statutes and recognize local ordinances. Some of these statutes are the Federal Water Pollution Control Act, the Water Quality Act, and other Federal, state, and local regulations.

- Access must be provided for maintenance.

- If the facility will be an "attractive nuisance" or is not considered reasonably safe, it may have to be fenced and/or signed.

8-3.2 Retention Facilities

8-3.2.1 Retention facilities as defined here include extended detention facilities, infiltration basins, and swales. In addition to storm water storage, retention may be used for water supply, recreation, pollutant removal, aesthetics, and/or groundwater recharge. As explained in Chapter 11, infiltration facilities provide significant water quality benefits, and although groundwater recharge is not a primary goal of highway storm water management, the use of infiltration basins and/or swales can provide this secondary benefit.

8-3.2.2 Retention facilities are typically designed to provide the dual functions of storm water quantity and quality control. These facilities may be provided at one or more locations and may be either above or below ground. These locations may exist as impoundments, collection and conveyance facilities (swales or perforated conduits), and on-site facilities such as parking lots and roadways using pervious pavements.

8-3.2.3 Design criteria for retention facilities are the same as those for detention facilities except that it may not be necessary to remove all runoff after each storm. Additional criteria should be applied, however. See paragraphs 8-3.3 and 8-3.4 for this criteria.

8-3.3 Wet Pond Facilities

- Wet pond facilities must provide sufficient depth and volume below the normal pool level for any desired multiple use activity.

- Shoreline protection should be provided where erosion from wave action is expected.

- The design should include a provision for lowering the pool elevation or draining the basin for cleaning purposes, shoreline maintenance, and emergency operations.

- Any dike or dam must be designed with a safety factor commensurate with an earth dam and/or as set forth in state statutes.

- Safety benching should be considered below the permanent water line at the toe of steep slopes to guard against accidental drowning.

8-3.4 Infiltration Facilities

- A pervious bottom is necessary to ensure sufficient infiltration capability to drain the basin in a reasonable amount of time so that it will have the capacity needed for another event.

- Because of the potential delay in draining the facility between events, it may be necessary to increase the emergency spillway capacity and/or the volume of impoundment.

- Detailed engineering geological studies are necessary to ensure that the infiltration facility will function as planned.

- Particulates from the inflow should be removed so they do not settle and preclude infiltration.

  The FHWA's TS-80-218 is recommended for additional information on underground detention and retention facilities.

CHAPTER 9

PIPE SELECTON, BEDDING AND BACKFILL

9-1 GENERAL. A drainage pipe is defined as a structure (other than a bridge) to convey water through a trench or under a fill or some other obstruction. Materials for permanent-type installations include non-reinforced concrete, reinforced concrete, corrugated steel, plastic, corrugated aluminum alloy, and structural plate steel pipe.

9-1.1 Pipe Selection

9-1.1.1 The selection of a suitable construction conduit will be governed by the availability and suitability of pipe materials for local conditions with due consideration of economic factors. It is desirable to permit alternates so that bids can be received with contractors' options for the different types of pipe suitable for a specific installation. Allowing alternates serves as a means of securing bidding competition. When alternate designs are advantageous, each system will be economically designed, taking advantage of full capacity, best slope, least depth, and proper strength and installation provisions for each material involved. Where field conditions dictate the use of one pipe material in preference to others, the reasons will be clearly presented in the design analysis.

9-1.1.2 Consider life cycle cost factors in selecting the type of pipe to be used in construction. The factors include strength under either maximum or minimum cover being provided, pipe bedding and backfill conditions, anticipated loadings, length of pipe sections, ease of installation, resistance to corrosive action by liquids carried or surrounding soil materials, suitability of jointing methods, provisions for expected deflection without adverse effect on the pipe structure or on the joints or overlying materials, and cost of maintenance. Although it is possible to obtain an acceptable pipe installation to meet design requirements by establishing special provisions for several possible materials, ordinarily only one or two alternates will economically meet the individual requirements for a proposed drainage system.

9-1.1.3 DOD has approved the use of plastic pipe for low volume roadway applications; however, it is not approved for use under any type of airfield pavement except for subsurface water collection and disposal. For FAA projects, plastic pipe used under airfield pavements shall comply with Item D-701, Pipe for Storm Drains and Culverts in AC 150/5370-10, Standards for Specifying Construction of Airports.

9-1.2 Selection of *n* Values. Roughness should be a considered when selecting pipe options. A designer is continually confronted with what coefficient of roughness, *n*, to use in a given situation. The question of whether *n* should be based on the new and ideal condition of a pipe or on an anticipated condition at a later date is difficult to answer. Sedimentation or paved pipe can affect the coefficient of roughness. Roughness coefficients for pipe are covered in Chapter 6.

9-1.3 Restricted Use of Bituminous-Coated Pipe. Corrugated metal pipe with any percentage of bituminous coating will not be installed where solvents can be

expected to enter the pipe. If corrugated steel is a pipe option where solvents are expected, polymeric coated corrugated steel pipe is recommended.

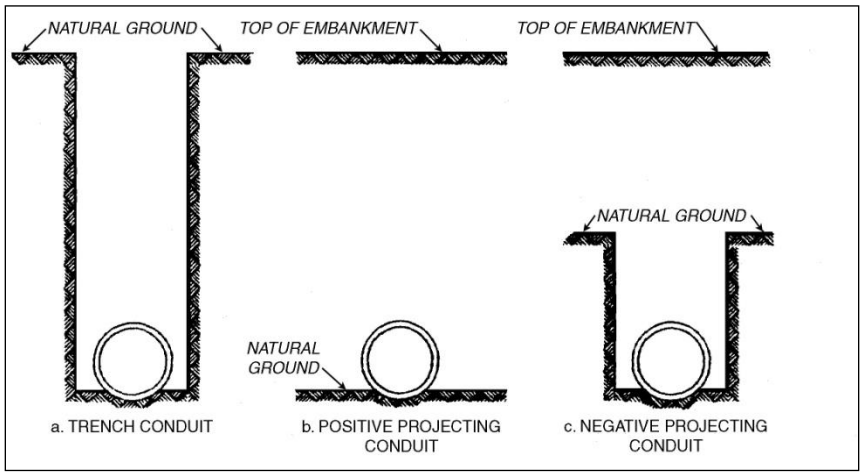
9-1.3.1 The selection of culvert materials to withstand deterioration from corrosion or abrasion will be based on these specific considerations:

9-1.3.1.1 Rigid or plastic pipes are preferable where industrial wastes, spilled petroleum products, or other substances harmful to bituminous paving and coating in corrugated metal pipe are apt to be present. Concrete pipe typically should not be used where soil is more acidic than pH 5.5 or where the fluid carried has a pH less than 5.5 or higher than 9.0. High density polyethylene (HDPE) pipe is unaffected by acidic or alkaline soil conditions. Concrete pipe can be engineered to perform very satisfactorily in the more severe acidic or alkaline environments. Type II or Type V cements should be used where soils and/or water have a moderate or high sulfate concentration, respectively. High-density concrete pipe is recommended when the culvert will be subject to tidal drainage and saltwater spray. Where highly corrosive substances are to be carried, the resistive qualities of vitrified clay pipe or plastic-lined concrete pipe should be considered.

9-1.3.1.2 Corrugated steel pipe will be galvanized and generally will be bituminous coated for permanent installations. Bituminous coating or polymeric coating is recommended for corrugated steel pipe subjected to stagnant water; where dense decaying vegetation is present to form organic acids; where there is continuous wetness or continuous flow; and in well-drained, normally dry, alkali soils. The polymeric-coated pipe is not damaged by spilled petroleum products or industrial wastes. Corrugated aluminum alloy pipe, fabricated in all of the shapes and sizes of the more familiar corrugated steel pipe, evidences corrosion resistance in clear granular materials even when subjected to sea water. Corrugated aluminum pipe will not be installed in soils that are highly acid (pH less than 5) or alkaline (pH greater than 9), or in metallic contact with other metals or metallic deposits, or where known corrosive conditions are present or where bacterial corrosion is known to exist. Similarly, this type pipe will not be installed in material classified as OH (organic clays of medium to high plasticity, organic silts) or OL (organic silts and organic silty clays of low plasticity) according to the Unified Soil Classification System (ASTM D2487). Although bituminous coatings can be applied to aluminum alloy pipe, such coatings do not afford adequate protection (bituminous adhesion is poor) under the aforementioned corrosive conditions. Suitable protective coatings for aluminum alloy have been developed but are not economically feasible for culverts or storm drains. When considering a coating for use, performance data from users in the area can be helpful. Performance history indicates various successes or failures of coatings and their probable cause, and such histories are available from local highway departments.

9-1.4 Classes of Bedding and Installation. Figures 9-1 through 9-4 indicate the classes of bedding for conduits. Figure 9- 5 is a schematic representation of the subdivision of classes of conduit installation that influence loads on underground conduits.

Figure 9-1. Three Main Classes of Conduits



9-1.5 Strength of Pipe. Pipe shall be considered of ample strength when it meets the conditions specified for the loads indicated in Tables 9-1 through 9-7. When railway or vehicular wheel loads or loads due to heavy construction equipment (live loads, LL) impose heavier loads, or when the earth (or dead loads, DL) vary materially from those normally encountered, these tables cannot be used for pipe installation design and separate analyses must be made. The suggested minimum and maximum cover shown in the tables pertain to pipe installations in which the backfill material is compacted to at least 90 percent of ASTM D1557 or AASHTO T99 density (100 percent for cohesionless sands and gravels). This does not modify requirements for any greater degree of compaction specified for other reasons. It is emphasized that proper bedding, backfilling, compaction, and prevention of infiltration of backfill material into pipe are important not only to the pipe, but also to protect overlying and nearby structures. When in doubt about minimum and maximum cover for local conditions, a separate cover analysis must be performed.

9-1.6 Rigid Pipe. Tables 9-1 and 9-2 indicate maximum and minimum cover for trench conduits employing pipe and concrete pipe. If positive projecting conduits are employed, they are installed in shallow bedding with a part of the conduit projecting above the surface of the natural ground and then covered with an embankment. Due allowance will be made in amounts of minimum and maximum cover for positive projecting conduits. Table 9-8 suggests guidelines for minimum cover to protect the pipe during construction and the minimum finished height of cover.

Figure 9-2. Free-Body Conduit Diagrams

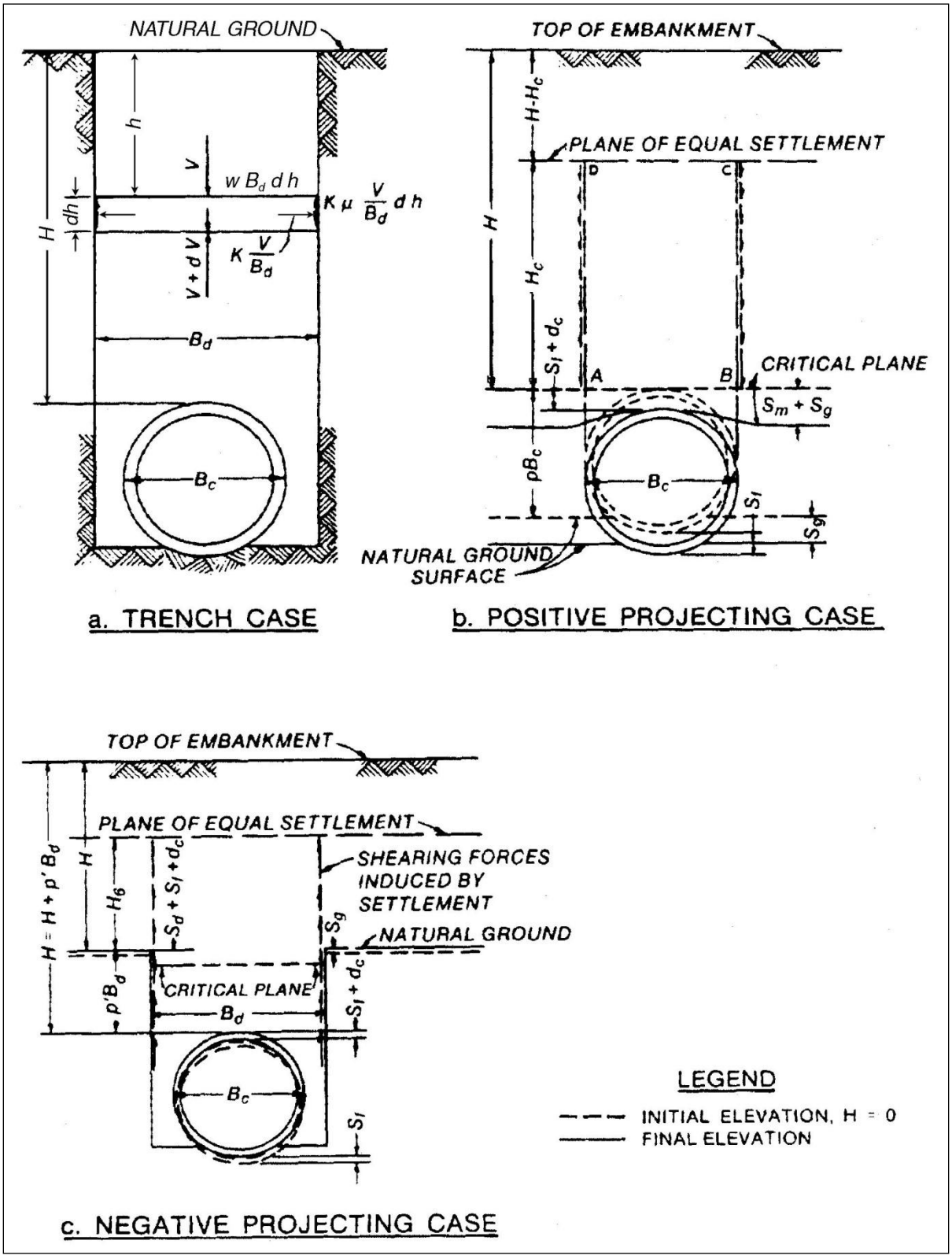
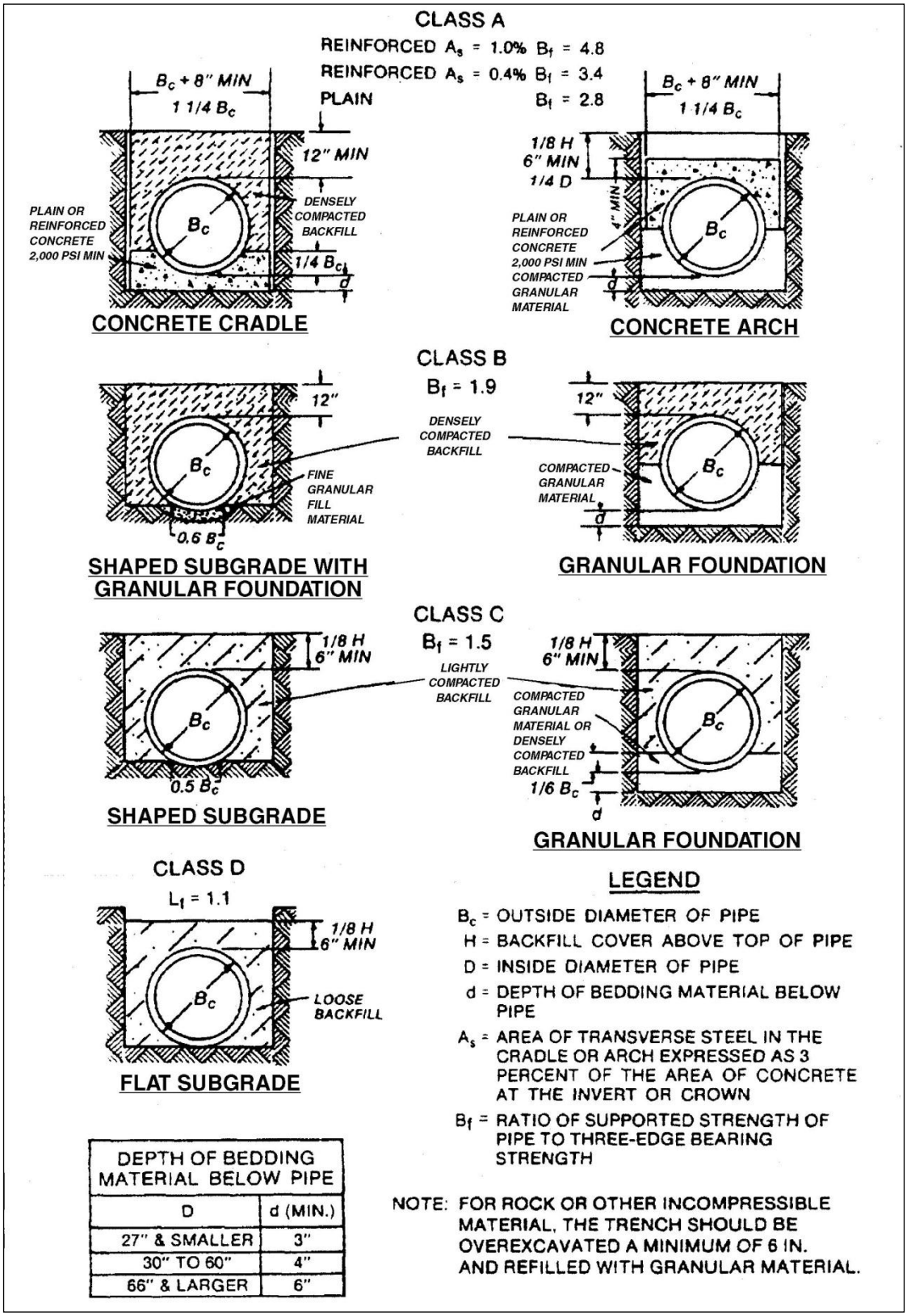


Figure 9-3. Trench Beddings for Circular Pipe



DEPTH OF BEDDING MATERIAL BELOW PIPE	
D	d (MIN.)
27" & SMALLER	3"
30" TO 60"	4"
66" & LARGER	6"

Figure 9-4. Beddings for Positive Projecting Conduits

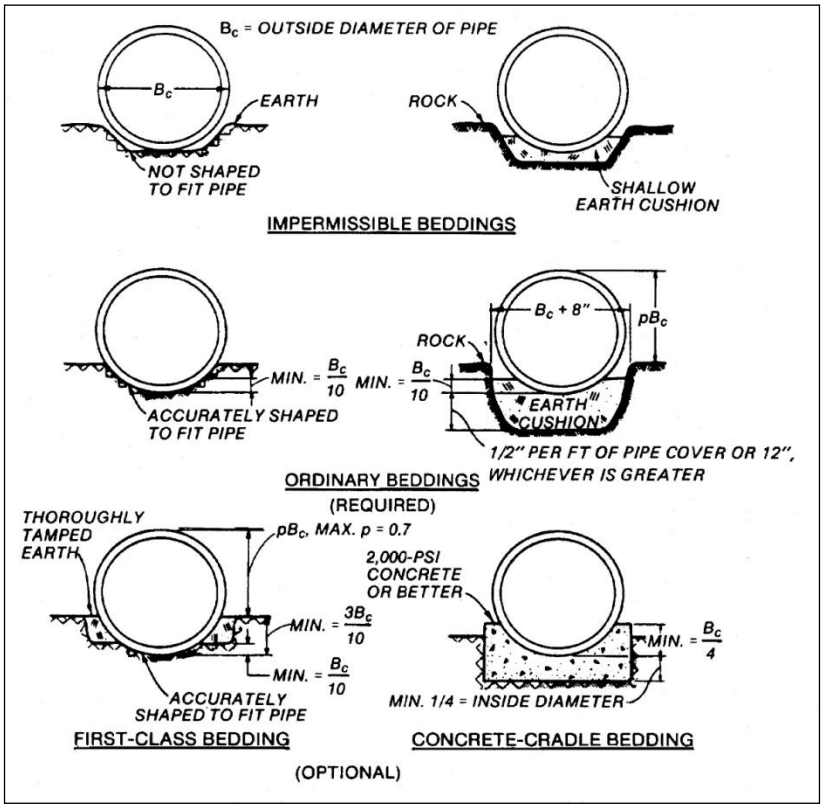


Figure 9-5. Installation Conditions that Influence Loads on Underground Conduits

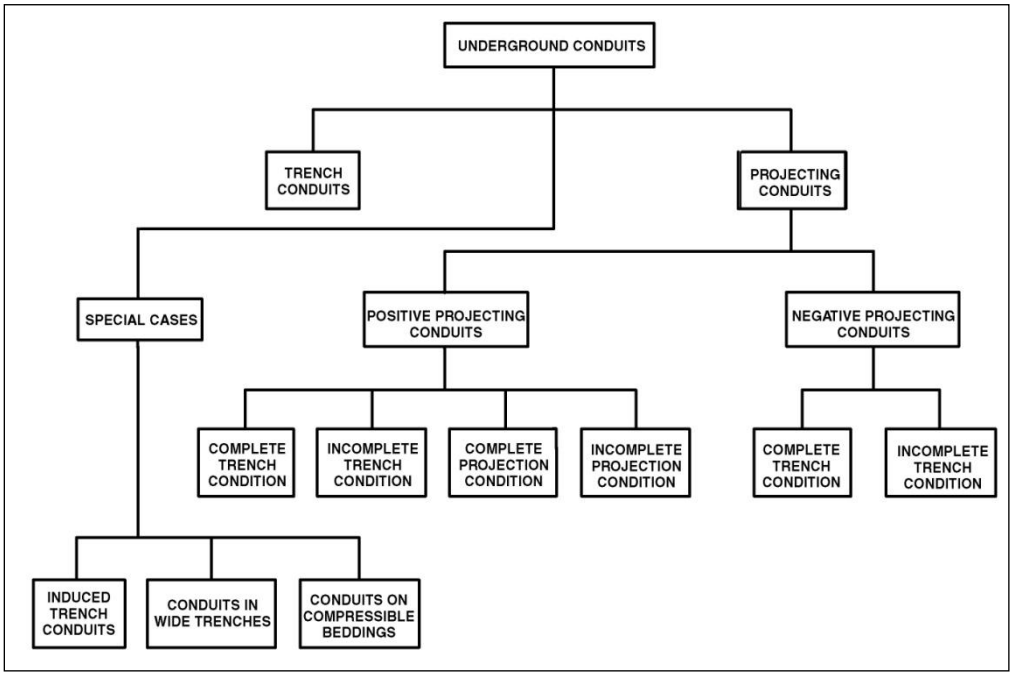


Table 9-1. Suggested Maximum Cover Requirements for Concrete Pipe, Reinforced Concrete, H-20 Highway Loading*

Diameter, inch	Suggested Maximum Cover Above Top of Pipe, feet				
	Circular Section				
	Class				
	1500	2000	2500	3000	3750
12	9	13	16	19	24
24	10	13	17	19	24
36	10	13	17	20	25
48	10	13	17	20	25
60	10	14	17	20	25
72	10	14	17	20	25
84	11	14	17	21	24
108	11	14	17	21	26
Non-reinforced Concrete					
Diameter, inch	**Suggested Maximum Cover Above Top of Pipe, feet**				
	Circular Section				
	I	**II**	**III**		
12	14	14	17		
24	13	13	14		
36	9	12	12		

*Source: U.S. Army Corps of Engineers

Notes:

1. The suggested values shown are for average conditions and are to be considered as guidelines only for dead load plus H-20 live load.
2. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
3. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
4. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
5. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
6. “D” loads listed for the various classes of reinforced-concrete pipe are the minimum required 3-edge test loads to produce ultimate failure in pounds per linear foot of interval pipe diameter.
7. Each diameter pipe in each class designation of non-reinforced concrete has a different D-load value that increases with wall thickness.
8. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, cover depths may be adjusted accordingly.
9. See Table 9-9 for suggested minimum cover requirements.

Table 9-2. Suggested Maximum Cover Requirements for Corrugated Aluminum Alloy Pipe, Riveted, Helical, or Welded Fabrication 2.66-inch Spacing, 0.5-inch-Deep Corrugations, H-20 Highway Loading*

Diameter, inch	Suggested Maximum Cover Above Top of Pipe, feet									
	Circular Section					Vertically Elongated Section				
	Thickness, inch					Thickness, inch				
	.060	.075	.105	.135	.164	.060	.075	.105	.135	.164
12	50	50	86	90	93					
15	40	40	69	72	74					
18	33	33	57	60	62					
24	25	25	43	45	46					
30	20	20	34	36	37					
36	16	16	28	30	31					
42	16	16	28	30	31			50	52	53
48			28	30	31			43	45	47
54			28	30	31					
60				30	31					
66					31					
72					31					

*Source: U.S. Army Corps of Engineers

Notes:

1. Corrugated aluminum alloy pipe will conform to the requirements of ASTM B745/B745M.
2. The suggested values shown are for average conditions and are guidelines only for dead load plus H-20 live load. Cooper E-80 railway loadings should be independently made.
3. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
4. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads.
5. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
6. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
7. Vertical elongation will be accomplished by shop fabrication and will usually be 5 percent of the pipe diameter.
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-3. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 2.66-inch Spacing, 0.5-inch-Deep Corrugations*

H-20 Highway Loading						
Suggested Maximum Cover Above Top of Pipe, feet						
Diameter, inch	Helical – Thickness, inch					
	.052	.064	.079	.109	.138	.168
12	170	213	266	372		
15	136	170	212	298		
18	113	142	173	212		
21	97	121	139	164		
24	85	106	120	137	155	
27	75	94	109	120	133	
30	68	85	101	110	119	
36	56	71	88	98	103	
42	48	60	76	92	95	99
48		53	66	88	91	93
54			59	82	88	90
60				74	86	87
66					85	86
72					79	85
78						84
84						75

*Source: U.S. Army Corps of Engineers

Notes:

1. Corrugated steel pipe will conform to the requirements of ASTM A760/A760M, ASTM A761/A761M, ASTM A762/A762M, and ASTM A849.
2. The suggested maximum heights of cover shown in the tables are calculated on the basis of the current AASHTO *Standard Specifications for Highway Bridges* and are based on circular pipe.
3. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
4. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
5. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
6. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
7. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, then cover depths may be adjusted accordingly.
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-4. Suggested Maximum Cover Requirements for Structural Plate Aluminum Alloy Pipe, 9-inch Spacing, 2.5-inch Corrugations*

H-20 Highway Loading							
Diameter, inch	Suggested Maximum Cover Above Top of Pipe, feet						
	Circular Section						
	Thickness, inch						
	0.10	0.125	0.15	0.175	0.20	0.225	0.250
72	24	32	41	48	55	61	64
84	20	27	35	41	47	52	55
96	18	24	30	36	41	45	50
108	16	21	27	32	37	40	44
120	14	19	24	29	33	36	40
132	13	17	22	26	30	33	36
144	12	16	20	24	27	30	33
156		14	18	22	25	28	30
168		13	17	20	23	26	28
180			16	19	22	24	26

*Source: U.S. Army Corps of Engineers

Notes:

1. Structural plate aluminum alloy pipe will conform to the requirements of ASTM B745/B745M.
2. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
3. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
4. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
5. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
6. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, cover depths may be adjusted accordingly.
7. See Table 9-9 for suggested minimum cover requirements.

Table 9-5. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 5-inch Span, 1-inch-Deep Corrugations*

H-20 Highway Loading					
Diameter, inch	Suggested Maximum Cover Above Top of Pipe, feet				
	Helical—Thickness, inch				
	.064	.079	.109	.138	.168
48	54	68	95	122	132
54	48	60	84	109	117
60	43	54	76	98	107
66	39	49	69	89	101
72	36	45	63	81	96
78	33	41	58	75	92
84	31	38	54	70	85
90	29	36	50	65	80
96		34	47	61	75
102		32	44	57	70
108			42	54	66
114			40	51	63
120			38	49	60

*Source: U.S. Army Corps of Engineers

Notes:

1. Corrugated steel pipe will conform to the requirements of ASTM A760/A760M, ASTM A761/A761M, ASTM A762/A762M, and ASTM A849.
2. The suggested maximum heights of cover shown in the table are calculated on the basis of the current AASHTO *Standard Specifications for Highway Bridges* and are based on circular pipe.
3. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
4. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
5. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
6. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
7. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, cover depths may be adjusted accordingly.
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-6. Suggested Maximum Cover Requirements for Structural Plate Steel Pipe, 6-inch Span, 2-inch-Deep Corrugations*

H-20 Highway Loading							
Diameter, ft	Suggested Maximum Cover Above Top of Pipe, feet						
	Thickness, inch						
	.109	.138	.168	.188	.218	.249	.280
5.0	46	68	90	103	124	146	160
5.5	42	62	81	93	113	133	145
6.0	38	57	75	86	103	122	133
6.5	35	52	69	79	95	112	123
7.0	33	49	64	73	88	104	114
7.5	31	45	60	68	82	97	106
8.0	29	43	56	64	77	91	100
8.5	27	40	52	60	73	86	94
9.0	25	38	50	57	69	81	88
9.5	24	36	47	54	65	77	84
10.0	23	34	45	51	62	73	80
10.5	22	32	42	49	59	69	76
11.0	21	31	40	46	56	66	72
11.5	20	29	39	44	54	63	69
12.0	19	28	37	43	51	61	66
12.5	18	27	36	41	49	58	64
13.0	17	26	34	39	47	56	61
13.5	17	25	33	38	46	54	59
14.0	16	24	32	36	44	52	57
14.5	16	23	31	35	42	50	55
15.0	15	22	30	34	41	48	53
15.5	15	22	29	33	40	47	51
16.0		21	28	32	38	45	50
16.5		20	27	31	37	44	48
17.0		20	26	30	36	43	47
17.5		19	25	29	35	41	45
18.0			25	28	34	40	44
18.5			24	27	33	39	43
19.0			23	27	32	38	42
19.5			23	26	31	37	41
20.0				25	31	36	40
20.5				25	30	35	39
21.0					29	34	38
21.5					28	34	37
22.0					28	33	36
22.5					27	32	35
23.0						31	34
23.5						31	34
24.0						30	33
24.5							32
25.0							32
25.5							31

*Source: U.S. Army Corps of Engineers

Notes:

1. Corrugated steel pipe will conform to the requirements of ASTM A760/A760M, ASTM A761/A761M, ASTM A762/A762M, and ASTM A849.
2. The suggested maximum heights of cover shown in the table are calculated on the basis of the current AASHTO *Standard Specifications for Highway Bridges* and are based on circular pipe.
3. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
4. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
5. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
6. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
7. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, cover depths may be adjusted accordingly.
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-7. Suggested Maximum Cover Requirements for Corrugated Steel Pipe, 3-inch Span, 1-inch Corrugations*

H-20 Highway Loading										
Diameter, inch	Suggested Maximum Cover Above Top of Pipe, feet									
	Riveted - Thickness, inch					Helical – Thickness, inch				
	.064	.079	.109	.138	.168	.064	.079	.109	.138	.168
36	53	66	98	117	130	81	101	142	178	201
42	45	56	84	101	112	69	87	122	142	157
48	39	49	73	88	98	61	76	107	122	132
54	35	44	65	78	87	54	67	95	110	117
60	31	39	58	70	78	48	61	85	102	107
66	28	36	53	64	71	44	55	77	97	101
72	26	33	49	58	65	40	50	71	92	96
78	24	30	45	54	60	37	47	65	84	93
84	22	28	42	50	56	34	43	61	78	91
90	21	26	39	47	52	32	40	57	73	89
96		24	36	44	49		38	53	69	84
102		23	34	41	46		35	50	64	79
108			32	39	43			47	61	75
114			30	37	41			45	58	71
120			29	35	39			42	55	67

*Source: U.S. Army Corps of Engineers

Notes:

1. Corrugated steel pipe will conform to the requirements of ASTM A760/A760M, ASTM A761/A761M, ASTM A762/A762M, and ASTM A849.
2. The suggested maximum heights of cover shown in the table are calculated on the basis of the current AASHTO *Standard Specifications for Highway Bridges* and are based on circular pipe.
3. Soil conditions, trench width, and bedding conditions vary widely throughout varying climatic and geographical areas.
4. Calculations to determine maximum cover should be made for all individual pipe and culvert installations underlying roads, streets, and open storage areas subject to H-20 live loads. Cooper E-80 railway loadings should be independently made.
5. Cover depths are measured from the bottom of the subbase of pavements, or the top of unsurfaced areas, to the top of the pipe.
6. Calculations to determine maximum cover for Cooper E-80 railway loadings are measured from the bottom of the tie to the top of the pipe.
7. If pipe produced by a manufacturer exceeds the strength requirements established by indicated standards, cover depths may be adjusted accordingly.
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-8. Suggested Guidelines for Minimum Cover*

H-20 Highway Loading			
Pipe	**Minimum Cover to Protect Pipe**		**Minimum Finished Height of Cover (From Bottom of Subbase to Top of Pipe)**
	Pipe Diameter, inch	**Height of Cover During Construction, feet**	
Concrete Pipe Reinforced	12 to 108	Diameter/2 or 3.0 ft, whichever is greater	Diameter/2 or 2.0 ft, whichever is greater
Non-Reinforced	12 to 36	Diameter/2 or 3.0 ft, whichever is greater	Diameter/2 or 2.0 ft, whichever is greater
Corrugated Aluminum Pipe 2.66 inch by 0.5 inch	12 to 24 30 and over	1.5 ft Diameter	Diameter/2 or 1.0 ft, whichever is greater Diameter/2
Corrugated Steel Pipe 3 inch by 1 inch	12 to 30 36 and over	1.5 ft Diameter	Diameter/2 or 1.0 ft, whichever is greater Diameter/2
Structural Plate Aluminum Alloy Pipe 9 inch by 2.5 inch	72 and over	Diameter/2	Diameter/4
Structural Plate Steel 6 inch by 2 inch	60 and over	Diameter/2	Diameter/4

*Source: U.S. Army Corps of Engineers

Notes:
1. All values shown above are for average conditions and are guidelines only.
2. Calculations should be made for minimum cover for all individual pipe installation for pipe underlying roads, streets, and open storage areas subject to H-20 live loads.
3. Calculations for minimum cover for all pipe installations should be made separately for all Cooper E-80 railroad live loading.
4. In seasonal frost areas, minimum pipe cover must meet local code requirements for protection of storm drains.
5. Pipe placed under rigid pavement will have minimum cover from the bottom of the subbase to the top of pipe of 1.0 ft for pipe up to 60 inch and greater than 1.0 ft for sizes above 60 inch if calculations so indicate.
6. Trench widths depend upon varying conditions of construction but may be as wide as is consistent with the space required to install the pipe and as deep as can be managed from practical construction methods.
7. Non-reinforced concrete pipe is available in sizes up to 36 inch
8. See Table 9-9 for suggested minimum cover requirements.

Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 1)

CORRUGATED ALUMINUM 2 2/3" x 1/2" or 2" x 1/2" CORRUGATIONS

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. single and up to 40,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.060	2.0	2.5	2.5	2.5	3.0				
0.075	1.5	2.0	2.5	1.5	2.0	2.5	3.0		
0.105		1.5	1.5	1.5	1.5	1.5	1.5		
0.135			1.0	1.0	1.0	1.5	1.5	2.0	2.0
0.165									

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.060	2.0	2.5	2.5	2.5	3.0				
0.075	1.5	2.0	2.5	1.5	2.0	2.5	3.0		
0.105		1.5	1.5	1.5	1.5	2.0	2.5	3.0	
0.135					1.5	1.5	2.0	2.0	2.5
0.165									

AIRCRAFT WHEEL LOAD—110,000 lb. dual to 200,000 lb. dual; 190,000 lb. dt. to 350,000 lb. dt; up to 750,000 lb. ddt & 1,500,000 lb

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.060	3.0	3.0	3.0						
0.075	3.0	3.0	3.0	3.5	5.0				
0.105		2.0	2.0	2.5	3.5	4.5			
0.135				2.0	3.0	4.0	4.5	5.5	
0.165					2.5	3.5	4.0	5.0	5.5

CORRUGATED ALUMINUM 6" x 1" CORRUGATIONS

AIRCRAFT WHEEL LOAD—up to 30,000 lb. single and up to 40,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.060	2.0	2.0	2.5	3.0				
0.075	1.0	1.5	2.0	2.5	3.5			
0.105	1.0	1.0	1.5	2.0	3.0	3.5		
0.135			1.5	2.0	2.5	3.0	4.0	
0.165					2.0	2.5	3.5	4.5

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.060	2.5	3.0	3.5	4.0				
0.075	1.5	2.0	2.5	3.0	4.0			
0.105	1.5	1.5	2.0	2.5	3.5	4.0		
0.135			2.0	2.5	3.0	3.5	4.5	
0.165					2.5	3.0	4.0	5.0

AIRCRAFT WHEEL LOAD—110,000 lb. d. to 200,000 lb. d; 190,000 lb. dt. to 350,000 lb. dt.; up to 750,000 lb. ddt. & 1,500,000 lb.

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.060	4.0	4.5	5.0	5.0				
0.075	3.0	3.5	3.5	4.0	4.0			
0.105	2.0	2.0	3.0	2.5	4.0	4.5		
0.135			2.5	3.0	3.5	4.0	5.0	
0.165					3.0	3.5	4.5	5.5

CLAY

AIRCRAFT WHEEL LOAD—up to 30,000 lb. single and up to 40,000 lb. dual

Pipe type	Pipe diameter (in.)								
	6	10	12	15	18	21	24	30	36
Std. strength clay	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Extra strength clay	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Pipe type	Pipe diameter (in.)								
	6	10	12	15	18	21	24	30	36
Std. strength clay	4.0	5.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Extra strength clay	2.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

ASBESTOS CEMENT

AIRCRAFT WHEEL LOAD—up to 30,000 lb. single and up to 40,000 lb. dual

Asbestos cement-class	Pipe diameter (in.)								
	6	10	12	16	18	24	30	36	42
1500	2.5	2.5	2.5	2.5					
2400	2.5	2.5	2.5	2.5	2.5	2.5			
3300	1.5	1.5	1.5	1.5	1.5	1.5	1.5		
4000		1.5	1.5	1.5	1.5	1.5	1.5	1.5	
5000		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
6000								1.0	1.0
7000								1.0	1.0

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Asbestos cement-class	Pipe diameter (in.)								
	6	10	12	16	18	24	30	36	42
1500	5.5	5.5	5.5	5.5					
2400	6.0	6.0	6.0	6.0	6.0	6.0			
3300	3.5	3.5	3.5	3.5	3.5	3.5			
4000		3.5	3.5	3.5	3.5	3.5	3.5	3.5	
5000		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
6000								2.5	2.5
7000								2.5	2.5

Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 2)

CORRUGATED STEEL 2 2/3" x 1/2" CORRUGATIONS

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. single and up to 40,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.052	1.0	1.0	1.5	1.5					
0.064	1.0	1.0	1.0	1.5	1.5				
0.079	1.0	1.0	1.0	1.5	1.5	1.5			
0.109			1.0	1.0	1.0	1.0	1.5		
0.138				1.0	1.0	1.0	1.0	1.5	
0.168				1.0	1.0	1.0	1.0	1.5	1.5

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.052	1.5	2.0	2.0	2.5					
0.064	1.5	1.5	2.0	2.5	2.5				
0.079	1.5	1.5	2.0	2.5	2.5	2.5			
0.109			1.5	2.0	2.0	2.0	2.5		
0.138				2.0	2.0	2.0	2.0	2.5	
0.168				2.0	1.5	2.0	2.0	2.0	2.5

AIRCRAFT WHEEL LOAD—110,000 lb. dual to 200,000 lb. dual; 190,000 lb. dt. to 350,000 lb. dt.; up to 750,000 lb. ddt.

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.052	2.0	2.5	3.0	3.0					
0.064	2.0	2.5	2.5	3.0	3.0				
0.079	2.0	2.0	2.5	2.5	2.5	3.0			
0.109			2.0	2.5	2.5	2.5	3.0		
0.138				2.0	2.0	2.5	3.0	3.0	
0.168				2.0	2.0	2.5	3.0	3.0	3.0

AIRCRAFT WHEEL LOAD—Up to 1,500,000 lb.

Metal thickness (in.)	Pipe diameter (in.)								
	12	18	24	36	48	60	72	84	96
0.052	2.5	2.5	3.0	3.0					
0.064	2.5	2.5	2.5	3.0	3.0				
0.079	2.5	2.5	2.5	2.5	2.5	3.0			
0.109			2.5	2.5	2.5	2.5	3.0		
0.138				2.5	2.5	2.5	3.0	3.0	
0.168				2.5	2.5	2.5	3.0	3.0	3.0

CORRUGATED STEEL 3" x 1" CORRUGATIONS

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. single and up to 40,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.052	1.5	2.0	2.0	2.0				
0.064	1.0	1.5	1.5	2.0	2.0	2.0		
0.079	1.0	1.0	1.5	1.5	2.0	2.0	2.0	
0.109	1.0	1.0	1.0	1.0	1.5	1.5	2.0	2.0
0.138	1.0	1.0	1.0	1.0	1.0	1.5	2.0	2.0
0.168	1.0	1.0	1.0	1.0	1.0	1.5	2.0	2.0

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.052	2.5	3.0	3.0	3.0				
0.064	2.0	2.5	2.5	3.0	3.0	3.0		
0.079	1.5	2.0	2.5	2.5	3.0	3.0	3.0	
0.109	1.5	1.5	2.0	2.0	2.0	2.5	3.0	3.0
0.138	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5
0.168	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.5

AIRCRAFT WHEEL LOAD—110,000 lb. dual to 200,000 lb. dual; 190,000 lb. dt. to 350,000 lb. dt; up to 750,000 lb. ddt.

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.052	3.0	3.5	3.5					
0.064	2.5	3.0	3.5	3.5	3.5			
0.079	2.0	2.5	3.0	3.0	3.5	3.5		
0.109	2.0	2.0	2.5	2.5	3.0	3.5	3.5	3.5
0.138	2.0	2.0	2.0	2.5	3.0	3.0	3.5	3.5
0.168	2.0	2.0	2.0	2.0	2.5	2.5	3.0	3.0

AIRCRAFT WHEEL LOAD—Up to 1,500,000 lb.

Metal thickness (in.)	Pipe diameter (in.)							
	36	48	60	72	84	96	108	120
0.052	3.0	3.5	3.5					
0.064	2.5	3.0	3.5	3.5	3.5			
0.079	2.5	2.5	3.0	3.0	3.5	3.5		
0.109	2.5	2.5	2.5	2.5	3.0	3.5	3.5	3.5
0.138	2.5	2.5	2.5	2.5	3.0	3.0	3.5	3.5
0.168	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0

STRUCTURAL PLATE PIPE—9" x 2 1/2" CORR. FOR ALUMINUM; 6" x 2" CORRUGATIONS FOR STEEL

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. s. or 40,000 lb. d.	AIRCRAFT WHEEL LOAD—40,000 lb. d. to 110,000 lb. d.	AIRCRAFT WHEEL LOAD—110 k.d. to 200 k.d.; 190 k d.t. to 350 k. d.t.; to 750 k. d.d.t.	AIRCRAFT WHEEL LOAD—Up to 1,500,000 lb.
Pipe dia. ÷8 but not less than 1.0′	Pipe dia ÷6 but not less than 1.5′	Pipe dia. ÷5 but not less than 2.0′	Pipe dia ÷4 but not less than 2.5′

Table 9-9. Minimum Depth of Cover in Feet for Pipe Under Flexible Pavement (Part 3)

NONREINFORCED CONCRETE

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. single and up to 40,000 lb. dual

Pipe type	Pipe diameter (in.)								
	4	6	8	10	12	15	18	21	24
Std. strength	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5
Extra strength	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Pipe type	Pipe diameter (in.)								
	4	6	8	10	12	15	18	21	24
Std. strength	3.5	4.0	4.0	4.5	5.5	6.0	6.0	6.0	6.0
Extra strength	1.5	2.0	2.5	3.0	3.5	3.5	3.5	3.5	3.5

REINFORCED CONCRETE

AIRCRAFT WHEEL LOAD—Up to 30,000 lb. single and up to 40,000 lb. dual

Reinf. concrete 0.01" crack D-load	Pipe diameter (in.)																			
	12	15	18	21	24	27	30	33	36	42	48	54	60	72	84	96	108	120	132	144
800													1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1000	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1350	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

AIRCRAFT WHEEL LOAD—40,000 lb. dual to 110,000 lb. dual

Reinf. concrete 0.01" crack D-load	Pipe diameter (in.)																			
	12	15	18	21	24	27	30	33	36	42	48	54	60	72	84	96	108	120	132	144
800													6.5	5.5	4.5	3.5	2.0	1.5	1.5	1.0
1000	5.5	5.5	5.5	5.5	5.5	5.0	5.0	5.0	4.5	4.5	4.0	4.0	3.5	3.0	2.0	1.5	1.0	1.0	1.0	1.0
1350	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.0	3.0	2.5	2.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0
2000	3.0	3.0	2.5	2.5	2.5	2.0	2.0	2.0	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

AIRCRAFT WHEEL LOAD—110,000 lb. dual to 200,000 lb. dual; 190,000 lb. dual tandem to 350,000 lb. dual tandem; up to 750,000 lb. d.d.t.

Reinf. concrete 0.01" crack D-load	Pipe diameter (in.)																			
	12	15	18	21	24	27	30	33	36	42	48	54	60	72	84	96	108	120	132	144
800																				
1000																				
1350	7.0	7.0	7.0	7.0	7.0	6.5	6.5	6.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.5	5.5	5.0	4.5	4.0
2000	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.0	2.5	2.0	2.0	2.5	2.5	2.0	2.0	2.0	1.5
3000	3.0	3.0	2.5	2.5	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.0	1.0	1.0	1.5	1.5	1.0	1.0	1.0	1.0

AIRCRAFT WHEEL LOAD—Up to 1,500,000 lb.

Reinf. concrete 0.01" crack D-load	Pipe diameter (in.)																			
	12	15	18	21	24	27	30	33	36	42	48	54	60	72	84	96	108	120	132	144
2000	7.0	7.0	7.0	7.0	7.0	6.5	6.5	6.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
3000	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

1. Cover depths are measured from top of flexible pavement, however, provide at least 1 foot between bottom of pavement structure and top of pipe.
2. The types of pipe shown are available in intermediate sizes, such as 6", 8", 15", 27", 33", etc.
3. For pipe installation in turfed areas use cover depths shown for 30,000 pound single; 40,000 pound dual.
4. Cover depths shown do not provide for freezing conditions. Usually the pipe invert should be below maximum frost penetration.
5. Blanks in tables indicate that pipe will not meet strength requirements.
6. Minimum cover depths shown for flexible pipe are based on use of excellent backfill.
7. Minimum cover depths shown for rigid pipe are based on use of class B bedding.
8. Minimum cover requirements for concrete arch or elliptical pipe may be taken from tables for reinforced concrete circular pipe, providing the outside horizontal span of the arch or elliptical pipe is matched to outside diameter of the circular pipe (assumes that classes of the pipes are the same).
9. Pipe cover requirements for "up to 1,500,000 pounds" are theoretical as gear configuration is not known.

RIGID PAVEMENT

For all types and sizes of pipe use 1.5 foot as minimum cover under rigid pavement (measure from bottom of slab, providing pipe is kept below subbase course). Rigid pipe for loads categorized as "up to 1,500,000 lb." must, however, be either class IV or class V reinforced concrete.

9-1.7 Flexible Pipe. Suggested maximum cover for trench and positive projecting conduits are indicated in Tables 9-3 through 9-7 for corrugated aluminum alloy pipe, corrugated steel pipe, structural plate aluminum alloy pipe, plastic, and structural plate steel pipe. Conditions other than those stated in the tables, particularly other loading conditions, will be compensated for as necessary. For unusual installation conditions, a detailed analysis will be made so that ample safeguards for the pipe will be provided with regard to strength and resistance to deflection due to loads. Determinations for deflections of flexible pipe should be made if necessary. For heavy live loads and heavy loads due to considerable depth of cover, it is desirable that a selected material, preferably bank-run gravel or crushed stone where economically available, be used for backfill adjacent to the pipe. Table 9-8 suggests guidelines for minimum cover to protect the pipe during construction and the minimum finished height of cover. ASTM D2321- provides standards for the installation of plastic pipe.

9-1.8 Bedding of Pipe (Culverts and Storm Drains). The contact between a pipe and the foundation on which it rests is the pipe bedding. It has an important influence on the supporting strength of the pipe. For drainpipes at military installations, the method of bedding shown in Figure 9-3 is generally satisfactory for both trench and positive projecting (embankment) installations. Some designs standardize and classify various types of bedding for the shaping of the foundation, use of granular material, use of concrete, and similar special requirements. Although such refinement is not considered necessary, at least for standardized cover requirements, select, fine granular material can be used as an aid in shaping the bedding, particularly where foundation conditions are difficult. Also, where economically available, granular materials can be used to good advantage for backfill adjacent to the pipe. When culverts or storm drains are to be installed in unstable or yielding soils, under great heights of fill, or where pipe will be subjected to very heavy live loads, a method of bedding can be used in which the pipe is set in plain or reinforced concrete of suitable thickness extending upward on each side of the pipe. In some instances, the pipe may be totally encased in concrete or concrete may be placed along the side and over the top of the pipe (top or arch encasement) after proper bedding and partial backfilling. Pipe manufacturers will be helpful in recommending type and specific requirements for encased, partially encased, or specially reinforced pipe in connection with design for complex conditions.

Figures 9-1, 9-2, 9-3, and 9-4 indicate the three main types of rigid conduit burial, the free-body conduit diagrams, trench beddings for circular pipe, and beddings for positive projecting conduits, respectively. Figure 9-5 is a schematic representation of the subdivision of classes of conduit installation that influences loads on underground conduits.

9-2 FROST CONDITION CONSIDERATIONS. The detrimental effects of heaving of frost-susceptible soils around and under storm drains and culverts are principal considerations in the design of drainage systems in seasonal frost areas. In such areas, water freezing within the drainage system, except icing at inlets, is of secondary importance provided the hydraulic design assures minimum velocity flow.

9-2.1. Drains, culverts, and other utilities under pavements on frost-susceptible subgrades are frequently locations of detrimental differential surface heaving. Heaving causes pavement distress and loss of smoothness because of abrupt differences in the rate and magnitude of heave of the frozen materials. Heaving of frost-susceptible soils under drains and culverts can also result in pipe displacement with consequent loss of alignment, joint failures, and in extreme cases, pipe breakage. Placing drains and culverts beneath pavements should be minimized to the extent possible. When this is unavoidable, to obtain maximum uniformity the pipes should be installed before the base course is placed. The practice of excavating through base courses to lay drain pipes and other conduits is unsatisfactory because attaining uniformity between the compacted trench backfill and the adjacent material is almost impossible.

9-2.2 No special measures are required to prevent heave in non-frost-susceptible subgrades. In frost-susceptible subgrades where the highest groundwater table is 5 feet or more below the maximum depth of frost penetration, the centerline of the pipe should be placed at or below the depth of maximum frost penetration. Where the highest groundwater table is less than 5 feet below the depth of maximum frost penetration and the pipe diameter is 18 inch or more, one of these measures should be taken:

- Place the centerline of the pipe at or below the depth of maximum frost penetration, and backfill around the pipe with a highly free-draining non-frost-susceptible material.

- Place the centerline of the pipe one-third diameter below the depth of maximum frost penetration.

9-2.3 To prevent water from freezing in the pipe, the invert of the pipe should be placed at or below the depth of maximum frost penetration. In arctic and subarctic areas, it may not be feasible economically to provide sufficient depth of cover to prevent freezing of water in subdrains; also, in the arctic, no residual thaw layer may exist between the depth of seasonal frost penetration and the surface of permafrost. Subdrains in such areas may be blocked with ice during the spring thawing period; however, subdrains will function normally the rest of the time. Water freezing in culverts also presents a serious problem in arctic and subarctic regions. The number of such structures should be held to a minimum and should be designed based on twice the normal design capacity. Thawing devices should be provided in all culverts up to 48 inch in diameter. Large-diameter culverts are usually cleaned manually immediately prior to the spring thaw. Drainage requirements for arctic and subarctic regions are presented in Chapter 10.

9-2.4 These design notes should be considered for installations located in seasonal frost areas:

- Note 1. The cover requirement for traffic loads will apply when such depth exceeds that necessary for frost protection.

- Note 2. Sufficient granular backfill will be placed beneath inlets and outlets to restrict frost penetration to nonheaving materials.

- Note 3. Design of short pipes with exposed ends, such as culverts under roads, will consider local icing experience. If necessary, larger pipe will be provided to compensate for icing.

- Note 4. The depth of frost penetration in well-drained, granular, non-frost-susceptible soil beneath pavements kept free of snow and ice will be determined from data in the appropriate UFC for pavement design. In all cases, estimates of frost penetration will be based on the design freezing index, which is defined as the average air-freezing index of the three coldest winters in a 30-year period, or the air-freezing index for the coldest winter in the past 10-year period if 30 years of records are unavailable. Additional design support can be obtained from the PCASE computer program.

- Note 5. Under traffic areas, and particularly where frost condition pavement design is based on reduced subgrade strength, gradual transitions between frost-susceptible subgrade materials and non-frost-susceptible trench backfill will be provided within the depth of frost penetration to prevent detrimental differential surface heave.

9-3 INFILTRATION OF FINE SOILS THROUGH DRAINAGE PIPE JOINTS. For DOD facilities, watertight joints are recommended under airfield pavements.

9-3.1 Infiltration of fine-grained soils into drainage pipelines through joint openings is one of the major causes of ineffective drainage facilities. This is a serious problem along pipes on relatively steep slopes such as those encountered with broken-back culverts or stilling wells or when the pipe operates under pressure flow conditions. Infiltration is not confined to non-cohesive soils. Dispersive soils have a tendency to slake and flow into drainage lines.

9-3.2 Infiltration, prevalent when the HGL (e.g., water table) is at or above the pipeline, occurs in joints of rigid pipelines and in joints and seams of flexible pipe unless these are made watertight. Watertight jointing is especially necessary in culverts and storm drains placed on steep slopes to prevent infiltration and/or leakage and piping that normally results in the progressive erosion of the embankments and loss of downstream energy dissipators and pipe sections.

9-3.3 Culverts and storm drains placed on steep slopes should be large enough and properly vented so that full pipe flow can never occur. This maintains the hydraulic gradient above the pipe invert but below crown of the pipe, thereby reducing the tendency for infiltration of soil water through joints. Pipes on steep slopes may tend to prime and flow full periodically because of entrance or outlet condition effects until the hydraulic or pressure gradient is lowered enough to cause venting or loss of prime at either the inlet or outlet. The alternating increase and reduction of pressure relative to atmospheric pressure is considered a primary cause of severe piping and infiltration. A

vertical riser should be provided upstream of or at the change in slope to provide sufficient venting for establishment of partial flow and stabilization of the pressure gradient in the portion of pipe on the steep slope. The riser may also be equipped with an inlet and used simultaneously to collect runoff from a berm or adjacent area.

9-3.4 Infiltration of backfill and subgrade material can be controlled by watertight flexible joint materials in rigid pipe and with watertight coupling bands in flexible pipe. Successful flexible watertight joints have been obtained in rigid pipelines with rubber gaskets installed in close-tolerance tongue-and-groove joints and factory-installed plastic gaskets installed on bell-and-spigot pipe. Bell-and-spigot joints caulked with oakum or other similar rope-type caulking materials and sealed with hot-poured joint compound have also been successful. Metal pipe seams may require welding, and the rivet heads may have to be ground to lessen interference with gaskets. Several kinds of connecting bands are adequate both hydraulically and structurally for joining corrugated metal pipes on steep slopes.

9-3.5 A conclusive infiltration test will be required for each section of pipeline involving watertight joints, and installation of flexible watertight joints will conform closely to manufacturers' recommendations. Although system layouts presently recommended are considered adequate, particular care should be exercised to provide a layout of subdrains that does not require water to travel appreciable distances through the base course due to impervious subgrade material or barriers. Pervious base courses with a minimum thickness of about 6 inch with provisions for drainage should be provided beneath pavements constructed on fine-grained subgrades and subject to perched water table conditions. Base courses containing more than 10 percent fines cannot be drained and remain saturated continuously.

9-4 MINIMUM AND MAXIMUM COVER FOR AIRFIELDS.

9-4.1 Heliport and airport layout will typically include underground conduits that pass under runways, taxiways, aprons, helipads, and other hardstands. In the design and construction of the drainage system, it will be necessary to consider both minimum and maximum earth cover allowable in the underground conduits to be placed under both flexible and rigid pavements as well as beneath unsurfaced airfields and medium-duty landing-mat-surfaced fields. Underground conduits are subject to two principal types of loads: dead loads (DL) caused by embankment or trench backfill plus superimposed stationary surface loads, uniform or concentrated; and live or moving loads (LL), including impact. FAA cover tables shall be used for all airfields' pipe cover requirements. These tables are included in this UFC as Table 9-9. Cover depths are valid for the specified loads and conditions, including average bedding and backfill. Deviations from these loads and conditions significantly affect the allowable maximum and minimum cover, requiring a separate design calculation.

9-4.2 Drainage systems should be designed to provide the greatest possible capacity to serve the planned pavement configuration. Additions to or replacements of drainage lines following initial construction are both costly and disrupting to aircraft traffic.

9-5 MINIMUM AND MAXIMUM COVER FOR ROADWAYS.

9-5.1 In the design and construction of the drainage system, it will be necessary to consider both minimum and maximum earth cover allowable on the underground conduits to be placed under both flexible and rigid pavements. Underground conduits are subject to two principal types of loads: DL, caused by embankment or trench backfill plus superimposed stationary surface loads, uniform or concentrated; and LL, including impact. LL assume increasing importance with decreasing fill height.

9-5.2 AASHTO *Standard Specifications for Highway Bridges* should be used for all H-20 highway loading analyses. The American Railway Engineering and Maintenance of Way Association (AREMA) *Manual for Railway Engineering* should be used for all Cooper's E-80 railway loadings. Appropriate pipe manufacturer design manuals should be used for maximum cover analyses.

9-5.3 Drainage systems should be designed to provide an ultimate capacity sufficient to serve the planned installation. Addition to, or replacement of, drainage lines following initial construction is costly.

9-5.4 Investigations of in-place drainage and erosion control facilities at fifty military installations were made during the period of 1966 to 1972. The age of the facilities varied from one to more than thirty years. The study revealed that buried conduits and associated storm drainage facilities installed from the early 1940s until the mid-1960s appeared to be in good to excellent structural condition; however, many installations reported failures of buried conduits during construction. Note, therefore, that minimum conduit cover requirements are not always adequate during construction. When construction equipment, which may be heavier than LL for which the conduit has been designed, is operated over or near an already in-place underground conduit, it is the responsibility of the contractor to provide any additional cover during construction to avoid damage to the conduit. Major improvements in the design and construction of buried conduits in the two decades include, among other items, increased strength of buried pipes and conduits, increased compaction requirements, and revised minimum cover tables.

9-5.5 The necessary minimum cover in certain instances may determine pipe grades. A safe minimum cover design requires consideration of a number of factors, including selection of conduit material, construction conditions and specifications, selection of pavement design, selection of backfill material and compaction, and the method of bedding underground conduits. Emphasis on these factors must be carried from the design stage through the development of final plans and specifications.

9-5.6 Tables 9-1 through 9-6 identify certain suggested cover requirements for storm drains and culverts. These suggested requirements should be considered as guidelines only. Cover requirements have been formulated for reinforced and non-reinforced concrete pipe, corrugated aluminum alloy pipe, corrugated steel pipe, structural plate aluminum alloy pipe, and structural plate steel pipe. The different sizes and materials of conduit and pipe have been selected to allow the reader to be aware of

the many and varied items that are commercially available for construction purposes. The cover depths listed are suggested only for average bedding and backfill conditions. Deviations from average conditions may result in significant minimum cover requirements, and separate cover analyses must be made in each instance of a deviation from average conditions. Specific bedding, backfill, and trench widths may be required in certain locations; each condition deviating from the average condition should be analyzed separately. Where warranted by design analysis, the suggested maximum cover may be exceeded.

9-5.7 As a minimum, pipe in non-paved areas shall be designed for expected maintenance equipment.

CHAPTER 10

GUIDELINES FOR DESIGN IN THE ARCTIC AND SUBARCTIC

10-1 GENERAL. The design criteria provided in this UFC are generally applicable to arctic and subarctic regions; however, the general information in this chapter on icings and special design considerations for arctic and subarctic conditions are applicable.

The arctic is the northern region in which the mean temperature for the warmest month is less than 50 degrees Fahrenheit (F) and the mean annual temperature is below 32 degrees F. In general, the arctic coincides with the tundra region north of the limit of trees.

The subarctic is the region adjacent to the arctic in which the mean temperature for the coldest month is below 32 degrees F, the mean temperature for the warmest month is above 50 degrees F, and in which there are fewer than 4 months with a mean temperature above 50 degrees F. In general, the subarctic land areas coincide with the circumpolar belt of dominant coniferous forests.

10-2 ICING.

10-2.1 Description. The term "icing" (sometimes misnamed “glaciering”) applies to a surface ice mass formed by the freezing of successive sheets of water, the source of which may be a river or stream, a spring, or seepage from the ground. When icing occurs at or near airfields, heliports, roadways, or railroads, the drainage structures and channels gradually fill with ice, which may spread over pavements or structures, endangering and disrupting traffic and operations. Ice must be removed from pavements or structures and drainage facilities must be cleared to avoid or limit the re-forming of icing. Obstruction of flow through drainage facilities—culverts, bridges, pipelines, or channels—can lead to washout of pavement embankments or undermining of structures. The spring thaw period is most critical in this regard. Prevention or control of icing at or near drainage structures and the related effects on pavements and other facilities are key considerations of drainage design and maintenance in the arctic and subarctic. Because icing can occur throughout both seasonal frost and permafrost areas, they are a widespread cause of recurring operational and maintenance problems. Drainage designs based only on conventional criteria will not fulfill the abnormal hydraulic conveyance requirements of icing-prone regions and will be subject to troublesome maintenance problems. Special design and maintenance concepts, based mainly on field experience under similar situations, are required.

10-2.2 Types. Icing is classed conveniently as river or stream icing, ground icing, or spring icing, although sometimes it is difficult to assign a specific type to a particular situation. There are three general types of icing:

10-2.2.1 **River or Stream Icing.** River or stream icing occurs more commonly on shallow streams with large width/depth ratios. Braided or meandering channels are more prone to icing formation than well-defined single channels. River or stream icing

normally begins to develop soon after normal ice cover forms on a stream surface, usually during October to December. The icing begins with the appearance of unfrozen water on the surface of the normal ice cover. This water may originate from cracks in the ice cover, from seepage through unfrozen portions of soil forming the channel banks, from adjacent springs that usually discharge into the channel, or other sources. This water, flowing in sheets of an inch or less in thickness to a foot or more, freezes in a layer. Each overflow event is followed by another, with new flow atop the previously frozen sheet, the icing growing higher layer upon layer with its boundaries extending laterally according to the topography. River icing may grow for only part of the winter or throughout the period of below-freezing temperatures. Icing behavior usually varies a little year by year, depending on availability of the feeding water. An icing surface is typically flat but can be gently terraced, with each step marking the frozen edge of a thin overflow layer. Occasionally ice mounds form and develop cracks that provide outlets for the confined water forming the mounds. The water flows out, continuing the growth of the icing for a limited period. Smaller icing is typically confined to the stream or drainage channel; larger icing may spread over floodplains or pavements. With the onset of the spring thawing season, runoff cuts channels through the icing to the streambed. Channels are widened by thawing, collapse of the ice forming the sides, and erosion. Depending on the size of the icing and its geographic location, its remnants may last only until May or June, or in colder regions remnants may last all summer. In extreme locations, they never completely melt and are known as perennial icing. River or stream icing occurring at culverts is objectionable in that fish migration is obstructed.

10-2.2.2 **Ground Icing.** Unlike river or stream icing, ground icing, while developing on certain topographic features, does not have clearly defined areas of activity. These icings are commonly referred to as seepage icings, due to the way their feed waters appear on the ground surface. Seepage icings may develop on nearly level ground or at points of contact of two different types of relief (such as at the base of a slope) or as encrustations on slopes. Ground icing begins to form at different times of the year depending on the sources and modes of discharge of the feeding waters. Where water seeps from the ground often or continuously, icing may begin to form in September or October, in which case it might also be termed a spring icing. Those forming where water does not usually issue from the ground typically begin to form in November or December, or even later in the winter. A characteristic of ground icing is that its development begins with unfrozen water appearing on the ground surface or with the saturation and subsequent freezing of snow on the ground. This water may seep from the soil or from fractures in the bedrock, or it may travel along the roots of vegetation, or it may issue from frost-induced cracks in the ground. As the seepage flows are exposed to the cold atmosphere, they freeze. Additional seepages follow repeatedly onto the icing surface and also freeze, building up successive thin ice layers, seldom over an inch thick. Ground icings may grow during the winter, being extremely sensitive to weather and local hydrologic conditions of the winter and its preceding seasons. Normally ground icings are limited in size as compared with stream spring icing since their source of supply is limited. Some rapid growth may occur with the advent of thawing weather. When general thawing occurs, the ground icing will slowly waste away. This disintegration is unlike that of stream icings, in which sizable runoff streams can rapidly erode icing.

10-2.2.3 **Spring Icing.** Springs found in a variety of topographic situations sustain continuous discharge, leading to early winter formation of icing, usually prior to ground icing. Spring outlets typically remain fixed in location and continue to grow throughout the winter, ultimately reaching a larger size than ground icing. A flow of 1 ft^3/min can create a 1-foot-deep icing covering an acre in one month. Spring icings melt away slowly on all sides, and these icings are also eroded by spring water channel flow.

10-2.3 Natural Factors Conducive to Icing Formation. Certain natural factors are conducive to icing:

10-2.3.1 A rainy season prior to freeze-up producing an abundance of groundwater in the annual frost zone of the soil or in the ground above the permafrost.

10-2.3.2 Low air temperatures and little snow during the first half of the winter, i.e., through January. Early heavy snow minimizes the occurrence of icing.

10-2.3.3 Nearness of an impervious horizon such as the permafrost table to the ground surface.

10-2.3.4 Heavy snow depth accumulations during the latter part of winter.

10-2.4 Effects of Human Activities on Icing. Airfields and heliports, by altering the natural physical environment, have profound effects on icing. The widespread clearing of vegetative cover, cutting and filling of soil, excavation of rock, and provisions for drainage, for example, greatly affect the natural thermal regime of the ground and the hydrologic regimes of both groundwater and surface water. Some of the effects are discussed in paragraphs 10-2.4.1 to 10-2.4.6.

10-2.4.1 Removal of vegetation and organic soil, with their typically higher insulation values than those of the construction materials replacing them, results in increased seasonal frost penetration. This may create or aggravate nearby damming of groundwater flow and cause icing. Airfield and heliport pavement areas, kept clear of snow, lack its insulating value and are subject to deeper seasonal frost penetration, causing icing.

10-2.4.2 Cut faces may intersect the water table, and fill sections may block natural drainage channels. Construction compaction operations can reduce permeability of natural soils, blocking natural discharge openings.

10-2.4.3 In cut sections, water comes into contact with the cold atmosphere, forming ground icing where none occurred prior to the construction. Icing grows on the cut face, fills the adjacent drainage ditches with ice, and eventually reaches the pavement surface. In these conditions, deep snow on the slope and ditch insulates seepage from the cut face. Seepage water passes under the snow without freezing and reaches the snow-free pavement where it is sufficiently exposed to freeze. This type of man-made icing is the most common and troublesome type along pavements.

10-2.4.4 Snowplowing and snow storage greatly affect the location and extent of icing by changing insulation values and damming seepage waters.

10-2.4.5 Channel realignment and grading into wider, more shallow sections, commonly done in airfield and heliport construction, renders the stream more susceptible to high heat losses, extensive freezing, and formation of icing.

10-2.4.6 Drainage designers customarily size hydraulic structures to accommodate runoff from a specified design storm. In the arctic and subarctic, the size of hydraulic structures based solely on these well-founded hydrologic principles will usually result in inadequate capacity, which will contribute or intensify icing formation. Culverts, small bridges, storm drains, and inlets designed to accommodate peak design discharges are usually much too small to accommodate icing volumes before becoming completely blocked by ice. Once the drainage openings become blocked, icing upstream from the affected structures grows markedly. The inadequacy of drainage facilities, both in capacity and number, because of failure to accommodate icing, leads to more serious effects of icing on engineering works.

10-2.5 Methods of Counteracting Icing. Several techniques are available for avoiding, controlling, or preventing icing. Although sound in principle, the methods are often applied without adequate understanding of the icing problems, leading to unsuccessful or poor results. Selection of a particular method from the many that might be applied for the given set of conditions is based principally on economics. One must use a systems approach considering costs of installation plus costs of operation and maintenance, energy conservation, and environmental impact. Where feasible, methods requiring no fuel or electrical energy output or little or no service by maintenance personnel are preferred. The techniques for dealing with icings fall into two categories: *avoidance and control* and *prevention*.

10-2.5.1 **Methods of Icing Avoidance and Control**. These methods deal with the effects of the icing at the location being protected, so that the type of icing (river or stream, ground, or spring) is of little significance. There are several methods of icing avoidance and control:

10-2.5.1.1 **Change of Location.** Site facilities where icings do not occur. This is an economic consideration that is difficult to resolve in siting an airfield because of its extensive area, grading, and lateral clearance requirements.

10-2.5.1.2 **Raising the Grade.** This will deter or postpone icing formation but is costly and depends on the availability of ample fill. There is also the threat of embankment washouts resulting from ice-blocked facilities, and the possibility of objectionable seepage effects.

10-2.5.1.3 **More and Larger Drainage Structures.** Susceptibility to icing problems can be reduced by providing more and larger drainage facilities. Openings as much as 2 or 3 times as large as those required by conventional hydraulic design criteria will accommodate sizable icing volumes without encroaching on design flows. Culverts with large vertical dimensions, or small bridges in lieu of culverts, are advantageous. Provision for adequate drainage channels and conduits will facilitate diversion of meltwater runoff from icings, protecting the installation from washouts.

10-2.5.1.4 **Storage Space**. This can be provided as a ponding basin or by shifting a cut face further back from the airfield or heliport. There, an icing can grow in an area where it will not encroach on operational facilities.

10-2.5.1.5 **Dams, Dikes, or Barriers.** Known also as ice fences, these are used often to limit the horizontal extent of icings. Permanent barriers of earth, logs, or lumber may be built between the source of the icing and the area to be protected. Temporary barriers may be erected of snow embankments, movable wooden fencing, corrugated metal, burlap, plastic sheeting, or expedient lumber construction. In some situations, a second or even third fence is required above the first as the icing grows higher.

10-2.5.1.6 **Culvert Closures.** To prevent a culvert being filled with snow and ice, which requires a laborious spring clearing operation, closures are sometimes placed over the culvert ends in the fall. These closures can be of rocks that will permit minor flows prior to freeze-up.

10-2.5.1.7 **Staggered (or Stacked) Culverts.** This involves placement of two (or more) culverts, one at the usual location at the base of the fill, the other(s) higher in the fill. When the lower culvert becomes blocked by an icing accumulation, the higher ones carry initial spring runoff over the icing. As the spring thaw progresses, the lower one becomes cleared, eventually carrying the entire flow. In cases where there is limited height, the second culvert is placed to the side with its invert at a slightly higher elevation. The ponding area available for icing accumulations must be large enough to store an entire winter’s ice without having the icing reach the upper culverts or the elevation of the area being protected.

10-2.5.1.8 **Heat.** Icing is commonly controlled by the application of heat in any of several ways, the objective being not to prevent icing but to establish and maintain thawed channels through it to minimize its growth and to pass spring runoff.

10-2.5.1.9 **Steam.** This method, common in North America, is used to thaw culvert openings and to thaw channels into icing for collecting icing feed water or early spring runoff. Steam, generated in truck-mounted boilers, is conducted through hoses to portable steam lances, or through hoses temporarily attached to permanently installed thaw pipes supported inside the tops of the culverts. Thaw pipes of 0.375- to 2-inch diameter have been used. The thaw pipe is terminated by a vertical riser at each end of the culvert, extending high enough to permit access above accumulated ice and snow. The pipe is filled with antifreeze, with the risers capped when not in use.

10-2.5.1.10 **Fuel Oil Heaters.** These heaters, known as firepots, are in common use. They consist of a 55-gallon oil drum equipped with an oil burner unit (railroads often use coal or charcoal as fuel). The drum, fed from a nearby fuel supply, is usually suspended from a tripod at the upstream end of the culvert. A continuous fire maintains a thaw pit in the icing. Fuel consumption varies, averaging about 30 gallons per day. Water, flowing over the icing, enters the pit where it receives heat, passes through the culvert, ideally without refreezing before it flows beyond the area to be protected. While firepots are simple devices, they are inefficient energy sources due to loss of most heat to the atmosphere rather than to the water or icing. Firepots are in decreasing favor due to their high maintenance requirements and the difficulty in preventing the theft of the fuel in remote locations.

10-2.5.1.11 **Electrical Heating.** Use of insulated heating cables to heat culverts is a recent adaptation successfully used where electrical power is available or, in important locations, where small generating stations are feasible. Heating cables have been used, not to prevent icing but to create and maintain a thawed tunnel-like opening in an icing to minimize its growth and to provide for spring runoff. Cable can be strung in the fall within the culvert and, in some cases, along its upstream drainageway, and removed in the spring. Cable can also be installed permanently in a small diameter metal pipe inside the culvert or buried at shallow depth under a drainage ditch or channel. Common heat output is 40 to 50 watts/lineal feet, with minimum heat lost to the atmosphere. A tunnel approximately 2 to 3 feet wide and 4 to 5 feet high is achieved by later winter. Electrical heating requires much less attention by maintenance personnel than steam thawing.

10-2.5.1.12 **Breaking and Removing Accumulated Ice.** This common technique, whether by manual or mechanical equipment, should be practiced only as an expedient or emergency measure. The timing of such operations, like that for the following two methods, critically limits their effectiveness.

10-2.5.1.13 **Blasting.** This has a twofold objective: the physical removal of ice and the fracturing of ice to provide paths for water flow deep in the icing. This flow can enlarge openings and still remain protected from the atmosphere and refreezing.

10-2.5.1.14 **Deicing Chemicals.** Chemicals such as sodium or calcium chloride are sometimes used to prevent refreezing of a drainage facility once it has been freed of ice by other means. A common practice is to place a burlap bag containing the salt at a culvert inlet, allowing the compound to be dissolved slowly by the flow, with the solution lowering the freezing point of the water. Objections are the detrimental effects on fish and wildlife, vegetation, and other downstream water uses and the corrosive effects on metal pipe.

10-2.5.2 **Methods of Icing Prevention.** These preventive techniques are best classified according to the general type of icing:

10-2.5.2.1 **River or Stream Icing**

- **Channel Modification**. Straightening and deepening a channel can prevent icing, although frequent maintenance is usually required to counteract the stream's tendency to resume its natural configuration by erosion and deposition. Rock-fill gabions have been used to create a deep, narrow channel for low winter discharges. Such deepened channels permit formation of ice cover to normal thickness while providing adequate space beneath for flow. Deepening at riffles, rapids, or drop structures is especially important because icing is more likely to form in these shallow areas.

- **Insulation of Critical Sections**. River or stream icing may be prevented by insulating critical sections of the stream where high heat losses cause excessive thickening of the normal ice cover, constricting or completely blocking flow and resulting in icing formation. These sections may be located under a bridge or taxiway or at riffles or rapids. The insulation, which may be placed on the initial ice cover, may consist of soil, snow, brush, peat, sawdust, or other material, typically 1 to 2 feet thick. Another method is to cover the stream before ice forms, using logs, timber, or corrugated metal as a support for insulating material, later augmented by snowfall. Insulating covers, while beneficial in lessening heat losses from the stream, must be removed each spring before annual freshets. They may also be washed downstream to become obstructions if high water occurs prior to cover removal.

- **Frost Belts**. Known also as "permafrost belts," these are addressed further in paragraph 10-2.5.2.2, Ground Icing. A frost belt is essentially a ditch or cleared strip of land upstream or upslope from the icing problem area. If organic soil and vegetative cover are removed and the area is kept clear of snow during the first half of the winter, deep seasonal frost will act as a dam to water seeping through the ground, forcing it to the surface where it will form an icing upstream or upslope from the belt. In applying this technique to a drainage channel, a belt is formed by periodically cutting transversely into the ice to cause the bottom of the ice cover to lower and merge with the bed. In this way, the icing is induced to form away from the bridge or culvert entrance being protected.

10-2.5.2.2 **Ground Icing.** The most successful methods of preventing ground icing involve drainage. Other procedures depend on preventing formation in one location by inducing formation elsewhere. There are several principal methods:

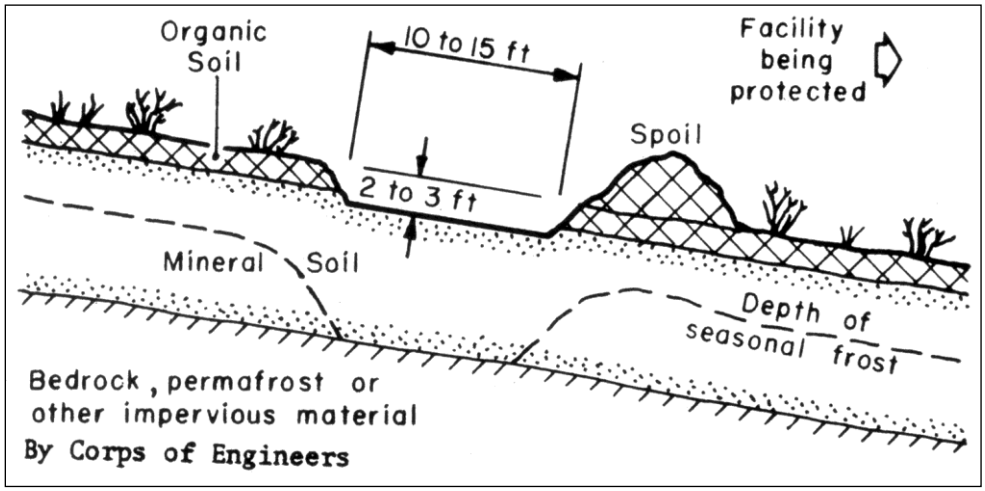
- **Surface Drainage**. This may be accomplished by a network of ditches located to drain the soil surface in the region of icing development. Ideally these ditches will be sited in compliance with airfield/heliport lateral safety

clearance criteria and be narrow and deep enough to drain the soil to an appreciable depth and to expose only a small surface area to heat loss to the atmosphere. In some cases, these drainage ditches are covered and insulated to maintain flow in winter. Open ditches can be as narrow as 1 foot or, if insulated, approximately 3 feet wide by 3 feet deep.

- **Insulation of the Ground**. In some cases, ground icings can be prevented by insulating the ground in areas where deep seasonal frost penetration forms a dam, blocking groundwater flow. Insulating material may be snow, soil, brush, or peat. This technique may merely shift the location where an impervious frost dam occurs. It is essential that the insulation of the ground extend under the pavement being protected to assure that groundwater flow is maintained past it. Otherwise, seasonal frost penetration under a snow-free airfield pavement would act as a frost dam and cause an icing to form upslope from the area. Suitable insulation materials for pavements are available and have been used effectively.

- **Permanent-type Frost Belts**. Successful use of frost belts requires careful siting, planning, and maintenance. Frost belts may be either permanent or seasonal. The permanent-type belt, as mentioned in paragraph 10-2.5.2.1 for control of river or stream icing, is a strip of land cleared of organic soil and vegetation, extending across a slope normal to the direction of seepage flow. Seasonal frost beneath this belt, merging with or approaching some impervious base, causes an icing to form upslope from the belt location. The belt must be long enough to prevent the icing from extending around the ends of the belt and approaching the airfield or other area being protected. Such a belt is usually approximately 2 to 3 feet deep and 10 to 15 feet wide. Spoil from the excavation is placed as a low ridge on the downslope side of the belt (Figure 10-1). The shape of the frost belt depends on the topography; often it is slightly convex downslope, or made of two straight segments meeting at an angle of 160 to 170 degrees on the upslope side of the belt. Sometimes more than one belt is necessary, with the belts arranged parallel to each other with their spacing depending on the channel slope. Permanent frost belts require attention to avoid degradation of the permafrost table underneath because the insulation of the ground has been reduced by removing the organic soil and vegetative cover. After a few years, the permafrost table may lower so much that the seasonal frost penetration in the winter will not reach it. In such a case, seepage flow in the soil is not stopped at the belt, and an icing does not develop at the belt but occurs instead downslope at the airfield or other facility intended to be protected. This can be avoided by covering the belt area in the spring with an insulating material and removing it in the fall before the onset of winter frosts. The belt must be kept clear of snow through the first half of the winter to permit rapid and deep seasonal frost penetration.

Figure 10-1. Typical Cross Section of a Frost Belt Installation

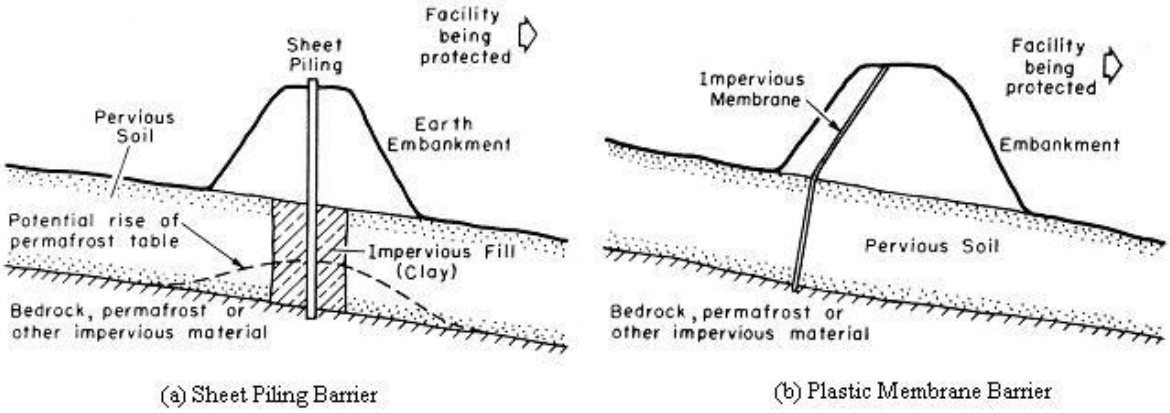


- **Seasonal-type Frost Belts**. Seasonal-type frost belts are free from most maintenance requirements associated with the permanent type and are much simpler and more economical to construct. Instead of preparing a ditch in the ground, one merely clears a strip of snow at the desired belt location and keeps it free of snow during the first half of the winter. The cleared snow is piled downslope of the belt, forming a ridge. The chief advantage of the seasonal belt is that it is less likely to degrade the underlying permafrost. This objective can be further assured by relocating the belt upslope or downslope in successive winters. A disadvantage of the seasonal belt is that seasonal frost penetrates below it more slowly because of the high specific heat of the wet organic soil and the insulation afforded by the vegetation left in place. It therefore takes longer for a frost dam to form and stop the flow of seepage water. This may permit formation of some icing at the downslope protected area early in the winter before the seasonal frost belt attains full effectiveness. Frost belts have not been widely accepted because of neglect in placement of summer insulation and priority attention to snow removal from pavements rather than from frost belt areas in the winter. Frost belts are much easier to maintain in locations where the impervious base that restricts groundwater flow is other than permafrost and thus is not subject to degradation.

- **Earth Embankments and Impervious Barriers**. Ground icing formation can also be prevented by use of earth embankments combined with impervious barriers to groundwater flow. These are placed well away from the area to be protected and function similarly to frost belts by damming seepage flow through the soil, causing it to rise to the ground surface where it freezes to form an icing. In southern permafrost zones where permafrost is close to freezing temperatures, embankments may cause the permafrost to melt, leading to subsidence. Methods of developing the impervious barrier include trenching across the slope down to the impervious stratum, filling the trench with clay and then driving a row of sheet piling through it

extending several feet above the surface to aid in ponding (Figure 10-2a). Other expedients include use of plastic membrane instead of piling (Figure 10-2b) or burial or horizontal air duct pipe (12 to 18 inch), usually located 4 to 6 feet below the bottom of the embankment. Vertical air shafts from the horizontal ducts permit cold winter air to permeate the system, removing heat from the ground and freezing the soil beneath the embankment to create an impervious barrier. The vertical air shafts are sealed in the summer to prevent excessive thawing in the soil. A problem that has arisen in some duct installations is that if they are not completely watertight, infiltrated water will freeze in the duct, causing an obstruction that is typically difficult to clear. Because this type installation would obstruct seepage flow year-round rather than just in winter, gated openings must be provided to allow accumulated water to flow downslope during the summer. The openings are closed all winter to ensure that the icing will form upslope from the embankment. An innovation is the use of a steel mesh grid with apertures 8 to 32 in^2. These permit water passage when the air is warm, but gradually freeze until a blockage forms in subfreezing weather. Grids must be removed in the summer to avoid debris accumulation.

Figure 10-2. Earth Embankments with Impervious Barriers



10-3 GUIDELINES FOR DESIGN OF STORM DRAINS IN THE ARCTIC AND SUBARCTIC. Certain principles used in design are particularly applicable to drainage facilities in arctic and subarctic regions. The planner should be cognizant of several features related to drainage to assure a successful design:

10-3.1 Sites should be selected in areas where cuts, or the placement or base course fills, will not intercept or block existing natural drainageways or subsurface drainageways. Adequate provision should be made for the changed drainage conditions.

10-3.2 Areas with fine-grained, frost-susceptible soils should be avoided if possible. In arctic and subarctic regions, most soils are of single grain structure with only a very small percentage of clay. Since the cohesive forces between grain particles are very small, the material erodes easily. Fine-grained soil profiles may also contain large numbers of ice lenses and wedges when frozen.

10-3.3 If the upper surface of the permafrost layer is deep, design features of a drainage system can be similar to those used in frost regions of the continental United States if due provisions are made for lower temperatures.

10-3.4 The avoidance, control, and prevention of icing are addressed in section 10-2.

10-3.5 The flow of water in a drainage channel accelerates the thawing of frozen soil and bedrock. This may cause the surface of the permafrost to dip considerably beneath streams or channels that convey water, and may result in the thaw of ice such as that contained in rock fissures and cracks. The latter could develop subsurface drainage channels in bedrock. Bank sloughing and significant changes in channels become prominent. Sloughing is often manifested by wide cracks paralleling the ditches. For this reason, drainage ditches should be located as far as practicable from runway and road shoulders and critical structures.

10-3.6 In many subarctic regions, freezing drainage channels of drifted snow and ice become a significant problem before breakup each spring. In these areas, it is advantageous to have ditch shapes and slopes sufficiently wide and flat to accommodate heavy snow-moving equipment. In other locations where flow continues year-round, narrow, deep ditches are preferable to lessen the amount of exposed water surface and avoid icing.

10-3.7 Large cut sections should be avoided in planning the drainage layout. Thawed zones or water-bearing strata may be encountered and later cause serious icing. Vegetative cover in permafrost areas should be preserved to the maximum degree practicable; where disturbed, it should be restored as soon as construction permits.

10-3.8 Fine-grained soils immediately above a receding frost zone are very unstable; consequently, much sliding and caving is to be expected on unprotected ditch side slopes in such soils.

10-3.9 Locating ditches over areas where permafrost lies on a steep slope should be avoided if possible. Slides may occur because of thawing and consequent wetting of the soil at the interface between frozen and unfrozen ground.

10-3.10 Provisions should be made for removal and disposal or storage of snow and ice, with due consideration to control of snowmelt water. Drainage maintenance facilities should include heavy snow-removal equipment and electric cables with energy sources or a steam boiler with accessories for thawing structures that become clogged with ice.

Pipes or cables for this purpose are often fastened inside the upper portions of culverts prior to their placement.

10-3.11 Usually inlets to closed conduits should be sealed before freeze-up and opened prior to breakup each spring.

10-4 GRADING. Proper grading is a very important factor contributing to the success of any drainage system. The development of grading and drainage plans must be coordinated most carefully. In arctic and subarctic regions, the need for elimination of soft, soggy areas cannot be overemphasized.

10-5 TEMPORARY STORAGE. Trunk drains and laterals should have sufficient capacity to accommodate the project design runoff. Supplementary detention ponds upslope from drain inlets should not be considered in drainage designs for airfields or heliports in the arctic and subarctic. Plans and schedules should be formulated in sufficient detail to avoid flooding even during the time of actual construction.

10-6 MATERIALS. Selection of suitable types of drainage materials for specific projects will be based on design requirements—hydraulic, structural, and durability—and economics for the specific drainage installation. In the arctic and subarctic, the flexible, thin-walled pipe materials—corrugated metal (galvanized steel or clad aluminum alloy)—have been most widely used for drainage applications because of their availability, weight and transportability considerations, relative ease of installation, and dependability of jointing. Heavier rigid-type pipe, reinforced and nonreinforced concrete, particularly with recently developed, flexible, gasketed joints, and the newer types of plastic pipe are used under certain conditions in the subarctic.

10-7 MAINTENANCE. Access for maintenance equipment and personnel is necessary for major drainage channels, debris control barriers, and icing control installations. Structures should be inspected periodically, particularly before fall freeze-up and after annual spring thaw breakup periods.

10-8 JOINTING. Disjointing, leakage, or failure in pipe joints can occur, especially where drainage lines are subject to movement caused by backfill settlement, live loads (LL), or frost action. Flexible, watertight joint pipe is available for use in such situations. Most watertight joints rely on the use of close-tolerance pipe ends connected over a closely fitting gasket.

10-9 END PROTECTION. End structures, factory-made or constructed in the field, are attached to the ends of storm drains or culverts to provide structural stability, hold the fill, reduce erosion, and improve hydraulic characteristics. A drain projecting beyond the slope of an airfield or roadway embankment is a hazard and is subject to damage or failure caused by ice, drift, or the current. Drain ends can be mitered to fit embankment slopes or provided with prefabricated, flared end sections. Headwalls and wingwalls to contain pipe ends are often constructed, usually of concrete, to meet the several design requirements, including provision of weight to offset uplift or buoyancy and to inhibit piping. Headwalls or wingwalls should be oriented or skewed to fit the drain line for

maximum hydraulic efficiency and to lessen icing formation and drift or debris accumulation. The effect of pipeline entrance design on the hydraulic efficiency of drainage systems is examined in Chapter 4. A properly shaped culvert entrance can be an important factor in reducing ponding at an inlet that can wash out an airfield or roadway embankment.

10-10 ANCHORAGE AND BUOYANCY. Forces on a drain line inlet during high flows, especially during spring breakup, are variable and unpredictable. Currents and vortexes cause scour, which can undermine a drainage structure and erode or fail embankments. These conditions are accentuated in the arctic and subarctic by accumulated ice and debris. Corrugated metal pipe sections, because they are thin-walled and flexible, are particularly vulnerable to entrance distortion or failure. Ends can be protected by providing secure heavy anchorage. This could be a concrete or grouted rock endwall or slope pavement. Rigid-type pipe with its shorter sections is subject to disjointing if undermined by scour unless provided with steel tiebars to prevent movement and separation. Buoyant forces must be determined for possible conditions such as blockage of a drainage line end by ice or debris, flow around the outside of a pipe, or, in coastal locations, tidal effects. These forces must be counteracted by adequately weighting the line, tying it down, or providing vents. Catastrophic drainage failures have resulted from failure to safeguard against such occurrences, even in temporary situations during construction.

10-11 DEBRIS AND ICING CONTROL. It is essential to control debris and icing to achieve desired hydraulic and structural performance and to avoid damages and operational interruption from flooding and uncontrolled icing. The debris problem can be solved by providing a structure large enough to pass the material or by retaining it at a convenient adequate storage and removal location upstream from the drainage structure.

10-12 TIDAL AND FLOOD EFFECTS. Airfields, with their requirements for large level areas, are often sited on coastal or alluvial floodplains where their drainage systems are subject to tidal and stream flood effects. In arctic and subarctic regions, ice jam and spring break-up dynamic forces and flood heights create major problems, including stream migration, which can adversely affect airfield embankments and protective levees, degrade permafrost, and shift or block drainage outlets. Stream meander control is difficult and costly, especially in the arctic. Flap gates may be required to prevent backflow into drainage systems, a situation particularly undesirable in tidal or brackish water locations due to corrosive action on drainage pipelines. These gates require a high level of maintenance to assure their operation despite ice, debris, sand, or silt accumulation.

10-13 INSTALLATION. Pipe construction in the arctic and subarctic, as in other regions, requires shaped bedding and systematic, layer-by-layer backfilling and compaction, and maintaining equal heights of fill along both sides of the pipe. Many culvert and storm drain failures during construction are caused by operating equipment too close to the pipe, failure to remove large projecting stones from backfill near the pipe, or inadequate caution in handling frozen backfill material.

CHAPTER 11

WATER QUALITY CONSIDERATIONS

11-1 GENERAL. The objective of this chapter is to provide an overview of water quality practices used in developed areas. The purpose of a best management practice (BMP) is to mitigate the adverse impacts of development activity. BMPs can be employed for storm water control benefits and/or pollutant removal capabilities. Several BMP options are available and should be considered carefully based on site-specific conditions and the overall management objectives of the watershed. Regulatory control for water quality practices is driven by National Pollution Discharge Elimination System (NPDES) requirements under such programs as the Clean Water Act. These requirements were addressed in Chapter 1 of this UFC. Water quality practices may not be required depending on local ordinances and regulations in specific project locations.

This chapter provides a brief introduction to the kinds of BMPs that have been used historically to provide water quality benefits. Tables 11-1 and 11-2 provide brief information on the selection criteria and the pollutant removal capabilities of the various BMP options. It is beyond the scope of this document to provide procedures for estimating pollutant loading or for the detailed design of the BMPs. Section 11-11 includes information and references for developing technologies referred to as "Ultra-Urban" technologies. For more information about the design of the BMPs, refer to HEC-22.

11-2 GENERAL BMP SELECTION GUIDANCE

11-2.1 Several factors are involved in determining the suitability of a particular BMP. They include physical conditions at the site, the watershed area served, and storm water and water quality objectives. Table 11-1 presents a matrix that shows site selection criteria for BMPs. A dot indicates that a BMP is feasible. The site selection restrictions for each BMP are also indicated. Be aware that the “Area Served” criteria presented in Table 11-1, and at other locations throughout this chapter, should not be taken as a strict limitation. They are suggested rules of thumb based primarily on pollutant removal effectiveness and cost effectiveness of typical facilities as reported in the literature. In terms of water quality benefit, Table 11-2 provides a comparative analysis of pollutant removal for various BMP designs. Generally, BMPs provide high pollutant removal for non-soluble particulate pollutants, such as suspended sediment and trace metals. Much lower rates are achieved for soluble pollutants such as phosphorus and nitrogen.

11-2.2 An important parameter in BMP design is the runoff volume treated. This volume is often referred to as the first-flush volume or the water quality volume (WQV). This initial flush of runoff is known to carry the most significant non-point pollutant loads. Definitions for this first flush or WQV vary. The most common definitions are (a) the first 0.5 inch of runoff per acre of impervious area, (b) the first 0.5 inch of runoff per acre of catchment area, and (c) the first 1.0 inch of runoff per acre of catchment area.

Table 11-1. BMP Selection Criteria*

Best Management Practices (BMPs)	Area Served (ha)					Soil Type and Minimum Infiltration Rate (mm/hr)											Other Restrictions			
						Sand 210	Loamy Sand 61	Sandy Loam 26	Loam 13	Silt Loam 7	Sandy Clay Loam 4	Clay Loam 2	Silty Clay Loam 1	Sandy Clay 1	Silty Clay 1	Clay 0.5	Ground-water Table (m)	Slope (%)	Prox. to Wells (m)	Normal Depth Range (m)
	0-2	2-4	4-12	12-20	20+	A	A	B	B	C	C	D	D	D	D	D				
Biofiltration	●	●						●	●	●	●	●	●				0.3 - 0.6	<4		
Infiltration Trench	●	●				●	●	●	●								0.6 - 1.2	< 20	> 30	0.6 - 1.8
Infiltration Basin		●	●	●		●	●	●	●								0.6 - 1.2	< 20	> 30	0.6 - 1.8
Grassed Swales (with Check Dams)	●	●	●			●	●	●	●	●	●						0.3 - 0.6	< 5		0.15 - 0.6
Filter Strips	●					●	●	●	●	●	●						0.3 - 0.6	< 20		
Water Quality Inlet	●					●	●	●	●	●	●	●	●	●	●	●				
Detention Ponds			●	●	●	●	●	●	●	●	●	●	●	●						
Retention Ponds			●	●	●				●	●	●	●	●	●	●	●				
Extended Detention/ Retention Ponds			●	●	●	●	●	●	●	●	●	●	●	●						
Detention/Retention With Wetland Bottoms			●	●	●	●	●	●	●	●	●	●	●							

*** Source: HEC-22**

Table 11-2. Pollutant Removal Comparison for Various Urban BMP Designs*

BMP/design		Pollutant removal efficiency (%)						
		Suspended Sediment	Total Phosphorus	Total Nitrogen	Oxygen Demand	Trace Metals	Bacteria	Overall Removal Capability
Extended detention pond	Design 1	60 - 80	20 - 40	20 - 40	20 - 40	40 - 60	Unknown	Moderate
	Design 2	80 - 100	40 - 60	20 - 40	40 - 60	60 - 80	Unknown	Moderate
	Design 3	80 - 100	60 - 80	40 - 60	40 - 60	60 - 80	Unknown	High
Wet pond	Design 4	60 - 80	40 - 60	20 - 40	20 - 40	20 - 40	Unknown	Moderate
	Design 5	60 - 80	40 - 60	20 - 40	20 - 40	60 - 80	Unknown	Moderate
	Design 6	80 - 100	60 - 80	40 - 60	40 - 60	60 - 80	Unknown	High
Infiltration trench	Design 7	60 - 80	40 - 60	40 - 60	60 - 80	60 - 80	60 - 80	Moderate
	Design 8	80 - 100	40 - 60	40 - 60	60 - 80	80 - 100	60 - 80	High
	Design 9	80 - 100	60 - 80	60 - 80	80 - 100	80 - 100	80 - 100	High
Infiltration basin	Design 7	60 - 80	40 - 60	40 - 60	60 - 80	40 - 60	60 - 80	Moderate
	Design 8	80 - 100	40 - 60	40 - 60	60 - 80	80 - 100	60 - 80	High
	Design 9	80 - 100	60 - 80	60 - 80	80 - 100	80 - 100	80 - 100	High
Porous pavement	Design 7	40 - 60	60 - 80	40 - 60	60 - 80	40 - 60	60 - 80	Moderate
	Design 8	80 - 100	60 - 80	60 - 80	60 - 80	80 - 100	80 - 100	High
	Design 9	80 - 100	60 - 80	60 - 80	80 - 100	80 - 100	80 - 100	High
Water quality inlet	Design 10	0 - 20	Unknown	Unknown	Unknown	Unknown	Unknown	Low
Filter strip	Design 11	20 - 40	0 - 20	0 - 20	0 - 20	20 - 40	Unknown	Low
	Design 12	80 - 100	40 - 60	40 - 60	40 - 60	80 - 100	Unknown	Moderate
Grassed swale	Design 13	0 - 20	0 - 20	0 - 20	0 - 20	0 - 20	Unknown	Low
	Design 14	20 - 40	20 - 40	20 - 40	20 - 40	0 - 20	Unknown	Low

Design 1: First-flush runoff volume detained for 6-12 h. **Design 2**: Runoff volume produced by 25 mm (1.0 in), detained 24 h. **Design 3**: As in Design 2, but with shallow marsh in bottom stage. **Design 4**: Permanent pool equal to 13 mm (0.5 in) storage per impervious hectare (acre). **Design 5**: Permanent pool equal to 2.5 (Vr); where Vr = mean storm runoff. **Design 6**: Permanent pool equal to 4.0 (Vr); approx. 2 weeks retention. **Design 7**: Facility exfiltrates first-flush; 13 mm (0.5 in) runoff/imper. hectare (acre). **Design 8**: Facility exfiltrates 25-mm (1-in) runoff volume per imper.hectare (acre). **Design 9**: Facility exfiltrates all runoff, up to the 2-yr design storm. **Design 10**: 11 m^3 (400 ft^3) wet storage per imper. hectare (acre). **Design 11**: 6-m (20-ft) wide turf strip. **Design 12**: 30-m (100-ft) wide forested strip, with level spreader. **Design 13**: High-slope swales with no check dams. **Design 14**: Low-gradient swales with check dams.

*** Source: HEC-22**

In general terms, the greater the volume treated, the better the pollutant removal efficiency; however, treating volumes in excess of 1.0 inch per acre of catchment area results in only minor improvements in pollutant removal efficiency.

11-3 ESTIMATING POLLUTANT LOADS

11-3.1 To predict the impact of development activities in a watershed, pollutant loadings can be estimated for both pre- and post-development scenarios. Several methods and models are currently available that employ algorithms for pollutant loading estimation. The Simple Method is an aptly named empirical method that is intended for use on sites of less than 1 mi^2. It assumes that an average pollutant concentration is multiplied by the average runoff to yield an average loading estimate.

11-3.2 The FHWA has developed a computer model that deals with the characterization of storm water runoff pollutant loads from highways. Impacts to receiving water, specifically lakes and streams, are predicted from the estimated loadings. More detail on the estimating procedures can be found in the 4-volume FHWA report, *Pollutant Loadings and Impacts from Highway Stormwater Runoff (1990), RD-88-006/008*.

11-3.3 Several other comprehensive storm water management models have the ability to generate pollutant loads and the fate and transport of the pollutants:

- Storm Water Management Model (SWMM)
- Storage, Treatment, Overflow, Runoff Model (STORM)
- Hydrologic Simulation Program, Fortran (HSPF)
- Virginia Storm Model (VAST)

11-4 EXTENDED DETENTION DRY PONDS. Extended detention dry ponds are depressed basins that temporarily store a portion of storm water runoff following a storm event. Water is typically stored for up to 48 hours following a storm by means of a hydraulic control structure to restrict outlet discharge. The extended detention of the storm water provides an opportunity for urban pollutants carried by the flow to settle out.

11-5 WET PONDS. A wet pond, or retention pond, serves the dual purpose of controlling the volume of storm water runoff and treating the runoff for pollutant removal. Wet ponds are designed to store a permanent pool during dry weather. These ponds are an attractive BMP alternative because the permanent pool can have aesthetic value and can be used for recreational purposes and as an emergency water supply. Pollutant removal in wet ponds is accomplished through gravity settling, biological stabilization of solubles, and infiltration.

11-6 INFILTRATION/EXFILTRATION TRENCHES. Infiltration trenches are shallow excavations that have been backfilled with a coarse stone media. An infiltration trench forms an underground reservoir that collects runoff and either exfiltrates it to the subsoil or diverts it to an outflow facility. The trenches primarily serve as a BMP that

provides moderate to high removal of fine particulates and soluble pollutants, but also are employed to reduce peak flows to pre-development levels. Use of an infiltration trench is feasible only when soils are permeable and the seasonal groundwater table is below the bottom of the trench.

11-7 INFILTRATION BASINS. An infiltration basin is an excavated area that impounds storm water flow and gradually exfiltrates it through the basin floor. Infiltration basins are similar in appearance and construction to conventional dry ponds; however, the detained runoff is exfiltrated though permeable soils beneath the basin, removing both fine and soluble pollutants. Infiltration basins can be designed as combined exfiltration/detention facilities or as simple infiltration basins.

11-8 SAND FILTERS. Sand filters provide storm water treatment for first flush runoff. The runoff is filtered through a sand bed before being returned to a stream or channel. Sand filters are generally used in urban areas and are particularly useful for groundwater protection where infiltration into soils is not feasible.

11-9 WATER QUALITY INLETS. Water quality inlets are pre-cast storm drain inlets that remove sediment, oil and grease, and large particulates from parking lot runoff before it reaches storm drainage systems or infiltration BMPs. As three-stage underground retention systems designed to settle out grit and absorbed hydrocarbons, they are commonly known as oil and grit separators. Water quality inlets typically serve highway storm drainage facilities adjacent to commercial sites where large amounts of vehicle wastes are generated, such as gas stations, vehicle repair facilities, and loading areas. These inlets may be used to pretreat runoff before it enters an underground filter system.

11-10 VEGETATIVE PRACTICES. Several types of vegetative BMPs can be applied to convey and filter runoff:

- Grassed swales
- Filter strips
- Wetlands

Vegetative practices are non-structural BMPs and are significantly less costly than structural controls. They are commonly used in conjunction with structural BMPs, particularly as a means of pre-treating runoff before it is transferred to a location for retention, detention, storage, or discharge.

11-11 ULTRA-URBAN BMPS.

11-11.1 The relative merits of traditional storm water control measures in the context of existing developed communities have become an important issue. The EPA Phase II storm water regulations (National Pollutant Discharge Elimination System Stormwater Program), the safety of public water supplies, and the threat to endangered aquatic species have intensified interest in identifying innovative approaches for protecting source and receiving water quality. Also, additional drivers for innovation are the

implementation of Section 6217g of the Coastal Zone Act Reauthorization Amendments (CZARA), state coastal nonpoint source management programs, and the desire of many local watershed committees to improve and restore degraded streams as part of their watershed restoration priorities submitted to EPA by states as requested by the Clean Water Action Plan. Comprehensive storm water regulations, space limitations, hardened infrastructure, high urban land values, limitations of traditional BMPs, and the increase in urban runoff pollutant loads over the last decade have spurred the development of a new class of products and technologies. These non-traditional methods of capturing runoff contaminants before they reach surface and groundwater have been labeled in many circles as "ultra-urban" technologies.

11-11.2 Ultra-urban storm water technologies have an appeal that historical methods of storm water management do not have in developed areas. They are particularly suited to retrofit applications in the normal course of urban renewal, community revitalization, and redevelopment, as well as new urban development. These engineered devices are typically structural and are made on a production line in a factory. They may be designed to handle a range of pollutant and water quality conditions in highly urbanized areas. Some ultra-urban storm water controls have small footprints and may be literally dropped into the urban infrastructure or integrated into the streetscape of both private and public sector property. Others may be installed beneath parking lots and garages or on rooftops. Still others are designed to remove pollutants before they are flushed into urban runoff collection systems.

11-12 TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES. Most states have erosion and sedimentation (E&S) control regulations for land disturbance activities. The purpose of E&S measures is to reduce erosive runoff velocity and to filter the sediment created by the land disturbance. Temporary E&S controls are applied during the construction process and consist of structural and/or vegetative practices. The control measures are usually removed after final site stabilization unless they prove to be necessary for permanent stabilization. A few of these practices are listed here (for more information on these practices, see HEC-22):

- Mulching
- Temporary/permanent seeding
- Sediment basins
- Check dams
- Silt fence
- Brush barrier
- Diversion dike
- Temporary slope drain

CHAPTER 12

DESIGN COMPUTER PROGRAMS

12-1 STORM WATER MANAGEMENT PROGRAMS. In developed areas, planners, designers, and operators of storm water drainage systems are often required to determine quantities of storm water runoff and evaluate its quality as an important component in the overall condition of an area or watershed.

Drainage analysis programs and software are constantly updated and/or new programs and software developed. The programs and software listed in this chapter are only a few of many available for drainage analysis and are not the only programs or software which may be used for analysis. Two computer models designed principally for urban areas are available. These are STORM, developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers, and SWMM, developed for the EPA.

12-2 DRIP (DRAINAGE REQUIREMENT IN PAVEMENTS). DRIP is a Windows® computer program developed by the FHWA for pavement subsurface drainage design.

12-3 CANDE (CULVERT ANALYSIS AND DESIGN). CANDE is a special-purpose, finite-element computer program developed for the structural analysis and design of buried culverts and structures for all shapes and materials including corrugated metal, reinforced concrete and thermoplastics. The program is available from the Cande Web site:

http://www.candeforculverts.com/download.html

12-4 MODBERG. ModBerg calculates the maximum depth of frost penetration for a given location. This program is available from the PCASE Downloads:

www.pcase.com

12-5 PIPECAR. PIPECAR is a program for structural analysis and design of circular and horizontal reinforced concrete pipe. Load analysis includes pipe weight, soil weight, internal fluid load, LL, and internal pressures up to 50 feet of head. The program is available for download from the Hydraulics Engineering page of the Federal Highway Administration Web site:

http://www.fhwa.dot.gov/bridge/pipecar.cfm

12-6 ADDITIONAL SOFTWARE. Several software packages are available that provide quick and precise analysis of urban hydrology and hydraulics. The software programs reviewed in this chapter are public sector programs that incorporate many of the procedures discussed in this UFC. These modeling packages are reviewed:

- HYDRAIN
- HYDRA
- WSPRO

- HYDRO
- HY8
- HYCHL
- NFF
- HYEQT
- TR-55
- TR-20
- HMS
- HEC-RAS
- SWMM
- PSRM-QUAL
- Hydraulic Toolbox (HY-TB)
- HY22 Urban Drainage Design Programs
- DR3M

Table 12-1 presents a software versus capabilities matrix for these software packages. Some of the models have a single capability, such as hydrologic analysis, while other packages offer a variety of analysis and design options.

Table 12-1. Software vs. Capabilities Matrix

	Storm Drains	Hydrology	Water Surface Profiles	Culverts	Roadside/ Median Channels	Water Quality	Pavement Drainage	Pond Routing	BMP Evalu-ation	Metric Version
HYDRAIN	●	●	●	●	●		●	●		●
TR-55		●								
TR-20		●						●		
HMS		●						●		●
SWMM	●	●				●	●	●	●	●
PSRM-QUAL	●	●				●	●	●	*	
DR3M	●	●					●	●		
HY-TB	●				●		●			
Urban Drainage	●				●		●	●		●
Evaluation of Water Quality						●			●	

*To be added in a future update.

Many private and public domain software products are available for the analysis and design of various components of storm drain systems. These products range from simple computational tools for specific components of the storm drain system to complex programs that can analyze complete storm drain systems using interactive graphical interfaces. The computer hardware and software industry is a rapidly changing industry in which new and more advanced applications software is

developed each year. This chapter is limited to a review of public sector software. For public sector software, user support is minimal or nonexistent if the software is obtained directly from the Government. Private vendors sell many of these packages and may offer user support.

12-6.1 HYDRAIN. HYDRAIN is an integrated computer software system consisting of hydraulic and hydrologic analysis programs. The system manages engineering computations and data associated with these subprograms:

- HYDRA - Storm Drain and Sanitary Sewer Design and Analysis
- WSPRO - Open Channel Water Surface Analysis, Bridge Hydraulics, Scour
- HYDRO - Design Event versus Return Period Hydrology
- HYCLV - Culvert Design and Analysis
- HY8 - FHWA Culvert Analysis and Design
- HYCHL - Flexible and Rigid Channel Lining Design and Analysis
- HYEQT - Equation Program
- NFF - USGS National Flood Frequency Program

12-6.1.1 HYDRAIN is a versatile hydrologic and hydraulic software package. The subprograms within the system offer a variety of analysis and design option tools. The HYDRAIN programs are embedded within a system shell that allows for quick and easy access to each module. File operations, access to program editors, and other Disk Operating System (DOS) utilities can be performed through the input shell.

12-6.1.2 Data entry for most programs within the system is done through the command line editor. The editor is equipped with short and long helps to aid the user. The user supplies the input data for the subprogram within one input file. If the subprogram is run from within the HYDRAIN environment, the input file may be modified without leaving HYDRAIN by using the built-in editor. This feature minimizes the time required for data modification and job resubmission.

12-6.1.3 HY8 and HYCHL are interactive programs. In other words, these programs access a series of menus that ask the user for specific input.

12-6.1.4 HYDRAIN can handle almost all aspects of storm drain design in a highway context. It is applicable to analysis of simple hydrologic situations and design or analysis of simple and complex hydraulic systems. HYDRAIN is easy to use, providing a full screen input editor and extensive help messages.

12-6.2 HYDRA. HYDRA (HighwaY Storm DRAinage) is a storm drain and sanitary sewer analysis and design program. Originally developed in 1975, the program ran on mainframe computer systems. HYDRA provides hydraulic engineers a means of accurately, easily, and quickly designing and analyzing storm, sanitary, or combined collection systems. Of HYDRA's many features, these are particularly useful:

12-6.2.1 **Operational Modes**. HYDRA operates in two modes: design and analysis. In the analysis mode, HYDRA analyzes a drainage system given user-supplied specifications. In the design mode, HYDRA can "free design" its own drainage system based on design criteria supplied by the user.

12-6.2.2 **System Types**. In either the design or the analysis mode, HYDRA can work with 3 possible types of systems: (1) storm drain systems, (2) sanitary (sewer) systems, and (3) combined (storm and sanitary) sewer systems.

12-6.2.3 **Hydraulic Analysis Features**. Two options are available to HYDRA users: the calculation of the HGL through a system and the simulation of a system under pressurized (surcharged) flow conditions.

12-6.2.4 **Storm Flow Simulation Methods**. HYDRA is capable of simulating storm flow based on either the Rational Method for peak flow simulation or user-supplied hydrographic simulation.

12-6.2.5 **Detention Basin Routing**. HYDRA will design or analyze a detention pond by routing a hydrograph with the storage-indication method.

12-6.2.6 **Planning**. HYDRA can be used for determining the most practical alternatives for unloading an existing overloaded storm drain and for formulating master plans to allow for the orderly growth of these systems.

12-6.2.7 **Drainage Systems Size**. HYDRA has a data handling algorithm especially designed to accept a drainage system of any realistically conceivable design, including complicated branching systems.

12-6.2.8 **Infiltration/Inflow Analysis**. HYDRA can account for undesirable inputs, such as infiltration in sanitary sewer systems.

12-6.2.9 **Cost Estimation**. HYDRA's cost estimation capabilities include consideration of de-watering, traffic control, sheeting, shrinkage of backfill, costs of borrow, bedding costs, surface restoration, rock excavation, pipe zone costs, and more. HYDRA is also sufficiently flexible to allow cost criteria to be varied for any segment of pipe in a system. Ground profiles, either upstream or downstream from any specified point along the system, can also be accepted for consideration in cost estimation.

12-6.3 WSPRO. WSPRO (Water Surface PROfile) is a water surface profile computation program originally developed by the USGS for the FHWA. Water surface profile computations are made with the standard step method in the absence of bridges. The majority of water surface profile computations are now performed by HEC-RAS, which is described in paragraph 12-7.12.

12-6.4 HYDRO. HYDRO is a hydrologic analysis program based on the FHWA's HDS-2. It combines existing approaches for rainfall runoff analysis into one system. HYDRO generates point estimates or a single design event. It is not a continuous simulation model. HYDRO uses the probabilistic distribution of natural events such as

rainfall or stream flow as a controlling variable. HYDRO can be considered a computer-based subset of HDS-2.

12-6.4.1 HYDRO capabilities are divided into three major hydrological categories: rainfall analysis, IDF curve generation, and flow analysis. HYDRO's rainfall analysis features allow the user to investigate steady-state (rainfall intensity) and dynamic (hyetograph) rainfall conditions. Both the rainfall analysis and IDF curve generation are a function of frequency, geographic location, and duration of the storm event.

- Rainfall Analysis. HYDRO can internally calculate rainfall intensities for any site in the continental United States. This rainfall is a single peak rainfall. HYDRO can also be used to create a triangular hyetograph.

- IDF Curves. IDF curves can be created using the internal intensity databases. The curves will show, for a user-provided frequency, the duration versus intensity for any location in the continental United States. The frequency can be any whole number between 2 and 100 year and the duration can extend from 5 min to 24 hour of rainfall duration.

- Peak Flow Methods. HYDRO implements three peak flow methods: the Rational Method; user-supplied regression equations; and the Log-Pearson Type III method. Each of these methods produces a single peak flow value or steady state of low-flow value.

- Hydrograph Method. HYDRO can combine the peak flow with the dimensionless hydrograph to handle hydrographic or dynamic flow conditions. HYDRO includes two dimensionless hydrograph methods: the USGS nationwide urban method and the semi-arid method.

12-6.5 HY8. HY-8 is a computerized implementation of FHWA-endorsed culvert hydraulic analysis approaches and protocols. The HY-8 program is available free of charge. The technical methods incorporated in the updated HY-8 program are based on the following research efforts and FHWA publications:

- “Hydraulic Design Series 5: Hydraulic Design of Highway Culverts” (HDS 5), Third Edition, February 2012

- “Hydraulic Engineering Circular 14: Hydraulic Design of Energy Dissipators for Culverts and Channels” (HEC-14), Third Edition, July 2006

- “Effects of Inlet Geometry on Hydraulic Performance of Box Culverts,” December, 2006

- NCHRP Project 15-24, Hydraulic Loss Coefficients for Culverts, 2011

12-6.6 HYCHL. HYCHL is a channel lining analysis and design program. The basis for program algorithms are the FHWA's HEC-15 and HEC-11. The program performs several options and analyses:

12-6.6.1 **Stability Analysis**. HYCHL can analyze drainage channels for stability given design flow and channel conditions (i.e., slope, shape, and lining type).

12-6.6.2 **Maximum Discharge**. The maximum discharge a particular channel lining can convey can be calculated based on the permissible shear stress of the lining.

12-6.6.3 **Multiple Lining Types**. Depending on channel function, material availability, costs, aesthetics, and desired service life, a designer may choose from a variety of lining types, whether single or composite. HYCHL can perform analysis on rigid or flexible linings. Rigid linings in HYCHL include concrete, grouted riprap, stone masonry, soil cement, and asphalt. Flexible linings include a variety of temporary and permanent lining types. Permanent flexible linings include vegetation, riprap, and gabions. Riprap-lined channels can be designed or analyzed as irregular or regular channel shapes. Temporary linings include woven paper, jute mesh, fiberglass roving, straw with net, curled wood mat, synthetic mat, and bare soil (unlined).

12-6.6.4 **Alternative Channel Shapes**. Channel cross sections available in HYCHL include trapezoidal, parabolic, triangular, triangular with rounded bottom, and irregular (user-defined) shapes.

12-6.6.5 **Constant on Variable Channel Inflow**. HYCHL can evaluate the performance of channel linings using a design flow that is assumed to be either a constant for the entire channel length or a variable inflow. The variable lineal flow results in an increasing discharge with channel length.

12-6.7 NSS. To provide simple methods of estimating streamflow statistics, the U.S. Geological Survey (USGS) has developed and published regression equations estimating the magnitude and frequency of floods for every State, the Commonwealth of Puerto Rico, and a number of metropolitan areas in the United States, and regression equations for estimating other streamflow statistics are available for many states. These equations have been compiled into the National Streamflow Statistics (NSS) Program.

12-6.8 HYEQT. The HYDRAIN equation program (HYEQT) is an application program that allows a user to input and solve regression equations for solving peak flow (or any other formula of interest). This program can be used instead of the NFF program to allow for modification of the USGS regression equations. These equations provide estimates that engineers and hydrologists can use for planning and design applications.

12-6.9 TR-55. TR-55 is a hydrology program that implements SCS methods for calculating time of concentration, peak flows, hydrographs, and detention basin storage volumes. It is applicable to urban drainage situations where detailed hydrograph routing procedures are not warranted. The program, now compatible with Windows™ operating systems, incorporates the procedures outlined in Technical Release 55 (TR-55). TR-55 contains simplified procedures to calculate storm runoff volume, peak rate of discharge,

hydrographs, and storage volumes required for storm water reservoirs. The procedures are applicable in small urbanizing watersheds in the United States.

TR-55 is extremely easy to use, with interactive menus that prompt the user for specific inputs. Several screens of input are normally required before an analysis can proceed. Help screens assist the user in successfully performing an analysis. These are some of the options and analyses included in TR-55:

12-6.9.1 **Estimating Runoff**. TR-55 employs the SCS Runoff Curve Number Method or the Graphical Peak Discharge Method to estimate peak discharges in a rural or urban watershed.

12-6.9.2 **Time of Concentration and Travel Time**. TR-55 computes travel time for sheet flow, shallow concentrated flow, and open-channel flow. Travel time for sheet flow is estimated using Manning's kinematic solution. Travel time in open channels is evaluated by applying Manning's equation.

12-6.9.3 **Tabular Hydrograph Method**. The Tabular Hydrograph method can develop partial composite flood hydrographs at any point in a watershed by dividing the watershed into homogeneous subareas.

12-6.9.4 **Storage Volume for Detention Basins**. TR-55 can also estimate detention basin storage volume.

12-6.10 TR-20. TR-20, based on SCS Technical Release 20, is a comprehensive hydrology program that implements SCS methods for generating and routing runoff hydrographs in a multibasin watershed. The program provides for hydrographic analyses of a watershed under present conditions and various combinations of land cover/use and structural or channel modifications using single rainfall events. Output consists of runoff peaks and/or flood hydrographs, their time of occurrence, and water surface elevations at any desired cross section or structure. Subarea surface runoff hydrographs are developed from storm rainfall using an SCS dimensionless unit hydrograph (UH), drainage areas, times of concentration, and SCS runoff curve numbers. Hydrographs can be developed, routed, added, stored, diverted, or divided to convey floodwater from the headwaters to the watershed outlet. TR-20 is applicable only to larger watersheds where detailed hydrograph routing is warranted. These are some of the options and analyses employed by TR-20:

12-6.10.1 **Runoff Volume**. A mass curve of runoff is developed for each subwatershed. The runoff curve number (CN), rainfall volume, and rainfall distribution are the input variables needed to determine the mass curve. CNs are determined by the user for each subwatershed based on soil, land use, and hydrologic condition information. The runoff volume is computed using the SCS runoff equation. The program can develop and route the runoff from as many as nine different rainfall distributions and ten different storms for each rainfall distribution. Runoff depths and durations will be developed and routed for a rainfall distribution defined in either dimensionless units or actual time units.

12-6.10.2 **Hydrograph Development**. An incremental UH is developed for each subwatershed. The UH time increment is calculated as a function of the time of concentration. The incremental runoff volume is determined for each time increment. The composite flood hydrograph is computed by summing the incremental hydrograph ordinates. A maximum of 300 ordinates (discharge values) can be stored for any composite flood hydrograph. The peak flow value of the composite flood hydrograph is computed by a separate routine that utilizes the Gregory-Newton forward difference formula for fitting a second degree polynomial through the 3 largest consecutive hydrograph values saved at the main time increment. In multiple peaked hydrographs, up to ten peaks may be computed.

12-6.10.3 **Reservoir Routing**. The composite flood hydrograph is routed through a reservoir using the storage indication method. The program can route a hydrograph through up to 99 structures and an unlimited number of variations for each structure.

12-6.10.4 **Reach Routing**. The composite flood hydrograph is routed through a valley reach using a modified Attenuation-Kinematic (Att-Kin) method. TR-20 can route through up to 200 stream reaches and an unlimited number of channel modifications for each reach.

12-6.11 HMS. HMS is a flood hydrograph package developed by the U.S. Army Corps of Engineers. The HMS model, like TR-20, is designed to simulate the surface runoff response of a river basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. Each component models an aspect of the precipitation-runoff process within a portion of the basin. A component may represent a surface runoff entity, a stream channel, or a reservoir. Representation of a component requires a set of parameters that specify the particular characteristics of the component and mathematical relations that describe the physical processes. The result of the modeling process is the computation of streamflow hydrographs at desired locations in the river basin. It is applicable to only larger watersheds where detailed hydrograph routing is warranted.

Simulating a river basin as a group of subareas interconnected through channel routing reaches and confluences, HMS performs hydrologic calculations on a user-specified time step for a single storm (soil moisture recovery during dry spells is not included). HMS is used to generate discharge, not water surface elevations (although it does calculate normal depth). The HEC-RAS model is typically used in conjunction with HMS to determine water surface profiles through detailed hydraulic computations. These are the major components and characteristics of HMS:

12-6.11.1 **Precipitation**. A precipitation hyetograph is used as input for all runoff calculations. Precipitation data for an observed event can be user-supplied or synthetic storms can be used. Snowfall and snowmelt can also be considered.

12-6.11.2 **Hydrographs**. There are three synthetic UH methods in the HMS model, including the Clark UH, the Snyder UH, and the SCS dimensionless UH. User-defined UHs can be entered directly.

12-6.11.3 **Flood Routing**. Flood routing can be computed by a variety of methods, including Muskingum, Muskingum-Cunge, kinematic wave, modified Puls, working R and D, and level-pool reservoir routing.

12-6.11.4 **Flood Damage/Flood Control System Optimization**. The reservoir component of the HMS model is employed in a stream network model to simulate dam failure. HMS also has a flood control system optimization option which is used to determine optimal sizes for the flood loss mitigation measures in a river basin flood control plan.

HMS was first developed in 1968 and has undergone several revisions over the years. New capabilities of the most recent version include database management interfaces and a graphics program that allows plots of information stored in the HMS database. In addition, a user-friendly input program is available to help first-time users of HMS. The program helps the user to assemble the correct sequence of records for an HMS input file.

12-6.12 HEC-RAS. HEC-RAS is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels.

The HEC-RAS system contains four one-dimensional river analysis components for: (1) steady flow water surface profile computations; (2) unsteady flow simulation; (3) movable boundary sediment transport computations; and (4) water quality analysis. A key element is that all four components use a common geometric data representation and common geometric and hydraulic computation routines. In addition to the four river analysis components, the system contains several hydraulic design features that can be invoked once the basic water surface profiles are computed.

- **Steady Flow Water Surface Profiles.** This component of the modeling system is intended for calculating water surface profiles for steady gradually varied flow. The system can handle a full network of channels, a dendritic system, or a single river reach. The steady flow component is capable of modeling subcritical, supercritical, and mixed flow regimes water surface profiles. The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's equation) and contraction/expansion (coefficient multiplied by the change in velocity head). The momentum equation may be used in situations where the water surface profile is rapidly varied. These situations include mixed flow regime calculations (i.e., hydraulic jumps), hydraulics of bridges, and evaluating profiles at river confluences (stream junctions).

- **Unsteady Flow Simulation.** This component of the HEC-RAS modeling system is capable of simulating one-dimensional unsteady flow through a full network of open channels. The unsteady flow equation solver was adapted from Dr. Robert L. Barkau's UNET model (Barkau, 1992 and HEC, 1997). The unsteady flow component was developed primarily for subcritical flow regime calculations. However, with the release of Version 3.1, the model can now performed mixed

flow regime (subcritical, supercritical, hydraulic jumps, and draw downs) calculations in the unsteady flow computations module.

The hydraulic calculations for cross-sections, bridges, culverts, and other hydraulic structures that were developed for the steady flow component were incorporated into the unsteady flow module. Special features of the unsteady flow component include: Dam break analysis; levee breaching and overtopping; Pumping stations; navigation dam operations; and pressurized pipe systems.

- **Sediment Transport/Movable Boundary Computations.** This component of the modeling system is intended for the simulation of one-dimensional sediment transport/movable boundary calculations resulting from scour and deposition over moderate time periods (typically years, although applications to single flood events are possible).

  The sediment transport potential is computed by grain size fraction, thereby allowing the simulation of hydraulic sorting and armoring. Major features include the ability to model a full network of streams, channel dredging, various levee and encroachment alternatives, and the use of several different equations for the computation of sediment transport.

  The model is designed to simulate long-term trends of scour and deposition in a stream channel that might result from modifying the frequency and duration of the water discharge and stage, or modifying the channel geometry. This system can be used to evaluate deposition in reservoirs, design channel contractions required to maintain navigation depths, predict the influence of dredging on the rate of deposition, estimate maximum possible scour during large flood events, and evaluate sedimentation in fixed channels.

- **Water Quality Analysis.** This component of the modeling system is intended to allow the user to perform riverine water quality analyses. An advection-dispersion module is included with this version of HEC–RAS, adding the apability to model water temperature. This new module uses the QUICKEST-ULTIMATE explicit numerical scheme to solve the one-dimensional advection-dispersion equation using a control volume approach with a fully implemented heat energy budget. Transport and Fate of a limited set of water quality constituents is now also available in HEC-RAS. The currently available water quality constituents are: Dissolved Nitrogen (NO3-N, NO2-N, NH4-N, and Org-N); Dissolved Phosphorus (PO4-P and Org-P); Algae; Dissolved Oxygen (DO); and Carbonaceous Biological Oxygen Demand (CBOD).

12-6.13 SWMM. EPA's Storm Water Management Model (SWMM) is used throughout the world for planning, analysis and design related to:

- stormwater runoff
- combined sewers
- sanitary sewers

- other drainage systems in urban areas
- many applications in non-urban areas

This general purpose urban hydrology and conveyance system hydraulics software is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. More information is available at the following web address:
http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/

12-7 HYDRAULIC TOOLBOX (HY-TB). Hydraulic Toolbox is a collection of four hydraulics programs. They are HY12, HY15, BASIN, and SCOUR. Hydraulic Toolbox evaluates gutter and inlet hydraulics, flexible channel lining design, riprap stilling basin design, and culvert outlet scour. It is applicable to analysis of any these drainage components on an individual basis but is not a tool for modeling hydraulic systems.

12-7.1 HY12. HY12 uses the design procedures of HEC-12. The program analyzes the flow in gutters and the interception capacity of grate inlets, curb-opening inlets, slotted drain inlets, and combination inlets on continuous grades and in sags. Both uniform and composite cross-slopes can be analyzed.

12-7.2 HY15. The HY15 program applies the methodologies in HEC-15. HY15 analyzes the hydraulic performance of flexible and concrete channel linings for trapezoidal or triangular channels in straight reaches. The design procedures are based on the concept of maximum permissible tractive force, where channel lining stability is determined by comparing the hydraulic forces exerted on the lining with the maximum permissible shear stress a particular lining can sustain.

12-7.3 BASIN. BASIN is a riprap design program that analyzes the adequacy of riprap-lined basins at the outlet of culverts.

12-7.4 SCOUR. The SCOUR program provides estimates of the scour at the outlet of culverts in terms of depth, width, length, and volume.

The programs in this package are simple and easy to use. Input screens prompt the user for all necessary information to perform an analysis, but there is no on-line user help. Although no supporting documentation exists, related references to the methodologies should provide an adequate theoretical basis for proper application.

12-8 URBAN DRAINAGE DESIGN PROGRAMS. The Urban Drainage Design software is a collection of three hydraulic programs written in BASIC. It includes: (1) Manning's equation for various channel shapes, (2) HEC-22 (Storm Drain Design), and (3) Stormwater Management. Urban Drainage Design software evaluates normal depth flow conditions, gutter and inlet hydraulics, and storm water management pond hydrograph routing. Like the Hydraulic Toolbox, this software is applicable to the analysis of individual drainage components, not to modeling hydraulic systems.

12-8.1 Manning's Equation. The Manning's equation program computes flow through circular, trapezoidal, and triangular channel shapes. Open-channel flow is solved by application of the Manning's equation. Critical depths are also computed by this program.

12-8.2 HEC-22. This is a pavement drainage program which applies the principles of HEC-22. The program allows for analysis of gutter flow, grates, curb openings, combination inlets, inlets in a sump, and median and side ditches. Both uniform and composite cross slopes can be analyzed.

12-8.3 Stormwater Management. This program provides options for computing stage-storage curves for circular pipes, trapezoidal basins, irregular basins, and rectangular basins. There is also an option for reservoir routing using the Storage Indication method. Reservoir routing is one of the main applications of this software.

The programs in this package are basic, straightforward hydraulics computation algorithms that are quick and easy to apply. The programs are menu-driven, prompting the user for all necessary data. Although no supporting documentation exists, related references to the methodologies should provide an adequate theoretical basis for proper application.

12-9 DR3M. The Distributed Routing Rainfall-Runoff Model (DR3M), developed by the USGS, is a watershed model for routing storm runoff through a branched system of pipes and/or natural channels. The model provides detailed simulation of storm runoff periods and a daily soil-moisture accounting between storms. Drainage basins are represented as sets of overland-flow, channel, and reservoir segments that together describe the drainage features of the basin. The kinematic wave theory is used for routing flows over contributing overland-flow areas and through channel networks. A set of model segments can be arranged into a network that will represent many complex drainage basins. The model is intended primarily for application to urban watersheds.

12-9.1 Rainfall-Excess Components. The rainfall-excess components of the model are more complex than the runoff methods discussed in this UFC, and include soil-moisture accounting, pervious area rainfall excess, impervious area rainfall excess, and parameter optimization. The soil-moisture accounting component determines the effect of antecedent conditions on infiltration. Soil moisture is modeled as a dual storage system, one representing the antecedent base-moisture storage, and the other representing the upper-zone storage caused by infiltration into a saturated moisture storage. Pervious-area rainfall excess is determined as a function of the point potential infiltration. In the model, point potential infiltration is computed using the Green-Ampt equation.

12-9.2 Impervious Surfaces. Two types of impervious surfaces are considered by the model. The first type, effective impervious surfaces, are those impervious areas that are directly connected to the channel drainage system. Roofs that drain into driveways, streets, and paved parking lots that drain onto streets are examples of effective impervious surfaces. The second type, noneffective impervious surfaces, are those

impervious areas that drain to pervious areas. An example of this type would be a roof that drains onto a lawn.

12-9.3 Routing. DR3M has the capability to perform routing calculations through application of the kinematic wave theory. The model approximates the complex topography and geometry of a watershed as a set of segments that jointly describe the drainage features of a basin. There are four types of segments: overland-flow segments, channel segments, reservoir segments, and nodal segments.

12-9.4 Model Versatility. DR3M can be used for a wide variety of applications. A set of model segments can be arranged easily into a network that will represent simple or complex drainage basins. The model can be applied to drainage basins ranging from tens of hectares to several square kilometers but not to exceed 25 km^2.

12-9.5 Urban Basin Planning. DR3M can be used for urban basin planning purposes by its determination of the hydrologic effects of different development configurations. Examples of this type of application include assessing the effects of increased impervious cover, detention ponds, or culverts on runoff volumes and peak flows.

12-9.6 Usability. DR3M is a comprehensive drainage system simulation tool. It is applicable to analysis of both simple and complex hydraulic systems. DR3M has menu driven input screens and help messages available to the user through ANNIE (Interactive Hydrologic Analyses and Data Management, a USGS water resources applications program), but the model is complex and requires extensive input data. DR3M, like SWMM, should be considered only for the most complex hydrologic and hydraulic systems.

12-10 EVALUATION OF WATER QUALITY

12-10.1 The Synoptic Rainfall Data Analysis Program (SYNOP) water quality program is the computer implementation of Pollutant Loadings and Impacts From Highway Stormwater Runoff, FHWA/RD-88-006/009. This software characterizes runoff water quality and estimates impacts to streams and lakes. The user defines the site characteristics and the pollutant target concentrations. The model then determines the expected runoff concentration given a user-defined exceedence probability (50th percentile is the site median concentration that is the default setting). The default concentrations included in the model are based on extensive monitoring data: 993 storm events at 31 highway sites in 11 states. After determining the expected runoff concentration, the model performs impact analysis for the stream (dilution modeling) or lake (Vollenweider model of phosphorus concentration only). If the computed concentration exceeds the target, the user can evaluate load reductions with these controls: grass channel, overland flow, wet ponds, and infiltration.

12-10.2 This software is simple and easy to use. Input screens prompt the user for all necessary information. Documentation for the software is adequate, while documentation for the underlying procedures is extensive (see the FHWA reports).

12-10.3 The FHWA highway pollutant loading model estimates the highway runoff load for a number of different pollutants, evaluates the impacts of pollutant load on a receiving stream or lake, and can estimate the water quality improvements with various BMPs. The model is based on a number of simplifying assumptions, but is generally applicable to water quality evaluation for all but the most environmentally sensitive highway projects.

12-11 SOFTWARE AVAILABILITY. Table 12-2 lists where some of the models summarized in this chapter may be obtained.

Table 12-2. Software Program Contact Information

Software Model	Contact Information
HYDRAIN	Mc*Trans* University of Florida PO Box 116585 Gainesville, Florida 32611-6585 (800) 226-1013 http://www-mctrans.ce.ufl.edu/
TR-55	Natural Resources Conservation Service National Water and Climate Center 1201 Lloyd Blvd., Suite 802 Portland, Oregon 97232-1274 (503) 414-3031 http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1042901
TR-20	Natural Resources Conservation Service National Water and Climate Center 1201 Lloyd Blvd., Suite 802 Portland, Oregon 97232-1274 (503) 414-3031 http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?cid=stelprdb1042793
HMS	U.S. Army Corps of Engineers Institute for Water Resources Hydrologic Engineering Center 609 Second Street Davis, California 95616-4687 (530) 756-1104 http://www.hec.usace.army.mil/

Software Model	Contact Information
HEC-RAS	U.S. Army Corps of Engineers Institute for Water Resources Hydrologic Engineering Center 609 Second Street Davis, California 95616-4687 (530) 756-1104 http://www.hec.usace.army.mil/
SWMM	U.S. Environmental Protection Agency National Risk Management Research Laboratory (NRMRL) Water Supply and Resources Division Urban Watershed Management Branch 2890 Woodbridge Ave. (MS104) Edison, New Jersey 08837 http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/
Hydraulic Toolbox	Mc*Trans* University of Florida PO Box 116585 Gainesville, Florida 32611-6585 (800) 226-1013 http://www-mctrans.ce.ufl.edu/
Urban Drainage Design	Mc*Trans* University of Florida PO Box 116585 Gainesville, Florida 32611-6585 (800) 226-1013 http://www-mctrans.ce.ufl.edu/
DR3M	United States Department of the Interior U.S. Geological Survey Hydrologic Analysis Software Support Program 437 National Center Reston, Virginia 20192 http://water.usgs.gov/software/dr3m/

GLOSSARY

Abbreviations and Acronyms

AASHTO—American Association of State Highway and Transportation Officials
AC—Advisory Circular
AFI—Air Force instruction
AFPAM—Air Force pamphlet
AFPD—Air Force policy directive
AFR—Air Force regulation
AIMM to SCORE—Assess, Implement, Manage, and Measure to Achieve Sustained Compliance and Operational Readiness through Environmental Excellence
AR—Army Regulation
AREMA—American Railway Engineering and Maintenance of Way Association
ASTM—American Society for Testing and Materials
ATT-Kin—attenuation-kinematic
AT&A—air traffic and airspace
AT&L—Acquisition, Technology, and Logistics
BDF—basin development factor
BMP—best management practice
CANDE-89—Culvert Analysis and Design software
CCR—Criteria Change Request
CERF—Civil Engineering Research Foundation
CERL—Construction Engineering Research Laboratory
CFR—Code of Federal Regulations
CNO/CMC—Chief of Naval Operations/Command Master Chief
CORPS—Conversationally-Oriented Real-Time Programming System
CZARA—Coastal Zone Act Reauthorization Amendments
Dia.—diameter
DDSOFT—Drainage Design Software
DEH—Director of Engineering and Housing
DL—dead load
DM—Design Manual
DOD—Department of Defense
DOS—disk operating system
DRIP—Drainage Requirement In Pavements
DR3M—Distributed Routing Rainfall-Runoff Model
EGL—energy grade line
EHGL—equivalent hydraulic grade line
EIA—Environmental Impact Assessment
EIS—Environmental Impact Statement
EPA—Environmental Protection Agency
EQI—Environmental Quality Initiative
ETL—Engineering Technical Letter
EvTEC—Environmental Technology Evaluation Center
EXTRAN—Extended Transport Module
E&S—erosion and sedimentation

F—Fahrenheit
FAA—Federal Aviation Administration
FONSI—finding of no significant impact
ft—feet
ft/ft—feet per foot
ft/s—feet per second
ft/s^2—feet per cubic second
ft^2—square feet
ft^3/min—cubic feet per minute
ft^3/s—cubic feet per second
ft^3/s/mi^2/in—cubic feet per second per square miles per in
FHWA—Federal Highway Administration
FWPCA—Federal Water Pollution Control Act
gal—gallons
gal/day—gallons per day
GUI—graphical user interface
H—head
HDPE—high density polyethylene
HDS—Hydraulic Design Series
HEC—Hydrologic Engineering Circular
HEC-RAS—Hydrologic Engineering Center River Analysis System
HGL—hydraulic grade line
HMS—Hydrologic Modeling System
HQ AFCESA—Headquarters Air Force Civil Engineer Support Agency
HQ USACE—Headquarters U.S. Army Corps of Engineers
hr—hour
HSPF—Hydrological Simulation Program – Fortran
HW—headwater
HW/D—headwater depth
HYCHL—flexible and rigid channel lining design and analysis software
HYCLV—culvert design and analysis software
HYDRA—storm drain and sanitary sewer design and analysis software
HYDRAIN—integrated drainage design software
HYDRO—design event versus return period hydrologic analysis software
HYEQT—flow equation program
HY-TB—Hydraulic Toolbox
HY8—FHWA culvert analysis and design software
ICAO—International Civil Aviation Organization
IDF—Intensity Duration Frequency
IFR—instrument flight rules
in—inches
in^2—square inches
in/ft—inch per foot
in/hr—inches per hour
IP—inch-pound
lb/ft^2—pounds per square foot

lb/in^2—pounds per square inch
LL—live load
LSP—length of stone protection
m—meter
MACOM—major command (Army)
MAJCOM—major command
Mc*Trans*—Center for Microcomputers in Transportation
mi^2—square miles
MIL-STD—Military Standard
min—minutes
mm—millimeter
mm/hr—millimeters per hour
MODBERG—frost penetration calculation program
m^3/s—cubic miles per second
NATO—North Atlantic Treaty Organization
NAVAID—navigational aid
NAVAIR—Naval Air Systems Command
NAVFAC—Naval Facilities Engineering Command
NAVFACENGCOM—Naval Facilities Engineering Command
NDSOFT—Normal Depth Software
NEPA—National Environmental Policy Act
NFF—National Flood Frequency
NSS—National Streamflow Statistics
NOAA—National Oceanic and Atmospheric Administration
NPDES—National Pollutant Discharge Elimination System
NRCS—National Resources Conservation Service
O.C.—on center
OH—Organic clays of medium to high plasticity, organic silts
OL—Organic silts and organic silty clays of low plasticity
OLS—optical lighting system
OSHA—Occupational Safety and Health Administration
PAPI—precision approach path indicator
PCASE—Pavement-Transportation Computer Assisted Structural Engineering
PIPECAR—Pipe Culvert Analysis and Reinforcing Design
PL—Public Law
PSI—pounds per square inch
PVC—polyvinyl chloride
R—radius
SAF—Saint Anthony Falls
SCS—Soil Conservation Service
SI—International System of Units
sq mi—square miles
STORM—Storage, Treatment, Overflow Runoff Model
SWMM—Storm Water Management Model
SYNOP—Synoptic Rainfall Data Analysis Program
TM—Technical Manual

TOC—top of conduit
TR—Technical Release
TS—Technical Standard
TSMCX—USACE Transportation Systems Center
TW—tailwater
UFC—Unified Facilities Criteria
UH—unit hydrograph
U.S.—United States
USAASA—U.S. Army Aeronautical Services Agency
USAAVNC—U.S. Army Aviation Center
USASC—U.S. Army Safety Center
USATCA—U.S. Army Training Center, Armor
USBR—United States Bureau of Reclamation
USC—United States Code
USD—Under Secretary of Defense
USDOT—United States Department of Transportation
USGS—United States Geological Survey
v.—versus
VASI—visual approach slope indicator
VAST—Virginia Storm Model
VFR—visual flight rules
vs.—versus
WQV—water quality volume
WSPRO—water surface profile (open channel water surface analysis) software
yr—year

APPENDIX A

REFERENCES

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Natural Resources Conservation Service P.O. Box 2890 Washington, DC 20250-0001 Internet site: http://www.nrcs.usda.gov/	TR-20, Project Formulation Hydrology TR-55, Urban Hydrology for Small Watersheds

2. U.S. Department of Commerce

DOC/NOAA/National Weather Service Office of Hydrologic Development, Hydrometeorological Design Studies Center, W/OHD12 1325 East-West Highway Silver Spring, MD 20910-3283 Internet site: http://www.nws.noaa.gov/oh/hdsc/	Technical Paper 40, Rainfall Frequency Atlas of the United States *f*or Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years (1961)

3. U.S. Department of Defense

Department of the Air Force Air Force e-Publishing Internet site: http://www.e-publishing.af.mil/	AFI 32-7061, The Environmental Impact Analysis Process AFPAM 91-212, Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques AFPD 32-70, Environmental Quality

Department of the Army Corps of Engineers (USACE) Engineering and Construction Division Directorate of Military Programs Washington, DC 20314-1000	AR 200-1, Environmental Protection and Enhancement ETL 1110-3-466, Selection and Design of Oil/Water Separators at Army Facilities Technical Report E-59, Handbook for Environmental Impact Analysis
Department of the Navy Standardization Documents Order Desk 700 Robbins Avenue, Bldg. 4D Philadelphia, PA 19111-5094	NAVFACINST 11010.44E, Shore Facilities Planning Manual NAVFAC P-272, Definitive Designs for Naval Shore Facilities
Unified Facilities Criteria Internet site: http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4	UFC 3-250-01FA, Design: Pavement Design for Roads, Streets, Walks and Open Storage Areas UFC 3-260-01, Design: Airfield and Heliport Planning and Design

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5. U.S. Department of Transportation

Federal Aviation Administration 800 Independence Avenue, SW Washington, DC 20591 Internet site: http://www.faa.gov/	Order 5050.4, Airport Environmental Handbook Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports AC 150/5300-13, Airport Design AC 150/5320-6, Airport Pavement Design and Evaluation
Federal Highway Administration 400 Seventh Street, SW Washington, DC 20590 Internet site: http://www.fhwa.dot.gov/	FHWA/RD-88-006/009, Pollutant Loadings and Impacts from Highway Stormwater Runoff, Vol. I – Vol. IV HDS-1, Hydraulics of Bridge Waterways HDS-3, Design Charts for Open-Channel Flow HDS-4, Introduction to Highway Hydraulics HDS-5, Hydraulic Design of Highway Culverts HEC-14, Hydraulic Design of Energy Dissipators for Culverts and Channels HEC-15, Design of Roadside Channels with Flexible Linings HEC-22, Urban Drainage Design Manual TS-80-218, Underground Disposal of Storm Water Runoff, Design Guidelines Manual

6. Public Laws, United States Code, and Code of Federal Regulations
   U.S. Government Printing Office
   732 N. Capitol Street, NW
   Washington, DC 20401
   Internet site:
   http://www.gpoaccess.gov/

Coastal Zone Act Reauthorization Amendments of 1990, Section 6217g, PL 101-508, 16 USC § 1455b, November 5, 1990

Coastal Zone Management Act of 1972, PL 92-583, amended by PL 94-310, 16 USC § 1451-1464, October 27, 1972

Environmental Impact Analysis Process (EIAP), 32 CFR 989

Federal Water Pollution Control Act, PL 87-88 (Clean Water Act), 33 USC § 1251-1387, October 18, 1972, as amended

Fish and Wildlife Act of 1956, 16 USC § 742a-742j, August 8, 1956

Fish and Wildlife Coordination Act, as amended, PL 104-66, 16 USC § 661-666c, January 3, 1995

Migratory Game Fish Study, 16 USC § 760c-760g, January 19, 2004

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Safe Water Drinking Act of 1974, as amended, PL 93-523, 42 USC § 300f-300j-26, December 16, 1974

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Section 401 of the Federal Water Pollution Control Act Amendments of 1972, PL 92-500, 33 USC § 1344, October 18, 1972

	Section 402 of the Federal Water Pollution Control Act Amendments of 1972, PL 92-500, 33 USC § 1344, October 18, 1972 Section 404 of the Federal Water Pollution Control Act Amendments of 1972, PL 92-500, 33 USC § 1344, October 18, 1972 Water Quality Act of 1987, PL 100-4, 33 USC § 1251-1387, February 4, 1987
7. Whole Building Design Guide National Institute of Building Sciences (NIBS) 1090 Vermont Avenue NW, Suite 700 Washington, DC 20005 Internet site: http://www.wbdg.org/design/greenspec.php	Federal Green Construction Guide for Specifiers

NON-GOVERNMENT PUBLICATIONS:

1. AASHTO 444 North Capitol Street N.W. Suite 249 Washington, DC 20001 Internet site: http://www.transportation.org/Pages/default.aspx	Highway Drainage Guidelines, Volume V Model Drainage Manual, Chapter 2 Policy on Geometric Design of Highways and Streets T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop HB-17, Standard Specifications for Highway Bridges
2. AREMA 4501 Forbes Blvd., Suite 130 Lanham, MD 20706 Internet site: http://www.arema.org/U5T	Manual for Railway Engineering
3. ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA, 19428-2959 Internet site: http://www.astm.org/	A760/A760M, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains A761/A761M, Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches A762/A762M, Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains A849, Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe B745/B745M, Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains

D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

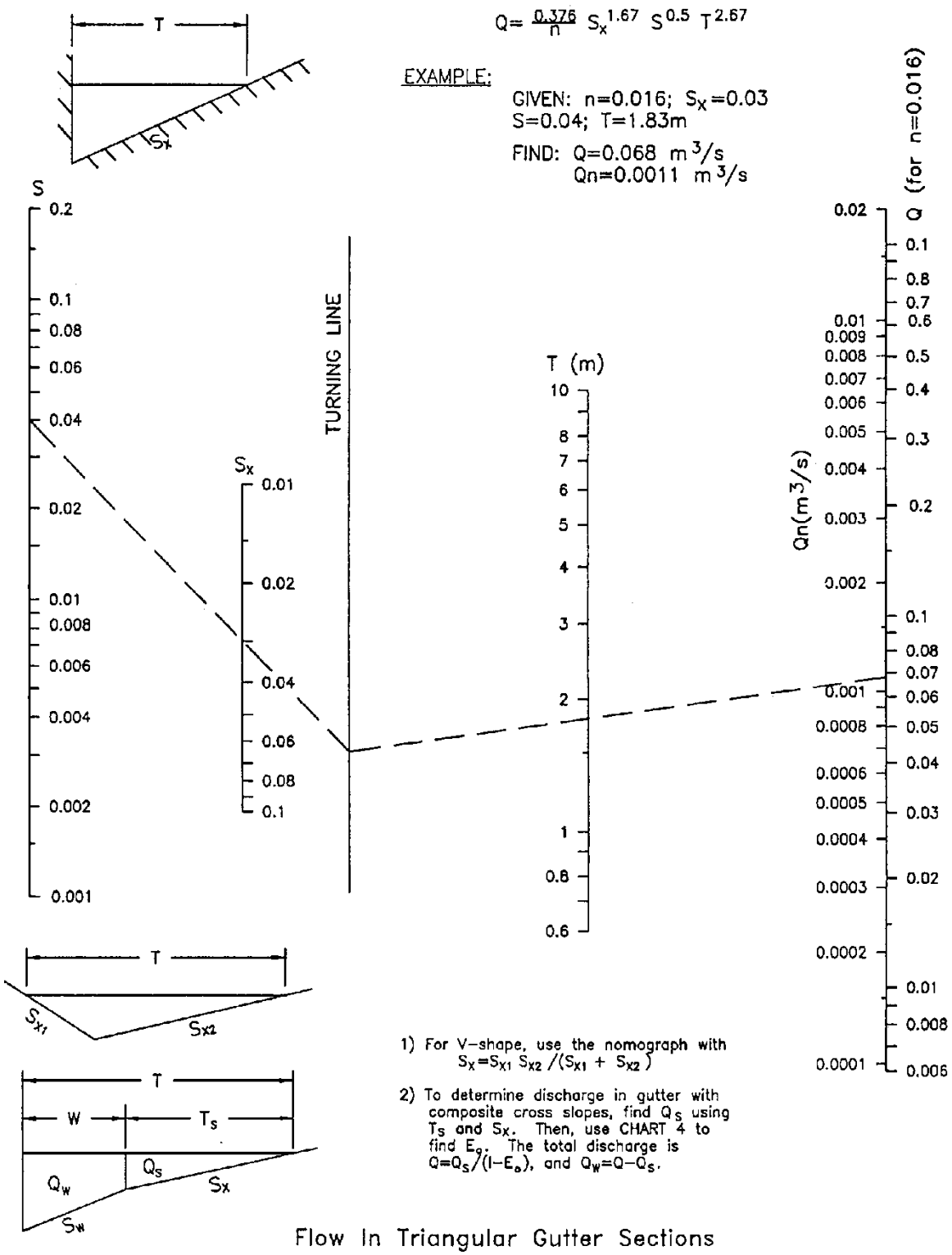
D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

APPENDIX B

LIST OF CHARTS

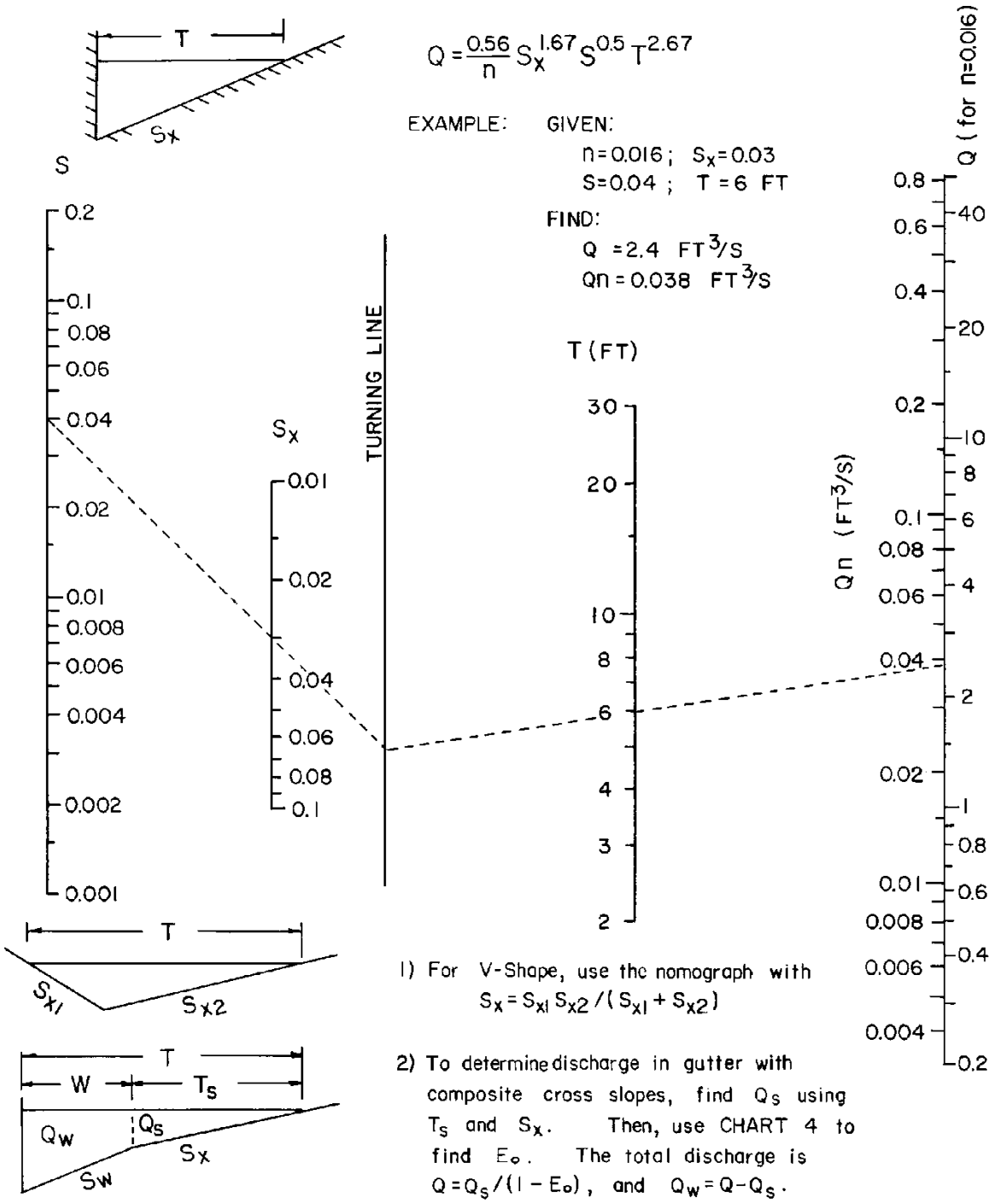
Chart	Description	Page
1A, 1B	Flow in triangular gutter sections	335, 336
2A, 2B	Ratio of frontal flow to total gutter flow	337, 338
3A, 3B	Conveyance in circular channels	339, 340
4A, 4B	Velocity in triangular gutter sections	341, 342
5A, 5B	Grate inlet frontal flow interception efficiency	343, 344
6A, 6B	Grate inlet side flow interception efficiency	345, 346
7A, 7B	Curb-opening and slotted drain inlet length for total interception	347, 348
8A, 8B	Curb-opening and slotted drain inlet interception efficiency	349, 350
9A, 9B	Grate inlet capacity in sump conditions	351, 352
10A, 10B	Depressed curb-opening inlet in sump locations	353, 354
11A, 11B	Undepressed curb-opening inlet in sump locations	355, 356
12A, 12B	Curb-opening inlet orifice capacity for inclined and vertical orifice throats	357, 358
13A, 13B	Slotted drain inlet capacity in sump locations	359, 360
14A, 14B	Solution of Manning's equation for channels of various side slopes	361, 362
15A, 15B	Ratio of frontal flow to total flow in a trapezoidal channel	363, 364
16	Manning's n versus relative roughness for selected lining types	365
17	Channel side shear stress to bottom shear stress ratio, K_1	366
18	Tractive force ratio, K_2	367
19	Angle of repose of riprap in terms of mean size and shape of stone	368
20A, 20B	Protection length, Lp, downstream of channel bend	369, 370
21	K_b factor for maximum shear stress on channel bends	371
22	Geometric design chart for trapezoidal channels	372
23	Permissible shear stress for non-cohesive soils	373
24	Permissible shear stress for cohesive soils	374
25A, 25B	Solution of Manning's formula for flow in storm drains	375, 376
26	Hydraulic elements chart	377
26	(Rotated) Hydraulic elements chart	378
27A, 27B	Critical depth in circular pipes	379, 380
28A, 28B	Headwater depth for concrete pipe culverts with inlet control	381, 382
29A, 29B	Headwater depth for c.m. pipe culverts with inlet control	383, 384

CHART 1A



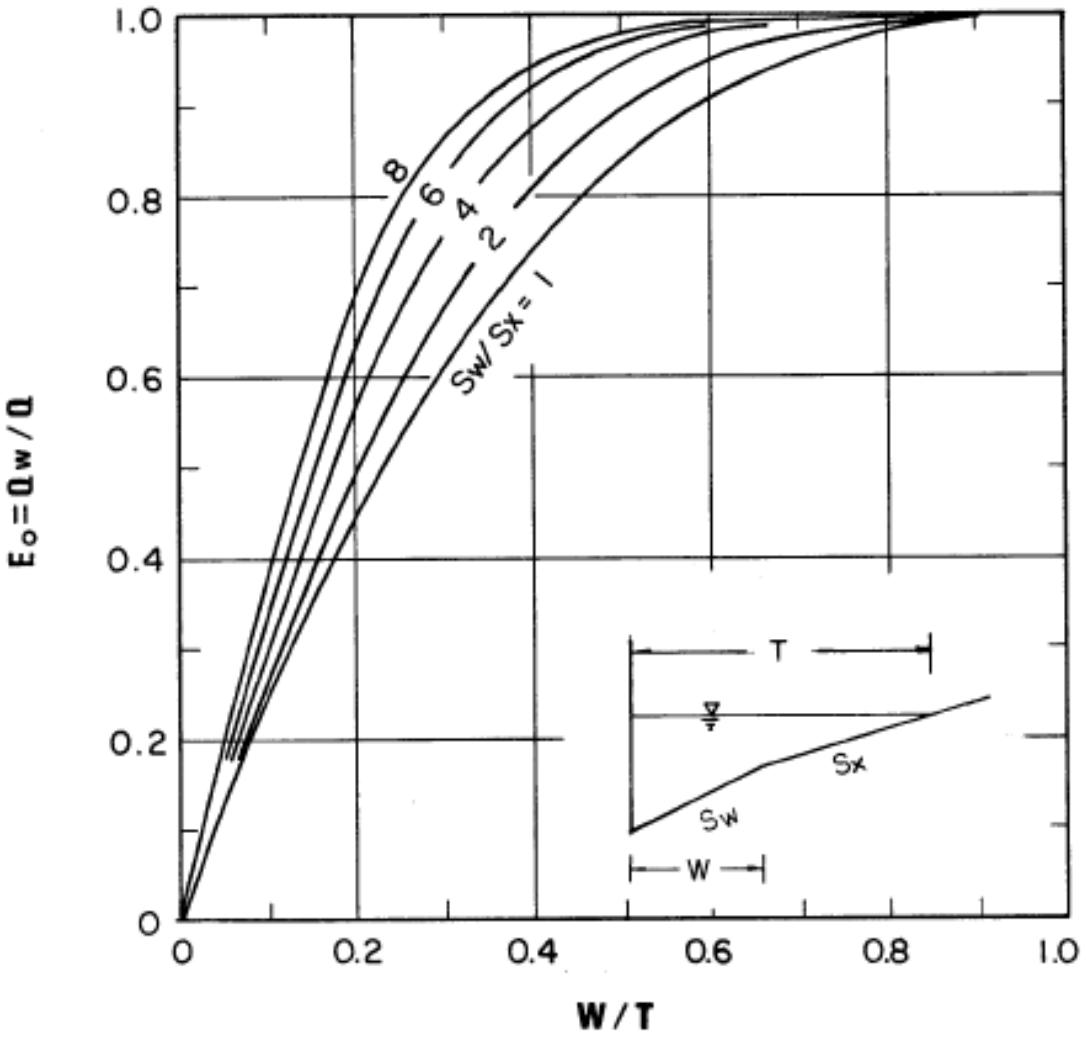
Flow In Triangular Gutter Sections

CHART 1B



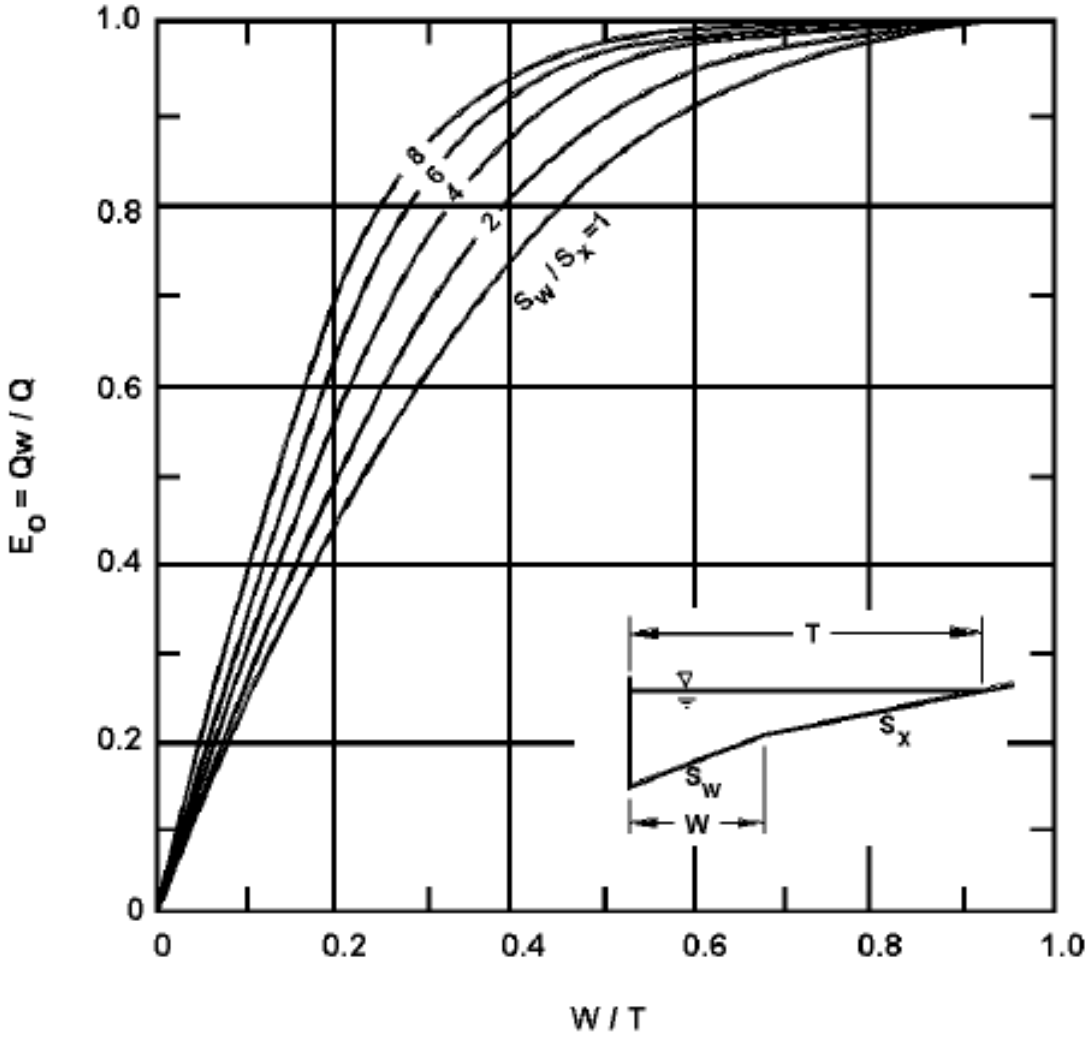
Flow in Triangular Gutter Sections - English Units

CHART 2A



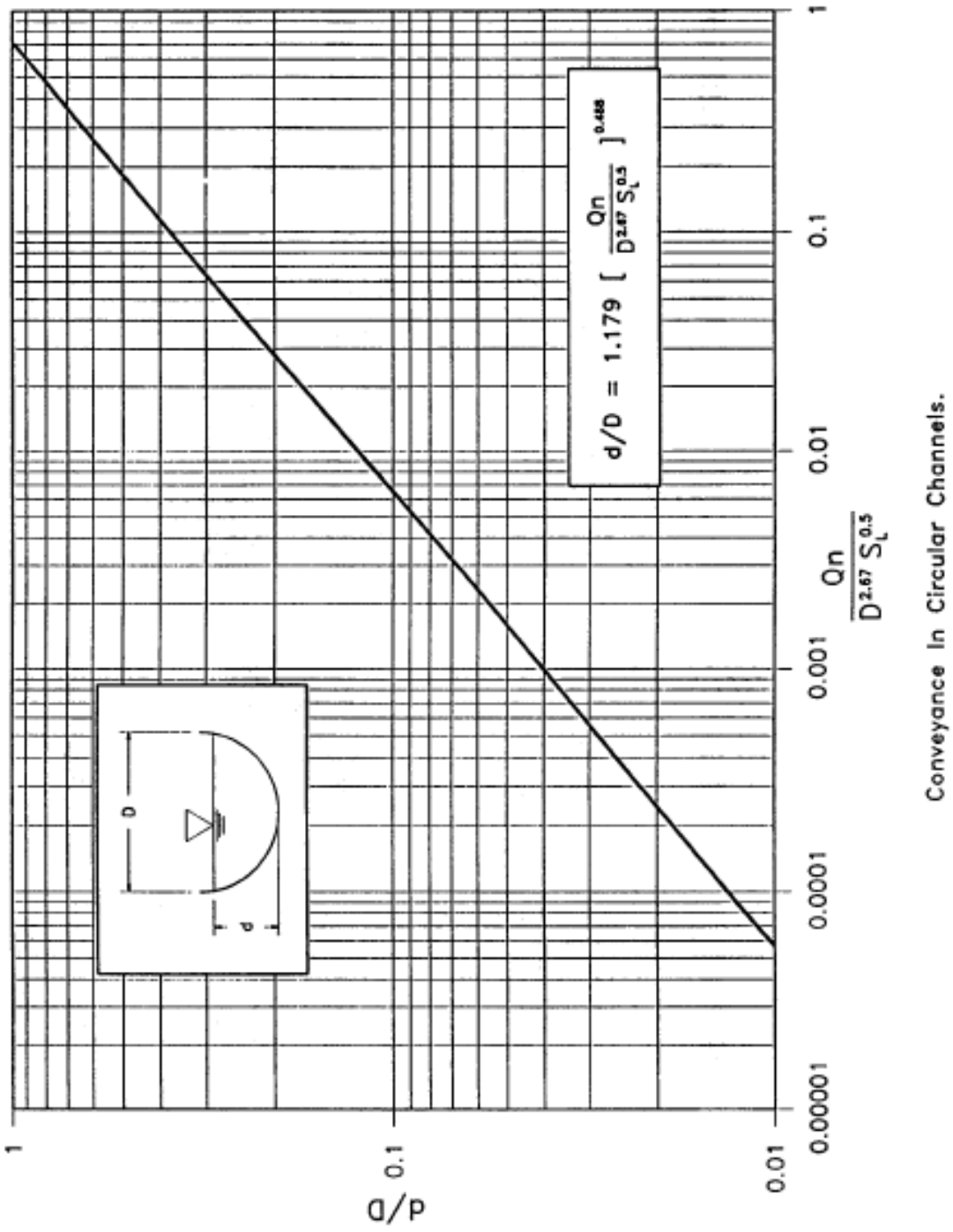
Ratio of frontal flow to total gutter flow.

CHART 2B



Ratio of Frontal Flow to Total Gutter Flow

CHART 3A



Conveyance In Circular Channels.

CHART 3B

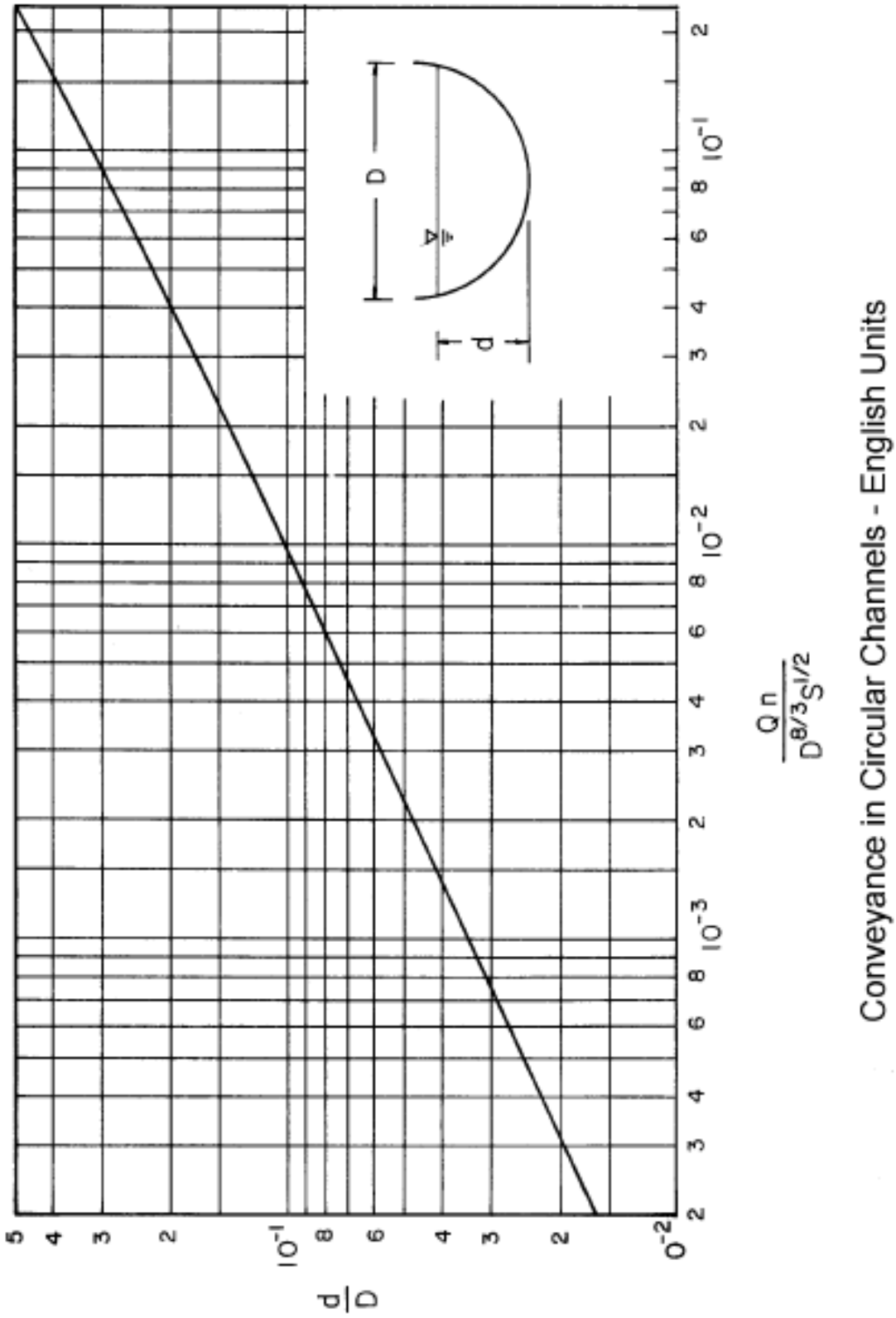
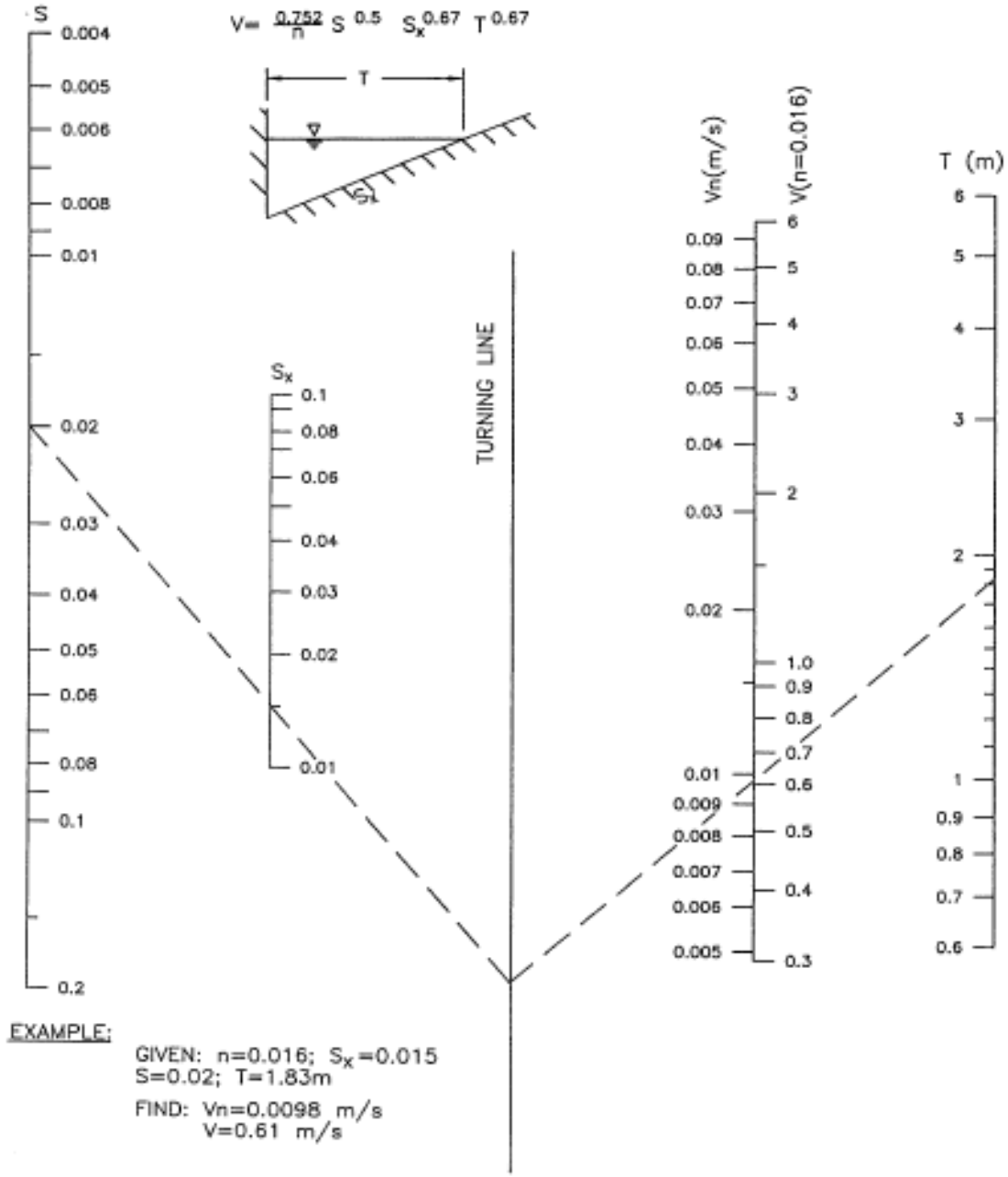
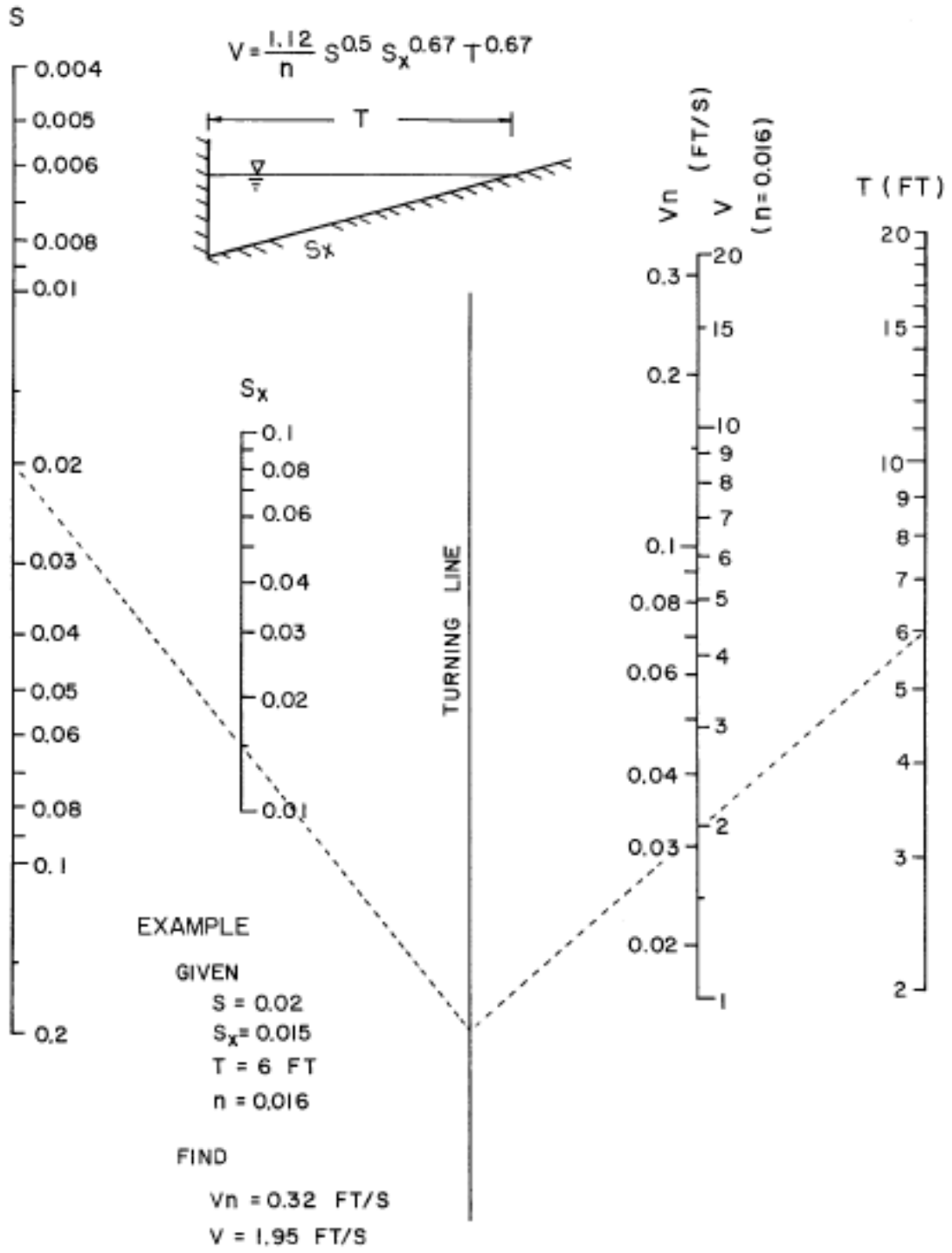

Conveyance in Circular Channels - English Units
$\frac{Q\,n}{D^{8/3}S^{1/2}}$
d/D
D
d
5
4
3
2
10^{-1}
8
6
4
3
2
10^{-2}
2
3
4
6
8
10^{-3}
2
3
4
6
8
10^{-2}
2
3
4
6
8
10^{-1}
2

CHART 4A



Velocity in Triangular Gutter Sections

CHART 4B



Velocity in Triangular Gutter Sections - English Units

CHART 5A

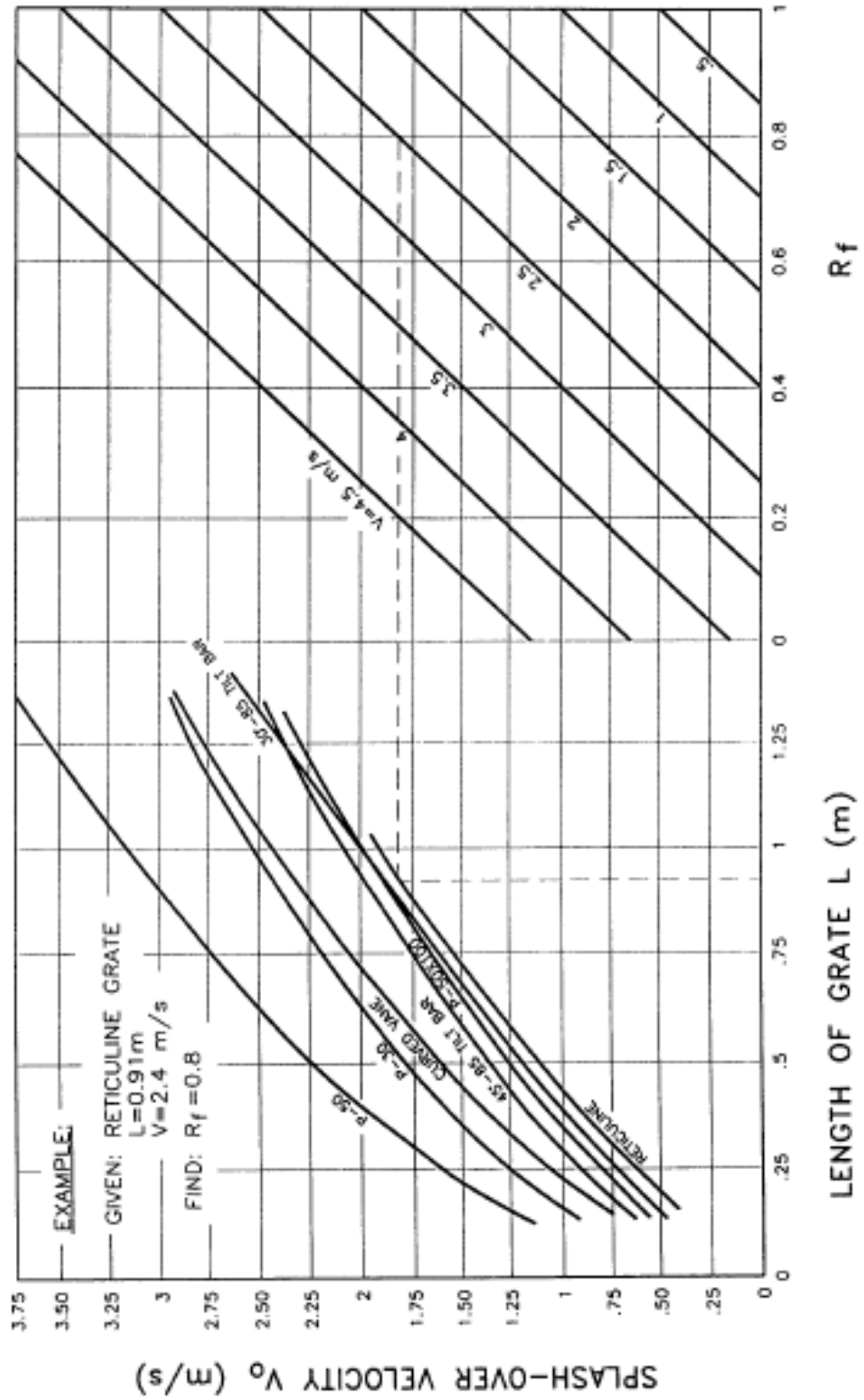

SPLASH-OVER VELOCITY V_o (m/s)
LENGTH OF GRATE L (m)
R_f
Grate Inlet Frontal Flow Interception Efficiency
EXAMPLE:
GIVEN: RETICULINE GRATE
L=0.91m
V=2.4 m/s
FIND: R_f =0.8
RETICULINE
45°-85 TILT BAR
P-50 CURVED VANE
P-50
30°-85 TILT BAR
V=4.5 m/s

CHART 5B

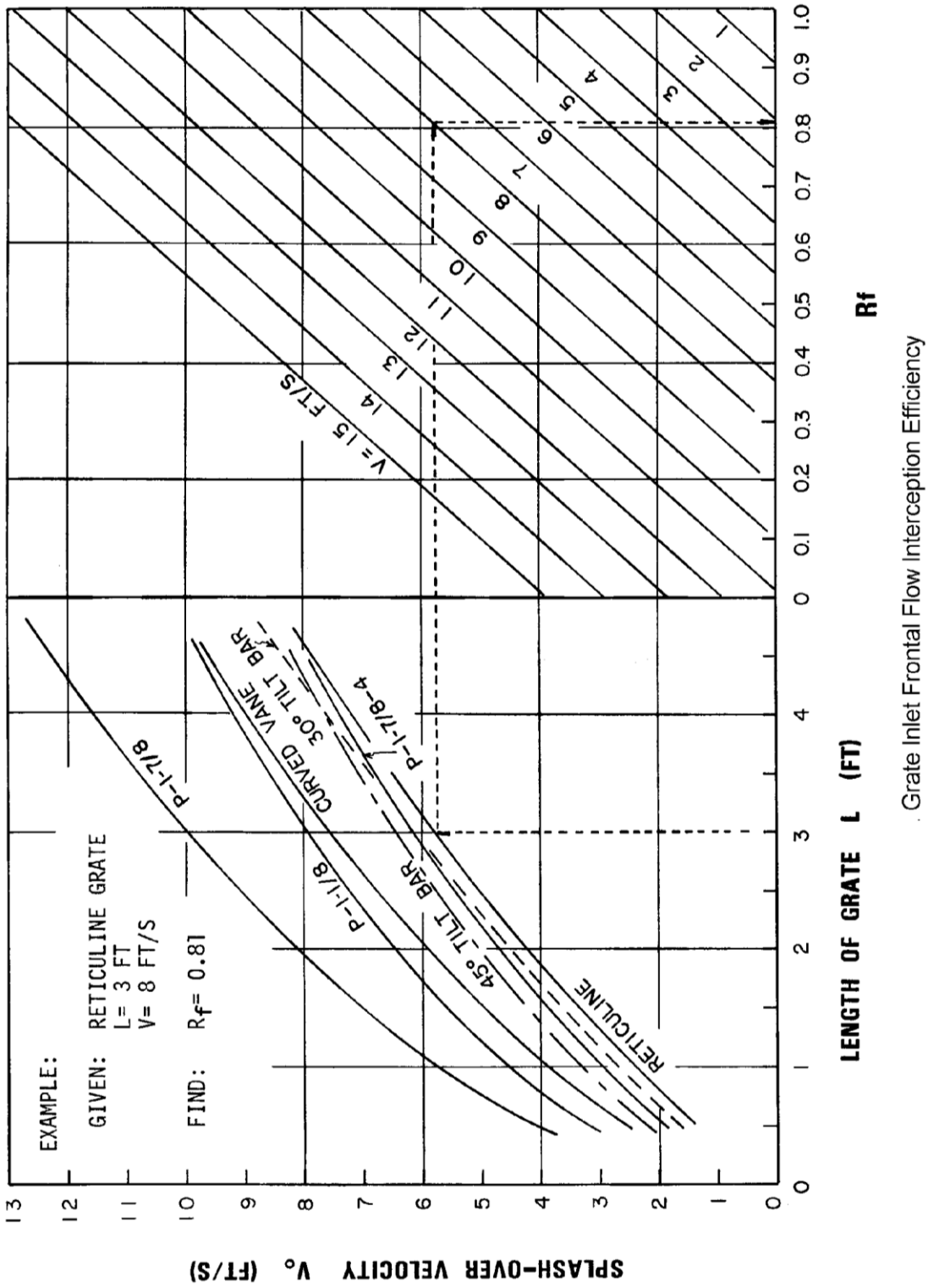
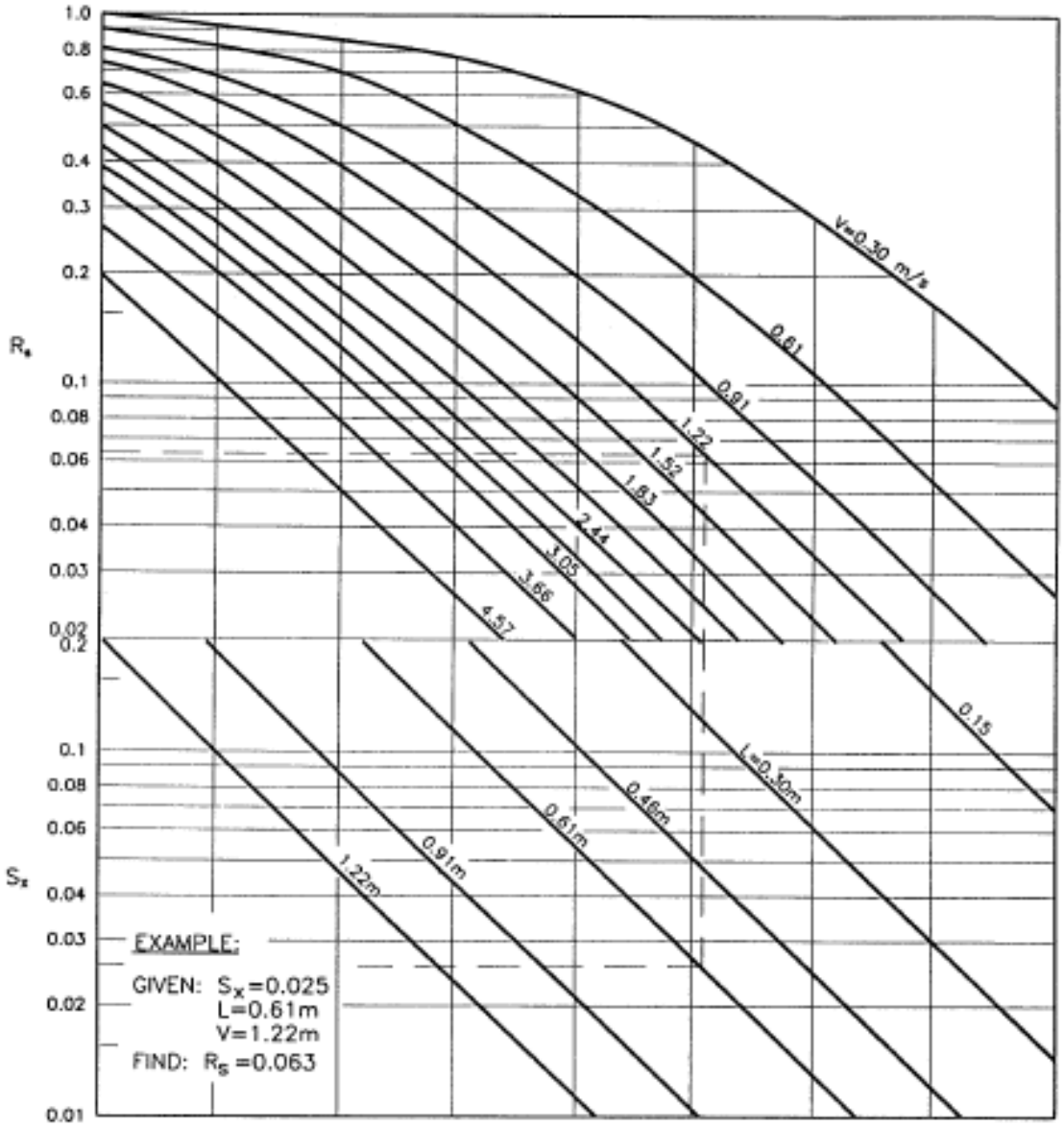
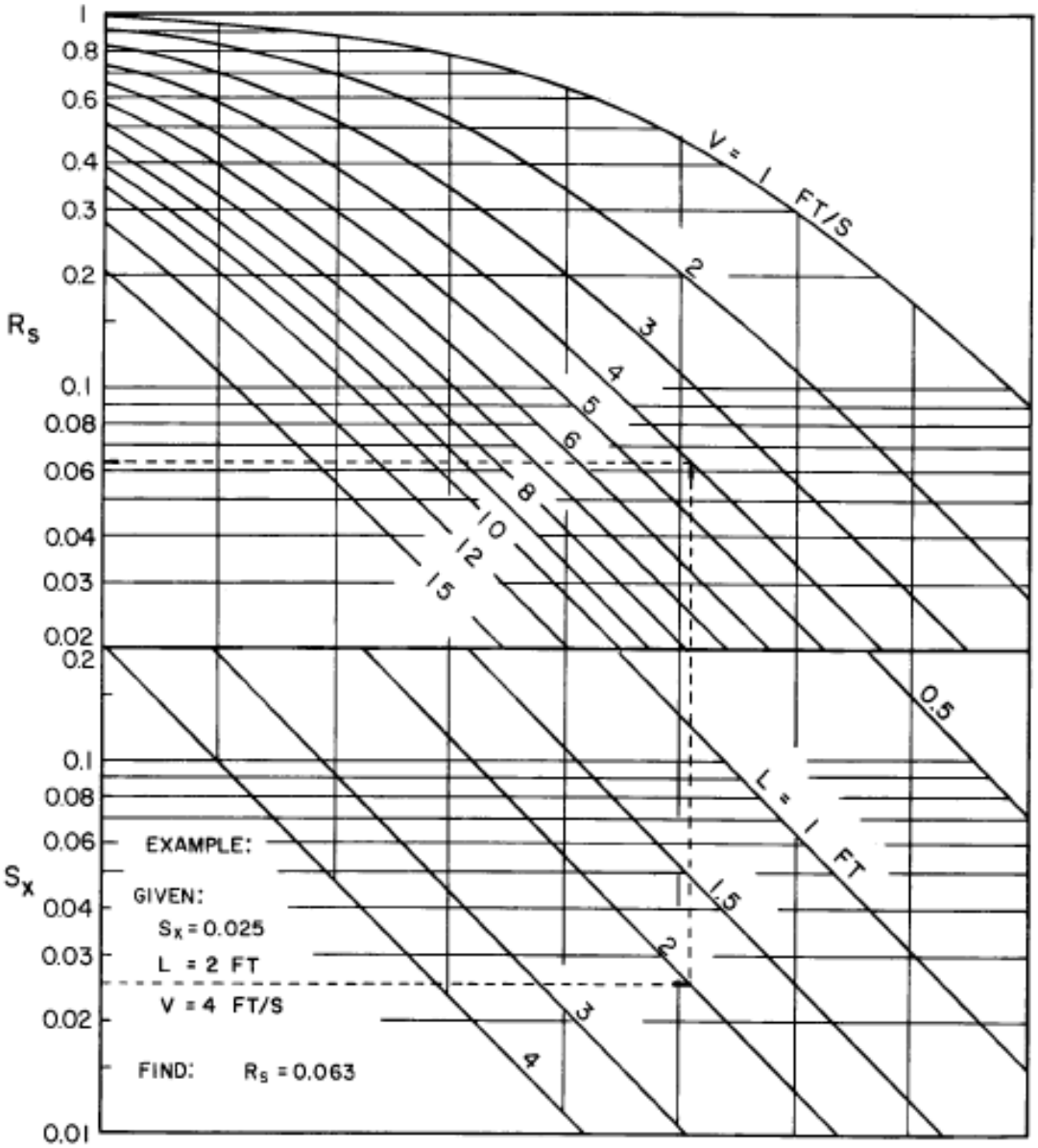

EXAMPLE:
GIVEN: RETICULINE GRATE
L= 3 FT
V= 8 FT/S
FIND: R_f= 0.81
P-1-7/8
P-1-7/8
CURVED VANE
30° TILT BAR
P-1-7/8-4
45° TILT BAR
RETICULINE
V= 15 FT/S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
SPLASH-OVER VELOCITY V_o (FT/S)
LENGTH OF GRATE L (FT)
Rf
Grate Inlet Frontal Flow Interception Efficiency

CHART 6A



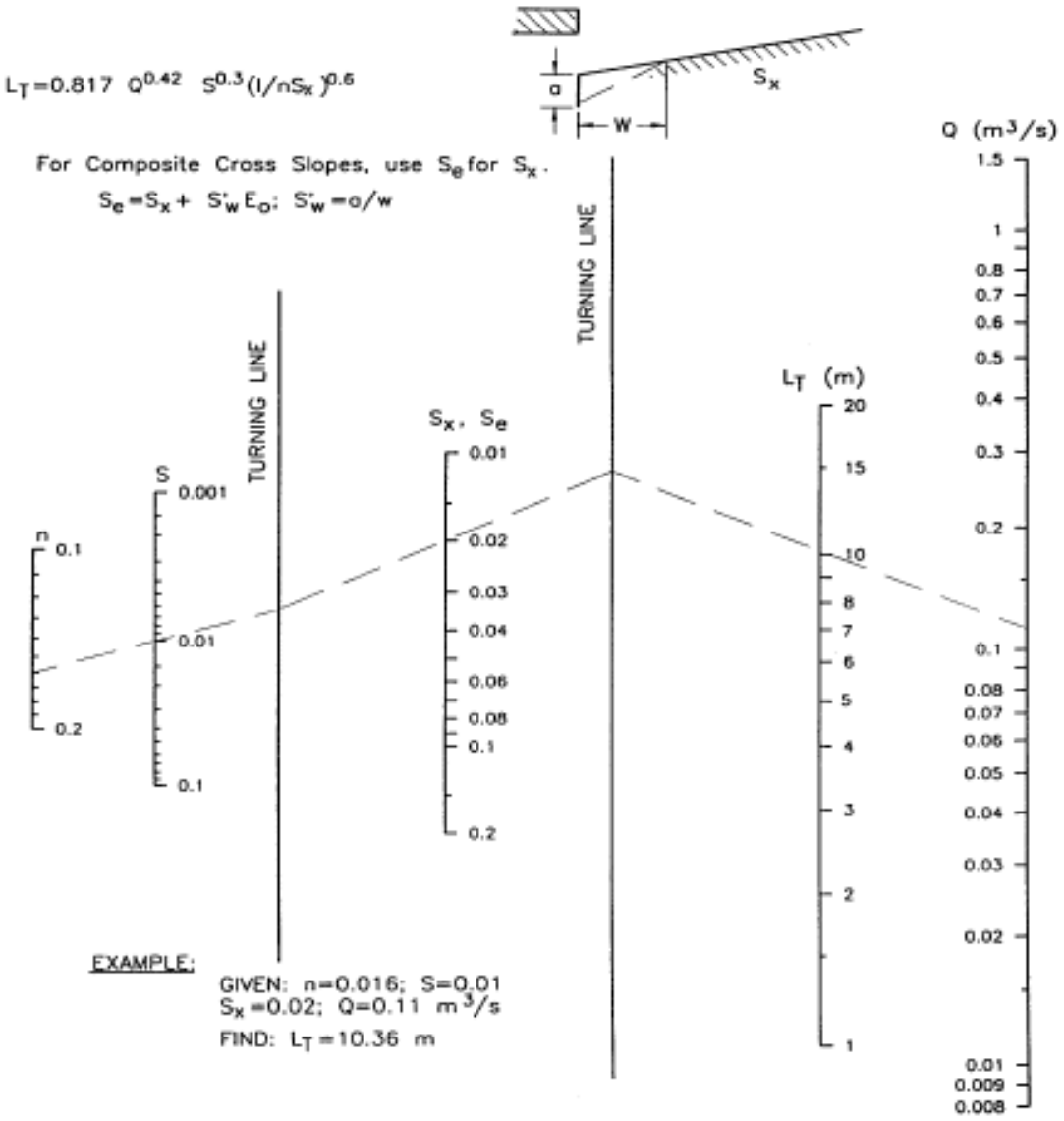
Grate Inlet Side Flow Intercept Efficiency.

CHART 6B



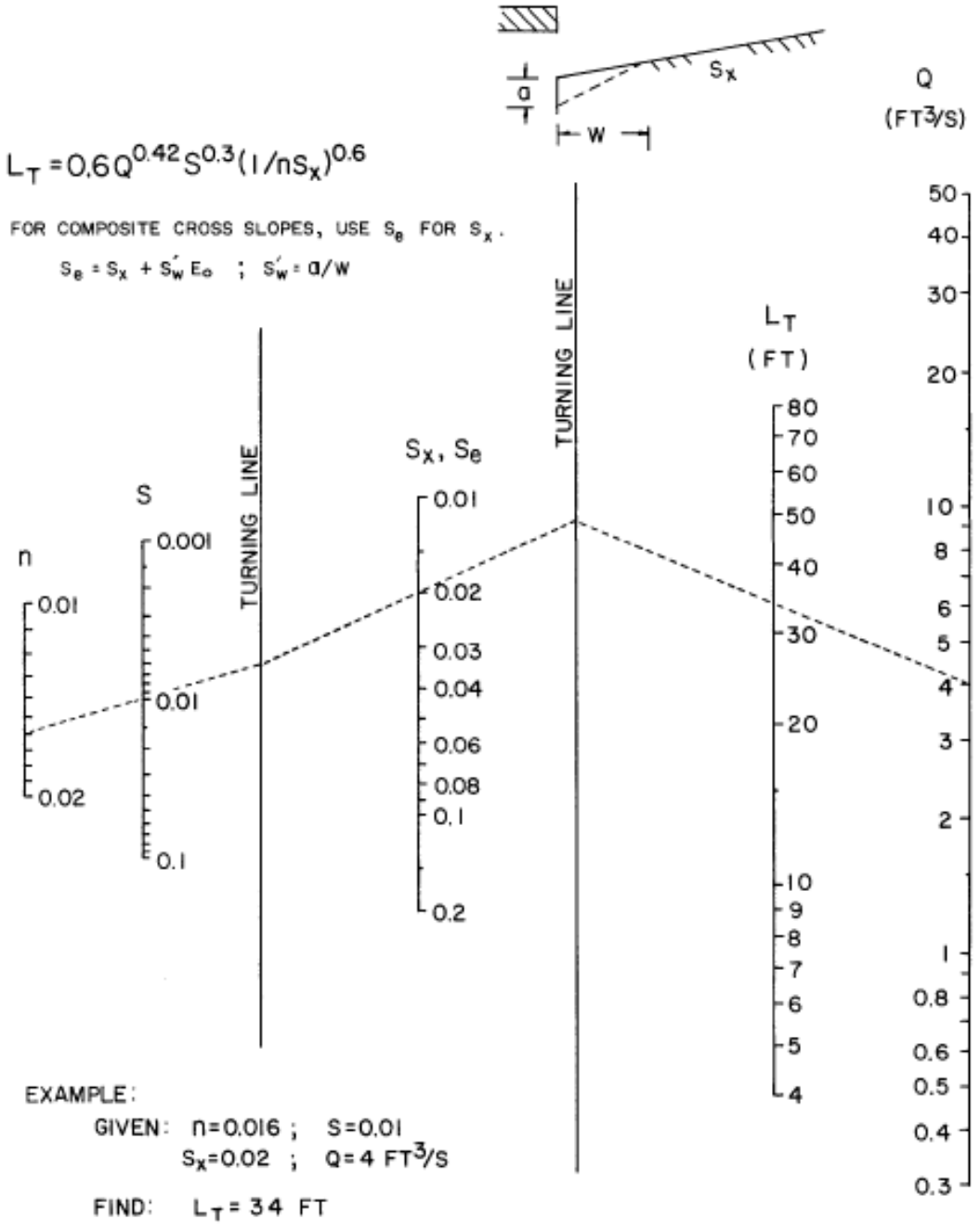
Grate Inlet Side Flow Intercept Efficiency

CHART 7A



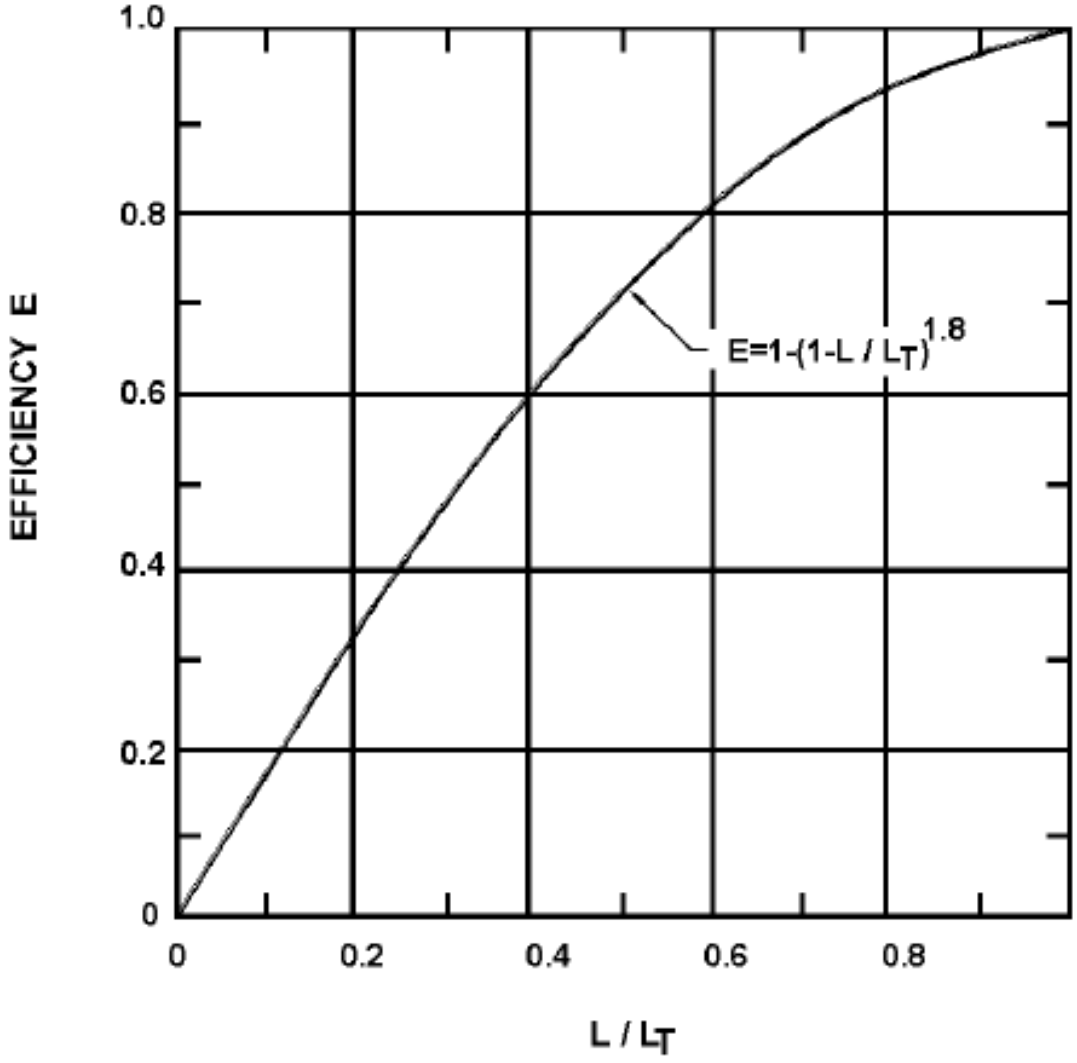
Curb Opening & Slotted Drain Inlet Length for Total Interception

CHART 7B



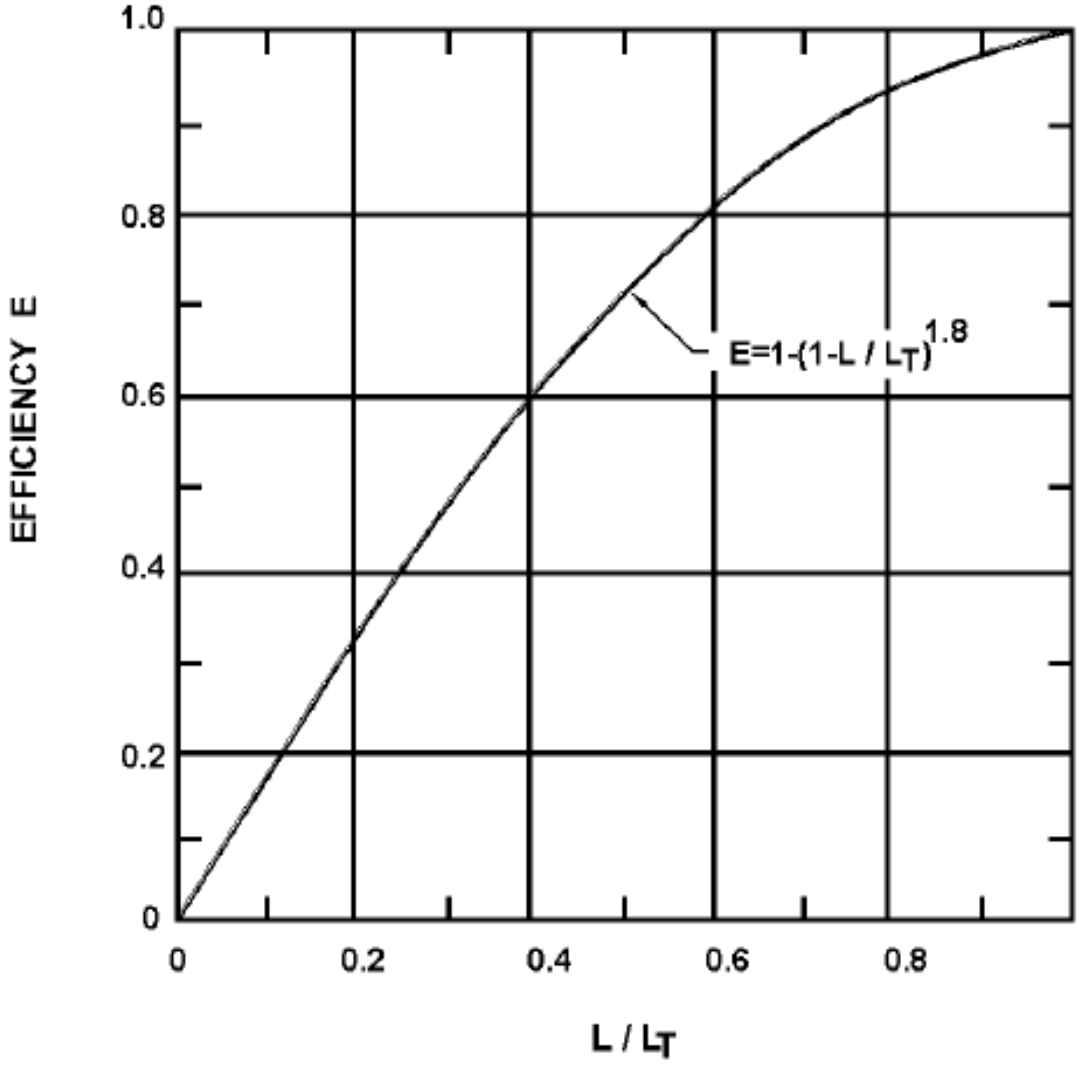
Curb-opening & Slotted Drain Inlet Length for Total Interception - English Units

CHART 8A



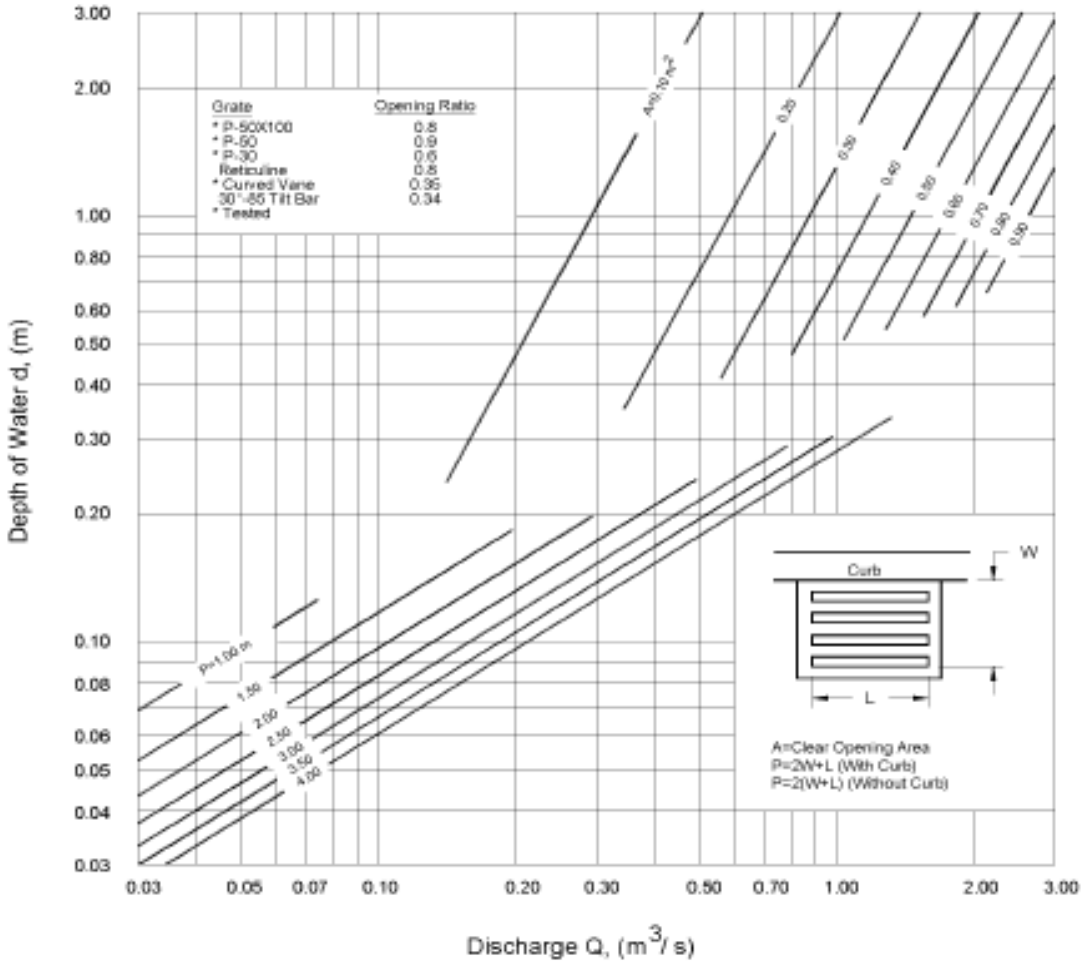
Curb-opening and Slotted Drain Inlet Interception Efficiency.

CHART 8B



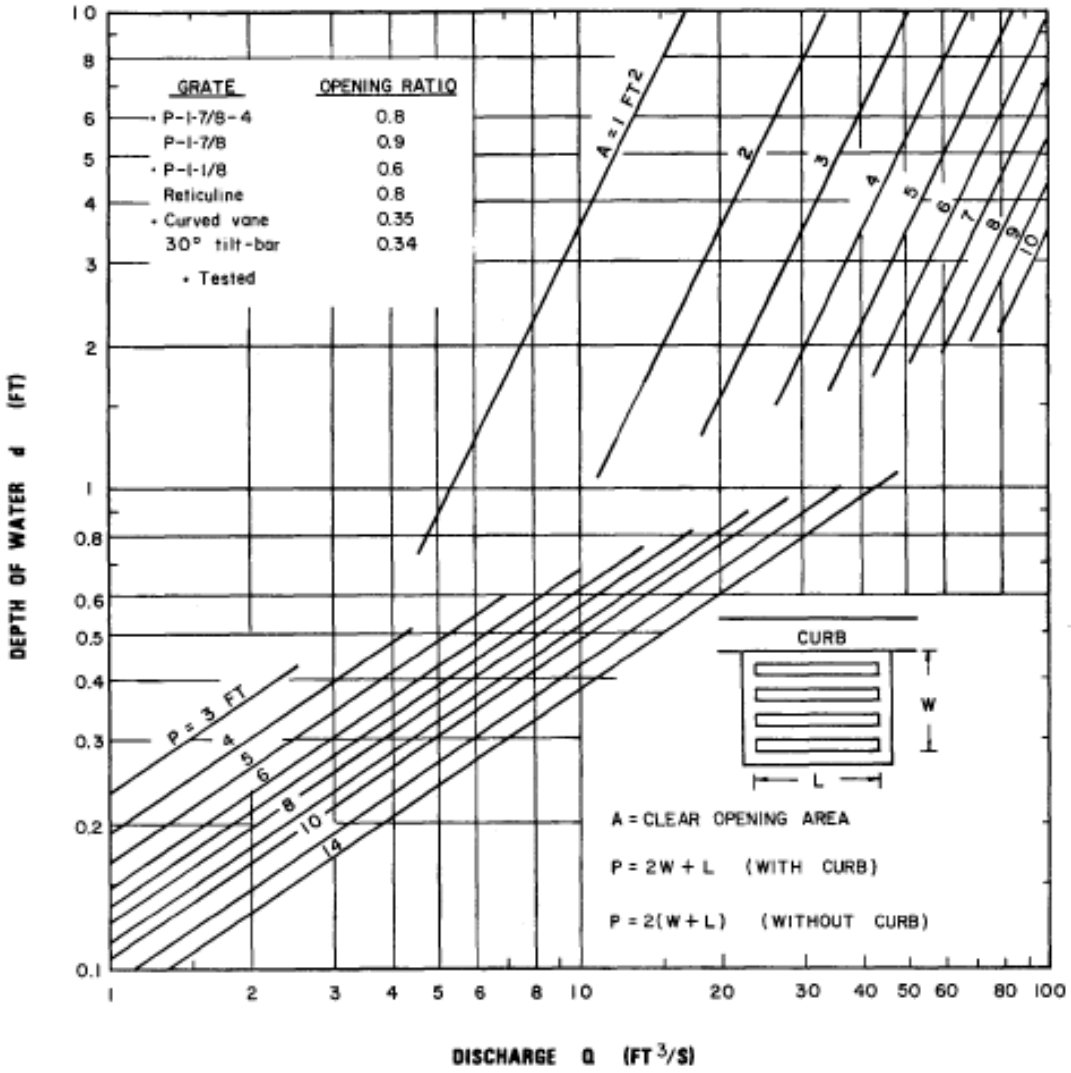
Curb-opening and Slotted Drain Inlet Interception Efficiency.

CHART 9A



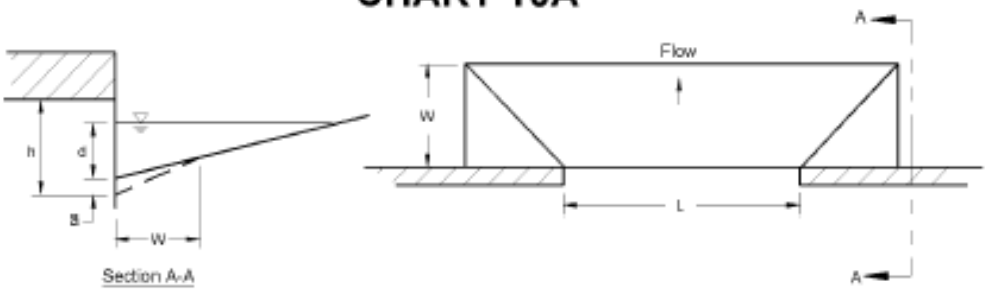
Grate Inlet Capacity in Sump Conditions.

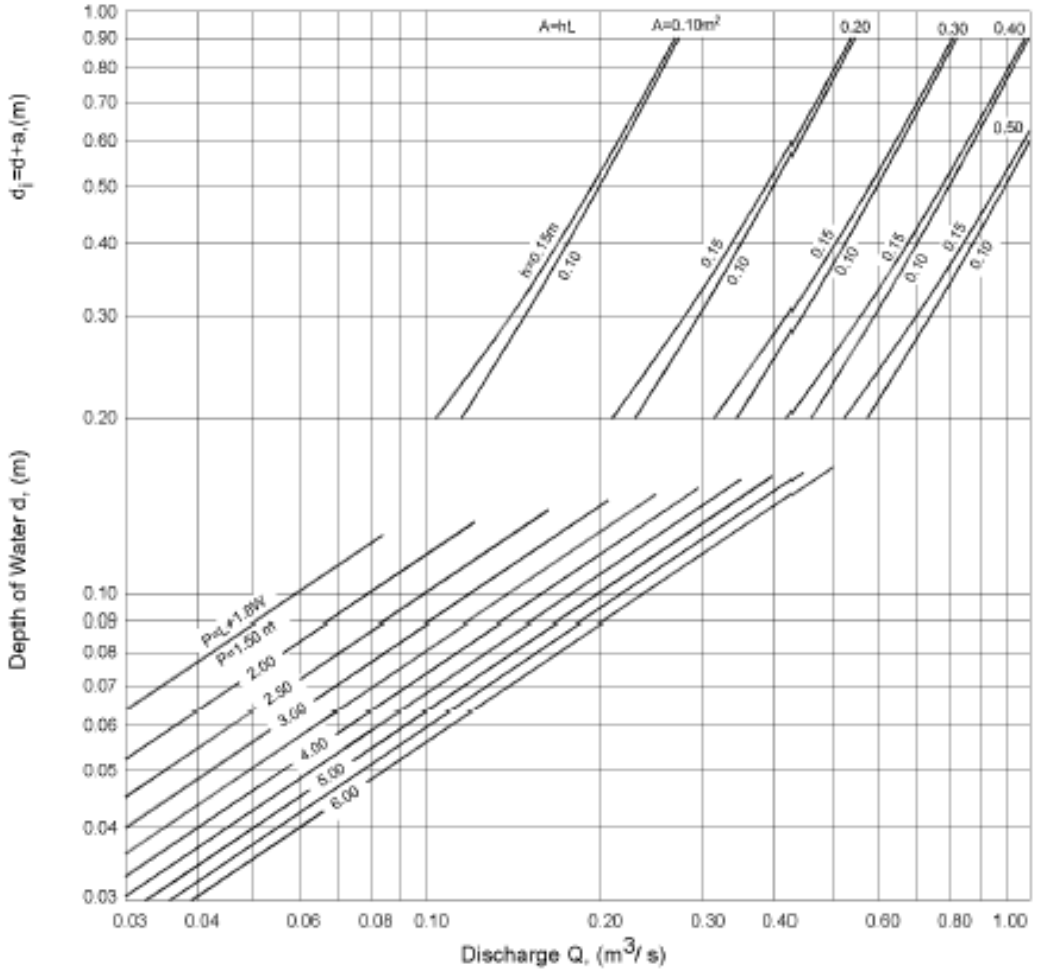
CHART 9B



Grate Inlet Capacity in Sump Conditions - English Units

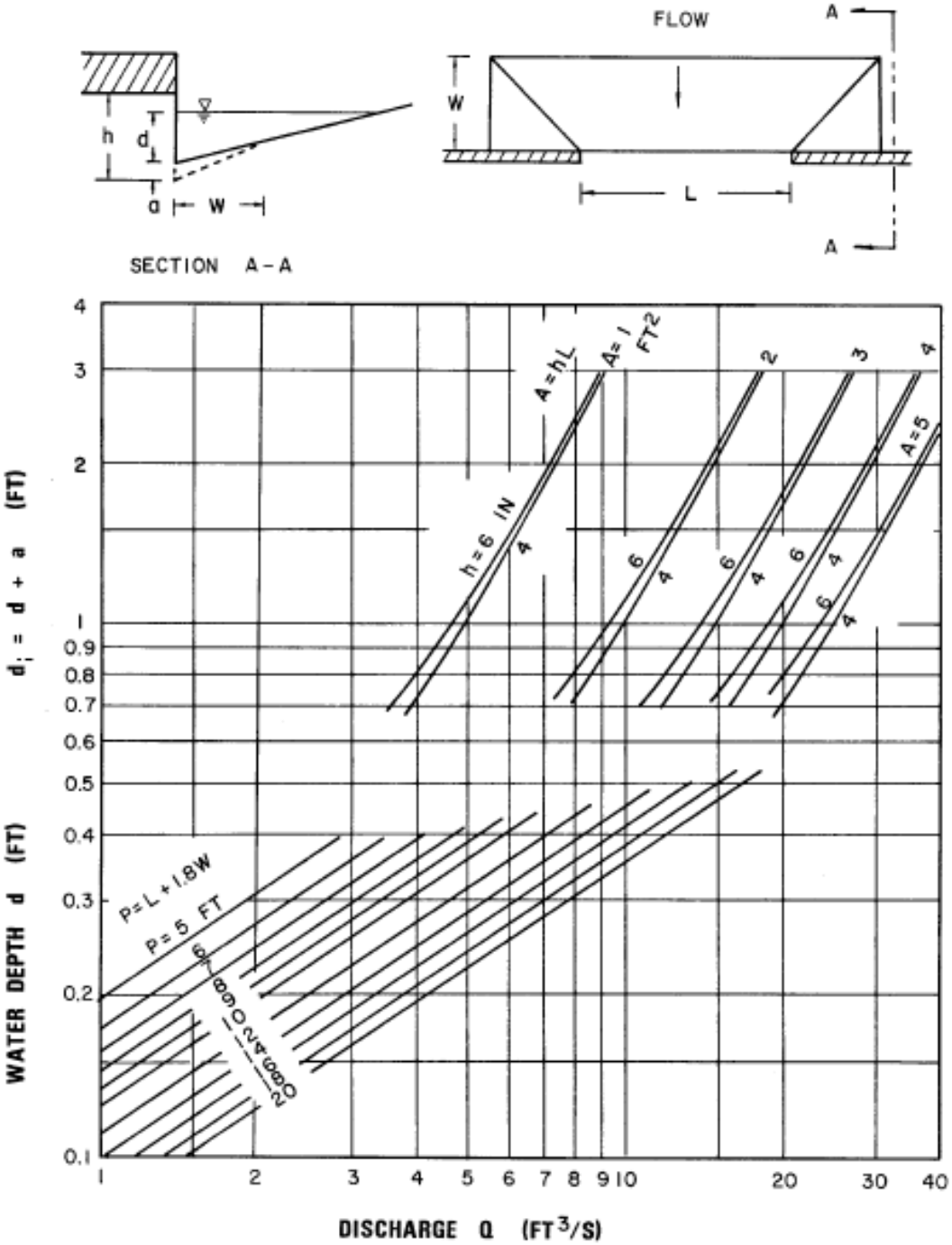
CHART 10A





Depressed Curb-opening Inlet Capacity in Sump Locations

CHART 10B



Depressed Curb-opening Inlet Capacity in Sump Locations - English Units

CHART 11A

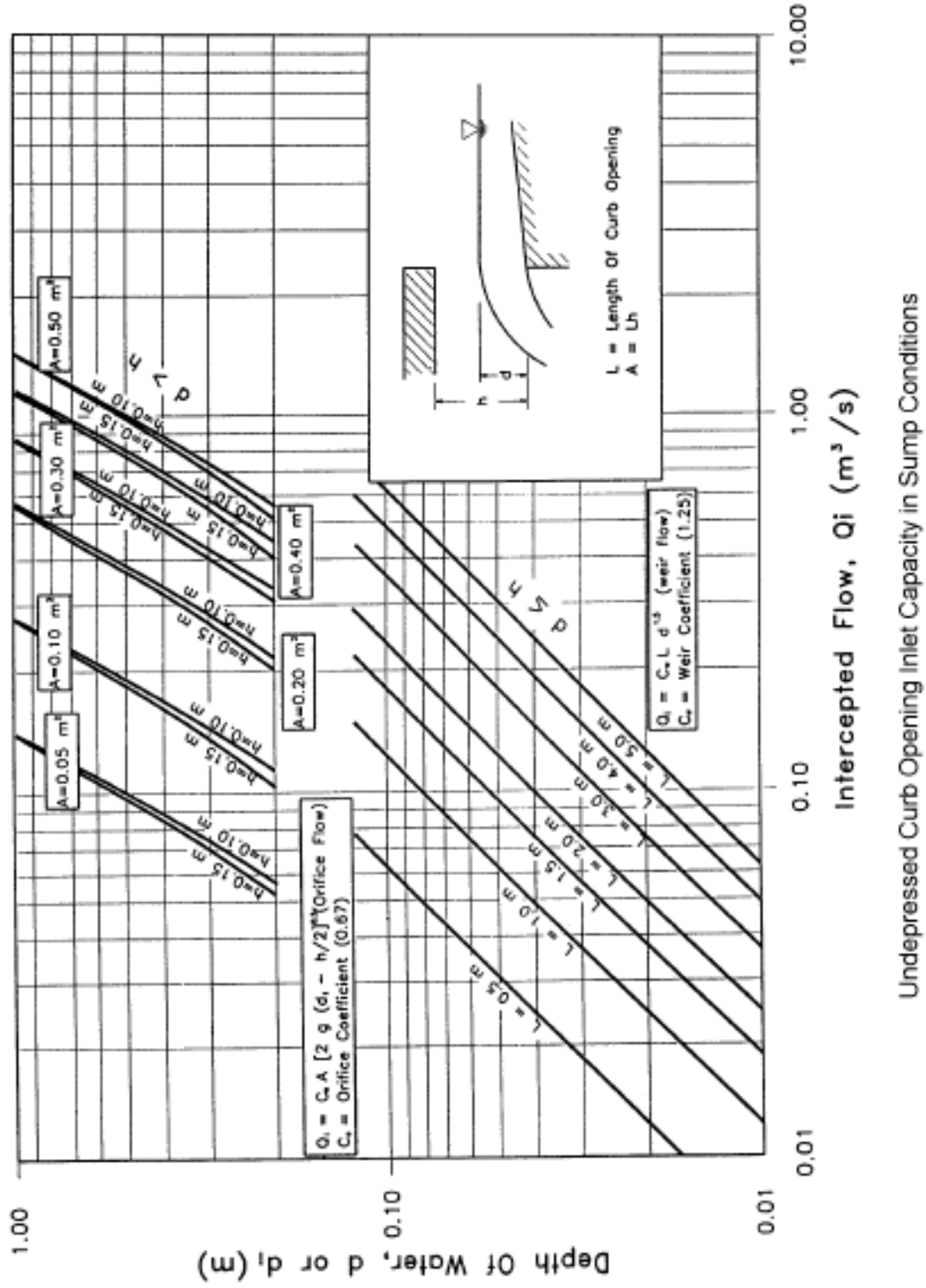
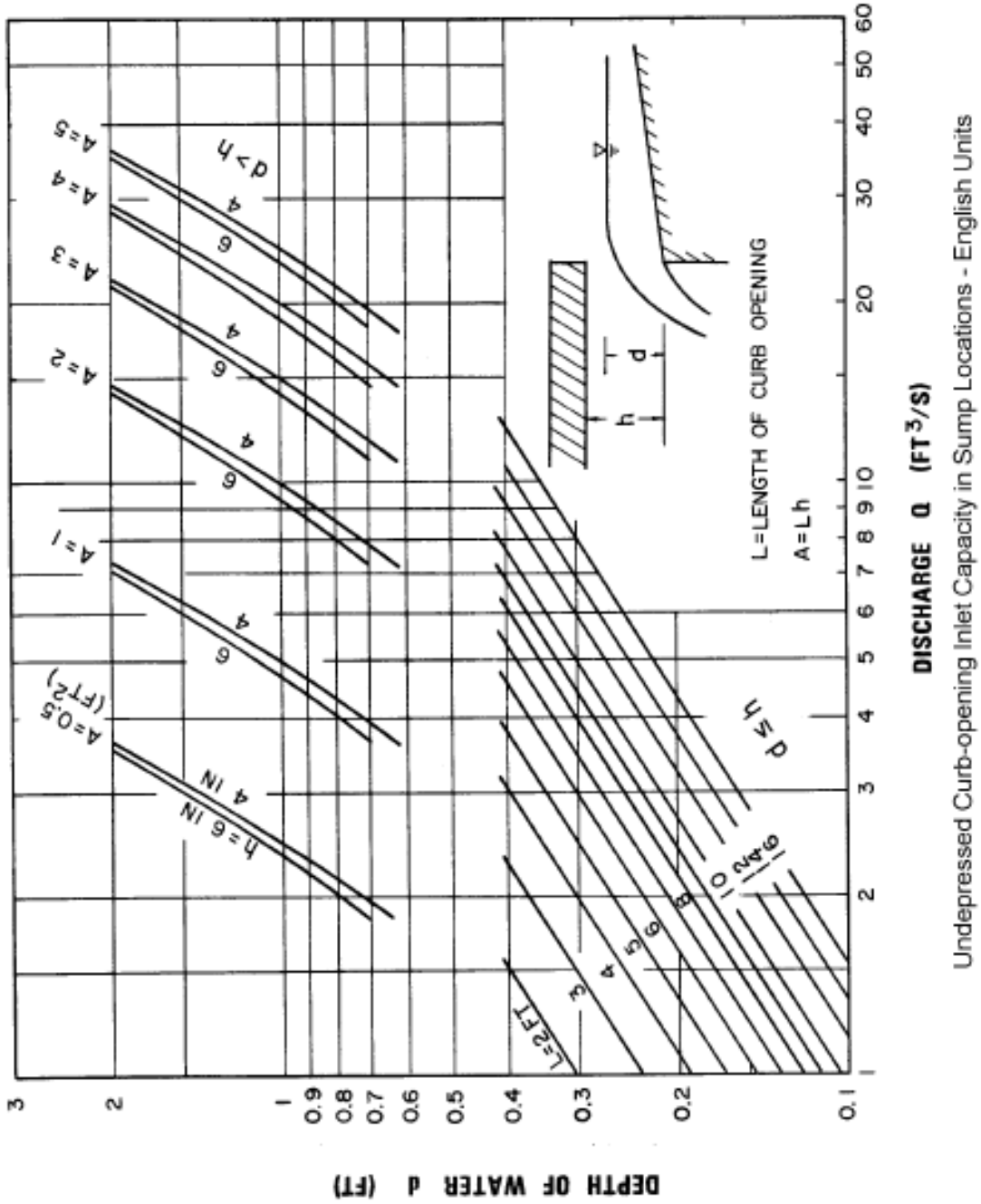
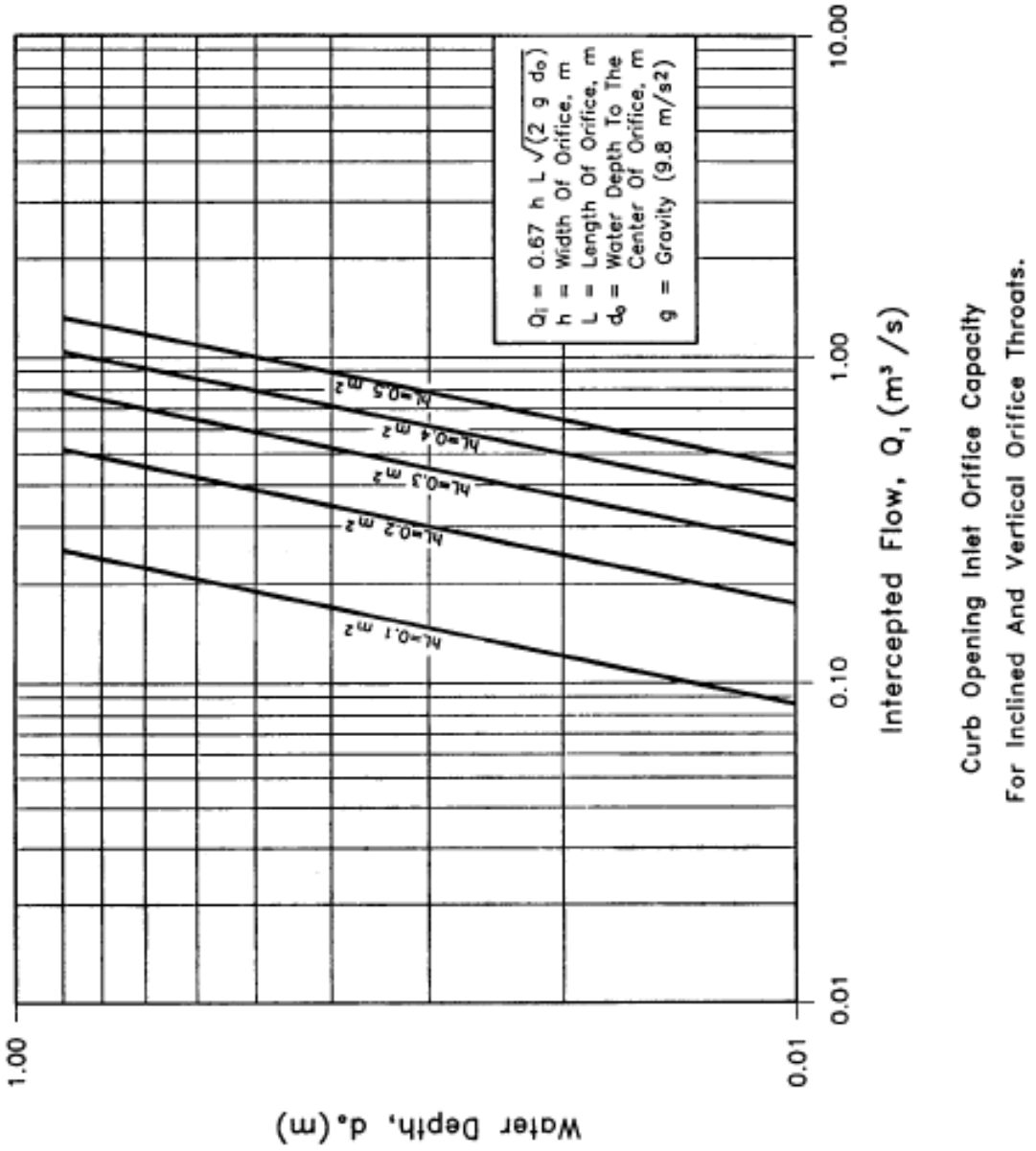

Undepressed Curb Opening Inlet Capacity in Sump Conditions
Intercepted Flow, Qi (m³/s)
10.00
1.00
0.10
0.01
Depth Of Water, d or di (m)
1.00
0.10
0.01
L = Length Of Curb Opening
A = Lh
Qi = Cw L d^1.5 (weir flow)
Cw = Weir Coefficient (1.25)
Qi = Co A [2 g (di - h/2)]^0.5 (Orifice Flow)
Co = Orifice Coefficient (0.67)
A=0.50 m²
A=0.30 m²
A=0.40 m²
A=0.10 m²
A=0.20 m²
A=0.05 m²
h=0.10 m
h=0.15 m
L = 5.0 m
L = 4.0 m
L = 3.0 m
L = 2.0 m
L = 1.5 m
L = 1.0 m
L = 0.5 m

CHART 11B



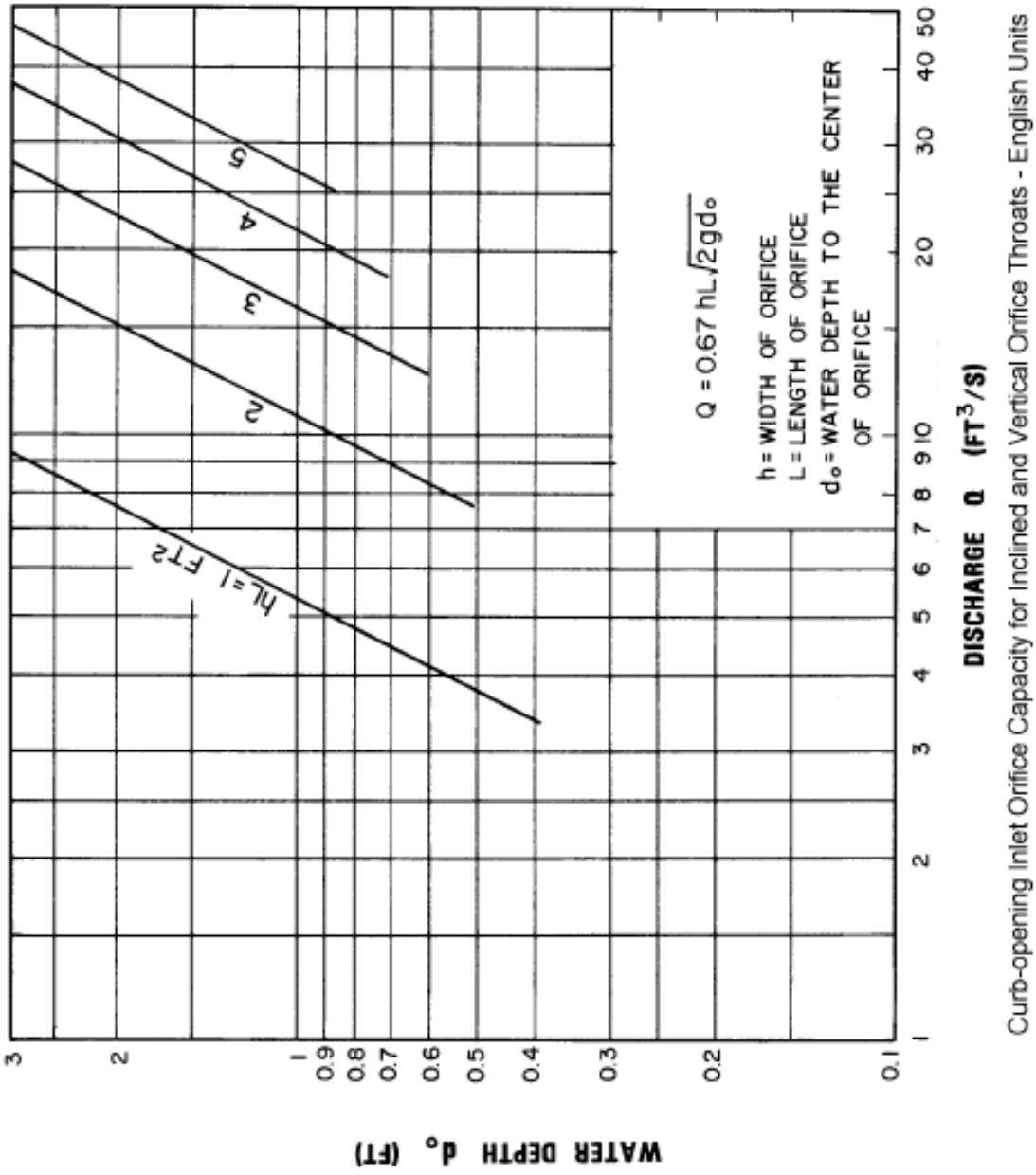
Undepressed Curb-opening Inlet Capacity in Sump Locations - English Units

CHART 12A



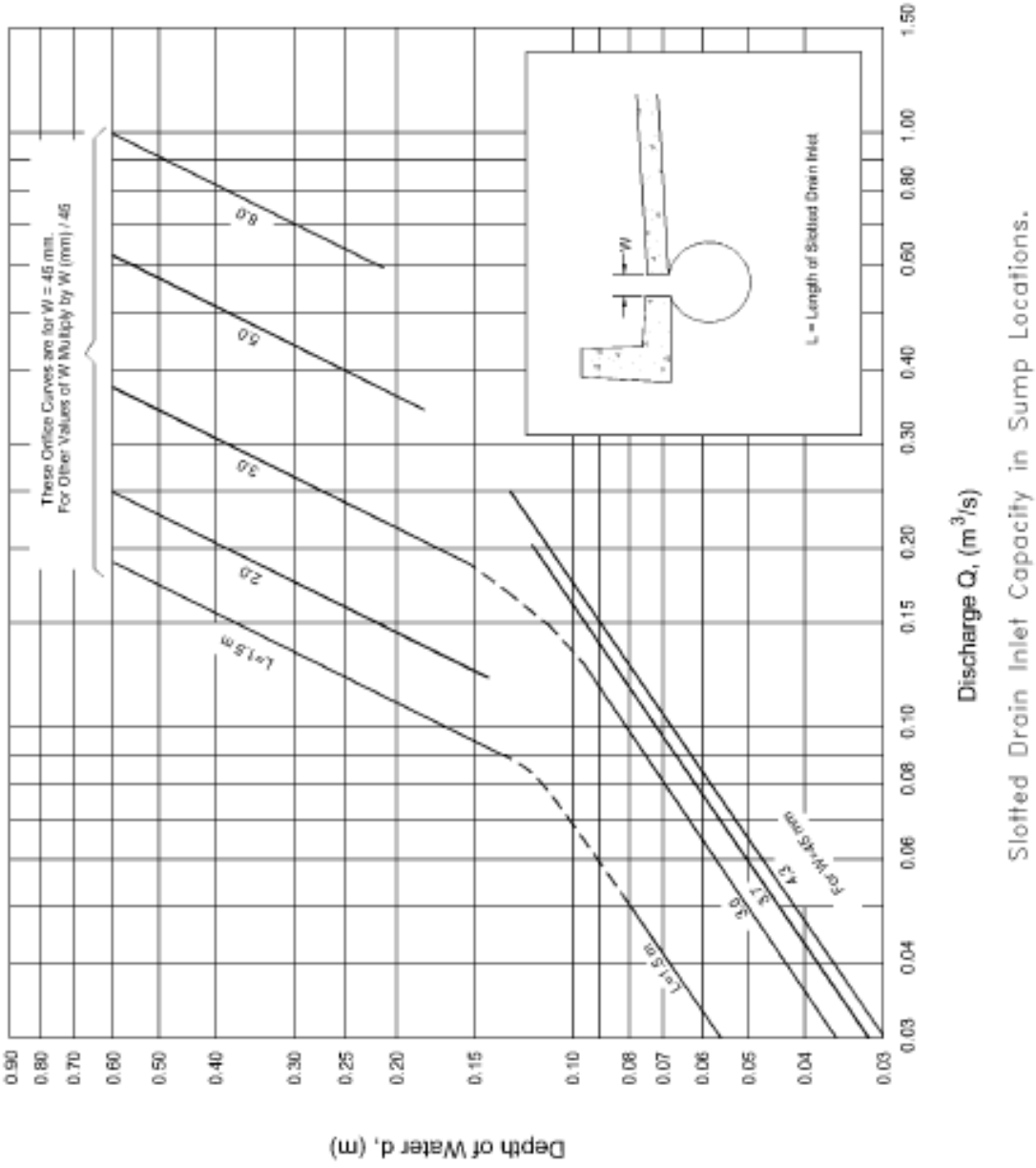
Curb Opening Inlet Orifice Capacity
For Inclined And Vertical Orifice Throats.

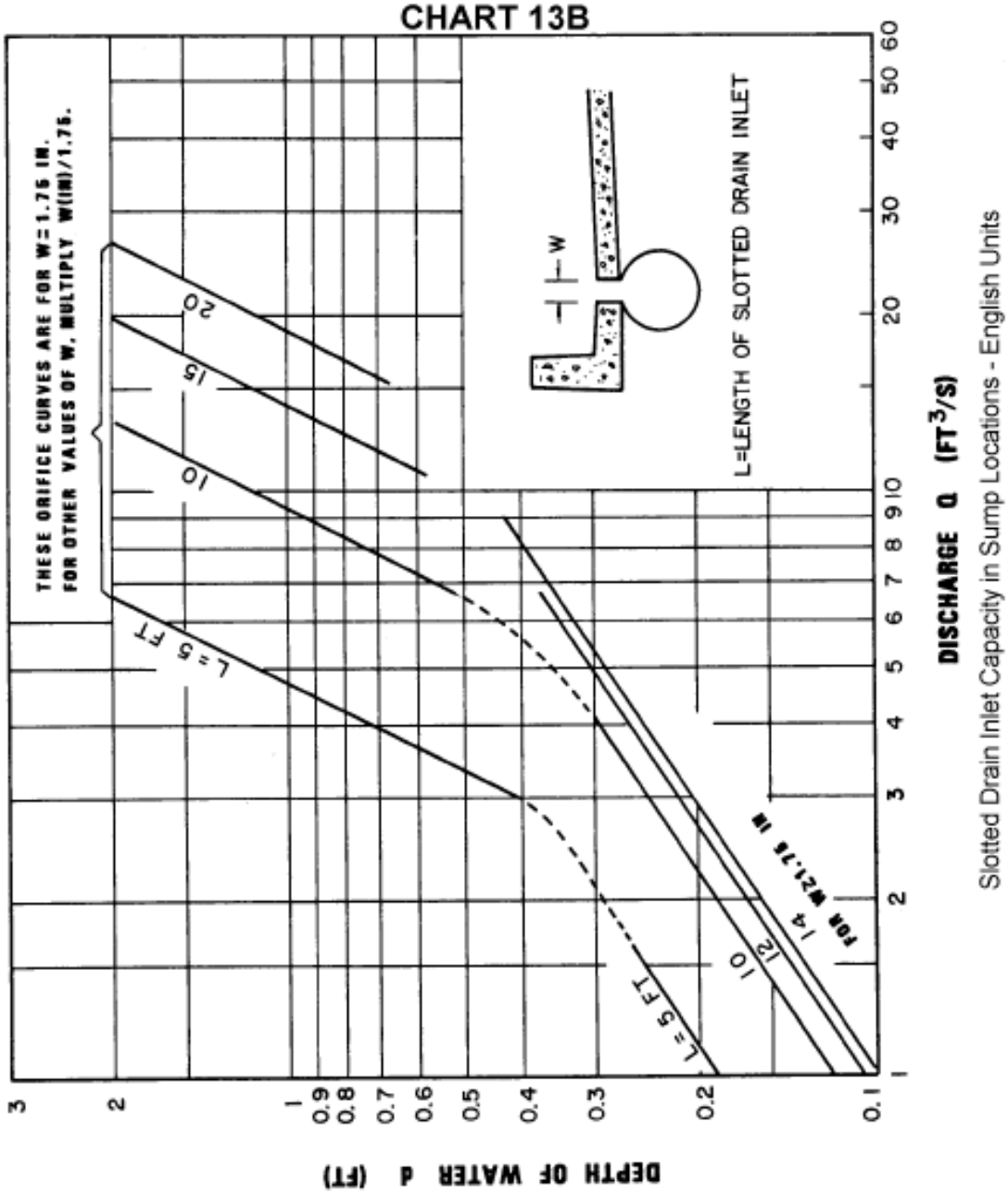
CHART 12B



Curb-opening Inlet Orifice Capacity for Inclined and Vertical Orifice Throats - English Units

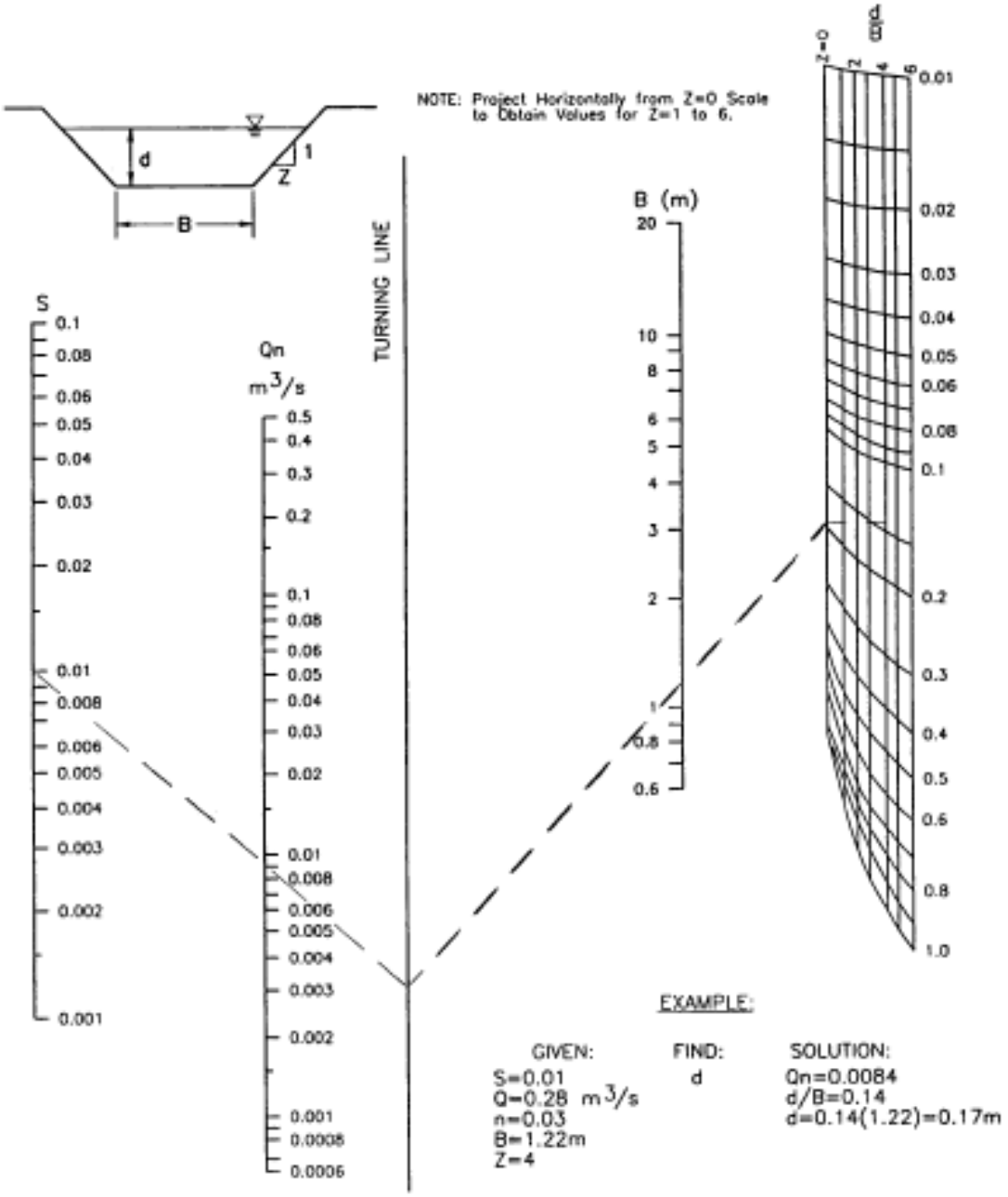
CHART 13A


These Orifice Curves are for W = 45 mm.
For Other Values of W Multiply by W (mm) / 45
L = Length of Slotted Drain Inlet
W
6.0
5.0
3.0
2.0
L=1.5m
L=1.5m
3.7
4.3
For Widths mm
Depth of Water d, (m)
Discharge Q, (m³/s)
Slotted Drain Inlet Capacity in Sump Locations.



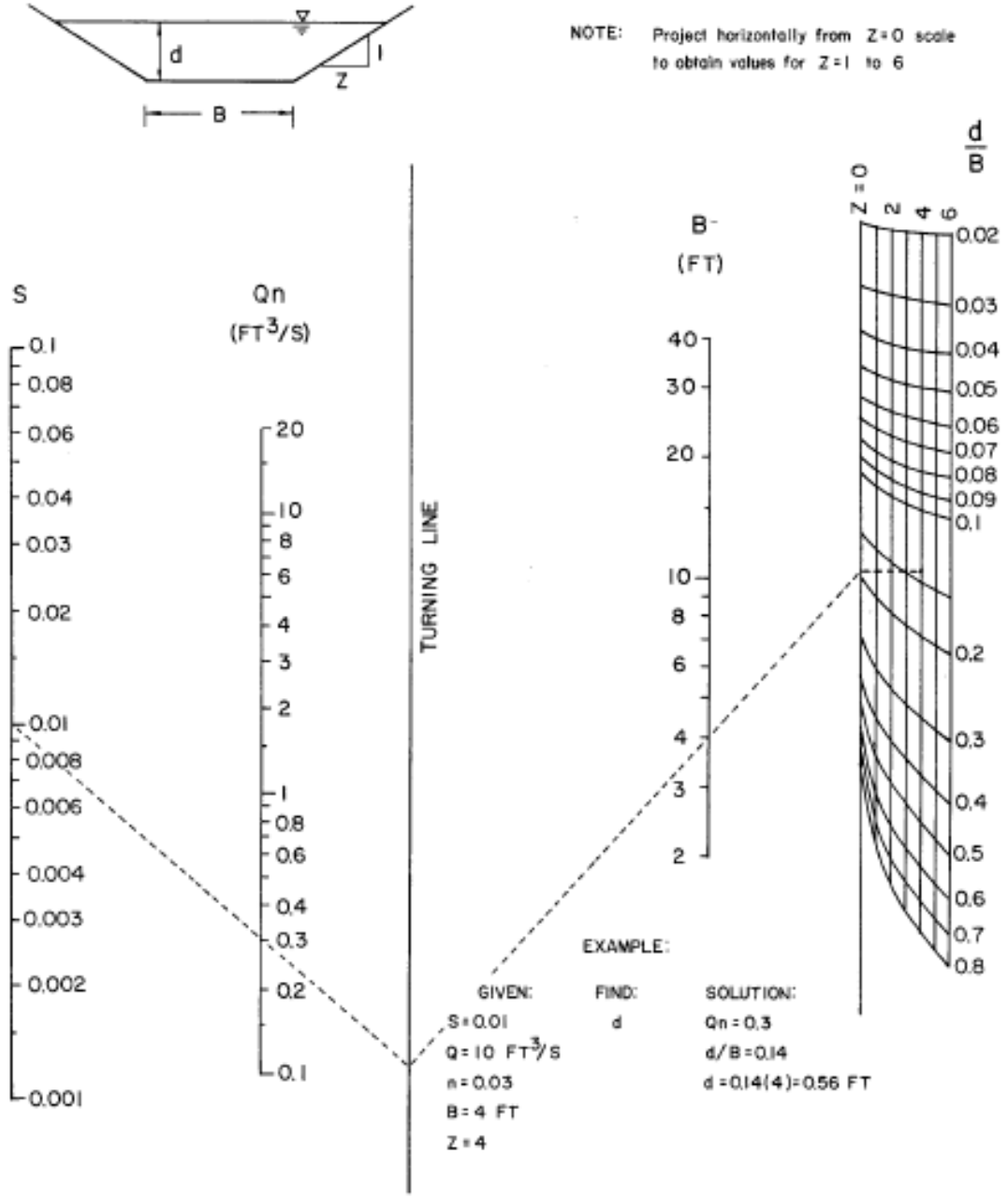
Slotted Drain Inlet Capacity in Sump Locations - English Units

CHART 14A



Solution to Manning's Equation for Channels of Various Side Slopes.

CHART 14B



Solution to Manning's Equation for Channels of Various Side Slopes - English Units

CHART 15A

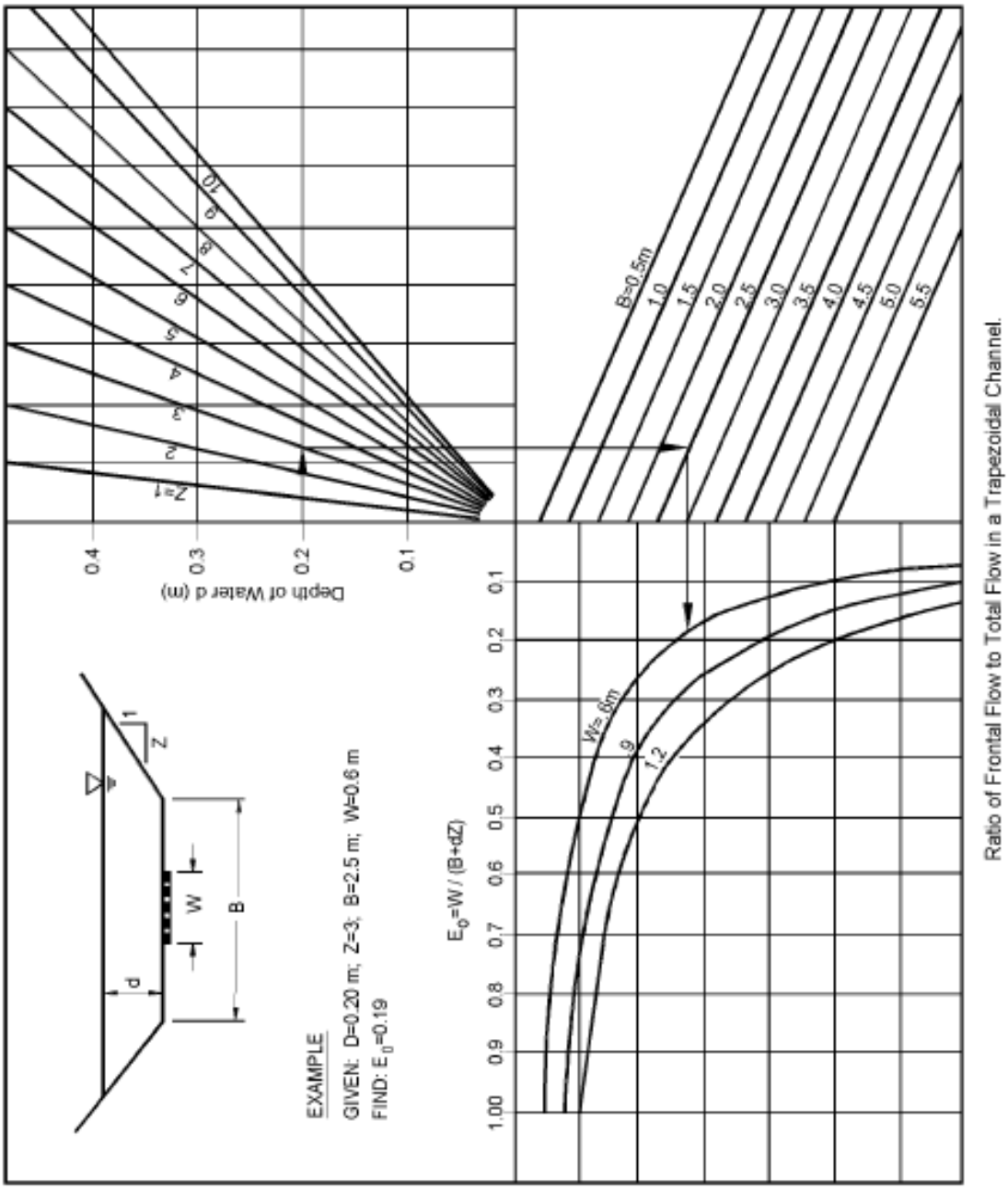
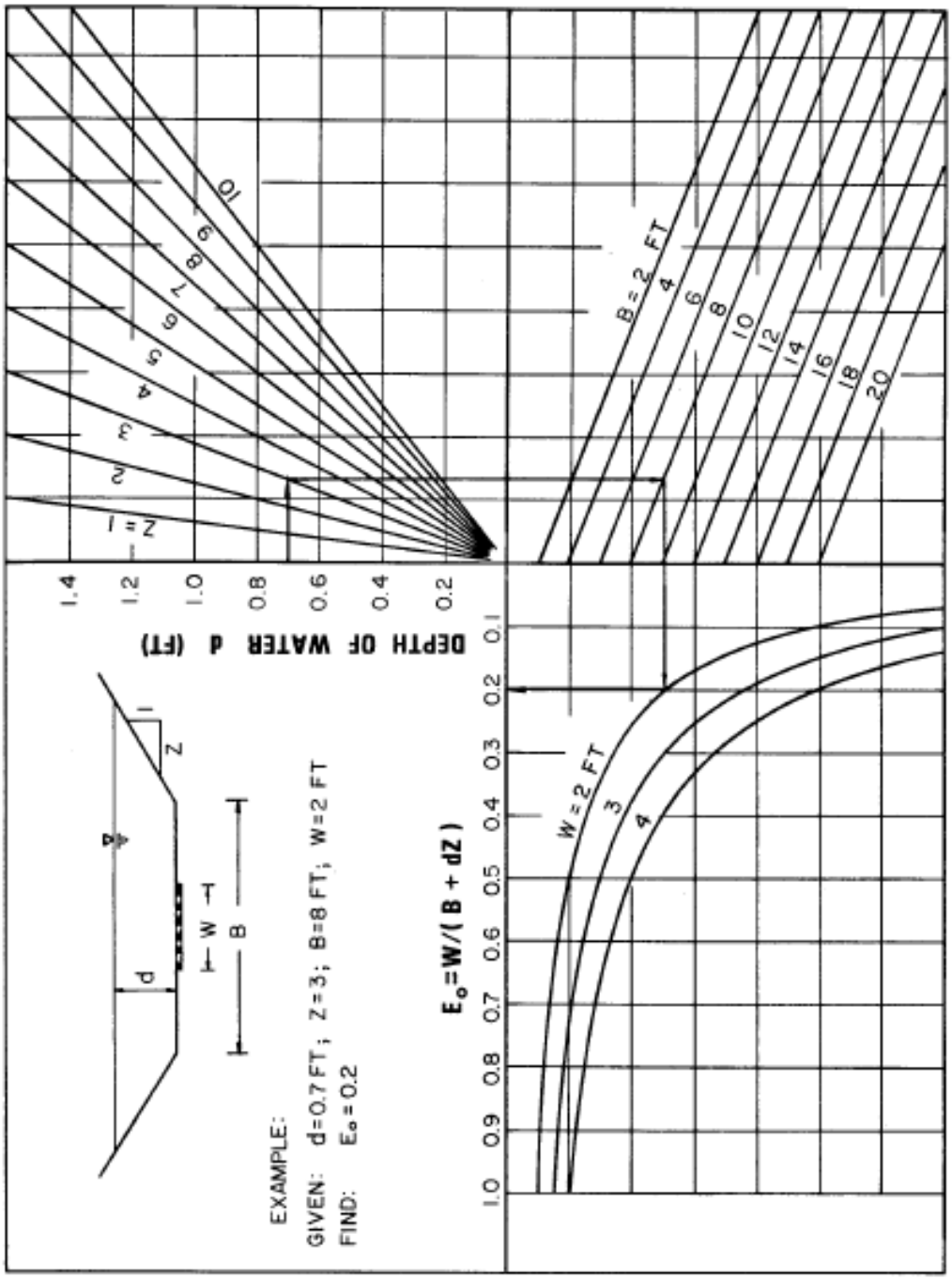
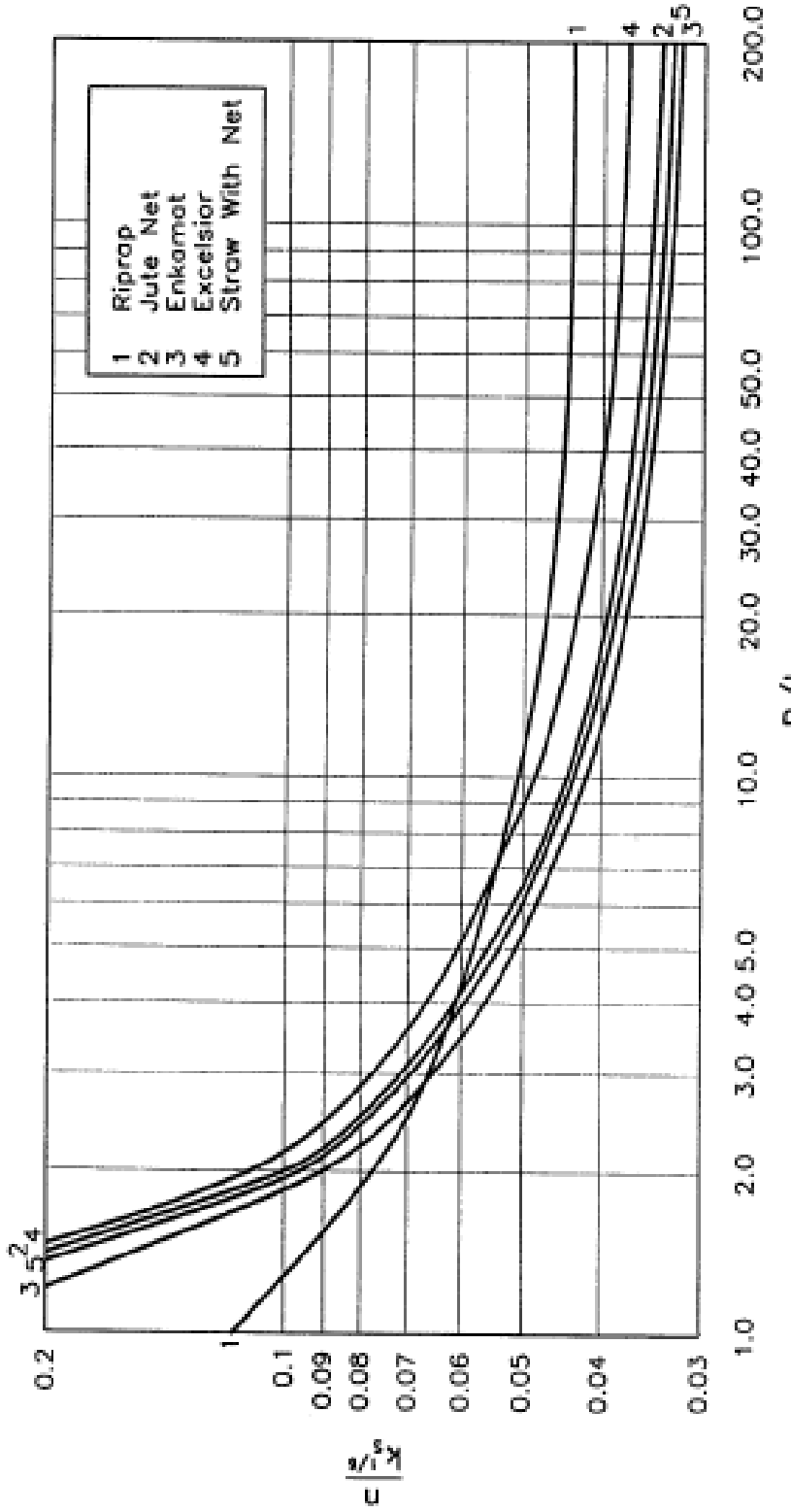

Depth of Water d (m)
0.4
0.3
0.2
0.1
Z=1
2
3
4
5
6
7
8
10
B=0.5m
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
W=.6m
.9
1.2
E_0=W / (B+dZ)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.00
Ratio of Frontal Flow to Total Flow in a Trapezoidal Channel.
EXAMPLE
GIVEN: D=0.20 m; Z=3; B=2.5 m; W=0.6 m
FIND: E_0=0.19
1
Z
W
B
d

CHART 15B



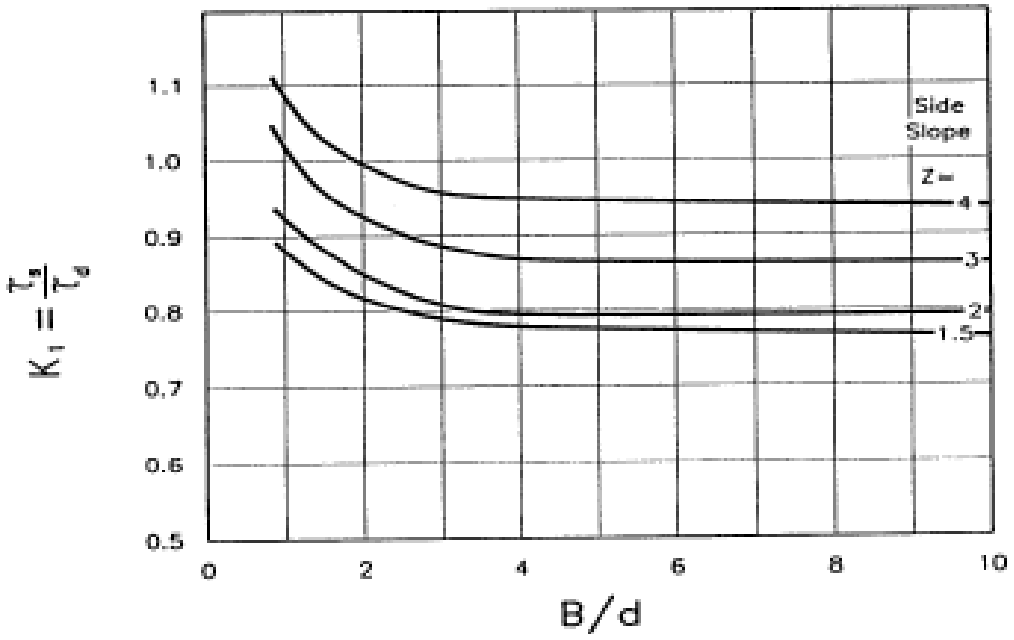
Ratio of Frontal Flow to Totl Flow in a Trapezoidal Channel - English Units

CHART 16



Manning's n Versus Relative Roughness
For Selected Lining Types

CHART 17



Channel Side Shear Stress To Bottom Shear Stress Ratio, K_1.

CHART 18

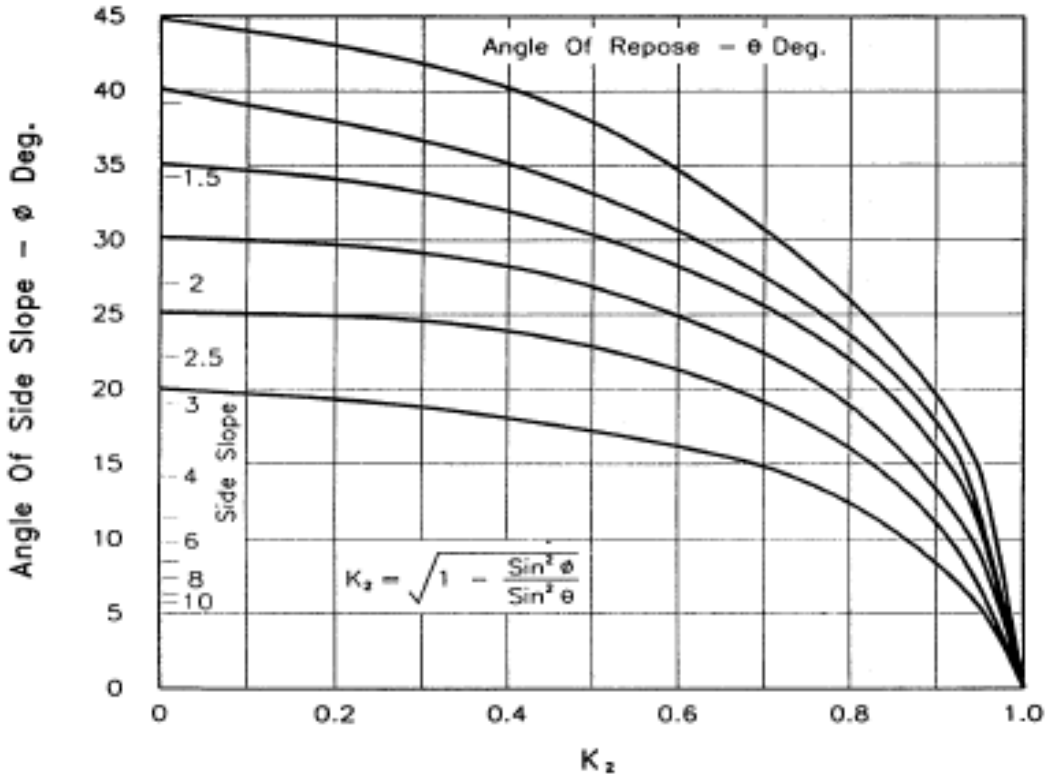
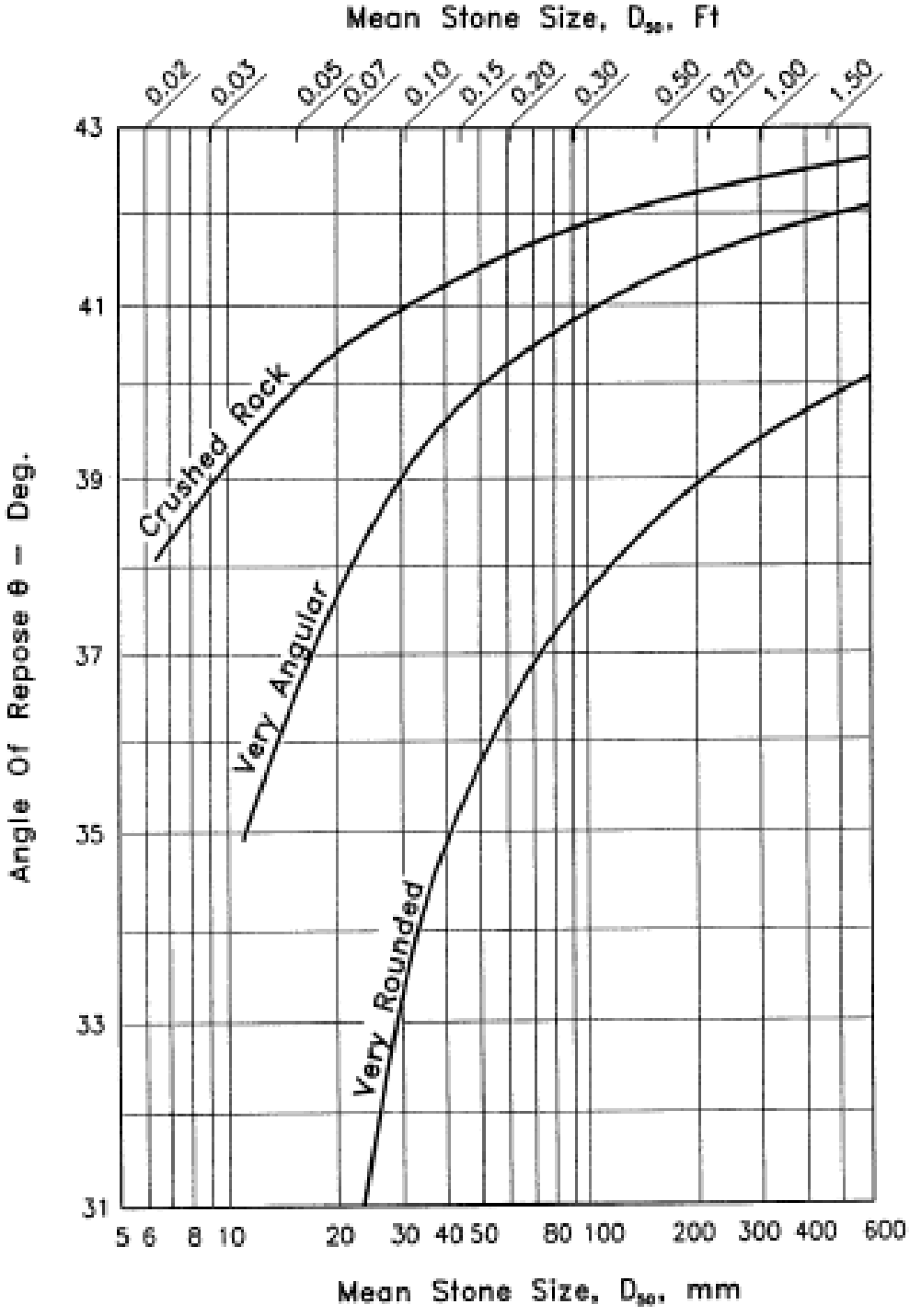


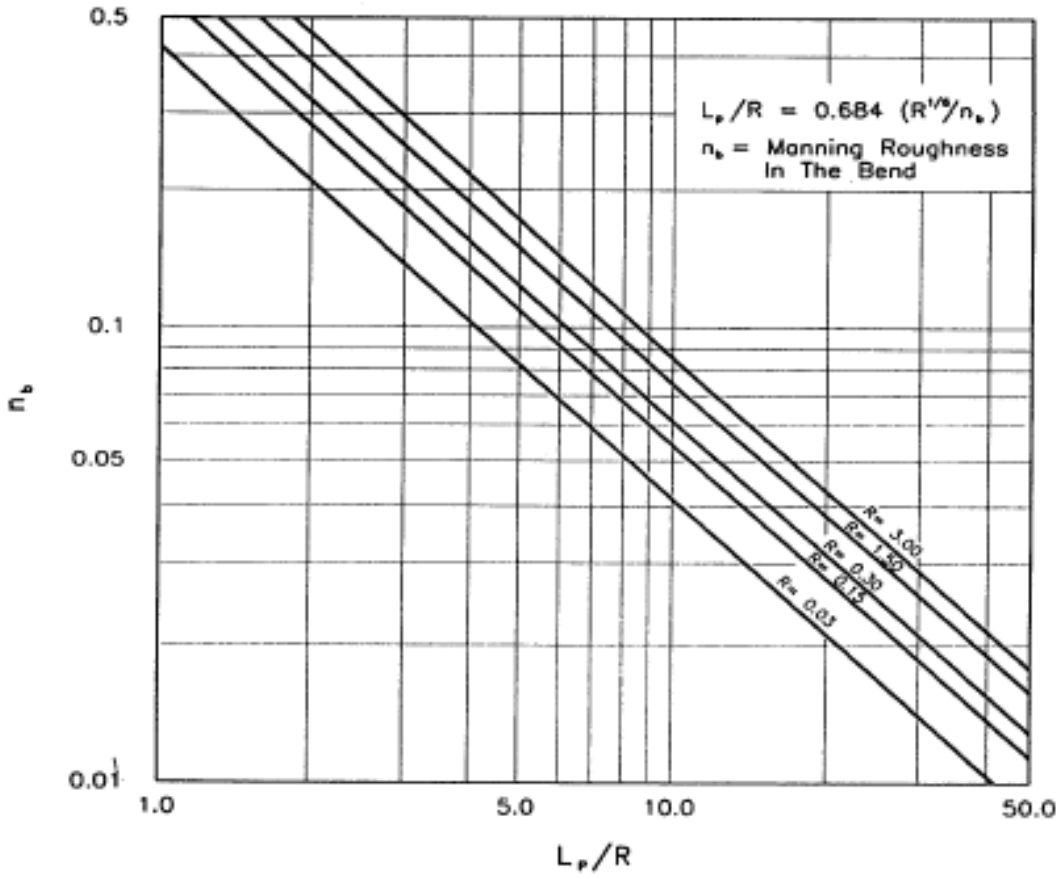
Chart 18. Tractive Force Ratio, K_2.

CHART 19



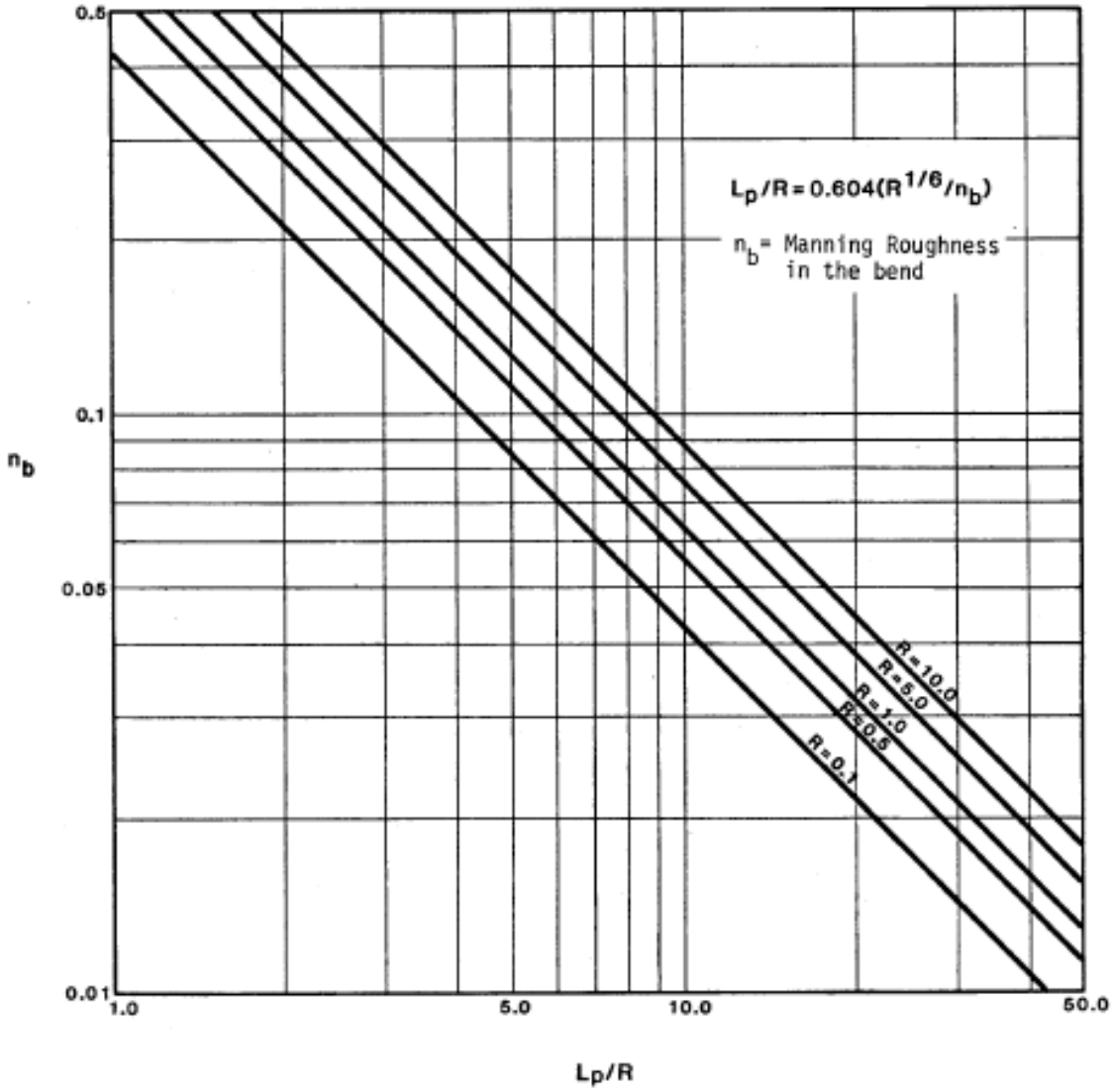
Angle Of Repose Of Riprap In Terms Of Mean Size And Shape Of Stone.

CHART 20A



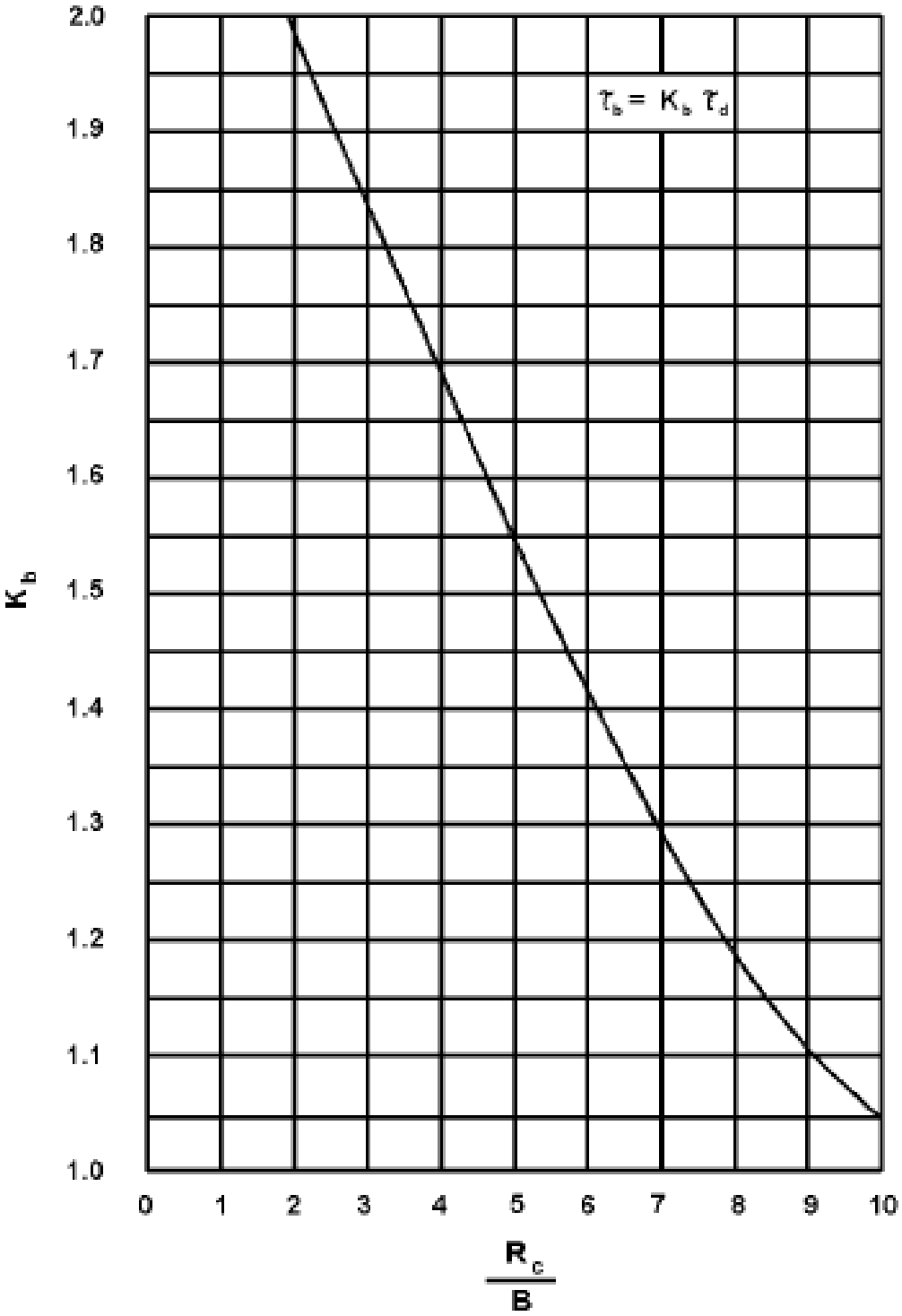
Protection Length, Lp, Downstream Of Channel Bend (11)

CHART 20B



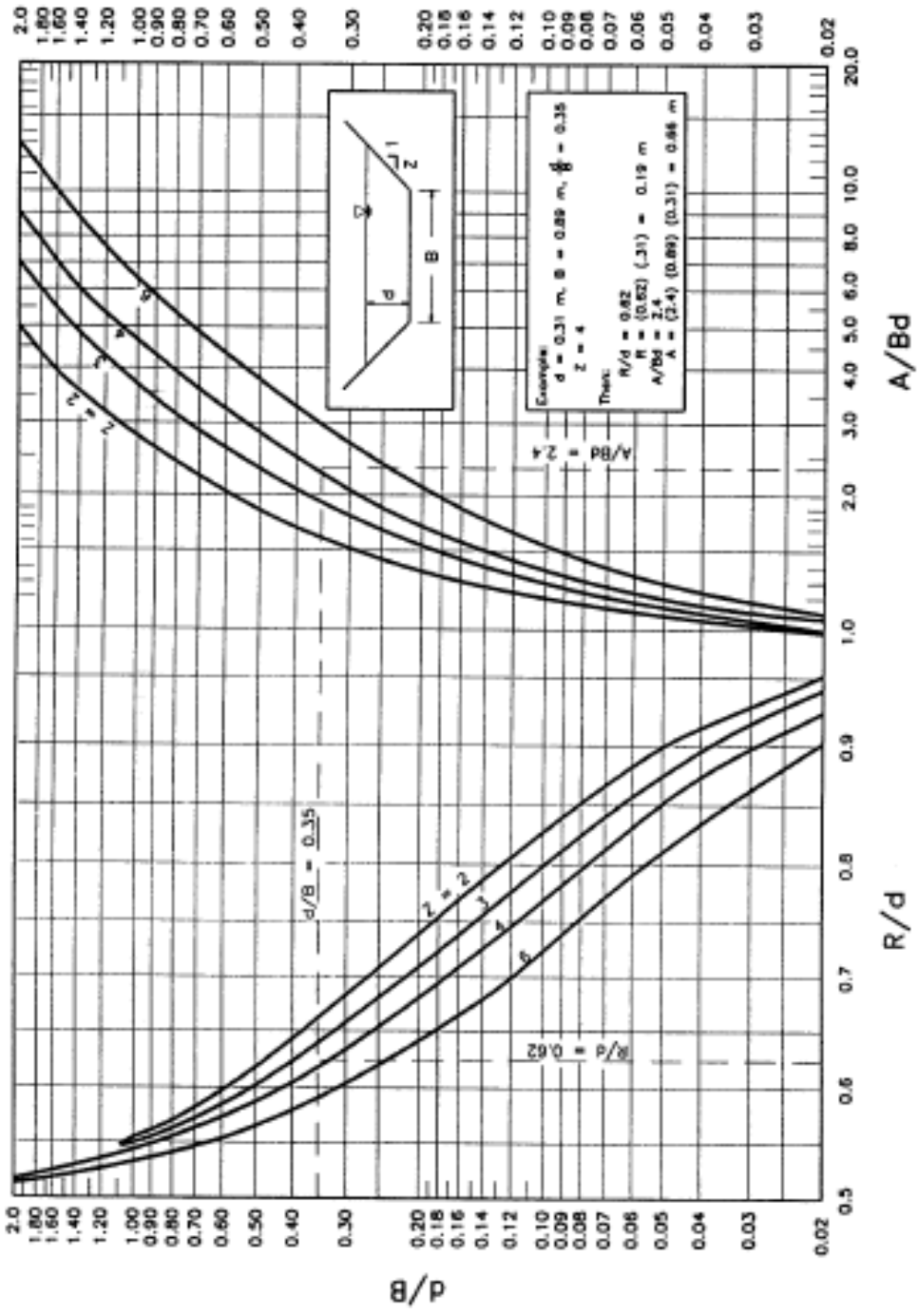
Protection Length, L_p, Downstream of Channel Bend[11] - English Units

CHART 21



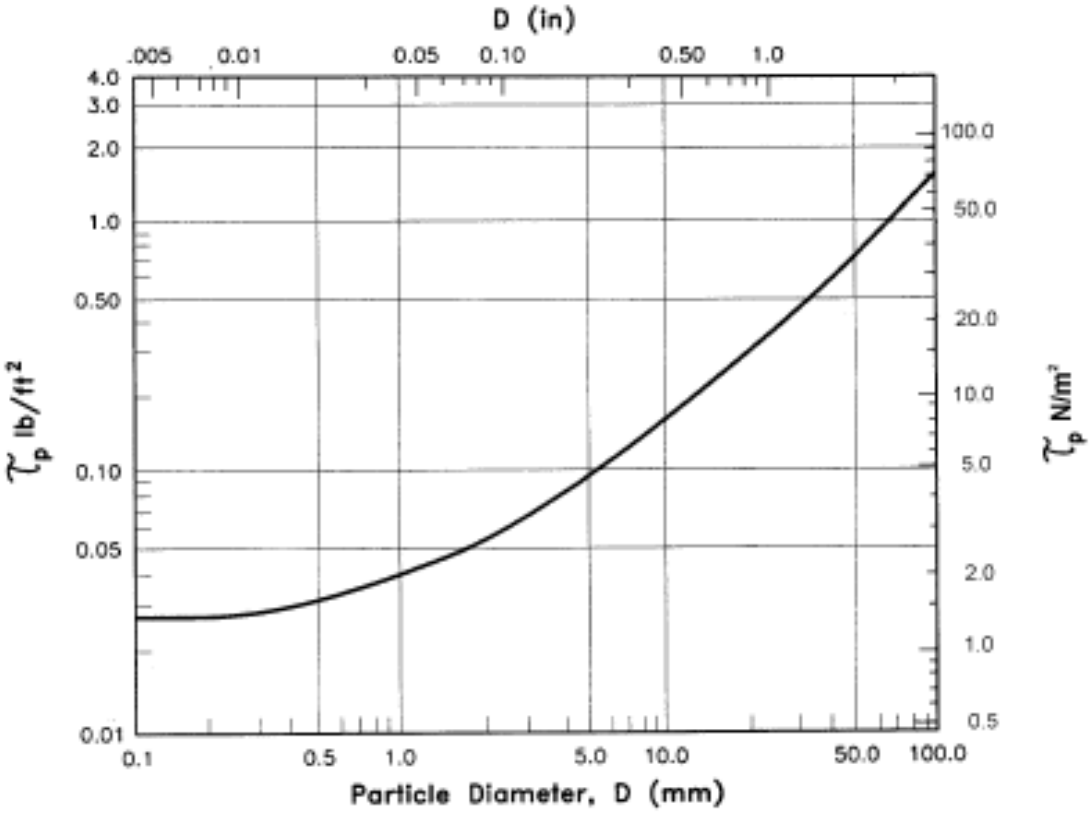
K_b Factor For Maximum Shear Stress On Channel Bends. (12)

CHART 22



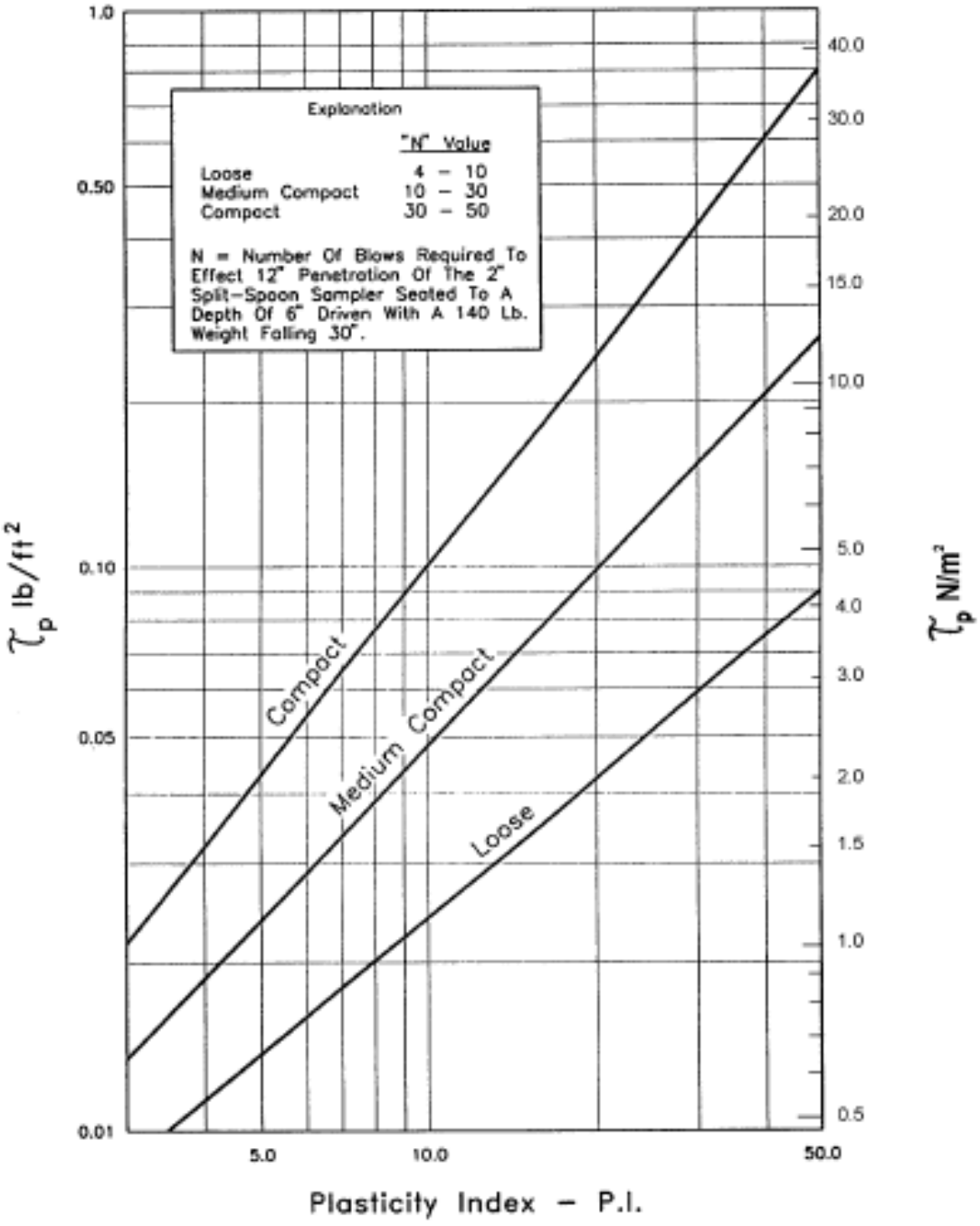
Geometric Design Chart For Trapezoidal Channels.

CHART 23



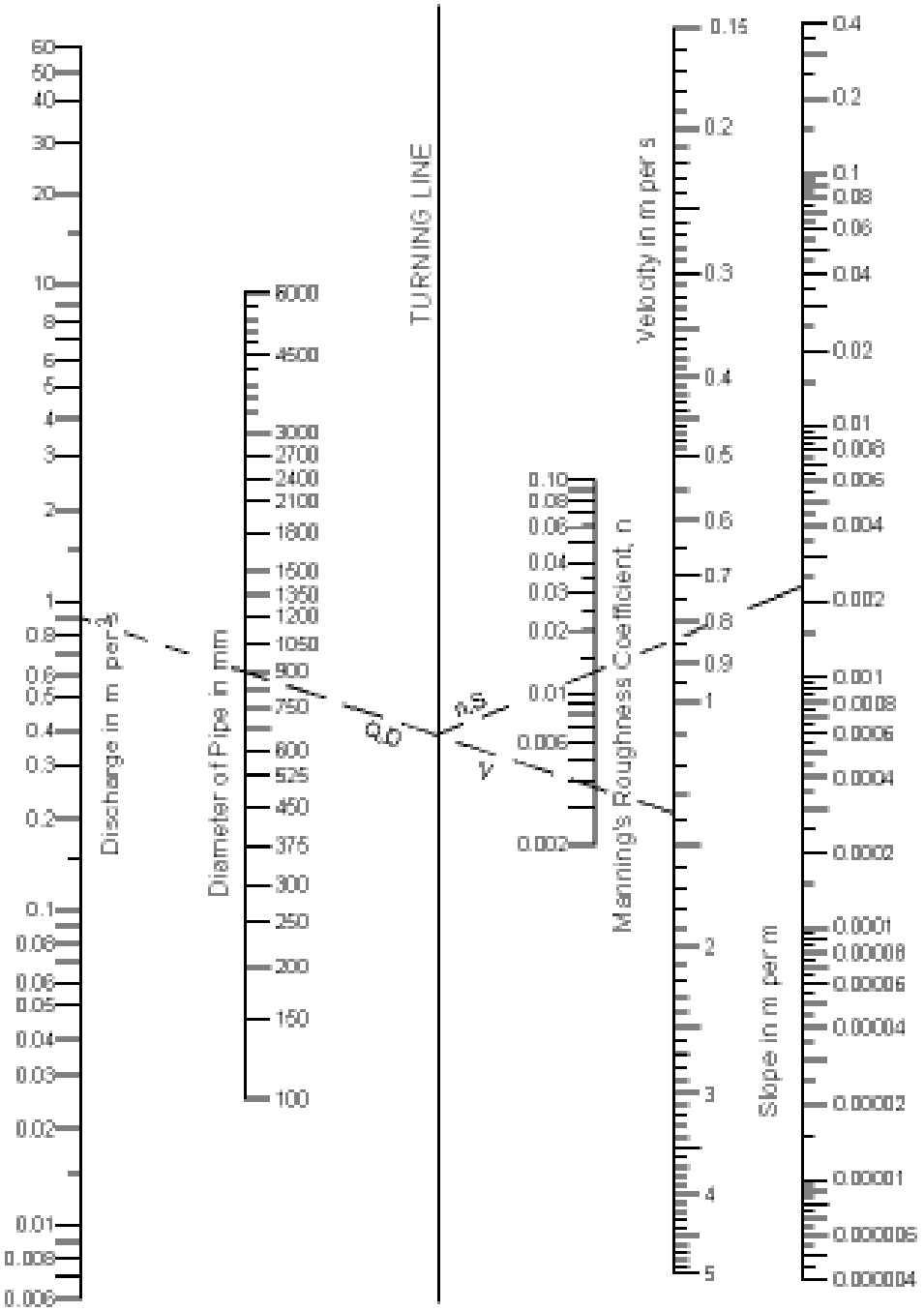
Permissible Shear Stress For Non-cohesive Soils. (After 15)

CHART 24



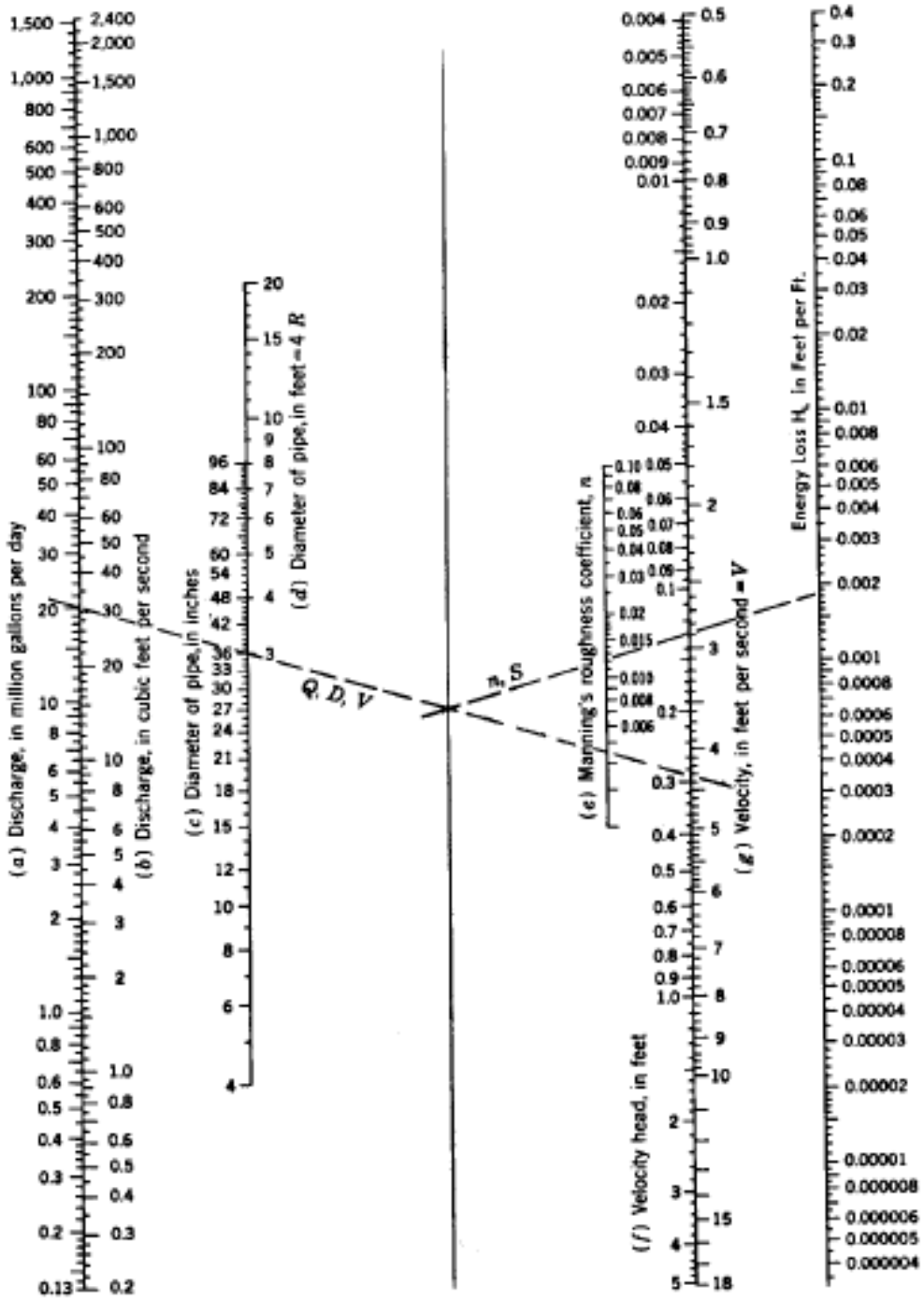
Permissible Shear Stress For Cohesive Soils.

CHART 25A



Solution of Manning's Equation for Flow in Storm Drains.

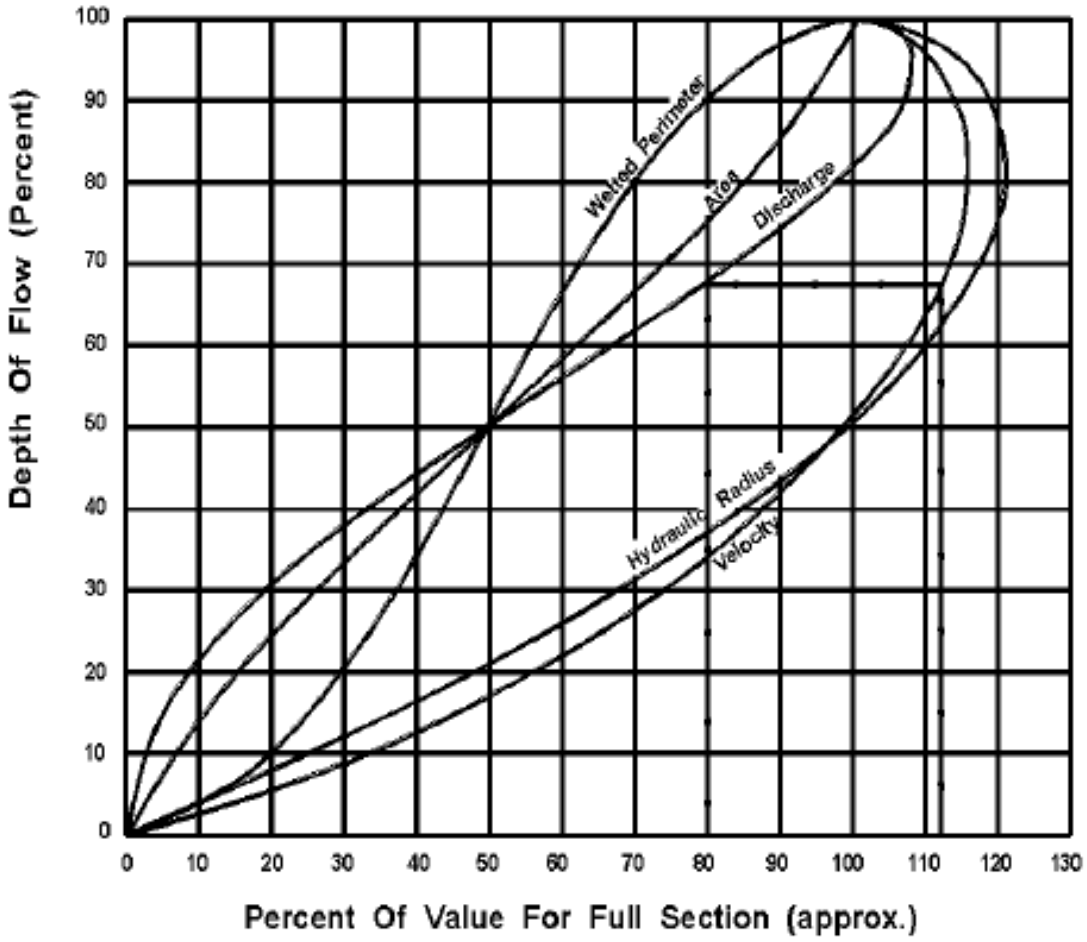
CHART 25B



Alignment chart for energy loss in pipes, for Manning's formula.
Note: Use chart for flow computations, $H_L = S$

Solution of Manning's Equation for Flow in Storm Drains - English Units
(Taken from "Modern Sewer Design" by American Iron and Steel Intitute)

CHART 26



Hydraulic Elements Chart

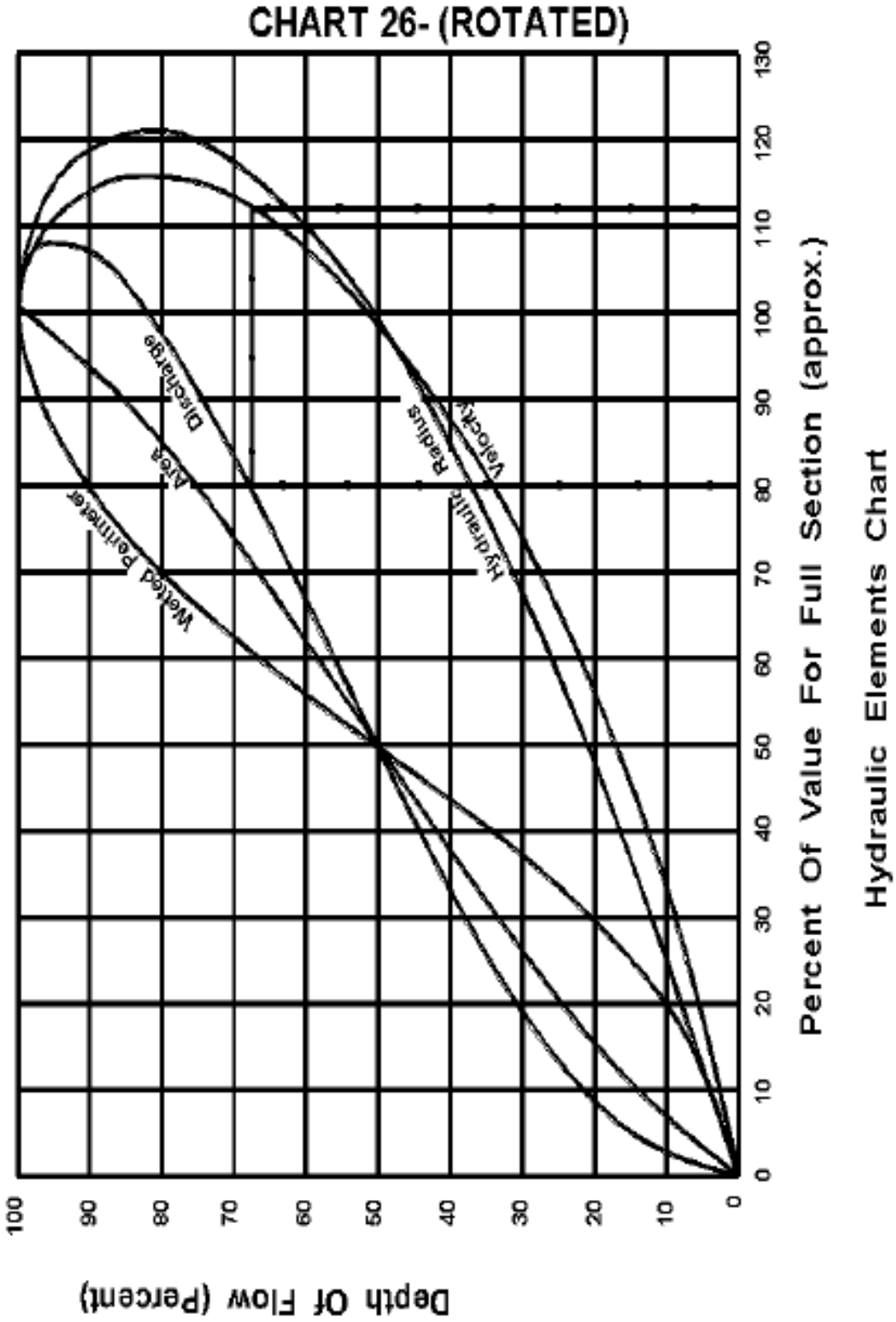
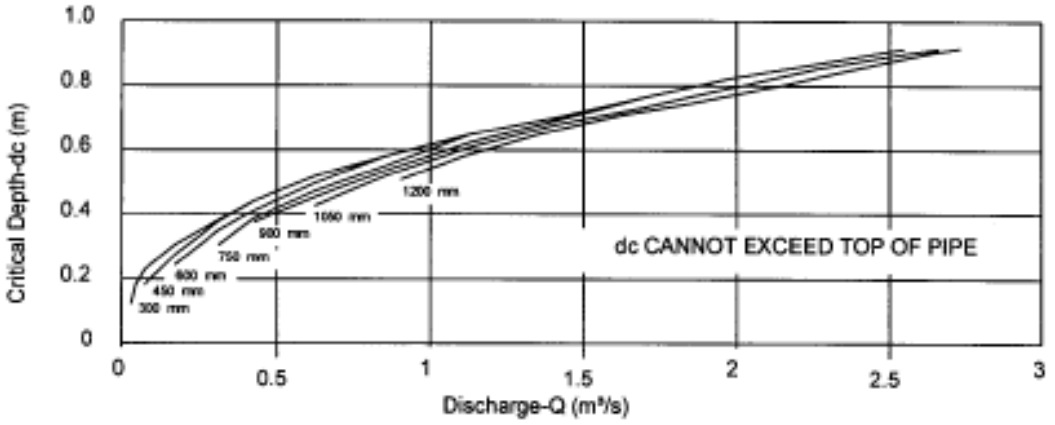
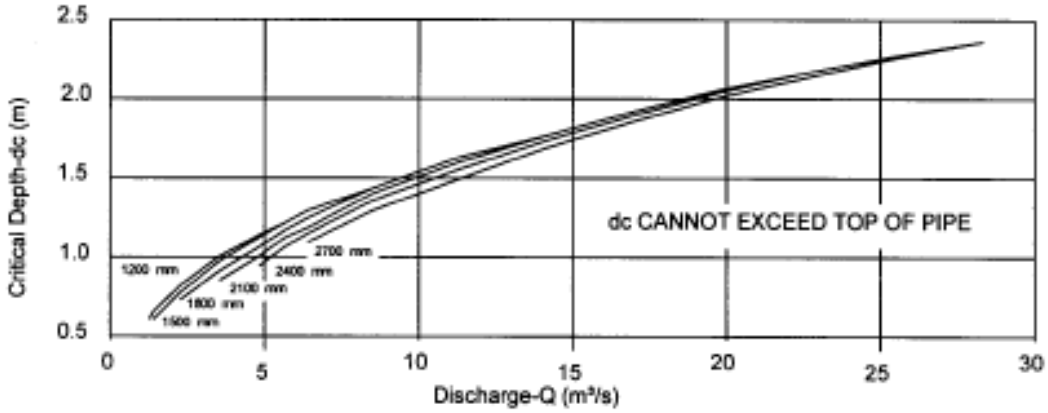
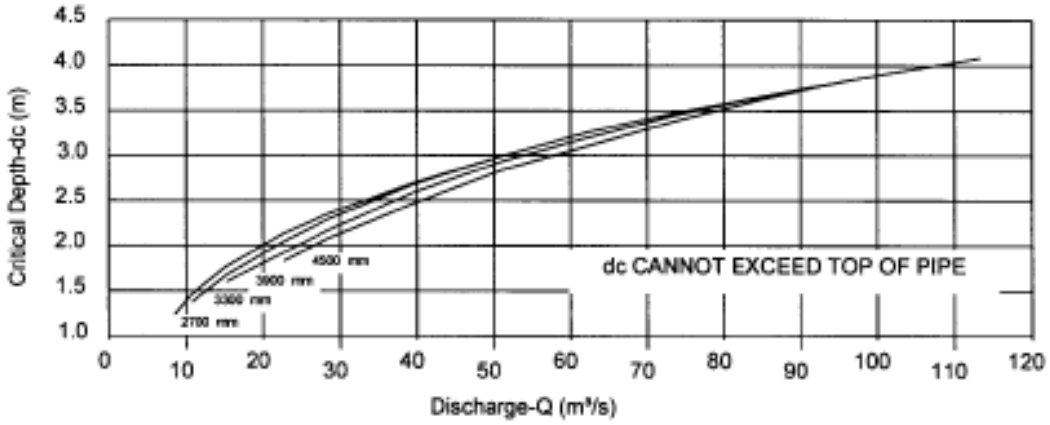


CHART 26- (ROTATED)
Hydraulic Elements Chart
Percent Of Value For Full Section (approx.)
Depth Of Flow (Percent)
Wetted Perimeter
Area
Discharge
Hydraulic
Radius
Velocity
0
10
20
30
40
50
60
70
80
90
100
110
120
130
100
90
80
70
60
50
40
30
20
10
0

CHART 27A







Adapted from Bureau of Public Roads

Critical Depth-Circular Pipe

CHART 27B

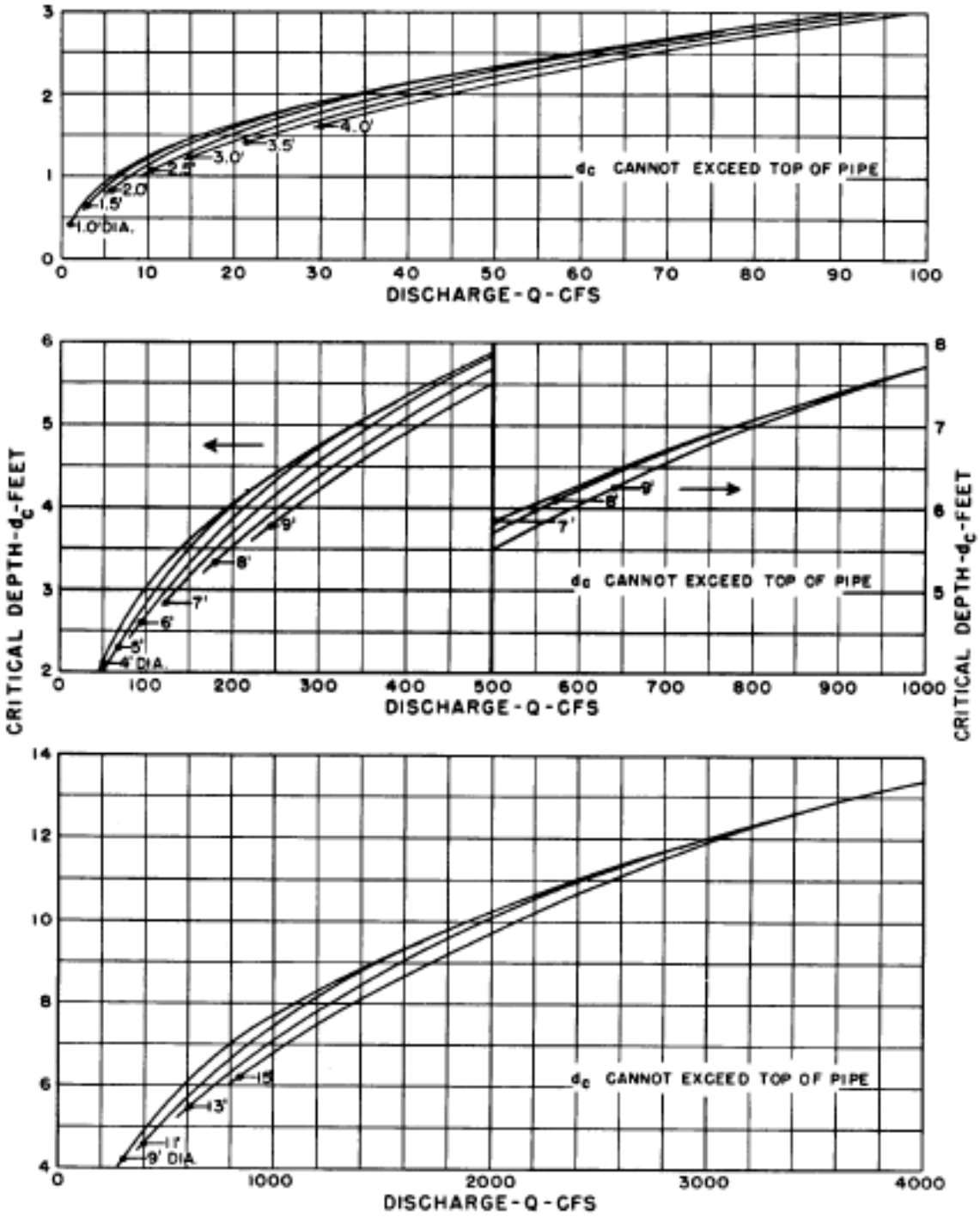
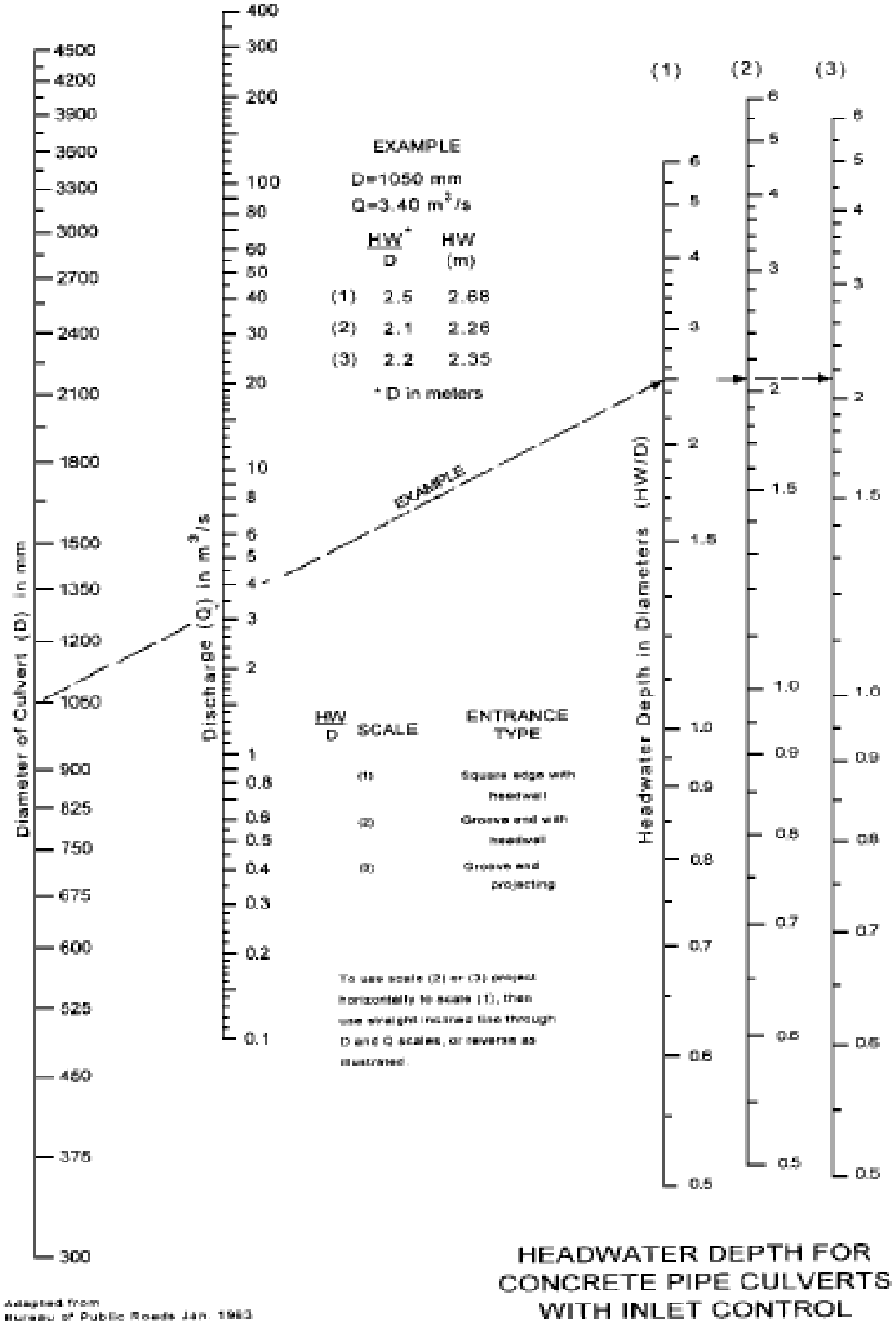


Chart 27B. Critical Depth in Circular Pipe - English Units

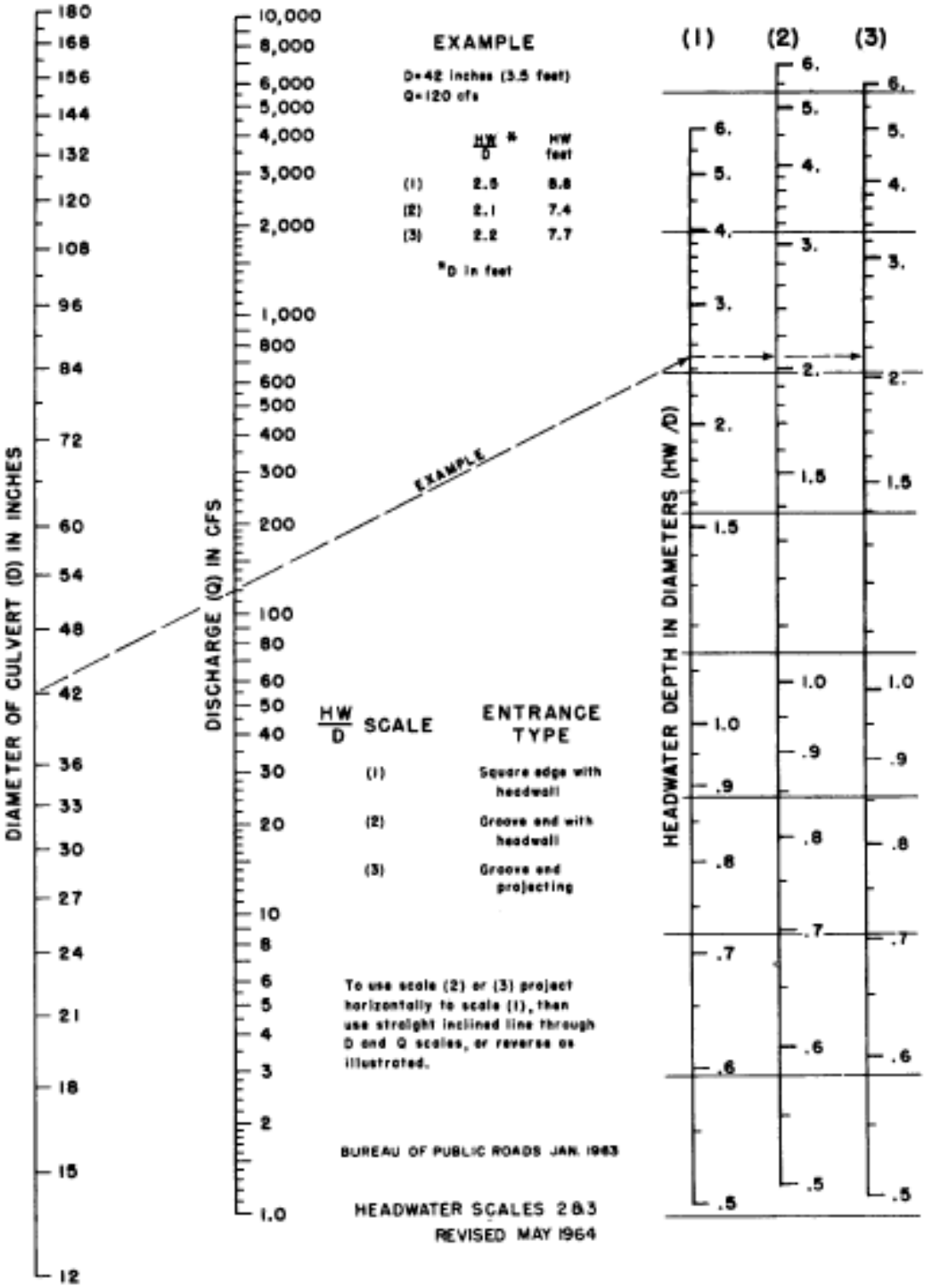
CHART 28A



Adapted from
Bureau of Public Roads Jan. 1963

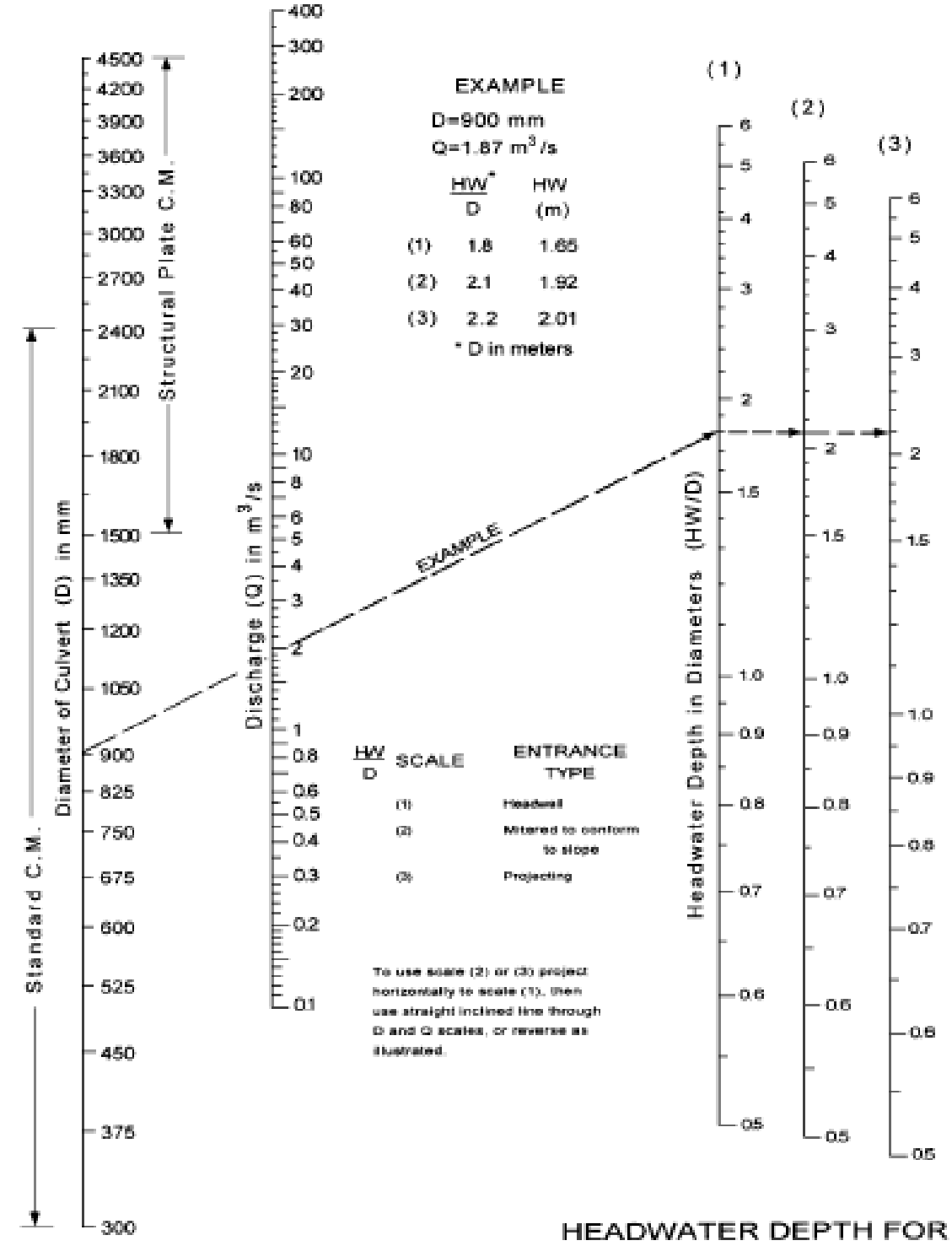
HEADWATER DEPTH FOR
CONCRETE PIPE CULVERTS
WITH INLET CONTROL

CHART 28B



Headwater Water Depth for Concrete Pipe Culverts with Inlet Control - English Units

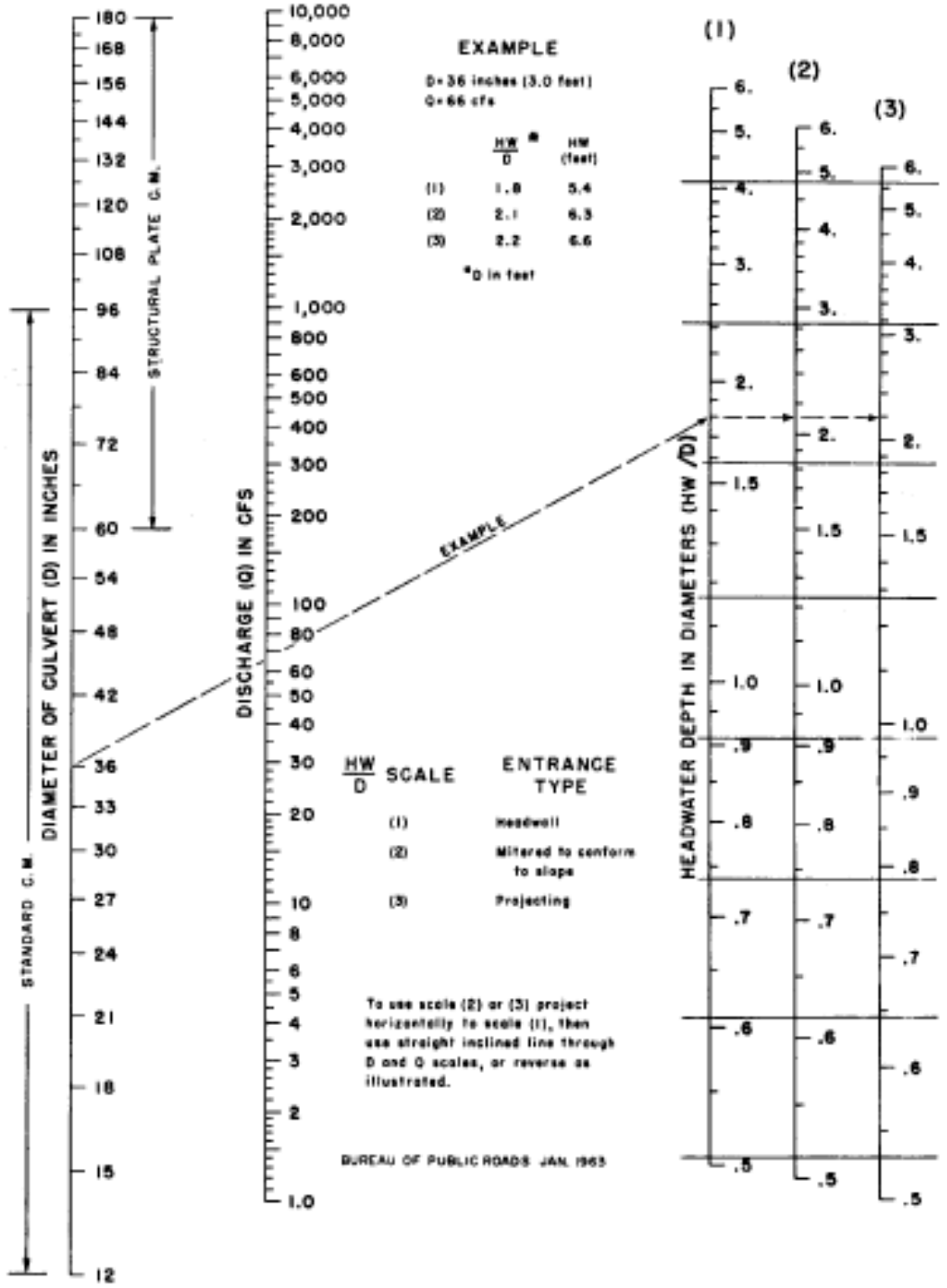
CHART 29A



Adapted from
Bureau of Public Roads Jan. 1963

HEADWATER DEPTH FOR
C.M. PIPE CULVERTS
WITH INLET CONTROL

CHART 29B



Headwater Depth for C. M. Pipe Culverts with Inlet Control - English Units

APPENDIX C

LIST OF SYMBOLS

Symbol	Description	Units, English
a	Regression constant	--
a	Gutter depression	inch
A	Cross sectional area of flow	ft^2
A	Drainage area	acres
A	Sub-basin drainage area	mi^2
A_c	The most downstream part of the larger primary area that will contribute to the discharge during the time of concentration associated with the smaller, less pervious area	acres
A_g	Clear opening area of the grate	ft^2
A_k	Basin area	sq mi
A_s	Contributing drainage area	sq mi
A_w	Flow area in depressed gutter width	ft^2
A'_w	Gutter flow area in a width equal to the grate width	ft^2
A,B,C	Basin characteristics	--
B	Bottom width of channel	ft
b, c, d	Regression coefficients	--
C	Dimensionless runoff coefficient	--
C_o	Orifice coefficient	--
C_w	Weir coefficient	--
CN	Curve number	--
d	Depth of flow	ft
d	Average depth across the grate: 0.5 (d_1 + d_2),	ft
d	Depth at curb measured from the normal cross slope, ($d=T\ S_x$)	ft
D	Culvert height or diameter	ft
d_B	Depth at point B of a V shaped gutter	ft
d_C	Depth at point C of a V shaped gutter	ft
d_c	Critical depth	ft
d_i	Depth at lip of curb opening	ft
d_o	Effective head on the center of the orifice throat	ft
d_2	Depth at curb	--

Symbol	Description	Units, English
d_{50}	Average riprap size	ft
D_{50}	Average riprap size	ft
E	Inlet efficiency	percent
EGL_i	EGL at the inlet end	
EGL_o	EGL at the outlet end	
E_o	Ratio of flow in a chosen width (usually the width of a grate) to total gutter flow (Q_w/Q)	--
E'_o	Adjusted frontal flow area ratio for grates in composite cross sections	--
F	Froude number	--
F_p	Adjustment factor for pond and swamp areas	--
g	Acceleration due to gravity	32.16 ft/s^2
G_i	Grade of roadway	percent
G_1	Approach grade	percent
G_2	Approach grade	percent
h	Height of curb-opening inlet or orifice	ft
h	Orifice throat width	ft
H	Head (above weir crest excluding velocity head)	ft
H_f	Friction loss	ft
h_o	Head measured as the distance from the culvert invert (flow line) at the outlet to the control elevation	ft
I	Rainfall intensity	in/hr
IA	Percent of basin occupied by impervious surfaces	percent
I_a	Initial abstraction	in
k	Intercept coefficient (Table 2-3)	--
K	Vertical curve constant, rate of vertical curvatures	ft/ percent
K_c	Empirical coefficient equal to .933	--
K_e	Entrance loss coefficient	--
L	Curb opening length	ft
L	Flow length	ft
L	Horizontal length of curve	ft
L	Actual culvert length	--
L_T	Curb opening length required to intercept 100 percent of the gutter flow	ft
L_1	Adjusted culvert length	--

Symbol	Description	Units, English
n	Hydraulic resistance variable	--
n	Manning's roughness coefficient	--
n_1	Desired n value	--
P	Depth of 24-hr precipitation	in
P	Perimeter of the grate disregarding the side against the curb	ft
q	Hydrograph ordinate for a specific time	ft_3/s
Q	Flow	ft^3/s
Q'	One half the total flow	--
q_a	Adjusted peak flow	ft^3/s
q_p	Peak flow	ft^3/s
q_t	Tabular hydrograph unit discharge from appropriate table (SCS TR-55 manual)	$ft^3/s/mi^2/in$
q_u	Unit peak flow	$ft^3/s/mi^2/in$
Q_b	Bypass flow	ft^3/s
Q_D	Depth of direct runoff	in
Q_i	Intercepted flow, interception flow capacity, inflow, flow capacity	ft^3/s
Q_s	Flow capacity of the gutter section above the depressed section	ft^3/s
Q_w	Flow rate in the depressed section of the gutter	ft^3/s
R	Hydraulic radius (flow area divided by the wetted perimeter)	ft
RI2	Rainfall intensity for 2-hour, 2-year recurrence	in/hr
RQ_T	T-year rural peak flow	ft^3/s
R_f	Ratio of frontal flow intercepted to total frontal flow	--
R_s	Ratio of side flow intercepted to total side flow	--
S	Surface slope	ft/ft
SL	Main channel slope (measured between points that are 10 and 85 percent of the main channel length upstream of the site)	ft/mi
S_L	Longitudinal slope	ft/ft
ST	Basin storage (percentage of basin occupied by lakes, reservoirs, swamps, and wetlands)	percent
S_e	Equivalent cross slope	ft/ft
S_p	Slope	percent

Symbol	Description	Units, English
S_R	Retention	in
S_w	Cross slope of the depressed gutter	ft/ft
S'_w	Cross slope of the gutter measured from the cross slope of the pavement, S_x	ft/ft
S_x	Cross slope	ft/ft
t	Time	--
t_b	Time base	hr
t_c	Time of concentration	hr
t_{c1}	Time of concentration of the smaller, less pervious tributary area	hr
t_{c2}	Time of concentration associated with the larger primary area	hr
t_p	Time to peak	hr or s
T	Distance of the spread, width of flow (spread)	ft
T'	Hypothetical spread	ft
T'	One half the total spread	ft
T_a	Spread at the average velocity in a triangular gutter	ft
T_s	Width of spread from the junction of the gutter and the road to the limit of the spread	--
T_{ti}	Travel time	min
T_{ti1}	Segment 1, sheet flow, travel time	min
T_{ti2}	Segment 2, shallow concentration flow, travel time	min
T_{ti3}	Segment 3, conduit flow, travel time	min
T_1	Spread at the upstream end of the triangular gutter section	ft
T_2	Spread at the downstream end of the triangular gutter section	ft
UQ_T	Urban peak discharge for T-year recurrence interval	ft^3/s
V	Velocity, frontal flow efficiency	ft/s
V_a	Average velocity	ft
V_o	Gutter velocity where splash-over first occurs	ft/s
W	Width of gutter, width of grate	ft
x	Subscript designating values for incremental areas with consistent land cover	--
X	Distance from sag point	--

Symbol	Description	Units, English
y	Depth of water in the channel	--
Y	Depth of ponding	--
Y_f	Depth at the flanking inlet	--
z	Horizontal distance of the side slope to a rise of 1 ft. vertical	ft
<	Less than	--
≤	Equal to or less than	--
>	Greater than	--
≥	Equal to or greater than	--
=	Equals	--
%	Percent	--
º	Degree	--
Φ	Diameter	--

APPENDIX D

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APPENDIX E

WAIVER PROCESSING PROCEDURES FOR DOD

E-1 **ARMY**

E-1.1 **Waiver Procedures:**

E-1.1.1 **Installation.** The installation's design agent, aviation representative (safety officer, operations officer, and/or air traffic and airspace [AT&A] officer) and DEH master planner will:

E-1.1.1.1 Jointly prepare/initiate waiver requests.

E-1.1.1.2 Submit requests through the installation to the major command (MACOM).

E-1.1.1.3 Maintain a complete record of all waivers requested and their disposition (approved or disapproved). A list of waivers to be requested and those approved for a project should also be included in the project design analysis prepared by the design agent, aviation representative, or DEH master planner.

E-1.1.2 **The MACOM will:**

E-1.1.2.1 Ensure that all required coordination has been accomplished.

E-1.1.2.2 Ensure that the type of waiver requested is clearly identified as either "Temporary" or "Permanent." "Permanent" waivers are required where no further mitigative actions are intended or necessary. "Temporary" waivers are for a specified period during which additional actions to mitigate the situation must be initiated to fully comply with criteria or to obtain a permanent waiver. Follow-up inspections will be necessary to ensure that mitigative actions proposed for each temporary waiver granted have been accomplished.

E-1.1.2.3 Review waiver requests and forward all viable requests to U. S. Army Aeronautical Services Agency (USAASA) for action. To expedite the waiver process, MACOMs are urged to simultaneously forward copies of the request to:

E-1.1.2.3.1 Commander, U. S. Army Aeronautical Services Agency (USAASA), ATTN: ATAS-AI, 9325 Gunston Road, Suite N319, Fort Belvior, VA 22060-5582.

E-1.1.2.3.2 Commander, U.S. Army Safety Center (USASC), ATTN: CSSC-SPC, Bldg. 4905, 5th Ave., Fort Rucker, AL 36362-5363.

E-1.1.2.3.3 Commander, U. S. Army Aviation Center (USAAVNC), ATTN: ATZQ-ATC-AT, Fort Rucker, AL 36362-5265.

E-1.1.2.3.4 Director, USACE Transportation Systems Center (TSMCX), ATTN: CENWO-ED-TX, 215 N 17th St., Omaha, NE 68102.

E-1.1.3 **USAASA.** USAASA is responsible for coordinating these reviews for the waiver request:

E-1.1.3.1 Air traffic control assessment by USATCA.

E-1.1.3.2 Safety and risk assessment by USASC.

E-1.1.3.3 Technical engineering review by TSMCX.

E-1.1.3.4 From these reviews, USAASA formulates a consolidated position and makes the final determination on all waiver requests and is responsible for all waiver actions for Army operational airfield/airspace criteria.

E-1.2 **Contents of Waiver Requests.** Each request must contain this information:

E-1.2.1 Reference to the specific standard and/or criterion to be waived by publication, paragraph, and page.

E-1.2.2 Complete justification for noncompliance with the airfield/airspace criteria and/or design standards. Demonstrate that noncompliance will provide an acceptable level of safety, economics, durability, and quality for meeting the Army mission. This includes reference to special studies made to support the decision. Specific justification for waivers to criteria and allowances must be included:

E-1.2.2.1 When specific site conditions (physical and functional constraints) make compliance with existing criteria impractical and/or unsafe. Some examples are the need to provide hangar space for all aircraft because of recurring adverse weather conditions; the need to expand hangar space closer to and within the runway clearances due to lack of land; and maintaining fixed-wing Class A clearances when support of Class B fixed-wing aircraft operations are over 10 percent of the airfield operations.

E-1.2.2.2 When deviation(s) from criteria fall within a reasonable margin of safety and do not impair construction or long range facility requirements. An example is locating security fencing around and within established clearance areas.

E-1.2.2.3 When construction that does not conform to criteria is the only alternative to meet mission requirements. Evidence of analysis and efforts taken to follow criteria and standards must be documented and referenced.

E-1.2.3 The rationale for the waiver request, including specific impacts on the assigned mission, safety, and/or environment.

E-1.3 **Additional Requirements:**

E-1.3.1 **Operational Factors**. Include information on the existing and/or proposed operational factors used in the assessment:

E-1.3.1.1 Mission urgency.

E-1.3.1.2 All aircraft by type and operational characteristics.

E-1.3.1.3 Density of aircraft operations at each air operational facility.

E-1.3.1.4 Facility capability (visual flight rules [VFR] or instrument flight rules [IFR]).

E-1.3.1.5 Use of self-powered parking versus manual parking.

E-1.3.1.6 Safety of operations (risk management).

E-1.3.1.7 Existing navigational aids (NAVAIDS).

E-1.3.2 **Documentation**. Record all alternatives considered, their consequences, necessary mitigative efforts, and evidence of coordination.

E-2 **AIR FORCE**

E-2.1 **Waivers to Criteria and Standards.** Waivers to criteria and standards in this publication must be approved by the major command (MAJCOM) pavements engineer.

E-2.2 **Waiver Procedure.** The design agent or, if designed by the Air Force, the base pavements engineer, prepares a Request for Waiver for each project. The request must contain a complete listing of all deviations from criteria and standards, including justification. If the base civil engineer concurs, the request is forwarded to the MAJCOM pavements engineer for consideration.

E-3 **NAVY AND MARINE CORPS**

E-3.1 **Applicability:**

E-3.1.1 **Use of Criteria.** The criteria in this manual apply to Navy and Marine Corps aviation facilities located in the United States, its territories, trusts, and possessions. Where a Navy or Marine Corps aviation facility is a tenant on a civil airport, use these criteria to the extent practicable; otherwise, FAA criteria apply. Where a Navy or Marine Corps aviation facility is host to a civilian airport, these criteria will apply. Apply these standards to the extent practical at overseas locations where the Navy and Marine Corps have vested base rights. While the criteria in this manual are not intended for use in a theater-of-operations situation, they may be used as a guideline where prolonged use is anticipated and no other standard has been designated.

E-3.1.2 **Criteria at Existing Facilities.** The criteria will be used for planning new aviation facilities and new airfield pavements at existing aviation facilities (exception: primary surface width for Class B runways). Existing aviation facilities have been developed using previous standards that may not conform to the criteria herein. Safety clearances at existing aviation facilities need not be upgraded solely for the purpose of conforming to this criteria; however, at existing aviation facilities where few structures have been constructed in accordance with previous safety clearances, it may be feasible to apply the revised standards herein.

E-3.2 **Approval.** Approval from Headquarters Naval Facilities Engineering Command (NAVFACENGCOM) must be obtained prior to revising safety clearances at existing airfield pavements to conform with these new standards. NAVFACENGCOM will coordinate the approval with the Naval Air Systems Command and Chief of Naval Operations/Command Master Chief (CNO/CMC) as required.

E-3.3 **Obtaining a Waiver.** Once safety clearances have been established for an aviation facility, there may be occasions where it is not feasible to meet the designated standards. In these cases, a waiver must be obtained from the Naval Air Systems Command (NAVAIR). The waiver and its relation to the site approval process is defined in NAVFACINST 11010.44E, *Shore Facilities Planning Manua*l.

E-3.4 **Exemptions from Waiver.** Certain navigational and operational aids usually are sited in violation of airspace safety clearances in order to operate effectively. The aids listed in paragraphs E-3.4.1 to E-3.4.8 are within this group and require no waiver from NAVAIR, provided they are sited in accordance with NAVFAC P-272, *Definitive Designs for Naval Shore Facilities*, and/or the NAVFAC Design Manuals (DM series):

E-3.4.1 Approach lighting systems.

E-3.4.2 Visual approach slope indicator (VASI) systems and precision approach path indicators (PAPI).

E-3.4.3 Permanent optical lighting systems (OLS), portable OLS, and Fresnel lens equipment.

E-3.4.4 Runway distance markers.

E-3.4.5 Arresting gear systems, including signs.

E-3.4.6 Taxiway guidance, holding, and orientation signs.

E-3.4.7 All beacons and obstruction lights.

E-3.4.8 Arming and de-arming pads.

APPENDIX F

FAA ORDER 5300.1, MODIFICATIONS TO AGENCY AIRPORT DESIGN, CONSTRUCTION, AND EQUIPMENT STANDARDS.

Procedures for requests and processing of modifications to FAA standards are detailed in FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards. The current FAA Order is available at the following website:

http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.list/parentTopicID/24

APPENDIX G (FAA ONLY)

DESIGN OF SUBSURFACE PAVEMENT DRAINAGE SYSTEMS.

G-1 INTRODUCTION

G-1.1 Purpose. This chapter provides guidance for the design and construction of subsurface drainage facilities for airfield runways, taxiways, and aprons.

G -1.2 Scope. The criteria within this chapter apply to paved runways, taxiways, and aprons. The criteria is limited to situations where the water can be drained from the pavement structure by gravity flow and is mainly concerned with elimination of water that enters the pavement through the surface.

G -1.3 Definitions. Several terms in this chapter have a unique usage within the chapter or may not be in common usage. Paragraphs G-1.3.1 through G-1.3.16 define these terms.

G-1.3.1 Apparent Opening Size (AOS). The AOS is a measure of the opening size of a geotextile. AOS is the sieve number corresponding to the sieve size at which 95 percent of the single-size glass beads pass the geotextile (O_{95}) when tested in accordance with ASTM D 4751.

G -1.3.2 Coefficient of Permeability (*k*).The coefficient of permeability is a measure of the rate at which water passes through a unit area of material in a given amount of time under a unit hydraulic gradient.

G-1.3.3 Choke Stone. A choke stone is a small-size stone used to stabilize the surface of an open-graded material (OGM). For a choke stone to be effective, the ratio of d_{15} of the coarse aggregate to the d_{15} of the choke stone must be less than 5, and the ratio of the d_{50} of the coarse aggregate to d_{50} of the choke stone must be greater than 2.

G-1.3.4 Drainage Layer. A drainage layer is a layer in the pavement structure that is specifically designed to allow rapid horizontal drainage of water from the pavement structure. The layer is also considered to be a structural component of the pavement and may serve as part of the base or subbase.

G-1.3.5 Effective Porosity. The effective porosity is defined as the ratio of the volume of voids that will drain under the influence of gravity to the total volume of a unit of aggregate. The difference between the porosity and the effective porosity is the amount of water that will be held by the aggregate. For materials such as the rapid draining material (RDM) and OGM, the water held by the aggregate will be small; thus, the difference between the porosity and effective porosity will be small (less than 10 percent). The effective porosity may be estimated by computing the porosity from the unit dry weight of the aggregate and the specific gravity of the solids, which then should be reduced by 5 percent to allow for water retention in the aggregate.

G-1.3.6 Geocomposite Edge Drain. A geocomposite edge drain is a manufactured product using geotextiles, geogrids, geonets, and/or geomembranes in laminated or composite form, which can be used as an edge drain in place of trench-pipe construction.

G-1.3.7 Geotextile. A geotextile is a permeable textile used in geotechnical projects. For this AC, geotextile will refer to a nonwoven needle punch fabric that meets the requirements of the AOS, grab strength, and puncture strength specified for the particular application.

G-1.3.8 Hazen's Effective Particle Diameter. The Hazen's effective particle diameter is the particle size, in millimeters, that corresponds to 10 percent passing on the grain-size distribution curve. This parameter is one of the major parameters in determining the permeability of a soil.

G-1.3.9 Open-Graded Material (OGM). An OGM is a granular material having a very high permeability (greater than 1,500 m/day (5,000 ft/day)) which may be used for a drainage layer. Such a material will normally require stabilization for construction stability or for structural strength to serve as a base in a flexible pavement.

G-1.3.10 Pavement Structure. Pavement structure is the combination of subbase, base, and surface layers constructed on a subgrade.

G-1.3.11 Permeable Base. An open-graded, granular material with most of the fines removed (e.g., less than 10 percent passing the No. 16 sieve) to provide high permeability 305 m/day (1,000 ft/day or more) for use in a drainage layer.

G-1.3.12 Porosity. Porosity refers to the volume of voids in a material and is expressed as the ratio of the volume of voids to the total volume.

G-1.3.13 Rapid Draining Material (RDM). A granular material having a sufficiently high permeability (300 to 1,500 m/day (1,000 to 5,000 ft/day)) to serve as a drainage layer and also having the stability to support construction equipment and the structural strength to serve as a base and/or a subbase.

G-1.3.14 Separation Layer. A separation layer is a layer provided directly beneath the drainage layer to prevent fines from infiltration or pumping into the drainage layer and to provide a working platform for construction and compaction of the drainage layer.

G-1.3.15 Stabilization. Stabilization refers to either mechanically or chemically stabilizing the drainage layer to increase the stability and strength to withstand construction traffic and/or design traffic. Mechanical stabilization is accomplished by the use of a choke stone and compaction. Chemical stabilization is accomplished by the use of either portland cement or asphalt.

G-1.3.16 Subsurface Drainage. The process of collecting and removing water from the pavement structure. Subsurface drainage systems are categorized by function: those that drain surface infiltration water and those that control groundwater.

G-1.4 Bibliography. In recent years, subsurface drainage has received increasing attention, particularly in the area of highway design. A number of studies have been conducted by state highway agencies and by the Federal Highway Administration that have resulted in a large number of publications on the subject of subsurface drainage. Appendix A and D provide a list of publications that contain information pertaining to the design of subsurface drainage for pavements.

G-1.5 Effects of Subsurface Water. Water has a detrimental effect on pavement performance, primarily by either weakening subsurface materials or eroding material by free water movement. For flexible pavements, the weakening of the base, subbase, or subgrade when saturated with water is one of the main causes of pavement failures. In rigid pavement, free water, trapped between the concrete surface and an impermeable layer directly beneath the concrete, moves due to pressure caused by loadings. This movement of water (referred to as pumping) erodes the subsurface material, creating voids under the concrete surface. In frost areas, subsurface water will contribute to frost damage by heaving during freezing and loss of subgrade support during thawing. Poor subsurface drainage can also contribute to secondary damage such as “D” cracking or swelling of subsurface materials.

G-1.6 Traffic Effects. The type, speed, and volume of traffic will influence the criteria used in the design of pavement drainage systems. For rigid pavements, pumping is greatly increased as the volume and speed of the traffic increases. For flexible pavements, the buildup of pore pressures as a result of high-volume, high-speed traffic is a primary cause of the weakening of the pavement structure. For these reasons, the criteria for a subsurface under airfield runways and taxiways will be more stringent than for airfield parking aprons or other pavements that have low-volume and low-speed traffic.

G-1.7 Sources of Water. The two types of water to be considered are water from infiltration and subterranean water. Infiltration is the most important source of water and is the source of most concern in this document. Subterranean water is important in frost areas and areas of very high water table or areas of artesian water. In many areas, perched water may develop under pavements due to a reduced rate of evaporation of the water from the surface. In frost areas, free water collects under the surface by freeze/thaw action.

G-1.7.1 Infiltration. Infiltration is surface water that enters the pavement from the surface through cracks or joints in the pavement, through the joint between the pavement and shoulder, through pores in the pavement, and through shoulders and adjacent areas. Since surface infiltration is the principal source of water, it is the source needing greatest control measures. Groundwater tables rise and fall depending upon the relation between infiltration, absorption, evaporation, and groundwater flow. Seasonal fluctuations are normal because of differences in the amount of precipitation and maybe relatively large in some localities. Prolonged drought or wet periods will cause large fluctuations in the groundwater level.

G-1.7.2 Subterranean Water. Subterranean water can be a source of water from a high water table, capillary forces, artesian pressure, and freeze-thaw action. This source of water is particularly important in areas of frost action when large volumes of water can be drawn into the pavement structure during the formation of ice lenses. For large paved areas, the evaporation from the surface is greatly reduced, which causes saturation of the pavement structure by capillary forces. Also, if impervious layers exist beneath the pavement, perched water can be present or develop from water entering the pavement through infiltration. This perched water then becomes a subterranean source of water. In general, the presence of near surface subterranean water must be identified during soil exploration, and drainage facilities must be designed to mitigate the influence of such water.

G-1.7.3 Freeze-Thaw. Freeze–thaw action can result in large amounts of water being drawn into the pavement structure. In freeze-thaw conditions, water flows to the freeze front by capillary action. Repeated cycles of freeze-thaw result in the growth of ice lenses that can cause heave in the pavement structure. It is not uncommon to note heaves in soils as great as 60 percent; under laboratory conditions, heaves of as much as 300 percent have been recorded. The formation of ice lenses in the pavement structure has two very detrimental effects on the pavement. One effect is that the formation of the ice lenses causes a loss of density of the pavement materials, resulting in strength loss. A second effect is that thawing of the ice results in a large volume of free water that must be drained from the pavement. Because thawing usually occurs simultaneously from both the top and bottom of the pavement structure, the free water can be trapped within the pavement structure. Providing adequate drainage will minimize pumping and promote the restoration of pavement strength. In the design of subdrain systems in frost areas, free water in both the upper and lower sections of the pavement must be considered.

G-1.7.4 Classification of Subdrain Facilities. Subdrain facilities can be categorized into two functional categories: those that control infiltration, and those that control groundwater. An infiltration control system is designed to intercept and remove water that enters the pavement from precipitation or surface flow. An important function of this system is to keep water from being trapped between impermeable layers. A groundwater control system is designed to reduce water movement into subgrades and pavement sections by controlling the flow of groundwater or by lowering the water table. Often, subdrains are required to perform both functions, and the two subdrain functions can be combined into a single subdrain system. Figures G-1 and G-2 illustrate examples of infiltration and groundwater control systems, respectively.

Figure G-1. Collector Drain to Remove Infiltration Water

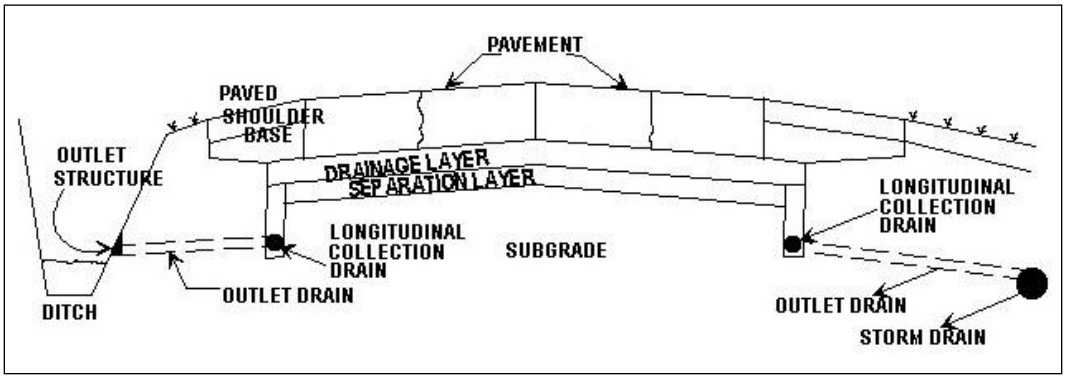
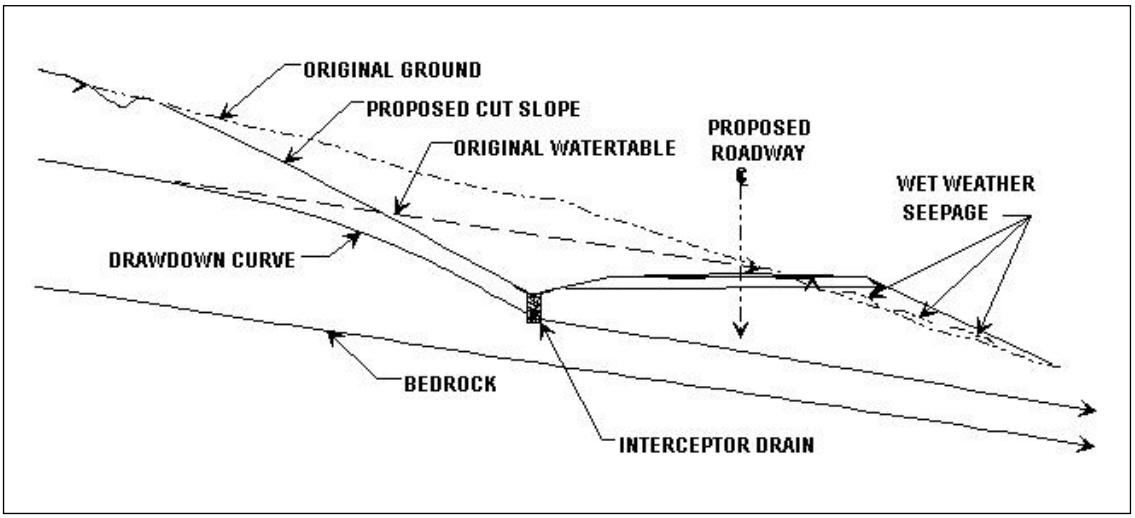


Figure G-2. Collector Drain to Intercept Seepage and Lower the Groundwater Table



G-1.8 Subsurface Drainage Requirements. Determining the subsurface soil properties and water condition is a prerequisite for the satisfactory design of a subsurface drainage system. Field explorations and borings made in connection with the project design should include certain investigations pertinent to subsurface drainage. A topographic map of the proposed area and the surrounding vicinity should be prepared; the map should indicate all streams, ditches, wells, and natural reservoirs. Analyzing aerial photographs of the areas selected for construction may furnish valuable information on general soil and groundwater conditions. An aerial photograph presents a graphic record of the extent, boundaries, and surface features of soil patterns occurring at the surface of the ground. The presence of vegetation, the slopes of a valley, the colorless monotony of sand plains, the farming patterns, the drainage pattern, gullies, eroded lands, and evidences of human works are revealed in detail by aerial photographs. The use of aerial photographs may supplement both the detail and knowledge gained in topographic survey and ground explorations. The sampling and

exploratory work can be made more rapid and effective after an analysis of aerial photographs has developed the general soil features. The location and depth of permanent and perched groundwater tables may be sufficiently shallow to influence the design. The season of the year and rainfall cycle will measurably affect the depth to the water table. In many locations, information may be obtained from residents of the surrounding areas regarding the behavior of wells and springs and other evidences of subsurface water. The soil properties investigated for other purposes in connection with the design will supply information that can be used for the design of the drainage system. It may be necessary to supplement these explorations at locations of subsurface drainage structures and in areas where soil information is incomplete for design of the drainage system.

G-1.9 Laboratory Tests. The design of subsurface drainage structures requires knowledge of these soil properties: strength, compressibility, swell and dispersion characteristics, the in situ and compacted unit dry weights, the coefficient of permeability, the in situ water content, specific gravity, grain-size distribution, and the effective void ratio. These soil properties may be satisfactorily determined by experienced soil technicians through laboratory tests. The final selected soil properties for design purposes may be expressed as a range, one extreme representing a maximum value and the other a minimum value. The true value should be between these two extremes, but it may approach or equal one or the other, depending on the variation within a soil stratum.

G-1.10 Drainage of Water from Soil. The quantity of water removed by a drain will vary depending on the type of soil and location of the drain with respect to the groundwater table. All of the water contained in a given specimen cannot be removed by gravity flow because water retained as thin films adhering to the soil particles and held in the voids by capillarity will not drain. Consequently, to determine the volume of water that can be removed from a soil in a given time, the effective porosity as well as the permeability must be known. Limited effective porosity test data for well-graded base-course materials, such as bank-run sands and gravels, indicate a value for effective porosity of not more than 0.15. Uniformly graded soils such as medium coarse sands, may have an effective porosity of not more than 0.25. Open-graded aggregate used for drainage layers will have an effective porosity of between 0.25 and 0.35.

G-2 PRINCIPLES OF PAVEMENT DRAINAGE

G-2.1 Flow of Water through Soils. The flow of water through soils is expressed by Darcy's empirical law, which states that the velocity of flow (V) is directly proportional to the hydraulic gradient (i). This law can be expressed as:

$$v = k \cdot i \qquad \text{(G-1)}$$

Where k is the coefficient of proportionality known as the coefficient-of-permeability. Equation G-1 can be expanded to obtain the rate of flow through an area of soil (A). The equation for the rate of flow (Q) is:

$$Q = k \cdot i \cdot A \quad \text{(G-2)}$$

According to Darcy's law, the velocity of flow and the quantity of discharge through a porous media are directly proportional to the hydraulic gradient. For this condition to be true, flow must be laminar or non-turbulent. Investigations have indicated that Darcy's law is valid for a wide range of soils and hydraulic gradients; however, in developing criteria for subsurface drainage, liberal margins have been applied to allow for turbulent flow. The criteria and uncertainty depend heavily on the permeability of the soils in the pavement structure. It is therefore useful to examine the influence of various factors on the permeability of soils. In examining permeability of soils in regard to pavement drainage, the materials of most concern are base and subbase aggregate and aggregate used as drainage layers.

G-2.2 Factors Affecting Permeability

G-2.2.1 Coefficient of Permeability. The value of permeability depends primarily on the characteristics of the permeable materials, but it is also a function of the properties of the fluid. An equation (after Taylor) demonstrating the influence of the soil and pore fluid properties on permeability was developed based on flow through porous media similar to flow through a bundle of capillary tubes. This equation is given here as Equation G-3:

$$k = D_s^2 \cdot C \cdot \left(\frac{\gamma \cdot e^3}{\mu \cdot (1-e)} \right) \quad \text{(G-3)}$$

where:

k = the coefficient of permeability
D_s = Hazen's effective particle diameter
C = shape factor
γ = unit weight of pore fluid
μ = viscosity of pore fluid
e = void ratio

G-2.2.2 Effect of Pore Fluid and Temperature. In the design of subsurface drainage systems for pavements, the primary pore fluid of concern is water. Therefore, when permeability is mentioned in this chapter, water is assumed to be the pore fluid. Equation G-3 indicates that the permeability is directly proportional to the unit weight of water and inversely proportional to the viscosity. The unit weight of water is essentially constant, but the viscosity of water will vary with temperature. Over the widest range of temperatures ordinarily encountered in seepage problems, viscosity varies about 100 percent. Although this variation seems large, it can be insignificant when considered in the context of the variations that can occur with changes in material properties.

G-2.2.3 Effect of Grain Size and Void Ratio. It is logical that the smaller the grain size the smaller the voids that constitute the flow channels, and hence, the lower the permeability. Equation G-3 suggests that permeability varies with the square of the effective particle diameter and the cube of the void ratio. Since for the most part the void ratio is a function of the material gradation, the influence of effective particle diameter will be magnified. Consider that according to Equation G-3, when the effective particle size increases from 0.075 mm (No. 200) to 1.18 mm (No. 16), the permeability would increase by a factor of approximately 250. Assuming the increase in effective particle size would result in an increase in the void ratio by a minimum of 2 times, the permeability due to the increase in void ratio would be by a factor of 8. Thus the total increase in permeability due to the increase in the effective particle size and increase in void ratio would be by a factor of approximately 2000.

Also, the shape of the void spaces has a marked influence on the permeability. As a consequence, the relationships between grain size, void ratio, and permeability are complex. Intuition and experimental test data suggest that the finer particles in a soil have the most influence on permeability. The coefficient of permeability of sand and gravel materials, graded between limits usually specified for pavement bases and subbases, depends principally upon the percentage by weight of particles passing the 0.075 mm (No. 200) sieve. Table G-1 provides estimates of the permeability for these materials for various amounts of material finer than the 0.075 mm (No. 200) sieve.

Table G-1. Coefficient of Permeability for Sand and Gravel Materials (Coefficient of 55)

Percent by Weight Passing 0.075 mm (No. 200) Sieve	Permeability for Remolded Samples	
	mm/sec	ft/min
3	5×10^{-1}	10^{-1}
5	5×10^{-2}	10^{-2}
10	5×10^{-3}	10^{-3}
15	5×10^{-4}	10^{-4}
20	5×10^{-5}	10^{-5}

Gigure G-3. Permeability Test Data (from Lambe and Whitman, with permission)

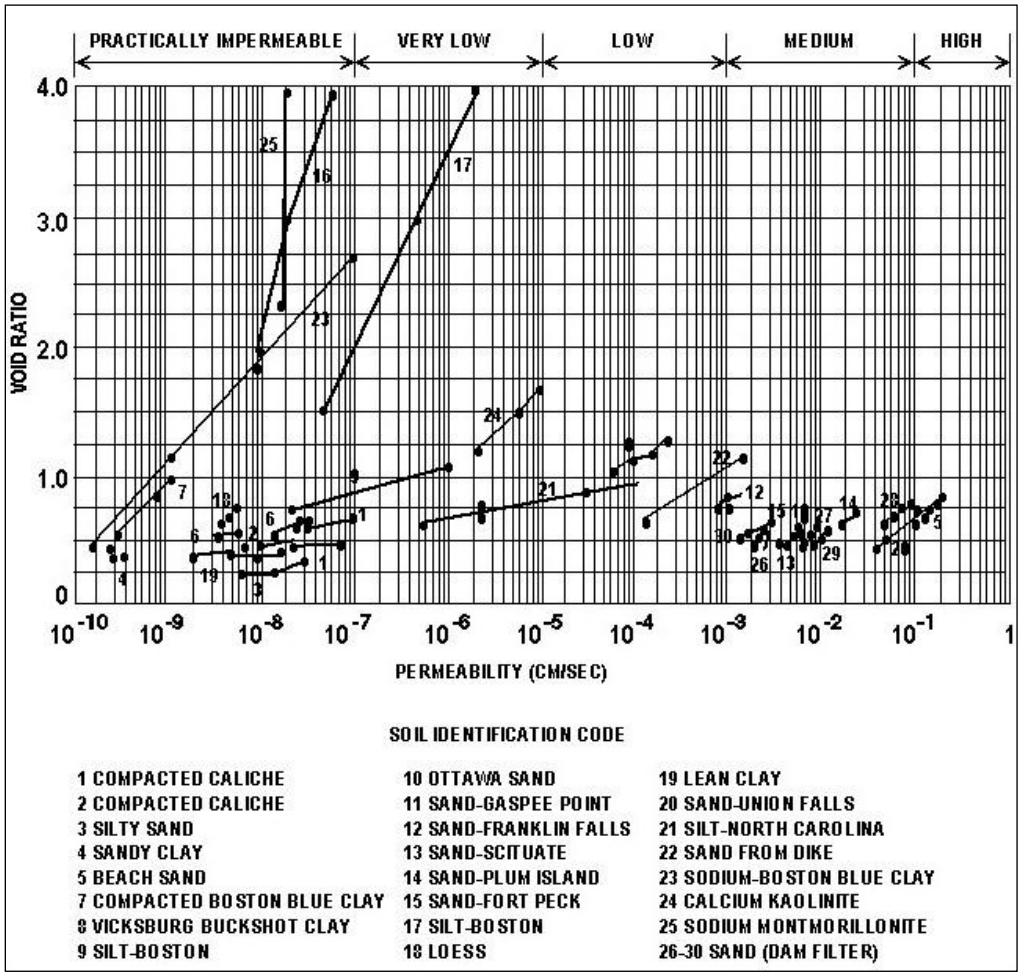


Figure G-3 presents the permeability for different soils as a function of the void ration. The amount of water that can be contained in a soil will directly relate to the void ratio. Not all water contained in a soil can be drained by gravity flow because water retained as thin films adhering to the soil particles and held by capillarity will not drain. Consequently, to determine the volume of water that can be removed from a soil, the effective porosity (n_e) must be known. The effective porosity is defined as the ratio of the volume of the voids that can be drained under gravity flow to the total volume of soil, and can be expressed mathematically as:

$$n_e = 1 - \frac{\gamma_d}{G_S \cdot \gamma_W}\left(1 + G_S \cdot W_e\right) \qquad \text{(G-4)}$$

where:

γ_d = dry density of the soil

G_S = specific gravity of solids

γ_W = unit weight of water

W_e = effective water content (after the soil has drained) expressed as a decimal fraction relative to dry weight

Limited effective porosity test data for well-graded, base-course materials, such as bank-run sands and gravels, indicate a value for effective porosity of not more than 0.15. Uniformly graded medium or coarse sands may have an effective porosity of not more than 0.25, while for a uniformly graded aggregate such as would be used in a drainage layer, the effective porosity may be above 0.25.

G-2.2.5 Effect of Structure and Stratification. Generally, in situ soils show a certain amount of stratification or a heterogeneous structure. Water-deposited soils usually exhibit a series of horizontal layers that vary in grain-size distribution and permeability, and generally these deposits are more permeable in the horizontal than in the vertical direction. In pavement construction, the subgrade, subbase, and base materials are placed and compacted in horizontal layers, which results in having a different permeability in the vertical direction than in the horizontal direction. The vertical drainage of water from a pavement can be disrupted by a single relatively impermeable layer. For most pavements, the subgrades have a very low permeability compared to the base and subbase materials. Therefore, water in the pavement structure can best be removed by horizontal flow. For a layered pavement system, the effective horizontal permeability is obtained from a weighted average of the layer permeability by the formula:

$$k = \frac{(k_1 \cdot d_1 + k_{2\cdot} \cdot d_2 + k_3 \cdot d_3 + ...)}{(d_1 + d_2 + d_3 + ...)} \quad \text{(G-5)}$$

where:

k = the effective horizontal permeability

$k_1, k_2, k_3 ...$ = the coefficients of horizontal permeability of individual layers

$d_1, d_2, d_3 ...$ = the thicknesses of the individual layers

When a drainage layer is employed in the pavement section, the permeability of the drainage material will likely be several orders of magnitude greater than that of the other materials in the section. Since water flow is proportional to permeability, the flow of water from the pavement section can be computed based only on the characteristics of the drainage layer.

G-2.3 Quantity and Rate of Subsurface Flow. Water flowing from the pavement section may come from infiltration through the pavement surface and groundwater. Normally groundwater flows into collector drains from the subgrade and will be an insignificant flow compared to the flow coming from infiltration. The computation of the groundwater flow is beyond the scope of this manual; should it be necessary to

compute the groundwater flow, consult a textbook on groundwater flow. The volume of infiltration water flow from the pavement will depend on factors such as the type and condition of the surface, the length and intensity of rainfall, the properties of the drainage layer, the hydraulic gradient, the time allowed for drainage, and the drained area. In the design of the subsurface drainage system, all of these factors must be considered.

G-2.3.1 Effects of Pavement Surface. The type and condition of the pavement surface will have considerable influence on the volume of water entering the pavement structure. In the design of surface drainage facilities, all rain falling on paved surfaces is assumed to be runoff. For new, well designed and constructed pavements, the assumption of 100 percent runoff is probably a good, conservative assumption for the design of surface drainage facilities. For design of the subsurface drainage facilities, the design should be based on the infiltration rate for a deteriorated pavement. Studies have shown that for badly deteriorated pavements, well over 50 percent of the rainfall can flow through the pavement surface. For well maintained pavements, the infiltration rate will be greatly reduced such that the run off will approach 100 percent.

G-2.3.2 Effects of Rainfall. It is only logical that the volume of water entering the pavement will be directly proportional to the intensity and length of the rainfall. Relatively low-intensity rainfalls can be used for designing the subsurface drainage facilities because high-intensity rainfalls do not greatly increase the adverse effect of water on pavement performance. The excess rainfall would, once the base and subbase were saturated, run off as surface drainage. For this reason, a seemingly non-conservative design rainfall can be selected.

G-2.3.3 Capacity of Drainage Layers. If water enters the pavement structure at a greater rate than the discharge rate, the pavement structure becomes saturated. The design of horizontal drainage layers for the pavement structure is based, in part, on the drainage layer serving as a reservoir for the excess water entering the pavement. The capacity of the drainage layer as a reservoir is a function of the storage capacity of the drainage layer plus the amount of water that drains from the layer during a rain event. The storage capacity of the drainage layer will be a function of the effective porosity of the drainage material and the thickness of the drainage layer. The storage capacity of the drainage layer, q_s, in terms of depth of water per unit area is computed by Equation G-6:

$$q_S = n_e \cdot h \qquad \text{(G-6)}$$

where:

n_e = the effective porosity
h = the thickness of the drainage layer

In the equation, the dimensions of q_s will be the same as the dimensions of *h*. If it is assumed that not all the water will be drained from the drainage layer, then the

storage capacity will be reduced by the amount of water in the layer at the start of the rain event. The criterion for design of the drainage layer calls for 85 percent of the water to be drained from the drainage layer within 24 hours; therefore, it is conservatively assumed that only 85 percent of the storage volume will be available at the beginning of a rain event. To account for the possibility of water in the layer at the beginning of a rain event, Equation G-6 is modified to be:

$$q_s = 0.85 \cdot n_e \cdot h \qquad \text{(G-7)}$$

The amount of water (q_d) that will drain from the drainage layer during the rain event may be estimated using Equation G-8:

$$q_d = \frac{t \cdot k \cdot i \cdot h}{2 \cdot L} \qquad \text{(G-8)}$$

where:

t = duration of the rain event
L = length of the drain path
k = permeability of the drainage layer
i = slope of the drainage layer
h = thickness of the drainage layer

G-2.3.3.1 In these equations, the dimensions of q_s, q_d, t, k, h, and L should be consistent. The total capacity (q) of the drainage layer will be the sum of q_s and q_d, resulting in this equation for the capacity:

$$q = (0.85 \cdot n_e \cdot h) + \left(\frac{t \cdot k \cdot i \cdot h}{2 \cdot L} \right) \qquad \text{(G-9)}$$

G-2.3.3.2 Knowing the water entering the pavement, Equation G-9 can be used to estimate the thickness of the drainage layer such that the drainage layer will have the capacity for a given design rain event. For most situations, the amount of water draining from the drainage layer will be small compared to the storage capacity. Therefore, in most cases, Equation G-7 can be used in estimating the thickness required for the drainage layer.

G-2.3.4 Time for Drainage. The water should be drained from the base and subbase layers as rapidly as possible. The time for drainage of these layers is a function of the effective porosity, the length of the drainage path, the thickness of the layers, the slope of the drainage path, and the permeability of the layers. Past criterion has specified that the base and subbase obtain a degree of 50 percent drainage within 10 days. The equation for computing the time for 50 percent drainage is:

$$T_{50} = \frac{\left(n_e \cdot D^2\right)}{\left(2 \cdot k \cdot H_o\right)} \quad \text{(G-10)}$$

where:

T_{50} = time for 50 percent drainage
n_e = effective porosity of the soil
k = coefficient of permeability
D, H_o, and H = base and subbase geometry dimensions (illustrated in Figure G-4)

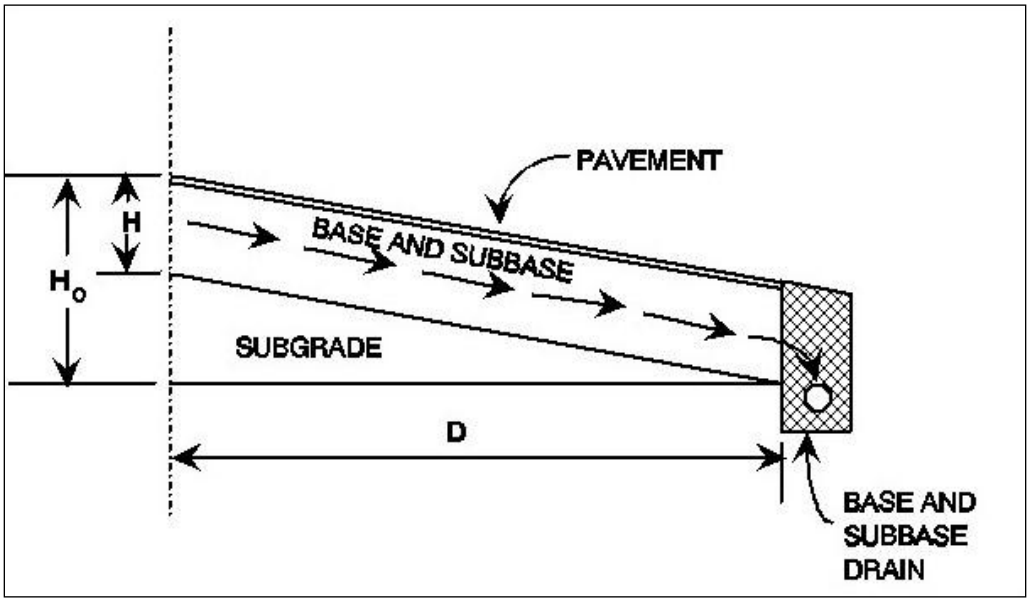
The dimensions of time k, H_o, H, and D must be consistent. If in Figure G-4 the thickness of the drainage layer is small compared to the length of the drainage path, the slope of the drainage path (i) can represent the value of $\left(\frac{H_o}{D}\right)$ and Equation G-10 can be written as:

$$T_{50} = \frac{n_e \cdot D}{2 \cdot i \cdot k} \quad \text{(G-11)}$$

Experience has shown that base and subbase materials, when compacted to densities required in pavement construction, seldom have sufficient permeability to meet the 10-day drainage criterion. In such pavements, the base and subbase materials become saturated, causing a reduced pavement life. When a drainage layer is incorporated into the pavement structure to improve pavement drainage, the criterion for design of the drainage layer is that the drainage layer must reach a degree of drainage of 85 percent within 24 hours. The time for 85 percent drainage is approximately twice the time for 50 percent drainage. The time for 85 percent drainage (T_{85}) is computed by:

$$T_{85} = \frac{n_e \cdot D}{i \cdot k} \quad \text{(G-12)}$$

Figure G-4. Pavement Geometry for Computation of Time for Drainage



G-2.3.5 Length and Slope of the Drainage Path. As can be seen in Equation **G-**10, the time for drainage is a function of the square of the length of the drainage path. For this reason and the fact that for most pavement designs the length of the drainage path can be controlled, the drainage path length is an important parameter in the design of the drainage system. The length of the drainage path (L) may be computed from this equation:

$$L = \frac{L_t \cdot \sqrt{i_t^2 + i_e^2}}{i_t} \qquad \text{(G-13)}$$

where:

L_t = the length of the transverse slope of the drainage layer
i_t = the transverse slope of the drainage layer
i_e = the longitudinal slope of the drainage layer

The slope of the drainage path (i) is a function of the transverse slope and the longitudinal slope of the drainage layer and is computed by Equation G-14:

$$i = \sqrt{i_t^2 + i_e^2} \qquad \text{(G-14)}$$

G-2.3.6 Rate of Flow. The edge drains for pavements having drainage layers must be designed to handle the maximum rate of flow from the drainage layer. This maximum rate of flow will be obtained when the drainage layer is flowing full and may be estimated using Equation G-2.

G-2.4 Use of Drainage Layers

G-2.4.1 Purpose of Drainage Layers. Special drainage layers may be used to promote horizontal drainage of water from pavements, prevent the buildup of hydrostatic water pressure, and facilitate the drainage of water generated by cycles of freeze-thaw.

G-2.4.2 Placement of Drainage Layers. In rigid pavements, the drainage layer will generally be placed directly beneath the concrete slab. In this location, the drainage layer will intercept water entering through cracks and joints and permit rapid drainage of the water away from the bottom of the concrete slab. In flexible pavements, the drainage layer will normally be placed beneath the dense graded aggregate base (DGA). Placing the drainage layer beneath the base will reduce the stresses on the drainage layer to an acceptable level and drainage will be provided for the base course.

G-2.4.3 Permeability Requirements for the Drainage Layer. The material for drainage layers in pavements must be of sufficient permeability to provide rapid drainage and to rapidly dissipate water pressure in addition to providing sufficient strength and stability to withstand load-induced stresses. There is a trade-off between strength or stability and permeability; therefore, the material for the drainage layers should have the minimum permeability for the required drainage application. For most applications, a material with a permeability of 300 m/day (1,000 ft/day) will provide sufficient drainage.

G-2.5 Use of Filters

G-2.5.1 Purpose of Filters in Pavement Structures. The purpose of filters in pavement structures is to prevent the movement of soil (piping) yet allow the flow of water from one material to another. The need for a filter is dictated by the existence of water flow from a fine grain material to a coarse grain material generating a potential for piping of the fine grain material. The principal location in the pavement structure for a flow from a fine grain material into a coarse grain material is where water flows from the base, subbase, or subgrade into the coarse aggregate surrounding the drain pipe. Thus, the principal use of a filter in a pavement system will be in preventing piping into the drain pipe. Although rare, the possibility exists for hydrostatic head forcing a flow of water upward from the subbase or subgrade into the pavement drainage layer. For such a condition, it would be necessary to design a filter to separate the drainage layer from the finer material.

G-2.5.2 Piping Criteria. The criteria for preventing movement of particles from the soil or granular material to be drained into the drainage material are:

$$\frac{15\,\text{percent size of drainage or filter material}}{85\,\text{percent size of material to be drained}} \leq 5$$

and

$$\frac{\text{50 percent size of drainage or filter material}}{\text{50 percent size of material to be drained}} \leq 25$$

These criteria will be used when protecting all soils except clays without sand or silt particles. For these soils, the 15 percent size of drainage or filterbv material may be as great as 0.4 mm and the d_{50} criteria may be disregarded.

G-2.5.3 Permeability Requirements. To assure that the filter material is sufficiently permeable to permit passage of water without hydrostatic pressure buildup, this requirement should be met:

$$\frac{\text{15 percent size of filter material}}{\text{15 percent size of material to be drained}} \geq 5$$

G-2.6 Use of Separation Layers

G-2.6.1 Purpose of Separation Layers. When drainage layers are used in pavement systems, the drainage layers must be separated from fine grain subgrade materials to prevent penetration of the drainage material into the subgrade or pumping of fines from the subgrade into the drainage layer. The separation layer is different from a filter in that there is no requirement, except during frost thaw, to protect against water flowing from the subgrade through the layer into the drainage layer.

G-2.6.2 Requirements for Separation Layers. The main requirements of the separation layer are that the material for the separation layer have sufficient strength to prevent the coarse aggregate of the drainage layer from being pushed into the fine material of the subgrade and that the material have sufficient permeability to prevent buildup of hydrostatic pressure in the subgrade. To satisfy the strength requirements, the material of the separation layer should have a minimum CBR of 50. To allow for release of hydrostatic pressure in the subgrade, the separation layer should have a permeability greater than that of the subgrade. This would not normally be a problem because the permeability of subgrades are orders of magnitude less than the permeability of a 50 CBR material, but to ensure sufficient permeability, the permeability requirements of a filter would apply.

G-2.7 Use of Geotextiles

G-2.7.1 Purpose of Geotextiles. Geotextiles (engineering fabrics) may be used to replace either the filter or the separation layer. The principal use of geotextiles is for the filter around the pipe for the edge drain. Although geotextiles can be used as a replacement for the separation layer, a geotextile adds no structure strength to the pavement; therefore, this practice is not recommended.

G-2.7.2 Requirements of Geotextiles for Filters. When geotextiles are to serve as a filter lining the edge drain trench, the most important function of the filter is to keep fines from entering the edge drain system. For pavement systems having drainage

layers, there is little requirement for water flow through the fabric; therefore, for most applications, it is better to have a heavier fabric than would normally be used as a filter. Since drainage layers have a very high permeability, geotextile fabric should never be placed between the drainage layer and the edge drain. The permeability of geotextiles is governed by the size of the openings in the fabric, which is specified in terms of the AOS in millimeters. For use as a filter for the trench of the edge drain, the geotextile should always have an AOS that is equal to or less than 0.212 mm. For geotextiles used as filters with drains installed to intercept groundwater flow in subsurface aquifers, the geotextile should be selected based on criteria similar to the criteria used to design a granular filter.

G-2.7.3 Requirements for Geotextiles Used for Separation. Geotextiles used as separation layers beneath drainage layers should be selected based primarily on survivability of the geotextiles, with slightly less emphasis placed on the AOS. When a geotextile is used as a separation layer, the geotextile's survivability should be rated very high by the rating scheme in AASHTO M 28890, *Standard Specification for Geotextiles, Asphalt Retention, and Area Change of Paving Engineering Fabrics*. This would ensure survival of the geotextile under the stress of traffic during the life of the pavement. To ensure that fines will not pump into the drainage layer yet allow water flow to prevent hydrostatic pressure, the AOS of the geotextile must be equal to or less than 0.212 mm and also equal to or greater than 0.125 mm.

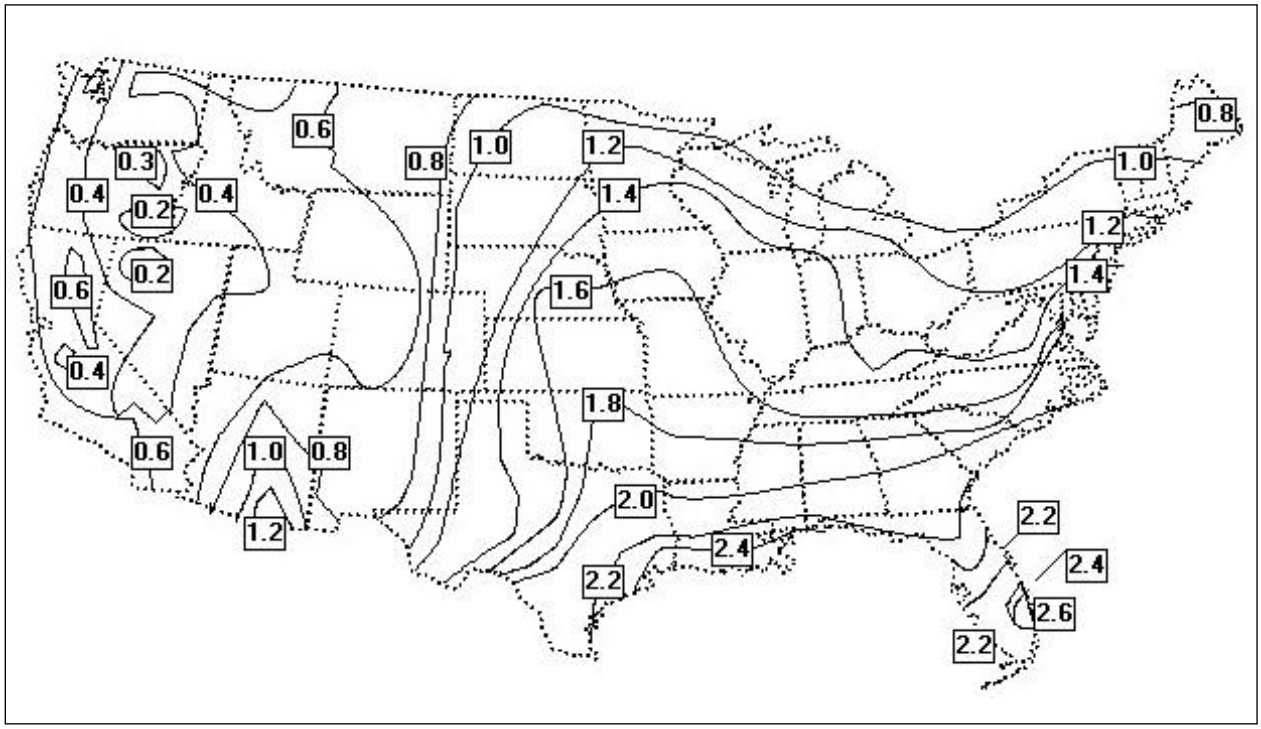
G-3 DESIGN OF THE PAVEMENT SUBSURFACE DRAINAGE SYSTEM. The design methodology contained in this chapter is for the design of a pavement subsurface drainage system for the rapid removal of surface infiltration water and water generated by freeze-thaw action. Although the primary emphasis will be on removing water from under the pavement, on occasion the system will also serve as an interceptor drain for groundwater.

G-3.1 Methods. For most pavement structures, water is to be removed by a special drainage layer that allows the rapid horizontal drainage of water. The drainage layer must be designed to handle surface infiltration from a design storm and withstand the stress of traffic. A separation layer must be provided to prevent intrusion of fines from the subgrade or subbase into the drainage layer and facilitate construction of the drainage layer. The drainage layer should feed into a collection system consisting of trenches with a drain pipe, backfill, and filter. The collection system must be designed to maintain progressively greater outflow capabilities in the direction of flow. The outlet for the subsurface drains should be properly located or protected to prevent backflow from the surface drainage system. Some pavements may not require a drainage system because the subgrade may have sufficient permeability for the water to drain vertically into the subgrade. In addition, some pavements designed for very light traffic may not justify the expense of a subsurface drainage system. Even for pavements designed for very light traffic, care must be taken to ensure that base and subbase material are free draining and that water will be not trapped in the pavement structure. For pavement without collection systems, the base and subbase must daylight at the shoulders.

G-3.2 Design Prerequisites. For the satisfactory design of a subsurface drainage system, the designer must have an understanding of environmental conditions, subsurface soil properties, and groundwater conditions.

G-3.2.1 Environmental Conditions. Temperature and rainfall data applicable to the local area should be obtained and studied. The depth of frost penetration is an important factor in the design of a subsurface drainage system. For most areas, the approximate depth of frost penetration can be determined by referring to AC 150/5320-6. Rainfall data are used to determine the volume of water to be handled by the subsurface drainage system. The data can be obtained from local weather stations, by using Figure G-5, or from the web at http://www.weather.gov/oh/hdsc/currentpf.htm.

Figure G-5. Design Storm Index, 1-Hour Rainfall Intensity-Frequency Data for the Continental United States Excluding Alaska



G-3.2.2 Subsurface Soil Properties. In most cases, the soil properties investigated for other purposes in connection with the pavement design will supply information that can be used for the design of the subsurface drainage system. The two properties of most interest are the coefficient of permeability and the frost susceptibility of the pavement materials.

G-3.2.3 Coefficient of Permeability. Knowing the coefficient of permeability of the existing subsurface soils is essential for determining if special horizontal drainage layers are necessary in the pavement. For pavements having subgrades with a high coefficient of permeability, the water entering the pavement will drain vertically and therefore horizontal drainage layers will not be required. For pavements having subgrades with a

low coefficient of permeability, the water entering the pavement must be drained horizontally to the collector system or to edge drains.

G-3.2.4 Frost-Susceptible Soils. Soils susceptible to frost action are those that have the potential of ice formation when the soil is subjected to freezing conditions with water available. Ice formation takes place at successive levels as freezing temperatures penetrate into the ground. Soils possessing a high capillary rate and low cohesive nature act as a wick in feeding water to ice lenses. Soils are categorized according to their degree of frost susceptibility as shown in Table G-2. Because a large volume of free water is generated during the thaw of ice lenses, horizontal drainage layers are required to permit the escape of the water from the pavement structure and thus facilitate restoring the pavement strength.

Table G-2. Frost-Susceptible Soils

Typical Soil			
Frost Group	**Type of Soil**	**Percent Finer than 0.02 mm by Weight**	**Types Under Unified Soil Classification System**
F1	Gravely soils	6-10	GW-GM, GP-GM, GW-GC, GP-GC
F2	(a) Gravely soils (b) Sands	3-20 6-15	GM, GC, GM-GC SM, SC, SW-SM, SP-SM, SW-SC, SP-SC, SM-SC
F3	(a) Gravely soils (b) Sands, except very fine silty sands (c) Clays (PI > 12)	> 20 > 15 --	GM, GC, GM-GC SM, SC, SM-SC CL, CH, ML-CL
F4	(a) Silts (b) Very fine sands (c) Clays (PI < 12) (d) Varved clays and other fine grained, with banded sediments	-- > 15 -- --	ML, MH, ML-CL SM, SC, SM-SC CL, ML-CL CL or CH layered ML, MH, SM, SC SM-SC or ML-CL

G-3.2.5 Sources for Data. From the field explorations made in connection with the project design, include a topographic map of the proposed pavement facility and surrounding vicinity indicating all streams, ditches, wells, and natural reservoirs. Analyze aerial photographs for information on general soil and groundwater conditions. Borings taken during the soil exploration should provide depth to water tables and subgrade soil types. Obtain typical values of permeability for subgrade soils from Figure G-3. Although the value of permeability determined from Figure G-3 must be considered as an estimate only, the value should be sufficiently accurate to determine if

subsurface drainage is required for the pavement. For the permeability of granular materials, determine estimates of the permeability from these equations:

$$k = \frac{217.5 \cdot (D_{10})^{1.478} \cdot (n)^{6.654}}{(P_{200})^{0.597}} \text{ in mm/sec} \quad \text{(G-15)}$$

or

$$k = \frac{(6.214 \times 10^5) \cdot (D_{10})^{1.478} \cdot (n)^{6.654}}{(P_{200})^{0.597}} \text{ in ft/day} \quad \text{(G-16)}$$

where:

n = porosity $= 1 - \frac{\gamma_d}{\gamma_w \cdot G}$
G = specific gravity of solids (assumed 2.7)
γ_d = dry density of material
γ_w = density of water
D_{10} = effective grain size at 10 percent passing in mm
P_{200} = percent passing 0.075 mm (No. 200) sieve

For the most part, the permeability values needed for design of the drainage layer will be assigned based on the gradation of the drainage material. In some cases, laboratory permeability tests may be necessary; however, use caution and be aware that the permeability of very open granular materials is very sensitive to test methods, methods of compaction, and gradation of the sample. Because of this, use conservative drainage layer permeability values for design.

G-3.3 Criteria for Subsurface Drainage Systems

G-3.3.1 Criteria for Requiring a Subsurface Drainage System. Not all pavements will require a subsurface drainage system, either because the subgrade is sufficiently permeable to allow water to drain vertically into the subgrade or because the pavement structure does not justify the expense of a subsurface drainage system. For pavements in nonfrost areas and having a subgrade with permeability greater than 6 m/day (20 ft/day), one can assume that the vertical drainage will be sufficient such that no drainage system is required. In addition to this exemption for the requirement for drainage systems, flexible pavements that are in nonfrost areas and that have a total thickness of structure above the subgrade of 200 mm (8 inch) or less are not required to have a drainage system. All pavements not meeting these criteria are required to have a subsurface drainage system. Even if a pavement meets the exemption requirements, conduct a drainage analysis for possible benefits for including the drainage system. For rigid pavements in particular, take care to ensure that water is drained rapidly from the

bottom of the slab and that the material directly beneath the concrete slab is not susceptible to pumping.

G-3.3.2 Design Water Inflow. Design the subsurface drainage of the pavement to handle infiltrated water from a design storm of 1-hour duration at an expected return frequency of 2 years. The design storm index for the continental United States can be obtained from Figure G-5. The inflow is determined by multiplying the design storm index (R) times an infiltration coefficient (F). The infiltration coefficient will vary over the life of the pavement depending on the type of pavement, surface drainage, pavement maintenance, and the structural condition of the pavement. Since determining a precise value of the infiltration coefficient for a particular pavement is very difficult, a value of 0.5 may be assumed for design.

G-3.3.3 Length and Slope of the Drainage Path. The length of the drainage path is measured along the slope of the drainage layer from the crest of the slope to where the water will exit the drainage layer. In simple terms, the length of the drainage path is the maximum distance water will travel in the drainage layer. The length of the drainage path (L) in meters (feet) may be computed using Equation G-13, and the slope (i) of the drainage path may be computed using Equation G-14.

G-3.3.4 Thickness of the Drainage Layer. The thickness of the drainage layer is computed such that the capacity of the drainage layer will be equal to or greater than the infiltration from the design storm. When the length of the drainage path (L) is in meters (feet), the design storm index (R) is in meters/hour (feet/hour), the permeability of the drainage layer (k) is in meters/hour (feet/hour), and the length of the design storm (t) is in hours, the equation for computing the thickness (H) in meters (feet) is:

$$H = \frac{2 \cdot F \cdot R \cdot L \cdot t}{(1.7 \cdot n_e \cdot L) + (k \cdot i \cdot t)} \quad \text{(G-17)}$$

The effective porosity (n_e), the infiltration coefficient (F), and the slope of the drainage path (i) are non-dimensional. If the term ($k \cdot i \cdot t$) is small compared to the term ($1.7 \cdot n_e \cdot L$), which would be the case for long drainage paths, i.e., for drainage paths longer than approximately 6 m (20 ft), then the required thickness of the drainage layer can be estimated by deleting the term ($k \cdot i \cdot t$) from Equation G-17 or:

$$H = \frac{F \cdot R}{0.85 \cdot n_e} \quad \text{(G-18)}$$

where the units are the same as in Equation G-17.

G-3.3.5 Drainage Criteria. The subsurface drainage criteria for airfield runways and taxiways require that, should the drainage layer become saturated, it should be capable of attaining 85 percent drainage within 24 hours. For airfield parking aprons and other pavement areas receiving only low-volume, low-speed traffic, the time for 85

percent drainage is 10 days. The time for 85 percent drainage is computed by the equation:

$$T_{85} = \frac{n_e \cdot L}{i \cdot k} \quad \text{(G-19)}$$

where the dimensions of T_{85} will be in days when L is in meters (feet) and k is in meters/day (feet/day). The time of drainage may be adjusted by changing the drainage material, the length of the drainage path, or the slope of the drainage path. Changing the drainage material will change both the effective porosity and the permeability, but the effective porosity will change, at the most, by a factor of 3, whereas the permeability may change by several orders of magnitude. Thus, providing a more open drainage material would decrease the time for drainage, but more open materials are less stable and more susceptible to rutting. It is therefore desirable to keep the drainage material as dense as possible. The drainage layer of a pavement is usually placed parallel to the surface; therefore, in most cases, the slope of the drainage path is governed by the geometry of the pavement surface. For large paved areas such as airfield apron areas, the time for drainage is best controlled by designing the collection system to minimize the length of the drainage path. For edge drains along airfield taxiways and runways, it may be difficult to reduce the length of the drainage path without resorting to placing drains under the pavement. Pavements having long longitudinal slopes may require transverse collector drains to prevent long drainage paths. Thus, designing the subsurface drainage system to meet the criteria for time of drainage involves matching the type of drainage material with the drainage path length and slope.

G-3.4 Placement of Subsurface Drainage Systems

G-3.4.1 Rigid Pavements. In the case of rigid pavements, the drainage layer, if required, should be placed directly beneath the concrete slab. In the structural design of the concrete slab, the drainage layer along with any granular separation layer is considered a base layer, and structural benefit may be realized from the layers.

G-3.4.2 Flexible Pavements. In the case of flexible pavements, the drainage layer should be placed either directly beneath the surface layer or beneath a graded, crushed aggregate base course. If the required thickness of the granular subbase is equal to or greater than the thickness of the drainage layer plus the thickness of the separation layer, the drainage layer is placed beneath the graded, crushed aggregate base. Where the total thickness of the pavement structure is less than 300 mm (12 inch), the drainage layer may be placed directly beneath the surface layer and the drainage layer used as a base. When the drainage layer is placed beneath an unbound aggregate base, take care to limit the material passing the 0.075 mm (No. 200) sieve in the aggregate base to 8 percent or less.

G-3.4.3 Separation Layer. The drainage layer must be protected from contamination of fines from the underlying layers by a separation layer placed directly beneath the drainage layer. In most cases, the separation layer should be a graded aggregate material meeting the requirements of a 50 CBR subbase and can, in fact, be

considered as part of the subbase. For design situations where a firm foundation already exists and thickness of the separation layer is not needed in the structure for protection of the subgrade, a filter fabric may be substituted for the granular separation layer. In frost areas, the separation layer should be NFS and, in fact, some materials used as non-susceptible fill may qualify as a separation layer.

G-3.5 Material Properties

G-3.5.1 For Drainage Layers. The material for a drainage layer should be a hard, durable crushed aggregate to withstand degradation under construction traffic as well as in-service traffic. The gradation of the material should be such that the material has sufficient stability for the operation of construction equipment. While it is desirable for strength and stability to have the well-graded aggregate, the permeability of the material must be maintained. For most drainage layers, the drainage materials should have a minimum permeability of 300 m/day (1,000 ft/day). Two materials, an RDM and an OGM, have been identified for use in drainage layers. The RDM is a material that has a sufficiently high permeability (300 m/day (1,000 ft/day) to 1,500 m/day (5,000 ft/day)) to serve as a drainage layer and that also has the stability to support construction equipment and the structural strength to serve as a base and/or a subbase. The OGM is a material that has a very high permeability (greater than 1,500 m/day (5,000 ft/day)) and that can be used for a drainage layer. The OGM will normally require stabilization for construction stability and/or for structural strength to serve as a base in a flexible pavement. Gradation limits for the two materials are given in Table G-3, and the design properties are given in Table G-4. The gradations given in Table G-3 provide very wide bands, and it is possible to produce gradations within these bands that may not be sufficiently stable for construction without the use of chemical stabilization. Table G-5 provides the gradation specifications for three aggregate materials, each of which will meet the criteria for stability. These gradations were developed to produce the maximum density given maximum aggregate sizes of 1.5 inch, 1 inch, and 0.75 inch, and a maximum of 4 percent passing the number 16 sieve. For drainage layer thicknesses less than 6 inch, gradations number 1 or 2 may be used. For drainage layers 6 inch or more in thickness, any of the three gradations may be used, but the gradations with larger aggregates will produce the more stable aggregate. Each of the gradations would produce a drainage layer with a permeability of approximately 1000 ft/day.

Table G-3. Gradations of Materials for Drainage Layers and Choke Stone

Drainage Layer Material			
Sieve Designation (mm) (inch)	**Rapid Draining Material**	**Open-Graded Material**	**Choke Stone**
38.0 (1-1/2 inch)	100	100	100
25.0 (1 in.)	70-100	95-100	100
19.0 (3/4 in.)	55-100	--	100

Drainage Layer Material			
Sieve Designation (mm) (inch)	**Rapid Draining Material**	**Open-Graded Material**	**Choke Stone**
12.5 (1/2 in.)	40-80	25-80	100
9.5 (3/8 in.)	30-65	--	80-100
4.75 (No. 4)	G-50	0-10	G-100
2.4 (No. 8)	0-25	0-5	5-40
1.2 (No. 16)	0-5	--	0-10

Table G-4. Properties of Materials for Drainage Layers

Property	Rapid Draining Material	Open-Graded Material
Permeability in m/sec (ft/day)	300-1,500 (1,000-5,000)	> 1,500 (> 5,000)
Effective Porosity	0.25	0.32
Percent Fractured Faces (Corps of Engineers method)	90 percent for 80 CBR 75 percent for 50 CBR	90 percent for 80 CBR 75 percent for 50 CBR
C_v	> 3.5	--
LA Abrasion	< 40	< 40
Note: C_v is the uniformity coefficient = D60/D10.		

Table G-5. Material Gradations for Drainage Layer

Sieve Size (inch) (mm)	Gradation #1 ¾ inch max.		Gradation #2 1 inch max.		Gradation #3 1½ inch max	
	Percent Passing	Tolerance	Percent Passing	Tolerance	Percent Passing	Tolerance
1 ½ in (37.0 mm)					100	-5
1 in (25 mm)			100	-5	79	±8
¾ in (19 mm)	100	-5	85	±8	66	±8
½ in (12.5 mm)	78	±8	65	±8	52	±8
3/8 in (9.5 mm)	63	±8	53	±8	42	±8

Sieve Size (inch) (mm)	Gradation #1 ¾ inch max.		Gradation #2 1 inch max.		Gradation #3 1½ inch max	
	Percent Passing	Tolerance	Percent Passing	Tolerance	Percent Passing	Tolerance
No. 4 (4.75mm)	38	±8	32	±6	25	±6
No. 8 (2.36 mm)	19	±6	16	±6	12	±4
No. 16 (1.18 mm)	2	±2	2	±2	2	±2

G-3.5.2 Aggregate for Separation Layer. The separation layer serves to prevent fines from infiltrating or pumping into the drainage layer and to provide a working platform for construction and compaction of the drainage layer. The material for the separation layer should be a graded aggregate with a 50 CBR maximum except that the maximum aggregate size should not be greater than 0.25 the thickness of the separation layer. The permeability of the separation layer should be greater than the permeability of the subgrade, but the material should not be so open as to permit pumping of fines into the separation layer. To prevent pumping of fines, the ratio of d_{15} of the separation layer to d_{85} of the subgrade must be equal to or less than 5. The material property requirements for the separation layer are given in Table G-6.

Table G-6 Criteria for Granular Separation Layer

Maximum Aggregate Size	Lesser of 50 mm (2 inch) or 0.25 of layer thickness
Maximum CBR	50
Maximum Percent Passing 2.00 mm (No. 10)	50
Maximum Percent Passing 0.075 mm (No. 200)	15
Maximum Liquid Limit	25
Maximum Plasticity Index	5
d_{15} of Separation Layer to d_{85} of Subgrade	≤ 5

G-3.5.3 Filter Fabric for Separation Layer. Although filter fabric provides protection against pumping, it does not provide extra stability for compaction of the drainage layer; therefore, fabric should be selected only when the subgrade provides adequate support for compaction of the drainage layer. The important characteristics of the fabric are strength for surviving construction and traffic loads, and AOS to prevent pumping of fines into the drainage layer. Filter fabric for separation should be a nonwoven needle punch fabric having a minimum grab strength in accordance with

ASTM D-4632 of 0.8 Kilonewtons (kN) (180 lbs) at 50% elongation and a minimum puncture strength in accordance with ASTM D-4833 of 0.35 kN (80 lbs). The AOS for the filter fabric is determined from Table G-7.

Table G-7. Criteria for Filter Fabric to be Used as a Separation Layer

Soil Type	Criteria	ASTM Test Method
Soil with 50% or Less Passing No. 200 Sieve	AOS (mm) < 0.6 mm Greater than No. 30 sieve	D-4751
Soil with Greater Than 50% Passing No. 200 Sieve	AOS (mm) < 0.297 Greater than No. 50 sieve	D-4751

G-4 STABILIZATION OF DRAINAGE LAYER. Stabilization of OGM is normally required for stability and strength and for preventing degradation of the aggregate in handling and compaction. Stabilization may also be used when high-quality crushed aggregate is not available, and on occasions when stabilization of RDM is necessary. Stabilization may be accomplished mechanically by use of a choke stone or by the use of a binder such as asphalt or portland cement.

G-4.1 Choke Stone Stabilization. A choke stone is a small-size stone used to stabilize the surface of an OGM. The choke stone should be a hard, durable, crushed aggregate having 90 percent fractured faces. The ratio of d_{15} of the coarse aggregate to the d_{15} of the choke stone must be less than 5, and the ratio of the d_{50} of the coarse aggregate to d_{50} of the choke stone must be greater than 2. The gradation range for acceptable choke stone is given in Table G-3. Normally, ASTM No. 8 or No. 9 stone will meet the requirements of a choke stone for the OGM.

G-4.2 Asphalt Stabilization. Stabilization of the drainage material with asphalt is accomplished by using only enough asphalt as is required to coat the aggregate. Take care so that the voids are not filled by excess asphalt. The asphalt grade used for stabilization should be AC20 or higher. For stabilization of OGM, 2 to 2.5 percent asphalt by weight should be sufficient to coat the aggregate. Higher rates of application may be necessary when stabilization of less open aggregate such as RDM is necessary.

G-4.3 Cement Stabilization. As with asphalt stabilization, portland cement stabilization is accomplished by using only enough cement paste to coat the aggregate, and care should be taken so that the voids are not filled by excess paste. The amount of portland cement required should be approximately 170 kg/m^3 (2 bags per cubic yard) depending on the gradation of the aggregate. The water-cement ratio should be just sufficient to provide a paste that will adequately coat the aggregate.

G-5 CONSTRUCTION OF THE DRAINAGE LAYER

G-5.1 Experience. Construction of drainage layers can present problems in handling, placement, and compaction. If the drainage material does not have adequate stability, major problems can develop in the placement of the surface layer above the drainage layer. Experience with highly permeable bases (drainage layers) both by the United States Army Corps of Engineers (USACE) and various state departments of transportation indicates that pavements containing such layers can be constructed without undue difficulties if necessary precautions are taken. The key to successful construction of the drainage layers is the training and experience of the construction personnel. Prior to the start of construction, the construction personnel should be taught how to handle and place the drainage material. Placing test strips is recommended for training construction personnel.

G-5.2 Placement of the Drainage Layer. The material for the drainage layer must be placed to prevent segregation and to obtain a layer of uniform thickness. The materials for the drainage layer will require extra care in stockpiling and handling. Placement of the RDM and OGM is best accomplished using an AC paver. To ensure good compaction, the maximum lift thickness should be no greater than 150 mm (6 inch). If choke stone is used to stabilize the surface of the OGM, place the choke stone after compaction of the final lift of OGM. Spread the choke stone in a thin layer no thicker than 10 mm (0.5 inch) using a spreader box or paver. Work the choke stone into the surface of the OGM by using a vibratory roller and by wetting. The choke stone remaining on the surface should not migrate into the OGM by the action of water or traffic.

G-5.3 Compaction. Compaction is a key element in the successful construction of the drainage layer. Compaction control normally used in pavement construction is not appropriate for materials such as the RDM and OGM. It is therefore necessary to specify compaction techniques and level of effort instead of the properties of the end product. It will be important to place the drainage material in relatively thin lifts of 150 mm (6 inch) or less and to have a good, firm foundation beneath the drainage material. The recommended method of determining the required compaction effort is to construct a test section and closely monitor the aggregate during compaction to determine when crushing of the aggregate appears excessive. Experience has indicated that sufficient compaction can be obtained by 6 passes or fewer of a vibratory roller loaded at approximately 9 metric tons (10 short tons). Material not being stabilized with asphalt or cement should be kept moist during compaction. Asphalt stabilized material for drainage layers must be compacted at a slightly lower temperature than a dense-graded asphalt material. In most cases, it will be necessary to allow an asphalt stabilized material to cool to less than 93 degrees Celsius (200 degrees Fahrenheit) before beginning compaction.

G-5.4 Protection after Compaction. After compaction, protect the drainage layer from contamination by fines from construction traffic and from the flow of surface water. The surface layer should be placed as soon as possible after placement of the drainage layer. Also, take precautions to protect the drainage layer from disturbance by

construction equipment. Only tracked asphalt pavers should be allowed for paving over any RDM or OGM that has not been stabilized. Drivers should avoid rapid acceleration, hard braking, or sharp turning on the completed drainage layer. Although curing of cement-stabilized drainage layers is not critical, efforts should be made at curing until the surface layer is placed.

G-5.5 Proof Rolling. For airfields with runways over 1,524 m (5,000 ft), proof rolling is recommended on the graded, crushed-aggregate base even when the base is used over a drainage layer. Proof rolling the separation layer prior to placing the drainage layer is recommended. It is recommended that the proof rolling be accomplished using a rubber-tired roller load to provide a minimum tire force of 89 kN (20,000 lbs) and inflated to at least 620 kPa (90 lb/in.^{2}). A minimum of 6 coverages should be applied, where a coverage is the application of one tire print over each point in the surface of the designated area. During proof rolling, action of the separation layer must be monitored for any sign of excessive movement or pumping that would indicate soft spots in the separation layer or the subgrade. Since the successful placement of the drainage layer depends on the stability of the separation layer, all weak spots must be removed and replaced with stable material. All replaced material must meet the appropriate material and construction specifications and upon replacement according to the appropriate specification, proof rolling as specified in this paragraph is recommended.

G-6 COLLECTOR DRAINS

G-6.1 Design Flow. Provide collector drains to collect and transport water from under the pavement. For pavements having drainage layers, collector drains are mandatory. The collector system should have the capacity to handle the water from the drainage layer plus water from other sources. The amount of water entering the collector system from the drainage layer is computed assuming the drainage layer is flowing full. Thus, the volume of water (Q) in cubic millimeters per second per meter (cubic feet per day per foot) of length of collector pipe (assuming the drainage layer is only on one side of the collector) would be:

$$Q = 1000 \cdot H \cdot i \cdot k \quad \text{in cubic mm per second per meter} \tag{G-20}$$

or

$$Q = H \cdot i \cdot k \quad \text{in cubic ft per day per foot} \tag{G-21}$$

where:

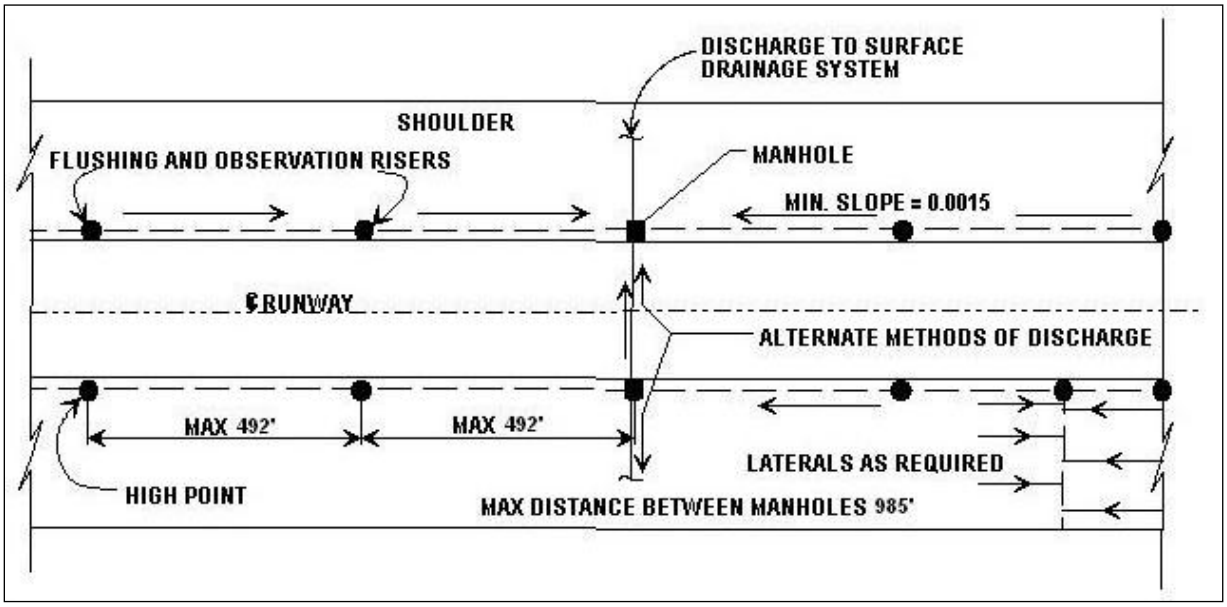
H = thickness of the drainage layer, mm (ft)
i = slope of the drainage layer
k = permeability of the material in the drainage layer, mm/sec (ft/day)

If the collector system has water entering from both sides, the volume of water entering the collector would be twice that given by Equation G-20.

G-6.2 Design of Collector Drains

G-6.2.1 Drainage System Layout. The collector drains are normally placed along the shoulder of the pavement as illustrated in Figure G-8. The system will consist of the drain pipe, flushing and observation risers, manholes, discharge laterals, filter fabric, and trench backfill. Since placing subsurface drains under pavements may result in differential settlement or heave, avoid this when possible. The drainage system for large areas of pavement may require placement of subsurface drains under the pavement. For these cases, place the subsurface drains to avoid high traffic areas. In areas of extreme cold temperatures and heavy snow buildup, place laterals to reduce the probability that they will become clogged with ice or snow. Also, in areas of extreme cold temperatures, placing the collector drains below the depth of frost penetration may not be possible; therefore, the collector pipe may be filled with ice while thawing is occurring near the surface. For this case, make provisions to drain the upper portion of the pavement either by daylighting the drainage layer or providing special laterals to drain the drainage layer.

Figure G-8. Plan View of Subsurface Drainage System



G-6.2.2 Collector Pipe. The collector pipe may be perforated flexible, acrylonitrile butadiene styrene (ABS), corrugated polyethylene (CPE), or smooth, rigid polyvinyl chloride pipe (PVC). Pipe should conform to the appropriate AASHTO specification. Most state highway agencies use either CPE or PVC. For CPE pipe, AASHTO M 252, Standard Specification for Corrugated Polyethylene Drainage Pipe, is suggested, while for PVC pipe, AASHTO M 278, Standard Specification for Class PS46 Poly(Vinyl Chloride) (PVC) Pipe, is recommended. Though asphalt-stabilized material is not recommended as backfill around pipe, if it is to be used, the pipe should be PVC 90 degrees Celsius electrical plastic conduit EPC-40 or EPC-80 conforming to the requirements of National Electrical Manufacturers Association (NEMA) Specification

TC-2. Geocomposite edge drains (strip drains) may be used in special situations, but only with the approval of a modification to standards (FAA Order 5100.1, Modifications to Agency Airport Design, Construction, and Equipment Standards) by AAS-100. Geocomposite edge drains should be considered only for pavements without a drainage layer.

G-6.2.3 Pipe Size and Slopes. The pipe must be sized, according to Equation G-22 or G-23, to have a capacity sufficient to collect the peak flow from under the pavement. Equations G-22 and G-23 are Manning equations for computing the capacity of a full-flowing circular drain. The equation for flow (Q) in cubic feet per second is:

$$Q = \frac{1.486}{n} \cdot (A) \cdot \left[\frac{d}{4}\right]^{2/3} \cdot \left(s^{1/2}\right) \quad \text{(G-22)}$$

where:

n = coefficient of roughness for the pipe
A = area of the pipe, ft^2
d = pipe diameter, ft
s = slope of the pipe invert

For metric units, the equation for flow in cubic meters per second is:

$$Q = \frac{1.0}{n} \cdot (A) \cdot \left[\frac{d}{4}\right]^{2/3} \cdot \left(s^{1/2}\right) \quad \text{(G-23)}$$

where:

n and s are as defined in Equation G-22
A = pipe area, m^2
d = pipe diameter, m

The coefficient of roughness for different pipe types can be obtained from Table G-8. Except for long intercepting lines and extremely severe groundwater conditions, 150-mm (6-inch) diameter drains should be satisfactory for most subsurface drainage installations. The minimum size pipe recommended for all collector drains is 150-mm (6-inch) diameter. The recommended minimum slope for subdrains is 0.15 percent.

Table G-8. Coefficient of Roughness for Different Types of Pipe

Type of Pipe	Coefficient of Roughness, *n*
Clay, concrete, smooth-wall plastic, and asbestos-cement	0.013
Bituminous-coated, non-coated corrugated metal pipe or corrugated metal pipe	0.024

G-6.3 Placement of the Drainage Layer and Collector Drains. In general, the drainage layer is placed below the concrete surface for a rigid pavement and below the base course for a flexible pavement. Typical designs details for placement of the drainage layer and the collector drains in non-frost areas are given in Figures G-9a, G-10a, G-11a, and G-12a. In most cases, the trench for the collector drains should be wide enough to provide 150 mm (6 inch) of clearance on each side of the pipe. The depth of the trench must be sufficient to provide a minimum 300 mm (12 inch) from the top of the pavement subgrade to the center of the pipe, plus 80 mm (3 inch) of clearance beneath the pipe. In frost areas, use extra care in placing subsurface drains. The typical design details for placement of the drainage layer and the collector drains for frost areas are given in Figures G-9b, G-9c, G-10b, G-11b, G-11c, and G-12b details (cross slopes varies in accordance with AC 150/5300-13). For F3 and F4 subgrades, always place a collector pipe such that there will be positive drainage for the drainage layer and any NFS fill. If possible, place the drains below the depth of frost penetration. For many locations, placing the drains below the depth of frost penetration will not be economically feasible and therefore the drains and backfill will be subject to freezing. In areas where the depth of frost penetration is greater than 1.2 m (4 ft) below the bottom of the drainage layer, the pipe need not be located deeper than 1.2 m (4 ft) from the bottom of the drainage layer. Because differential frost heave will cause pavement problems in frost areas, the sides of the trench must be sloped not steeper than 1 vertical on 10 horizontal for the depth of frost penetration. At the edge of the pavement where the pavement will not be subject to traffic, the sides of the trench may be sloped at a slope of 1 vertical on 4 horizontal. The sloping of the trench sides is not required for the parts of the trench in NFS materials or for F1 or S1 soils unless the pavement over the trench is subjected to high-speed traffic.

The placement of collector drains under the interior portion of a pavement in frost areas is a special case where the collector drain is not directly connected to the drainage layer by an OGM or an RDM. This case is illustrated in figures G-9b, G-9c, G-11b, and G-11c. The interior designs are based on the premise that NFS fill will have sufficient permeability to allow vertical drainage of the drainage layer into the collector pipes. Another premise is that the filter fabric will have sufficient area as not to impede the flow of water from the NFS fill to the collector pipe. The exception to the minimum requirement for the depth of the collector pipe below the surface of the subgrade is the interior case in a frost area for an F3 or F4 subgrade when the collector pipe is above the depth of frost penetration. For this case, keep the depth of the pipe below the surface of the subgrade to a minimum.

Figure G-9a. Typical Interior Subdrain Detail for Rigid Pavement (Non-Frost Areas)

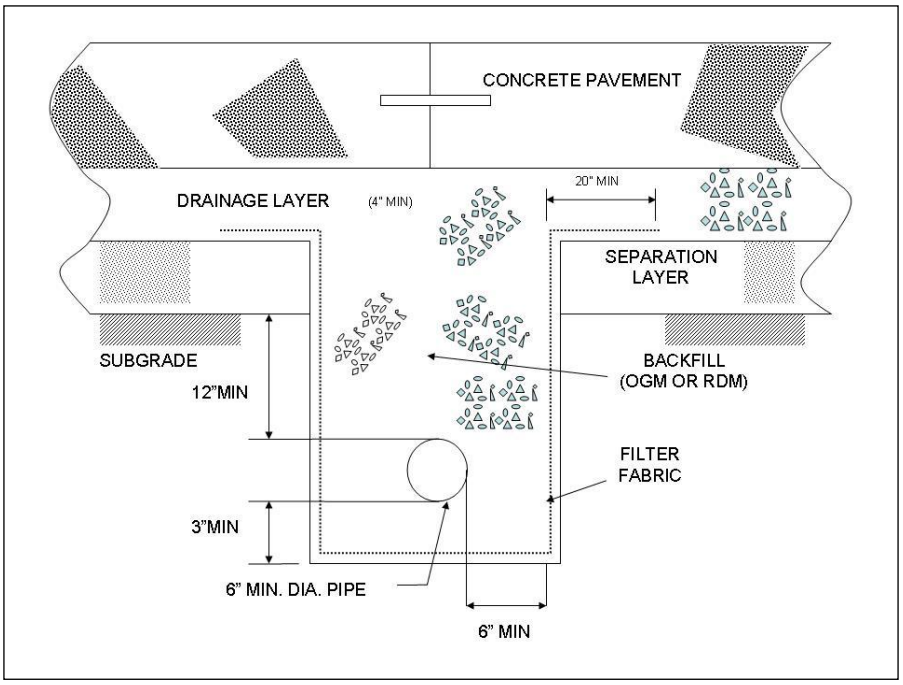


Figure G-9b. Typical Interior Subdrain for Rigid Pavement (Frost Areas, Depth of Frost > Depth to Pipe)

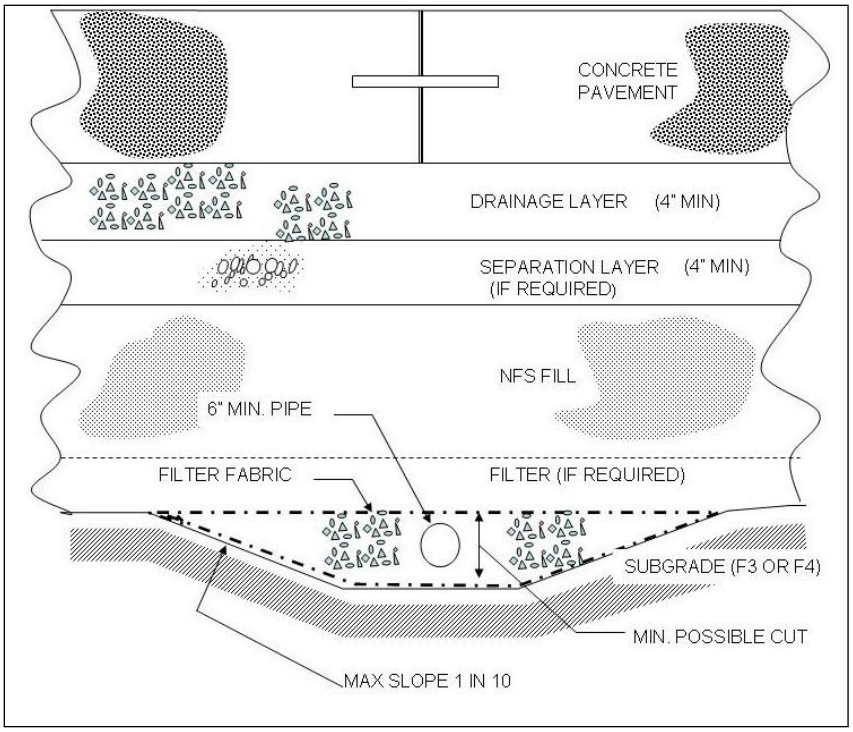


Figure G-9c. Typical Interior Subdrain for Rigid Pavement (Frost Areas, Depth of Frost < Depth to Pipe)

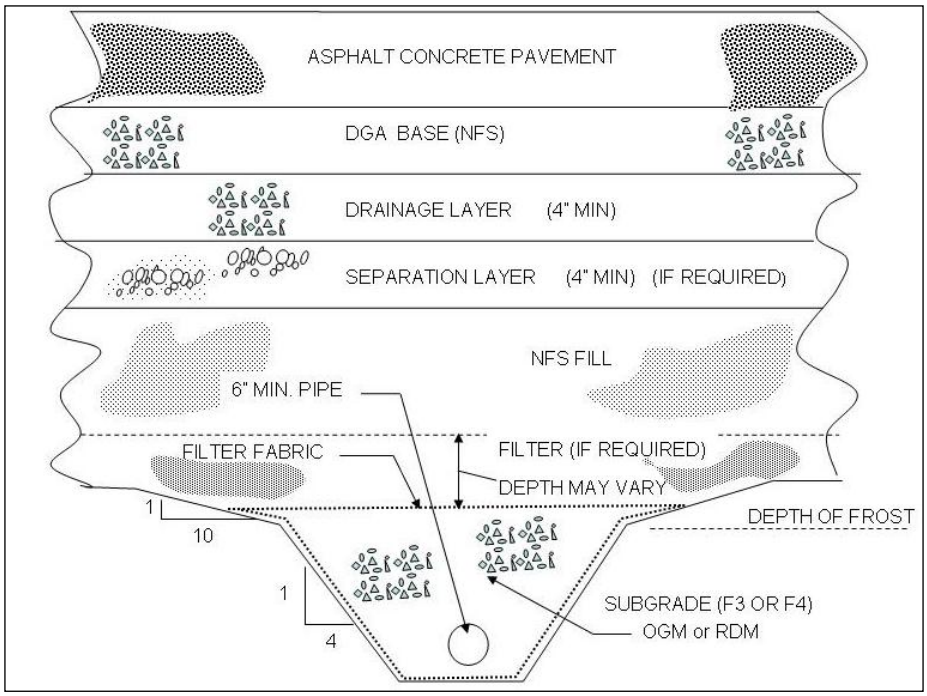


Figure G-10a. Typical Edge Subdrain Detail for Rigid Pavement (Non-Frost Areas)

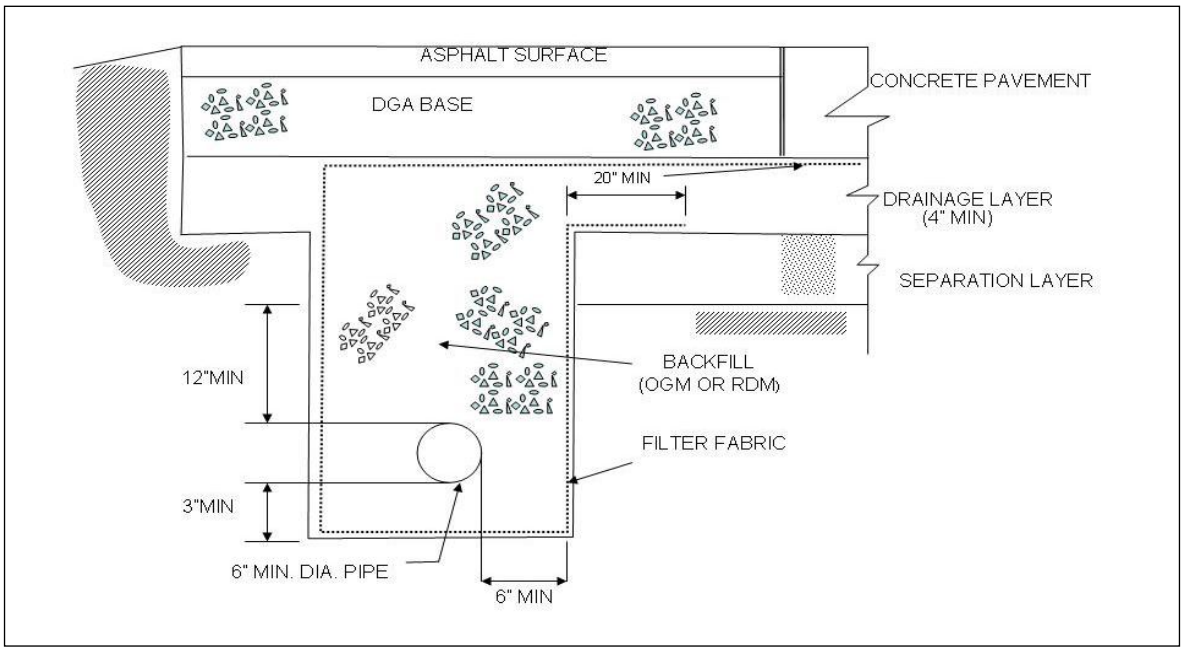


Figure G-10b. Typical Edge Subdrain Detail for Rigid Pavement (Frost Areas)

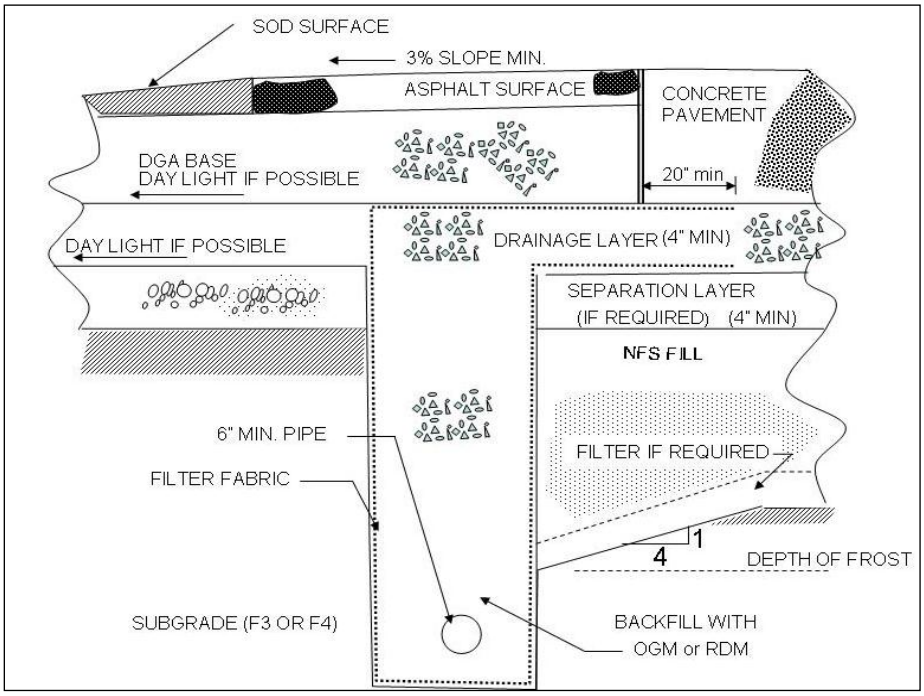


Figure G-11a. Typical Interior Subdrain Detail for Flexible Pavement (Non-Frost Areas)

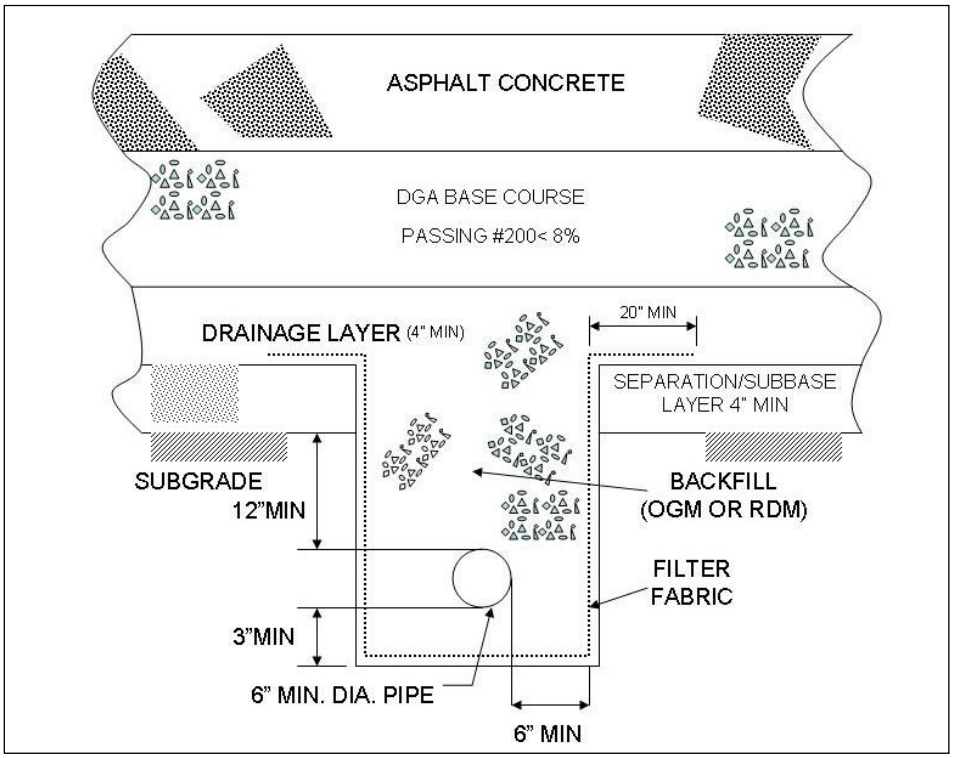


Figure G-11b. Typical Interior Subdrain Detail for Flexible Pavement (Frost Areas, Depth of Frost > Depth of Pipe)

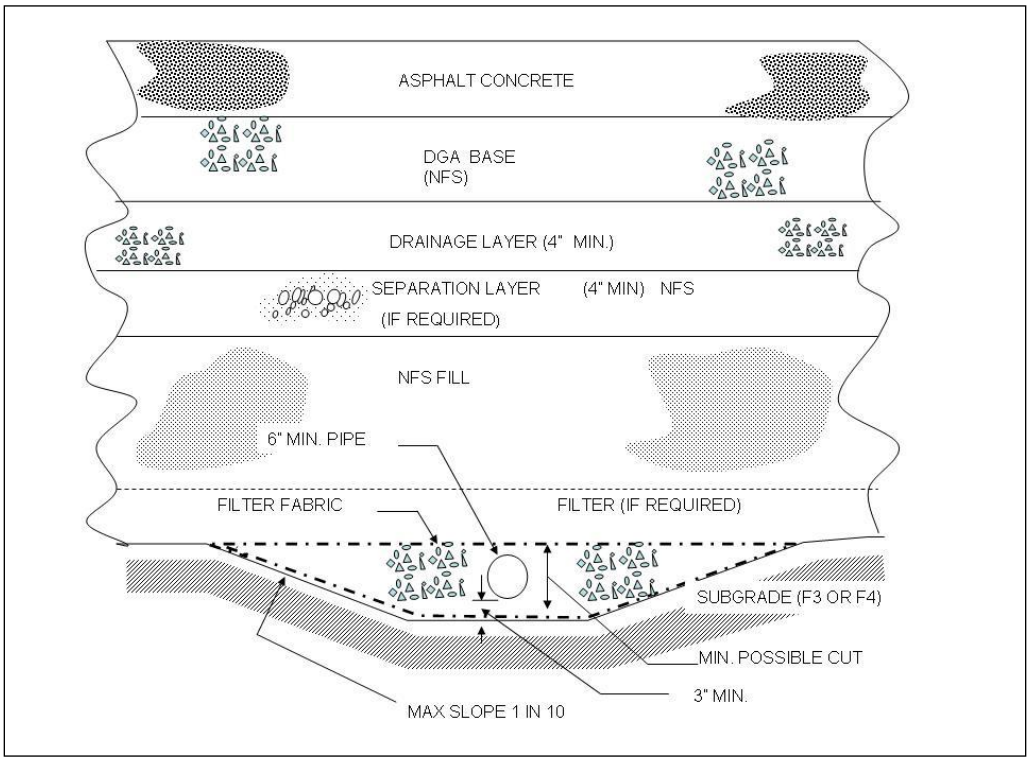


Figure G-11c. Typical Interior Subdrain Detail for Flexible Pavement (Frost Areas, Depth of Frost < Depth of Pipe)

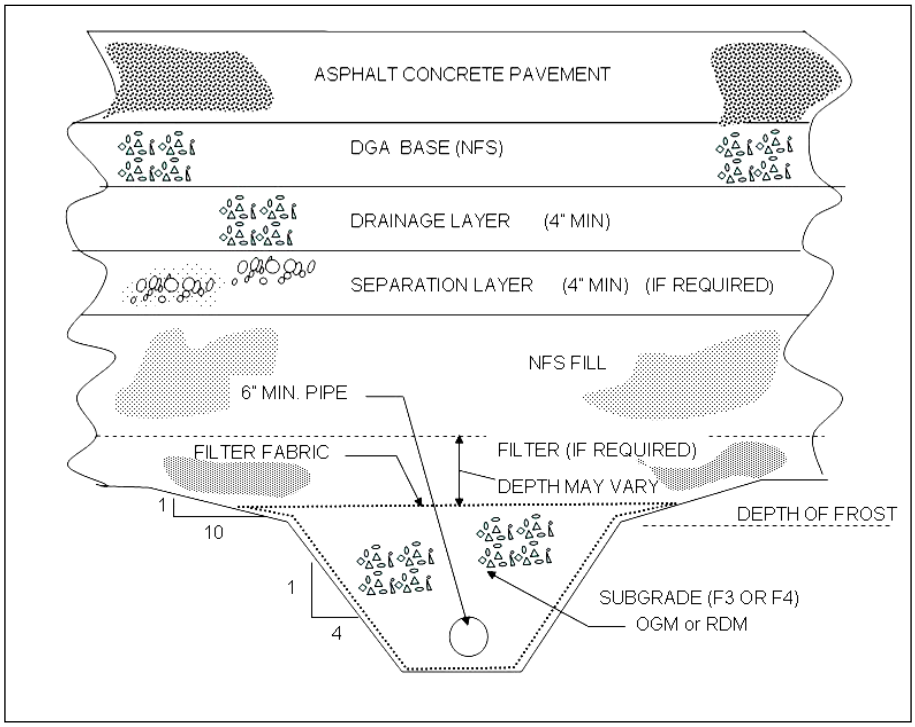


Figure G-12a. Typical Edge Subdrain Detail for Flexible Pavement (Non-Frost Areas)

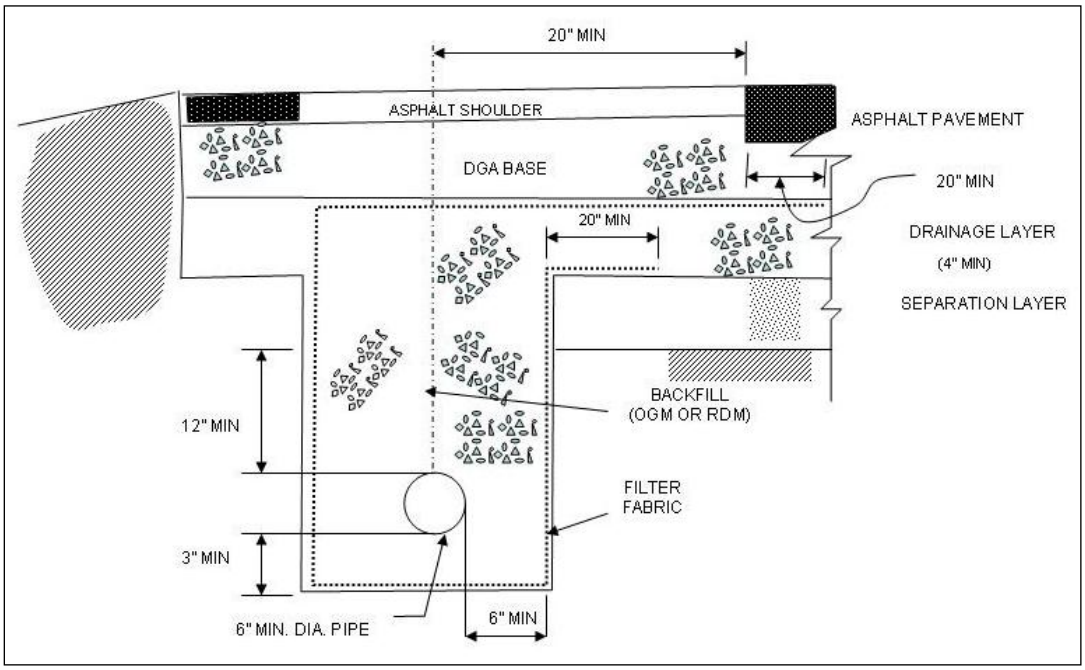
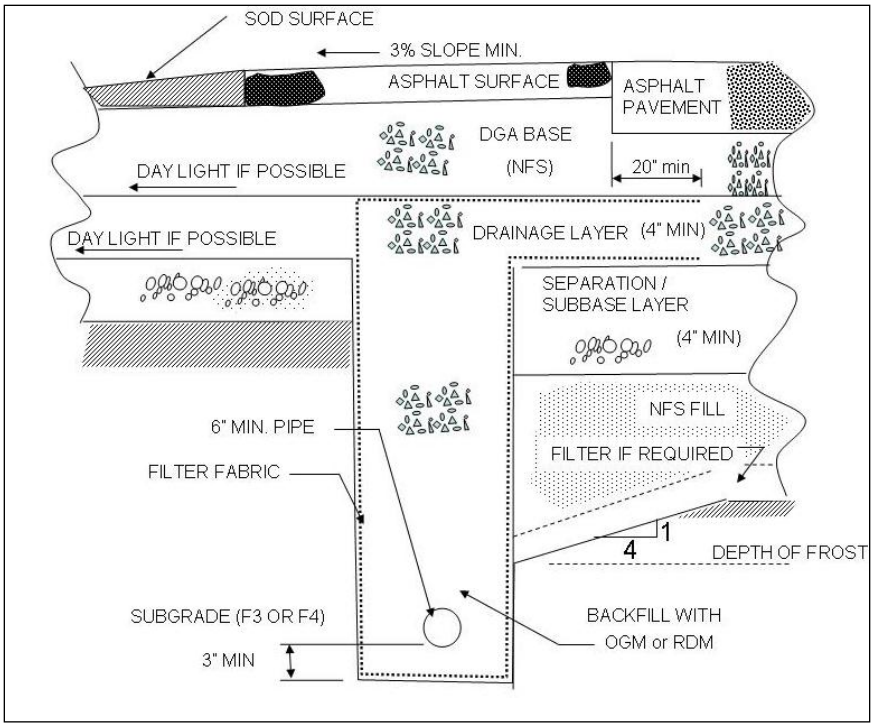


Figure G-12b. Typical Edge Subdrain Detail for Flexible Pavement (Frost Areas)



G-6.3.1 Backfill. The trench should be backfilled with a permeable material to rapidly convey water to the drainage pipe. The backfill material may be an OGM, RDM,

or other uniformly graded aggregate. A minimum of 80 mm (3 inch) of aggregate should be placed beneath the drainage pipe. Proper compaction or chemical stabilization of the backfill is necessary to prevent settlement of the fill. In placing the backfill, compact it in lifts not exceeding 300 mm (6 inch). When using geocomposites in place of pipe, placing the geocomposites against the material to be drained should keep the backfill from conveying water. For this reason, the backfill for the geocomposites will not require the high permeability required for the backfill around the pipe drains; however, since the backfill for the geocomposites will be against the side of the trench, the backfill should meet the requirements of a granular filter.

G-6.3.2 Geotextiles in the Trench. Line the trench with a geotextile filter fabric as shown in Figures G-9 through G-12, which provide the typical. The filter fabric should be placed to separate the permeable backfill of the trench from the subgrade or subbase materials, but it must not impede the flow of water from the drainage layer to the drain pipe. The filter fabric must also protect from the infiltration of fines from any surface layers. This is particularly important for drains placed outside the pavement area where surface water can enter the drain through a soil surface. The filter fabric for the trench should be a nonwoven needle punch fabric meeting the criteria in Table G-9.

Table G-9. Criteria for Fabrics Used in Trench Construction

Soil or Fabric Characteristic	ASTM Test Method	Criteria
Soil with 50% or Less Passing No. 200 Sieve	D 4751	AOS < 0.6 mm (Sieve No. 30)
Soil with Greater Than 50% Passing No. 200 Sieve	D 4751	AOS < 0.297 mm (Sieve No. 50)
Minimum Grab Strength in kN (lbs) at 50% Elongation	D 4632	0.6 (130)
Minimum Puncture Strength in kN (lbs)	D 4833	0.25 (55)

G-6.3.3 Trench Cap. Edge drains placed outside of a paved area should be capped with a layer of low-permeability material, such as an asphalt-stabilized surface, to reduce the infiltration of surface water into the subsurface drainage system. If the area above the edge drain is to be sod surfaced, a filter layer will be required between the drain layer and sod.

G-6.4 Lateral Outlet Pipe

G-6.4.1 Design. The lateral outlet pipe provides a means of getting water out of the edge drains and of cleaning and inspecting the system. Edge drains should be provided with lateral outlet pipes spaced at intervals (90 to 150 m) (300 to 500 ft) along the edge drains and at the low point of all vertical curves. To facilitate drain cleanout, the outlet pipes should be placed at approximately a 45-degree angle from the direction of flow in the collector drain. The lateral pipe should be a metal or rigid solid-walled pipe and

should be equipped with an outlet structure. A 3-percent slope from the edge drain to the outlet structure is recommended. Where possible, outlet pipes should, be connected to existing storm drains or inlets to reduce outlet maintenance. For a lateral pipe flowing to a ditch, the invert of the outlet pipe should be a minimum of 150 mm (6 inch) above the 2-year design flow in the ditch. To prevent piping, the trench for the outlet pipes must be backfilled with a material of low permeability, or provided with a cutoff wall or diaphragm. Dual outlets are recommended for maintenance considerations, as shown in Figure G-13. The dual outlet system allows sections of collector drains to be flushed to clear any debris material blocking the free flow of water. Note these additional recommended design details for drainage outlets:

(a) Provide dual outlets with large-radius bends, as shown in Figure G-14.

(b) Use rigid walls, not perforated pipes. For pipe drains, use the same diameter pipe as the collector drains. For prefabricated, geocomposite drains, 102-mm to 152-mm- (4-inch to 6-inch) diameter pipe should provide adequate hydraulic capacity. The flow capacity of the outlets must be greater than that of the collector drains. In general, because of the greater slope provided for outlet pipes, the hydraulic capacity is not a problem.

(c) Place the discharge end of the outlet pipe at least 150 mm (6 inch) above the G-year design flow in the drainage ditch (Figure G-15). This requirement applies even if the outlet is discharging into storm drain inlets.

(d) In frost areas, give special attention to the placement of the outlet pipes so they do not become clogged with ice or snow.

G-6.4.2 Outfall for Outlet Pipe. The outfall for the outlet pipe should be provided with a headwall to protect the outlet pipe from damage, prevent slope erosion, and facilitate the location of outlet pipes. Headwalls should be placed flush with the slope so that mowing operations are not impaired. Easily removable rodent screens should be installed at the pipe outlet. The headwall may be precast or cast in place. Figure G-16 is an example of a design for a headwall.

Figure G-13. Schematic of Dual Outlet System Layout (Baumgardner 1998)

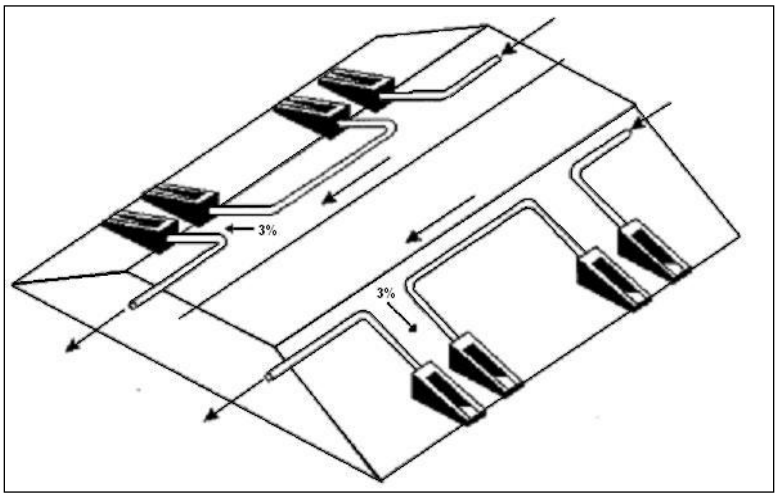


Figure G-14. Illustration of Large-Radius Bends Recommended for Drainage Outlet

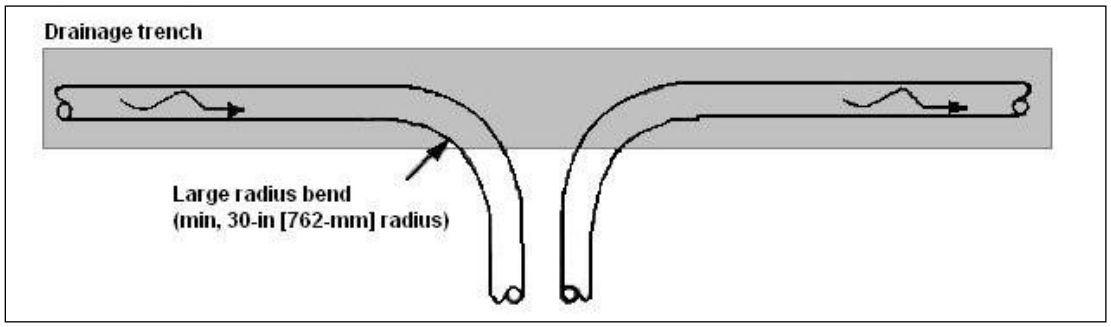


Figure G-15. Recommended Outlet Design Detail

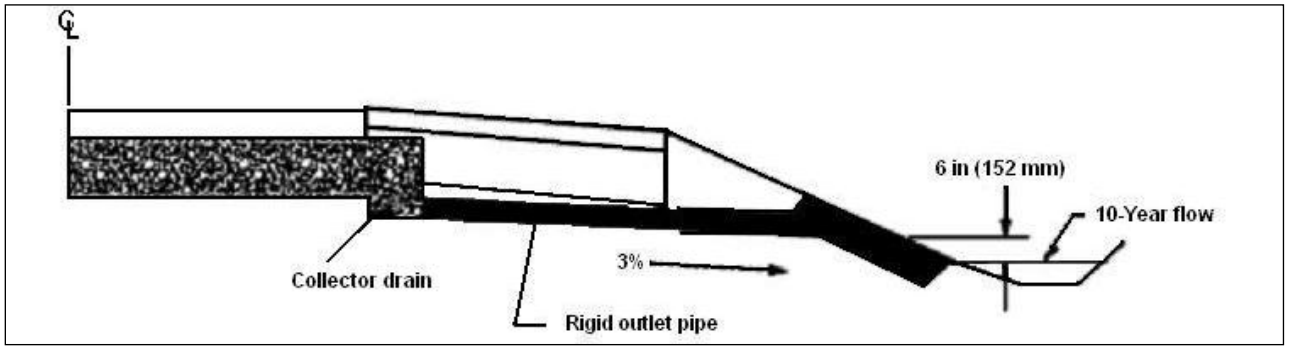
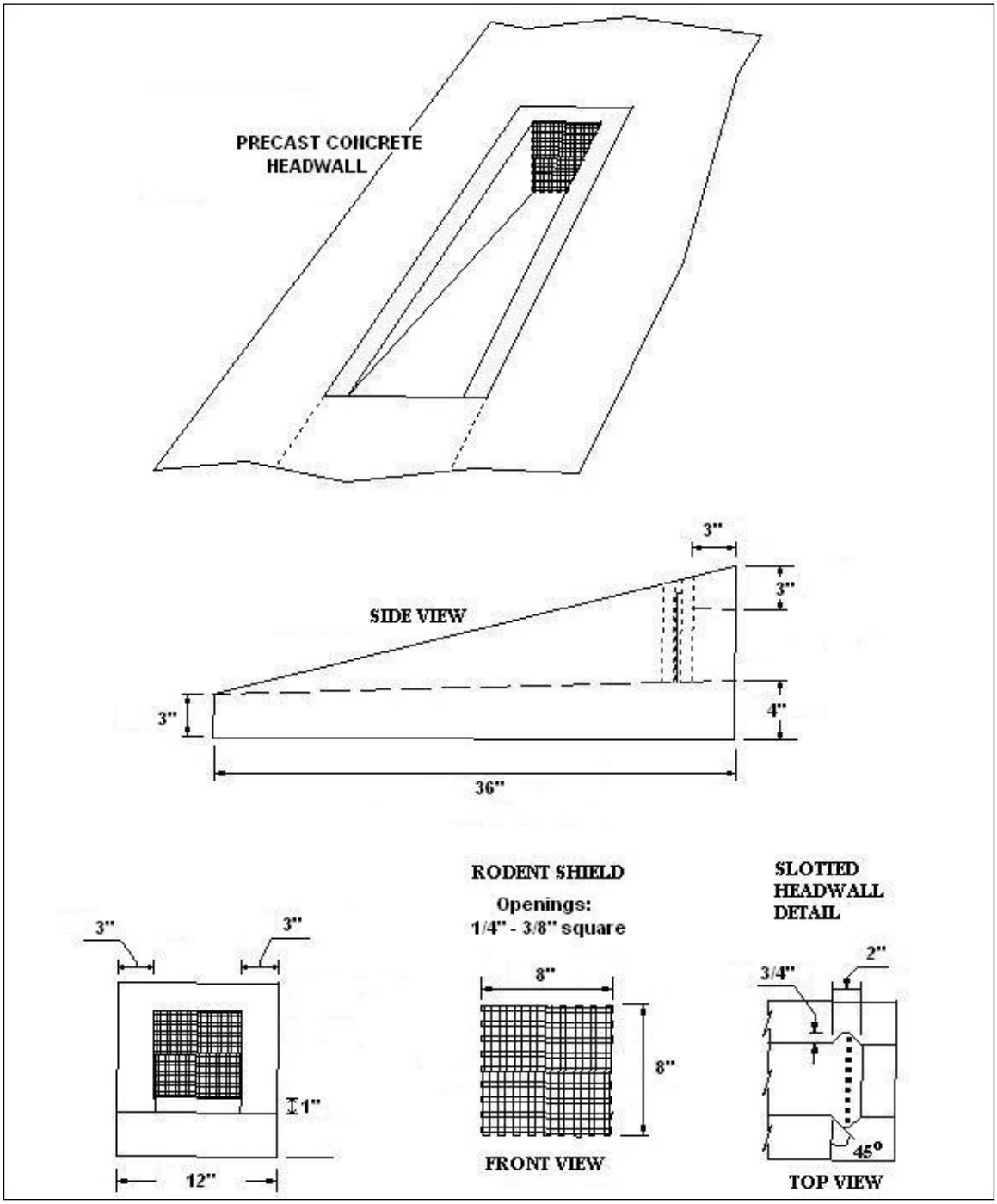


Figure G-16. Example Design for a Headwall



G-6.4.3 Reference Markers. Although not a requirement, reference markers are recommended for the outlets to facilitate maintenance and/or observation. A simple, flexible marker post or marking on the shoulder will suffice to mark the outlet.

G-6.5 Cross Drains. Cross drains may be required at locations where flow in the drainage layer is blocked, for steep longitudinal grades, or at the bottom of vertical

curves. For example, cross drains may be required where pavements abut building foundations, at bridge approach slabs, or where drainage layers abut impermeable bases.

G-6.6 Manholes and Observation. Manholes, observation basins, and risers are installed on subsurface drainage systems for access to the system to observe its operation and to flush or rod the pipe for cleaning. When required, manholes on subgrade pipe drains should be located at intervals of not over 300 m (1,000 ft) with one flushing riser located between manholes and at dead ends. Manholes should be provided at principal junction points of several drains. Typical details of construction are provided in Chapter 4.

G-7 MAINTENANCE OF SUBSURFACE DRAINAGE SYSTEMS. Commitment to maintenance is as important as providing subsurface drainage systems. In fact, an improperly maintained drainage system can cause more damage to the pavement structure than if no drainage were provided at all. Poor maintenance leads to clogged or silted outlets and edge-drain pipes, missing rodent screens, excessive growth of vegetation blocking outlet pipes and openings on daylighted bases, and growth of vegetation in side ditches. These problems can potentially cause backing up of water within the pavement system, thereby defeating the purpose of providing the drainage system. Therefore, inspections and maintenance of subsurface drainage systems should be made an integral part of the policy of any agency installing these systems. The inspection process comprises of two parts: (a) visual inspection, and (b) video inspection.

G-7.1 Visual Inspection. The visual inspection process includes these items:

G-7.1.1 Evaluation of external drainage-related features, including measuring ditch depths and checking for crushed outlets, excessive vegetative growth, clogged and debris-filled daylighted openings, condition of headwalls, presence of erosion, and missing rodent screens. This operation should be performed at least once a year.

G-7.1.2 Pavement condition evaluation to check for moisture-related pavement distresses such as pumping, faulting, and D-cracking in PCC pavements and fatigue cracking and AC stripping in AC pavements. This operation could be either a full-scale PCI survey or a brief overview survey, depending on agency needs. The recommended frequency for this activity is once every 2 years.

G-7.2 Video Inspection. Video inspections play a vital role in monitoring in-service drainage systems. The video inspection process can be used to check for clogged drains due to silting and intrusion of surrounding soil as well as for any problems with the drainage system such as ruptured pipes and broken connections. Video inspections should be carried out on an as-needed basis whenever there is evidence of drainage-related problems. A video inspection system typically consists of a camera head, a long, flexible probe mounted on a frame for inserting the camera head into the pipe, and a data acquisition unit fitted with a video screen and a video recorder. This system can be used to detect and correct any construction problems before a

project is accepted. The construction-related problems that are easily detected using video equipment include crushed or ruptured drainage pipes, improper connections between drainage pipes, and problems with the connection between the outlet pipe and headwall.

G-7.3 Maintenance Guidelines

G-7.3.1 Collector Drains and Outlets. The collector drains and outlets should be flushed periodically with high-pressure water jets to loosen and remove any sediment that has built up within the system. The key to this operation is having the appropriate outlet details that facilitate the process, such as the dual headwall system shown in Figure G-13. The area around the outlet pipes should be kept mowed to prevent any buildup of water. Missing rodent screens and outlet markers, and damaged pipes and headwalls need to be either repaired or replaced.

G-7.3.2 Daylighted Systems. Routine removal of roadside debris and vegetation clogging the daylighted openings of a permeable or dense-graded base is very important for maintaining the functionality of these systems.

G-7.3.3 Drainage Ditches. Drainage ditches should be kept mowed to prevent excessive vegetative growth. Debris and silt deposited at the bottom of the ditch should be cleaned periodically to maintain the ditch line and to prevent water from backing up into the pavement system.

INDEX

access hole lid displacement..... 211
adjustment factor (Fp) 31
airport drainage systems
  design load 255
  recommended design parameters 255
  special design considerations..... 255
allowable spread 41
anchorage and buoyancy 301
applicability..... 1
appurtenant structures 232
  check dams 248
  chutes..... 243
  drop structures..... 248
  flap gates..... 250
  flow splitters..... 248
  fuel/water separators 246
  inlets 232
  junction chambers 243
  manholes..... 236
  outlet energy dissipators..... 246
  security fencing..... 243, 246
  siphons 249
  transitions 248
arctic and subarctic drainage systems
  298
area inlets..... 233
  failure..... 234
  settling rates 235
auxiliary drains 204
barriers..... 245, 246
basin development factor 27
BDF..... 27
bedding for conduits..... 266
bends
  shear stresses 195, 196
best management practices (BMPs) ... 2, 302
  design
    runoff volume treated 302
  selection guidance..... 302
box-culvert nomograph..... 152
catch basins 232
cellular blocks..... 166
channel design 187
channel instability..... 155
channels
  erosion
    riprap to control 174
  geometry..... 198
  improved..... 248
  instability..... 116
  lining materials..... 187
  slope 198
  stability..... 193
check dams 248
check storm..... 42
chutes..... 113
  closed 113
  open..... 113
composite gutter sections..... 49
computer programs 12, 32, 40, 176
  ANNIE..... 320
  BASIN..... 318
  CANDE-89..... 308
  DR3M 319, 320, 322
  DRIP 308
  HEC-RAS 32, 316, 322
  HMS..... 32, 315, 321
  HSPF 305
  HY12..... 318
  HY15..... 318
  HY8 310
  HY-8 163
  HYCHL 310, 313
  HYCLV..... 310
  HYDRA 223, 310
  HYDRAIN 33, 310, 312, 321
  Hydraulic Toolbox (HY-TB)... 318, 322
  HYDRO..... 310, 311
  HYEQT 310, 313
  ModBerg..... 308
  NFF..... 310, 313
  PIPECAR..... 308
  SCOUR..... 318
  STORM..... 305

SWMM 305, 320, 322
TR-20 ..... 32, 314, 315, 321
TR-55 ..... 32, 313, 321
Urban Drainage Design 318, 322
urban hydrology and hydraulics 308
VAST 305
WSPRO 310, 311
constant rainfall intensity 12
cover
minimum and maximum for airfields 286
minimum and maximum for roadways 287
requirements 117
storm drains and culverts 287
cross (transverse) slope 43
cross-drainage structures 105
culverts
beveled entrance 116
broken-back 117, 285
capacity 116
construction types 115
culvert pipe 115
design procedure 147
flow types 119
hydraulic design data for 119
hydraulic design of 115
inlet control 119
materials 115
mitered entrance 116
outlet control 119, 129, 140
rounded entrance 116
curb and gutter flow
spread 44
curbs
disadvantages 45
use 44
curbs and gutters 44
curved vane grates 114
dead loads 257, 267
degree of protection 10
design capacity 10
design discharge
Rational Method 214
time of concentration 214
design frequency and spread 41
design objectives 1
design storm frequencies 118, 214
headwater depth 118
higher than minimum 10
sag points 214
Design Storm Frequencies
areas other than airfields 11
DOD airfields and heliports 10
FAA 11
design storm frequency 214
detention facilities 261, 262
design guidance and criteria . 262, 263
detention/retention facilities 258, 259
direct loading
design requirements 257
discharge frequencies 198, 212
downdrains 113
drainage culvert
definition 115
drainage inlet design 63
drainage pipe
definition 265
drainage pipelines
infiltration 117
drainage structures
vehicular safety 176
drainage system design
frost condition considerations 283, 284, 285
grading 203, 300
procedures 203
drop inlets 105
drop structures 248
end structure protection 300
endwalls 116, 154, 155, 247
energy dissipators 113, 168
designs 163
flared outlet transition 168, 169
hydraulic jump 169
riprap use with 174
Saint Anthony Falls (SAF) stilling basin 169
stilling well 169
USBR impact energy dissipator 169
energy grade line (EGL)

definition 210
manual calculation
energy loss method 223
energy loss method 223
environmental considerations
Air Force environmental quality program 8
Army environmental quality program 7
discharge permits 9
effects of surface drainage systems . 8
environmental impact analysis 8
FAA environmental quality program . 8
Federal guidelines 3
Federal regulations 3
local laws 7
Navy environmental quality program 8
NEPA 2, 4
regulatory considerations 3
state regulations 5
Equations
2-1 16
2-10 26
2-11 26
2-12 26
2-13 26
2-14 26
2-15 28
2-16 29
2-17 29
2-18 29
2-19 31
2-2 16
2-20 35
2-21 38
2-22 39
2-23 39
2-3 19
2-4 20
2-5 21
2-6 22
2-7 25
2-8 26
2-9 26
3-1 43
3-10 66
3-11 75
3-12 75
3-13 75
3-14 76
3-15 76
3-15a 76
3-16 77
3-17 80
3-18 80
3-19 81
3-2 46
3-20 82
3-21 88
3-22 88
3-23 91
3-24 92
3-25 92
3-26a 92
3-26b 92
3-27 106
3-28 106
3-29 106
3-3 47
3-4 49
3-5 49
3-6 49
3-7 54
3-8 62
3-9 66
4-1 130
4-10 174
4-11 174
4-12 174
4-2 131
4-3 131
4-4 140
4-5 152
4-6 168
4-7 168
4-8 174
4-9 174
5-1 187
5-10 195
5-11 196
5-12 200
5-2 190
5-3 190

5-4 190
5-5 190
5-6 190
5-7 194
5-8 194
5-9 195
6-1 205
6-2 216
6-3 216
erosion 116
control at outlets 163
protection 116
erosion and sedimentation (E&S) control regulations 307
estimating pollutant loads 305
Examples
2-1 18
2-2 23
2-3 24
2-4 27
2-5 31
2-6 35
2-7 39
3-1 48
3-10 94
3-11 102
3-12 107
3-13 109
3-14 111
3-2 50
3-3 55
3-4 57
3-5 62
3-6 77
3-7 78
3-8a 82
3-8b 86
3-9 89
4-1 177
4-10 185
4-11 185
4-12 185
4-13 186
4-2 178
4-3 179
4-4 180
4-5 181
4-6 182
4-7 183
4-8 184
4-9 184
5-1 191
5-2 196
5-3 201
5-4 201
6-1 208
6-2 209
extended detention dry ponds 305
fish passage considerations 117
flanking inlets 102, 103
flap gates 212, 232, 250
flexible pipe 283
flow
in gutters 45
resistance 187
splitters 232, 248
flow friction formulas 205
flowline 211
freeboard 198
fuel/water separators 246
gear configurations 255, 256
general investigations 2
geometric controls 96
grading 203
grates 251
30°- 3-1/4 tilt bar 66
45°- 2-1/4 tilt bar 66
45°- 3-1/4 tilt bar 66
curved vane 66
efficiency 74, 114
for airport loadings 252
loading conditions 114
materials 251
P-1-1/8 ..... 66, 114
P-1-7/8 ..... 65, 114
P-1-7/8 x 4 66
parallel bar 114
protection of 252
reticuline 66
type selection 113
gravity flow 204

gully scour 116, 155, 156
gutters
composite sections 49
conventional 47
dimensions 44
flow 41, 45
flow calculations 46
flow time 61
headwalls 116, 153
advantages of 153
construction of 154
design of 153
headwalls and endwalls 153, 155
headwalls and wingwalls 153
heaving 284
HEC-RAS 311, 315
hydraulic grade line (HGL)
definition 210
manual calculation
energy loss method 223
hydraulic jump 247
hydrologic methods
Rational Method 12, 15
regression equations
USGS 12
hydrologic methods
TR-55 12
hydrologic methods
TR-55 15
hydrologic methods
TR-55 327
icing 289
debris and icing control 301
description 289
effects of human activities on 291
ground icing 290, 295
methods of counteracting 292
methods of prevention 295
natural factors conducive to 291
river or stream icing 289, 295
spring icing 291
types 289
IDF curves 12, 13
regional 18
infiltration 117, 285
basins 263, 306
control 286
facilities 263, 264
required testing 286
infiltration/exfiltration trenches 305
inlets
capacity 41
catch basins 232
combination inlets 64, 65, 112
continuous inlets 64, 65
curb-opening inlets 64, 65, 80
embankment inlets 112
grate inlets 64, 65, 74, 112
inlet-control nomographs 119, 150
interception capacity 65, 72
factors affecting 66
locations 95
median and roadside ditch inlets .. 105
median, embankment, and bridge 104
on embankments 112
placement 235
slotted inlets 64, 73
spacing 235
spacing on continuous grades 96
surcharging 211
sweeper inlets 112
types 63
water quality 306
interception capacity
combination inlets 73
curb-opening inlets in sag locations 91
grate inlets 74
grate inlets in sag locations 87
inlets in sag locations 87
inlets on grade 73
slotted inlets 73
invert elevation 211
jointing 300
kinematic wave equation 19
ladders 252
length of stone protection (LSP) 163
live loads 257, 267
longitudinal slope 42
manholes 236
chamber and access shaft 237
channels and benches 241

configuration 236
depth 241, 242
frames and covers 237, 241
ladders 252
location and spacing 242
settlement 242
steps 255
Manning's equation . 19, 21, 46, 61, 106, 140, 150, 187, 205, 206, 207, 210, 314, 318, 319, 334
maximum highwater
definition 216
minimum velocity and grades 216
NFF 25, 26, 313
NOAA 5, 19, 396
NRCS 13, 29
peak flow method 28, 32
open channel flow 187, 204
outfall design 211
outfall headwalls 247
outlets
energy dissipators 246
riprap 247
stilling basins 247
outlet control 129
outlet-control nomographs 151
protection design example 177
protection of 116
paved apron 247
peak flow
attenuation 259
rates
derivation methods 15
pipe
bedding 283
downdrains 113
drains 105
installation
arctic and subarctic 301
selection 265, 266
arctic and subarctic 300
bituminous-coated pipe restrictions 265
life cycle cost factors 265
plastic pipe
DOD restrictions 265
roughness 265
pipestrength 267
plain outlets 247
ponding 119
pressure flow 204
primary drains 203
Rational Formula 10, 15, 16, 25
Rational Method 10, 15, 18, 33, 311, 312
exceptions to application 215
regression equations 312, 313
regional 25
rural 25
urban 26
USGS 10, 15, 25
Regression Equations
urban 26
USGS 26
release timing 259, 260
retention facilities 261, 263
definition 263
design guidance and criteria 263
retention ponds 305
rigid pipe 267
riprap 163, 174, 247
aprons 212
failure 166
size of stone 163, 165, 166
roadside and median channels 45
design parameters 198
channel geometry 198
channel slope 198
discharge frequence 198
freeboard 198
shear stress 200
runoff coefficient 16
sack revetment 166
sag points
design storm frequency 214
sag vertical curves
flow in 61
Saint Anthony Falls (SAF) stilling basin 169
sand filters 306
scour 116, 247
estimating the extent of 177

preventing local scour 177
scour holes 116, 155, 156, 157
scour holes
calculations 163
SCS
peak flow method 28, 32
tabular hydrograph method 33
secondary currents 195
shallow ditch sections 45
shear stress 193, 194
bends 195, 196
distribution of 194
permissible 200
sheet flow 19
side slope stability 195
Simple Method 305
siphons 232, 250
definition 249
stable channel design 193, 194
concepts 193
stilling wells 169, 285
storage facility types 261
storm drain
arctic and subarctic guidelines 298
auxiliary drains 204
classification 203
computation sheet 217
conduit 203
conduit shapes 207
design 203
check storms 214
energy grade line (EGL) 210
energy losses 213
hydraulic capacity 205
conduit shape 207
Manning's equation 205, 207
hydraulic grade line (HGL) 210, 211
open channel flow 204
open channel flow advantages .. 205
outfall conditions 211
outfall orientation 213
preliminary design procedure 217
pressure flow 204
pressure flow advantages 205
Rational Method 214
maintenance 300
outfalls 211
primary drains 203
system
design procedures 203
flow type assumptions 204
grading 203
hydraulics 204
storm water
control facilities 258
storm water management 258
models 305
HSPF 305
STORM 305
SWMM 305
VAST 305
peak runoff rate 259
programs 308
storm water quantity control facilities 259
maintenance 261
release timing 259
safety 260, 261
storm water runoff
detention/retention facilities .. 258, 259
storage 258, 300
subsurface pavement drainage systems
(FAA only) 404
surface drainage 41, 42
surface runoff 10, 11
swales 263
synthetic rainfall 12, 13
tailwater depth 211
tidal and flood effects 301
time of concentration 19, 61
definition 214
inlet spacing 214
pipe sizing 215
tractive force theory 193
transitions 247, 248
triangular gutter sections 62
ultra-urban BMPs 306
units of measurement 1
USBR impact energy dissipator 169
USGS

regression equations ... 10, 12, 15, 25, 26
vegetal covers
degree of retardance 189
vegetative practices..... 306
vehicular safety
drainage structures..... 176
hydraulically efficient drainage practice 176
waiver procedures
Air Force..... 400
Army 398
Navy and Marine Corps..... 400
waivers..... 2
warped endwalls 247
water quality practices
overview 302
waterfowl hazards 10, 261
watertight joints 117, 285
DOD facilities..... 285
wet ponds..... 305
facilities..... 263
wingwalls..... 116, 154, 247

8. E.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Genevieve Pearthree, Planning Development Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Final Plat

TLC PC Land Investors LLC requests final plat approval for The Estates at Pine Canyon Pine Run located at 2080 E. Del Rae Dr., a single-family home subdivision on 17.5 acres in the R1 (Single Family Residential) Zone.

STAFF RECOMMENDED ACTION:

Approve the final plat and authorize the Mayor to sign the plat and City Subdivider Agreement when notified by staff that the documents are ready for recording

Executive Summary:

TLC PC Golf requests final plat approval for The Estates at Pine Canyon Pine Run located at 2080 E. Del Rae Dr. This plat proposes 26 single-family home lots on 17.5 acres in the R1 Zone. The site has a Resource Protection Overlay and is currently vacant. It is located in the southeastern corner of the larger 660-acre Pine Canyon development.

Financial Impact:

No financial impacts are anticipated with this final plat.

Policy Impact:

There are no policy impacts affiliated with this final plat.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

PBB Key Community Priorities/Objectives

Robust Resilient Economy - Grow and strengthen a more equitable and resilient economy.

Regional Plan Policies and Goals

- Policy LU.5.1. Encourage development patterns within the designated growth boundaries to sustain efficient infrastructure projects and maintenance.
- Policy LU.5.2. Promote infill development over peripheral expansion to conserve environmental resources, spur economic investments, and reduce the cost of providing infrastructure and services.
- Goal NH.1. Foster and maintain healthy and diverse urban, suburban, and rural neighborhoods in the Flagstaff region.

- Policy WR.4.3. Development requiring public utility services will be located within the Urban Growth Boundary.

Has There Been Previous Council Decision on This:

The City Council approved the Pine Canyon development through a rezoning (Ordinance No. 2000-11) and development agreement in June 2000.

A revised development agreement was approved in January 2007 to resolve disputes between the Developer of Pine Canyon and the City of Flagstaff with respect to the Rezoning Ordinance. This agreement stipulates that the Developer may, at its option, abandon the third entrance to Pine Canyon, providing the main entrance and the clubhouse entrance remain open and available for ingress and egress to the public.

In October of 2013, City Council approved an agreement with the Developer that committed the City to erect and maintain a directional sign at the intersection of Lake Mary Road and John Wesley Powell Boulevard, committed staff support to amend the rezoning ordinance to modify the gated provision during nighttime, and extended the developers' transportation improvement contribution. In May 2014, the City Council approved a modification to Ordinance No. 2000-11 to modify Condition #8 which stated "That all private roads within the development remain open to the public and never be gated" to "All streets within Pine Canyon shall remain open to the public, without the use of a gate, from sunrise to sunset. Any means to restrict access to the streets of Pine Canyon may only be utilized from sunset to sunrise and never restrict emergency access."

The City Council has also previously approved several subdivision plats in Pine Canyon, including the Estates at Pine Canyon Units 1-5, Coconino Ridge, Deer Creek Crossing, Mountain Villas, Mountain Vista Condominiums, and Club Cabin Condominiums.

The City Council approved the Preliminary Plat for this subdivision (previously called The Estates at Pine Canyon Pine Bluff) on December 1, 2020. On November 12, 2020, the Planning and Zoning Commission voted 6-1 in favor of forwarding the preliminary plat to the City Council with a recommendation for approval.

Options and Alternatives:

1. Approve the final plat with no conditions.
2. Approve the final plat with conditions.
3. Deny the final plat based on non-compliance with the Zoning Code, the Subdivision Code, and/or the Engineering Design Standards and Specifications for New Infrastructure.

Background/History:

In June of 2000, the City Council approved a rezoning request and development agreement allowing the development of Pine Canyon, which includes a mixture of condominium, townhomes, estate homes, clubhouse and recreational facilities, maintenance and storage facilities, and an 18-hole private golf course with accessory facilities, located on approximately 660 acres. The primary entrance to Pine Canyon is located at the intersection of Lone Tree Road and John Wesley Powell Blvd.

The applicant is seeking final plat approval for a 26-lot single-family residential subdivision within the larger Pine Canyon development. The subdivision is one of the last undeveloped areas in Pine Canyon and is located between the existing golf course and the residential uses. The site has significant topography requiring the applicant to create larger lots and unique building envelopes to ensure resource protection standards are met.

All areas in the subdivision not allocated as lots are reserved as tracts. Tract A covers Woodland

Hills Drive (a private drive) and is to be used for ingress/egress, landscaping, and utilities. Tracts B1 and B2 are used for stormwater conveyance and golf course use. The new infrastructure will need to be provided for the project including a private roadway (Woodland Hills Drive) as is the adopted standard in Pine Canyon, 8" water and sewer lines, LID (Low Impact Development) basins, and a golf cart path.

Key Considerations:

Staff approved the final plat on May 27, 2021, based on conformance with City Code Title 10, Flagstaff Zoning Code; City Code Title 11, General Plans and Subdivisions; and City Code Title 13, Engineering Design Standards and Specifications.

The property is zoned R1, Single Family Residential, which requires a minimum of two units per acre and allows a maximum of five units per acre within the Resource Protection Overlay (RPO). This subdivision has a density of 1.48 units per acre which is slightly lower than the required two units per acre. The Development Agreement for Pine Canyon identifies 26 lots for this tract, which is what is proposed. The overall density of the Pine Canyon development meets the minimum density standards for the R1 zone. The subdivision is one of the last undeveloped areas in Pine Canyon.

Lots within the proposed subdivision range from 18,872 sq. ft. to 38,282 square feet, which comply with the minimum lot size of 6,000 square feet for the R1 Zone. For the purposes of tree and steep slope resource protection, the plat proposes four flag lots that do not meet the minimum lot width at the front setback line (15 feet) for the R1 Zone. However, the Zoning Code allows the City Council to approve alternate lot sizes and setbacks on a final plat. The plat designates alternate front setback lines on the flag lots to ensure compliance with the 60’ minimum lot width Table 10-40.30.030.C(2). Additionally, unique building envelopes for each lot that meet or exceed the minimum required setbacks for the R1 zone (see page 3 of the final plat) have been provided.

Community Benefits and Considerations:

The community benefits of this project are encapsulated in the PBB Key Community Priorities/Objectives and the Regional Plan goals and policies that it meets, such as providing new housing within the urban growth boundary.

Community Involvement:

Inform. The existing zoning of the subject property allows for the proposed subdivision. No public hearings or public outreach are required by either the Zoning Code or the Subdivision Code as part of the Subdivision Plat review process.

Attachments:

Application
Final Plat
City/Subdivider Agreement
Utility Notices and Responses
Vicinity Map

City of Flagstaff — Community Development Division

211 W. Aspen Ave
Flagstaff, AZ 86001
www.flagstaff.az.gov
P: (928) 213-2618
F: (928) 213-2609

Date Received	Application for Subdivision Review	File Number
4/13/21		PZ 19-00099-04

Property Owner(s) TLC PC Land Investors LLC		**Phone** 602-616-6828
Mailing Address 8601 N. Scottsdale Rd., Ste. 335	**City, State, Zip** Scottsdale, AZ 85253	**Email** TSeverson@symmetrycompanies.com
Applicant(s) TLC PC Land Investors LLC		**Phone** 602-616-6828
Mailing Address 8601 N. Scottsdale Rd. Ste. 335	**City, State, Zip** Scottsdale, AZ 85253	**Email** TSeverson@symmetrycompanies.com
Project Representative Todd Severson, Partner VP		**Phone** 602-616-6828
Mailing Address 15075 N. Talking Rock Ranch Road	**City, State, Zip** Prescott, AZ 86305	**Email** TSeverson@symmetrycompanies.com

Requested Review: ☐ Development Master Plan ☐ Modified Subdivision ☐ Conceptual Plat Preliminary Plat ☐ Preliminary Plat P&Z and Council X Final Plat- Council

Project Name: The Estates at Pine Canyon - Pine Run	**Site Address** 2811 East Byrds View Drive		**Parcel Number** 105-10-183A
Proposed Use Residential	**Existing Use** Undeveloped	**Subdivision, Tract & Lot Number** The Estates at Pine Canyon, Tract 9	
Zoning District R1	**Regional Plan Category** PAD	**Flood Zone** X	**Size of Site (Sq. ft. or Acres)** 17.50 acres

Property Information:
☐ Yes ☒ No Located in an existing Local/National Historic District? (Name:_____)
☐ Yes ☒ No Existing structures are over 50 years old at the time of application?
☒ Yes ☐ No Subject property is undeveloped land?

Surrounding Uses (Res, Com, Ind)	North	South	East	West
	Residential/golf	Residential/golf	Residential/golf	Residential/golf

Proposed Use:	Number of Lots	Number of Units	Number of acres per use	Building Square Feet
Residential/golf	26	N/A	1.49	N/A

Please complete a *"Subdivision Review Application"* and provide an initialed *"Application and Information Checklist"* form along with the required number of plans and information as appropriate for a Development Master Plan, Conceptual, Preliminary or Final Plat. **Incomplete submittals will not be scheduled.**

Property Owner Signature: (required)	Date:	Applicant Signature:	Date:
	04/13/21		04/13/21

For City Use

Date Filed: 4/13/21	**Case Number (s)** PZ-19-0099-04	
P & Z Hearing Date: NA	**Publication and Posting Date:** NA	
Council Hearing Date: 6/15/21	**Publication and Posting Date:** NA	
Fee Receipt Number: REC-2110826	**Amount:** $1,840	**Date:** 4/13/21

Action by Planning and Zoning Commission:	Action By City Council:
☐ Approved	☐ Approved
☐ Denied	☐ Denied
☐ Continued	☐ Continued

Staff Assignments	Planning	Engineering	Fire	Public Works/Utilities	Stormwater

PLOTTED: May 26, 2021 – 10:52am

FINAL PLAT FOR

THE ESTATES AT PINE CANYON PINE RUN

PZ-19-00099-02

APN 105-10-183A

A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 1"
RECORDED AT CASE 8 OF MAPS, PAGE 92, C.C.O.R.
AND
A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 2"
RECORDED AT CASE 9 OF MAPS, PAGE 28, C.C.O.R.
SITUATED IN THE SOUTHEAST QUARTER OF SECTION 34, TOWNSHIP 21 NORTH, RANGE 7 EAST
OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA

DEDICATIONS TO THE CITY

STATE OF ARIZONA

COUNTY OF COCONINO

KNOW ALL PERSONS BY THESE PRESENTS: THAT TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY,AS OWNER, HAS SUBDIVIDED UNDER THE NAME, "THE ESTATES AT PINE CANYON - PINE RUN," A SUBDIVISION LOCATED IN A PORTION OF THE SOUTHEAST QUARTER OF SECTION 34, TOWNSHIP 21 NORTH, RANGE 7 EAST OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA AS SHOWN AND PLATTED HEREON AND DOES HEREBY PUBLISH THIS PLAT AS FOR THE PLAT OF "THE ESTATES AT PINE CANYON - PINE RUN," AND DECLARES THAT THIS PLAT SETS FORTH THE LOCATION AND GIVES DIMENSIONS OF EACH LOT, TRACT, STREET (PRIVATE), AND EASEMENT CONSTITUTION THE SAME, AND THAT EACH LOT, TRACT, STREET, AND EASEMENT SHALL BE KNOWN BY THE NUMBER, LETTER, AND/OR NAME GIVEN TO EACH RESPECTIVELY AS SHOWN ON THIS PLAT.

SAID SUBDIVISION BEING OF A PORTION OF TRACT 9, "THE ESTATES AT PINE CANYON - UNIT 1" AS RECORDED AT CASE 8 OF MAPS, PAGE 92, COCONINO COUNTY OFFICIAL RECORDS AND ALSO SAID SUBDIVISION BEING A PORTION OF TRACT 9, " THE ESTATES AT PINE CANYON - UNIT 2" AS RECORDED AT CASE 9 OF MAPS, PAGE 28, COCONINO COUNTY OFFICIAL RECORDS.

1. GRANTOR HEREBY DEDICATES TO THE CITY OF FLAGSTAFF, ARIZONA, AN ARIZONA MUNICIPAL CORPORATION, PERPETUAL NON-EXCLUSIVE EASEMENTS OVER, UNDER, UPON, AND ACROSS ALL EASEMENT AREAS DESIGNATED ON THE PLAT FOR THE EASEMENT PURPOSES, INCLUDING ANY RELATED FACILITIES AND EQUIPMENT ACROSS TRACT A AS FOLLOWS:

A. "EMERGENCY AND SERVICE VEHICLE ACCESS EASEMENT (ESVAE) FOR PUBLIC USE, INCLUDING WITHOUT LIMITATION, THE RIGHT OF ACCESS FOR EMERGENCY, POLICE, FIRE, PUBLIC SAFETY, REFUSE COLLECTION, UTILITY, AND OTHER SERVICE PERSONNEL AND VEHICLES. GRANTOR SHALL CONSTRUCT AND MAINTAIN THE ESVAE IN ACCORDANCE WITH ENGINEERING STANDARDS FOR HEAVY EQUIPMENT IN COMPLIANCE WITH THE FLAGSTAFF CITY CODE. "

B. "PUBLIC UTILITY EASEMENT (PUE), FOR PUBLIC USE, FOR UTILITY PURPOSES, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF ELECTRICITY, ENERGY, GAS, WATER, SEWER, PUBLIC STORM WATER SYSTEM, TELECOMMUNICATIONS, INTERNET SERVICES, CABLE TELEVISION, AND OTHER UTILITIES."

2. GRANTOR HEREBY DEDICATES TO THE CITY OF FLAGSTAFF, ARIZONA, AN ARIZONA MUNICIPAL CORPORATION, PERPETUAL NON-EXCLUSIVE EASEMENTS OVER, UNDER, AND ACROSS ALL EASEMENT AREAS DESIGNATED ON THE PLAT FOR THE EASEMENT PURPOSES, INCLUDING ANY RELATED FACILITIES AND EQUIPMENT AS FOLLOWS:

A. DRAINAGE EASEMENT (DE), FOR PUBLIC USE, FOR DRAINAGE AND FLOOD CONTROL PURPOSES, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF NATURAL AND MAN-MADE CHANNELS, WASHES, WATERCOURSES, LEVEES, DIKES, DAMS, RETENTION AND DETENTION BASINS, STORAGE BASINS, STORM DRAINS, MONITORING DEVICES. CITY IS RESPONSIBLE FOR MAINTENANCE OF THE EASEMENT AREA FOR DRAINAGE AND FLOOD CONTROL PURPOSES.

B. SEWER LINE EASEMENT (SLE), FOR PUBLIC SEWER SYSTEMS, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF UNDERGROUND SEWER PIPELINES, MONITORING DEVICES, PIPES, MANHOLES, VALVES, AND ACCESS VAULTS.

C. WATERLINE EASEMENT (WE) FOR PUBLIC WATER SYSTEMS, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF WATER PIPELINES, MONITORING DEVICES, MANHOLES, VALVES, ACCESS VAULTS, AND SIMILAR FACILITIES.

3. ALL EASEMENTS GRANTED HEREIN ARE SUBJECT TO THE FOLLOWING GENERAL CONDITIONS:

A. GRANTOR SHALL NOT ALLOW USE OF THE EASEMENT AREA IN A MANNER THAT INTERFERES WITH EASEMENT;

B. GRANTOR SHALL MAINTAIN EASEMENT AREAS FREE AND CLEAR OF VEGETATION OR OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT, PER THE FLAGSTAFF CITY CODE AS AMENDED; AND

C. GRANTEE MAY MAINTAIN VEGETATION AND REMOVE OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT;

D. IN THE EVENT THE CITY OF FLAGSTAFF HAS NOTIFIED GRANTOR AND PROVIDED REASONABLE OPPORTUNITY TO MAINTAIN THE SLOPE, VEGETATION AND/OR REMOVE OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT, CITY OF FLAGSTAFF MAY ISSUE AN ASSESSMENT AGAINST GRANTOR TO RECOVER THE CITY'S ACTUAL, REASONABLE MAINTENANCE COSTS AND RECORD IT AS A LIEN AGAINST GRANTOR'S PROPERTY UNTIL THE ASSESSMENT AND ANY STATUTORY INTEREST IS PAID;

E. GRANTEE SHALL HAVE A LIMITED, TEMPORARY RIGHT OF ACCESS ACROSS GRANTOR'S ADJACENT PROPERTY FOR EASEMENT PURPOSES IF ACCESS CANNOT BE REASONABLY ACHIEVED BY OTHER MEANS.

4. BINDING EFFECT. THE EASEMENTS GRANTED WITHIN THIS DEDICATION ARE PERMANENT AND PERPETUAL AND SHALL RUN WITH THE LAND AND BE BINDING UPON OWNER AND ITS HEIRS, ASSIGNS, AND SUCCESSORS IN INTEREST TO THIS PLAT OR ANY PARCEL OR LOT THEREOF.

NOW, THEREFORE, IN WITNESS WHEREOF, GRANTOR HAS HEREUNTO CAUSED ITS CORPORATE NAME TO BE SIGNED AND ITS CORPORATE SEAL TO BE AFFIXED BY THE UNDERSIGNED, DULY AUTHORIZED OFFICER THIS _____ DAY OF _____, 20__.

TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY

BY_____

ITS_____

IN WITNESS WHEREOF, GRANTOR(S) HAS/HAVE HEREUNTO CAUSED HIS/HER/THEIR NAME(S) TO BE SIGNED, THIS_____ DAY OF _____, 20__.

TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY

BY_____

ITS_____

TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY ("GRANTOR")

BY: _____
DATE: _____

STATE OF ARIZONA)
) SS
COUNTY OF COCONINO)
ON THIS_____DAY OF _____, 20__, BEFORE ME PERSONALLY
APPEARED_____, THE_____, AN_____
FOR AND ON BEHALF THEREOF, WHOSE IDENTITY WAS PROVEN TO ME ON THE BASIS OF SATISFACTORY EVIDENCE TO BE THE PERSON WHO HE OR SHE CLAIM TO BE, AND ACKNOWLEDGED THAT HE OR SHE SIGNED THE ABOVE DOCUMENT.

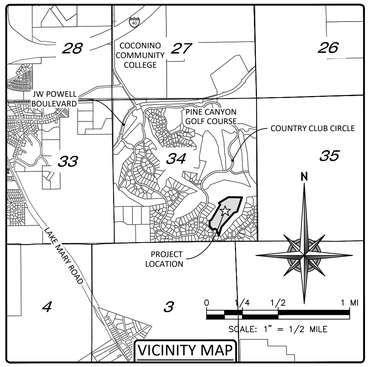
_____
NOTARY PUBLIC

PUBLIC UTILITY EASEMENT NOTE

EXCEPT FOR CONSTRUCTION AND IMPROVEMENTS BY GOVERNMENTAL ENTITIES AND CERTIFICATED PUBLIC UTILITIES, CONSTRUCTION AND IMPROVEMENTS WITHIN UTILITY EASEMENTS SHALL BE LIMITED TO ONLY THE FOLLOWING: REMOVABLE WOOD, WIRE OR SECTION-TYPE FENCING; CONSTRUCTION, STRUCTURES OR BUILDING EXPRESSLY APPROVED IN WRITING BY ALL PUBLIC UTILITIES WHICH USE OR SHALL USE THE UTILITY EASEMENT.

PROJECT WATER INFORMATION

1. THE CITY OF FLAGSTAFF PROVIDES WATER [UTILITY] SERVICE PURSUANT TO STATE LAW, AND IS CURRENTLY OPERATING UNDER A DESIGNATION OF ADEQUATE WATER SUPPLY GRANTED BY THE ARIZONA DEPARTMENT OF WATER RESOURCES, APPLICATION NO. 41-900002.0002.



DEDICATIONS BY THE DEVELOPER

STATE OF ARIZONA

COUNTY OF COCONINO

KNOW ALL PERSONS BY THESE PRESENTS: THAT TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY,AS OWNER, HAS SUBDIVIDED UNDER THE NAME, "THE ESTATES AT PINE CANYON - PINE RUN," A SUBDIVISION LOCATED IN A PORTION OF THE SOUTHEAST QUARTER OF SECTION 34, TOWNSHIP 21 NORTH, RANGE 7 EAST OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA AS SHOWN AND PLATTED HEREON AND DOES HEREBY PUBLISH THIS PLAT AS FOR THE PLAT OF "THE ESTATES AT PINE CANYON - PINE RUN," AND DECLARES THAT THIS PLAT SETS FORTH THE LOCATION AND GIVES DIMENSIONS OF EACH LOT, TRACT, STREET (PRIVATE), AND EASEMENT CONSTITUTION THE SAME, AND THAT EACH LOT, TRACT, STREET, AND EASEMENT SHALL BE KNOWN BY THE NUMBER, LETTER, AND/OR NAME GIVEN TO EACH RESPECTIVELY AS SHOWN ON THIS PLAT.

SAID SUBDIVISION BEING OF A PORTION OF TRACT 9, "THE ESTATES AT PINE CANYON - UNIT 1" AS RECORDED AT CASE 8 OF MAPS, PAGE 92, COCONINO COUNTY OFFICIAL RECORDS AND ALSO SAID SUBDIVISION BEING A PORTION OF TRACT 9, " THE ESTATES AT PINE CANYON - UNIT 2" AS RECORDED AT CASE 9 OF MAPS, PAGE 28, COCONINO COUNTY OFFICIAL RECORDS.

IN ADDITION TO THE DEDICATIONS TO THE CITY OF FLAGSTAFF, ARIZONA, THE GRANTOR HEREBY DEDICATES THE FOLLOWING:

1. TRACT "A" IS HEREBY DEDICATED TO THE THE HOMEOWNER'S ASSOCIATION FOR USE AS A PRIVATE ROAD FOR INGRESS AND EGRESS, UTILITIES AND LANDSCAPING.
2. TRACT "B1" AND TRACT "B2" ARE HEREBY DEDICATED TO THE HOMEOWNER'S ASSOCIATION FOR PRIVATE STORMWATER CONVEYANCE AND GOLF COURSE USE.
3. THE EASEMENTS AS SHOWN HEREON ARE FOR THE USES DESCRIBED FOR EACH, RESPECTIVELY, AND ARE DETAILED AS FOLLOWS:

A. CROSS ACCESS #1 IS EXCLUSIVELY FOR THE USE OF LOT 370 AND 371 FOR INGRESS/EGRESS AND SHARED DRIVEWAY.

B. CROSS ACCESS #2 IS EXCLUSIVELY FOR THE USE OF LOT 372, 373 AND 374 FOR INGRESS/EGRESS AND SHARED DRIVEWAY.

C. GOLF ACCESS EASEMENT AS SHOWN ACROSS LOT 384 FOR THE EXISTING CART PATH TO CONNECT TO TRACT B2.

D. GOLF COURSE EASEMENT AS SHOWN ACROSS LOT 361, 362, 363, 364, 365 AND 366 FOR THE EXISTING CART PATH, EXISTING GOLF COURSE AMENITIES AND EXISTING LANDSCAPING TO REMAIN IN PLACE.

E. GOLF ENCROACHMENT EASEMENT AS SHOWN ACROSS LOT 360 FOR EXISTING GOLF COURSE LANDSCAPING TO REMAIN IN PLACE.

F. COMMUNITY MONUMENT SIGN AND LANDSCAPE EASEMENT #1 AS SHOWN ACROSS LOT 360 FOR INSTALLATION AND MAINTENANCE OF MONUMENT SIGN AND ASSOCIATED LANDSCAPING.

G. COMMUNITY MONUMENT SIGN AND LANDSCAPE EASEMENT #2 AS SHOWN ACROSS LOT 385 FOR INSTALLATION AND MAINTENANCE OF MONUMENT SIGN AND ASSOCIATED LANDSCAPING.

4. ALL LOTS WITHIN THIS SUBDIVISION REQUIRES THE INSTALLATION OF INDIVIDUAL PRIVATE GRINDER PUMPS (E/ONE EXTREME SERIES OR APPROVED EQUAL). ALL LOT OWNERS ARE RESPONSIBLE FOR INSTALLING THEIR INDIVIDUAL PRIVATE GRINDER PUMPS TO THE MANUFACTURERS SPECIFICATIONS. THESE INDIVIDUAL PRIVATE GRINDER PUMPS WILL CONVEY SEWAGE THROUGH A PRIVATE LOW PRESSURE SERVICE LINE INSTALLED BY EACH INDIVIDUAL LOT OWNER AND CONNECT TO THE PUBLIC SEWER SERVICE STUB PLACED AT EACH INDIVIDUAL LOT.
5. THIS SUBDIVISION SHALL BE SUBJECT TO AND TOGETHER WITH ALL DECLARATIONS, COVENANTS, RESERVATIONS & RESTRICTIONS WITHIN THE EXISTING DOCUMENTS FOR THE SUBJECT PROPERTY ON FILE WITHIN THE COCONINO COUNTY OFFICIAL RECORDS. THE DECLARATIONS OF COVENANTS, CONDITIONS AND RESTRICTIONS FOR "THE ESTATES AT PINE CANYON ARE RECORDED AT DOCUMENT NUMBER 3171314, COCONINO COUNTY OFFICIAL RECORDS, DATED NOVEMBER 22, 2002, AND AT DOCUMENT NUMBER 3216111, COCONINO COUNTY OFFICIAL RECORDS, DATED AUGUST 8, 2003, WHICH SAID SUBDIVISION SHOWN AND PLATTED HEREIN IS A PART OF THE PARCEL(S) REFERRED TO IN THE RECITALS THEREOF, AND THERE MAY BE HEREAFTER PUBLISHED DESIGN GUIDELINES THAT MAY BE OR MAY NOT BE RECORDED THAT SAID LOTS WOULD BE SUBJECT TO AND AMENDMENTS TO THE DECLARATIONS OF COVENANTS, CONDITIONS AND RESTRICTIONS AND MAY INCLUDE THE GRANT OF EASEMENT AND OTHER RIGHTS FOR THE PURPOSE OF REGULATING ANY LOTS OR TRACTS WITHIN THE ABOVE DESCRIBED PREMISES.

NOW, THEREFORE, IN WITNESS WHEREOF, GRANTOR HAS HEREUNTO CAUSED ITS CORPORATE NAME TO BE SIGNED AND ITS CORPORATE SEAL TO BE AFFIXED BY THE UNDERSIGNED, DULY AUTHORIZED OFFICER THIS _____ DAY OF _____, 20__.

TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY

BY_____

ITS_____

IN WITNESS WHEREOF, GRANTOR(S) HAS/HAVE HEREUNTO CAUSED HIS/HER/THEIR NAME(S) TO BE SIGNED, THIS_____ DAY OF _____, 20__.

TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY

BY_____

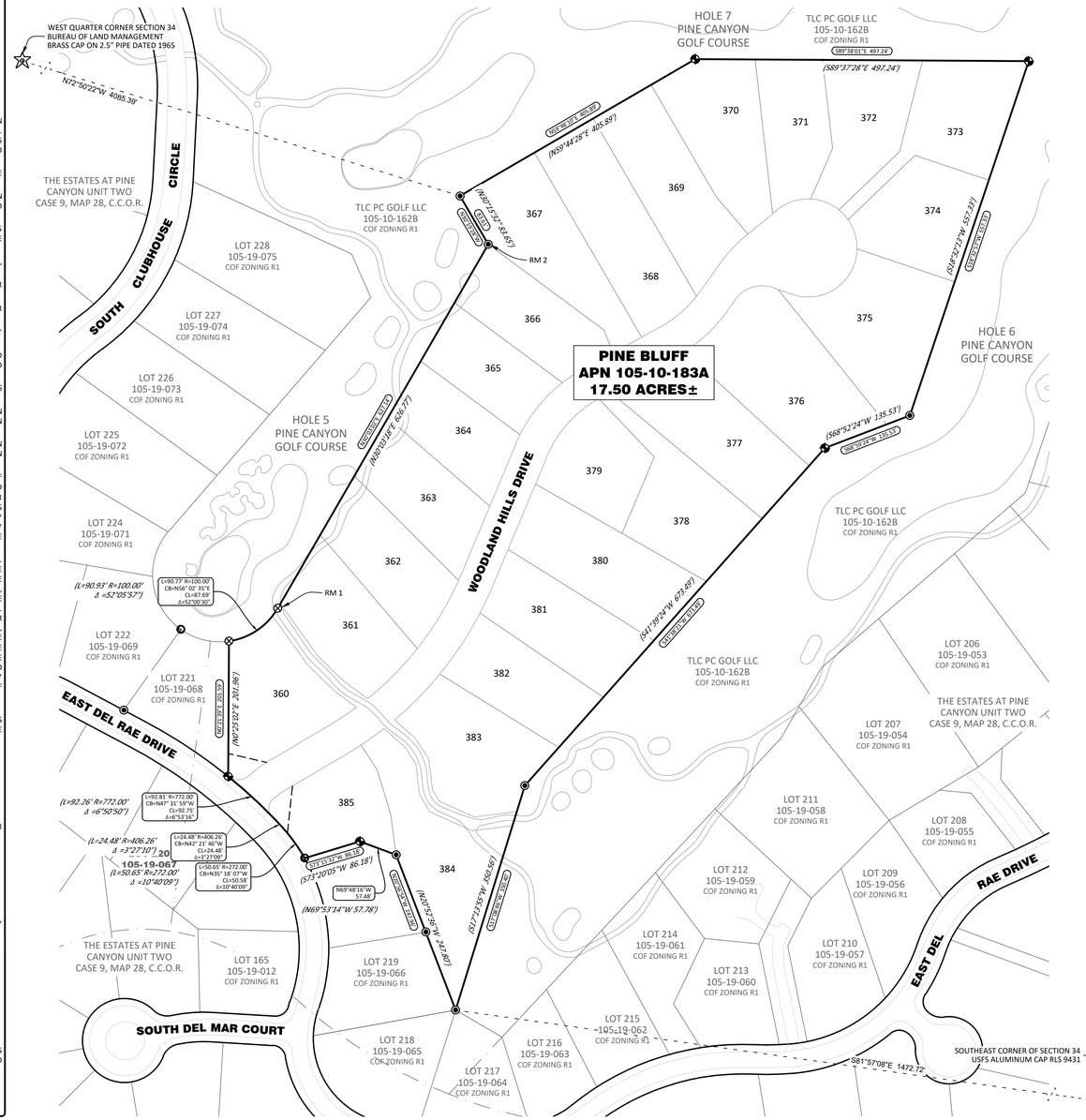
ITS_____

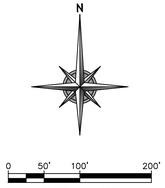
TLC PC LAND INVESTORS, LLC, AN ARIZONA LIMITED LIABILITY COMPANY ("GRANTOR")

BY: _____
DATE: _____

STATE OF ARIZONA)
) SS
COUNTY OF COCONINO)
ON THIS_____DAY OF _____, 20__, BEFORE ME PERSONALLY
APPEARED_____, THE_____, AN_____
FOR AND ON BEHALF THEREOF, WHOSE IDENTITY WAS PROVEN TO ME ON THE BASIS OF SATISFACTORY EVIDENCE TO BE THE PERSON WHO HE OR SHE CLAIM TO BE, AND ACKNOWLEDGED THAT HE OR SHE SIGNED THE ABOVE DOCUMENT.

_____
NOTARY PUBLIC





THERE ARE PUBLIC UTILITIES LOCATED WITHIN THE SUBJECT PROPERTY. PLEASE CONTACT AZ811 BEFORE CONSTRUCTION.

TRACT AREAS

A	69,476 S.F. OR 1.60 ACRES±
B1	3,804 S.F. OR 0.09 ACRES±
B2	5,425 S.F. OR 0.13 ACRES±

PROJECT INFORMATION

CLIENT:
TLC PC LAND INVESTORS, LLC
8601 NORTH SCOTTSDALE ROAD SUITE 335
SCOTTSDALE, ARIZONA 85253
(928) 830-0866

ENGINEER / SURVEYOR:
GRANITE BASIN ENGINEERING, INC.
1981 COMMERCE CENTER CIRCLE, SUITE B
PRESCOTT, ARIZONA 86301
(928) 717-0171
DAVIN M. BENNER, PE #37846
THOMAS A. LIUZZO, RLS #33861

SITE DATA:
ASSESSOR PARCEL NUMBER(S)
105-10-183A (17.5 AC.±)
2080 EAST DEL RAE DRIVE

SITE DATA:
1.49 UNITS PER ACRE

ZONING NOTE:
CITY OF FLAGSTAFF ZONING INFORMATION
R1; SINGLE FAMILY RESIDENTIAL
(SEE BUILDING ENVELOPE DATA, SHEETS 5 & 6)

PLAT NOTES

AIRPORT OVERFLIGHT AREA. THE PROPERTY IS LOCATED WITHIN AIRCRAFT OVERFLIGHT AREA AS SHOWN IN THE AIRPORT MASTER PLAN. THIS PROPERTY MAY BE AFFECTED BY NOISE OR EMISSIONS FROM AIRCRAFT.

RESOURCE PROTECTION. A BUILDING ENVELOPE FOR EACH LOT IS SHOWN AND PLATTED HEREON FOR THE PURPOSE OF MAINTAINING RESOURCES IN ACCORDANCE WITH THE ZONING CODE'S RESOURCE PROTECTION OVERLAY DESIGNATION. ALL DEVELOPMENT ON A LOT SHALL OCCUR WITHIN THE BUILDING ENVELOPE, EXCEPT THAT ACCESSORY STRUCTURES THAT COMPLY WITH THE REQUIREMENTS OF THE ZONING CODE MAY BE DEVELOPED OUTSIDE OF THE BUILDING ENVELOPE, PROVIDED THAT NO RESOURCES ARE REMOVED OR ENCROACHED UPON. A MODIFICATION TO A LOT'S BUILDING ENVELOPE THAT COMPLIES WITH THE ZONING CODE MAY BE APPROVED BY THE CITY OF FLAGSTAFF'S PLANNING DIRECTOR AND RECORDED IN COCONINO COUNTY, ARIZONA. ALL APPLICABLE PROVISIONS OF THE ZONING CODE, AS AMENDED, SHALL APPLY.

CITY OF FLAGSTAFF CERTIFICATION

IT IS HEREBY CERTIFIED THAT THIS PLAT HAS BEEN OFFICIALLY APPROVED FOR THE RECORD BY THE COUNCIL OF THE CITY OF FLAGSTAFF, ARIZONA ON THE_____ DAY OF _____, 20__.

BY: _____
MAYOR

ATTEST: _____
CITY CLERK

IT IS HEREBY CERTIFIED THAT THIS PLAT HAS BEEN OFFICIALLY APPROVED FOR THE RECORD BY THE INTER-DIVISION STAFF REVIEW OF THE CITY OF FLAGSTAFF, ARIZONA ON THE DAY OF _____, 20__.

BY: _____
CITY ENGINEER

BY: _____
PLANNING DIRECTOR

UTILITY COMPANY APPROVALS

ARIZONA PUBLIC SERVICE COMPANY	DATE
UNISOURCE ENERGY SERVICES	DATE
CENTURYLINK	DATE
SPARKLIGHT	DATE

BASIS OF BEARINGS & BENCHMARKS

THE BASIS OF BEARING FOR THIS PROJECT IS N30°03'02"E A DISTANCE OF 627.14 FEET ALONG THE NORTHWEST LINE OF THE SUBJECT PARCEL BETWEEN A SURVEY NAIL AND TAG RLS 23372 AT THE WESTERN "PT" AND A 1/2" REBAR AND CAP RLS 23372 AS A WESTERN ANGLE POINT.

REFERENCE MARK	NORTHING	EASTING	ELEVATION(29)
RM 1	37032.86	35330.44	6990.37
RM 2	37575.70	35644.49	6971.52

THE COORDINATE SYSTEM FOR THIS PROJECT IS THE CITY OF FLAGSTAFF LOCAL COORDINATE SYSTEM MODIFIED FROM ARIZONA STATE PLANE CENTRAL ZONE. THE PROJECT IS DESIGNED ON THE NGVD 29 VERTICAL DATUM, ADD 3.44 FEET TO ALL ELEVATIONS TO ARRIVE AT THE NAVD 88 ELEVATION.

SURVEYOR'S CERTIFICATE:

I, THOMAS A. LIUZZO, DO HEREBY CERTIFY THAT I AM A REGISTERED LAND SURVEYOR, AND THAT I HOLD LICENSE NUMBER 33861 AS PRESCRIBED UNDER THE LAWS OF THE STATE OF ARIZONA, I FURTHER CERTIFY THAT I HAVE PREPARED THIS PLAT FROM THE ORIGINAL FIELD NOTES MADE DURING A SURVEY OF THE TRACT OF LAND SHOWN ON THIS PLAT AND THAT THIS PLAT IS A TRUE AND ACCURATE MAP OF THE LAND SURVEYED AND WAS PREPARED IN ACCORDANCE WITH THE ARIZONA MINIMUM STANDARDS FOR LAND SURVEY EFFECTIVE FEBRUARY 2002.

SHEET INDEX

1	SITE OVERVIEW
2	LOTTING PLAN
3	BUILDING ENVELOPES PLAN
4	BUILDING ENVELOPE GEOMETRIC TABLES

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REVISIONS

DESCRIPTION	NUM.	DATE	BY

	FOR REVIEW ONLY	FOR BID ONLY	FOR APPROVAL ONLY	FOR RECORDING ONLY	FOR CONSTRUCTION ONLY	FOR AS-BUILT ONLY
	☐	☐	☒	☐	☐	☐

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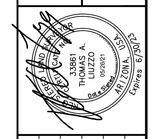
WWW.GRANITEBASINENGINEERING.COM

TLC PC LAND INVESTORS, LLC
8601 NORTH SCOTTSDALE ROAD SUITE 335
SCOTTSDALE, ARIZONA 85253

FINAL PLAT FOR
THE ESTATES AT PINE CANYON - PINE RUN
SITE OVERVIEW



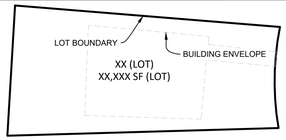
JOB:	19010
DATE:	05/26/21
SCALE:	AS SHOWN
FIELD:	DP
DRAWN:	TL/TS
CHECKED:	TL

1

SHEET 1 OF 4

FILE: Z:\Projects\PINE_CANYON\PROJECTS\19010 PC Tract 9\DWG\PPLAT\19010 FINAL PLAT S1.dwg <<C3D_Imperial>>

PLOTTED: May 27, 2021 – 10:30am



TYPICAL LOT DETAIL

NOT TO SCALE

THERE ARE PUBLIC UTILITIES LOCATED WITHIN THE SUBJECT PROPERTY. PLEASE CONTACT AZ811 BEFORE CONSTRUCTION.

FINAL PLAT FOR

THE ESTATES AT PINE CANYON
PINE RUN

PZ-19-00099-02

APN 105-10-183A

A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 1"
RECORDED AT CASE 8 OF MAPS, PAGE 92, C.C.O.R.
AND
A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 2"
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SITUATED IN THE SOUTHEAST QUARTER OF SECTION 34, TOWNSHIP 21 NORTH, RANGE 7 EAST
OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA

CURVE DATA					
CURVE #	ARC LENGTH	RADIUS	DELTA	CHORD BEARING	CHORD LENGTH
C1	59.20	200.00	16.96	N50° 57' 50"E	58.99
C2	320.21	500.00	36.69	N41° 05' 50"E	314.77
C3	134.42	200.00	38.51	N42° 00' 18"E	131.91
C4	90.00	200.00	25.78	N48° 22' 07"E	89.24
C5	89.37	125.00	40.96	N55° 57' 34"E	87.48
C6	3.49	772.00	0.26	N44° 13' 07"W	3.49
C7	31.29	18.00	99.59	N6° 08' 54"E	27.50
C9	13.64	100.00	7.82	N33° 56' 51"E	13.63
C10	14.12	225.00	3.59	S24° 32' 52"W	14.12
C11	100.95	225.00	25.71	S39° 11' 57"W	100.11
C12	36.15	225.00	9.21	S56° 39' 23"W	36.12
C13	71.04	175.00	23.26	S49° 37' 48"W	70.56
C14	7.70	175.00	2.52	S36° 44' 20"W	7.70

CURVE DATA					
CURVE #	ARC LENGTH	RADIUS	DELTA	CHORD BEARING	CHORD LENGTH
C15	58.93	225.00	15.01	S42° 58' 51"W	58.76
C16	54.29	73.00	42.61	S71° 47' 22"W	53.05
C17	45.57	73.00	35.77	N69° 01' 13"W	44.84
C18	20.06	73.00	15.75	N43° 15' 42"W	20.00
C19	46.46	73.00	36.46	N17° 09' 20"W	45.68

LEGEND

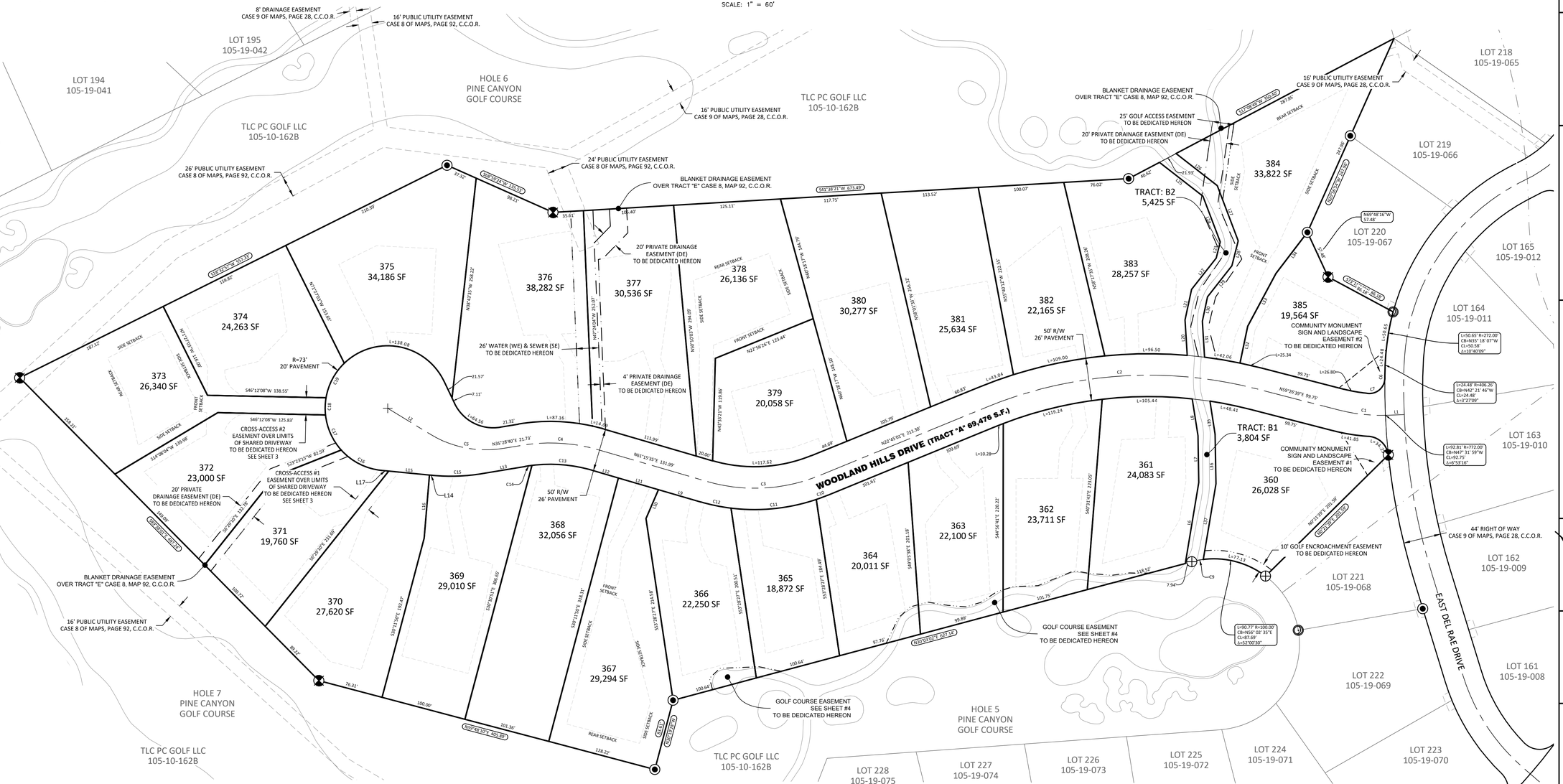
- FOUND 1/2" REBAR & CAP RLS 23372
- FOUND 1/2" REBAR & CAP RLS 23372
- FOUND BOAT SPIKE & WASHER RLS 23372
- FOUND 1/2" REBAR NO MARKINGS
- CALCULATED POINT NOTHING FOUND OR SET
- TO BE SET 1/2" REBAR WITH MARKINGS RLS 33861
- S45°45'45"W 45.00' — PROPOSED LOT DATA BASED ON CALCULATIONS
- S73°15'32"W 86.18' — PARENT PARCEL DATA BASED ON FIELD SURVEY
- (S55°55'55"W 50.00')R — RECORD DATA; CASE 9 OF MAPS PAGE 28 OF C.C.O.R.
- PROPOSED LOT BOUNDARY
- PLATTED RIGHT OF WAY
- ADJACENT BOUNDARY LINE
- CENTERLINE
- BUILDING ENVELOPES
- BOUNDARY TIE LINES
- EXISTING EASEMENT AS NOTED
- GOLF COURSE EASEMENT
- SIGN & LANDSCAPE EASEMENT
- WATER & SEWER EASEMENT
- PRIVATE DRAINAGE EASEMENT

LINE DATA		
LINE #	LENGTH	BEARING
L1	18.05	N42° 29' 00.14"E
L2	57.98	N76° 26' 29.10"E
L6	95.91	N35° 31' 36.42"W
L7	54.60	N45° 59' 42.90"W
L8	43.62	N53° 52' 18.01"W
L9	51.43	S61° 15' 35.04"W
L10	36.75	S21° 38' 30.75"E
L11	48.72	S61° 15' 35.04"W
L12	31.84	S61° 15' 35.04"W
L13	50.53	S35° 28' 39.58"W
L14	3.63	S50° 29' 03.29"W
L15	47.72	S50° 29' 03.29"W
L16	73.89	S40° 13' 40.60"E
L17	8.26	S50° 29' 03.29"W
L20	41.46	N48° 31' 54.90"W
L21	36.52	N33° 07' 37.01"W
L22	46.51	N6° 43' 51.13"W

LINE DATA		
LINE #	LENGTH	BEARING
L23	19.56	N30° 57' 44.82"W
L24	57.02	N65° 47' 06.10"W
L25	64.31	S82° 56' 29.64"W
L26	60.92	N82° 56' 29.64"E
L27	68.89	S65° 47' 06.10"E
L28	30.12	S30° 57' 44.82"E
L29	46.11	S6° 43' 51.13"E
L30	29.13	S33° 07' 37.01"E
L31	42.11	S48° 31' 54.90"E
L32	43.86	N33° 19' 16.24"W
L33	70.00	N16° 51' 10.95"W
L34	60.55	N7° 32' 17.24"W
L35	39.18	S53° 52' 18.01"E
L36	57.81	S45° 59' 42.90"E
L37	89.67	S35° 31' 36.42"E

0 30' 60' 120'

SCALE: 1" = 60'



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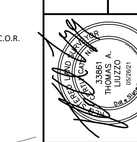
FINAL PLAT FOR
THE ESTATES AT PINE CANYON - PINE RUN
LOTTING PLAN



JOB:	19010
DATE:	05/26/21
SCALE:	AS SHOWN
FIELD:	DP
DRAWN:	TL/TS
CHECKED:	TL

2

SHEET 2 OF 4

FILE: Z:\Projects\PINE CANYON\PROJECTS\19010 PC Tract 9\DWG\FPLAT\19010 FINAL PLAT S2.dwg <<C3D_Imperial>>

PLOTTED: May 26, 2021 – 10:53am

FINAL PLAT FOR
THE ESTATES AT PINE CANYON
PINE RUN

PZ-19-00099-02
APN 105-10-183A
A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 1"
RECORDED AT CASE 8 OF MAPS, PAGE 92, C.C.O.R.
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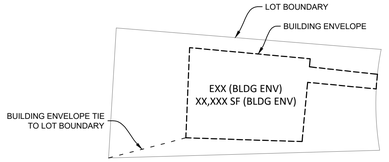
0 30' 60' 120'
SCALE: 1" = 60'



TYPICAL BUILDING ENVELOPE DETAIL
NOT TO SCALE

DRIVEWAY SLOPES	
LENGTH	MAXIMUM DRIVEWAY SLOPE
0' TO 25'	* 16%
25' TO 150'	* 20%
150'+	* 10%

(*) NOTE: UNLESS A MORE GENTLE SLOPE IS REQUIRED BY CITY CODE AT THE TIME OF BUILDING PERMIT REVIEW.

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WWW.GRANITEBASINENGINEERING.COM

TLC PC LAND INVESTORS, LLC
8601 NORTH SCOTTSDALE ROAD SUITE 335
SCOTTSDALE, ARIZONA 85253

FINAL PLAT FOR
THE ESTATES AT PINE CANYON - PINE RUN
BUILDING ENVELOPES PLAN

REGISTERED LAND SURVEYOR 33861 THOMAS A. LEDFORD ARIZONA 6/30/22

JOB:	19010
DATE:	05/20/21
SCALE:	AS SHOWN
FIELD:	DP
DRAWN:	TL/TS
CHECKED:	TL

3
SHEET 3 OF 4

FILE: Z:\Projects\PINE CANYON\PROJECTS\19010 PC Tract 9\DWG\FPLAT\19010 FINAL PLAT S3.dwg <<t3D_Imperial>>

PLOTTED: May 26, 2021 – 10:53am

FINAL PLAT FOR

THE ESTATES AT PINE CANYON
PINE RUN

PZ-19-00099-02

APN 105-10-183A

A SUBDIVISION OF A PORTION OF TRACT 9 "THE ESTATES AT PINE CANYON - UNIT 1"
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RECORDED AT CASE 9 OF MAPS, PAGE 28, C.C.O.R.
SITUATED IN THE SOUTHEAST QUARTER OF SECTION 34, TOWNSHIP 21 NORTH, RANGE 7 EAST
OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA

LOT 360 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L100	63.99	N68° 33' 11.11"E	
L101	54.05	S35° 31' 36.42"E	
L102	41.69	S31° 52' 52.00"E	
L103	69.20	S59° 26' 46.13"W	
L104	49.83	S30° 33' 13.87"E	
L105	16.00	S59° 26' 46.13"W	
L106	49.83	N30° 33' 13.87"W	
L107	9.82	S59° 26' 46.13"W	
L108	33.61	N70° 49' 47.00"W	
L109	93.26	N0° 21' 38.56"E	
L110	28.69	N31° 09' 31.51"W	

LOT 361 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L111	146.54	S36° 03' 14.45"E	
L112	38.23	S42° 32' 23.67"W	
L113	48.61	S42° 00' 54.69"E	
C100	16.00	1.93	475.00
L114	47.35	N42° 00' 54.69"W	
L115	19.91	S42° 32' 23.67"W	
L116	52.19	N45° 59' 42.90"W	
L117	45.11	N35° 31' 36.42"W	
L118	37.21	N14° 42' 18.83"W	
L119	74.15	N30° 03' 01.94"E	
L120	35.16	N15° 16' 23.77"W	

LOT 362 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L121	126.13	S44° 56' 41.00"E	
L122	48.58	S44° 42' 54.49"W	
L123	35.37	S41° 24' 16.04"E	
L124	31.48	S14° 40' 02.07"E	
L125	24.28	S53° 43' 46.70"E	
C101	16.01	1.93	475.00
L126	30.38	N53° 43' 46.70"W	
L127	33.35	N14° 40' 02.07"W	
L128	30.48	N41° 24' 16.04"W	
L129	13.67	S44° 42' 54.49"W	
L130	108.17	N40° 31' 43.45"W	
L131	72.43	N30° 03' 01.94"E	
L132	33.45	N18° 18' 19.48"W	

LOT 363 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L133	123.86	S53° 28' 26.86"E	
L134	9.00	S22° 10' 36.65"W	
L135	35.22	S65° 37' 06.77"E	
C102	2.57	0.65	225.00
L136	13.44	S22° 45' 01.27"W	
L137	35.05	N65° 37' 06.77"W	
L138	47.53	S22° 10' 36.65"W	
L139	128.19	N55° 01' 43.51"W	
L140	75.02	N26° 00' 28.87"E	
L141	28.13	N32° 39' 09.59"W	

LOT 364 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L142	92.67	S49° 05' 38.26"E	
L143	34.35	S8° 14' 54.01"E	
L144	23.47	S5° 21' 17.27"W	
L145	30.83	S88° 29' 33.64"E	
L146	20.23	S66° 49' 01.71"E	
L147	16.00	S22° 45' 01.27"W	
L148	17.29	N66° 49' 01.71"W	
L149	28.84	N88° 29' 33.64"W	
L150	20.66	S5° 21' 17.27"W	
L151	147.84	N48° 26' 15.32"W	
L152	34.13	N30° 03' 01.94"E	
L153	36.21	N41° 53' 18.80"E	
L154	38.90	N26° 24' 52.74"W	

LOT 365 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L155	170.02	S53° 28' 26.86"E	
C103	16.23	4.13	225.00
L156	42.52	N53° 28' 26.86"W	
L157	58.60	S59° 22' 22.74"W	
L158	94.12	N53° 28' 26.86"W	
L159	70.45	N30° 03' 01.94"E	
L160	30.77	N24° 17' 44.26"W	

LOT 366 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L161	160.40	S53° 28' 26.86"E	
L162	29.69	S52° 21' 17.41"W	
L163	18.51	S53° 28' 26.86"E	
L164	33.69	S33° 09' 38.99"E	
C104	16.04	0.50	1826.28
L165	29.63	N33° 09' 38.99"W	
L166	20.18	N53° 28' 26.86"W	
L167	22.53	N72° 12' 51.10"W	
L168	19.92	S60° 34' 07.44"W	
L169	110.36	N53° 28' 26.86"W	
L170	70.45	N30° 03' 01.94"E	
L171	30.77	N24° 17' 44.26"W	

LOT 367 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L172	88.16	N59° 48' 10.45"E	
L173	174.77	S30° 11' 49.55"E	
L174	39.11	S38° 45' 26.39"E	
L175	38.94	S18° 47' 43.71"E	
L176	41.48	S22° 50' 25.76"E	
L177	16.09	S61° 15' 35.04"W	
L178	44.56	N22° 50' 25.76"W	
L179	35.79	N18° 42' 18.48"W	
L180	36.00	N39° 05' 43.07"W	
L181	20.28	N30° 11' 49.55"W	
L182	11.00	S59° 48' 10.45"W	
L183	123.72	N59° 46' 02.31"W	
L184	49.62	N30° 19' 28.24"W	
L185	35.39	N75° 15' 38.89"W	

LOT 368 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L186	100.00	S30° 10' 50.95"E	
L187	5.01	S59° 51' 13.27"W	
L188	19.92	S49° 00' 13.87"E	
C105	16.02	5.25	175.00
L189	24.65	N49° 00' 13.87"W	
L190	54.37	S59° 51' 13.27"W	
L191	100.00	N30° 11' 49.55"W	
L192	76.31	N59° 51' 13.27"E	
L193	191.25	N27° 11' 00.70"W	

LOT 369 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L194	131.07	S30° 11' 49.55"E	
L195	29.01	S59° 49' 09.05"W	
L196	56.34	S55° 46' 41.70"E	
L197	36.49	S30° 38' 06.03"E	
C106	16.75	4.27	225.00
L198	37.88	N30° 38' 06.03"W	
L199	60.43	N55° 46' 41.70"W	
L200	28.30	S59° 49' 09.05"W	
L201	65.72	N34° 32' 39.77"W	
L202	65.53	N30° 10' 50.95"W	
L203	80.01	N59° 48' 10.45"E	
L204	53.60	N19° 26' 42.52"W	

LOT 370 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L205	37.68	N59° 48' 10.45"E	
L206	75.32	S89° 38' 01.33"E	
L207	99.40	S6° 29' 10.14"E	
L208	33.29	S23° 57' 59.69"E	
L209	76.56	S6° 29' 10.14"E	
L210	11.93	S50° 29' 03.29"W	
L211	61.55	N6° 29' 10.14"W	
L212	55.84	N23° 57' 59.69"W	
L213	58.23	S83° 30' 49.86"W	
L214	99.34	N26° 40' 36.08"W	
L215	40.45	N82° 01' 05.35"W	

LOT 371 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L216	80.58	S89° 38' 01.33"E	
L217	104.81	S6° 29' 10.14"E	
L218	60.49	S83° 30' 49.86"W	
L219	34.09	S28° 25' 16.99"W	
L220	56.54	S6° 29' 10.14"E	
C117	3.62	2.84	73.00
L221	8.26	S50° 29' 03.29"W	
L222	17.47	N28° 25' 16.99"E	
L223	114.42	N6° 29' 10.14"W	
L224	28.21	N27° 14' 43.73"W	

LOT 372 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L225	84.81	S14° 08' 04.30"W	
L226	17.70	S43° 47' 52.07"E	
C108	39.91	76.23	30.00
L229	63.61	S83° 30' 49.86"W	
L230	107.42	N6° 32' 59.24"W	
L231	109.16	S89° 38' 01.33"E	
L227	15.33	S14° 08' 04.30"W	
L228	37.01	S46° 12' 07.93"W	
L232	33.94	N40° 21' 49.79"E	

LOT 373 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L233	70.00	S18° 32' 57.08"W	
L234	83.14	N71° 27' 02.92"W	
L235	16.47	S46° 12' 07.93"W	
L236	50.00	S46° 12' 07.93"W	
L237	89.01	S46° 12' 07.93"W	
C109	20.06	15.75	73.00
L238	88.82	N46° 12' 07.93"E	
L239	8.14	S43° 47' 52.07"E	
L240	15.26	N46° 12' 07.93"E	
L241	75.61	N14° 08' 04.30"E	
L242	55.23	S57° 12' 11.51"E	
L243	53.71	S71° 27' 02.92"E	
L244	105.14	N32° 18' 17.93"E	

LOT 374 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L245	68.70	N53° 29' 08.60"W	
L246	48.87	N1° 20' 09.63"W	
L247	40.23	N30° 42' 53.06"E	
C110	47.12	90.00	30.00
L248	33.20	S43° 47' 52.07"E	
L249	61.38	S71° 27' 02.92"E	
L250	122.70	S18° 32' 57.08"W	
L251	33.38	S29° 57' 02.77"E	

LOT 375 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L252	100.00	N42° 07' 41.51"W	
L253	53.48	N47° 52' 18.49"E	
L254	16.41	N56° 32' 55.64"W	
C111	16.13	12.66	73.00
L255	18.75	S56° 32' 55.64"E	
L256	87.19	S71° 27' 02.92"E	
L257	48.97	S18° 32' 57.08"W	
L258	70.00	S47° 52' 18.49"W	
L259	94.80	S15° 23' 52.26"E	

LOT 376 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L260	60.43	S33° 31' 10.25"W	
L261	26.38	S37° 21' 34.83"W	
L262	119.53	N47° 24' 03.66"W	
L263	16.69	N42° 35' 56.34"E	
L264	35.00	N75° 53' 29.30"W	
L265	75.00	N47° 24' 03.66"W	
C112	16.21	4.17	222.50
L266	68.38	S47° 24' 03.66"E	
L267	39.62	S75° 53' 29.30"E	
L268	26.06	N42° 35' 56.34"E	
L269	110.45	S60° 28' 30.03"E	
L270	81.50	S63° 31' 59.70"E	

LOT 377 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L271	34.24	N50° 10' 02.89"W	
L272	95.18	N37° 18' 43.03"W	
L273	21.97	N64° 22' 24.43"W	
L274	80.77	N37° 26' 06.78"W	
L275	16.19	N61° 15' 35.04"E	
L276	74.49	S37° 26' 06.78"E	
L277	33.49	S64° 22' 24.43"E	
L278	29.82	N21° 22' 34.22"E	
L279	20.20	N42° 35' 56.34"E	
L280	119.52	S47° 24' 03.66"E	
L281	83.31	S36° 16' 45.04"W	
L282	50.87	S38° 49' 51.02"E	

LOT 378 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L283	74.91	N64° 35' 07.13"W	
L284	97.10	N22° 56' 25.97"E	
L285	134.59	N43° 46' 42.88"W	
L286	16.57	N61° 15' 35.04"E	
L287	123.41	S43° 46' 42.88"E	
L288	82.45	S50° 10' 02.89"E	
L289	93.88	S25° 24' 52.87"W	
L290	65.06	S33° 04' 28.22"E	

LOT 379 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L291	93.33	N60° 18' 17.27"W	
L292	16.12	N22° 45' 01.27"E	
L293	15.74	S60° 18' 17.27"E	
L294	33.85	N24° 59' 13.86"E	
L295	50.84	N38° 19' 38.85"E	
L296	74.69	S60° 18' 17.27"E	
L297	100.00	S29° 41' 42.73"W	
L298	58.93	S45° 33' 34.21"E	

LOT 380 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L299	155.36	N58° 01' 33.08"W	
L300	16.21	N22° 45' 01.27"E	
L301	33.51	S57° 59' 25.59"E	
L302	31.11	N28° 58' 11.06"E	
L303	74.88	S87° 23' 00.89"E	
L304	57.44	S60° 18' 17.27"E	
L305	86.11	S29° 41' 42.73"W	
L306	104.49	S49° 46' 19.07"E	

LOT 381 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L307	100.00	N55° 40' 12.49"W	
L308	67.05	N34° 19' 47.51"E	
L309	26.57	N67° 14' 58.73"W	
L310	16.00	N22° 45' 01.27"E	
L311	29.85	S67° 14' 58.73"E	
L312	100.08	S58° 01' 33.08"E	
L313	87.50	S34° 19' 47.51"W	
L314	109.87	S50° 26' 53.68"E	

LOT 382 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L315	158.16	N58° 17' 35.08"W	
C113	16.06	1.75	525.00
L316	17.09	S58° 17' 35.08"E	
L317	61.96	N31° 42' 24.92"E	
L318	105.57	S55° 40' 12.49"E	
L319	80.72	S6° 39' 24.34"W	
L320	50.59	S41° 02' 45.78"E	

LOT 383 ENVELOPE

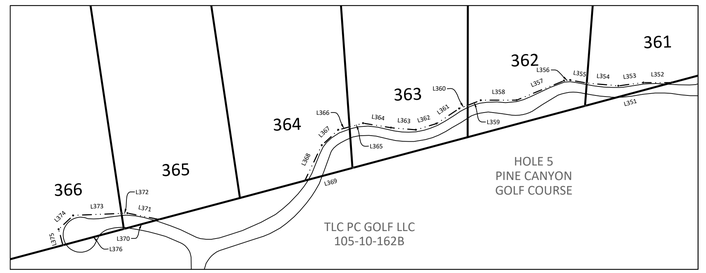
SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L321	70.16	S31° 42' 24.92"W	
L322	52.90	N67° 29' 11.14"W	
L323	26.91	N77° 09' 03.69"W	
L324	30.75	N42° 06' 56.30"W	
L325	44.70	N31° 42' 24.92"E	
L326	47.05	N46° 26' 44.62"W	
C114	16.00	1.75	525.00
L327	43.90	S46° 26' 44.62"E	
L328	17.69	N31° 42' 24.92"E	
L329	107.22	S58° 17' 35.08"E	
L330	63.60	S71° 56' 08.10"E	

LOT 384 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L331	209.42	N20° 56' 53.81"W	
L332	9.40	N5° 20' 03.48"W	
L333	102.55	N20° 51' 22.74"W	
L334	29.65	N34° 33' 41.20"W	
C115	16.00	1.75	525.00
L335	31.81	S34° 33' 41.20"E	
L336	108.92	S20° 51' 22.74"E	
L337	6.79	N84° 40' 26.69"E	
L338	53.97	S65° 47' 06.10"E	
L339	34.65	S34° 30' 31.55"E	
L340	32.46	S51° 55' 54.19"E	
L341	142.71	S17° 06' 00.58"W	
L342	76.44	S1° 51' 33.88"E	

LOT 385 ENVELOPE

SEGMENT #	LENGTH	BEARING/DELTA	RADIUS
L343	70.00	N16° 51' 10.95"W	
L344	83.16	N73° 08' 49.05"E	
L345	37.00	N35° 00' 14.34"W	
L350	1.30	N59° 26' 39.08"E	
C116	14.73	1.61	525.00
L346	41.21	S35° 00' 45.31"E	
L347	70.00	S16° 51' 10.95"E	
L348	100.00	S73° 08' 49.05"W	
L349	40.63	S35° 15' 00.36"W	



GOLF COURSE EASEMENT

LINE #	LENGTH	BEARING
L351	75.31	S30° 03' 01.94"W
L352	23.66	S45° 09' 54.75"W
L353	21.22	S37° 30' 48.20"W
L354	26.67	S50° 05' 10.50"W
L355	13.99	S55° 09' 15.64"W
L356	5.18	S40° 10' 48.10"W
L357	43.07	S22° 41' 48.66"W
L358	29.88	S44° 46' 35.80"W
L359	11.88	S24° 16' 36.80"W
L360	7.63	S24° 16' 36.80"W
L361	22.78	S11° 07' 55.43"W
L362	18.06	S28° 22' 47.67"W
L363	20.91	S49° 40' 38.34"W

LINE #	LENGTH	BEARING
L364	23.68	S54° 16' 01.52"W
L365	11.82	S30° 09' 17.59"W
L366	9.82	S30° 09' 17.59"W
L367	18.95	S1° 45' 02.90"W
L368	32.81	S19° 20' 28.33"E
L369	41.37	N30° 03' 01.94"E
L370	30.55	S30° 03' 01.94"W
L371	26.87	S56° 21' 24.83"W
L372	5.11	S42° 39' 03.57"W
L373	40.58	S42° 39' 03.57"W
L374	16.84	S1° 20' 24.14"W
L375	13.79	S59° 56' 58.06"E
L376	52.90	N30° 03' 01.94"E

REVISIONS

NUM.	DESCRIPTION	DATE	BY

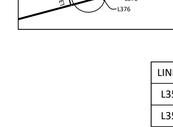
☐ FOR REVIEW ONLY
☐ FOR BID ONLY
☒ FOR APPROVAL ONLY
☐ FOR RECORDING ONLY
☐ FOR CONSTRUCTION ONLY
☐ FOR AS-BUILT ONLY

Call at least two full working days before you begin excavation
ARIZONA 811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County: (602) 263-1100

GRANITE BASIN ENGINEERING, INC.
CIVIL ENGINEERING & LAND PLANNING
1061 COMMERCE CENTER DRIVE, SUITE 101, PRESCOTT, ARIZONA 86301
PH: (928) 237-0171 FAX: (928) 237-0181
WWW.GRANITEBASINENGINEERING.COM

TLC PC LAND INVESTORS, LLC
8601 NORTH SCOTTSDALE ROAD SUITE 335
SCOTTSDALE, ARIZONA 85253

FINAL PLAT FOR
THE ESTATES AT PINE CANYON - PINE RUN
BUILDING ENVELOPE GEOMETRIC TABLES



JOB: 19010
DATE: 05/26/21
SCALE: AS SHOWN
FIELD: DP
DRAWN: TL/TS
CHECKED: TL

4

SHEET 4 OF 4

FILE: Z:\Projects\PINE CANYON\PROJECTS\19010 PC Tract 9\DWG\PPLAT\19010 FINAL PLAT S4.dwg <<C3D_Imperial>>

CITY / SUBDIVIDER AGREEMENT
CITY OF FLAGSTAFF, ARIZONA

This Agreement is entered into by and between the CITY OF FLAGSTAFF, a municipal corporation duly created and existing under the laws of the State Arizona, hereinafter referred to as CITY; and TLC PC LAND INVESTORS, LLC Subdivider, hereinafter referred to as SUBDIVIDER.

W I T N E S S E TH

WHEREAS, TLC PC LAND INVESTORS LLC (Subdivider) desires to subdivide property within the City of Flagstaff, Arizona known as THE ESTATES AT PINE CANYON-PINE RUN; and

WHEREAS, CITY is agreeable to accepting said subdivision as proposed; providing that the subdivider constructs the subdivision in accordance with City standards and as set forth in the approved preliminary plat, and while fulfilling the obligations set forth below, which the subdivider hereby assumes; and

WHEREAS, building permit(s) is (are) required and will be issued following execution of this agreement;

NOW, THEREFORE, in consideration of the subdivision and the mutual covenants of the parties hereinafter expressed, the parties hereto agree as follows:

1. SUBDIVIDER agrees to construct all improvements in conformance with the CITY'S Subdivision Regulations and the "General Construction, Standards and Specifications" of the CITY, and to employ a responsible supervisor.

2. SUBDIVIDER further agrees to dedicate all streets and rights-of-way to the CITY for public use and to offer all public improvements to the CITY for acceptance into the CITY system.

3. The CITY agrees to accept the Subdivision as platted and to accept ownership of public improvements upon their completion and approval by the CITY.

4. In the event that the CITY should be required to institute any action for the enforcement of this agreement, SUBDIVIDER, shall be required to pay a reasonable attorney's fee in addition to all other costs assessed in any such action.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed on their own behalf and by the duly authorized officials and officers on the day and year herein written.

(Signed): _____

AUTHORIZED AGENT
Subdivider/Title

_____
Subdivider/Title

STATE OF ARIZONA)
) ss
County of Coconino)

SUBSCRIBED AND SWORN to before me this 28 day of April, 2021 by Peter Burger.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

SWANIE SACCENTE
Notary Public
Commission Number 581002
Expires: April 21, 2024
Maricopa County

_____
Notary Public

My Commission expires: 4/21/24

Dated this _____ day of _____ 20_____ in Flagstaff, Coconino County, Arizona.

By: _____
Mayor

ATTEST:

_____
City Clerk

Kaline Hutchinson

From:	Kaline Hutchinson
Sent:	Tuesday, August 6, 2019 11:29 AM
To:	'MEGAN.MCCARTHY@APS.COM'
Subject:	Will Serve Letter - The Estates at Pine Canyon - Pine Bluff
Attachments:	II.2_Concept Plat (revised 2019-07-11).pdf; 19010 - Pine Bluff at PC - Will Serve - APS.pdf

Good Morning Megan –

Please find a request for a "will serve" letter for The Estates at Pine Canyon – Pine Bluff. Also attached is a Concept Plat for your reference. Please let me know if you need anything else. We hope to submit for Final Plat no later than the 20th of August.

We sincerely appreciated your time and consideration.

GRANITE BASIN ENGINEERING, INC

Kaline Hutchinson
Operations Manager
1981 Commerce Center Circle, Suite B
Prescott, Arizona, 86301
Office: 928-717-0171
www.granitebasinengineering.com

aps

2200 E Huntington Dr.
Flagstaff, AZ 86004

August 6, 2019

Kaline Hutchinson
Granite Basin Engineering, INC
1981 Commerce Center Circle, Ste. B
Prescott, AZ 86301

Re: The Estates at Pine Canyon – Pine Bluff

Dear Kaline,

The above referenced project is located in Arizona Public Service Company's electric service area. The Company extends its lines in accordance with the "Conditions Governing Extensions of Electric Distribution Lines and Services," Schedule 3, and the "Terms and Conditions for the Sale of Electric Service," Schedule 1, on file with the Arizona Corporation Commission at the time we begin installation of the electric facilities.

Application for the Company's electric service often involves construction of new facilities for various distances and costs depending upon customer's location, load size and load characteristics. With such variations, it is necessary to establish conditions under which Arizona Public Service will extend its facilities.

The enclosed Schedule 3 policy governs the extension of overhead and underground electric facilities to customers whose requirements are deemed by Arizona Public Service to be usual and reasonable in nature.

Please give me a call at 928-864-8351 when the final plat is approved so that we may set up an appointment to discuss the details necessary for your project.

Sincerely,

Megan McCarthy

Megan McCarthy
Customer Project Rep
Flagstaff Construction

Kaline Hutchinson

From:	Kaline Hutchinson
Sent:	Tuesday, August 6, 2019 11:35 AM
To:	'jason.dale@centurylink.com'
Subject:	Will Serve Letter - The Estates at Pine Canyon - Pine Bluff
Attachments:	II.2_Concept Plat (revised 2019-07-11).pdf; 19010 - Pine Bluff at PC - Will Serve - CenturyLink.pdf

Good Morning Jason –

Please find a request for a "will serve" letter for The Estates at Pine Canyon – Pine Bluff. Also attached is a Concept Plat for your reference. Please let me know if you need anything else or if this should be redirected to another staff member. We hope to submit for Final Plat no later than the 20th of August and sincerely appreciated your time and consideration.

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GRANITE BASIN
ENGINEERING, INC

August 6, 2019

Jason Dale
CenturyLink Field Engineer
112 N. Beaver Street
Flagstaff, AZ 86001

Re: The Estates at Pine Canyon – Pine Bluff

Dear Jason;

On behalf of TLC PC Land Investors, LLC, Granite Basin Engineering is requesting a "will serve" letter from your organization as part of the predevelopment, due diligence review of a proposed 26 residential lot community on parcel 105-10-183A within the Pine Canyon master community as seen in the attached Concept Plat. The 17.5 acre property is located in Section 34, Township 21 North, Range 7 East of the Gila and Salt River Meridian, Flagstaff, AZ.

Please respond at your soonest convenience or let me know if further information is needed. Thank you for your assistance.

Sincerely,

Kaline Hutchinson
Operations Manager
Granite Basin Engineering

1981 Commerce Center Circle, Suite B | Prescott, Arizona 86301 | Phone: 928.717.0171 | Fax: 928.717.0181

GRANITE BASIN
ENGINEERING, INC

August 6, 2019

Martin Conboy
Unisource Energy Services
2901 W. Shamrell Blvd. Ste. 110
Flagstaff, AZ 86001

mconboy@uesaz.com

Re: The Estates at Pine Canyon – Pine Bluff

Dear Martin;

On behalf of TLC PC Land Investors, LLC, Granite Basin Engineering is requesting a "will serve" letter from your organization as part of the predevelopment, due diligence review of a proposed 26 residential lot community on parcel 105-10-183A within the Pine Canyon master community as seen in the attached Concept Plat. The 17.5 acre property is located in Section 34, Township 21 North, Range 7 East of the Gila and Salt River Meridian, Flagstaff, AZ.

Please respond at your soonest convenience or let me know if further information is needed. Thank you for your assistance.

Sincerely,

Kaline Hutchinson
Operations Manager
Granite Basin Engineering

August 6, 2019

Kaline Hutchinson
Granite Basin Engineering
1981 Commerce Center Circle, Suite B
Prescott, Arizona 86301

RE: Estates at Pine Canyon – Pine Bluff

After reviewing your project, we have determined that Unisource Energy Services will be able to serve the new development. We have a 2" PE gas main stubbed out at the southwest end of parcel #105-10-183A, which would serve as our tie in point. A new gas main will need to be installed through the property with all required underground clearances. Service stubs would then be ran to the property corner of each of the 26 lots off of the 2" main line. Thank you for selecting UniSource for your natural gas needs.

If you have any further questions or concerns, feel free to contact me at (928) 525-8135.

Sincerely,

Blake Berner
Planner
UniSource Energy Services
Office (928)525-8135
Cell (928)300-0005

Kaline Hutchinson

From: Kaline Hutchinson
Sent: Monday, August 19, 2019 2:24 PM
To: 'hmurray@coconino.az.gov'
Subject: The Estates at Pine Canyon - Pine Bluff
Attachments: II.2_Concept Plat (revised 2019-07-11).pdf

Good Afternoon Mr. Hugh Murray –

Thank you for returning my call today. I'm sorry that this notice doesn't make any sense to you, but it is simply a prerequisite to notify the Coconino County Health Department per Item 5 of their Preliminary Plat Application Checklist. I appreciate your agreement to accept this notification, though you're not aware of the necessity.

On behalf of TLC PC Land Investors, LLC, Granite Basin Engineering is notifying you of our intent to file a Preliminary Plat Application for The Estates at Pine Canyon – Pine Bluff. This is a new phase of the Master Planned Community, Pine Canyon. The projects consists of 26 residential lots on parcel 105-10-183A. Please see the attached Concept Plat. The 17.5 acre property is located in Section 34, Township 21 North, Range 7 East of the Gila and Salt River Meridian, Flagstaff, AZ.

Please let us know if you have any questions about this information. Thanks very much in advance.

GRANITE BASIN ENGINEERING, INC

Kaline Hutchinson
Operations Manager
1981 Commerce Center Circle, Suite B
Prescott, Arizona, 86301
Office: 928-717-0171
www.granitebasinengineering.com

Kaline Hutchinson

From: Kaline Hutchinson
Sent: Monday, August 19, 2019 2:39 PM
To: 'mpenca@fusd1.org'
Subject: The Estates at Pine Canyon - Pine Bluff
Attachments: II.2_Concept Plat (revised 2019-07-11).pdf

Dear Mr. Michael Penca –

My name is Kaline Hutchinson and I serve as Operations Manager for Granite Basin Engineering. I left a message for your business office about whom to address this, but didn't hear back. We have a prerequisite to notify the Flagstaff Unified School District of a new community per Item 5 of their Preliminary Plat Application Checklist and I hope it's alright that I'm notifying you directly.

On behalf of TLC PC Land Investors, LLC, we are notifying you of our intent to file a Preliminary Plat Application for The Estates at Pine Canyon – Pine Bluff. This is a new phase of the Master Planned Community, Pine Canyon. The projects consists of 26 residential lots on parcel 105-10-183A. Please see the attached Concept Plat. The 17.5 acre property is located in Section 34, Township 21 North, Range 7 East of the Gila and Salt River Meridian, Flagstaff, AZ.

Please let us know if there are any questions or concerns. Thank you in advance.

GRANITE BASIN ENGINEERING, INC

Kaline Hutchinson
Operations Manager
1981 Commerce Center Circle, Suite B
Prescott, Arizona, 86301
Office: 928-717-0171
www.granitebasinengineering.com

Kaline Hutchinson

From: Kaline Hutchinson
Sent: Tuesday, August 6, 2019 11:37 AM
To: 'glen.clark@suddenlink.com'
Subject: Will Serve Letter - The Estates at Pine Canyon - Pine Bluff
Attachments: II.2_Concept Plat (revised 2019-07-11).pdf; 19010 - Pine Bluff at PC - Will Serve - Suddenlink.pdf

Good Morning Glen –

Please find a request for a "will serve" letter for The Estates at Pine Canyon – Pine Bluff. Also attached is a Concept Plat for your reference. Please let me know if you need anything else or if this should be redirected to another staff member. We hope to submit for Final Plat no later than the 20th of August and sincerely appreciated your time and consideration.

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Kaline Hutchinson
Operations Manager
1981 Commerce Center Circle, Suite B
Prescott, Arizona, 86301
Office: 928-717-0171
www.granitebasinengineering.com

GRANITE BASIN
ENGINEERING, INC

August 6, 2019

Suddenlink Communications
Attn: Glen Clark
glen.clark@alticeUSA.com

Re: The Estates at Pine Canyon – Pine Bluff

Dear Glen;

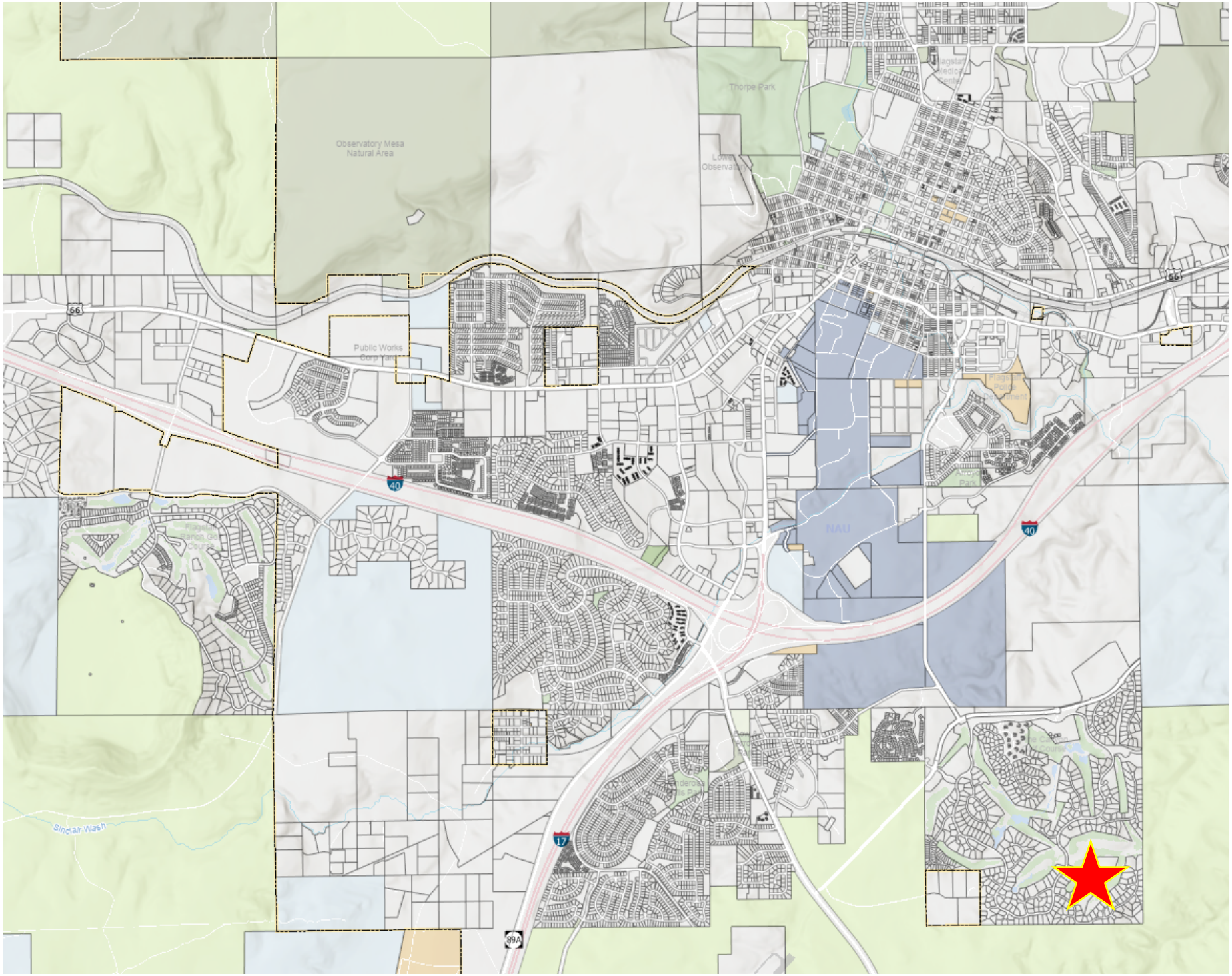
On behalf of TLC PC Land Investors, LLC, Granite Basin Engineering is requesting a "will serve" letter from your organization as part of the predevelopment, due diligence review of a proposed 26 residential lot community on parcel 105-10-183A within the Pine Canyon master community as seen in the attached Concept Plat. The 17.5 acre property is located in Section 34, Township 21 North, Range 7 East of the Gila and Salt River Meridian, Flagstaff, AZ.

Please respond at your soonest convenience or let me know if further information is needed. Thank you for your assistance.

Sincerely,

Kaline Hutchinson
Operations Manager
Granite Basin Engineering

1981 Commerce Center Circle, Suite B | Prescott, Arizona 86301 | Phone: 928.717.0171 | Fax: 928.717.0181


Observatory Mesa
Natural Area
Thorpe Park
Public Works
NAU
Sinclair Wash
66
40
17
89A

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Genevieve Pearthree, Planning Development Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Final Plat: Request from JP 325 LLC. for Parcel 1 at Juniper Point Final Plat (PZ-19-00122-03), a 38-unit single-family residential subdivision located at 2000 W. JW Powell Blvd. in the R1 (Single Family Residential) and RR (Rural Residential) zones.

STAFF RECOMMENDED ACTION:

Approve the final plat and authorize the Mayor to sign the plat and City Subdivider Agreement when notified by staff that the documents are ready for recording.

Executive Summary:

Parcel 1 at Juniper Point Final Plat is a 38-unit single-family residential subdivision located at 2000 W. JW Powell Blvd. in the R1 (Single Family Residential) and RR (Rural Residential) zones. The site is 105.08 acres in size, of which 16.85 acres are being developed for this subdivision. The site has a Resource Protection Overlay and is currently vacant.

Financial Impact:

The subdivision will include the dedication of approximately 1,200 linear feet of new residential street, including curb, gutter, parkway, sidewalk, and associated water and sewer utility mains. The initial cost of construction will be the developer's responsibility. The maintenance of the streets and utility mains will be the City's responsibility.

Policy Impact:

There are no policy impacts affiliated with this final plat.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

PBB Key Community Priorities/Objectives

Robust Resilient Economy - Grow and strengthen a more equitable and resilient economy.

Flagstaff Regional Plan

- Policy LU.5.1. Encourage development patterns within the designated growth boundaries to sustain efficient infrastructure projects and maintenance.
- Policy LU.5.2. Promote infill development over peripheral expansion to conserve environmental resources, spur economic investments, and reduce the cost of providing infrastructure and services.

- Goal NH.1. Foster and maintain healthy and diverse urban, suburban, and rural neighborhoods in the Flagstaff region.
- Policy WR.4.3. Development requiring public utility services will be located within the Urban Growth Boundary.

Has There Been Previous Council Decision on This:

On July 22, 2020, the Planning and Zoning Commission voted 5-1 in favor of forwarding the Parcel 1 at Juniper Point Preliminary Plat to the City Council with a recommendation for approval with the 6 conditions listed below. The City Council approved the preliminary plat on September 1, 2020, with the same 6 conditions, listed below:

1. With the civil engineering plans submittal, provide details of the Walking/Hiking Trail across Tract A and across Tract E to the Bow and Arrow FUTS. This trail should: 1) follow existing terrain; and 2) where slopes become too steep, rocks and boulders shall be used to create steps. Please provide a detail for each condition.
2. The typical T3N.2 Single-Family (4-sheets) lot detail that is shown on the preliminary plat (Sheet SS01) must be placed on the final plat as well as the special notes related to “PRD Modifications as allowed per Section 10-40.60-208.B.2.”
3. A Development Master Plan shall be submitted and reviewed by the Planning and Zoning Commission as per Section 11-20.80 prior to the next subdivision proposal for the area known as Juniper Point.
4. The area between the easterly subdivision boundary and lots 27-38 be assigned a tract number on the final plat.
5. The forest and slope resource disturbance area calculations for the sewer line and drainage easements be identified on the final plat and be accountable to Tract E development.
6. The slope and forest resources removed or encroached upon with the construction of the Extended Detention Basin be identified on the final plat and credited toward the development of APN 104-14-003C.

Conditions 1, 2, 4, 5, and 6 have been addressed with the final plat and/or the civil plans (currently under review). To meet Condition 3, the applicant will submit a Development Master Plan prior to the next subdivision proposal.

Options and Alternatives:

1. Approve the final plat with no conditions.
2. Approve the final plat with conditions.
3. Deny the final plat based on non-compliance with the Zoning Code, the Subdivision Code, and/or the Engineering Design Standards and Specifications for New Infrastructure

Background/History:

The applicant, JP 325 LLC., is seeking final plat approval for a 38-lot single-family residential subdivision on approximately 105 acres. The property is located in the southwest portion of the city, north of the Pine Canyon residential subdivision and south of Interstate 40, and approximately one-half mile southeast of the Coconino Community College Lone Tree Road campus. The site has a Resource Protection Overlay and is currently vacant.

The subdivision will be developed using the Planned Residential Development (PRD) mechanism, which requires the applicant to select compatible transect zone, building type, and private frontage type standards to guide building form and placement. This plat will be developed under the T3N.2 Transect Zone, Single Family House Building Type (with slight modifications), and Porch Frontage Type standards. See page 5 of the final plat for more information.

Key Considerations:

Staff approved the Parcel 1 at Juniper Point Final Plat on May 24, 2021, based on conformance with City Code Title 10, Flagstaff Zoning Code; City Code Title 11, General Plans and Subdivisions; and City Code Title 13, Engineering Design Standards and Specifications.

Planned Residential Development (PRD) is a permitted use in the R1 and RR zones. The applicant has provided a typical lot cross-section to confirm that all lots will meet the PRD building form and setbacks requirements (see attached).

The proposed number of units is within the allowed density range for the R1 and RR zones. However, the developer has decided to concentrate some of the total allowed density of the entire 105.08-acre site in the 16.85-acre subdivision being created with this plat. A total of 130 units on the site and 38 units are being created with this plat. Ninety-two (92) additional units are allowed under the current zoning.

It should be noted that in 2006, Resolution No. 2006-80, Juniper Point Specific Plan, was approved by the City Council. The Juniper Point Specific Plan continues to be a relevant document to the approximately 320 acres previously known as Juniper Point (JP) subdivision (the 105.08 acres included in this final plat are part of the larger 320-acre Juniper Point site). The rezoning application for Juniper Point was never brought to the public hearing as the developer and the City were not able to agree on the cost responsibilities for offsite infrastructure. Staff has reviewed the Specific Plan and believes that Parcel 1 at Juniper Point Final Plat is consistent with the Specific Plan and therefore allowed the plat to move forward. However, staff has determined that a Development Master Plan (DMP) for the balance of the 320-acres must be provided prior to the next development proposal. The DMP will help determine if revisions to the Specific Plan and the General Plan (Flagstaff Regional Plan 2030) are warranted.

Community Benefits and Considerations:

The community benefits that this project brings are encapsulated in the Regional Plan goals that it meets, such as promoting economic development, providing additional housing, and integrating open space characteristics into development.

Community Involvement:

Inform. No public hearings or public outreach are required by either the Zoning Code or the Subdivision Code as part of the Subdivision Plat review process.

Attachments:

Application
Vicinity Map
City/Subdivider Agreement
Utility Company Responses
Typical Lot Cross-Section
Final Plat

City of Flagstaff — Community Development Division

211 W. Aspen Ave
Flagstaff, AZ 86001
www.flagstaff.az.gov
P: (928) 213-2618
F: (928) 213-2609

Date Received	Application for Subdivision Review	File Number
9/29/2021		PZ-19-00122-03

Property Owner(s) JP325 LLC		**Phone**
Mailing Address 3605 S. Flagstaff Ranch Rd.	**City, State, Zip** Flagstaff, AZ 86005	**Email**
Applicant(s) John Sutherland		**Phone** 928-774-3826
Mailing Address 3605 S. Flagstaff Ranch Rd.	**City, State, Zip** Flagstaff, AZ 86005	**Email** jsutherland@capstonehomesaz.com
Project Representative Kayla Fleishman, EIT	Text	**Phone** 928-773-0354
Mailing Address 110 W. Dale Avenue	**City, State, Zip** Flagstaff, AZ 86001	**Email** kfleishman@swiaz.com

Requested Review:
- ☐ Development Master Plan
- ☐ Modified Subdivision
- ☐ Conceptual Plat
- ☐ Preliminary Plat
- ☐ Preliminary Plat P&Z and Council
- ☒ Final Plat- Council

Project Name: Juniper Point - Phase 1	**Site Address** No address		**Parcel Number** APN #104-14-001B & 105-10-187
Proposed Use Residential	**Existing Use** Undeveloped	**Subdivision, Tract & Lot Number** N/A	
Zoning District RR & R1 (PRD - T3N.2)	**Regional Plan Category** Suburban	**Flood Zone** Zone X	**Size of Site (Sq. ft. or Acres)** 17.23 ac +/-

Property Information:
- ☐ Yes ☒ No Located in an existing Local/National Historic District? (Name: _____)
- ☐ Yes ☒ No Existing structures are over 50 years old at the time of application?
- ☒ Yes ☐ No Subject property is undeveloped land?

Surrounding Uses (Res, Com, Ind)	North	South	East	West
	Undeveloped	Residential	Undeveloped	Commercial

Proposed Use:	Number of Lots	Number of Units	Number of acres per use	Building Square Feet
Residential	38	38 Single Family Units	5.83 ac +/-	

Please complete a *"Subdivision Review Application"* and provide an initialed *"Application and Information Checklist"* form along with the required number of plans and information as appropriate for a Development Master Plan, Conceptual, Preliminary or Final Plat. **Incomplete submittals will not be scheduled.**

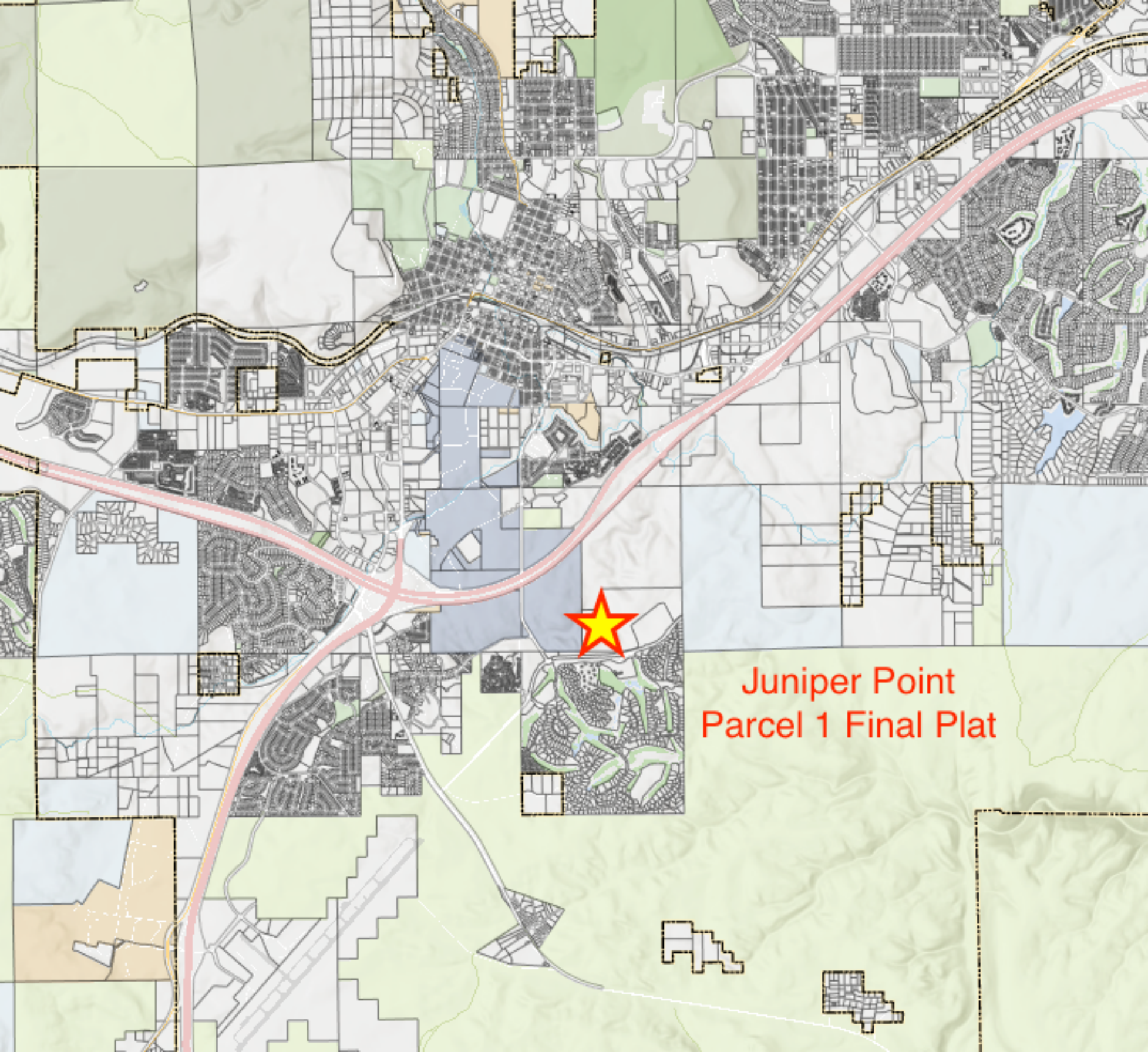
Property Owner Signature: (required)	Date: 9/22/20	Applicant Signature: John Sutherland	Date: 9/22/20

For City Use

Date Filed: 9/29/20	**Case Number (s)** PZ-19-00122-03	
P & Z Hearing Date: NA	**Publication and Posting Date:** NA	
Council Hearing Date: 6/15/21	**Publication and Posting Date:** NA	
Fee Receipt Number: REC-2036194	**Amount:** $1,840	**Date:** 9/29/20

Action by Planning and Zoning Commission:	Action By City Council:
☐ Approved	☐ Approved
☐ Denied	☐ Denied
☐ Continued	☐ Continued

Staff Assignments	Planning	Engineering	Fire	Public Works/Utilities	Stormwater


Juniper Point
Parcel 1 Final Plat

CITY / SUBDIVIDER AGREEMENT
CITY OF FLAGSTAFF, ARIZONA

This Agreement is entered into by and between the CITY OF FLAGSTAFF, a municipal corporation duly created and existing under the laws of the State Arizona, hereinafter referred to as CITY; and JP325, LLC _____ Subdivider, hereinafter referred to as SUBDIVIDER.

W I T N E S S E TH

WHEREAS, JP325, LLC (Subdivider) desires to subdivide property within the City of Flagstaff, Arizona known as JP325, LLC ; and

WHEREAS, CITY is agreeable to accepting said subdivision as proposed; providing that the subdivider constructs the subdivision in accordance with City standards and as set forth in the approved preliminary plat, and while fulfilling the obligations set forth below, which the subdivider hereby assumes; and

WHEREAS, building permit(s) is (are) required and will be issued following execution of this agreement;

NOW, THEREFORE, in consideration of the subdivision and the mutual covenants of the parties hereinafter expressed, the parties hereto agree as follows:

1. SUBDIVIDER agrees to construct all improvements in conformance with the CITY'S Subdivision Regulations and the "General Construction, Standards and Specifications" of the CITY, and to employ a responsible supervisor.

2. SUBDIVIDER further agrees to dedicate all streets and rights-of-way to the CITY for public use and to offer all public improvements to the CITY for acceptance into the CITY system.

3. The CITY agrees to accept the Subdivision as platted and to accept ownership of public improvements upon their completion and approval by the CITY.

4. In the event that the CITY should be required to institute any action for the enforcement of this agreement, SUBDIVIDER, shall be required to pay a reasonable attorney's fee in addition to all other costs assessed in any such action.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed on their own behalf and by the duly authorized officials and officers on the day and year herein written.

(Signed):

owner
Subdivider/Title

Subdivider/Title

STATE OF ARIZONA)
) ss
County of Coconino)

SUBSCRIBED AND SWORN to before me this 28th day of September, 2020 by Brian Rhoton.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

JODY KATHLEEN HICKS
Notary Public - Arizona
Coconino County
My Comm. Expires Oct 29, 2021

Notary Public

My Commission expires: Oct 29, 2021

Dated this _____ day of _____ 20_____ in Flagstaff, Coconino County, Arizona.

By: _____
Mayor

ATTEST:

_____
City Clerk

Shephard Wesnitzer, Inc.
Engineering an environment of excellence

110 West Dale Avenue
Flagstaff, AZ 86001

928.773.0354
928.774.8923

www.swiaz.com

Engineering an environment of excellence.

July 30, 2020 **Job #18256**

PROJECT: ***Juniper Point – Phase 1***

UTILITY CONFLICT LETTER

TO: AlticeUSA

Sanford Yazzie
1601 S Plaza Way
Flagstaff, AZ 86001

FROM: Shephard-Wesnitzer Inc.

Kayla Fleishman
110 W Dale Ave
Flagstaff, AZ 86001

In conformance with the City of Flagstaff subdivision development process, we have enclosed the Construction Plans for the Juniper Point – Phase 1 development prepared by Shephard-Wesnitzer, Inc. The site is situated on the north side of J.W. Powell Boulevard.

Please provide any comments and return them to us as soon as possible. Please also provide maps of any existing Altice USA utilities in the vicinity of the site for coordination purposes. Thank you for taking the time to complete, sign, date, and return this document. Your transmittal may be by mail or email as indicated on the bottom of this page.

_____ APPROVED WITHOUT COMMENT

X_____ APPROVED WITH COMMENT, AS FOLLOWS

_____ ACKNOWLEDGED, APPROVAL NOT REQUIRED, COMMENTS AS FOLLOWS

Would like to know when project is set to begin & final power map will be required for Joint Trenching.

SIGNED: Sanford Yazzie **TITLE:** Sr. Construction Supervisor

AGENCY: Suddenlink/Altice **DATE:** 08-06-2020

110 W. Dale Ave.
Flagstaff, AZ 86001

Phone #: 928-773-0354

Email: kfleishman@swiaz.com

Shephard Wesnitzer, Inc.
Engineering an environment of excellence

110 West Dale Avenue
Flagstaff, AZ 86001

928.773.0354
928.774.8923

www.swiaz.com

Engineering an environment of excellence.

July 30, 2020 **Job #18256**

PROJECT: ***Juniper Point – Phase 1***

UTILITY CONFLICT LETTER

TO: Arizona Public Service

Chad Brooks
2200 E Huntington Dr.
Flagstaff, AZ 86004

FROM: Shephard-Wesnitzer Inc.

Kayla Fleishman
110 W Dale Ave
Flagstaff, AZ 86001

In conformance with the City of Flagstaff subdivision development process, we have enclosed the Construction Plans for the Juniper Point – Phase 1 development prepared by Shephard-Wesnitzer, Inc. The site is situated on the north side of J.W. Powell Boulevard.

Please provide any comments and return them to us as soon as possible. Please also provide maps of any existing APS utilities in the vicinity of the site for coordination purposes. Thank you for taking the time to complete, sign, date, and return this document. Your transmittal may be by mail or email as indicated on the bottom of this page.

_____ APPROVED WITHOUT COMMENT

___X__ APPROVED WITH COMMENT, AS FOLLOWS

_____ ACKNOWLEDGED, APPROVAL NOT REQUIRED, COMMENTS AS FOLLOWS

_PLEASE SEE THE ATTACHED

SIGNED: Chad Brooks **TITLE:** CUSTOMER PROJ REP

AGENCY: APS **DATE:** 8-17-2020

110 W. Dale Ave.
Flagstaff, AZ 86001

Phone #: 928-773-0354

Email: kfleishman@swiaz.com

A subsidiary of Pinnacle West Capital Corporation

Station 4423
2200 E Huntington DR
Flagstaff, AZ 86004
www.aps.com

August 5, 2020,

Re: JUNIPER POINT – PHASE 1

SHEPHARD WESNITZER, INC.
110 W DALE AVE
FLAGSTAFF, AZ, 86001

Dear Elizabeth,

Thank you for your recent request for a utility conflict check. Please complete the attached Map Request, and e-mail it to the e-mail address on the form (mapprint@apsc.com). Once APS receives a completed Map Request, you should receive the map or maps by email within 5-7 business days.

The APS maps show facility locations adjacent to or within the property shown on the proposed plans we received from you. Please review these maps for possible conflicts. The utility locations are approximate only and are not reliable for construction purposes. It is important to note that there may be additional conflicts in existence due to recent construction that are not shown on the current maps you receive.

Please be advised that it is the responsibility of the customer to maintain proper clearances and blue stake prior to digging. For actual conditions, please contact the Arizona Blue Stake Center at 602-263-1100.

Also enclosed is APS's General Design Guidelines for Proposed Improvements in APS Transmission ROW Please review this document carefully.

If I can be of further assistance, please do not hesitate to call me at 602-371-5770. Further information is also available on the APS Construction Services at:

www.aps.com/construction

Sincerely,

Chad Brooks

Chad Brooks
Customer Project Representative
Flagstaff Construction

Enclosures

CenturyLink™ Conflict Memorandum

Date: August 6, 2020

To: Elizabeth Tague (Shephard Wesnitzer, Inc.)
ETague@swiaz.com

From: Kevin Wagner, Terra Technologies LLC

Subject: CenturyLink™ – Conflict Memo – Project No. 19-00122 – Juniper Point – Phase 1, Flagstaff

---

Terra Technologies is in receipt of the plans. Below you will see an overview of CenturyLink™ facilities within the project limits, and a brief project overview along with comments regarding any CenturyLink™ facilities with respect to the proposed project.

Inventory of CenturyLink™ Facilities
CenturyLink™ has no facilities within the project limits. Plan markups have been attached with CenturyLink™ comments.

Project Overview
The design intent of this project appears to be developing a vacant parcel of land for a residential subdivision.

Facility Locations and Impacts
Plans have been reviewed for conflicts with CenturyLink™ facilities based on NDS mapping which show a general location of utility locations. Neither Terra Technologies LLC nor CenturyLink™ makes any representation regarding the completeness or accuracy of vertical and horizontal utility information used to determine conflicts or no conflicts.

Based on CenturyLink™ mapping and the construction drawings provided there appear to be **no conflicts.**

Utility conflicts with this private development project will be 100% reimbursable. Payment for design and mitigation of conflicts is to be coordinated prior to work commencing.

CenturyLink™ Conflict Memorandum

In accordance with state law, Blue Staking for location of CenturyLink™ facilities must be completed prior to any construction. When crossing CenturyLink™ facilities you will be required to pothole to determine depth and maintain a minimum of 12 inch vertical and horizontal separation from facilities.

Pursuant to state law, support and protection is required for all CenturyLink™ facilities during construction.

Should the Contractor locate or expose an unknown CenturyLink™ facility, please contact CenturyLink™ as soon as possible.

In the event CenturyLink™ facilities need to be removed/relocated, some or all cost may be at the expense of the sponsoring agency.

If you have any questions or concerns regarding this review feel free to contact me immediately, either by phone or email at the number/address provided below. The contractor is also responsible for contacting CenturyLink™ prior to construction around the CenturyLink™ facilities.

Notification List

Terra Technologies LLC Kevin Wagner, Project Manager kwagner@terratechllc.net 815-245-9640	**Terra Technologies LLC** Jason Jensen, P.E. jjensen@terratechllc.net 801-735-2464
CenturyLink™ (Engineer II) Manny Hernandez Manuel.Hernandez4@centurylink.com 112 N Beaver Street Flagstaff AZ, 86001 Work: 928-779-4935	**CenturyLink™ (SR Account Mgr – BDP/MDU)** Wendy Lofton Wendy.Lofton@centurylink.com Work: 602-403-4052
CenturyLink™ (SR Account Mgr – BDP/MDU-GF) John West John.West1@centurylink.com Work: 480-423-4737	**CenturyLink™ (SR Account Mgr – BDP/MDU)** Jerry Lumpkin Jerry.F.Lumpkin@centurylink.com

Shephard Wesnitzer, Inc.
Engineering an environment of excellence

110 West Dale Avenue
Flagstaff, AZ 86001

928.773.0354
928.774.8923

www.swiaz.com

Engineering an environment of excellence.

September 22, 2020 **Job #18256**

PROJECT: ***Juniper Point – Phase 1***

UTILITY CONFLICT LETTER

TO: Unisource Energy Services

Martin Conboy
1459 East Butler Ave.
Flagstaff, AZ 86001

FROM: Shephard-Wesnitzer Inc.

Kayla Fleishman
110 W Dale Ave
Flagstaff, AZ 86001

In conformance with the City of Flagstaff subdivision development process, we have enclosed the Preliminary Plat for the Juniper Point – Phase 1 development prepared by Shephard-Wesnitzer, Inc. The site is situated on the north side of J.W. Powell Boulevard.

Please provide any comments and return them to us as soon as possible. Please also provide maps of any existing Unisource utilities in the vicinity of the site for coordination purposes. Thank you for taking the time to complete, sign, date, and return this document. Your transmittal may be by mail or email as indicated on the bottom of this page.

__X__ APPROVED WITHOUT COMMENT

_____ APPROVED WITH COMMENT, AS FOLLOWS

_____ ACKNOWLEDGED, APPROVAL NOT REQUIRED, COMMENTS AS FOLLOWS

SIGNED: Martin Conboy **TITLE:** Gas Engineering Supervisor

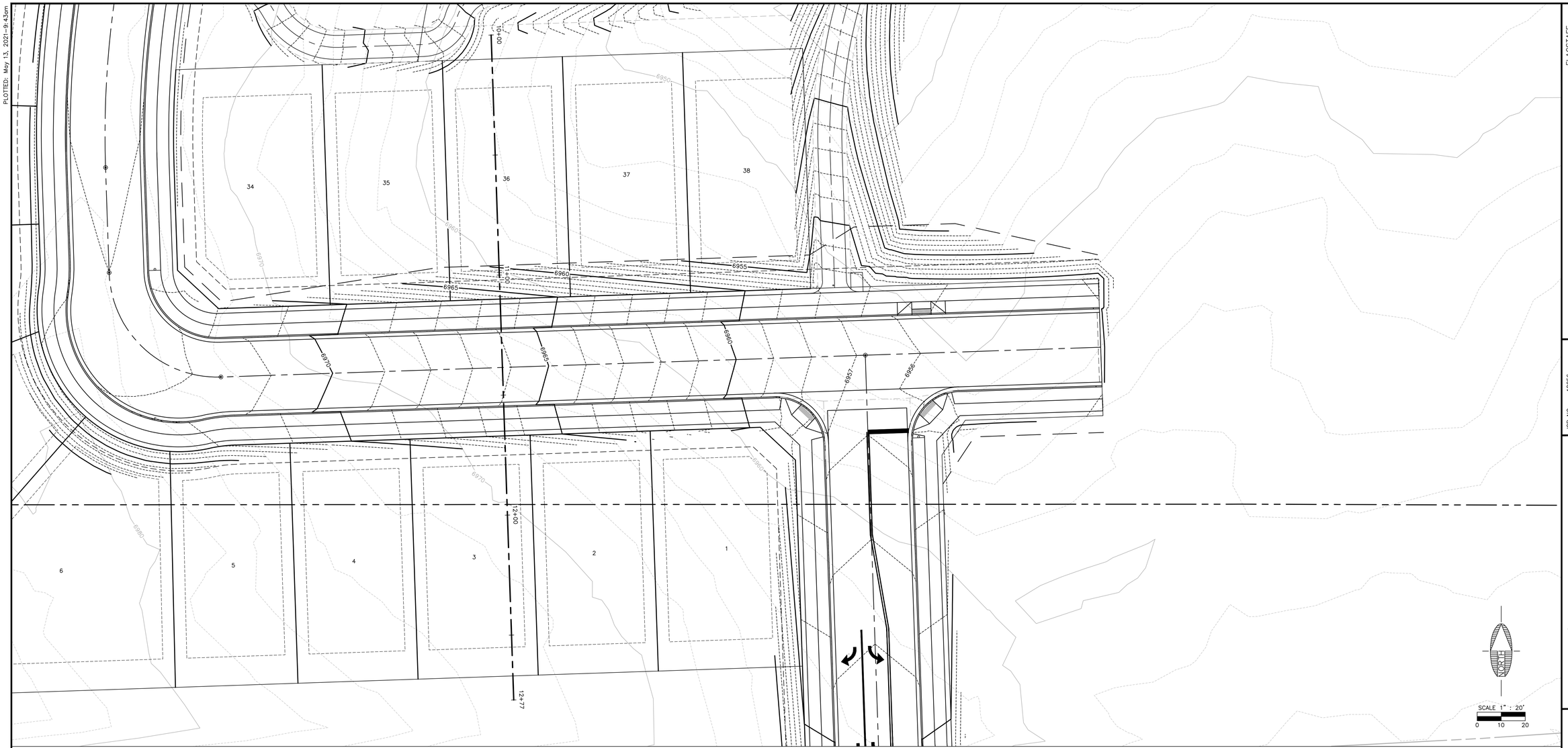
AGENCY: UNS Gas, Inc. **DATE:** September 22, 2020

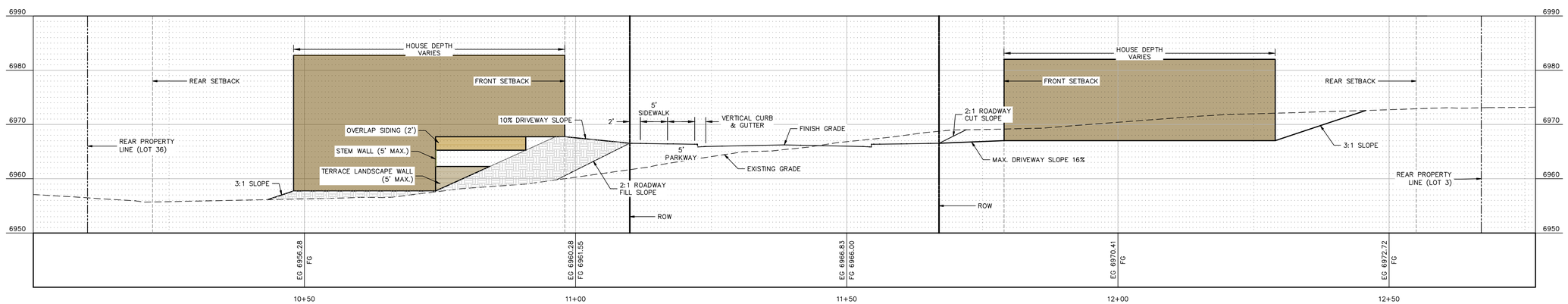
110 W. Dale Ave.
Flagstaff, AZ 86001

Phone #: 928-773-0354

Email: kfleishman@swiaz.com

PLOTTED: May 13, 2021–9:43am





Juniper Point Phase 1 Cross Section PROFILE

H: 1" = 10'

V: 1" = 10'

(NO VERT. EXAGGERATION)

PRELIMINARY

NOT FOR CONSTRUCTION, BIDDING OR RECORDING

C.O.F. Project #PZ-19-00122

FLAGSTAFF ARIZONA

PARCEL 1 AT JUNIPER POINT

LOT CROSS SECTION

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	KMF
DESIGN:	KMF
CHECKED:	SCI

REVISIONS			
NO.	DESCRIPTION	DATE	BY

110 W. Dale Avenue
Flagstaff, AZ 86001
928.773.0334
928.774.6934 fax
www.swiaz.com

SWI
Shephard Wesnitzer, Inc.

Call at least two full working days before you begin excavation
ARIZONA811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
XS01

SHT NO. 1 OF 1

FILE: P:\2018\18256\DRAWINGS\EXHIBITS\18256-CROSS SECTION.DWG SIRWIN

PLOTTED: May 27, 2021–9:21am

DEDICATIONS TO CITY

STATE OF ARIZONA
SS.
COUNTY OF COCONINO

KNOW ALL PERSONS BY THESE PRESENTS: THAT JP 325, LLC, ["GRANTOR" OR "OWNER"], HAS SUBDIVIDED UNDER THE NAME "PARCEL 1 AT JUNIPER POINT", A SUBDIVISION LOCATED IN SOUTH SECTIONS 27 AND 34, TOWNSHIP 21 NORTH, RANGE 7 EAST, OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA, AS SHOWN AND PLATTED HEREON AND DOES HEREBY PUBLISH THIS PLAT AS AND FOR THE PLAT OF PARCEL 1 AT JUNIPER POINT AND DECLARES THAT THIS PLAT SETS FORTH THE LOCATION AND GIVES THE DIMENSIONS OF EACH LOT, TRACT, STREET, AND EASEMENT CONSTITUTING SAME, AND THAT EACH LOT, TRACT, STREET, AND EASEMENT SHALL BE KNOWN BY THE NUMBER, LETTER, AND/OR NAME GIVEN TO EACH RESPECTIVELY AS SHOWN ON THIS PLAT.

RIGHT-OF-WAYS DEDICATED

PUBLIC RIGHT-OF-WAY (ROW). GRANTOR HEREBY DEDICATES TO THE CITY OF FLAGSTAFF, IN FEE SIMPLE, ALL PUBLIC RIGHTS-OF-WAY SHOWN ON THE PLAT FOR PUBLIC USE. GRANTOR AS ABUTTING PROPERTY OWNER SHALL MAINTAIN THE SIDEWALK AND LANDSCAPING WITHIN THE RIGHT-OF-WAY BETWEEN THE STREET CURB AND THE ABUTTING PROPERTY, IN COMPLIANCE WITH THE FLAGSTAFF CITY CODE.

EASEMENTS DEDICATED

GRANTOR HEREBY DEDICATES TO THE CITY OF FLAGSTAFF, ARIZONA, AN ARIZONA MUNICIPAL CORPORATION, PERPETUAL NON-EXCLUSIVE EASEMENTS OVER, UNDER, UPON, AND ACROSS ALL EASEMENT AREAS DESIGNATED ON THE PLAT FOR THE EASEMENT PURPOSES, INCLUDING ANY RELATED FACILITIES AND EQUIPMENT AS FOLLOWS:

PUBLIC ACCESS EASEMENT TRAIL (PAET) FOR PUBLIC ACCESS PURPOSES FOR PEDESTRIANS, BICYCLES, AND NON-MOTORIZED VEHICLES. GRANTOR SHALL MAINTAIN ALL TRAIL IMPROVEMENTS. MOTORIZED USES AND PRIVATE IMPROVEMENTS ARE PROHIBITED IN THE EASEMENT AREA, EXCEPT FOR CITY OPERATIONAL PURPOSES. TRAIL MAY BE REALIGNED AND/OR RECONFIGURED WITH FUTURE DEVELOPMENT.

PUBLIC UTILITY EASEMENT (PUE), FOR PUBLIC USE, FOR UTILITY PURPOSES, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF ELECTRICITY, ENERGY, GAS, WATER, SEWER, PUBLIC STORM WATER SYSTEM, TELECOMMUNICATIONS, INTERNET SERVICES, CABLE TELEVISION, AND OTHER UTILITIES.

SEWER LINE EASEMENT (SLE), FOR PUBLIC SEWER SYSTEMS, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF UNDERGROUND SEWER PIPELINES, MONITORING DEVICES, PIPES, MANHOLES, VALVES, AND ACCESS VAULTS.

SLOPE EASEMENT (SE) FOR SLOPE AND NATURAL DRAINAGE OF WATER PURPOSES ADJACENT TO ROADS, SIDEWALKS, TRAILS, AND OTHER SURFACE IMPROVEMENTS, INCLUDING WITHOUT LIMITATION, CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, REPLACEMENT AND REPAIR OF MAN-MADE AND NATURAL SLOPES, SOIL NAILS, GABIONS, RETAINING WALLS, EROSION CONTROL IMPROVEMENTS, AND VEGETATION. GRANTOR IS RESPONSIBLE FOR MAINTAINING THE STRUCTURAL INTEGRITY OF THE SLOPE, IN COMPLIANCE WITH THE FLAGSTAFF CITY CODE. THE SLOPE EASEMENTS ARE AUTOMATICALLY ABANDONED ON A LOT OR PARCEL WHEN THE CITY OF FLAGSTAFF ISSUES CERTIFICATE OF OCCUPANCY FOR THE LOT OR PARCEL.

FLAGSTAFF URBAN TRAILS SYSTEM EASEMENT (FUTS) FOR PUBLIC ACCESS PURPOSES FOR PEDESTRIANS AND BICYCLES, INCLUDING WITHOUT LIMITATION THE CONSTRUCTION, OPERATION, MAINTENANCE, MODIFICATION, OF THE FLAGSTAFF URBAN TRAILS SYSTEM, INCLUDING ANY CITY FENCING, WALLS, GRADING, LANDSCAPING, LATERAL AND SUBJACENT SUPPORT, DRAINAGE STRUCTURES AND FACILITIES, SIGNS, OR OTHER FEATURES ASSOCIATED WITH THE TRAIL. MOTORIZED USES AND PRIVATE IMPROVEMENTS ARE PROHIBITED IN THE EASEMENT AREA, UNLESS PERMITTED BY THE FLAGSTAFF CITY CODE OR FOR CITY OPERATIONAL PURPOSES.

THE OWNER HERBY DEDICATES TO UNISOURCE ENERGY SERVICES AND ITS SUBSIDIARY, UNS GAS:
ASSIGNS ALL AREAS ON THIS PLAT MARKED PUE OR PUBLIC UTILITY EASEMENT AND THE PROPERTY DESIGNATED ON THE PLAT FOR STREETS. WHETHER PUBLIC OR PRIVATE, FOR EXISTING NATURAL GAS FACILITIES TOGETHER WITH THE RIGHT TO INSTALL REQUIRED SERVICE CONNECTIONS OVER OR UNDER THE SURFACE TO SERVE IMPROVEMENTS THEREON OR ADJACENT TO.

THE OWNER HEREBY DEDICATES THE FOLLOWING TO THE HOMEOWNERS ASSOCIATION:
1. TRACT A IS DEDICATED FOR THE PURPOSE OF A POCKET PARK AS SHOWN HEREON.
2. TRACT B IS DEDICATED FOR THE PURPOSE OF RESOURCE PROTECTION AS SHOWN HEREON.
3. TRACT C IS DEDICATED FOR THE PURPOSE OF RESOURCE PROTECTION AS SHOWN HEREON.
4. TRACT D IS DEDICATED FOR THE PURPOSE OF RESOURCE PROTECTION AS SHOWN HEREON.
5. TRACT E IS DEDICATED FOR THE PURPOSE OF RESOURCE PROTECTION AS SHOWN HEREON.
6. TRACT F IS DEDICATED FOR THE PURPOSE OF RESOURCE PROTECTION AS SHOWN HEREON.

EASEMENT GENERAL CONDITIONS: ALL EASEMENTS GRANTED HEREIN ARE SUBJECT TO THE FOLLOWING GENERAL CONDITIONS:
a. GRANTOR SHALL NOT ALLOW USE OF THE EASEMENT AREA IN A MANNER THAT INTERFERES WITH EASEMENT;
b. GRANTOR SHALL MAINTAIN EASEMENT AREAS FREE AND CLEAR OF VEGETATION OR OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT, PER THE FLAGSTAFF CITY CODE AS AMENDED; AND
c. GRANTEE MAY MAINTAIN VEGETATION AND REMOVE OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT;
d. IN THE EVENT THE CITY OF FLAGSTAFF HAS NOTIFIED GRANTOR AND PROVIDED REASONABLE OPPORTUNITY TO MAINTAIN THE SLOPE, VEGETATION AND/OR REMOVE OBSTRUCTIONS THAT INTERFERE WITH THE EASEMENT, CITY OF FLAGSTAFF MAY ISSUE AN ASSESSMENT AGAINST GRANTOR TO RECOVER THE CITY'S ACTUAL, REASONABLE MAINTENANCE COSTS AND RECORD IT AS A LIEN AGAINST GRANTOR'S PROPERTY UNTIL THE ASSESSMENT AND ANY STATUTORY INTEREST IS PAID;
e. GRANTEE SHALL HAVE A LIMITED, TEMPORARY RIGHT OF ACCESS ACROSS GRANTOR'S ADJACENT PROPERTY FOR EASEMENT PURPOSES IF ACCESS CANNOT BE REASONABLY ACHIEVED BY OTHER MEANS.

BINDING EFFECT. THE EASEMENTS GRANTED WITHIN THIS DEDICATION ARE PERMANENT AND PERPETUAL AND SHALL RUN WITH THE LAND AND BE BINDING UPON OWNER AND ITS HEIRS, ASSIGNS, AND SUCCESSORS IN INTEREST TO THIS PLAT OR ANY PARCEL OR LOT THEREOF.

IMPROVEMENTS. GRANTOR HEREBY DEDICATES TO THE CITY OF FLAGSTAFF ALL IMPROVEMENTS INSTALLED OR CONSTRUCTED BY GRANTOR FOR CITY PUBLIC RIGHTS-OF-WAY AND CITY UTILITIES WITHIN THE EASEMENT AREAS, AND SUCH DEDICATION SHALL BE EFFECTIVE WHEN FORMALLY ACCEPTED BY THE CITY ENGINEER (THE "ACCEPTANCE DATE.").

NOW, THEREFORE, IN WITNESS WHEREOF, GRANTOR HAS HEREUNTO CAUSED ITS CORPORATE NAME TO BE SIGNED AND ITS CORPORATE SEAL TO BE AFFIXED BY THE UNDERSIGNED, DULY AUTHORIZED OFFICER THIS _____ DAY OF _____, 20__.

BY: JP 325, LLC

ITS: _____
BRIAN RHOTON
ITS: MANAGING MEMBER

STATE OF ARIZONA
SS.
COUNTY OF COCONINO

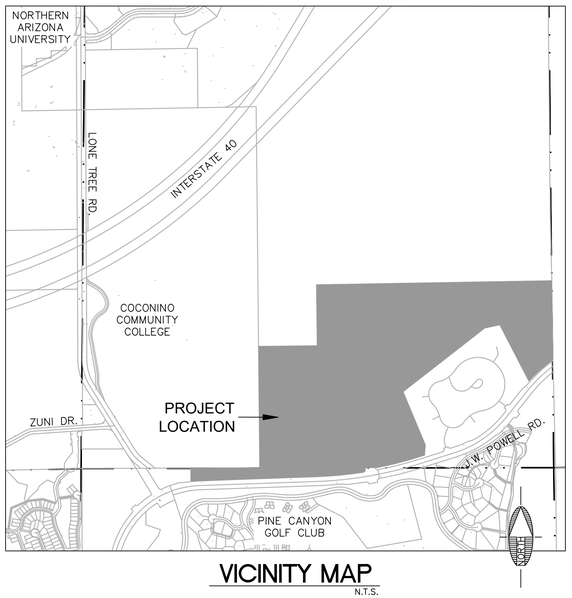
ON THIS _____ DAY OF _____, 2021, BEFORE ME, THE UNDERSIGNED PERSONALLY APPEARED _____ WHO ACKNOWLEDGED BY SELF TO THE REPRESENT JP 325, LLC, AND THAT HE/SHE AS SUCH, BEING AUTHORIZED SO TO DO, EXECUTED THE FOREGOING INSTRUMENT FOR THE PURPOSE THEREIN CONTAINED.

IN WITNESS WHEREOF: I HEREUNTO FORTH MY HAND AND OFFICIAL SEAL.

_____
NOTARY PUBLIC MY COMMISSION EXPIRES

FINAL PLAT
FOR
PARCEL 1 AT JUNIPER POINT
A PLANNED RESIDENTIAL DEVELOPMENT
FLAGSTAFF, ARIZONA

LOCATED IN PORTIONS OF SECTION 27 & 34, TOWNSHIP 21 NORTH, RANGE 7 EAST OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, CITY OF FLAGSTAFF, ARIZONA



VICINITY MAP
N.T.S.

PROPERTY OWNER:
JP 325 LLC
BRIAN RHOTON
3605 S. FLAGSTAFF RANCH RD.
FLAGSTAFF, AZ 86005

SURVEYOR:
SHEPHARD-WESNITZER, INC.
AARON BORLING, RLS #48756
110 WEST DALE AVE
FLAGSTAFF, AZ 86001
(928) 773-0354

PROJECT ENGINEER:
SHEPHARD-WESNITZER INC.
STEPHEN C. IRWIN, P.E. #58405
110 WEST DALE AVE
FLAGSTAFF, AZ 86001
(928) 773-0354

LEGEND

- ROW BOUNDARY
- EX. EASEMENT
- ROAD CENTERLINE
- LOT LINE
- EASEMENT
- SECTION LINE
- SLOPE EASEMENT
- EASEMENT CENTERLINE
- LOT SETBACK
- FOUND MONUMENTS
- SECTION CORNER AS NOTED
- CALCULATED POINT

SWI SHEET INDEX		
SHT NO.	DWG. NO.	DESCRIPTION
1	CVR	COVER SHEET
2	FP1	EXISTING BOUNDARY & EASEMENTS
3	FP2	FINAL PLAT OVERVIEW
4	FP3	FINAL PLAT
5	FP4	SECTIONS & SETBACKS

SOURCE OF PROJECT INFORMATION

BOUNDARY INFORMATION BASED ON ALTA/NSPS LAND TITLE SURVEY OF APN'S 104-14-003C & 104-14-001B BY NORTHLAND EXPLORATION SURVEYS, INC., DATED 07/06/2018.

TOPOGRAPHIC INFORMATION BASED ON ALTA/NSPS LAND TITLE SURVEY OF APN'S 104-14-003C & 104-14-001B BY NORTHLAND EXPLORATION SURVEYS, INC., DATED 01/03/2006.

SUPPLEMENTAL TOPOGRAPHIC INFORMATION BASED ON TOPOGRAPHIC SURVEY PROVIDED BY SHEPHARD-WESNITZER, INC., DATED 2/25/2020. BOUNDARY INFORMATION FOR APN 105-10-187 PROVIDED BY SWI, DATED 2/25/2020.

BASIS OF BEARING

N 00°20'48" W 2620.29' FROM EAST QUARTER CORNER OF SECTION 27 TO THE NORTHEAST CORNER OF SECTION 27, TOWNSHIP 21 NORTH, RANGE 7 EAST OF THE GILA AND SALT RIVER MERIDIAN, COCONINO COUNTY, ARIZONA AS SHOWN ON ALTA/NSPS LAND TITLE SURVEY OF APN'S 104-14-003C & 104-14-001B BY NORTHLAND EXPLORATION SURVEYS, INC., DATED 07/06/2018.

LEGAL DESCRIPTION:

APN 104-14-001B
A PORTION OF PARCELS 1 AND 2 BASED ON ALTA/NSPS LAND TITLE SURVEY OF APN'S 104-14-003C & 104-14-001B BY NORTHLAND EXPLORATION SURVEYS, INC., DATED 07/06/2018.

APN 104-10-187
TRACT 13 ACCORDING TO THE FINAL PLAT OF ESTATES AT PINE CANYON UNIT 1, CASE 8, MAP 92 OFFICIAL RECORDS OF COCONINO COUNTY.

FLOOD ZONE CLASSIFICATION:

THE SUBJECT PARCEL IS LOCATED WITHIN ZONE X OF FEMA FIRM MAP #04005C6817, EFFECTIVE SEPTEMBER 3, 2010. ZONE X IS DESCRIBED AS AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

FIRE PREVENTION

EACH HOME WILL BE EQUIPPED WITH AN AUTOMATIC FIRE SPRINKLER SYSTEM PER THE INTERNATIONAL FIRE CODE (IFC) AND CITY OF FLAGSTAFF AMENDMENTS TO IFC.

PROPERTY INFORMATION:

PARCEL 1 AT JUNIPER POINT
ADDRESS – TBD
FLAGSTAFF, AZ 86005

NUMBER OF UNITS/LOTS: 38
NUMBER OF TRACTS: 7
BUILDING TYPE: JUNIPER POINT PARCEL 1 SINGLE FAMILY HOME
FRONTAGE TYPE: PORCH

APN# 104-14-001B (± 100.03 AC)
ZONING: RURAL RESIDENTIAL (RR)
GROSS ACREAGE: 100.03 ACRES
NET ACREAGE: 98.37 ACRES
MAXIMUM DENSITY: 1 UNIT PER ACRE
MAXIMUM DENSITY FOR THIS PARCEL: 100 UNITS

APN# 104-10-187 (± 5.05 AC)
ZONING: SINGLE-FAMILY RESIDENTIAL (R1)
GROSS ACREAGE: 5.05 ACRES
NET ACREAGE: 4.90 ACRES
MAXIMUM DENSITY WITHIN THE RESOURCE PROTECTION OVERLAY, INSIDE OF A PEDESTRIAN SHED OF AN ACTIVITY CENTER: 6 UNITS PER ACRE
MAXIMUM DENSITY FOR THIS PARCEL: 30 UNITS

130 UNITS ARE ALLOWED UNDER THE CURRENT ZONING. THIS SUBDIVISION IS CREATING 38 UNITS. THE REMAINING DENSITY UNDER THE CURRENT ZONING IS 92 UNITS.

1. THE CITY OF FLAGSTAFF PROVIDES WATER (UTILITY) SERVICE PURSUANT TO STATE LAW AND IS CURRENTLY OPERATING UNDER A DESIGNATION OF ADEQUATE WATER SUPPLY GRANTED BY THE ARIZONA DEPARTMENT OF WATER RESOURCES, APPLICATION NO 41-90000.0002.
2. ALL UTILITIES, INCLUDING STREET LIGHT AND ELECTRIC LINES INSTALLED WITH THIS DEVELOPMENT SHALL BE PLACED UNDERGROUND.
3. DEVELOPMENT AND USE OF THIS SITE WILL CONFORM TO ALL APPLICABLE CITY OF FLAGSTAFF CODES AND ORDINANCES.
4. A HOMEOWNERS ASSOCIATION WILL BE FORMED AND HAVE THE RESPONSIBILITY FOR MAINTAINING TRACTS A-F, LANDSCAPING IN THE JW POWELL RIGHT OF WAY, THE LANDSCAPE CIRCLE IN THE CUL-DE-SAC, THE PUBLIC ACCESS TRAIL, AND THE DETENTION BASIN.
5. EXCEPT FOR CONSTRUCTION AND IMPROVEMENTS BY GOVERNMENTAL ENTITIES AND CERTIFIED PUBLIC UTILITIES, CONSTRUCTION AND IMPROVEMENTS WITHIN UTILITY EASEMENTS SHALL BE LIMITED TO ONLY THE FOLLOWING: REMOVABLE WOOD, WIRE OR SECTION TYPE FENCING; CONSTRUCTION, STRUCTURES OR BUILDING EXPRESSLY APPROVED IN WRITING BY ALL PUBLIC UTILITIES WHICH USE OR SHALL USE THE UTILITY EASEMENT
6. NO FENCING, RE-GRADING, DISTURBANCE OF NATURAL GROUND, PLACEMENT OF FILL OR ANY OTHER OBSTRUCTIONS ARE PERMITTED WITHIN THE DRAINAGE EASEMENTS
7. ALL INDIVIDUAL LOT AREAS OUTSIDE THE MAXIMUM BUILDING COVERAGE, DRIVEWAYS, AND UTILITIES ARE DEEMED AS PRIVATE OPEN SPACE AND PROTECTED FOREST RESOURCE AREAS.
8. THE DECLARATION OF COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, AND EASEMENTS FOR THE PARCEL 1 AT JUNIPER POINT SHALL BE RECORDED IN THE OFFICE OF THE COCONINO COUNTY RECORDER AND ARE HEREBY INCORPORATED AS A PART OF THIS PLAT.
9. TRACT G IS OWNED AND MAINTAINED FOR FUTURE DEVELOPMENT BY JP 325, LLC, OR ITS SUCCESSORS.
10. RESOURCE PROTECTION. A BUILDING ENVELOPE FOR EACH LOT IS SHOWN AND PLATTED HEREON FOR THE PURPOSE OF MAINTAINING RESOURCES IN ACCORDANCE WITH THE ZONING CODE'S RESOURCE PROTECTION OVERLAY DESIGNATION. ALL DEVELOPMENT ON A LOT SHALL OCCUR WITHIN THE BUILDING ENVELOPE, EXCEPT THAT ACCESSORY STRUCTURES THAT COMPLY WITH THE REQUIREMENTS OF THE ZONING CODE MAY BE DEVELOPED OUTSIDE OF THE BUILDING ENVELOPE, PROVIDED THAT NO RESOURCES ARE REMOVED OR ENCROACHED UPON. A MODIFICATION TO A LOT'S BUILDING ENVELOPE THAT COMPLIES WITH THE ZONING CODE MAY BE APPROVED BY THE CITY OF FLAGSTAFF'S PLANNING DIRECTOR AND RECORDED IN COCONINO COUNTY, ARIZONA. ALL APPLICABLE PROVISIONS OF THE ZONING CODE, AS AMENDED, SHALL APPLY.
11. SLOPE AND FOREST RESOURCES REMOVED OR ENCROACHED UPON WITH THE CONSTRUCTION OF THE EXTENDED DETENTION BASIN SHALL BE CREDITED TOWARD THE DEVELOPMENT OF APN 104-14-003C. EXCESS PROTECTED RESOURCES WILL BE TRANSFERED TO FUTURE DEVELOPMENT PARCELS WITHIN JUNIPER POINT.
12. THE CITY OF FLAGSTAFF MAY PERIODICALLY INSPECT DETENTION FACILITIES TO VERIFY THAT REGULAR MAINTENANCE ACTIVITIES ARE BEING PERFORMED.
13. THE SUBDIVISION WILL BE DEVELOPED AS A PLANNED RESIDENTIAL DEVELOPMENT USING THE T3N.2 STANDARDS.
14. AIRPORT OVERFLIGHT AREA. THE PROPERTY IS LOCATED WITHIN AIRCRAFT OVERFLIGHT AREA AS SHOWN ON THE AIRPORT MASTER PLAN. THIS PROPERTY MAY BE AFFECTED BY NOISE OR EMISSIONS FROM AIRCRAFT.
15. FOREST AND SLOPE RESOURCES DISTURBED BY THE SEWER LINE AND DRAINAGE EASEMENTS WILL BE COUNTED IN THE TOTAL DISTURBANCE OF FUTURE DEVELOPMENT OF TRACT G AND APN 104-14-003C.

ZONING:

THE PROJECT IS LOCATED WITHIN THE CITY OF FLAGSTAFF'S R1 AND RR ZONING DISTRICTS. THE PROPOSED DEVELOPMENT IS USING THE PLANNED RESIDENTIAL DEVELOPMENT OPTION.

UTILITY COMPANY CONTACTS

APS
CONTACT: CHAD BROOKS
2200 E. HUNTINGTON
FLAGSTAFF, AZ 86004
CHAD.BROOKS@APS.COM
PHONE: (928) 773-6440

UNISOURCE ENERGY SERVICES
CONTACT: MARTIN CONBOY
2901 W SHAMRELL BLVD #110
FLAGSTAFF, AZ 86001
MCONBOY@UESAZ.COM
PHONE: (928) 226-2269

CENTURYLINK
CONTACT: MANUEL HERNANDEZ
112 NORTH BEAVER STREET
FLAGSTAFF, AZ 86001
MANUEL.HERNANDEZ4@CENTURYLINK.COM
PHONE: (928) 779-4935

ALTICE USA
CONTACT: SANFORD YAZZIE
1601 SOUTH PLAZA WAY
FLAGSTAFF, AZ 86001
SANFORD.YAZZIE@ALTICEUSA.COM
PHONE: (928) 266-0672

UTILITY COMPANY APPROVAL

ARIZONA PUBLIC SERVICE
CHAD BROOKS (BY LETTER) 3/4/2020
BY: DATE:

UNISOURCE ENERGY SERVICES
MARTIN CONBOY (BY LETTER) 3/23/2020
BY: DATE:

CENTURYLINK
KEVIN WAGNERY (BY LETTER) 9/25/2020
BY: DATE:

ALTICE USA
SANFORD YAZZIE (BY LETTER) 3/12/2020
BY: DATE:

UTILITY CONFLICT

UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE AND WERE COMPILED FROM RECORD DRAWINGS, SURVEY, AND CONSTRUCTION PLANS FURNISHED BY OTHERS. THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR DETERMINING THE ACTUAL LOCATIONS OF ALL UNDERGROUND LINES THAT MAY AFFECT WORK PRIOR TO CONSTRUCTION. THERE ARE NO APPARENT UTILITY CONFLICTS. REFER TO THE REVIEW AGENCY RESPONSE LETTERS FOR MORE INFORMATION.

CERTIFICATE OF LAND SURVEYOR

THIS IS TO CERTIFY THAT THE SURVEY OF THE PROPERTY DESCRIBED AND PLATTED HEREON WAS MADE UNDER MY DIRECTION AND SUPERVISION AND IS ACCURATELY REPRESENTED ON THIS PLAT. I ALSO CERTIFY THAT THE PLAT IS IN SUBSTANTIAL CONFORMANCE TO THE APPROVED TENTATIVE PLAT AND THAT THIS PLAT IS CORRECT AND ACCURATE AS SHOWN TO THE BEST OF MY KNOWLEDGE AND BELIEF.

_____
Aaron D. Borling, RLS 48756

REGISTERED LAND SURVEYOR — 48756 — AARON D. BORLING — Date Signed 5/17/19 — ARIZONA, USA — Expires 12/31/20

C.O.F. Project #PZ-19-00122

FLAGSTAFF ARIZONA

PARCEL 1 AT JUNIPER POINT FINAL PLAT

COVER SHEET

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	KMF
DESIGN:	KMF
CHECKED:	ADB/SCI

NO.	DESCRIPTION	DATE	BY
REVISIONS			

110 W. Dale Avenue
Flagstaff, AZ 86001
928.773.0354
928.774.8934 fax
www.swiaz.com
Shephard Wesnitzer, Inc.

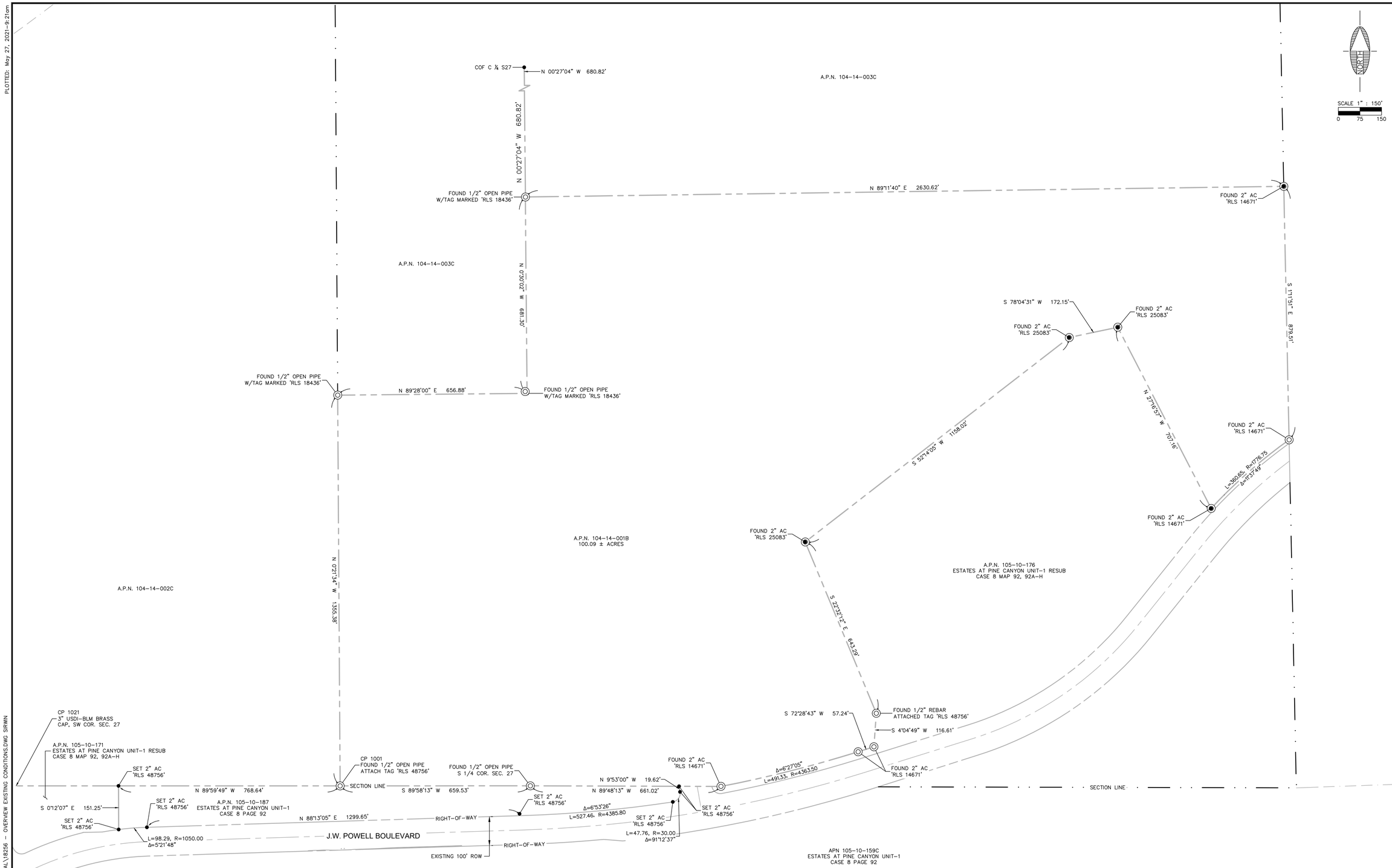
Call at least two full working days before you dig in Arizona!
ARIZONA811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
CVR

SHT NO. 1 OF 5

FILE: P:\2018\18256\DRAWINGS\PLATS\FINAL\18256 - COVER SHEET.DWG SRWIN

PLOTTED: May 27, 2021–9:21am



EXISTING BOUNDARY & EASEMENTS

PARCEL 1 AT JUNIPER POINT FINAL PLAT

FLAGSTAFF ARIZONA

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	MMB
DESIGN:	KMF
CHECKED:	ADB/SCI

REVISIONS

NO.	DESCRIPTION	DATE	BY

Shephard Wesnitzer, Inc.
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Flagstaff, AZ 86001
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ARIZONA811 Arizona Blue Stake, Inc.
Call at least two full working days before you begin excavation
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
FP1

SHT NO. 2 OF 5

CERTIFICATE OF LAND SURVEYOR

THIS IS TO CERTIFY THAT THE SURVEY OF THE PROPERTY DESCRIBED AND PLATTED HEREON WAS MADE UNDER MY DIRECTION AND SUPERVISION AND IS ACCURATELY REPRESENTED ON THIS PLAT. I ALSO CERTIFY THAT THE PLAT IS IN SUBSTANTIAL CONFORMANCE TO THE APPROVED TENTATIVE PLAT AND THAT THIS PLAT IS CORRECT AND ACCURATE AS SHOWN TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Aaron D. Borling, RLS 48756

REGISTERED LAND SURVEYOR 48756 AARON D. BORLING Date Signed 5/27/21 ARIZONA, U.S.A. Expires 12/31/22

C.O.F. Project #PZ-19-00122

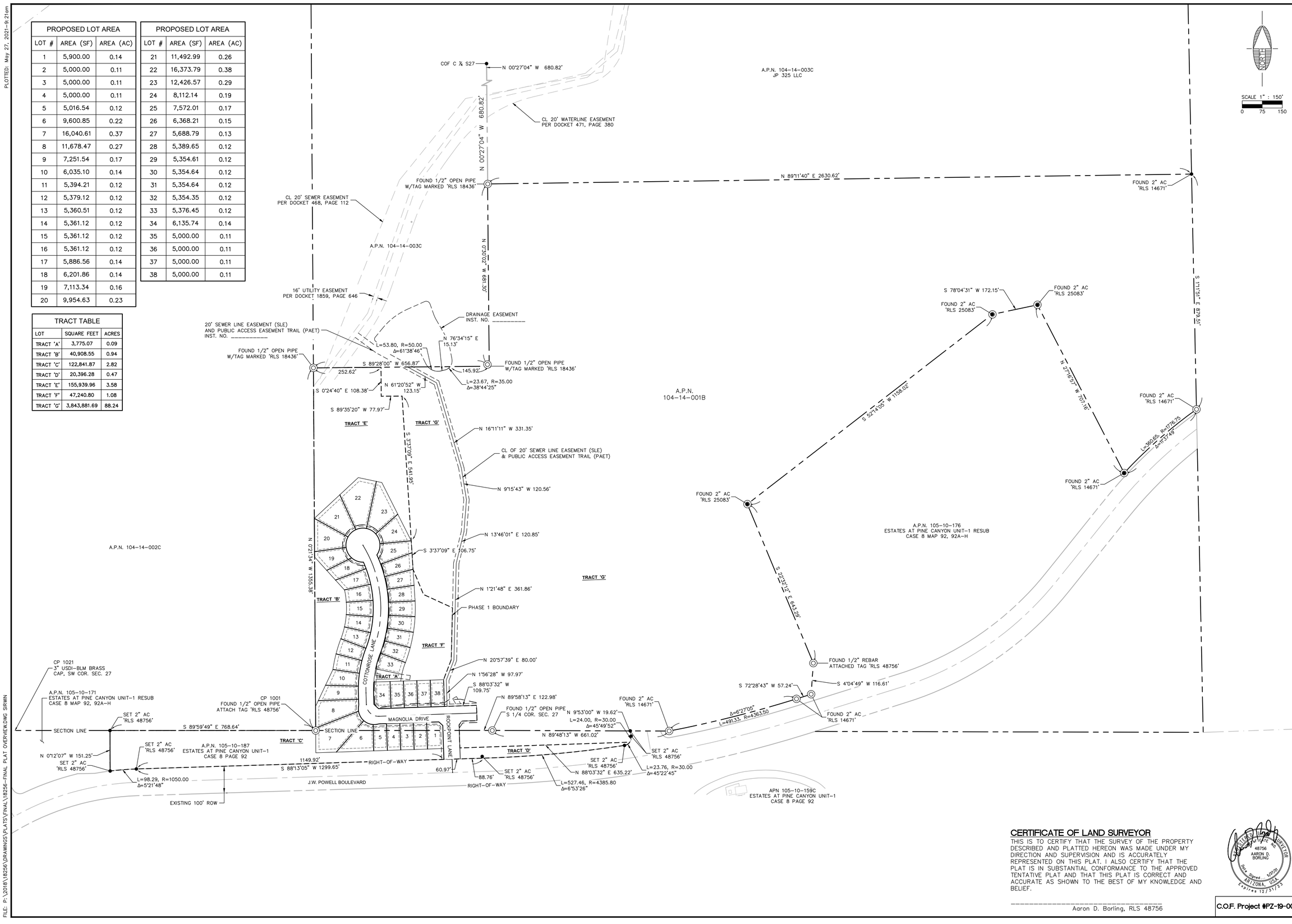
FILE: P:\2018\18256\DRAWINGS\PLATS\FINAL\18256 – OVERVIEW EXISTING CONDITIONS.DWG SIRWIN

PLOTTED: May 27, 2021–9:21am

PROPOSED LOT AREA		
LOT #	AREA (SF)	AREA (AC)
1	5,900.00	0.14
2	5,000.00	0.11
3	5,000.00	0.11
4	5,000.00	0.11
5	5,016.54	0.12
6	9,600.85	0.22
7	16,040.61	0.37
8	11,678.47	0.27
9	7,251.54	0.17
10	6,035.10	0.14
11	5,394.21	0.12
12	5,379.12	0.12
13	5,360.51	0.12
14	5,361.12	0.12
15	5,361.12	0.12
16	5,361.12	0.12
17	5,886.56	0.14
18	6,201.86	0.14
19	7,113.34	0.16
20	9,954.63	0.23

PROPOSED LOT AREA		
LOT #	AREA (SF)	AREA (AC)
21	11,492.99	0.26
22	16,373.79	0.38
23	12,426.57	0.29
24	8,112.14	0.19
25	7,572.01	0.17
26	6,368.21	0.15
27	5,688.79	0.13
28	5,389.65	0.12
29	5,354.61	0.12
30	5,354.64	0.12
31	5,354.64	0.12
32	5,354.35	0.12
33	5,376.45	0.12
34	6,135.74	0.14
35	5,000.00	0.11
36	5,000.00	0.11
37	5,000.00	0.11
38	5,000.00	0.11

TRACT TABLE		
LOT	SQUARE FEET	ACRES
TRACT 'A'	3,775.07	0.09
TRACT 'B'	40,908.55	0.94
TRACT 'C'	122,841.87	2.82
TRACT 'D'	20,396.28	0.47
TRACT 'E'	155,939.96	3.58
TRACT 'F'	47,240.80	1.08
TRACT 'G'	3,843,881.69	88.24



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FLAGSTAFF
ARIZONA

PARCEL 1 AT JUNIPER POINT FINAL PLAT

FINAL PLAT OVERVIEW

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	KMF
DESIGN:	KMF
CHECKED:	ADB/SCI

REVISIONS			
NO.	DESCRIPTION	DATE	BY

110 W. Dale Avenue
Flagstaff, AZ 86001
928.773.0354
928.774.8934 fax
www.swiaz.com
Shephard Wesnitzer, Inc.

Call at least two full working days before you dig (602) 263-1100
ARIZONA811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

CERTIFICATE OF LAND SURVEYOR

THIS IS TO CERTIFY THAT THE SURVEY OF THE PROPERTY DESCRIBED AND PLATTED HEREON WAS MADE UNDER MY DIRECTION AND SUPERVISION AND IS ACCURATELY REPRESENTED ON THIS PLAT. I ALSO CERTIFY THAT THE PLAT IS IN SUBSTANTIAL CONFORMANCE TO THE APPROVED TENTATIVE PLAT AND THAT THIS PLAT IS CORRECT AND ACCURATE AS SHOWN TO THE BEST OF MY KNOWLEDGE AND BELIEF.

_____
Aaron D. Borling, RLS 48756

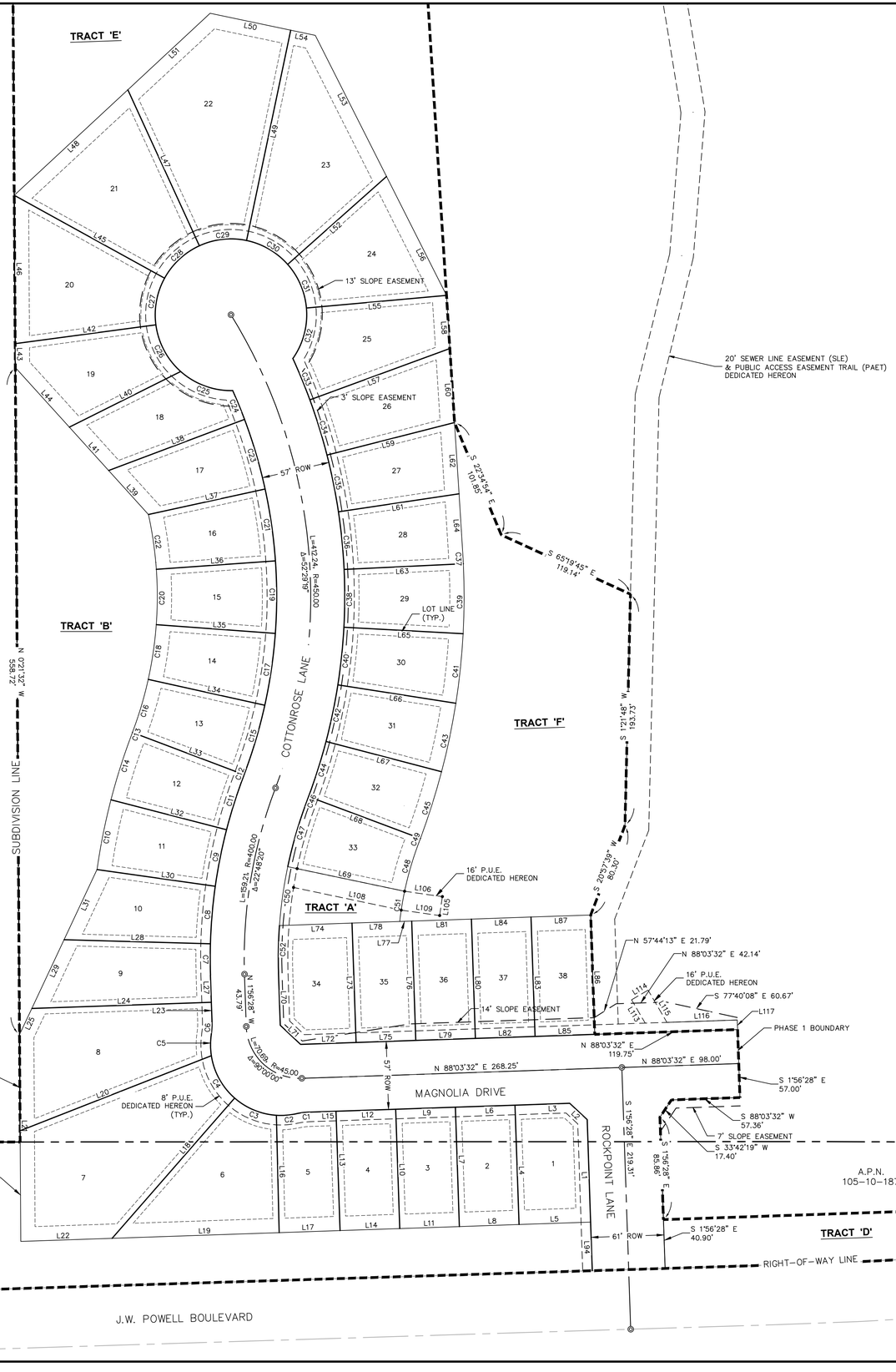
REGISTERED LAND SURVEYOR
48756
AARON D. BORLING
Date Signed 12/7/19
ARIZONA, U.S.A.
Expires 12/31/20

C.O.F. Project #PZ-19-00122

DRAWING NO.
FP2

SHT NO.	OF
3	5

PLOTTED: May 27, 2021–9:21am



SCALE 1" : 50'
0 25 50

FLAGSTAFF ARIZONA

PARCEL 1 AT JUNIPER POINT FINAL PLAT

FINAL PLAT

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	MMB
DESIGN:	MMB/KMF
CHECKED:	ADB/SCI

REVISIONS			
NO.	DESCRIPTION	DATE	BY

110 W. Dale Avenue
Flagstaff, AZ 86001
928.773.0334
928.774.8934 fax
www.swiaz.com
SWI Shephard Wesnitzer, Inc.

Arizona Blue Stake, Inc. ARIZONA811
Call at least two full working days before you dig, excavate or demolish
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

CERTIFICATE OF LAND SURVEYOR

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Aaron D. Borling, RLS 48756

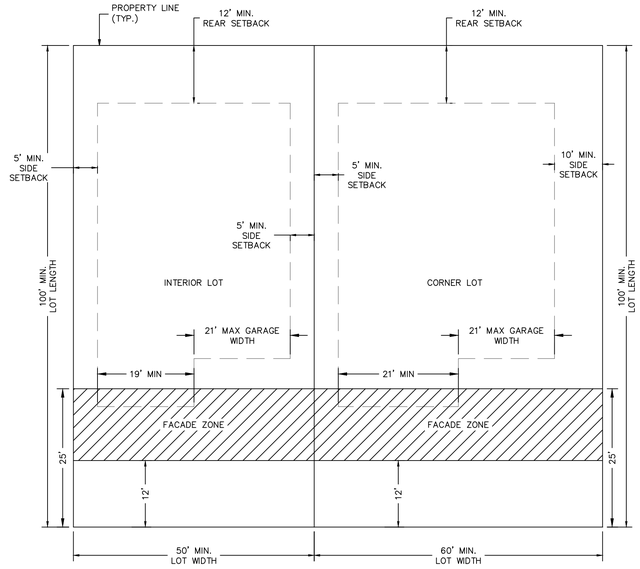
REGISTERED LAND SURVEYOR
48756
AARON D. BORLING
Date Signed 1/2/19
ARIZONA, USA
Expires 12/31/23

C.O.F. Project #PZ-19-00122

DRAWING NO.
FP3

SHT NO.	OF
4	5

FILE: P:\2018\18256\DRAWINGS\PLATS\FINAL\18256 – FINAL PLAT.DWG SIRWIN

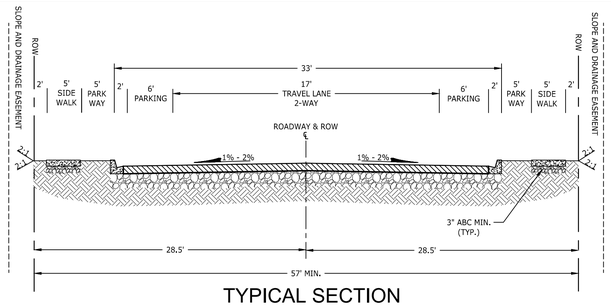


LOT PROVISIONS:

1. NOMINAL LOT AREA TO BE MIN. 5,000 SF, TYPICAL 50'X100' LOTS.
2. LOT WIDTH FOR INTERIOR LOTS IS 50 FT AT FRONT SETBACK LINE.
3. LOT WIDTH FOR CORNER LOTS IS 60 FT AT FRONT SETBACK LINE.
4. MAXIMUM ALLOWABE LOT COVERAGE IS 50%.
5. PER TRANSECT T3N2 AT LEAST 50% OF THE WIDTH OF THE HOUSE IS IN THE FACADE ZONE. ON 50' LOTS THE MINIMUM FACADE WIDTH IS 19'.
6. ALLOWABLE FRONTAGE TYPES PER TRANSECT T3N2: PORCH (ENGAGED, INTEGRAL, PROJECTING) AND COMMON YARD.
7. MINIMUM 10' GARAGE SETBACK FROM FRONT OF HOME.
8. MAXIMUM 21' GARAGE WIDTH.
9. PROVIDE A MINIMUM OF 2 PARKING SPACES PER LOT.
10. GROUND FINISH FLOOR LEVEL MAY BE LOWER THAN SIDEWALK GRADE AND 12" ABOVE SURROUNDING GRADE PROVIDING POSITIVE STORMWATER FLOW AWAY FROM THE HOME.
11. THE FRONT OF THE HOUSE MAY BE LOCATED OUTSIDE OF THE FRONT FACADE ZONE TO PRESERVE TREE RESOURCES, TO BE EVALUATED ON A CASE BY CASE BASIS.

JUNIPER POINT PARCEL 1 SINGLE FAMILY HOME

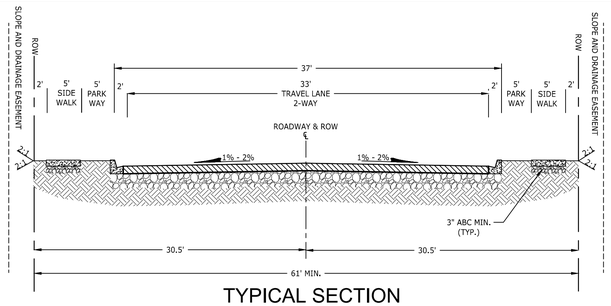
N.T.S.



TYPICAL SECTION

RESIDENTIAL LOCAL (COF 10-09-038)

N.T.S.



TYPICAL SECTION

RESIDENTIAL LOCAL "WIDE" (COF 10-09-037)

N.T.S.

NOTE: ONLY FOR SEGMENT OF ROCKPOINT THAT INTERSECTS WITH J.W. POWELL

LINE TABLE		
LINE #	LENGTH	DIRECTION
L1	85.86	N 1°56'28" W
L2	20.00	N 46°56'28" W
L3	45.86	S 88°03'32" W
L4	100.00	S 1°56'28" E
L5	60.00	N 88°03'32" E
L6	50.00	S 88°03'32" W
L7	100.00	S 1°56'28" E
L8	50.00	N 88°03'32" E
L9	50.00	S 88°03'32" W
L10	100.00	S 1°56'28" E
L11	50.00	N 88°03'32" E
L12	50.00	S 88°03'32" W
L13	100.00	S 1°56'28" E
L14	50.00	N 88°03'32" E
L15	22.61	S 88°03'32" W
L16	98.29	S 1°21'29" E
L17	51.00	N 88°03'32" E
L18	155.93	N 41°08'01" E
L19	140.03	N 88°03'32" E
L20	171.97	S 68°35'30" W
L21	80.45	S 0°22'24" E
L22	76.49	N 88°03'32" E
L23	16.07	N 1°56'28" W
L24	150.47	N 88°03'32" E
L25	24.23	S 25°08'36" W
L27	22.59	N 1°56'28" W
L28	122.56	S 88°23'58" E
L29	63.61	S 25°08'36" W
L30	100.00	S 81°56'11" E
L31	64.89	S 25°08'36" W
L32	100.00	S 75°28'39" E
L33	100.00	S 69°15'48" E
L34	100.00	S 77°31'51" E
L35	100.00	S 85°47'57" E
L36	100.00	N 85°55'57" E
L37	100.00	N 77°39'51" E
L38	121.61	N 69°23'44" E
L39	49.71	S 42°09'52" E
L40	104.24	N 63°28'39" E
L41	49.04	S 42°09'52" E
L42	118.83	N 82°23'21" E
L43	20.00	S 0°21'39" E
L44	67.35	S 42°09'52" E
L45	143.79	S 61°07'10" E
L46	124.27	S 0°21'39" E
L47	143.79	S 24°37'41" E
L48	129.80	S 47°07'35" W
L49	180.00	S 11°51'48" W
L50	68.94	N 78°08'12" W
L51	94.12	S 47°07'35" W
L52	110.84	S 48°21'17" W
L53	132.31	N 26°46'45" W
L54	21.05	N 78°08'12" W
L55	117.76	S 84°50'46" W
L56	111.53	N 26°46'45" W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L57	124.90	S 69°51'51" W
L58	44.61	N 3°37'09" W
L59	110.25	S 75°40'54" W
L60	62.13	N 3°37'09" W
L61	102.13	S 81°29'02" W
L62	59.76	N 3°37'09" W
L63	100.00	S 87°17'10" W
L64	49.65	N 3°37'09" W
L65	100.00	N 86°54'43" W
L66	100.00	N 81°06'35" W
L67	100.00	N 75°18'27" W
L68	100.00	N 69°30'00" W
L69	100.00	S 78°07'07" E
L70	43.79	S 1°56'28" E
L71	23.33	S 46°56'28" E
L72	46.50	N 88°03'32" E
L73	100.00	N 1°56'28" W
L74	60.87	S 88°03'32" W
L75	50.00	N 88°03'32" E
L76	100.00	N 1°56'28" W
L77	10.08	S 88°03'32" W
L78	39.92	S 88°03'32" W
L79	50.00	N 88°03'32" E
L80	100.00	S 1°56'28" E
L81	50.00	S 88°03'32" W
L82	50.00	N 88°03'32" E
L83	100.00	S 1°56'28" E
L84	50.00	S 88°03'32" W
L85	50.00	N 88°03'32" E
L86	100.00	S 1°56'28" E
L87	50.00	S 88°03'32" W
L88	119.75	N 88°03'32" E
L89	57.00	S 1°56'28" E
L90	57.36	S 88°03'32" W
L91	17.40	S 33°42'19" W
L92	20.73	S 1°56'28" E
L93	106.03	S 1°56'28" E
L94	40.73	N 1°56'28" W

LINE TABLE		
LINE #	LENGTH	DIRECTION
L105	16.00	S 8°04'37" W
L106	31.97	S 81°55'23" E
L108	92.18	S 78°07'07" E
L109	32.50	S 81°55'23" E
L113	22.66	S 30°20'54" E
L114	16.00	N 59°43'58" E
L115	31.29	S 30°20'54" E
L116	58.97	S 88°03'32" W
L117	8.00	N 1°56'28" W

CURVE TABLE			
CURVE #	LENGTH	RADIUS	DELTA
C1	10.88	59.00	10°33'50"
C2	16.64	59.00	16°09'37"
C3	38.59	59.00	37°28'43"
C4	41.28	59.00	40°05'29"
C5	17.92	59.00	17°23'52"
C6	10.88	59.00	10°33'50"
C7	26.49	428.50	3°32'30"
C8	48.33	428.50	6°27'47"
C9	48.31	428.50	6°27'33"
C10	59.58	528.50	6°27'33"
C11	47.43	428.50	6°20'30"
C12	0.94	421.50	0°07'40"
C13	0.72	321.50	0°07'40"
C14	58.50	528.50	6°20'30"
C15	60.82	421.50	8°16'03"
C16	46.39	321.50	8°16'03"
C17	60.83	421.50	8°16'06"
C18	46.40	321.50	8°16'06"
C19	60.83	421.50	8°16'06"
C20	46.40	321.50	8°16'06"
C21	60.83	421.50	8°16'06"
C22	46.40	321.50	8°16'06"
C23	60.83	421.50	8°16'06"
C24	26.11	421.50	3°32'58"
C25	47.47	63.50	42°50'08"
C26	45.26	63.50	40°50'09"
C27	40.44	63.50	36°29'29"
C28	40.44	63.50	36°29'29"
C29	40.44	63.50	36°29'29"
C30	40.44	63.50	36°29'29"
C31	40.44	63.50	36°29'29"
C32	44.80	63.50	40°25'15"
C33	37.39	478.50	4°28'40"
C34	48.48	478.50	5°48'17"
C35	48.48	478.50	5°48'19"
C36	48.48	478.50	5°48'19"
C37	9.08	578.50	0°53'59"
C38	48.48	478.50	5°48'19"
C39	58.61	578.50	5°48'17"
C40	48.48	478.50	5°48'19"
C41	58.61	578.50	5°48'17"
C42	48.48	478.50	5°48'19"
C43	58.61	578.50	5°48'17"
C44	48.48	478.50	5°48'16"
C45	58.61	578.50	5°48'18"
C46	3.04	478.50	0°21'51"
C47	58.24	371.50	8°58'58"
C48	42.57	271.50	8°58'58"
C49	3.68	578.50	0°21'51"
C50	49.84	371.50	7°41'13"
C51	25.65	271.50	5°24'47"
C52	39.78	371.50	6°08'08"

CERTIFICATE OF LAND SURVEYOR

THIS IS TO CERTIFY THAT THE SURVEY OF THE PROPERTY DESCRIBED AND PLATTED HEREON WAS MADE UNDER MY DIRECTION AND SUPERVISION AND IS ACCURATELY REPRESENTED ON THIS PLAT. I ALSO CERTIFY THAT THE PLAT IS IN SUBSTANTIAL CONFORMANCE TO THE APPROVED TENTATIVE PLAT AND THAT THIS PLAT IS CORRECT AND ACCURATE AS SHOWN TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Aaron D. Borling, RLS 48756

REGISTERED LAND SURVEYOR — 48756 — AARON D. BORLING — Date Signed 12/7/20 — ARIZONA, USA — Expires 12/31/22

C.O.F. Project #PZ-19-00122

FLAGSTAFF ARIZONA

PARCEL 1 AT JUNIPER POINT FINAL PLAT

SECTIONS & SETBACKS

JOB NO:	18256
DATE:	MAY 21
SCALE:	AS SHOWN
DRAWN:	MMB
DESIGN:	MMB/KMF
CHECKED:	ADB/SCI

NO.	DESCRIPTION	DATE	BY
REVISIONS			

Shephard Wesnitzer, Inc.
110 W. Dale Avenue
Flagstaff, AZ 86001
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ARIZONA811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
FP4

SHT NO. 5 OF 5

PLOTTED: May 27, 2021–9:21am

FILE: P:\2018\18256\DRAWINGS\PLATS\FINAL\18256 – FINAL PLAT.DWG SRWIN

8. G.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
:	
Co-Submitter:	Allison Hughes
Co-Submitter:	Allison Hughes
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Contract: Five (5)-year Master Services and Purchasing Agreement with Axon Enterprise, Inc. (formerly known as TASER International) for the Axon Officer Safety Plan, including, the Axon Flex body-worn cameras, Evidence.com License, and TASER 7 equipment in a five (5)-year total amount of $1,003,291.67.

STAFF RECOMMENDED ACTION:

1. Approve the funding of the five (5)-year Master Services and Purchasing Agreement with Axon Enterprise, Inc. for the Axon Officer Safety Plan in the total amount of $1,003,291.67, including, the Axon Flex body-worn cameras, Evidence.com License, and TASER 7 equipment. The first payment, which will be due in FY2021-22, will be in the amount of $124,909.99; the remaining four (4) payments, over the remaining four (4)-years of the contract will be in the amounts of $219,595.42; and
2. Authorize the City Manager to execute all necessary documents.

Executive Summary:

The Flagstaff Police Department is committed to the belief that body-worn cameras and TASERs are important and valuable tools, which help support the mission of the agency, with an emphasis on the valuing and protecting of life. The Flagstaff Police Department currently utilizes AXON Enterprise, Inc. (Axon) (formerly TASER International) body-worn cameras in conjunction with software known as Evidence.com. The body-worn camera video is audio-video documentation of a police officer's investigative and enforcement activities from the perspective of the officer. The use of body-worn cameras has created greater transparency, more effective prosecution, more efficient citizen complaint investigations, and improved protection against false allegations of excessive use of force, misconduct, or racial profiling. Approval of this Master Services and Purchasing Agreement (Agreement) will allow the Flagstaff Police Department to bundle next generation of body-worn cameras with TASER 7 equipment to provide the latest technologies and assure the City of Flagstaff has the necessary unlimited data storage to maintain captured videos. The Agreement will replace the two (2) existing contracts that the Flagstaff Police Department has for the Axon body-worn camera program and the TASER program which are set to expire at the end of FY 22.

The main reason for requesting this new Agreement is:

- It will allow the Flagstaff Police Department to bundle Axon equipment (body-worn cameras and

TASERs) and have new equipment issued every year-and-a-half from Axon. This will allow for new technology and increased performance.

- The upgrade allows the Flagstaff Police Department to have increased technology, better products, substantial savings (estimated at $200,000) over a five (5)-year period, and unlimited data storage.
- It will provide the opportunity to lock in 2021 prices with Axon for the next five (5)-years. This is the first year (2021), that Axon has decreased contract pricing, in an effort to help support law enforcement agencies, who may be struggling financially as a result of the COVID-19 pandemic. Additionally, the Flagstaff Police Department recognizes technology related costs have a consistent history of increasing year after year and this Agreement will help ensure the greatest cost-saving opportunity is maximized with Axon.

Financial Impact:

The current Axon body-worn cameras and TASER warranties will expire upon completion of FY2021-22. There will need to be a solution to continue the maintenance and replacement of the body-worn cameras and TASER platforms. This Agreement provides the Flagstaff Police Department that solution. The agency will retain credit from original contracts and receive substantial discounts from AXON to put towards the TASER Assurance Plan. This TASER Assurance Plan also warranties the equipment and allows the Flagstaff Police Department to have an open stock on accessories which are included in the Agreement. If the Agreement is approved, the first payment, which will be due in FY2021-22, will be in the amount of $124,909.99; the remaining four (4) payments, over the remaining four (4)-years of the Agreement will be the amount of $219,595.42. The FY2021-22 payment is budgeted in the Police budget in account number 001-04-062-0221-2-4303.

Policy Impact:

Failure to continue use of the body-worn cameras and/or TASER program will have significant impacts to the Flagstaff Police Department policy and procedures.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

Governance (Public Safety)
The AXON body-worn camera system benefits the City of Flagstaff, community members, the Flagstaff Police Department and individual officers. The use of this technology will help to protect officers and the Flagstaff Police Department from false accusations of wrongdoing as well as continue the agency's history of transparency with the community. The body-worn cameras have also assisted with prosecution of criminal cases.

Has There Been Previous Council Decision on This:

No. However, a similar five (5)-year contract for Axon body-worn cameras received approval from City Council in June 2017. Additionally, in FY2020-21, a contract for the use of a TASER products was also approved by City Council for one (1)-year.

Options and Alternatives:

1. The City Council may approve the Agreement with the Axon for the next five (5)-years with an option to renew; or
2. The City Council may choose to reject the Agreement. If the Agreement is rejected, the warranty for the current body-warn cameras will expire in FY2021 and Axon will start charging for the overage in data and all replacement of body-worn camera components. Further, the Flagstaff Police Department would be required to pay for any future upgrades to body-worn camera systems/equipment and TASER equipment.

Background/History:
The Flagstaff Police Department successfully implemented the use of body-worn cameras in July of 2014. Currently, all sworn officers assigned to patrol and working in the field have been equipped with Axon FLEX 2 body-worn cameras. There are currently two (2) contracts for Axon Flex 2 body-worn cameras and evidence storage.

The use of body-worn cameras supports a reduction in citizen complaints, use of force incidents; they support an increase in capturing valuable evidence to help with the prosecution of crimes and to continue to assist with the transparency of the Flagstaff Police Department operations with the community. In the first year of the body-worn cameras, there was a 38% decrease in complaints (2015 compared to 2014). The Flagstaff Police Department is committed to the belief that the body-worn camera is an important and valuable tool for law enforcement, including, the software known as Evidence.com which offers storage and redaction. The officers have been able to record their investigations which are then reviewed by detectives and attorneys facilitating prosecution. The body-worn cameras have proven to work well with the Flagstaff Police Department and meet the needs of officers and citizens of Flagstaff.

The benefits of using body-worn cameras include:

- Reducing use of force incidents and citizen complaints.
- Provide an exceptional point of view recording of incidents and crime scenes.
- Capturing valuable statements by victims, witnesses, and suspects to aid in prosecution.
- Afford officers an opportunity to review incidents to enhance their reports and their testimony in court.
- Allows supervisors to review officer interactions to provide mentorship and training, if they recognize areas of potential improvement.
- The Officer Safety Plan allows the police department to have new technology and better support from Axon.

The customer service provided by Axon has been exceptional and support is available when needed, especially during major investigations. As noted, Axon has developed a product called Evidence.com which is a cloud-based storage system that complies with the requirements of the Arizona Criminal Justice Information System (ACJIS). Evidence.com stores all officers' video in accordance with retention schedules, allowing investigators to review the investigations and share them with the City and County Attorney's Office. This is an exceptional tool for prosecution as well as investigations. Evidence.com has redaction software which allows the Flagstaff Police Department to release videos to the public in an expedient manner, but stay in compliance with state law by redacting any personal and sensitive video footage. The redaction tool and ability to quickly upload redacted video has been invaluable to supporting our agency's dedication to transparency and communication.

There are many benefits of a cloud-based system offered by Evidence.com. The first being that there are no hardware costs to the Flagstaff Police Department; no hardware systems need to be replaced and no additional computer or servers are needed for initial or ongoing purchase/replacement. There is no burden on the Flagstaff Police Department to worry about available storage space since there is unlimited storage available on Evidence.com. This helps reduce the amount of physical or tangible media placed in our evidence room; this digital media is stored in the cloud. Officers also use the Axon Capture phone application, which allows them to take and upload crime scene photographs with their personal electronic devices, which are uploaded and stored in Evidence.com. Similarly, Axon has developed Axon Citizen, allowing officers, detectives or any department user, to share a link to a community member and afford an opportunity to the community member to upload photos or videos from their device to the associated incident. This reduces staff time in uploading or gathering the photos or videos electronically, then burning those videos or images to a disc.

One component of the Agreement is the Axon Assurance Plan which allows for extended hardware

coverage, spare parts for the cameras, and upgrade models every year and a half. Additionally, new Axon docking stations are included for both the TASER 7 and body-worn camera Flex 3 platforms. The Agreement will also include unlimited storage and have an improved redaction software to help save on staff time and resources when producing public record and/or media requests.

The Procurement Department has done its due diligence and determined that this Agreement qualifies as a sole source purchase. The Flagstaff Police Department has been using Axon products for many years and has trained its officers extensively on use of the Axon Flex body-worn cameras and TASER products. This Agreement will promote continuity within the department on very complex products and technology. This includes the use of the software program, Evidence.com which under the proposed Agreement, has expanded to cloud storage technology. New Axon body-worn camera products are compatible with this cloud storage technology. The Flagstaff Police Department has been implementing Axon's products and services successfully and entering into the Agreement would be an appropriate sole source purchase.

Key Considerations:

1. The Flagstaff Police Department has been using Axon body-worn camera systems since 2017. Officers are familiar with the devices, the software and how to label, upload, download, share, search, categorize and store the videos properly in Evidence.com.
2. The Agreement would allow the Flagstaff Police Department to have unlimited data.
3. The Agreement provides officers with additional training and materials as required for the continued deployment of Axon equipment.
4. The Agreement affords the Flagstaff Police Department great long-term training advantages by offering the ability to have two (2) “TASER Master Instructors”, which is an ongoing financial benefit to the City of Flagstaff, insofar as, the agency would be able to recertify existing TASER Instructors (in lieu of sending them to Scottsdale for multiple days for the recertification) and train new TASER Instructors (in lieu of sending personnel to Scottsdale for two weeks to receive their certification).
5. The Agreement will upgrade to the TASER 7 platform, which has shown increased effectiveness for penetrating dense clothing, greater incapacitation of combative subjects, multiple prong deployment ability (currently the TAXER X26 only has a one-time prong deployment capability, while the TASER 7 has two opportunities for long-range deployment to incapacitate a combative subject).

Expanded Financial Considerations:

The initial payment of $124,909.99, will allow for an immediate upgrade to the TASER 7 conductive energy weapon for sworn officers, training cartridges and live TASER 7 cartridges. In addition to the TASER 7 equipment, the costs for body-worn camera evidence storage and retention will also be included; basic and professional evidence storage licensing along with unlimited data for all videos stored on Evidence.com is also part of this Agreement.

The total amount for the five (5)-year term of the Agreement will be $1,003,291.67. The amount requested for year one (FY 2021-22) is $124,909.99.

The true value of the Agreement without the Flagstaff Police Department's credit or discount would be $1,129,364.50. Based on the total value of the contract ($1,129,364.50), the Axon discount is $200,820.62, or a 17.8% discount of list price. The subtotal of the Agreement before taxes, and shipping and handling is $928,543.88. Taxes of $74,747.79 bringing the total amount of the Agreement to $1,003,291.67.

- **Year ONE** will be in the amount of $124,909.99 and will include replacement equipment and unlimited evidence storage and retention of videos. The Agreement also includes redaction and sharing tools to properly manage the release of videos, as well as TASER Instructor/Master Instructor certification vouchers.

- **Year TWO** will be in the amount of $219,595.42 and will include replacement of broken or damaged equipment along with unlimited evidence storage, retention of videos and redacting software, as well as TASER Instructor/Master Instructor certification vouchers.
- **Year THREE** will be in the amount of $219,595.42 and will include a replacement of all body-worn cameras with Axon's newest technology and unlimited evidence storage, retention of videos and redacting software, as well as TASER Instructor/Master Instructor certification vouchers.
- **Year FOUR** will be in the amount of $219,595.42 and will include replacement of broken or damaged equipment along with unlimited evidence storage and retention of videos, as well as TASER Instructor/Master Instructor certification vouchers.
- **Year FIVE** will be in the amount of $219,595.42 and will include a replacement of all body-worn cameras with Axon's newest technology and unlimited evidence storage and retention of video, as well as TASER Instructor/Master Instructor certification vouchers. This will be the last year of the Agreement.

Community Benefits and Considerations:

The Flagstaff Police Department values customer service and community trust. Axon body-worn camera videos will aid in prosecution, accurately documenting victim and witness statements as well as creating an objective recording of the crime scene. The use of Axon body-worn cameras allows the City of Flagstaff and the Flagstaff Police Department to be more transparent in officer interactions with the public. As a risk management tool, the video recorded by the body-worn cameras and stored in the Evidence.com cloud may alleviate accusations of wrong-doing and prevent use of force incidents.

Community Involvement:

The audio and video recording from the body-worn cameras have helped enhance the Flagstaff Police Department's ability to review probable cause for arrests, view officer and suspect interactions, provide feedback for officers in training and allows for a visual of evidence collecting for investigation and prosecution. The Flagstaff Police Department has received multiple requests from the media and citizens requesting body-camera footage and by having this tool has helped to increase trust between the department and the community. There have been many meetings with City community members who have vocalized their support of the body-worn camera program.

Attachments: Contract with Axon
Quote for products

Master Services and Purchasing Agreement between Axon and Agency

This Master Services and Purchasing Agreement ("**Agreement**") is between Axon Enterprise, Inc., a Delaware corporation ("**Axon**"), and the agency on the Quote ("**Agency**"). This Agreement is effective as of the later of the (a) last signature date on this Agreement or (b) signature date on the Quote ("**Effective Date**"). Axon and Agency are each a "**Party**" and collectively "**Parties**". This Agreement governs Agency's purchase and use of the Axon Devices and Services detailed in the Quote Appendix ("**Quote**"). It is the intent of the Parties that this Agreement act as a master agreement governing all subsequent purchases by Agency for the same Axon products and services in the Quote, and all such subsequent quotes accepted by Agency shall be also incorporated into this Agreement by reference as a Quote. The Parties therefore agree as follows:

1 **Definitions**.

"**Axon Cloud Services**" means Axon's web services for Axon Evidence, Axon Records, Axon Dispatch, and interactions between Evidence.com and Axon Devices or Axon client software. Axon Cloud Service excludes third-party applications, hardware warranties, and my.evidence.com.

"**Axon Device**" means all hardware provided by Axon under this Agreement.

"**Quote**" means an offer to sell and is only valid for devices and services on the quote at the specified prices. Any terms within Agency's purchase order in response to a Quote will be void. Orders are subject to prior credit approval. Changes in the deployment estimated ship date may change charges in the Quote. Shipping dates are estimates only. Axon is not responsible for typographical errors in any offer by Axon, and Axon reserves the right to cancel any orders resulting from such errors.

"**Services**" means all services provided by Axon under this Agreement, including software, Axon Cloud Services, and professional services.

2 **Term**. This Agreement begins on the Effective Date and continues until all subscriptions hereunder have expired or have been terminated ("**Term**").

All subscriptions including Axon Evidence, Axon Fleet, Officer Safety Plans, Technology Assurance Plans, and TASER 7 plans begin after shipment of the applicable Axon Device. If Axon ships the Axon Device in the first half of the month, the start date is the 1st of the following month. If Axon ships the Axon Device in the second half of the month, the start date is the 15th of the following month. For purchases solely of Axon Evidence subscriptions, the start date is the Effective Date. Each subscription term ends upon completion of the subscription stated in the Quote ("**Subscription Term**").

Upon completion of the Subscription Term, the Subscription Term will automatically renew for an additional 5 years ("**Renewal Term**"). For purchase of TASER 7 as a standalone, Axon may increase pricing to its then-current list pricing for any Renewal Term. For all other purchases, Axon may increase pricing on all line items in the Quote up to 3% at the beginning of each year of the Renewal Term. New devices and services may require additional terms. Axon will not authorize services until Axon receives a signed Quote or accepts a purchase order, whichever is first.

3 **Payment**. Axon invoices upon shipment. Payment is due net 30 days from the invoice date. Payment obligations are non-cancelable. Agency will pay invoices without setoff, deduction, or withholding. If Axon sends a past due account to collections, Agency is responsible for collection and attorneys' fees.

4 **Taxes**. Agency is responsible for sales and other taxes associated with the order unless Agency provides Axon a valid tax exemption certificate.

5 **Shipping**. Axon may make partial shipments and ship Axon Devices from multiple locations. All shipments are FOB shipping point via common carrier. Title and risk of loss pass to Agency upon Axon's delivery to the common carrier. Agency is responsible for any shipping charges in the Quote.

6 **Returns**. All sales are final. Axon does not allow refunds or exchanges, except warranty returns or as provided by state or federal law.

7 Warranty.

7.1 Hardware Limited Warranty. Axon warrants that Axon-manufactured Devices are free from defects in workmanship and materials for 1 year from the date of Agency's receipt, except Signal Sidearm, which Axon warrants for 30 months from the date of Agency's receipt. Axon warrants its Axon-manufactured accessories for 90-days from the date of Agency's receipt. Used conducted energy weapon ("**CEW**") cartridges are deemed to have operated properly. Extended warranties run from the expiration of the 1-year hardware warranty through the extended warranty term. Non-Axon manufactured Devices are not covered by Axon's warranty. Agency should contact the manufacturer for support of non-Axon manufactured Devices.

7.2 Claims. If Axon receives a valid warranty claim for an Axon manufactured Device during the warranty term, Axon's sole responsibility is to repair or replace the Device with the same or like Device, at Axon's option. A replacement Axon Device will be new or like new. Axon will warrant the replacement Axon Device for the longer of (a) the remaining warranty of the original Axon Device or (b) 90-days from the date of repair or replacement.

If Agency exchanges a device or part, the replacement item becomes Agency's property, and the replaced item becomes Axon's property. Before delivering a Axon Device for service, Agency must upload Axon Device data to Axon Evidence or download it and retain a copy. Axon is not responsible for any loss of software, data, or other information contained in storage media or any part of the Axon Device sent to Axon for service.

7.3 Spare Axon Devices. For qualified purchases, Axon may provide Agency a predetermined number of spare Axon Devices as detailed in the Quote ("**Spare Axon Devices**"). Spare Axon Devices are intended to replace broken or non-functioning units while Agency submits the broken or non-functioning units, through Axon's warranty return process. Axon will repair or replace the unit with a replacement Axon Device. Title and risk of loss for all Spare Axon Devices shall pass to Agency in accordance with shipping terms under Section 5. Axon assumes no liability or obligation in the event Agency does not utilize Spare Axon Devices for the intended purpose.

7.4 Limitations. Axon's warranty excludes damage related to: (a) failure to follow Axon Device use instructions; (b) Axon Devices used with equipment not manufactured or recommended by Axon; (c) abuse, misuse, or intentional damage to Axon Device; (d) force majeure; (e) Axon Devices repaired or modified by persons other than Axon without Axon's written permission; or (f) Axon Devices with a defaced or removed serial number.

7.4.1 To the extent permitted by law, the above warranties and remedies are exclusive. Axon disclaims all other warranties, remedies, and conditions, whether oral, written, statutory, or implied. If statutory or implied warranties cannot be lawfully disclaimed, then such warranties are limited to the duration of the warranty described above and by the provisions in this Agreement.

7.4.2 Axon's cumulative liability to any Party for any loss or damage resulting from any claim, demand, or action arising out of or relating to any Axon Device or Service will not exceed the purchase price paid to Axon for the Axon Device, or if for Services, the amount paid for such Services over the 12 months preceding the claim. Neither Party will be liable for direct, special, indirect, incidental, punitive or consequential damages, however caused, whether for breach of warranty or contract, negligence, strict liability, tort or any other legal theory.

8 Statement of Work. Certain Axon Devices and Services, including Axon Interview Room, Axon Channel Services, and Axon Fleet, may require a Statement of Work that details Axon's Service deliverables ("**SOW**"). In the event Axon provides an SOW to Agency, Axon is only responsible to perform Services described in the SOW. Additional services are out of scope. The Parties must document scope changes in a written and signed change order. Changes may require an equitable adjustment in fees or schedule. The SOW is incorporated into this Agreement by reference.

9 Axon Device Warnings. See www.axon.com/legal for the most current Axon Device warnings.

10 **Design Changes**. Axon may make design changes to any Axon Device or Service without notifying Agency or making the same change to Axon Devices and Services previously purchased by Agency.

11 **Bundled Offerings**. Some offerings in bundled offerings may not be generally available at the time of Agency's purchase. Axon will not provide a refund, credit, or additional discount beyond what is in the Quote due to a delay of availability or Agency's election not to utilize any portion of an Axon bundle.

12 **Insurance**. Axon will maintain General Liability, Workers' Compensation, and Automobile Liability insurance. Upon request, Axon will supply certificates of insurance.

13 **Indemnification**. Axon will indemnify Agency's officers, directors, and employees ("**Agency Indemnitees**") against all claims, demands, losses, and reasonable expenses arising out of a third-party claim against an Agency Indemnitee resulting from any negligent act, error or omission, or willful misconduct by Axon under this Agreement, except to the extent of Agency's negligence or willful misconduct, or claims under workers compensation.

14 **IP Rights**. Axon owns and reserves all right, title, and interest in Axon devices and services and suggestions to Axon, including all related intellectual property rights. Agency will not cause any Axon proprietary rights to be violated.

15 **IP Indemnification**. Axon will indemnify Agency Indemnitees against all claims, losses, and reasonable expenses from any third-party claim alleging that the use of Axon Devices or Services infringes or misappropriates the third-party's intellectual property rights. Agency must promptly provide Axon with written notice of such claim, tender to Axon the defense or settlement of such claim at Axon's expense and cooperate fully with Axon in the defense or settlement of such claim. Axon's IP indemnification obligations do not apply to claims based on (a) modification of Axon Devices or Services by Agency or a third-party not approved by Axon; (b) use of Axon Devices and Services in combination with hardware or services not approved by Axon; (c) use of Axon Devices and Services other than as permitted in this Agreement; or (d) use of Axon software that is not the most current release provided by Axon.

16 **Agency Responsibilities**. Agency is responsible for (a) Agency's use of Axon Devices; (b) breach of this Agreement or violation of applicable law by Agency or an Agency end user; and (c) a dispute between Agency and a third-party over Agency's use of Axon Devices.

17 **Termination**.

17.1 **For Breach**. A Party may terminate this Agreement for cause if it provides 30 days written notice of the breach to the other Party, and the breach remains uncured at the end of 30 days. If Agency terminates this Agreement due to Axon's uncured breach, Axon will refund prepaid amounts on a prorated basis based on the effective date of termination.

17.2 **By Agency**. If sufficient funds are not appropriated or otherwise legally available to pay the fees, Agency may terminate this Agreement. Agency will deliver notice of termination under this section as soon as reasonably practicable.

17.3 **Effect of Termination**. Upon termination of this Agreement, Agency rights immediately terminate. Agency remains responsible for all fees incurred before the effective date of termination. If Agency purchases Axon Devices for less than the manufacturer's suggested retail price ("**MSRP**") and this Agreement terminates before the end of the Term, Axon will invoice Agency the difference between the MSRP for Axon Devices received, including any Spare Axon Devices, and amounts paid towards those Axon Devices. Only if terminating for non-appropriation, Agency may return Axon Devices to Axon within 30 days of termination. MSRP is the standalone price of the individual Axon Device at the time of sale. For bundled Axon Devices, MSRP is the standalone price of all individual components.

18 **Confidentiality**. "**Confidential Information**" means nonpublic information designated as confidential or, given the nature of the information or circumstances surrounding disclosure, should reasonably be

understood to be confidential. Each Party will take reasonable measures to avoid disclosure, dissemination, or unauthorized use of the other Party's Confidential Information. Unless required by law, neither Party will disclose the other Party's Confidential Information during the Term and for 5-years thereafter. Axon pricing is Confidential Information and competition sensitive. If Agency is required by law to disclose Axon pricing, to the extent allowed by law, Agency will provide notice to Axon before disclosure. Axon may publicly announce information related to this Agreement.

19 General.

19.1 Force Majeure. Neither Party will be liable for any delay or failure to perform due to a cause beyond a Party's reasonable control.

19.2 Independent Contractors. The Parties are independent contractors. Neither Party has the authority to bind the other. This Agreement does not create a partnership, franchise, joint venture, agency, fiduciary, or employment relationship between the Parties.

19.3 Third-Party Beneficiaries. There are no third-party beneficiaries under this Agreement.

19.4 Non-Discrimination. Neither Party nor its employees will discriminate against any person based on race; religion; creed; color; sex; gender identity and expression; pregnancy; childbirth; breastfeeding; medical conditions related to pregnancy, childbirth, or breastfeeding; sexual orientation; marital status; age; national origin; ancestry; genetic information; disability; veteran status; or any class protected by local, state, or federal law.

19.5 Export Compliance. Each Party will comply with all import and export control laws and regulations.

19.6 Assignment. Neither Party may assign this Agreement without the other Party's prior written consent. Axon may assign this Agreement, its rights, or obligations without consent: (a) to an affiliate or subsidiary; or (b) for purposes of financing, merger, acquisition, corporate reorganization, or sale of all or substantially all its assets. This Agreement is binding upon the Parties respective successors and assigns.

19.7 Waiver. No waiver or delay by either Party in exercising any right under this Agreement constitutes a waiver of that right.

19.8 Severability. If a court of competent jurisdiction holds any portion of this Agreement invalid or unenforceable, the remaining portions of this Agreement will remain in effect.

19.9 Survival. The following sections will survive termination: Payment, Warranty, Axon Device Warnings, Indemnification, IP Rights, and Agency Responsibilities.

19.10 Governing Law. The laws of the state where Agency is physically located, without reference to conflict of law rules, govern this Agreement and any dispute arising from it. The United Nations Convention for the International Sale of Goods does not apply to this Agreement.

19.11 Notices. All notices must be in English. Notices posted on Agency's Axon Evidence site are effective upon posting. Notices by email are effective on the sent date of the email. Notices by personal delivery are effective immediately. Contact information for notices:

Axon: Axon Enterprise, Inc.	Agency:
Attn: Legal	Attn:
17800 N. 85th Street	Street Address
Scottsdale, Arizona 85255	City, State, Zip
legal@axon.com	Email

19.12 Entire Agreement. This Agreement, including the Appendices and any SOW(s), represents the entire agreement between the Parties. This Agreement supersedes all prior agreements or

understandings, whether written or verbal, regarding the subject matter of this Agreement. This Agreement may only be modified or amended in a writing signed by the Parties.

Each representative identified below declares they have been expressly authorized to execute this Agreement as of the date of signature.

Axon Enterprise, Inc.	**Agency**
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____

Axon Cloud Services Terms of Use Appendix

1 **Definitions**.

"Agency Content" is data uploaded into, ingested by, or created in Axon Cloud Services within Agency's tenant, including media or multimedia uploaded into Axon Cloud Services by Agency. Agency Content includes Evidence but excludes Non-Content Data.

"**Evidence**" is media or multimedia uploaded into Axon Evidence as 'evidence' by an Agency. Evidence is a subset of Agency Content.

"**Non-Content Data**" is data, configuration, and usage information about Agency's Axon Cloud Services tenant, Axon Devices and client software, and users that is transmitted or generated when using Axon Devices. Non-Content Data includes data about users captured during account management and customer support activities. Non-Content Data does not include Agency Content.

"**Personal Data**" means any information relating to an identified or identifiable natural person. An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

2 **Access**. Upon Axon granting Agency a subscription to Axon Cloud Services, Agency may access and use Axon Cloud Services to store and manage Agency Content. Agency may not exceed more end users than the Quote specifies. Axon Air requires an Axon Evidence subscription for each drone operator. For Axon Evidence Lite, Agency may access and use Axon Evidence only to store and manage TASER CEW and TASER CAM data ("**TASER Data**"). Agency may not upload non-TASER Data to Axon Evidence Lite.

3 **Agency Owns Agency Content**. Agency controls and owns all right, title, and interest in Agency Content. Except as outlined herein, Axon obtains no interest in Agency Content, and Agency Content is not Axon's business records. Agency is solely responsible for uploading, sharing, managing, and deleting Agency Content. Axon will only have access to Agency Content for the limited purposes set forth herein. Agency agrees to allow Axon access to Agency Content to (a) perform troubleshooting, maintenance, or diagnostic screenings; and (b) enforce this Agreement or policies governing use of the Axon products.

4 **Security**. Axon will implement commercially reasonable and appropriate measures to secure Agency Content against accidental or unlawful loss, access or disclosure. Axon will maintain a comprehensive information security program to protect Axon Cloud Services and Agency Content including logical, physical access, vulnerability, risk, and configuration management; incident monitoring and response; encryption of uploaded digital evidence; security education; and data protection. Axon agrees to the Federal Bureau of Investigation Criminal Justice Information Services Security Addendum.

5 **Agency Responsibilities**. Agency is responsible for (a) ensuring Agency owns Agency Content; (b) ensuring no Agency Content or Agency end user's use of Agency Content or Axon Cloud Services violates this Agreement or applicable laws; and (c) maintaining necessary computer equipment and Internet connections for use of Axon Cloud Services. If Agency becomes aware of any violation of this Agreement by an end user, Agency will immediately terminate that end user's access to Axon Cloud Services.

Agency will also maintain the security of end user names and passwords and security and access by end users to Agency Content. Agency is responsible for ensuring the configuration and utilization of Axon Cloud Services meet applicable Agency regulation and standards. Agency may not sell, transfer, or sublicense access to any other entity or person. Agency shall contact Axon immediately

if an unauthorized party may be using Agency's account or Agency Content, or if account information is lost or stolen.

To the extent Agency uses the Axon Cloud Services to interact with YouTube®, such use may be governed by the YouTube Terms of Service, available at https://www.youtube.com/static?template=terms.

6 **Privacy**. Agency's use of Axon Cloud Services is subject to the Axon Cloud Services Privacy Policy, a current version of which is available at https://www.axon.com/legal/cloud-services-privacy-policy. Agency agrees to allow Axon access to Non-Content Data from Agency to (a) perform troubleshooting, maintenance, or diagnostic screenings; (b) provide, develop, improve, and support current and future Axon products and related services; and (c) enforce this Agreement or policies governing the use of Axon products.

7 **Axon Body 3 Wi-Fi Positioning**. Axon Body 3 cameras offer a feature to enhance location services where GPS/GNSS signals may not be available, for instance, within buildings or underground. Agency administrators can manage their choice to use this service within the administrative features of Axon Cloud Services. If Agency chooses to use this service, Axon must also enable the usage of the feature for Agency's Axon Cloud Services tenant. Agency will not see this option with Axon Cloud Services unless Axon has enabled Wi-Fi Positioning for Agency's Axon Cloud Services tenant. When Wi-Fi Positioning is enabled by both Axon and Agency, Non-Content and Personal Data will be sent to Skyhook Holdings, Inc. ("**Skyhook"**) to facilitate the Wi-Fi Positioning functionality. Data controlled by Skyhook is outside the scope of the Axon Cloud Services Privacy Policy and is subject to the Skyhook Services Privacy Policy.

8 **Storage**. For Axon Unlimited Device Storage subscriptions, Agency may store unlimited data in Agency's Axon Evidence account only if data originates from Axon Capture or the applicable Axon Device. Axon may charge Agency additional fees for exceeding purchased storage amounts. Axon may place Agency Content that Agency has not viewed or accessed for 6 months into archival storage. Agency Content in archival storage will not have immediate availability and may take up to 24 hours to access.

9 **Location of Storage**. Axon may transfer Agency Content to third-party subcontractors for storage. Axon will determine the locations of data centers for storage of Agency Content. For United States agencies, Axon will ensure all Agency Content stored in Axon Cloud Services remains within the United States. Ownership of Agency Content remains with Agency.

10 **Suspension**. Axon may temporarily suspend Agency's or any end user's right to access or use any portion or all of Axon Cloud Services immediately upon notice, if Agency or end user's use of or registration for Axon Cloud Services may (a) pose a security risk to Axon Cloud Services or any third-party; (b) adversely impact Axon Cloud Services , the systems, or content of any other customer; (c) subject Axon, Axon's affiliates, or any third-party to liability; or (d) be fraudulent.

Agency remains responsible for all fees incurred through suspension. Axon will not delete Agency Content because of suspension, except as specified in this Agreement.

11 **Axon Cloud Services Warranty**. Axon disclaims any warranties or responsibility for data corruption or errors before Agency uploads data to Axon Cloud Services.

12 **Axon Records**. Axon Records is the software-as-a-service product that is generally available at the time Agency purchases an OSP 7 bundle. During Agency's Axon Records Subscription Term, Agency will be entitled to receive Axon's Update and Upgrade releases on an if-and-when available basis.

The Axon Records Subscription Term will end upon the competition of the Axon Records

Subscription as documented in the Quote, or if purchased as part of an OSP 7 bundle, upon competition of the OSP 7 Term ("**Axon Records Subscription**")

An "**Update**" is a generally available release of Axon Records that Axon makes available from time to time. An "**Upgrade**" includes (i) new versions of Axon Records that enhance features and functionality, as solely determined by Axon; and/or (ii) new versions of Axon Records that provide additional features or perform additional functions. Upgrades exclude new products that Axon introduces and markets as distinct products or applications.

New or additional Axon products and applications, as well as any Axon professional services needed to configure Axon Records, are not included. If Agency purchases Axon Records as part of a bundled offering, the Axon Record subscription begins on the later of the (1) start date of that bundled offering, or (2) date Axon provisions Axon Records to Agency.

13 **Axon Cloud Services Restrictions**. Agency and Agency end users (including employees, contractors, agents, officers, volunteers, and directors), may not, or may not attempt to:

- **13.1** copy, modify, tamper with, repair, or create derivative works of any part of Axon Cloud Services;
- **13.2** reverse engineer, disassemble, or decompile Axon Cloud Services or apply any process to derive any source code included in Axon Cloud Services, or allow others to do the same;
- **13.3** access or use Axon Cloud Services with the intent to gain unauthorized access, avoid incurring fees or exceeding usage limits or quotas;
- **13.4** use trade secret information contained in Axon Cloud Services, except as expressly permitted in this Agreement;
- **13.5** access Axon Cloud Services to build a competitive device or service or copy any features, functions, or graphics of Axon Cloud Services;
- **13.6** remove, alter, or obscure any confidentiality or proprietary rights notices (including copyright and trademark notices) of Axon's or Axon's licensors on or within Axon Cloud Services; or
- **13.7** use Axon Cloud Services to store or transmit infringing, libelous, or other unlawful or tortious material; to store or transmit material in violation of third-party privacy rights; or to store or transmit malicious code.

14 **After Termination**. Axon will not delete Agency Content for 90-days following termination. There will be no functionality of Axon Cloud Services during these 90-days other than the ability to retrieve Agency Content. Agency will not incur additional fees if Agency downloads Agency Content from Axon Cloud Services during this time. Axon has no obligation to maintain or provide Agency Content after these 90-days and will thereafter, unless legally prohibited, delete all Agency Content. Upon request, Axon will provide written proof that Axon successfully deleted and fully removed all Agency Content from Axon Cloud Services.

15 **Post-Termination Assistance**. Axon will provide Agency with the same post-termination data retrieval assistance that Axon generally makes available to all customers. Requests for Axon to provide additional assistance in downloading or transferring Agency Content, including requests for Axon's data egress service, will result in additional fees and Axon will not warrant or guarantee data integrity or readability in the external system.

16 **U.S. Government Rights**. If Agency is a U.S. Federal department or using Axon Cloud Services on behalf of a U.S. Federal department, Axon Cloud Services is provided as a "commercial item," "commercial computer software," "commercial computer software documentation," and "technical data", as defined in the Federal Acquisition Regulation and Defense Federal Acquisition Regulation Supplement. If Agency is using Axon Cloud Services on behalf of the U.S. Government and these terms fail to meet the U.S. Government's needs or are inconsistent in any respect with federal law, Agency will immediately discontinue use of Axon Cloud Services.

17 **Survival**. Upon any termination of this Agreement, the following sections in this Appendix will survive: Agency Owns Agency Content, Storage, Axon Cloud Services Warranty, and Axon Cloud Services Restrictions.

Axon Customer Experience Improvement Program Appendix

1 **Axon Customer Experience Improvement Program (ACEIP)**. The ACEIP is designed to accelerate Axon's development of technology, such as building and supporting automated features, to ultimately increase safety within communities and drive efficiency in public safety. To this end, subject to the limitations on Axon as described below, Axon, where allowed by law, may make limited use of Agency Content from all of its customers, to provide, develop, improve, and support current and future Axon products (collectively, "**ACEIP Purposes**"). However, at all times, Axon will comply with its obligations pursuant to the Axon Cloud Services Terms of Use Appendix to maintain a comprehensive data security program (including compliance with the CJIS Security Policy for Criminal Justice Information), privacy program, and data governance policy, including high industry standards of de-identifying Personal Data, to enforce its security and privacy obligations for the ACEIP. ACEIP has 2 tiers of participation, Tier 1 and Tier 2. By default, Agency will be a participant in ACEIP Tier 1. If Agency does not want to participate in ACEIP Tier 1, Agency can revoke its consent at any time. If Agency wants to participate in Tier 2, as detailed below, Agency can check the ACEIP Tier 2 box below. If Agency does not want to participate in ACEIP Tier 2, Agency should leave box unchecked. At any time, Agency may revoke its consent to ACEIP Tier 1, Tier 2, or both Tiers.

1.1 ACEIP Tier 1.

1.1.1. When Axon uses Agency Content for the ACEIP Purposes, Axon will extract from Agency Content and may store separately copies of certain segments or elements of the Agency Content (collectively, "**ACEIP Content**"). When extracting ACEIP Content, Axon will use commercially reasonable efforts to aggregate, transform or de-identify Agency Content so that the extracted ACEIP Content is no longer reasonably capable of being associated with, or could reasonably be linked directly or indirectly to a particular individual ("**Privacy Preserving Technique(s)**"). For illustrative purposes, some examples are described in footnote 1[1]. For clarity, ACEIP Content will still be linked indirectly, with an attribution, to the Agency from which it was extracted. This attribution will be stored separately from the data itself, but is necessary for and will be solely used to enable Axon to identify and delete all ACEIP Content upon Agency request. Once de-identified, ACEIP Content may then be further modified, analyzed, and used to create derivative works. At any time, Agency may revoke the consent granted herein to Axon to access and use Agency Content for ACEIP Purposes. Within 30 days of receiving the Agency's request, Axon will no longer access or use Agency Content for ACEIP Purposes and will delete any and all ACEIP Content. Axon will also delete any derivative works which may reasonably be capable of being associated with, or could reasonably be linked directly or indirectly to Agency. In addition, if Axon uses Agency Content for the ACEIP Purposes, upon request, Axon will make available to Agency a list of the specific type of Agency Content being used to generate ACEIP Content, the purpose of such use, and the retention, privacy preserving extraction technique, and relevant data protection practices

[1] For example; (a) when extracting specific text to improve automated transcription capabilities, text that could be used to directly identify a particular individual would not be extracted, and extracted text would be disassociated from identifying metadata of any speakers, and the extracted text would be split into individual words and aggregated with other data sources (including publicly available data) to remove any reasonable ability to link any specific text directly or indirectly back to a particular individual; (b) when extracting license plate data to improve Automated License Plate Recognition (ALPR) capabilities, individual license plate characters would be extracted and disassociated from each other so a complete plate could not be reconstituted, and all association to other elements of the source video, such as the vehicle, location, time, and the surrounding environment would also be removed; (c) when extracting audio of potential acoustic events (such as glass breaking or gun shots), very short segments (<1 second) of audio that only contains the likely acoustic events would be extracted and all human utterances would be removed.

applicable to the Agency Content or ACEIP Content ("Use Case"). From time to time, Axon may develop and deploy new Use Cases. At least 30 days prior to authorizing the deployment of any new Use Case, Axon will provide Agency notice (by updating the list of Use Case at https://www.axon.com/aceip and providing Agency with a mechanism to obtain notice of that update or another commercially reasonable method to Agency designated contact) ("**New Use Case**").

1.1.2. **Expiration of ACEIP Tier 1**. Agency consent granted herein, will expire upon termination of the Agreement. In accordance with section 1.1.1, within 30 days of receiving the Agency's request, Axon will no longer access or use Agency Content for ACEIP Purposes and will delete ACEIP Content. Axon will also delete any derivative works which may reasonably be capable of being associated with, or could reasonably be linked directly or indirectly to Agency.

1.2 **ACEIP Tier 2**. In addition to ACEIP Tier 1, if Agency wants to help further improve Axon's services, Agency may choose to participate in Tier 2 of the ACEIP. ACEIP Tier 2, grants Axon certain additional rights to use Agency Content, in addition to those set forth in Tier 1 above, without the guaranteed deployment of a Privacy Preserving Technique to enable product development, improvement, and support that cannot be accomplished with aggregated, transformed or de-identified data.

☐ Check this box if Agency wants to help further improve Axon's services by participating in ACEIP Tier 2 in addition to Tier 1. By checking this box, Agency hereby agrees to the Axon Customer Experience Improvement Program Tier 2 Terms of Service, available at https://www.axon.com/sales-terms-and-conditions and incorporated herein by reference.

Technology Assurance Plan Appendix

If Technology Assurance Plan ("**TAP**") or a bundle including TAP is on the Quote, this appendix applies.

1 **TAP Warranty**. The TAP warranty is an extended warranty that starts at the end of the 1-year Hardware Limited Warranty.

2 **Officer Safety Plan**. If Agency purchases an Officer Safety Plan ("**OSP**"), Agency will receive the deliverables detailed in the Quote. Agency must accept delivery of the TASER CEW and accessories as soon as available from Axon.

3 **OSP 7 Term**. OSP 7 begins after Axon ships the Axon Body 3 or TASER 7 hardware to Agency. If Axon ships in the first half of the month, OSP 7 starts the 1st of the following month. If Axon ships in the second half of the month, OSP 7 starts the 15th of the following month ("**OSP 7 Term**").

4 **TAP BWC Upgrade**. If Agency has no outstanding payment obligations and purchased TAP, Axon will provide Agency a new Axon body-worn camera ("**BWC Upgrade**") as scheduled in the Quote. If Agency purchased TAP Axon will provide a BWC Upgrade that is the same or like Axon Device, at Axon's option. Axon makes no guarantee the BWC Upgrade will utilize the same accessories or Axon Dock.

5 **TAP Dock Upgrade**. If Agency has no outstanding payment obligations and purchased TAP, Axon will provide Agency a new Axon Dock as scheduled in the Quote ("**Dock Upgrade**"). Accessories associated with any Dock Upgrades are subject to change at Axon discretion. Dock Upgrades will only include a new Axon Dock bay configuration unless a new Axon Dock core is required for BWC compatibility. If Agency originally purchased a single-bay Axon Dock, the Dock Upgrade will be a single-bay Axon Dock model that is the same or like Axon Device, at Axon's option. If Agency originally purchased a multi-bay Axon Dock, the Dock Upgrade will be a multi-bay Axon Dock that is the same or like Axon Device, at Axon's option.

6 **Upgrade Delay**. Axon may ship the BWC and Dock Upgrades as scheduled in the Quote without prior confirmation from Agency unless the Parties agree in writing otherwise at least 90 days in advance. Axon may ship the final BWC and Dock Upgrade as scheduled in the Quote 60 days before the end of the Subscription Term without prior confirmation from Agency.

7 **Upgrade Change**. If Agency wants to change Axon Device models for the offered BWC or Dock Upgrade, Agency must pay the price difference between the MSRP for the offered BWC or Dock Upgrade and the MSRP for the model desired. If the model Agency desires has an MSRP less than the MSRP of the offered BWC Upgrade or Dock Upgrade, Axon will not provide a refund. The MSRP is the MSRP in effect at the time of the upgrade.

8 **Return of Original Axon Device**. Within 30 days of receiving a BWC or Dock Upgrade, Agency must return the original Axon Devices to Axon or destroy the Axon Devices and provide a certificate of destruction to Axon including serial numbers for the destroyed Axon Devices. If Agency does not return or destroy the Axon Devices, Axon will deactivate the serial numbers for the Axon Devices received by Agency.

9 **Termination**. If Agency's payment for TAP, OSP, or Axon Evidence is more than 30 days past due, Axon may terminate TAP or OSP. Once TAP or OSP terminates for any reason:

- **9.1** TAP and OSP coverage terminate as of the date of termination and no refunds will be given.
- **9.2** Axon will not and has no obligation to provide the Upgrade Models.
- **9.3** Agency must make any missed payments due to the termination before Agency may purchase any future TAP or OSP.

TASER 7 Appendix

This TASER 7 Appendix applies to Agency's TASER 7, OSP 7, or OSP 7 Plus purchase from Axon.

1 **Duty Cartridge Replenishment Plan**. If the Quote includes "**Duty Cartridge Replenishment Plan**", Agency must purchase the plan for each CEW user. A CEW user includes officers that use a CEW in the line of duty and those that only use a CEW for training. Agency may not resell cartridges received. Axon will only replace cartridges used in the line of duty.

2 **Training**. If the Quote includes a training voucher, Agency must use the voucher within 1 year of issuance, or the voucher will be void. Axon will issue Agency a voucher annually beginning on the start of the TASER Subscription Term. The voucher has no cash value. Agency cannot exchange it for another device or service. Unless stated in the Quote, the voucher does not include travel expenses and will be Agency's responsibility. If the Quote includes Axon Online Training or Virtual Reality Content Empathy Development for Autism/Schizophrenia (collectively, "**Training Content**"), Agency may access Training Content. Axon will deliver all Training Content electronically.

3 **Extended Warranty**. If the Quote includes an extended warranty, the extended warranty coverage period warranty will be for a 5-year term, which includes the hardware manufacturer's warranty plus the 4-year extended term.

4 **Trade-in**. If the Quote contains a discount on CEW-related line items, including items related to OSP, then that discount may only be applied as a trade-in credit, and Agency must return used hardware and accessories associated with the discount ("**Trade-In Units**") to Axon. Agency must ship batteries via ground shipping. Axon will pay shipping costs of the return. If Axon does not receive Trade-In Units within the timeframe below, Axon will invoice Agency the value of the trade-in credit. Agency may not destroy Trade-In Units and receive a trade-in credit.

Agency Size	Days to Return from Start Date of TASER 7 Subscription
Less than 100 officers	30 days
100 to 499 officers	90 days
500+ officers	180 days

5 **TASER 7 Subscription Term**. The TASER 7 Subscription Term for a standalone TASER 7 purchase begins on shipment of the TASER 7 hardware. The TASER 7 Subscription Term for OSP 7 begins on the OSP 7 Start date.

6 **Access Rights**. Upon Axon granting Agency a TASER 7 Axon Evidence subscription, Agency may access and use Axon Evidence for the storage and management of data from TASER 7 CEW devices during the TASER 7 Subscription Term. Agency may not upload any non-TASER 7 data or any other files to Axon Evidence. Agency may not exceed the number of end users than the Quote specifies.

7 **Privacy.** Axon will not disclose Agency Content or any information about Agency except as compelled by a court or administrative body or required by any law or regulation. Axon will give notice if any disclosure request is received for Agency Content, so Agency may file an objection with the court or administrative body.

8 **Termination**. If payment for TASER 7 is more than 30 days past due, Axon may terminate Agency's TASER 7 plan by notifying Agency. Upon termination for any reason, then as of the date of termination:

8.1 TASER 7 extended warranties and access to Training Content will terminate. No refunds will be given.

8.2 Axon will invoice Agency the remaining MSRP for TASER 7 products received before termination. If terminating for non-appropriations, Axon will not invoice Agency if Agency returns the CEW, rechargeable battery, holster, dock, core, training suits, and unused cartridges to Axon within 30 days of the date of termination.

8.3 Agency will be responsible for payment of any missed payments due to the termination before being allowed to purchase any future TASER 7 plan.

Flagstaff Police Dept. - AZ

AXON SALES REPRESENTATIVE
Brian Moutinho
9168062275
bmoutinho@axon.com

ISSUED
4/26/2021

Axon Enterprise, Inc.
17800 N 85th St.
Scottsdale, Arizona 85255
United States
Phone: (800) 978-2737

Q-286171-44312.802BM

Issued: 04/26/2021

Quote Expiration: 06/30/2021

Account Number: 107126

Payment Terms: Net 30
Delivery Method: Fedex - Ground

SHIP TO
Chad Smith
Flagstaff Police Dept. - AZ
911 E. Sawmill Road
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US

BILL TO
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Year 1 - TAP Refresh #00012138

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
11528	FLEX 2 CAMERA, (ONLINE)		89	470.00	0.00	0.00
11537	DOCK, FLEX 2, 6-BAY + CORE		15	1,563.00	0.00	0.00
87058	TECH ASSURANCE PLAN 6-BAY FLEX 2 DOCK WARRANTY	60	15	0.00	0.00	0.00
87066	TECH ASSURANCE PLAN FLEX 2 CAMERA WARRANTY	60	89	0.00	0.00	0.00
87067	TECH ASSURANCE PLAN FLEX 2 CONTROLLER WARRANTY	60	89	0.00	0.00	0.00
11532	FLEX 2 CONTROLLER		89	262.00	0.00	0.00
11509	BELT CLIP, RAPIDLOCK		89	0.00	0.00	0.00
11534	USB-C to USB-A CABLE FOR AB3 OR FLEX 2		89	0.00	0.00	0.00
11545	COLLAR MOUNT, FLEX 2		1	0.00	0.00	0.00
					Subtotal	0.00
					Estimated Shipping	0.00
					Estimated Tax	0.00
					Total	0.00

Year 1 - OSP7

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Axon Plans & Packages						
73746	PROFESSIONAL EVIDENCE.COM LICENSE	60	89	0.00	0.00	0.00

Year 1 - OSP7 (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Axon Plans & Packages (Continued)						
73686	EVIDENCE.COM UNLIMITED AXON DEVICE STORAGE	60	89	0.00	0.00	0.00
73683	10 GB EVIDENCE.COM A-LA-CART STORAGE	60	890	0.00	0.00	0.00
20248	TASER 7 EVIDENCE.COM ACCESS LICENSE	60	89	0.00	0.00	0.00
73638	STANDARDS ACCESS LICENSE	60	89	0.00	0.00	0.00
20246	TASER 7 DUTY CARTRIDGE REPLACEMENT ACCESS LICENSE	60	89	0.00	0.00	0.00
73687	EVIDENCE.COM VIEWER LICENSE	60	1	0.00	0.00	0.00
20248	TASER 7 EVIDENCE.COM ACCESS LICENSE	60	1	0.00	0.00	0.00
73683	10 GB EVIDENCE.COM A-LA-CART STORAGE	60	22	0.00	0.00	0.00
73840	EVIDENCE.COM BASIC ACCESS LICENSE	60	22	0.00	0.00	0.00
73683	10 GB EVIDENCE.COM A-LA-CART STORAGE	60	69	0.00	0.00	0.00
73746	PROFESSIONAL EVIDENCE.COM LICENSE	60	23	0.00	0.00	0.00
Hardware						
20160	TASER 7 HOLSTER - SAFARILAND, RH+CART CARRIER		89	0.00	0.00	0.00
75015	SIGNAL SIDEARM KIT		89	0.00	0.00	0.00
20050	HOOK-AND-LOOP TRAINING (HALT) SUIT		2	0.00	0.00	0.00
20008	TASER 7 HANDLE, YLW, HIGH VISIBILITY (GREEN LASER), CLASS 3R		89	0.00	0.00	0.00
20040	TASER 7 HANDLE WARRANTY, 4-YEAR		89	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		267	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		267	0.00	0.00	0.00
22179	TASER 7 INERT CARTRIDGE, STANDOFF (3.5-DEGREE) NS		50	0.00	0.00	0.00
22181	TASER 7 INERT CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		50	0.00	0.00	0.00
71044	BATTERY, SIGNAL SIDEARM, CR2430 SINGLE PACK		178	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		178	0.00	0.00	0.00

Year 1 - OSP7 (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware (Continued)						
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		178	0.00	0.00	0.00
22177	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, STANDOFF NS		178	0.00	0.00	0.00
22178	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, CLOSE QUART NS		178	0.00	0.00	0.00
20018	TASER 7 BATTERY PACK, TACTICAL		106	0.00	0.00	0.00
20041	TASER 7 BATTERY PACK WARRANTY, 4-YEAR		106	0.00	0.00	0.00
20042	TASER 7 DOCK & CORE WARRANTY, 4-YEAR		1	0.00	0.00	0.00
70033	WALL MOUNT BRACKET, ASSY, EVIDENCE.COM DOCK		1	0.00	0.00	0.00
74200	TASER 7 6-BAY DOCK AND CORE		1	0.00	0.00	0.00
80090	TARGET FRAME, PROFESSIONAL, 27.5 IN. X 75 IN., TASER 7		1	0.00	0.00	0.00
Other						
73946	OFFICER SAFETY PLAN 7 BUNDLE HEADER	60	89	0.00	0.00	0.00
73958	OFFICER SAFETY PLAN 7 PAYMENT	12	89	1,908.00	1,200.26	106,823.14
73841	EVIDENCE.COM BASIC LICENSE PAYMENT	12	22	180.00	0.00	0.00
73837	EVIDENCE.COM PROFESSIONAL LICENSE PAYMENT	12	23	468.00	0.00	0.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
20119	TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
80087	TASER 7 TARGET, CONDUCTIVE, PROFESSIONAL (RUGGEDIZED)		1	0.00	0.00	0.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		3	495.00	0.00	0.00
73953	OFFICER SAFETY PLAN 7 TRUE UP PAYMENT 1	2	89	108.50	98.66	8,780.74
					Subtotal	115,603.88
					Estimated Tax	9,306.11
					Total	124,909.99

Year 1 - T7 Cert

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Axon Plans & Packages						
20248	TASER 7 EVIDENCE.COM ACCESS LICENSE	60	31	0.00	0.00	0.00
20246	TASER 7 DUTY CARTRIDGE REPLACEMENT ACCESS LICENSE	60	31	0.00	0.00	0.00
20248	TASER 7 EVIDENCE.COM ACCESS LICENSE	60	1	0.00	0.00	0.00
Hardware						
20160	TASER 7 HOLSTER - SAFARILAND, RH+CART CARRIER		31	0.00	0.00	0.00
20050	HOOK-AND-LOOP TRAINING (HALT) SUIT		1	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		93	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		93	0.00	0.00	0.00
20008	TASER 7 HANDLE, YLW, HIGH VISIBILITY (GREEN LASER), CLASS 3R		31	0.00	0.00	0.00
20040	TASER 7 HANDLE WARRANTY, 4-YEAR		31	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		62	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		62	0.00	0.00	0.00
22177	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, STANDOFF NS		62	0.00	0.00	0.00
22178	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, CLOSE QUART NS		62	0.00	0.00	0.00
20018	TASER 7 BATTERY PACK, TACTICAL		37	0.00	0.00	0.00
20041	TASER 7 BATTERY PACK WARRANTY, 4-YEAR		37	0.00	0.00	0.00
20042	TASER 7 DOCK & CORE WARRANTY, 4-YEAR		1	0.00	0.00	0.00
70033	WALL MOUNT BRACKET, ASSY, EVIDENCE.COM DOCK		1	0.00	0.00	0.00
74200	TASER 7 6-BAY DOCK AND CORE		1	0.00	0.00	0.00

Year 1 - T7 Cert (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Other						
20430	TASER 7 CERTIFICATION BUNDLE HEADER	60	31	0.00	0.00	0.00
20437	TASER 7 CERTIFICATION BUNDLE PAYMENT	12	31	690.00	0.00	0.00
Not Eligible TASER 7 INSTRUCTOR COURSE VOUCHER	Not Eligible TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
Not Eligible TASER 7 MASTER INSTRUCTOR SCHOOL VOUC	Not Eligible TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
Not Eligible Target and Frame	Not Eligible Target and Frame		31	0.00	0.00	0.00
					Subtotal	0.00
					Estimated Tax	0.00
					Total	0.00

Spares

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
20008	TASER 7 HANDLE, YLW, HIGH VISIBILITY (GREEN LASER), CLASS 3R		2	0.00	0.00	0.00
20040	TASER 7 HANDLE WARRANTY, 4-YEAR		2	0.00	0.00	0.00
20008	TASER 7 HANDLE, YLW, HIGH VISIBILITY (GREEN LASER), CLASS 3R		1	0.00	0.00	0.00
20040	TASER 7 HANDLE WARRANTY, 4-YEAR		1	0.00	0.00	0.00
					Subtotal	0.00
					Estimated Tax	0.00
					Total	0.00

Year 2

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		178	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		178	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		62	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		62	0.00	0.00	0.00
Other						
73958	OFFICER SAFETY PLAN 7 PAYMENT	12	89	1,908.00	1,908.00	169,812.00
73841	EVIDENCE.COM BASIC LICENSE PAYMENT	12	22	180.00	180.00	3,960.00
73837	EVIDENCE.COM PROFESSIONAL LICENSE PAYMENT	12	23	468.00	351.00	8,073.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
20119	TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
20437	TASER 7 CERTIFICATION BUNDLE PAYMENT	12	31	690.00	690.00	21,390.00
					Subtotal	203,235.00
					Estimated Tax	16,360.42
					Total	219,595.42

Year 3

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		178	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		178	0.00	0.00	0.00
22177	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, STANDOFF NS		178	0.00	0.00	0.00

Year 3 (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware (Continued)						
22178	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, CLOSE QUART NS		178	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		62	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		62	0.00	0.00	0.00
22177	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, STANDOFF NS		62	0.00	0.00	0.00
22178	TASER 7 HOOK-AND-LOOP TRN (HALT) CARTRIDGE, CLOSE QUART NS		62	0.00	0.00	0.00
Other						
73309	AXON CAMERA REFRESH ONE		89	0.00	0.00	0.00
73958	OFFICER SAFETY PLAN 7 PAYMENT	12	89	1,908.00	1,908.00	169,812.00
73841	EVIDENCE.COM BASIC LICENSE PAYMENT	12	22	180.00	180.00	3,960.00
73837	EVIDENCE.COM PROFESSIONAL LICENSE PAYMENT	12	23	468.00	351.00	8,073.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
20119	TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
73689	MULTI-BAY BWC DOCK 1ST REFRESH		15	0.00	0.00	0.00
20437	TASER 7 CERTIFICATION BUNDLE PAYMENT	12	31	690.00	690.00	21,390.00
					Subtotal	203,235.00
					Estimated Tax	16,360.42
					Total	219,595.42

Year 4

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		178	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		178	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		62	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		62	0.00	0.00	0.00

Year 4 (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Other						
73958	OFFICER SAFETY PLAN 7 PAYMENT	12	89	1,908.00	1,908.00	169,812.00
73841	EVIDENCE.COM BASIC LICENSE PAYMENT	12	22	180.00	180.00	3,960.00
73837	EVIDENCE.COM PROFESSIONAL LICENSE PAYMENT	12	23	468.00	351.00	8,073.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
20119	TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
20437	TASER 7 CERTIFICATION BUNDLE PAYMENT	12	31	690.00	690.00	21,390.00
					Subtotal	203,235.00
					Estimated Tax	16,360.42
					Total	219,595.42

Year 5

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Hardware						
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		178	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		178	0.00	0.00	0.00
22175	TASER 7 LIVE CARTRIDGE, STANDOFF (3.5-DEGREE) NS		62	0.00	0.00	0.00
22176	TASER 7 LIVE CARTRIDGE, CLOSE QUARTERS (12-DEGREE) NS		62	0.00	0.00	0.00
Other						
73310	AXON CAMERA REFRESH TWO		89	0.00	0.00	0.00
73958	OFFICER SAFETY PLAN 7 PAYMENT	12	89	1,908.00	1,908.00	169,812.00
73841	EVIDENCE.COM BASIC LICENSE PAYMENT	12	22	180.00	180.00	3,960.00
73837	EVIDENCE.COM PROFESSIONAL LICENSE PAYMENT	12	23	468.00	351.00	8,073.00
20120	TASER 7 INSTRUCTOR COURSE VOUCHER		1	0.00	0.00	0.00
20119	TASER 7 MASTER INSTRUCTOR SCHOOL VOUCHER		1	0.00	0.00	0.00
73688	MULTI-BAY BWC DOCK 2ND REFRESH		15	0.00	0.00	0.00

Year 5 (Continued)

Item	Description	Term (Months)	Quantity	List Unit Price	Net Unit Price	Total (USD)
Other (Continued)						
20437	TASER 7 CERTIFICATION BUNDLE PAYMENT	12	31	690.00	690.00	21,390.00
					Subtotal	203,235.00
					Estimated Tax	16,360.42
					Total	219,595.42
					Grand Total	**1,003,291.67**

Discounts (USD)

Quote Expiration: 06/30/2021

List Amount	1,129,364.50
Discounts	200,820.62
Total	**928,543.88**

Total excludes applicable taxes

Summary of Payments

Payment	Amount (USD)
Year 1 - TAP Refresh #00012138	0.00
Year 1 - OSP7	124,909.99
Year 1 - T7 Cert	0.00
Spares	0.00
Year 2	219,595.42
Year 3	219,595.42
Year 4	219,595.42
Year 5	219,595.42
Grand Total	**1,003,291.67**

Notes

Agency has existing contract #00012138 (originated via Q-103143) and is terminating that contract upon the new license start date (7/15/2021) of this quote.

The parties agree that Axon is charging a fee of $8,780.88 (applied to Year #1 OSP7 True-up licenses) to capture the remaining value owed on TAP to replace hardware via TAP Refresh. This fee is based on a ship date range of 6/15/2021-6/30/2021, resulting in a 7/15/2021 license date. Any change in this date and resulting license start date will result in modification of this fee value which may result in additional fees due to or from Axon.

100% discounted body-worn camera and docking station hardware contained in Year 1 reflects a TAP replacement for hardware purchased under existing contract #00012138. All TAP obligations from this contract will be considered fulfilled upon execution of this quote.

Purchase of TASER 7 are governed by the TASER 7 Agreement located at https://www.axon.com/legal/sales-terms-and-conditions and not the Master Services and Purchasing Agreement referenced below.

Tax is subject to change at order processing with valid exemption.

Axon's Sales Terms and Conditions

This Quote is limited to and conditional upon your acceptance of the provisions set forth herein and Axon's Master Services and Purchasing Agreement (posted at www.axon.com/legal/sales-terms-and-conditions) **and the Axon Customer Experience Improvement Program Appendix, which includes the sharing of de-identified segments of Agency Content with Axon to develop new products and improve your product experience** (posted at www.axon.com/legal/sales-terms-and-conditions), as well as the attached Statement of Work (SOW) for Axon Fleet and/or Axon Interview Room purchase, if applicable. **The Axon Customer Experience Improvement Program Appendix ONLY applies to Customers in the USA**. In the event you and Axon have entered into a prior agreement to govern all future purchases, that agreement shall govern to the extent it contemplates the products and services being purchased and does not conflict with the Axon Customer Experience Improvement Program Appendix. Any purchase order issued in response to this Quote is subject solely to the above referenced terms and conditions. By signing below, you represent that you are lawfully able to enter into contracts. If you are signing on behalf of an entity (including but not limited to the company, municipality, or government agency for whom you work), you represent to Axon that you have legal authority to bind that entity. If you do not have this authority, please do not sign this Quote.

Signature: _____ **Date:** _____

Name (Print): _____ **Title:** _____

PO# (Or write N/A): _____

Please sign and email to Brian Moutinho at bmoutinho@axon.com or fax to

Thank you for being a valued Axon customer. For your convenience on your next order, please check out our online store buy.axon.com

The trademarks referenced above are the property of their respective owners.

Axon Internal Use Only		
		SFDC Contract #:
		Order Type:
		RMA #:
		Address Used:
Review 1	Review 2	SO #:
Comments:		

ATTENTION

This order may qualify for freight shipping, please fill out the following information.

What is the contact name and phone number for this shipment?	
What are your receiving hours? (Monday-Friday)	
Is a dock available for this incoming shipment?	
Are there any delivery restrictions? (no box trucks, etc.)	

9. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Dan Symer, Zoning Code Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-26 and Ordinance No. 2021-13: A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the existing Zoning Code provisions to accommodate medical and recreational marijuana and the associated land uses.

STAFF RECOMMENDED ACTION:

1) Adopt Resolution No. 2021-26
2) Read Ordinance No. 2021-13 by title only for the final time
3) City Clerk reads Ordinance No. 2021-13 by title only (if approved above)
4) Adopt Ordinance No. 2021-13

Executive Summary:

The proposed amendment (Exhibit A to the Resolution No. 2021-26) modifies the existing marijuana use provisions of the Zoning Code to address Proposition 207 – Smart and Safe Arizona Act (the "Act") that the Arizona voters approved in November 2020 to allow recreational use of marijuana. Furthermore, the amendment is to implement the City Council's January 12, 2021, and March 2, 2021, direction to allow dual license (medical and recreational) dispensaries and the testing, cultivation, and manufacturing of marijuana products.

The Planning and Zoning Commission reviewed and provided a recommendation of approval at the May 12, 2021, Planning and Zoning Commission meeting.

Financial Impact:

There are no anticipated financial impacts affiliated with the proposed Zoning Code Text Amendment.

Policy Impact:

City Council Goal: Grow and strengthen a more equitable and resilient economy.

- The proposed Zoning Code Text Amendment is intended to address the Proposition 207 – Smart and Safe Arizona Act (recreational use of marijuana) that was approved by the Arizona voters in November 2020, and allow the recreational sales, testing, manufacturing, and storage of marijuana and marijuana products within the City. This amendment will allow and assist in providing for a more diverse and resilient business environment.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

- Ensure the built environment is safe through the use of consistent standards, rules & regulations, & land use practices.
- Maintain & enhance an equitable & effective business recruitment, retention, & expansion program throughout the community

Regional Plan

Staff's analysis of the Regional Plan's goals and policies is included below under the Zoning Code Text Amendment Criteria heading, Finding #1 of the report. In addition, the staff's narrative and Regional Plan analysis are included as Attachment 1.

Has There Been Previous Council Decision on This:

There has not been a previous City Council decision on this ordinance.

Options and Alternatives:

The City Council may choose to adopt, modify, or deny the amendment.

Proposed Amendment:

The proposed amendment (Exhibit A to the Resolution No. 2021-26) modifies the existing marijuana use provisions of the Zoning Code to address Proposition 207 – Smart and Safe Arizona Act (the "Act") that the Arizona voters approved in November 2020 to allow recreational use of marijuana. Furthermore, the amendment is to implement the City Council's January 12, 2021, and March 2, 2021, direction to allow dual license (medical and recreational) dispensaries and the testing, cultivation, and manufacturing of marijuana products. To accommodate both the medical marijuana and the associated uses, which is also referred to as Marijuana Establishments, the proposed revisions to the Zoning Code incorporate the following modifications:

- The Medical Marijuana Dispensary land use has been revised to be called Marijuana Dispensary. In addition, the associated definition has been modified to accommodate both medical and dual license (medical or recreational) sales. Furthermore, the definition incorporates the associated accessory uses (cultivation, manufacturing, processing, packaging, or storage of marijuana products) to be consistent with the Arizona Revised Statutes (ARS) pertaining to a dispensary's allowed operation characteristics under ARS.
- A new land use, Marijuana Testing Facility, and its associated definition have been added. This land use is a laboratory that tests marijuana and marijuana products for potency and impurities. The Marijuana Testing Facility is proposed to be allowed in the Suburban Commercial (SC), Community Commercial (CC), Highway Commercial (HC), Commercial Service (CS), Research and Development (RD), Light Industrial (LI), and Light Industrial – Open (LI-O) zones as an allowed use.
- Medical Marijuana Off-Site Cultivation Location is proposed to be revised to Marijuana Off-Site Cultivation Location. In addition, the existing definition is proposed to be deleted, and a new definition is proposed to be added that conforms with the Act and the existing ARS provisions for medical marijuana. The Marijuana Off-Site Cultivation Location land use allows for the cultivation, manufacturing, packaging, processing, and storage of marijuana and marijuana products, but it excludes the sale or transfer of marijuana and marijuana products to consumers. The Marijuana Off-Site Cultivation Location use is proposed to be maintained as an allowed use in the Light Industrial (LI), Light Industrial – Open (LI-O), Heavy Industrial (HI), and Heavy Industrial – Open (HI-O) zones.
- A new land use, Marijuana Off-Site Manufacturing Location, and its associated definition have been added. The proposed definition of this land use allows for the manufacturing, packaging, processing, and storage of marijuana and marijuana products, excluding the sale or transfer of

marijuana and marijuana products to consumers. The Marijuana Off-site Manufacturing Location land use is proposed to be allowed in the Light Industrial (LI), Light Industrial – Open (LI-O), Heavy Industrial (HI), and Heavy Industrial – Open (HI-O) zones.
- The term and definition of Marijuana Establishment have been added to maintain consistency with the Act. A Marijuana Establishment is any of the following: Marijuana Dispensary, Marijuana Off-Site Cultivation Location, Marijuana Off-site Manufacturing Location, or Marijuana Testing Facility.
- The existing provisions have been modified to include a Concept Plan Review prior to the submittal of a Building Permit or Business License application or prior to a structure's occupancy for a Marijuana Establishment.

In addition to the above modifications, several of the existing provisions are proposed to be deleted since they are regulated and verified by the Arizona Department of Health Services as part of the department's review and certification of Marijuana Establishments and marijuana facility agents. Also, the provisions have been updated, requiring a dimensioned plan drawn by a surveyor and an affidavit signed by the applicant attesting that the lot or parcel proposed to contain the Marijuana Establishment meets the separation requirements specified in subsection F. of Section 10-40.60.220 (Exhibit A to the Resolution No. 2021- ###). Furthermore, several provisions have been modified for simplification purposes.

Zoning Code Text Amendment Criteria:
A Zoning Code Text Amendment shall be evaluated based on the following findings:

A. Finding #1:
The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;

The amendment's primary purpose is to implement the City Council's direction to update the Zoning Code to conform with the Act and to maintain consistency and conformance with the Regional Plan's (General Plan) goals and policies. Therefore, the modifications would allow for Marijuana Establishments to cultivate, manufacture, sell, and store marijuana products. The proposed provisions address multiple goals and policies of the Regional Plan. Staff's narrative and comprehensive Regional Plan Conformance Analysis are included as Attachment #1. A summary of the goals and policies that the proposed Zoning Code Text Amendment is consistent and conforms with include:

- Providing submittal and locational requirements that are transparent and minimize duplication with the State of Arizona's requirements to be a certified Marijuana Establishment that is allowed to cultivate, manufacture, sell, and store marijuana products (Regional Plan Goal ED.1.);
- Allowing the Marijuana Establishment land uses (Marijuana Dispensary, Marijuana Off-Site Cultivation Location, Marijuana Off-site Manufacturing Location, and Marijuana Testing Facility) in several commercial and industrial zones that will permit new and existing marijuana-based businesses to be retained, expanded, and located in Flagstaff, as well as providing for scientific testing of marijuana products (Regional Plan Goal ED.3., and Policies CC.5.1., CC.5.5., ED.3.1., ED.3.5., and ED.4.2.); and,
- Allowing Marijuana Establishments to group related operations (cultivation, manufacturing, sales, and storage of marijuana products) in commercial and industrial zones in a manner that will permit urban agriculture, the utilization of existing transportation facilities, and provide leasing and development opportunities of commercial and industrial property (Policies ED.3.5., ED.4.2, LU.3.5., and LU.15.1.).

B. Finding #2
The proposed amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City;
The provisions of the amendment are not anticipated to be detrimental to the public interest, health, safety, convenience, or welfare of the city. To assist in ensuring that the proposed Marijuana Establishment land uses are not detrimental, minimum separation requirements are established from

facilities and locations that contain any of the following uses: daycares, educational, family recreation and entertainment, public libraries and parks, drug or alcohol rehabilitation, and other Marijuana Establishments. In addition, provisions have been incorporated pertaining to the security, disposal of marijuana remnants and by-products, and prohibition of onsite consumption of marijuana products and emissions of dust, fumes, vapors, smoke, or odors into the environment from a Marijuana Establishment

C. Finding #3
The proposed amendment is internally consistent with other applicable provisions of this Zoning Code. The amendment is internally consistent, utilizes the existing format, and does not conflict with other Zoning Code provisions. It maintains the Zoning Code's purpose as a comprehensive contemporary set of land uses and requirements that are straightforward, usable, and easily understood.

Citizen Participation:
Persons of interest on file with the Planning and Development Services section of the Community Development Division were notified of the Planning and Zoning Commission and City Council work sessions and public hearing via first-class mail. Moreover, notification of the work sessions and public hearings were published on the City's Facebook and Flagstaff Community Forum web pages and in the Arizona Daily Sun. As of the date of this report, staff has not had any public comments on the proposed Zoning Code Text Amendment.

Planning and Zoning Commission Work Session:
At the Planning and Zoning Commission Work Session of April 14, 2021, staff reviewed the text amendment application with the Commission. The Commission had a general question regarding the odor regulations to clarify their understanding of the proposed Zoning Code Text Amendment. The existing regulations and proposed Zoning Code Text Amendment maintenance the prohibition of the emittance of odor from a Marijuana Establishment.

The Planning and Zoning Commission reviewed and provided a recommendation of approval at the May 12, 2021, Planning and Zoning Commission meeting.

City Council Work Session:
At the City Council Work Sessions of January 12, 2021, and March 2, 2021, the City Council provided direction to staff to modify the existing medical marijuana Zoning Code provisions to accommodate the Act's associated uses. In addition, the City Council's direction included limiting the sales of marijuana to entities that are certified by the State of Arizona to operate as dual licensees (medical and recreational). The direction also included utilizing the applicable medical marijuana Zoning Code criteria for all marijuana uses that the Act addresses.

Attachments: Res. 2021-26
Exhibit A to the Resolution No. 2021-26
Ord. 2021-13
1. Application Narrative and Regional Plan Analysis
Staff Presentation

RESOLUTION NO. 2021-26

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT FILED WITH THE CITY CLERK AND ENTITLED "CASE NO. PZ-21-00056 ZONING CODE TEXT AMENDMENT - 2021: MARIJUANA USES"

RECITALS:

WHEREAS, pursuant to A.R.S. § 9-802 a municipality may enact or amend provisions of the City Code by reference to a public record, provided that the adopting ordinance is published in full;

WHEREAS, the City of Flagstaff wishes to incorporate by reference amendments to the Flagstaff Zoning Code, Ordinance No. 2021-13, by first declaring said amendments to be a public record.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General.

That certain document known as *"Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses"* attached hereto as Exhibit A is hereby declared to be a public record, and one (1) paper copy and one (1) electronic copy shall remain on file with the City Clerk in compliance with A.R.S. § 44-7041, and said copies shall remain on file with the City Clerk.

SECTION 2. Effective Date.

This resolution shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____

CITY ATTORNEY

Exhibits:
Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses

Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses

HOW TO READ THIS DOCUMENT

Unless otherwise stated, existing provisions that are being deleted are shown in bold red strikethrough text, like this: ~~**Provisions that are being deleted are shown with a bold red strikethrough text.**~~

Provisions that are being added are shown in bold blue text, like this: **Provisions that are being added are shown in bold blue text.**

Section 1. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-20.30 Common Procedures, Section 10-20.30.050 Concept Plan Review, Subsection B. Applicability., as follows:

Section 10-20.30.050 Concept Plan Review

B. Applicability.

1. All developments requiring site plan review and approval (Section 10-20.40.140);
2. Any change of use that triggers an increase in required parking;
3. A proposed duplex;
4. Structural modifications to an exterior facade that is visible from a public way, including, but not limited to, public and private streets, public trails and paths, and alleys; ~~**and**~~
5. A proposed single-family residence located on a parcel that is not part of a platted ~~**subdivision.**~~ **subdivision; and**
6. **Any use that requires a Concept Plan in accordance with the regulations of Division 10-40.60: Specific to Uses.**

Section 2. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.040 Commercial Zones, Subsection B. Commercial Zones – Allowed Uses., Table 10-40.30.040.B., Medical Marijuana Dispensary, and to add Marijuana Testing Facility, as follows:

Section 10-40.30.040 Commercial Zones

Table 10-40.30.040.B. Commercial Zones – Allowed Uses						
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**				
		SC	**CC**	**HC**	**CS**	**CB**
~~**Medical**~~ Marijuana Dispensary	10-40.60.220	--	--	P	--	--
Marijuana Testing Facility		**P**	**P**	**P**	**P**	--

Section 3. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.050 Industrial Zones, Subsection B. Industrial Zones – Allowed Uses., Table 10-40.30.050.B., Medical Marijuana Cultivation Location, and to add Marijuana Testing Facility, as follows:

Section 10-40.30.050 Industrial Zones

Table 10-40.30.050.B. Industrial Zones – Allowed Uses						
Primary Land Use[1]	**Specific Use Regulations**	**Industrial Zones**				
		RD	**LI**	**LI-O**	**HI**	**HI-O**
~~**Medical**~~ Marijuana Off-Site Cultivation Location	**10-40.60.220**	--	P	P[7]	P	P[7]
Marijuana Off-site Manufacturing Location	**10-40.60.220**	**--**	**P**	**P[7]**	**P**	**P[7]**
Marijuana Testing Facility	**10-40.60.220**	**P**	**P**	**P[7]**	--	--

Section 4. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.60: Specific to Uses, Section 10-40.60.220 Medical Marijuana Uses, as follows:

10-40.60.220 ~~Medical~~ Marijuana ~~Uses~~ Facilities

A. ~~General Requirements for Medical Marijuana Uses~~ **Applicability**. The ~~minimum~~ requirements of this section shall apply to all ~~medical marijuana dispensaries and to medical marijuana dispensary off-site cultivation locations~~ **Marijuana Facilities**.

B. Concept Plan Requirement. Prior to the submittal of a Building Permit or Business License application, or prior to the occupancy of a structure, for a Marijuana Facility, the applicant shall complete a Concept Plan in accordance with Section 10-20.30.050 Concept Plan Review.

1. In addition to the requirements of Section 10-20.30.050, the Concept Plan application shall include the following:

~~B. In addition to any other application requirements, an applicant for any medical marijuana dispensary or medical marijuana dispensary off-site cultivation location shall provide the following:~~

~~1.~~ a. A notarized authorization executed by the property owner acknowledging and consenting to the ~~proposed~~ use of the property as a ~~medical marijuana dispensary or a medical marijuana dispensary off-site cultivation location, as applicable~~ **Marijuana Facility**;

~~2.~~ **b.** The ~~legal~~ **name of the Marijuana Facility and the name of the owner(s) of the Marijuana Facility** ~~the name of the medical marijuana dispensary or a medical marijuana dispensary off-site cultivation location~~;

~~3. If the application is for a medical marijuana dispensary off-site cultivation location, the name and location of the medical marijuana dispensary with which it is associated;~~

~~4. The name, address and birth date of each officer and board member of the nonprofit medical marijuana dispensary;~~

~~5.~~ **c.** The name, address, birth date, and valid registry identification card number of each nonprofit medical marijuana dispensary agent **or registered marijuana facility** agent;

~~6. A copy of the operating procedures adopted in compliance with A.R.S. § 36-2804;~~

~~7 A notarized certification that none of the nonprofit medical marijuana dispensary officers or board members has been convicted of any of the following offenses:~~

~~a. A violent crime as defined in A.R.S. § 13.901.03(B) that was classified as a felony in the jurisdiction where the person was convicted; or~~

~~b. A violation of State or Federal controlled substance law that was classified as a felony in the jurisdiction where the person was convicted except an offense for which the sentence including any term of probation incarceration or supervised release was completed 10 or more years earlier or an offense involving conduct that would be immune from arrest prosecution or penalty under A.R.S. § 36-2811 except that the conduct occurred before the effective date of that statute or was prosecuted by an authority other than the State of Arizona.~~

~~8. A notarized certification that none of the nonprofit medical marijuana dispensary officers or board members has served as an officer or board member for a medical marijuana dispensary that has had its registration certificate revoked;~~

~~9.~~ **d.** A security plan describing details of alarm systems and exterior lighting in compliance with Division 10-50.70, Outdoor Lighting Standards, and including a floor plan showing the location, ~~dimensions~~ **dimensions,** and type of security measures demonstrating that the ~~medical marijuana dispensary or medical marijuana dispensary off-site cultivation location~~ **Marijuana Facility** will be secured, enclosed, and locked as required by law; and

~~10.~~ **e. A scaled survey sealed by a land surveyor registered in the State of Arizona** ~~A scale drawing~~ depicting the property lines **of the lot or parcel that is proposed to contain the Marijuana Facility** and the separations from the nearest ~~property boundary of the parcel containing the medical marijuana dispensary or medical marijuana dispensary off-site cultivation location to the property boundary of the parcel~~ **lot or parcel that contain** ~~containing~~ any **of the** existing uses listed in subsection (~~F~~ **E**) of this section. ~~If any of the uses are located within 50 feet of the minimum separation, the drawing showing actual surveyed separations shall be prepared by a registered land surveyor.~~

~~6.~~ **f. An affidavit signed and notarized by the applicant attesting that the lot or parcel proposed to contain the Marijuana Facility meets the separation requirements from the nearest lot or parcel containing any of the existing uses listed in subsection (E) of this section.**

~~C.~~ B. A ~~medical marijuana dispensary~~ **Marijuana Dispensary** shall have operating hours not earlier than 8:00 a.m. and not later than 7:00 p.m.

~~D.~~ C. A ~~medical marijuana dispensary or medical marijuana dispensary off-site cultivation location~~ **Marijuana Facility** shall:

1. ~~Be~~ **Not be** located in a ~~permanent~~ **temporary** building **or structure (e.g.** ~~and may not be located in a semi-trailer,~~ shipping container, **storage structure, tent, trailer,** ~~or motor vehicle~~ **vehicle, etc. as determined by the Zoning Administrator)**;

~~2. Not have drive through service;~~

~~3.~~ **2.** Not emit dust, fumes, vapors, ~~smoke~~ **smoke,** or odors into the environment;

~~4.~~ **3.** Prohibit consumption of marijuana on the premises, including the parking area associated with the ~~marijuana dispensary or medical marijuana dispensary off-site cultivation location~~ **Marijuana Facility**;

~~5. Not have outdoor seating areas;~~

~~6.~~ **4.** Display a current City of Flagstaff business license ~~applicable to medical marijuana uses~~;

~~7.~~ **5.** Include a secure storage area that can be enclosed and locked as required by law;

~~8. Have a single secure entrance as required by law. Additional fire exits that may be required by applicable Building Code requirements shall be provided with an alarm system to prevent unauthorized exiting; and~~

6. Have a single secure entrance or, if a dual licensee, demonstrate appropriate security measures to deter and prevent the theft of marijuana and to reasonably regulate customer access to the premises, including equipping all entrances and exits with an alarm system;

7. Provide additional exits in accordance with the Building Code or Fire Code; and

~~9.~~ **8.** ~~**Shall dispose**~~ **Dispose** of ~~**medical**~~ marijuana remnants and by-products in accordance with State and local regulations.

D. A Marijuana Dispensary shall not have a drive-through service or an outdoor seating area for dispensary customers. An outdoor seating area for employees shall be designed in a manner that prohibits access and use by dispensary customers.

~~**E. Medical marijuana infusion facilities shall only be permitted within a medical marijuana dispensary or at a medical marijuana off-site cultivation location.**~~

~~**F.**~~ **E.** A ~~**medical marijuana dispensary or medical marijuana dispensary off-site cultivation location**~~ **Marijuana Facility** shall meet the following minimum separations, measured in a straight line from the boundary of the **lot or** parcel containing the ~~**medical marijuana dispensary or medical marijuana dispensary off-site cultivation location**~~ **use** to the property boundary of the **lot or** parcel containing any **of the** existing uses listed below:

1. Two thousand feet from ~~**any other medical marijuana dispensary, medical marijuana dispensary off-site cultivation location, or medical marijuana infusion facility**~~ **another Marijuana Facility**;
2. Five hundred feet from a ~~**licensed**~~ residential substance abuse treatment facility or other residential drug or alcohol rehabilitation facility **licensed by the State of Arizona**;
3. Five hundred feet from a community college, university, or from any public, private, parochial, charter, dramatic, dancing, music learning ~~**center**~~ **center,** or other similar school or educational facility that caters to children;
4. Five hundred feet from a daycare home or daycare center;
5. Five hundred feet from a public library or public park; and
6. Five hundred feet from a facility devoted to family recreation or entertainment.

~~**G. A medical marijuana off-site cultivation location not associated with a medical marijuana dispensary located in Flagstaff is prohibited.**~~

~~**H. Medical marijuana cultivation may occur within a medical marijuana dispensary.**~~

~~**I. Medical Marijuana Qualifying Patient Cultivation Location. A qualifying patient may cultivate at their place of residence within the Flagstaff City limits subject to compliance with A.R.S. § 36-2804.02, i.e., a qualifying patient may not cultivate medical marijuana at their place of residence if there is a medical marijuana dispensary located within 25 miles of the qualifying patient's home.**~~

~~**J. Medical Marijuana Designated Caregiver Cultivation Location.**~~

~~**1. All conditions and restrictions for medical marijuana dispensary off-site cultivation locations apply except that the designated caregiver cultivation location cultivation area is limited to a total of 250 square feet maximum, including any storage areas.**~~

~~**2. A designated caregiver may cultivate at their residence for a single qualifying patient subject to compliance with A.R.S. § 36-2806.01.**~~

~~**3. More than one designated caregiver may co-locate cultivation locations as long as the total cultivation area does not exceed 250 square feet maximum, including storage areas.**~~

Section 5. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-80.20: Definition of Specialized Terms, Phrases, and Building Functions, Section 10-80.20.130 Definitions "M", to modify Medical Marijuana, Medical Marijuana Dispensary, Medical Marijuana Dispensary Cultivation Location and Medical Marijuana Infusion Facility, and incorporate Marijuana Cultivation and Manufacturing Standalone Location, and Marijuana Testing Facility in alphabetical order, as follows:

10-80.20.130 Definitions "M"

~~**Medical Marijuana: All parts of the genus Cannabis whether growing or not, and the seed of such plants that may be administered to treat or alleviate a qualifying patient's debilitating medical condition or symptoms associated with the patient's debilitating medical condition.**~~

Marijuana: Means Marijuana and Marijuana Concentrate as defined in A.R.S. §36-2850, as amended.

~~**Medical**~~ Marijuana Dispensary: A ~~**nonprofit**~~ medical **or dual licensee (as defined in ARS §36-2850, as amended)** marijuana dispensary ~~**registered and certified pursuant to A.R.S. § 36-2804 that may also include a medical marijuana infusion facility.**~~ **certified by the State of Arizona to sell marijuana and marijuana products to consumers, which may include the cultivation, manufacturing, processing, packaging, or storage of marijuana products as an accessory use to the dispensary.**

~~**Medical Marijuana Dispensary Off-Site Cultivation Location: The one additional location, if any, where marijuana may be cultivated for the use of a medical marijuana dispensary as disclosed pursuant to A.R.S. § 36-2804.**~~

Marijuana Facility(ies) : Means any of following: Marijuana Dispensary, Marijuana Off-Site Cultivation Location, Marijuana Off-site Manufacturing Location, and Marijuana Testing Facility.

~~**Medical Marijuana Infusion Facility: A facility that incorporates medical marijuana by means of cooking, blending, or incorporation into consumable/edible goods.**~~

Marijuana Off-Site Cultivation Location: A location used by an entity certified by the State of Arizona to cultivate, manufacture, package, process, and store marijuana and marijuana products, excluding the sale or transfer of marijuana and marijuana products to consumers.

Marijuana Off-site Manufacturing Location: A location used by an entity certified by the State of Arizona to manufacture, package, process, and store marijuana and marijuana products, excluding the sale or transfer of marijuana and marijuana products to consumers.

Marijuana Testing Facility: Means Marijuana Testing Facility as defined in A.R.S. §36-2850, as amended.

ORDINANCE NO. 2021-13

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF FLAGSTAFF, AMENDING THE FLAGSTAFF CITY CODE, TITLE 10, FLAGSTAFF ZONING CODE, BY ADOPTING BY REFERENCE THAT CERTAIN DOCUMENT ENTITLED "CASE NO. PZ-21-00056 ZONING CODE TEXT AMENDMENT - 2021: MARIJUANA USES"; PROVIDING FOR PENALTIES, REPEAL OF CONFLICTING ORDINANCES, SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

RECITALS:

WHEREAS, the City of Flagstaff wishes to amend Title 10 Flagstaff Zoning Code of the Flagstaff City Code, to modify the existing medical marijuana regulations and incorporate medical and dual license (medical or recreational) dispensaries and the testing, cultivation, and manufacturing of marijuana products; and

WHEREAS, a citizen review session was held at the Planning Commission work session on April 14, 2021, to discuss the proposed Zoning Code text amendment in accordance with Section 10-20.50.040 of the Flagstaff Zoning Code; and

WHEREAS, the Planning and Zoning Commission held public hearing on May 12, 2021, and provided a recommendation to City Council on proposed Zoning Code text amendment; and

WHEREAS, the Council has read and considered the staff report prepared by the Planning and Development Services section of the Community Development division and all attachments to those reports, and the Council finds that the proposed Zoning Code text amendment is in conformance with the General Plan, and the findings of Section 10- 20.50.040 of the Flagstaff Zoning Code have been met; and

WHEREAS, that certain document known as *"Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses"*, one (1) paper copy and one (1) electronic copy of which are on file with the City Clerk in compliance with A.R.S. § 44-7041, was declared to be a public record by Resolution No. 2021-26.

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. The foregoing recitals are incorporated as if fully set forth herein.

SECTION 2. That certain document known as "Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses", one(1) paper copy and (1) electronic copy are on file in the office of the City Clerk of the City of Flagstaff, Arizona, which document is declared a public record by Resolution No. 2021-26 of the City of Flagstaff, Arizona, is hereby referred to, adopted and made a part hereof as if fully set out in this ordinance and its provisions are hereby declared to amend the Flagstaff City Code, replacing and superseding the existing relevant provisions of

the City Code, as set forth therein.

SECTION 3. The amendment is consistent with and conforms to the goals of the Regional Plan (General Plan).

SECTION 4. The amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City, and will add to the public good as described in the General Plan.

SECTION 5. The amendment is internally consistent with other applicable provisions of this Zoning Code.

SECTION 6. Repeal of Conflicting Ordinances

All ordinances and parts of ordinances in conflict with the provisions of the code adopted herein are hereby repealed.

SECTION 7. Severability

If any section, subsection, sentence, clause, phrase or portion of this ordinance or any part of the code adopted herein by reference is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 8. Clerical Corrections

The City Clerk is hereby authorized to correct clerical and grammatical errors, if any, related to this ordinance, and to make formatting changes appropriate for purposes of clarity, form, or consistency with the Flagstaff City Code.

SECTION 9. Effective Date

This Ordinance shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Case No. PZ-21-00056 Zoning Code Text Amendment - 2021: Marijuana Uses

Narrative and Regional Conformance Analysis

Narrative

Approved by the Arizona voters in November 2020, Proposition 207 – Smart and Safe Arizona Act (the "Act") allows for the recreational use and retail sales of marijuana to persons 21 years of age and older. In addition, the Act allows for cities, towns, and counties to enact local zoning regulations pertaining to the Act and the associated sale, cultivation, product manufacturing, and testing of marijuana, provided that the regulations are not more restrictive than the community's provisions for medical marijuana use.

On January 12, 2021, and March 2, 2021, the City Council provided direction to staff to modify the existing medical marijuana Zoning Code provisions to accommodate the Act's associated uses (Marijuana Dispensary, Marijuana Off-Site Cultivation Location, Marijuana Off-site Manufacturing Location, and Marijuana Testing Facility). In addition, the City Council's direction included limiting the sales of marijuana to entities that are certified by the State of Arizona to operate as a medical dispensary or dual license (medical or recreational) dispensary. The direction also included utilizing the applicable medical marijuana Zoning Code criteria for all marijuana uses that the Act addresses.

To accommodate the City Council's direction to allow both the medical marijuana and the Act's uses, the proposed revisions to the Zoning Code incorporate changes to the existing Medical Marijuana provisions that combine the uses in a general manner while utilizing the Act's more inclusive terms and definitions. Therefore, several existing terms and land use are either modified or deleted, and new terms and land uses are added. In addition, the new land uses have been added to several zones. The following is a summary of the modification:

- The Medical Marijuana Dispensary land use has been revised to be called Marijuana Dispensary.
- Medical Marijuana Off-Site Cultivation Location is proposed to be revised to Marijuana Off-Site Cultivation Location.
- A new land use, Marijuana Testing Facility, and its associated definition has been added. This land use is a laboratory that researches and tests marijuana and marijuana products for potency and impurities.
- A new land use, Marijuana Off-site Manufacturing Location, and its associated definition has been added. The proposed definition of the land use allows for the manufacturing, packaging, processing, and storage of marijuana and marijuana products, excluding the sale or transfer of marijuana and marijuana products to consumers.
- A new term and definition of Marijuana Facility has been added. A Marijuana Facility is any of the following: Marijuana Dispensary, Marijuana Off-Site Cultivation Location, Marijuana Off-site Manufacturing Location, or Marijuana Testing Facility.
- The Marijuana Off-site Manufacturing Location and Marijuana Testing Facility land uses are proposed to be allowed in the Light Industrial (LI), Light Industrial – Open (LI-O), Heavy Industrial (HI), and Heavy Industrial – Open (HI-O) zones.
- In addition to the Industrial zones, the Marijuana Testing Facility land use is proposed to be allowed in the Suburban Commercial (SC), Community Commercial (CC), Highway Commercial (HC), Commercial Service (CS), and Research and Development (RD) zones. These facilities are similar to specimen and material testing facilities (e.g., Sonora Quest, LabCorp, etc.).

Regional Plan Conformance

Chapter VIII - Community Character

- Policy CC.5.1. Promote first class arts, research, and educational facilities.
- Policy CC.5.5. Promote and expand scientific research as a key component to the Flagstaff region's character.

The Zoning Code's modifications incorporate the Marijuana Testing Facility land use into several zones to achieve the above-referenced policies. The primary function of these facilities is to research and test for potency and impurities. An essential component of the marijuana use industry is to inform consumers of product information pertaining to what they are purchasing, including safety considerations. Adding this land use to the Zoning Code helps expand the potential businesses that could contribute to Flagstaff's research community and diversification of services, which will also contribute to a new and expanding consumer marijuana industry. Furthermore, the incorporation of the land use allows for local marijuana facilities to have their products tested locally, negating the necessity to ship products for analysis to other testing facilities throughout the state.

Chapter IX - Growth Areas & Land Use

- Policy LU.3.5. Allow and encourage urban agriculture.
- Policy LU.15.1. Encourage the grouping of medical and professional offices, light industrial, research, and skill training with other necessary workforce services and transportation options.

The modifications to incorporate the marijuana facility land uses and the zones they are permitted allow for locating complementary uses nearby, which will help create embryonic synergies of the industry's varying components. In addition, the cultivation of medical and recreational marijuana within Flagstaff may assist in promoting, expanding, and diversifying the urban agriculture industry in the industrial areas and within dispensaries. Also, the commercial and industrial zones that these uses are allowed are typically nearby transportation facilities that may assist with the shipment of products and promote a new and expanded industry.

Chapter XIV - Economic Development

- Goal ED.1. Create a healthy environment for business by ensuring transparent, expeditious, and predictable government processes.
- Goal ED.3. Regional economic development partners support the start-up, retention, and expansion of existing business enterprises.
- Policy ED.3.1. Encourage regional economic development partners to continue proactive programs to foster the retention and expansion of existing enterprises and home-based businesses in the community.
- Policy ED.3.5. Advocate the economic sustainability and growth of businesses with opportunities for transitional commercial space, leased space, and property ownership.
- Policy ED.4.2. Promote variety and flexibility in land use and development options within the urban growth boundary.

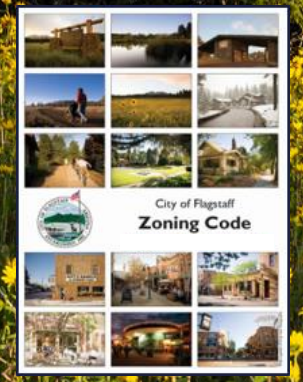
To achieve the above-referenced policies, the Zoning Code's modifications are intended to provide simplified requirements that are transparent and minimize duplication with the State of Arizona's requirements to be certified to cultivate, manufacture, sell, and store marijuana products. In addition, the modification to the existing medical dispensary provisions to allow the sales of recreational marijuana will permit existing businesses to expand. The incorporation of these land uses, and the removal of the current provisions that require cultivation locations to be associated with a Flagstaff dispensary, may also assist in the utilization of existing vacant industrial buildings and expand Flagstaff's exportation of products grown, stored, and manufactured within the city. Furthermore, the land uses expand the diversity of uses allowed within the Zoning Code.

Updates to Zoning Code 2021 – Recreational Marijuana

City's Request to Amend the Zoning Code

Case PZ-21-00056

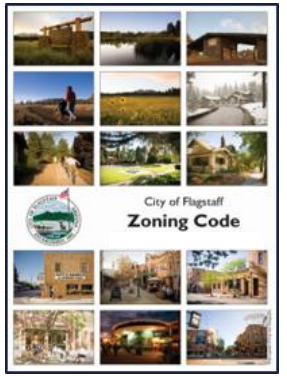
Dan Symer, AICP
Zoning Code Manager



City's Proposed Zoning Code Text Amendment

Purpose:

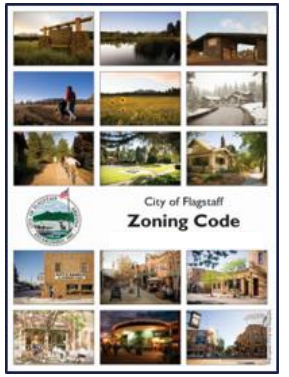
- **Amend the Zoning Code to modify the existing Medical Marijuana land use and application provisions to address Proposition 207 – Smart and Safe Arizona Act (recreational marijuana use) that was approved by the Arizona voters in November 2020**



City's Proposed Zoning Code Text Amendment

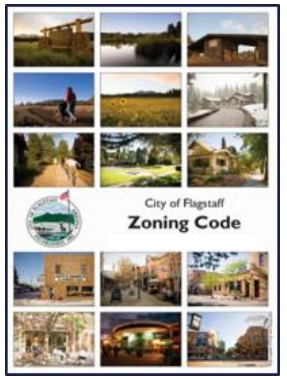
Overview of Proposed Amendment:

- **Land Uses:**
  - **Marijuana Testing Facility**
  - **Marijuana Dispensary**
  - **Marijuana Off-Site Cultivation Location**
  - **Marijuana Off-site Manufacturing Location**



Marijuana Uses Zoning Code Text Amendment

City's Proposed Zoning Code Text Amendment



Overview of Proposed Amendment:

- **Marijuana Testing Facility**
  - **Laboratory that tests marijuana and marijuana products**

- **Allowed in the zones:**
  - **Suburban Commercial (SC)**
  - **Commercial Service (CS),**
  - **Community Commercial (CC)**
  - **Research and Development (RD)**
  - **Highway Commercial (HC)**
  - **Light Industrial (LI)**
  - **Light Industrial – Open (LI-O)**

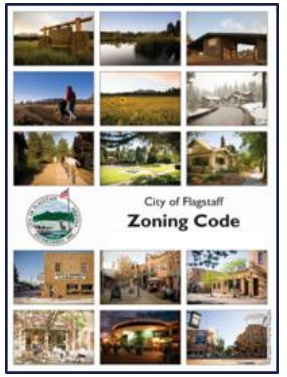
Marijuana Uses Zoning Code Text Amendment

City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **Medical Marijuana Dispensary renamed to Marijuana Dispensary**
  - **Medical and dual license (medical or recreational) sales**
  - **Associated accessory uses (cultivation, manufacturing, processing, packaging, or storage of marijuana products**

- **Maintains allowed use in the Highway Commercial (HC) zone**

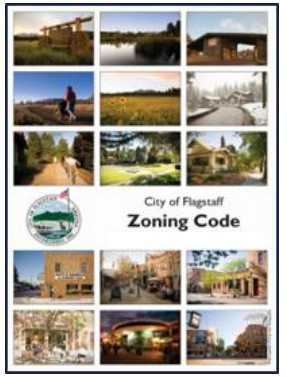


City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **Medical Marijuana Off-Site Cultivation Location renamed to Marijuana Off-Site Cultivation Location**
  - **Allows for the cultivation, manufacturing, packaging, processing, and storage of marijuana and marijuana products**

- **Allowed in the zones:**
  - **Light Industrial (LI)**
  - **Light Industrial – Open (LI-O)**
  - **Heavy Industrial (HI)**
  - **Heavy Industrial – Open (HI-O)**

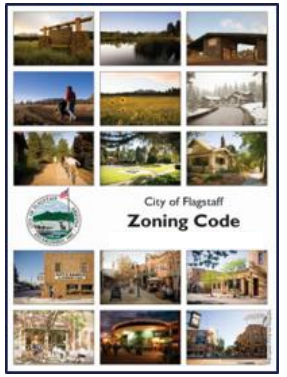


City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **Marijuana Off-Site Manufacturing Location**
  - **Allows for the manufacturing, packaging, processing, and storage of marijuana and marijuana products**

- **Allowed in the zones:**
  - **Light Industrial (LI)**
  - **Light Industrial – Open (LI-O)**
  - **Heavy Industrial (HI)**
  - **Heavy Industrial – Open (HI-O)**

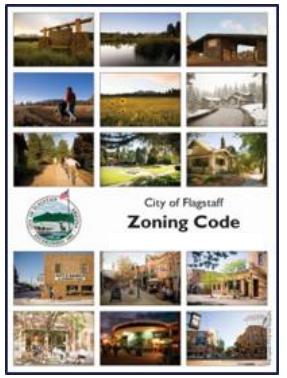


Marijuana Uses Zoning Code Text Amendment

City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

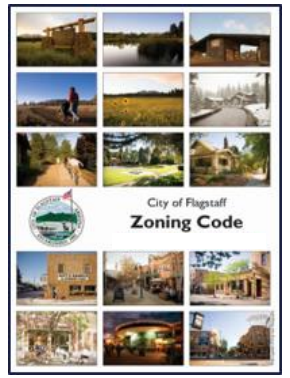
- **Concept Plan submittal requirements have been incorporated**
- **Affidavit requirements have been incorporated**
- **Antiquated definitions deleted**
- **Existing and new definition have been modified for:**
  - **Marijuana Testing Facility**
  - **Marijuana Dispensary**
  - **Marijuana Off-Site Cultivation Location**
  - **Marijuana Off-site Manufacturing Location**



City's Proposed Zoning Code Text Amendment

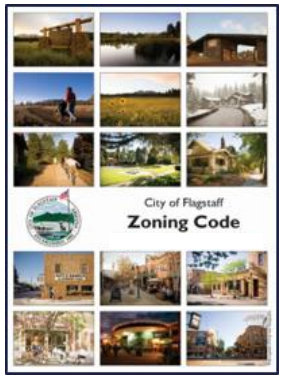
Overview of Proposed Amendment:

- Removed existing requirements that are regulated by the state
- Maintained and clarified several requirements including:
  - Exiting and security plan provisions
  - Drive-thru preclusion
  - Separation provisions:
    - 2000 feet from a treatment facilities
    - 500 feet from:
      - Education facilities
      - Daycare facilities
      - Public libraries and parks
      - Family recreation and entertainment facility



Zoning Code Amendment

- **Required findings to approve the Zoning Code Text Amendment:**
  - **The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;**
  - **The proposed amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City; and**
  - **The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.**



Updates to Zoning Code 2021 – Recreational Marijuana

City's Request to Amend the Zoning Code

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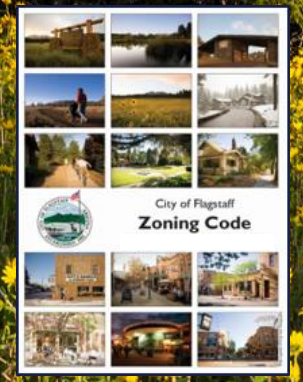


9. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
:	
Co-Submitter:	Mac McNamara
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval of Contract: Approve the Construction Contract with Jud Co., LLC in the amount of $820,375.50 for the Phoenix Avenue Bridge and Waterline Replacement Project.

STAFF RECOMMENDED ACTION:

1. Approve the Construction Contract with Jud Co., LLC in the amount of $820,375.50, which includes a $57,235.50 Contract Allowance which is 7.5% of the lowest responsive bid, and a contract time of 155-calendar days: and
2. Approve Administrative Change Order Authority to the City Manager in the amount of $76,314.00 (10% of the contract amount, less the Contract Allowances); and
3. Authorize the City Manager to execute the necessary documents.

Executive Summary:

The Construction Contract award of $820,375.50 to Jud Co., LLC is proposed to complete the Phoenix Avenue Bridge and Waterline Replacement Project (Project) in accordance with the approved public improvement plans prepared by The WLB Group, Inc. The Project consists of installing a new 2 cell concrete bridge culvert, 11 feet by 4 feet, 20 LF of 18” CMP with riprap and gabion baskets, 350 LF of new 12” PVC and 6” ductile iron waterline, 20 LF of new 8” ductile sewer line with manholes, 675 SY of new asphalt and 2,100 SF of new concrete sidewalk. Included will be a new air release valve, new manholes, drainage improvements and driveways. This Project will remove the existing box culvert that is in need of replacement based on inspection by the ADOT Bridge Inspection Group. The existing 12” and 6” water mains will also be replaced as part of the City’s ongoing aging water infrastructure replacement program. Pending Council’s approval, construction is anticipated to begin in July 2021 and is anticipated to be complete in November 2021.

After consulting with the Information Technology Division (IT), staff determined that the bridge and street impacted by the Phoenix Avenue Bridge and Waterline Replacement Project are not included in IT's Broadband Master Plan. However, staff is committed in assisting with the Broadband Master Plan and has added to the Project 100 LF of the conduits and two pull boxes on the north side of Phoenix Avenue.

Financial Impact:

The Project will be funded by the total budget appropriations, $1,597,949, remaining in FY 2020-2021 and proposed FY 2021-2022 for account numbers 206-08-385-3476-0 and 202-08-370-3437-0-4463.

Policy Impact:

No impact

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Sustainable, Innovative Infrastructure
Utilize existing long-range plan(s) that identify the community's future infrastructure needs and all associated costs

Council Goal 2017 – 2019 - Transportation and Other Public Infrastructure
Deliver quality community assets and continue to advocate and implement a highly performing multi-modal transportation system.

Regional Plan: Policy WR.2.2
Maintain and develop facilities to provide reliable, safe, and cost-effective water, wastewater, and reclaimed water services.

Council Goal - Transportation and Other Public Infrastructure
Deliver quality community assets and continue to advocate and implement a highly performing multi-modal transportation system.

Team Flagstaff: Foster a Resilient and Economically Prosperous City
Deliver outstanding services through a healthy environment, resources, and infrastructure.

Has There Been Previous Council Decision on This:

Council has previously approved the FY 2020-2021 Capital Improvement 5-Year Plan and authorized the FY 2020-2021 budget for this project in the amount of $1,563,449

Options and Alternatives:

1. Approve the Construction Contract as recommended. Approval will allow work to move forward in the calendar year 2021; or,
2. Reject approval of the Construction Contract as recommended. This action would delay the Project.

    a. If rejection occurs, possible options include:
        i. Direct Staff to re-advertise the Project; or
        ii. Suspend or cancel the Project completely.

Background/History:

On April 5, 2021, the Purchasing Section posted an Invitation for Bids (IFB) solicitation for construction on the PlanetBids' website and advertised the IFB in the Arizona Daily Sun on April 11 and April 18, 2021. There were four (4) bids received and opened electronically on April 26, 2021. A summary of the bids received is identified in the Key Considerations section below. Jud Co., LLC was determined to be the lowest responsive and responsible bidder.

Key Considerations:

The existing Phoenix Avenue bridge is in need of replacement due to deteriorating conditions. The bridge was inspected by the ADOT Bridge Inspection Group. The existing 6" water main in this area was constructed in 1906. This existing water main is aging and needs replacement. The City Water Services Division has approved funding for new improvements to reduce maintenance costs, improve safety and service reliability to the community.

Engineering did consult with IT on whether fiber-optic conduit should be included in this project, in support of the Broadband Master Plan. Specifically, the Broadband Master Plan shows that the broadband fiber will be located in Beaver Street, south of Route 66, and then turn westward in Phoenix Avenue, ultimately ending at City Hall. Staff is committed to assisting with the implementation of the Broadband Master Plan and will coordinate with IT's project to ensure seamless completion of this work. Namely, if necessary, we will add approximately 100 LF of conduit (and up to two pull boxes) within the footprint of the Phoenix Avenue Bridge Project if this Project advances prior to IT's project in 2021.

Expanded Financial Considerations:

On April 26, 2021, bids were received to construct the Phoenix Avenue Bridge and Waterline Replacement Project. The summary results are listed below.

Engineer's Estimate	$ 930,564.10
Jud Co., LLC	$ 763,140.00
Mountain High Excavation, LLC	$ 856,269.00
Scholz Contracting, LLC	$1,335,185.00
Standard Construction Co. Inc.	$2,662,746.00
Allowance at 7.5% of lowest bid	$ 57,235.50

After the bidding process, the Contract Allowance is established to address certain unforeseen items of work where details cannot be determined at the time of contracting and may be included in the Contract Amount per the City of Flagstaff's Procurement Code Manual. The $57,235.50 Contract Allowance is 7.5% of the low bid amount, which does not include a Contract Allowance. The Contract Allowance is used only at the City's discretion. See attached allowance justification form.

Administrative Change Order Authority is established to address inevitable differing field conditions usually becoming time-sensitive major construction issues resulting in unforeseen costs that are more than the Contract Amount. Change Order Authority provides the City Manager, on behalf of the Council, the administrative authority to amend the Contract Amount up to an established dollar amount (10% of the Contract Amount, less the Contract Allowance) and is only utilized if the Contract Allowance is or would become exhausted.

Community Involvement:

The Community benefits of this Project include a new bridge that is safer for the traveling public and better service from the water distribution infrastructure. Additional Project information and traffic restriction advisories will be provided during construction via local media and through the City Manager's office as needed. The Project will replace an existing bridge, an old waterline, reducing failures and maintenance costs over time.

Expanded Options and Alternatives:

1. Approve the construction contract as recommended. This would allow the Project to be constructed in 2021.
2. Reject all bids. This option would delay the construction start and possibly cause the work to be deferred until 2022.

Attachments: Presentation
Contract
Contract - Exhibit A
Contract - Exhibit B
Context Map
Vicinity Map
Signed Justification Form

City of Flagstaff

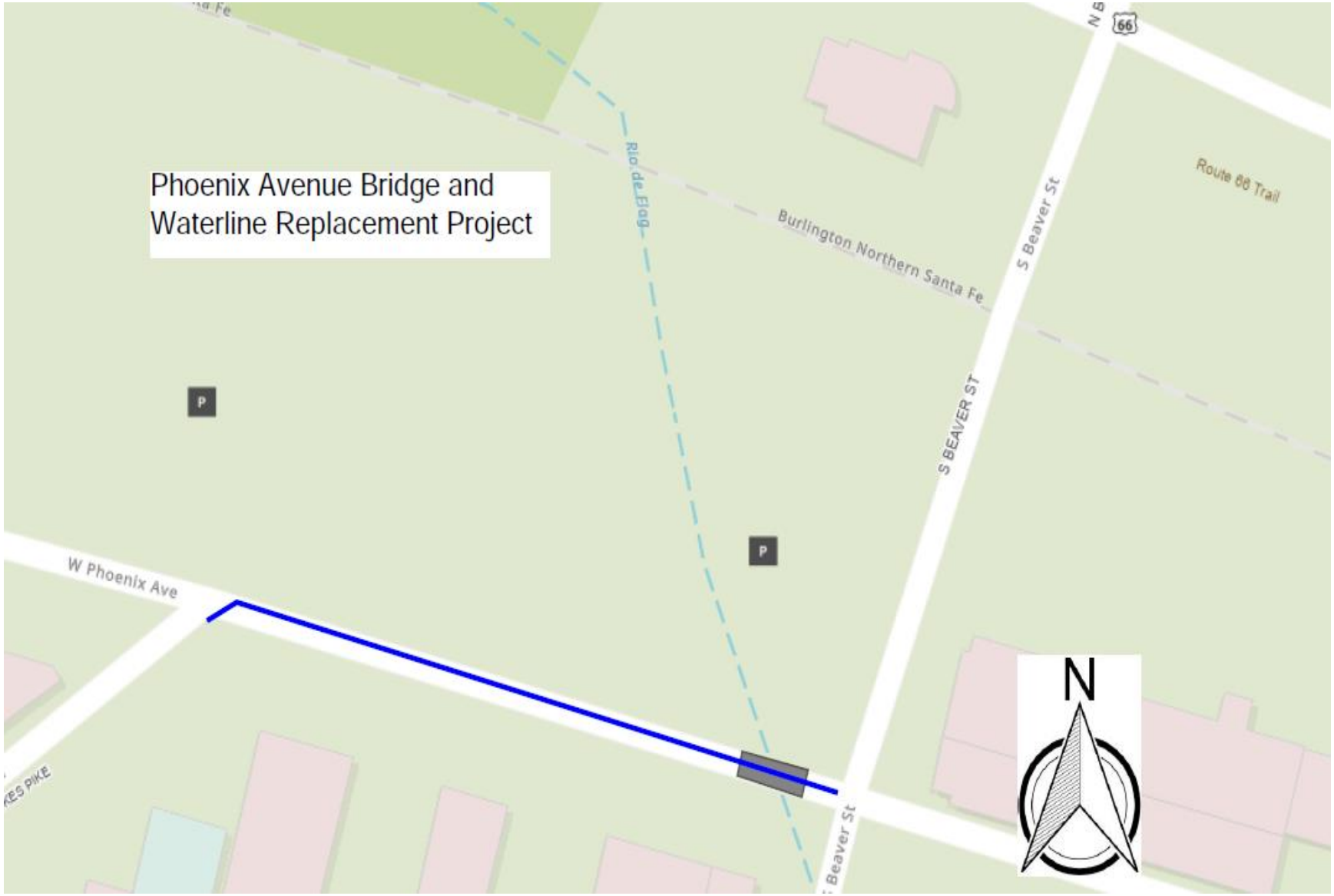
Consideration and Approval of Construction Contract

Phoenix Avenue Bridge and Waterline Replacement Project

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

Vicinity Map



Phoenix Ave. Bridge & Waterline

- Bridge
  - Existing Structure was constructed in 1929
  - ADOT Bridge Inspection Group 2013 – conditions have deteriorated, and repairs or replacement is needed.
- Waterline
  - Existing 6” water main – 1906
  - New 12”, 8” and 6” water mains
  - Utility work is part of the Aging Replacement Program
- IT Broadband Master Plan Infrastructure

Phoenix Ave. Bridge & Waterline

- Project Schedule
  - Pending Council approval – construction July 2021
  - Project completion – Anticipated November 2021
- Funding
  - Water Services Budget – Programmed in FY 21 & FY 22

Phoenix Ave. Bridge & Waterline

Questions?

CONSTRUCTION CONTRACT #2021-96

City of Flagstaff, Arizona
and
Jud Co, LLC

This Construction Contract ("Contract") is made and entered into this _____ day of _____ 2021, by and between the City of Flagstaff, an Arizona municipal corporation with offices at 211 West Aspen Avenue, Flagstaff, Arizona, 86001 ("Owner") and Jud Co, LLC ("Contractor") with offices at PO Box 522, Cedar City, Utah, 84721. Contractor and the Owner may be referred to each individually as a "Party" and collectively as the "Parties."

RECITALS

A. Owner desires to obtain construction services; and

B. Contractor has available and offers to provide personnel and materials necessary to accomplish the work and complete the Project as described in the Scope of Work within the required time in accordance with the calendar days included in this Contract.

NOW, THEREFORE, the Owner and Contractor agree as follows:

1. Scope of Work. The Contractor shall furnish any and all labor, materials, equipment, transportation, utilities, services and facilities for the **Phoenix Avenue Bridge and Waterline Replacement Project** (the "Project"). The Project scope is specific to the attached Special Provisions (Exhibit A). Contractor shall construct the Project for the Owner in a good, workmanlike and substantial manner and to the satisfaction of the Owner through its engineers and under the direction and supervision of the City Engineer, or his properly authorized agents including but not limited to project managers and project engineers. Contractor's work shall be strictly pursuant to and in conformity with the Contract.

1.1 A Pre-Construction Conference will be held with the successful Contractor after the Notice of Award is issued. The date and time of the Conference will be agreed upon between the Contractor and the Engineer at a location identified by the City. The meeting will be held at a location identified by the City. The purpose of the meeting is to outline specific construction items and procedures that the Owner feels require special attention on the part of the Contractor. The Contractor may also present any variations in procedures to improve the workability of the Project, reduce the cost, or reduce inconvenience to the public. The Contractor shall submit a written proposal at this conference outlining intended plans for pavement replacement, maintaining continuous access to residences and businesses along the construction site, and traffic control.

2. Contract; Ownership of Work. Contractor shall furnish and deliver all of the materials and perform all of the work in accordance with this Contract; Construction Plans; Special Provisions; the City of Flagstaff Engineering Design and Construction Standards and Specifications; the latest version of the Maricopa Association of Governments ("MAG") Specifications for Public Works Construction and City revisions to the MAG Specifications for

Public Works Construction ("Exhibit B); and any Arizona Department of Transportation (A.D.O.T.) Standards that may be referenced on the Plans or in the specifications, incorporated in this Contract by reference, plans and associated documents. All provisions of the Invitation for Construction Bids, Performance Bond, Payment Bond, Certificates of Insurance, Addenda, Change Orders and Field Orders, if any, are hereby incorporated into this Contract. All materials, work, specifications and plans shall be the property of the Owner.

The following exhibits are incorporated by reference and are expressly made a part of this Contract:

2.1.1	Special Provisions	Exhibit A
2.1.2	Revisions of MAG Standard Specifications for Public Works Construction ("Flagstaff Addendum to MAG")	Exhibit B

3. Payments. In consideration of the faithful performance of the work described in this Contract, the Owner shall pay an amount not to exceed Total Contract Amount of **eight hundred twenty thousand three hundred seventy five dollars and fifty cents ($820,375.50**), which is the sum of the Contractor's bid amount of $763,140.00 and a Contract Allowance of $57,235.50, to the Contractor for work and materials provided in accordance with the bid schedule, which amount includes all federal, state, and local taxes, as applicable. This amount shall be payable through monthly progress payments, subject to the following conditions:

3.1 Contractor shall promptly submit to the Owner all proper invoices necessary for the determination of the prices of labor and materials;

3.2 Progress payments shall be made in the amount of ninety percent (90%) of the value of labor and materials incorporated in the work, based on the sum of the Contract prices of labor and material, and of materials stored at the worksite, on the basis of substantiating paid invoices, as estimated by the Owner, less the aggregate of all previous payments, until the work performed under this Contract is fifty percent (50%) complete. When and after such work is fifty (50%) complete, the ten percent (10%) of value previously retained may be reduced to five percent (5%) of value completed if Contractor is making satisfactory progress as determined by the Owner, and providing that there is no specific cause or claim requiring a greater amount to be retained. If at any time the Owner determines that satisfactory progress is not being made, the ten percent (10%) retention shall be reinstated for all subsequent progress payments made under this Contract;

3.3 The City Engineer shall have the right to finally determine the amount due to Contractor;

3.4 Monthly progress payments shall be made by the Owner, on or before fourteen (14) calendar days after the receipt by the Owner of an approved estimate of the work completed;

3.5 Contractor agrees that title to materials incorporated in the work, and stored at the site, shall vest with the Owner upon receipt of the corresponding progress payment;

3.6 The remainder of the Contract price, after deducting all such monthly payments and any retention, shall be paid within sixty (60) days after final acceptance of completed work by the Owner. The release of retention or alternate surety shall be made following the Owner's receipt and acceptance of: Contractor's Affidavit Regarding Settlement of Claims, Affidavit of Payment, Consent of Surety for Final Payment, and Unconditional Full and Final lien waivers from all subcontractors and suppliers who have filed an Arizona Preliminary 20 Day Lien Notice in accordance with A.R.S. §§ 33-992.01 and 33-992.02.

4. Time of Completion. Contractor agrees to complete all work as described in this Contract within **one hundred fifty-five (155) calendar days** from the date of the Owner's Notice to Proceed, **anticipated to be June 7, 2021**, free of all liens, claims and demands of any kind for materials, equipment, supplies, services, labor, taxes and damages to property or persons, in the manner and under the conditions specified within the time or times specified in this Contract.

5. Performance of Work. All work covered by this Contract shall be done in accordance with the latest and best accepted practices of the trades involved. The Contractor shall use only skilled craftsmen experienced in their respective trades to prepare the materials and to perform the work.

6. Acceptance of Work; Non-Waiver. No failure of the Owner during the progress of the work to discover or reject materials or work not in accordance with this Contract shall be deemed an acceptance of, or a waiver of, defects in work or materials. No payment shall be construed to be an acceptance of work or materials which are not strictly in accordance with the Contract.

7. Delay of Work. Any delay in the performance of this Contract due to strikes, lockouts, fires, or other unavoidable casualties beyond the control of the Contractor and not caused by any wrongful act or negligence of the Contractor shall entitle the Contractor to an extension of time equal to the delay so caused. The Contractor shall notify the Owner in writing specifying such cause within twenty-four (24) hours after its occurrence. In the event such delay is caused by strikes, lockouts, or inability to obtain workmen for any other cause, the Owner shall have the right but shall not be obligated to complete the work on the same basis as is provided for in Section 13 below (Contract Violations).

8. Failure to Complete Project in Timely Manner. If Contractor fails or refuses to execute this Contract within the time specified in Section 4 above, or such additional time as may be allowed, the proceeds of Contractor's performance guaranty shall become subject to deposit into the Treasury of the municipality as monies available to compensate the Owner for damages as provided by A.R.S. § 34-201 for the delay in the performance of work under this Contract, and the necessity of accepting a higher or less desirable bid from such failure or refusal to perform this Contract as required. If Contractor has submitted a certified check or cashier's check as a performance guaranty, the check shall be returned after the completion of this Contract.

9. Labor Demonstration. It is understood that the work covered by this Contract is for the Owner's business purposes and that any unfavorable publicity or demonstrations in connection with the work will have a negative effect upon the Owner. If Contractor's actions in performance of the Contract result in any public demonstration on behalf of the laborers or organized labor in the vicinity of the Owner's premises, whether such demonstration is in the form of picketing, posting of

placards or signs, violence, threats of violence or in any other form, which in the Owner's judgment, might convey to the public the impression that the Owner or the Contractor or any subcontractor is unfair to laborers or to organized labor, the Owner shall have the right to terminate this Contract immediately, unless the Contractor shall have caused such demonstration to be discontinued within two (2) days after request of the Owner to do so. In the event any such demonstration is attended by violence, the Owner may fix lesser time within which a discontinuance shall be accomplished. In the event of Contract termination, the Contractor agrees to remove from the Premises within twenty-four (24) hours of termination, all machinery, tools, and equipment belonging to it or to its subcontractors. All obligations or liabilities of the Owner to the Contractor shall be discharged by such termination, except the obligation to pay to the Contractor a portion of the Contract price representing the value based upon the Contract prices of labor and materials incorporated in the work as established by the Owner, less the aggregate of all previous payments, but subject to all of the conditions pertaining to payments generally.

10. Material Storage. During the progress of the work, the Contractor shall arrange for office facilities and for the orderly storage of materials and equipment. Contractor shall erect any temporary structures required for the work at his or her own expense. The Contractor shall at all times keep the premises reasonably free from debris and in a condition which will not increase fire hazards. Upon completion of the work, the Contractor shall remove all temporary buildings and facilities and all equipment, surplus materials and supplies belonging to the Contractor. Contractor shall leave the Premises in good order, clean, and ready to use by the Owner. The establishment of any temporary construction yard, material storage area or staging area to be located within City of Flagstaff limits and outside the public right-of-way or Project limits generally requires a Temporary Use Permit. (See Exhibit B, Section 107.2.1.)

11. Maintenance During Winter Suspension of Work. A "Winter Shutdown" is the period of time typically including December through March during which no Work will be performed by any person or entity (including but not limited to the Contractor) on the Project and Contractor shall shutdown, properly insulate and shelter the Project in a safe and workmanlike manner pursuant to local, state and federal laws. Although December through March is typically the time frame, the Owner reserves the right to initiate and terminate a Winter Shutdown at the Owner's sole discretion in the event of adverse weather conditions. A Winter Shutdown may be declared by the Owner despite delays, *for any reason,* on the Project. Owner retains the right to declare a Winter Shutdown. If work has been suspended due to winter weather, the Contractor shall be responsible for maintenance and protection of the improvements and of partially completed portions of the work until final acceptance of the project. Winter Shutdown shall be by field order, change order or original contract. If repairs and/or maintenance are needed during the Winter Shutdown, the Contractor is required to perform the repairs and/or maintenance within twenty-four (24) hours of notification from the Owner. If the needed repairs and/or maintenance are not addressed within the timeframe, the Owner will accomplish the work and deduct the cost from monies due or become due to the Contractor.

The Owner shall provide snow removal operations on active traffic lanes only during the Winter Shutdown. All other snow removal and maintenance operations shall be the responsibility of the Contractor during the Winter Shutdown. All cost associated with snow removal and proper disposal

shall be considered incidental to the work including repair of temporary surface improvements due to normal wear and snow removal operations during the Winter Shutdown.

12. Assignment. Contractor shall not assign this Contract, in whole or in part, without the prior written consent of the Owner. No right or interest in this Agreement shall be assigned, in whole or in part, by Contractor without prior written permission of the Owner and no delegation of any duty of Contractor shall be made without prior written permission of the Owner. The Owner shall not unreasonably withhold consent to such assignment. Contractor agrees that any assignment agreement between Contractor and the Assignee shall include and subject to the assignee to all obligations, terms and conditions of this Contract and that Contractor shall also remain liable under all obligations, terms and conditions of this Contract.

13. Notices. Many notices or demands required to be given, pursuant to the terms of this Contract, may be given to the other Party in writing, delivered in person, sent by facsimile transmission, emailed, deposited in the United States mail, postage prepaid, or deposited with any commercial air courier or express service at the addresses set forth below, or to such other address as the Parties may substitute by written notice, given in the manner prescribed in this paragraph. However, notices of termination, notices of default and any notice regarding warranties shall be sent via registered or certified mail, return receipt requested at the address set forth below ***and*** to legal counsel for the party to whom the notice is being given.

If to Owner:	**If to Contractor:**
Matthew Luhman, CPP, CPPB	John Barlow, Project Manager
Purchasing Manager	Jud Co, LLC
211 West Aspen Avenue	PO Box 522
Flagstaff, AZ 86001	Cedar City, UT 84721
mluhman@flagstaffaz.gov	johnl@judcollc.com

14. Contract Violations. In the event of any of the provisions of this Contract are violated by the Contractor or by any of Contractor's subcontractors, the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate such Contract (the "Notice to Terminate"). The Contract shall terminate within five (5) days of the date Contractor receives the Notice to Terminate, unless the violation ceases and Contractor makes arrangements for correction satisfactory to the Owner. In the event of any such termination, the Owner shall immediately serve notice of the termination upon the Surety by registered mail, return receipt requested. The Surety shall have the right to take over and perform the Contract. If the Surety does not commence performance within ten (10) days from the date of receipt of the Owner's notice of termination, the Owner may complete the work at the expense of the Contractor, and the Contractor and his or her Surety shall be liable to the Owner for any excess cost incurred by the Owner to complete the work. If the Owner completes the work, the Owner may take possession of and utilize such materials, appliances and plants as may be on the worksite site and necessary for completion of the work.

15. Termination for Convenience. The Owner may terminate this Contract at any time for any reason by giving at least **thirty (30) days** written notice to the Contractor. If termination occurs under this Section 15, the Contractor shall be paid fair market value for work completed by Contractor as of the date of termination. The parties agree that fair market value shall be determined

based on the Contractor's original bid price, less any work not yet completed by the Contractor as of the date the written notice of termination is given to the Contractor.

16. Contractor's Liability and Indemnification. To the fullest extent permitted by law, Provider shall indemnify, save and hold harmless the City of Flagstaff and its officers, officials, agents, and employees (hereinafter referred to as "Indemnitee") from and against liabilities, damages, losses and costs, including reasonable attorney fees, but only to the extent caused by the, recklessness or intentional wrongful conduct of the contractor, subcontractor or design professional or other persons employed or used by the contractor, subcontractor or design professional in the performance of the Contract. The amount and type of insurance coverage requirements set forth in the Contract (Exhibit B, Section 103.6) will in no way be construed as limiting the scope of the indemnity in this paragraph.

17. Non-Appropriation. In the event that no funds or insufficient funds are appropriated and budgeted in any fiscal period of the Owner to meet the Owner's obligations under this Contract, the Owner will notify Contractor in writing of such occurrence, and this Contract will terminate on the earlier of the last day of the fiscal period for which sufficient appropriation was made or whenever the funds appropriated for payment under this Contract are exhausted. No payments shall be made or due to the other party under this Contract beyond these amounts appropriated and budgeted by the Owner to fund the Owner's obligations under this Contract.

18. Amendment of Contract. This Contract may not be modified or altered except in writing and signed by duly authorized representatives of the parties.

19. Subcontracts. Contractor shall not enter into any subcontract, or issue any purchase order for the completed work, or any substantial part of the work, unless in each instance, prior written approval shall have been given by the Owner. Contractor shall be fully responsible to the Owner for acts and omissions of Contractor's subcontractors and all persons either directly or indirectly employed by them.

20. Cancellation for Conflict of Interest. This Contract is subject to the cancellation provisions of A.R.S. § 38-511.

21. Compliance with All Laws. Contractor shall comply with all applicable laws, statutes, ordinances, regulations and governmental requirements in the performance of this Contract.

22. Employment of Aliens. Contractor shall comply with A.R.S. § 34-301, which provides that a person who is not a citizen or ward of the United States shall not be employed upon or in connection with any state, county or municipal public works project.

23. Compliance with Federal Immigration Laws and Regulations. Contractor warrants that it complies with all Federal Immigration laws and regulations that relate to its employees and complies with A.R.S. § 23-214.A. Contractor acknowledges that pursuant to A.R.S. § 41-4401 a breach of this warranty is a material breach of this Contract subject to penalties up to and including termination of this contract, and that the Owner retains the legal right to inspect the papers of any employee who works on the contract to ensure compliance with this warranty.

24. Contractor's Warranty. Contractor warrants that it complies with all Federal Immigration laws and regulations that relate to its employees and complies with A.R.S. § 23-214.A, Verification of Employment Eligibility. Contractor shall not employ aliens in accordance with A.R.S. § 34-301, Employment of Aliens on Public Works Prohibited. Contractor acknowledges that pursuant to A.R.S. § 41-4401, Government Procurement; E-Verify Requirement; Definitions, a breach of this warranty is a material breach of this contract subject to penalties up to and including termination of this Contract, and that the Owner retains the legal right to inspect the papers of any employee who works on the Contract to ensure compliance with this warranty.

25. Jurisdiction and Venue. This Contract shall be administered and interpreted under the laws of the State of Arizona. The Contractor hereby submits itself to the original jurisdiction of those courts located within Coconino County, Arizona.

26. Attorneys' Fees. If suit or action is initiated in connection with any controversy arising out of this Contract, the prevailing party shall be entitled to recover in addition to costs such sum as the court may adjudge reasonable as attorney fees, or in event of appeal as allowed by the appellate court.

27. Time is of the Essence. Contractor acknowledges that the completion of the Contract by the dates specified final completion is critical to the Owner, time being of the essence of this Contract.

28. No Third-Party Beneficiaries. The Parties acknowledge and agree that the terms, provisions, conditions, and obligations of this Contract are for the sole benefit of, and may be enforceable solely by, the Parties to this Contract, and none of the terms, provisions, conditions, and obligations of this Contract are for the benefit of, or may be enforced by, any person or entity not a party to this Contract.

29. Headings. The article and section headings contained herein are for convenience in reference and are not intended to define or limit the scope of any provision of this Contract.

30. Severability. If any part of this Contract is determined by a court to be in conflict with any statute or constitution or to be unlawful for any reason, the parties intend that the remaining provisions of this Contract shall remain in full force and effect unless the stricken provision leaves the remaining Contract unenforceable.

31. Force Majeure. The Parties acknowledge that there may be events that occur during the term of this Contract that are beyond the control of both the Owner and the Contractor, including events of war, floods, labor, disputes, earthquakes, epidemics, pandemics, adverse weather conditions not reasonably anticipated, forest fires, and other acts of God. These events may result in temporary delay or permanent shut down of the work that is the subject of this Contract, as set forth in Exhibit A – Special Provisions. This may be caused by such things as stay-at-home orders, loss of labor force, supply chain delays, and other impediments to timely delivery of the Contract.

The Parties agree that there will be no claims arising from a temporary delay or permanent shut down caused by the events described above and that the Owner will pay no additional costs incurred as a result of such events.

The Parties agree to act in good faith to extend the Contract completion date without any penalty to the Contractor and that the extension will be in an amount of time equal to any temporary delay. This term supersedes all other terms regarding temporary delay, permanent shut down, or increased costs.

IN WITNESS WHEREOF, the Owner and Contractor, by their duly authorized representatives, have executed this Contract as of the date written above.

(Please sign in blue ink. Submit original signatures – photocopies not accepted)

Owner, City of Flagstaff	**Contractor**
Greg Clifton, City Manager	Signature
Attest:	Printed Name
City Clerk	Title
Approved as to form:	
City Attorney	

CITY OF FLAGSTAFF, ARIZONA
PAYMENT BOND

PROJECT NAME: Phoenix Avenue Bridge and Waterline Replacement Project
PROJECT NUMBER: 03-20008 **BID NUMBER:** 2021-96

STATUTORY PAYMENT BOND PURSUANT TO TITLE 34
CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES
(Penalty of this Bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That, _____
(Hereinafter called the Principal), as Principal, and, _____
_____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ ("Surety"), as Surety, are held and firmly bound unto the City of Flagstaff, Arizona ("Obligee"), in the amount of _____
_____Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated this _____ day of_____, 20___, to the City of Flagstaff which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

Now, therefore, the condition of this obligation is such, that if the principal promptly pays all monies due to all persons supplying labor or materials to the principal or the principal's subcontractors in the prosecution of the work provided for in the contract, this obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of said Title and Chapter, to the same extent as if it were copied at length in this Contract.

The prevailing party in a suit on this bond shall recover as a part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this _____ day of _____ 20___.

_____	_____
Principal (Seal)	Surety (Seal)
By: _____	By: _____
_____	_____
Agency of Record	Agency Address

CITY OF FLAGSTAFF, ARIZONA
PERFORMANCE BOND

PROJECT NAME: Phoenix Avenue Bridge and Waterline Replacement Project
PROJECT NUMBER: 03-20008 **BID NUMBER:** 2021-96

STATUTORY PERFORMANCE BOND PURSUANT TO TITLE 34
CHAPTER 2, ARTICLE 2, OF THE ARIZONA REVISED STATUTES
(Penalty of this Bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That, _____
(hereinafter called the Principal), as Principal, and, _____
_____, a corporation organized and existing under the laws of the State of _____
_____, with its principal office in the City of _____
("Surety"), as Surety, are held and firmly bound unto the City of Flagstaff, Arizona ("Obligee"), in the amount of _____Dollars ($_____
_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated this ____day of _____ 20__ in the City of Flagstaff which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

Now, therefore, the condition of this obligation is such, that if the principal faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of contract during the original term of the contract and any extension of the contract, with or without notice to the surety, and during the life of any guaranty required under the contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the surety being hereby waived, the above obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined

in accordance with the provisions of said Title and Chapter, to the extent as if it were copied at length in this Contract.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this _____ day of _____20__.

_____	_____
Principal (Seal)	Surety (Seal)
By: _____	By: _____
_____	_____
Agency of Record	Agency Address

FINAL SPECIAL PROVISIONS

City of Flagstaff
Phoenix Avenue Waterline & Bridge Replacement

Prepared By:

The WLB Group, Inc.

500 N. Beaver Street
Flagstaff, Arizona 86001
Phone 928-779-1500
Fax 928-779-1501
e-mail: bjoerger@wlbgroup.com

March 15, 2021

WLB Project Number: 317005A001

City of Flagstaff Project Number: WS3476/03-20008

INDEX TO THE SPECIAL PROVISIONS:

PART 100	GENERAL CONDITIONS
PART 200	EARTHWORK
PART 300	STREETS AND RELATED WORK
PART 400	RIGHT OF WAY AND TRAFFIC CONTROL
PART 600	WATER, SEWER, STORM DRAIN AND IRRIGATION
PART 800	ROADSIDE DEVELOPMENT (ADOT)
APPENDIX A	Structural Special Provisions
APPENDIX B	Geotechnical Report Addendum No. 1, dated 8-8-18, and Geotechnical Report, dated 9-8-17

MAG UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 2020 EDITION, CITY OF FLAGSTAFF REVISIONS OF MAG STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND CITY OF FLAGSTAFF ENGINEERING STANDARDS ARE HEREBY AMENDED TO INCLUDE THE FOLLOWING:

PART 100 - GENERAL CONDITIONS

SECTION 104: SCOPE OF WORK

104.1 WORK TO BE DONE:

104.1.1 GENERAL:

(Revise to include the following)

The City of Flagstaff Stormwater Section of the Water Services Division has identified the bridge culvert that conveys the Rio De Flag under Phoenix Ave (Structure No. 8709) is in need of replacement based on inspection by the ADOT Bridge Inspection Group. The inspection and an associated report identify the crossing is made up of three structural elements identified as the Beam, Bridge 1, and Bridge 2.

The two bridge sections which comprise the bridge culvert are owned by the City of Flagstaff and within the Phoenix Avenue Right-of-way. The identified Beam is under the wall of the Zani Store and is owned by the private property owner. The project's work is based around a mutually beneficial private-public partnership to repair/replace the deficient structures.

Existing 12" and 6" waterline mains in Phoenix Avenue between Mikes Pike and Beaver Street are being abandoned and replaced by a new 12" waterline which will cross below the Phoenix Avenue Bridge Culvert structure. The project work includes replacement/reconstruction of the structural system, new waterline construction, and associated roadway improvements. The work includes the following elements:

- New Bridge Culvert, per the structural design
- Reconstruction of the Zani Beam, per the structural design.
- New stormdrain pipes
- Coordination for relocation of franchise utilities
- New COF Fiber Optic conduits and Pull Boxes
- Waterline main replacement with associated water services
- Sewer manhole replacement
- New curbs
- New sidewalks
- Roadway asphalt paving

- Roadway mill and overlay
- Pavement Striping

The scope of work includes all material installation costs associated with construction of the items listed above.

Rio De Flag conveyance shall be maintained at all times during construction.

104.1.2 MAINTENANCE OF TRAFFIC:
(Revise to include the following)

The contractor shall furnish to the City a traffic control plan for the project that includes provisions for access to all adjacent private properties within the project area. The contractor may temporarily limit vehicular and pedestrian traffic to properties through advance written notice and coordination with the City's Project Representative and the property owners.

The Phoenix Avenue roadway and pedestrian facilities across the bridge culvert portion of the project area shall be shut down during the duration of the structural system replacement, including during non-working hours. This full-time shutdown area shall be limited to be from ten (10) feet east of the bridge eastern abutment wall to ten (10) feet west of the bridge western abutment wall. However, every effort must me be made to prioritize reopening of the Phoenix Avenue southern sidewalk for business access. Upon project award, the contractor shall provide the City a construction schedule and phasing plan which identifies the limits of the shutdown, the durations, and identifying the reopening time of the sidewalk. The contractor shall coordinate with the City the shutdown and re-opening schedule, including any phased or temporary re-openings. Temporary openings to the businesses may be required through the construction zone for deliveries and building maintenance.

The Contractor is responsible for securing the construction site and maintaining safe passage for pedestrian and bicycle traffic.

Special Access Requirements:

The Contractor shall maintain access to all side streets, access roads, and driveways at all times during their hours of operations. Access to all residential driveways shall be provided during all non-working hours. Where property has more than one driveway, no more than one access will be restricted or closed at one time. Should it be necessary to close access to private property or driveways, the closure must be for as short a time as possible and be restored at the end of the work shift.

Sanitation Pickup:

Trash pickup in and around the project area is scheduled every Tuesday and Wednesday. Recycle pickup in and around the project area is scheduled every Friday. When construction

activity interferes with pickup, the contractor shall provide for sanitation vehicle access to the affected properties or relocate the trash containers where access is acceptable. The Solid Waste Division of the Public Works Department contact is 213-2110.

Emergency Access:

Traffic control information shall be submitted to the City's Project Representative who will forward the information to the Fire Department and Police Department. All notices shall be submitted at least 72 hours in advance of the closures.

U.S. Postal Service Access:

The contractor shall be responsible for maintaining access for Postal Service within the project area at all times.

104.2.2 ALTERATION OF WORK:
(Revise to include the following)

During construction, should the footings of the existing, remaining culvert walls be uncovered or exposed, the contractor is to immediately notify the City Project Manager of the exposed condition and footing depth to allow the City to determine if further evaluation or construction is necessary to protect against scour.

SECTION 105: CONTROL OF WORK

105.2 PLANS AND SHOP DRAWINGS:
(Revise to include the following)

The Contractor shall be required to maintain an as-built "red-line" set of construction plans that fully describes work that deviated from the approved contract documents. The redline planset will be reviewed at each weekly meeting with the City's PM and the engineer to assure that all deviations from the plans are being noted. The redline planset needs to be legible and contain accurate information that will be used by the Contractor to prepare Record Drawings at the conclusion of the project. The redlines and Record Drawings will include at least the following information, and what is defined in the City of Flagstaff's most current As-Built Plans/Record Drawings Checklist:

- Ground surface elevations including channel flow lines and embankment edges
- Horizontal locations of channel flow lines and embankment edges
- Locations and elevations of headwalls
- Location and elevation of the bridge culvert inverts
- Size of the bride culvert, including any walls
- Location and elevations of the Zani Beam
- Dimensions of the Zani Beam
- Locations and elevations of the relocated or new utilities and appurtenances

- Inverts and horizontal locations of stormdrain pipes and their stubs
- Slope of the stormdrain pipes

The As-Built survey for the sealed Record Drawings shall include verifying all channel and structure locations and elevations in sufficient detail to verify conformance with the design drawings. The contractor shall submit the final As-Built/Record Drawing planset to the City's Project Manager at the conclusion of the project per the City of Flagstaff's most current As-Built Plans/Record Drawings Checklist and the City of Flagstaff Amendments to MAG Standard Specifications.

SECTION 107: LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.2 PERMITS:
(Revise to include the following)

The contractor is responsible for acquiring a Public Improvement Permit, a Temporary Use Permit (for construction yard), and Floodplain Use Permit, but the City will cover all costs and will help with the permit paperwork. The contractor is responsible for obtaining a Floodplain Use Permit from the City of Flagstaff for work around, in, and over the Rio de Flag. The Floodplain Use Permit application will be prepared by Doug Slover, Stormwater Project Manager with the City's Water Services Division, and the contractor is to coordinate with him for filing for the permit.

107.9 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE:
(Revise to include the following)

Survey monuments and property corners shall be protected and not disturbed. All costs associated with protecting or re-establishing disturbed survey monuments and property corners shall be borne solely by the Contractor.

The Contractor is will have to propose a yard location.

107.9.1 EROSION PROTECTION AND SITE RESTORATION:
(revise to include the following)

The Contractor will be required prepare a Stormwater Polution Prevention Plan (SWPPP) manual and to submit a Notice of Intent (NOI), at the beginning of the project, and a Notice of Termination (NOT), at the end of the project, to be in compliance with the most current AZPDES General Permit. The Contractor shall use best management practices (BMP) in controlling stormwater runoff and shall install the SWPPP per the erosion control plans. A copy of the NOI and NOT shall be submitted to the City. All costs associated with the SWPPP manual, NOI, NOT and BMP's for stormwater runoff are the responsibility of the Contractor. The SWPPP will be paid as a lump sum.

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICE:
(Revise to include the following)

The Contractor shall protect existing water, sewer, gas, electric, fiber optic, telephone and cable service lines where the proposed work crosses individual service lines. Not all services lines are shown on the plans and it is the Contractor's responsibility to determine their location in the field. Protection or repair of existing service lines not in conflict with the work is considered incidental to the other work. In the event that there is a physical conflict between an existing service line and the proposed work, the Contractor shall immediately notify the City of the conflict. The City will make a determination as to how the conflict will be resolved. On City ROW projects, all City water and sewer issues are to go through the assigned Engineering Inspector, and they will coordinate with the City PM and/or Water Services (which now is both sewer and water).

Utility company contacts are listed below:

Arizona Public Service	Ryan Weisner	(928) 773-6414
CenturyLink	Manuel Hernandez	(928) 779-4935
SuddenLink	Sanford Yazzie	(928) 606-4521
Unisource	Martin Conboy	(928) 226-2269

SECTION 108: COMMENCEMENT, PROSECUTION AND PROGRESS

108.5 LIMITATIONS OF OPERATIONS:
(Revise to include the following)

Working hours shall be from 7 am – 5 pm. Rock excavation working hours shall be from 8 am – 5 pm.

PART 200 - EARTHWORK

SECTION 220: RIPRAP CONSTRUCTION

220.1 DESCRIPTION
The work for gabion riprap baskets shall consist of furnishing all materials, including filter or erosion control geosynthetic fabric, and anchoring stakes. The work shall be completed in accordance with the requirements ADOT Standard Specifications Section 913, 2008 edition, and these Special Provisions.

220.2 MATERIALS:
Standard specifications shall be revised to include the following for gabion baskets:

A) Metal Items:

At the contractor's option, either woven wire mesh or welded wire mesh (welded mesh) may be used. For each individual gabion, the same mesh style shall be used for the base, front, ends, back, diaphragms, and lid panels. Each gabion shall be divided into cells of equal length, no greater than 3 feet, by diaphragm panels.

Mesh: Individual wires of either mesh style (woven or welded) shall conform to the definitions and requirements of ASTM A641 for "carbon steel", zinc-coated wire. All zinc coated gabions shall conform to ASTM A975 Style 1 (zinc coated gabions) for woven gabions and ASTM A974 Style 1 for welded gabions, and shall meet the following requirements:

Characteristic	**Test Designation**	**Requirement**
Minimum Tensile Strength	ASTM A370	60,000 psi
Zinc Coating	ASTM A641	Class 3
Wire Size (Minimum) Wire Diameter (Minimum) Galvanizing	USA Steel Wire Gage ASTM A641 ASTM A641, Table 3 ASTM A641, Table 1 And ASTM A90	11 0.120 inch 0.116 inch 0.85 oz/sf
Wire Size (Minimum) Wire Diameter (Minimum) Galvanizing	USA Steel Wire Gage ASTM A641 ASTM A641, Table 3 ASTM A641, Table 1 And ASTM A90	9 0.148 inch 0.144 inch 0.90 oz/sf

Twisted-mesh wires shall form a uniform hexagonal pattern and shall be formed with a non-raveling twist. The area of hexagonal opening shall not exceed 3-1/4 inch. Twisted-mesh gabion panels shall be manufactured from 11-gage wires with 9-gage selvage wires.

Welded-mesh wires shall form a grid pattern. Welds shall be made by resistance welding. Welds and panels shall conform to ASTM A185, "Steel Welded Wire Fabric –Plain for Concrete," except weld shears shall be 600 pounds force for 11-gage wires and 800 pounds force for 9-gage wires.

Joints: Wires used to form joints shall conform to the definitions and requirements of ASTM A641 for "carbon steel", zinc-coated wire and shall meet the following requirements:

Characteristic	Test Designation	Requirement
Minimum Tensile Strength	ASTM A370	60,000 psi
Zinc Coating	ASTM A641	Class 3
Tie Wire Wire Size (Minimum) Wire Diameter (Minimum) Galvanizing	 USA Steel Wire Gage ASTM A641 ASTM A641, Table 3 ASTM A641, Table 1 And ASTM A90	 13.5 0.086 inch 0.083 inch 0.70 oz/sf
Spirals Wire Size (Minimum) Wire Diameter (Minimum) Galvanizing	 USA Steel Wire Gage ASTM A641 ASTM A641, Table 3 ASTM A641, Table 1 And ASTM A90	 9 0.148 inch 0.144 inch 0.90 oz/sf

Spiral binders shall have a 3-inch separation between continuous, successive loops. Overlapping fasteners (rings) may be used in lieu of, or to complement, lacing wire for basket assembly and installation. The spacing of the fasteners during all phases of assembly and installation shall be in accordance with spacing based pull apart resistance of 1,400 lb/ft for galvanized mesh when tested in accordance with ASTM A975 section 13.1.2, with a nominal spacing of 4 in., and not to exceed 6 in.

- Galvanized Fasteners: Diameter = 0.120 in. (3.05mm), according to ASTM A313/A313M-98, Type 302, Class I.
- Tensile Strength: 230,000 to 273,000 psi (1586-1882 MPa) in accordance with ASTM A764-95(2001).
- Proper Installation of Rings: A properly formed ring fastener shall have a nominal overlap of one (1) in. after closure.

Any internal cross tie connecting wires or preformed stiffeners shall be at least 13.5-gage. Each wire shall also meet the minimum requirements of the wire in this specification.

The contractor shall request acceptance of alternative fasteners. Alternative fasteners for woven and welded gabions must be tested in accordance with ASTM A975 Table 2 panel to panel connection. Contractor shall provide a copy of the tests made by a recognized laboratory 15 days prior to construction of gabions. The contractor's request shall describe how and where the proposed alternative fasteners will be used.

Random samples of alternative fasteners shall be submitted for testing at least 15 calendar days prior to construction of gabions. The contractor shall submit 12 formed and 12

unformed alternative fasteners. Formation of the 12 formed alternative fasteners shall be done at the job site by the contractor and shall be witnessed by the Engineer.

Gabions which have been constructed with unacceptable alternative fasteners shall be removed or reconstructed at no additional cost to the City at the discretion of the Engineer.

Certificates of Compliance conforming to the requirements of Subsection 106.05 of the ADOT Standard Specifications shall be submitted.

B) Soil Anchor Stakes:

Soil anchor stakes shall meet the requirements of Subsection 913-2.02 (F) of the ADOT Standard Specifications.

C) Gabion Baskets:

Gabion baskets are wire baskets that are filled on-site with hard, durable rock. A single gabion can be made of square or rectangular panels.

Acceptable individual gabion basket nominal dimensions of width, height, and length are as follows, and shall not vary more than 5 percent from the dimensions listed in these special provisions:

- Width = 3 feet
- Height = 1.5 feet
- Length = 9 feet and 12 feet

Woven wire baskets shall consist of a uniform hexagonal wire mesh woven in double twist pattern with openings of approximately 2-1/2 inches by 3-1/4 inches, fabricated in such a manner as to be non-raveling, and designed to provide the required flexibility and strength.

Welded wire baskets shall consist of wire spaced at 3 inches center to center.

Empty gabion baskets shall be manufactured individually, in the factory with base, front, ends, back, and diaphragms all connected together on one side minimum, lids may be assembled on the site. Gabion baskets shall be assembled such that the strength and flexibility along the joints are in accordance with ASTM A975 (woven gabion) and A974 (welded gabion) panels to panels connection.

D) Bedding Material:

Bedding material shall consist of granular material having a maximum dimension of two inches and shall be free of clay or organic material. The bedding material shall be compacted to 95%.

E) Filter Fabric:

Geotextile filter fabric shall meet the requirements of Subsection 913-2.05 of the ADOT Standard Specifications.

220.5 RIPRAP PLACEMENT:

Standard specifications shall be revised to include the following for gabion baskets:

A) General:

Areas on which the gabions are to be constructed shall be cleared, grubbed, and excavated or backfilled in accordance with the requirements of the appropriate sections of these Special Provisions and ADOT Specifications to produce a ground surface in reasonable conformance with the lines and grades shown on the plans or established by the Engineer.

B) Gabion Baskets:

The gabion bed shall be excavated to the width, line and grade as shown on the plans. The gabions shall be founded on this bed and laid to the lines and dimensions required. Excavation for toe shall be made to the neat lines of the toe.

Gabions shall be preassembled in the factory with sides, ends, and diaphragms all connected together, on side minimum where they can be assembled at the construction site into rectangular units of the specified sizes. Lids may be assembled on site. Gabions are to be of single unit construction; the base, ends and sides either to be woven into a single unit or one edge of these members connected to the base section of the unit.

Where the length of the gabion exceeds its horizontal width, the gabion is to be equally divided by diaphragms, of the same mesh and gauge as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base section in such a manner that no additional tying at this juncture will be necessary. All perimeter edges of gabions are to be securely selvedged or bound so that the joints formed by tying the selvedges have the minimum connection strength.

Gabions shall be placed to conform to the specifications and dimensions shown on the project plans. Rock shall be placed in close contact in the unit so that maximum fill is obtained. The units may be filled by machine with sufficient handwork to accomplish requirements of this specification. Units shall be overfilled by 1.5 to 2 inches before closing the lid to compensate for settlement.

The exposed face or faces shall be hand-placed using selected rocks or prevent bulging or the gabion cell and to improve appearance.

Two connecting tie wires shall be placed between each lift in each cell. All connecting tie wires shall be looped around two mesh openings and the ends of the wires shall be securely

twisted to prevent loosening. Care shall be taken to protect the vertical panels and diaphragms from being bent during filling operations.

The last lift of stone in each cell shall be level with the top of the gabion in order to properly close the lid and provide an even surface for the next course.

All gabion units shall be tied together, each to its neighbor along all contacting edges in order to form a continuous connecting structure.

Empty gabions stacked on filled gabions shall be laced to the filled gabion at the front, side and back. Interlocking rings or overlapping rings may be used for assembly of individual gabions. There shall be a ring in each mesh opening along the joint in lieu of tie wire or spiral binders. The use of alternative joint fasteners shall be approved by the Engineer in writing.

C) Filter Fabric:

Filter fabric shall be placed on all areas to receive gabions, as shown on the project plans, prior to placement of the gabion. The surface to receive the filter fabric shall be free of obstructions, depressions, and debris. The fabric shall be loosely laid and not placed in a stretched condition.

The strips of filter fabric shall be placed to provide a minimum 24-inch overlap along each joint. On horizontal joints, the uphill strip shall overlap the downhill strip. On vertical joints the upstream strip shall overlap the downstream strip. The fabric shall be protected at all times during construction from extensive exposure to sunlight.

Placement of the gabions shall be done in such a manner as not to damage the fabric. If, in the opinion of the Engineer, the fabric is damaged or displaced during the placement of the gabion to the extent that it cannot function as intended, the contractor shall remove the rock and replace the filter fabric.

The filter fabric shall be attached to the bottom and side of the gabions that make up the outside perimeter of a finished bank protection unit. Typically, this attachment will be made horizontally along the top-of-bank and end-of-apron, and vertically along the upstream and downstream limits of each continuous unit of bank protection.

D) Testing:

When requested by the Engineer, gabions manufacturer shall provide a copy of all tests made by an approved laboratory for the following properties:

For woven gabions all tests for zinc coating, mesh tensile strength, panels to panels connection, and salt spray test when alternative fastener is used, shall be made in accordance with ASTM A975 Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revert Mattresses.

For welded gabions all tests for zinc coating, welds shear strength, and panels to panels connection shall be made in accordance with ASTM A974 Standard Specification for Welded Wire Fabric Gabions and Gabion Mattresses.

All tests shall not be older than 5 years.

E) Manufacturer Construction Drawings/Details:

Prior to fabrication of the baskets, the contractor shall submit manufacturer details, assembly instructions, and material data in accordance with the requirements of Subsection 105.03 of the ADOT Standard Specifications. The submittal(s) shall include complete fabrication and erection details for the frames including detailed dimensions and sizes of component parts.

F) Guarantee and Warrantee Provisions:

The Contractor shall guarantee the work against defective workmanship or materials for a period of 1 year from the date of its final acceptance under the contract, ordinary wear and tear and unusual abuse or neglect excepted.
Any omission on the part of the Engineer to condemn defective work or materials at the time of construction shall not be deemed an acceptance, and the Contractor will be required to correct defective work or materials at any time before final acceptance and within 1 year thereafter.

Should any defects develop within 1 year from the date of final acceptance due to faults in workmanship or materials, the Contractor shall, within 14 calendar days of receipt of written notice from the City, begin making the necessary repairs to the satisfaction of the Engineer. Such work shall include the repair or replacement of other work or materials damaged or affected by making the above repairs or corrective work, all at no additional cost to the City.

If defects develop which are determined by the Engineer to be an emergency, the Engineer shall notify the Contractor, via the most expeditious means, regarding the nature and condition of the defects. In turn, the Contractor shall immediately dispatch necessary forces to correct the defect or the emergency condition. If the Contractor, in his initial action, resolves the emergency condition but not the defect, a letter as discussed above will follow and normal procedures for corrections will be employed. If immediate or appropriate action, satisfactory to the Engineer, is not taken by the Contractor, or if the Contractor cannot be contacted, the Engineer will deploy necessary forces to correct and/or secure the deficiency. Costs of the Engineer's action shall be paid by the Contractor and/or his bonding agency. Should it later be determined that the defects requiring such emergency action are not the responsibility of the Contractor, the Contractor will be paid for all costs incurred as a result of these demands. Such action by the Engineer will not relieve the Contractor of the guarantees required by this section or elsewhere in the Contract Documents.

In case of work, materials, or equipment for which written warranties are required by the special provisions, the Contractor shall provide or secure from the appropriate Subcontractor or supplier such warranties addressed to and in favor of the City and deliver same to the Engineer prior to final acceptance of the work. Delivery of such warranties shall not relieve the Contractor from any obligation assumed under any other provisions of the contract.

The warrantees and guarantees provided in this subsection of the contract documents shall be in addition to and not in limitation of any other warrantees, guarantees or remedies required by law.

220.8 PAYMENT:
Payment for gabions will be made by the following.

Pay Item:	Pay Unit:
Gabion Baskets	Cubic Yard

PART 300 – STREETS AND RELATED WORK

SECTION 301 SUBGRADE PREPARATION

301.1 DESCRIPTION:

Compaction under all sidewalks shall be 95%.

SECTION 350 REMOVAL OF EXISTING IMPROVEMENTS

350.1 DESCRIPTION:

Work under this sections shall be in accordance with Section 350 of the MAG Standard Specifications. Removal and replacement of existing curb or asphalt not specifically called out shall be considered incidental to project construction and must be approved by the engineer and COF Project Manager. No separate or additional measurement or payment will be made for additional removal and replacement items unless provided in writing by the COF Project Manager.

PART 400 – RIGHT OF WAY AND TRAFFIC CONTROL

SECTION 401 TRAFFIC CONTROL

401.7 PAYMENT:
Traffic Control will be paid as a lump sum as shown on the bid schedule.

PART 600 – WATER, SEWER, STORM DRAIN AND IRRIGATION

SECTION 631 SUBGRADE PREPARATION

631.3 INSTALLATIONS:
(Revise to include the following)

New water service lines shall be installed to replace the existing water service lines. Construction includes replacement of all water services to COF Engineering Standards, including the service saddle at the main, corporation stop, pipe and curb stop to the meter and adjust the customers' service to the new outlet meter coupling elevation. The lines shall be extended to the new polymer meter box location and a new meter box shall be installed and shall connect to the existing meter. It the existing meter is not at the City's standard depth; the contract shall adjust the elevation of the meter. In cases where the meter box moves, the contractor shall salvage the existing meter and shift it to the proposed location. At each of these locations the contractor is required to connect to the existing water services on the private side of the meter. The Contractor shall coordinate with each property owner where private construction is required to verify the water line rerouting and to restore landscaping to its original condition.

City of Flagstaff utility tapping fees are the responsibility of the contractor. The contractor shall perform all work and coordinate payment directly with the City Utilities Department at City Hall. All costs for utility tap work and fees shall be included in the line item for installation of the new service, including but not limited to all labor and materials for complete installation. Repair associated within any abandoned or new tap shall be included in the contract bid item.

PART 800 – ROADSIDE DEVELOPMENT

SECTION 810 EROSION CONTROL AND POLLUTION PREVENTIONS

810.1 DESCRIPTION:

The work under this section shall be in accordance with Section 810 of the ADOT Standard Specifications and as modified herein. This section refers to all work as specified on the Erosion Control Plan. Completion of the SWPPP includes preparation of the SWPPP Manual, hydroseeding of disturbed areas, BMP maintenance, inspections, and NOI and NOT filings are all incidental to the SWPPP bid item. Additional BMPs may be required during construction and are to be included in the bid price.

The contractor is responsible for the SWPPP until the NOT has been filed with and accepted by ADEQ.

810.4 METHOD OF MEASUREMENT:

Measurement for the SWPPP shall be a lump sum and includes the elements as specified in 810.1, above.

810.5 BASIS OF PAYMENT:

Payment for the SWPPP is by Lump Sum.

Pay Item:	Pay Unit:
SWPPP	Lump Sum

APPENDIX A

Structural Special Provisions

SPECIAL PROVISIONS FOR PHOENIX AVENUE BRIDGE CULVERT REPLACEMENT (STRUCTURE NO. 8709) AND ZANI CONCRETE BEAM REPAIR

PROPOSED WORK

The proposed project is located in the City of Flagstaff, Arizona on the Phoenix Avenue crossing of the Rio de Flag Wash, about 50 feet west of the junction with Beaver Street. The existing two span reinforced concrete bridge culvert structure was built in 1929 and will be replaced with a new bridge culvert. The work includes demolition of the existing bridge, strengthening the existing Zani concrete beam, and constructing a new two span cast-on-place reinforced concrete bridge culvert, as shown on the project plans.

PROFESSIONAL SEALS

This book of specifications and related contract documents represents the efforts of the following:

- Cannon Consultants, LLC

A representative of the firm has affixed his/her seal below. The seal attests that those specifications that relate to the plan sheets appearing with his/her seal were prepared under his/her direction.

Cannon Consultants, LLC
Jerry A. Cannon, P.E., S.E., Bridge Engineer
Bridge Plans – Sheets B1 through B13
Sheets S1 & S2

MISCELLANEOUS CONTRACT REQUIREMENTS

PRE-CONSTRUCTION MEETING

A pre-construction meeting will be scheduled by the Owner. Attendance by the Contractor, the Bridge Engineer-of-Record, and the City of Flagstaff Project Manager and Inspector is required at the scheduled place and time.

TECHNICAL REQUIREMENTS:

All work shall conform to the 2008 Edition of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, and current ADOT Stored Specifications, unless otherwise noted in these Special Provisions.

The average elevation of the project is about 6800 feet.

The project site is environmentally sensitive. City of Flagstaff has the right-of-way for the roadway and new bridge culvert structure. Contractor may use a portion of the existing roadway for contractor staging area as approved by the Engineer.

The City of Flagstaff has specified the following clarifications to these project Special Provisions:

1. Material submittal demonstrating and certifying compliance with the Contract Documents shall be made to City of Flagstaff as identified in the pre-construction conference.

2. Payment shall be by the Unit Price for the items of work listed on the Bid Schedule. If an item of miscellaneous work is not included it shall be deemed as having been included by the bidder in a related or similar bid item or within mobilization.

3. The table of "Approximate Quantities" shown on the Contract Plans is for information only. The use of this table in determining actual quantities or in estimating the work is wholly at the risk of the bidder.

ENVIRONMENTAL REQUIREMENTS:

The Contractor shall be responsible for compliance to the following mitigation measures during the construction of this project:

1. To prevent the introduction of invasive species, all earthmoving and hauling equipment shall be washed at the Contractor's storage facility prior to entering the construction site.

2. To prevent the spread of invasive species to uncontaminated areas, all earthmoving and hauling equipment shall be washed at a designated location prior to leaving the construction site.

3. No construction materials or debris shall be allowed to fall into the Rio de Flag Wash.

4. If suspected hazardous materials are encountered during construction, work shall cease at that location and the City of Flagstaff shall be contacted to arrange for proper assessment, treatment, or disposal of those materials.

5. If previously unidentified cultural resources are encountered during activity related to the construction of the project, the Contractor shall stop work immediately at that location and shall take all reasonable steps to secure the preservation of those resources. The Contractor will contact the City of Flagstaff immediately and make arrangements for proper treatment of those resources.

No measurement or direct payment will be made for compliance with environmental requirements. The cost will be considered as included in the cost of the contract items.

MISCELLANEOUS ITEMS:

- The Contractor shall make arrangements for temporary power during construction. No measurement or payment will be made for temporary power.

- No source of water is designated for construction of this project. The Contractor shall make arrangements for obtaining water for use during construction. No measurement or direct payment will be made for furnishing the water supply.

- The Contractor shall prevent contaminants from entering Rio de Flag Wash. The Contractor shall not place oily or greasy substances that originate from the Contractor's operations where they will later enter the wash. The Contractor shall prevent concrete or curing water for the concrete from entering the wash.

- **Equipment List/Schedule of Manpower/Construction Schedule:** The Contractor shall provide a list of equipment to be utilized on this project, a schedule of manpower to be utilized on this project, and a detailed construction schedule, for review and approval by the Owner prior to award.

- **Project Superintendent:** The Project Superintendent must be on-site at all times during performance of work and must attend the weekly construction meetings.

- **Guarantee:** All portions of the work under this contract shall be guaranteed for workmanship and materials for a period of two years from the date of final acceptance of the product by the owner.

- **Responsibility:** The Contractor shall be fully responsible for the project until the date of final acceptance.

- **Clean-Up:** The Contractor shall, at all times, keep the premises free from accumulation of waste materials and/or rubbish caused by his operations. At the completion of the work, the Contractor shall completely clean the premises, removing and disposing of all rubbish and debris, and cleaning all stains, spots, marks, dirt, smear, etc.

Weekly Meetings:

The Contractor shall provide meeting agenda and meeting minutes of the weekly construction meetings. All meetings will be held at the Phoenix Avenue Bridge site.

No measurement or payment will be made for weekly meetings, the cost being considered as included in the cost of contract items.

Concrete Testing:

Concrete testing, including concrete slump test, air content and compression strength tests, shall be made for each day's concrete placement and for every 10 CY of concrete and results submitted to the Engineer. All concrete tests will be paid for by the City of Flagstaff.

Pay Item:	**Pay Unit:**
106001: Quality Control	Lump Sum

Plan for Construction Activities:

Before starting work on the project, the Contractor shall submit a written plan for construction activities related to the Phoenix Avenue Bridge project. The plan shall describe how the Contractor will prevent material from falling into the Rio de Flag Channel, protection of existing adjacent buildings and accommodate the flow of water in the Rio de Flag Wash during construction, the location of Contractor storage and staging sites, a plan for construction activities and maintenance of traffic, protect cultural resources, insure the safety of the public and construction workers, and the removal of existing bridge structure. The plan shall consider for the need for cooperation and coordination with all parties involved in the project.

The Contractor shall submit the plan to the Engineer prior to the start of the construction, for the Engineer's review and approval, and obtain approval of the plan prior to the start of construction activities.

No measurement or direct payment will be made for the plan for construction activities related to the Phoenix Avenue Bridge project as described above, the cost being considered as included in the cost of contract items.

SECTION 202: ITEMS 2020034 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

202.1 Description of: of the ADOT Standard Specifications is modified to add:

The work under this section shall consist of removing and disposing of all vegetation, concrete, steel, debris and other material from the bridge construction area in accordance with ADOT Standard Specifications.

202-3.05 Removal of Bridge: of the ADOT Standard Specifications is modified to add:

Contractor Requirements:

The Contractor shall remove the existing concrete bridge culvert structure, as shown on the project plans. (See Section 202-3.05 of ADOT Standard Specifications.) The Contractor shall first install falsework under the existing Zani concrete beam that supports the adjacent concrete Zani channel deck slab, the existing Zani building masonry wall, etc., then saw cut the existing walls and the existing bridge culvert deck slab adjacent to the Zani concrete beam, removing the existing box culvert structure in such a manner so that the Zani building beam and masonry wall adjacent to the building are not damaged in any way. The Contractor shall dispose of the concrete and reinforcing steel and other steel members, hauling it to an approval disposal site. Any damage to the existing Zani building or adjacent buildings as a result of these removals shall be repaired to the satisfaction of the Engineer at no additional cost to the owner.

The Contractor shall make sure not to damage the existing reinforcing remaining steel and then using a hand held 30 pound maximum jackhammer to remove the existing walls and deck slab in a manner so as to not damage the remaining structure.

Submittals:

The Contractor shall prepare and submit, prior to start of construction, removal and demolition plans to the Bridge Engineer for review and approval. The Contractor shall include in that submittal shoring and falsework to support the existing Zani concrete beam and the protection of the adjacent buildings and walls, and how they plan to remove the existing concrete box culvert structure and protect adjacent buildings. The Contractor shall accomplish all work in such a manner so that no materials or debris enter the Rio de Flag Wash. Also, the Contractor shall include how they plan to accommodate water that may be flowing in the wash as this work is being done.

The falsework and temporary shoring shall be designed in accordance with Section 601-3.02 of the ADOT Standard Specifications for Road and Bridge Construction, 2008 Edition. The Contractor shall provide and submit design calculations and plans for the falsework and shoring design, signed and stamped by an Arizona professional engineer for review and approval of the Engineer.

The falsework shall be founded on solid footings that are safe against undermining during a storm event in the wash and capable of supporting loads imposed. The falsework and shoring shall be designed using working stress method of design.

The submittal shall include a detailed plan for removal saw cutting walls, deck slabs and the stabilization of the remaining beams and wall, dealing with water in the wash, and protection of the Rio de Flag Wash and adjacent structures, and disposal of materials.

Method of Measurement:

Removal of the existing concrete bridge structure and obstructions will be measured on a lump sum basis.

Basis of Payment:

The accepted quantities for the work, measured as provided above, will be paid for at the contract unit price which shall be full compensation for the item, complete in place, as defined and described above including removal of the existing bridge concrete culvert structure barrier railing, providing and removal of temporary shoring and falsework, saw cutting walls and deck slab, protection of adjacent buildings, designing and installation of falsework to support the Zani concrete beam, accommodating water flow in the wash, disposal of debris and materials, structural excavations and structure backfill, and miscellaneous related items as shown on the project plans, complete in place.

Pay Items:	**Pay Unit:**
2020034: Removal of Existing Concrete Bridge Structure	Lump Sum (LS)

SECTION 203: EARTHWORK

203-5 Structural Excavation and Structure Backfill

203-5.01 Description: of the Standard Specifications is revised to add:

The structure excavation shall include the excavation of the Rio de Flag Wash channel for the new bridge abutment walls, pier walls and the bridge wing walls, as shown on the project plans. This work shall include furnishing all equipment and labor in accordance with the details shown on the project plans and these Special Provisions. The work shall comply with the 2008 edition of the ADOT Standard Specifications for Roads and Bridges.

Construction Requirements:

The foundations for the bridge abutment walls, the pier wall, and the wing walls shall be keyed into bedrock, a minimum of 1'-0", and to bear on bedrock as shown on the project plans. The bottom foundations shown on the project plans is the estimated depth of bedrock based core borings by the geotechnical engineer that show the estimated depth to bedrock. After the foundation excavations are complete, and prior to placement of reinforcing steel, the exposed surface of rock shall be inspected and approved the the Geotechnical Engineer and the Bridge Engineer. It may be necessary to excavate the footing deeper than shown on the plans or to excavate to a more shallow depth than shown on the plans in order to bear on bedrock material.

Any voids encountered at the bottom of the concrete foundation excavation shall be filled with a sand/ cement grout mixture designed to develop a minimum 28 day compressive strength of 4000 psi with a slump of five to seven inches.

The spread footings for the bridge shall bear on bedrock in accordance with the project plans. The surface shall be relatively level using stepped footings where necessary. All weathered and fractured bedrock material shall be removed from the excavations.

The foundation excavation shall be inspected and approved by the Geotechnical Engineer and the Bridge Engineer prior to placement of reinforcing steel.

If the bedrock is found at a lower elevation than the estimate on the project plans, or if rock voids are found below the bottom of the footings, the soil shall be removed and replaced with Class S 4000 psi concrete as direction by the Engineer.

In cases where the bottom of the wall footings can be raised and are still embedded into bedrock 1'-0", and have a minimum 18 inch cover over the top of the footings, the wall heights and size of the footing can be decreased in accordance with the project plans. In all cases, if bedrock is located at elevations different than that shown on the project plans, the Contractor shall notify the Bridge Engineer so that adjustments can be made to the project plans.

Submittals:

The Contractor shall provide and submit to the Engineer for review and approval the temporary shorings and falsework needed to protect and not damage the adjacent buildings or Zani building, and shall conform to Section 610-3.02 of the ADOT Standard Specifications. The Contractor shall retain the services of an Arizona structural or civil engineer to design the shoring and falsework and prepare plans and details for this work. The Contractor shall submit those plans, details and structural calculations, stamped and signed by an Arizona professional engineer for review and approval of the Bridge Engineer prior to the start of that work.

The Contractor shall submit the bottom of footing elevations to the Bridge and Geotechnical Engineers for review and approval prior to placement of the reinforced steel. See Plan Sheet B1 for additional requirements.

203-5.02 Description: Geocomposite Materials

The geocomposite wall drains material shall conform to the following requirements of subsection 1014-1 and 1014-6. The geocomposite wall drains shall be installed on the soil side of the new abutment walls and the new wing walls as shown on the project plans.

The concrete surface of the structure against which the geocomposite drain is to be placed, shall be free of soil, debris and excessive irregularities that will prevent continuous contact between the concrete surface and the drain material. The geocomposite drain shall be installed with the single fabric surface in contact with the backfill material. When the core of the geo composite wall drain is not perforated during manufacture, perforations shall be made in the core where the wall drain will lay against a weep hole or other drainage outlet. When making these perforations, the fabric shall not be damaged in any way.

Unless otherwise specified, geocomposite wall drains shall be constructed in horizontal courses and in accordance with the details shown on the plans. To prevent infiltration of the backfill material, the geocomposite material shall be firmly secured to the face, top and sides of the wall by using adhesive or 1.5 – 2-inch long concrete nails, with approved washers or wood battens of not less than 4 square inches in area. The adhesive or alignment of the core shall not affect the drainage area or downward

flow within the core. The spacing of concrete nails shall be as directed by the Engineer, but shall not be more than 4 feet apart, both horizontally and vertically. When nails are utilized, there shall be at least 1 horizontal row of nails in each course of geocomposite.

Structural backfill operations shall be started as soon as possible after place the geocomposite material but in no case shall the geocomposite material be exposed to sunlight for more than fourteen (14) days after installation. Care shall be taken during the backfill operation not to damage the geotextile surface of the drain, and to avoid excessive settlement of the backfill material.

203-5.03 Description: Backfill Material

The structure backfill material shall conform to Section 203-5.03 (B) Backfill, of the ADOT Standard Specifications 2008 Edition and shall be compacted to 95 percent of the maximum dry density ASTM D-698, and shall conform to the following gradation (Arizona Test Method 201):

SIEVE SIZE	PERCENT PASSING
3 inch	100
¾ inch	60 – 100
No. 8	35 – 80
No. 200	0 – 12

The plasticity index shall not exceed 5 when tested in accordance with the requirement of AASHTO T90. The existing soil material at the site may be used as long as it conforms to the above gradation.

Measurement and Payment:

Structural excavation, structure backfill and geocomposite materials will be measured on a lump sum basis.

Basis of Payment:

The accepted quantities for the work, measured as provided above, will be paid for at the contract unit price which shall be full compensation for the item, complete in place, as defined and described above including structural excavation, structure backfill, geocomposite drain system, temporary shoring, falsework, and miscellaneous related items as shown on the project plans, complete in place.

Pay Items:	**Pay Unit:**
2030035: Structural Excavation and Structure Backfill	Lump Sum (LS)

ITEM 60100010: STRUCTURAL CONCRETE (F'c = 4500 psi)

ITEM 60100011: STRUCTURAL CONCRETE (F'c = 4000 psi)

The work under this section shall consist of furnishing all materials and construction structures, parts of structures and form, to the shapes and dimensions shown on the project plans, complete-in-place and in accordance with the requirements of the specifications. All work under this section shall conform to Section 601 Concrete Structures, Section 605 Steel Reinforcement and Section 1006 Portland Cement of the ADOT Standard Specifications for Road and Bridge Construction, 2008 Edition, except as herein noted in these Special Provisions and on the project plans.

Materials:

All concrete shall be ADOT Class S concrete with the following strengths:

F'c = 4000 psi @ 28 days – substructure walls and miscellaneous
F'c = 4500 psi @ 28 days – super structure bridge deck

All concrete shall be Type II Portland cement.

Reinforcing steel shall be epoxy coated and shall conform to ASTM A615 and shall be furnished as Grade 60. Reinforcing steel to be welded, where approved by the Engineer, shall conform to ASTM A706. The structural steel angles and sliding steel plate shall conform to ASTM A36 or equal, and shall be galvanized in accordance with ASTM A123.

Construction Requirements:

The concrete deck shall be cured in accordance with Section 1006-6.01 Curing Cast-in-Place of the ADOT Standard Specifications using a burlap cover with water cure for a minimum of 7 days. The finish of the bridge deck shall be in accordance with Section 601-3.05D Finishing Bridge Deck of the ADOT Standard Specifications.

The Contractor shall use Sikadur 32 Hi Mod or approved bonding agent, to bond fresh concrete to hardened concrete. The Sikadur 32 product shall be used in accordance with product manufacturer's requirements for bonding new concrete to hardened concrete.

The foundations for the bridge abutment walls, the pier wall, and the wing walls shall be keyed into bedrock, a minimum of 1'-0", and to bear on bedrock as shown on the project plans. The bottom foundations shown on the project plans is the estimated depth of bedrock based core borings by the geotechnical engineer that show the estimated depth to bedrock. After the foundation excavations are complete, and prior to placement of reinforcing steel, the exposed surface of rock shall be inspected and approved by the Geotechnical Engineer and the Bridge Engineer. It may be necessary to excavate the footing deeper than shown on the plans or to excavate to a more shallow depth than shown on the plans in order to bear on bedrock material. This additional work, or lesser work, will be negotiated for, or reduced, based on the unit price shown in the Bid Schedule.

Any voids encountered at the bottom of the concrete foundation excavation shall be filled with a sand/ cement grout mixture designed to develop a minimum 28 day compressive strength of 4000 psi with a slump of five to seven inches.

The removal of falsework and forms shall conform to Section 601-3.02(D) of the ADOT Standard Specifications and no falsework or forms shall be relieved of load and no forms shall be removed without approval of the Bridge Engineer.

The spread footings for the bridge shall bear on bedrock in accordance with the project plans. The surface shall be relatively level using stepped footings where necessary. All weathered and fractured bedrock material shall be removed from the excavations.

All foundation excavation shall be inspected and approved by the Geotechnical Engineer and the Bridge Engineer prior to placement of reinforcing steel.

If the bedrock is found at a lower elevation than the estimate on the project plans, or if rock voids are found below the bottom of the footings, the soil shall be removed and replaced with Class S 4000 psi concrete as directed by the Engineer.

In cases where the bottom of the wall footings can be raised and are still embedded into bedrock 1'-0", and have a minimum of an 18 inch cover over the top of the footings, the wall heights and size of the footing can be decreased in accordance with the project plans. In all cases, if bedrock is located at elevations different than that shown on the project plans, the Contractor shall notify the Bridge Engineer so that adjustments can be made to the project plans.

Cold Weather Concrete Requirements and Submittal:

Cold weather concreting shall comply and shall meet the requirements of Section 1006-5.03 Cold Weather Concreting of the ADOT Standard Specifications including tenting the structure and using space heaters, etc., to comply with the specifications. The Contractor shall submit a written outline of the proposed protection method submitted to the Engineer for approval prior to placement of concrete.

Submittals:

The Contractor shall submit concrete mix designs in accordance with the ADOT Standard Specifications. The Contractor shall submit shop drawings for all falsework and form designs and reinforcing steel and in accordance with Subsection 105.03 of the ADOT Standard Specifications.

The Contractor shall also submit the method of curing the concrete deck, methods for curing and forming for concrete deck for review and approval of the Bridge Engineer.

The falsework and forms shall be designed and constructed in accordance with Section 601-3.02(A) of the ADOT Standard Specifications for Road and Bridge Construction, 2008 Edition. The Contractor shall provide and submit design calculations and plans for the falsework design, using working stress method of design, signed and stamped by an Arizona professional engineer for review and approval of the Engineer.

The Contractor shall submit shop drawings and lists showing the bending of reinforcement bars, splice locations, and details, in accordance with ADOT Subsection 105.03, to the Engineer for review and approval prior to proceeding with the work. Approval of the submittal shall not relieve the Contractor of responsibility for the correctness of the shop drawings and lists.

The Contractor shall prepare shop drawings for the edge angles and sliding steel plate as shown on the project plans.

Method of Measurement:

The measurement of structural concrete shall be by the cubic yard in accordance with the dimensions shown on the project plans. No deduction will be made for the volume occupied by reinforcing steel, or other materials embedded or recessed in the concrete.

Basis of Payment:

The accepted quantities for this work, measured as provided above, will be paid for at the contract unit price per cubic yard, which shall be full compensation for furnishing all labor, materials, reinforcing steel, concrete, tools, equipment, structural excavation, structure backfill, cold weather concrete, keying wall footings into bedrock, edge angles and sliding cover plate, steel sleeves for utilities, the new concrete abutment and pier walls with footings that are used to connect the new bridge structure to the existing remaining culvert structure, and incidentals for doing all work involved in furnishing, placing, and curing concrete, design of falsework and shoring, and miscellaneous related items as shown on the project plans and complete-in-place.

Pay Items:	**Pay Unit:**
60100010: Structural Concrete (f'c = 4500 psi) Class S	Cubic Yard (CY)
60100011: Structural Concrete (f'c = 4000 psi) Class S	Cubic Yard (CY)

ITEM 6010012: CONCRETE WINGWALLS (F'c = 4000 psi)

Description:

The work under this section shall consist of furnishing all materials and construction wingwalls, parts of structures and form to the shapes and dimensions shown on the project plans, complete-in-place and in accordance with the requirements of the specifications. All work under this section shall conform to Section 601 Concrete Structures in Section 605 Steel Reinforcement and Section 1006 Portland Cement of the ADOT Standard Specifications for Road and Bridge Construction, 2008 Edition, except as herein notes in these Special Provisions and on the project plans.

Materials:

All concrete shall be ADOT Class S concrete with the following strengths:

F'c = 4000 psi @ 28 days – wingwalls

All concrete shall be Type II Portland cement.

Reinforcing steel shall be epoxy coated and shall conform to ASTM A615 and shall be furnished as Grade 60. Reinforcing steel to be welded, where approved by the Engineer, shall conform to ASTM A706.

Construction Requirements:

The concrete walls shall be cured by leaving the forms on the walls for a minimum of 7 days before removal. The walls shall have a Class II finish. The foundation for the wing walls shall bear on bedrock.

Cold Weather Concrete Requirements and Submittal:

Cold weather concreting shall comply and shall meet the requirements of Section 1006-5.03 Cold Weather Concreting of the ADOT Standard Specifications including tenting the structure and using space heaters, etc., to comply with the specifications. The Contractor shall submit a written outline of the proposed protection method submitted to the Engineer for approval prior to placement of the concrete. Concrete curing shall be by the forms in place method for a minimum of 7 days before forms are removed.

Submittals:

The Contractor shall submit concrete mix designs in accordance with the ADOT Standard Specifications. The Contractor shall submit shop drawings for all falsework form designs and reinforcing steel and in accordance with Subsection 105.03 of the ADOT Standard Specifications.

The falsework and form work shall be designed in accordance with Section 601-3.02 of the ADOT Standard Specifications for Road and Bridge Construction, 2008 Edition. The Contractor shall provide and submit design calculations and plans for the falsework design, signed and stamped by an Arizona professional engineer for review and approval of the Engineer.

The Contractor shall submit shop drawings and lists showing the bending of reinforcement bars, splice locations, and details, in accordance with ADOT Subsection 105.03, to the Engineer for review

and approval prior to proceeding with the work. Approval of the submittal shall not relieve the Contractor of responsibility for the correctness of the shop drawings and lists.

Method of Measurement:

The measurement of concrete retaining walls shall be by the square foot in accordance with the dimensions shown on the project plans from top of wall to bottom of wall times length of wall. No deduction will be made for the volume occupies by reinforcing steel or other materials embedded or recessed in the concrete.

Basis of Payment:

The accepted quantities for this work, measured as provided above, will be paid for at the concrete unit price per square foot which shall be full compensation for furnishing all labor, materials, reinforcing steel, tools, equipment, structural excavation and the structure backfill, and incidentals for doing all work involved in furnishing, placing, and curing concrete, design of falsework and forms, and transporting and erecting falsework forms, and miscellaneous related items as shown on the project plans, complete and in place.

Pay Items:	**Pay Unit:**
60100012: Concrete Wingwalls (f'c = 4000 psi)	Square Foot (SF)

ITEM 9240053: MISCELLANEOUS WORK (Epoxy Dowels)

Description:

The work under this item shall include providing epoxy coated dowels as shown on the project plans, Special Provisions, and ADOT Standard Specifications as modified herein.

Materials:

All reinforcing steel shall be ASTM A615, Grade 60, epoxy coated and ADOT approved epoxy grout into existing concrete walls or slabs.

Construction Requirements:

The Contractor shall provide and install the epoxy dowels as shown on the project plans. The Contractor shall drill holes for dowels ¼-inch larger diameter than dowels, clean holes of any dust or other contaminants, and epoxy grout dowels into existing concrete. The Contractor shall notify the Engineer as to when the work will be done so the Engineer can provide inspection of epoxy dowel installation work.

Submittals:

The Contractor shall provide shop drawings for the dowels and submit manufacturer's specifications and test performance data and procedures for installation of epoxy grout. The epoxy grout shall be selected from the ADOT Approved Product List for epoxy.

Method of Measurement:

The epoxy dowels will be measured by each dowel installed into the existing concrete.

Basis of Payment:

The accepted quantities for the epoxy dowels, as provided above, will be paid for at the contract price amount which price shall be full compensation for all work and materials described herein and as shown on the project plans. Payment shall include epoxy coated reinforced steel dowels, drilling and clean out of holes for the dowels, and epoxy grouting dowels into existing concrete as shown on the project plans, complete and in place.

Pay Item:	Pay Unit:
9240053: Miscellaneous Work (Epoxy Dowels)	Each (EA)

ITEM 9240054: MISCELLANEOUS WORK (Concrete Bridge Barrier Rail)

Description:

The work under this item shall include the construction of the concrete bridge barrier rail which shall consist of furnishing all materials and labor in accordance with the details shown on the project plans and in these Special Provisions and ADOT Standard Specifications as modified herein.

Materials:

Reinforcing steel shall conform to ASTM A615, Grade 60, and be epoxy coated. All concrete shall be Class S f'c = 4000 psi @ 28 days.

Construction Requirements:

The Contractor shall construct the reinforced concrete bridge barrier rail as shown on the project plans. The wall shall be a near replica of the barrier rail on the existing bridge with a Class II finish and to match the existing wall appearance.

Submittals:

The Contractor shall submit detailed shop drawings of the new concrete barrier wall showing reinforcing steel, and the rustication to match existing barrier rail.

Method of Measurement:

Concrete barrier rail will be measured per lineal foot.

Basis of Payment:

Payment for this item will be made at the unit price, which includes full compensation for all labor, equipment and materials needed to construct barrier as described herein including: reinforcing steel, recess rustication, concrete and miscellaneous related items as shown on the project plans and these Special Provisions, complete and in place.

Pay Item:	Pay Unit:
9240054: Concrete Bridge Barrier Rail	Lineal Foot (LF)

ITEM 9240055: MISCELLANEOUS WORK (Zani Concrete Beam Repair)

Description:

The work under this item shall include all labor and materials for the repair of the existing Zani concrete beam, including additional temporary falsework , shoring and form work for the Zani concrete beam, and the preparation of existing concrete beam, installation and providing externally bonded reinforcement concrete, protective encasement and reinforcing steel, in accordance with the

details shown on the project plans and in these Special Provisions and ADOT Standard Specifications as modified herein.

Materials:

Concrete shall be Class S, f'c = 4000 psi @ 28 days, and all reinforcing steel shall conform to ASTM A615, Grade 60, and be epoxy coated. Externally bonded FRP shall be provided by the Contractor to strengthen the Zani concrete beam.

Construction Requirements:

The Contractor shall provide additional falsework shoring as needed to support the Zani concrete beam while repairs are being made to the beam. The Contractor shall construct the new pier and abutment concrete walls that bear on bedrock material and are used to support the Zani concrete beam as shown on the project plans. The Contractor shall prepare the existing Zani concrete beam and then apply the externally bonded reinforcement (FRP) to the concrete beam. The preparation of the Zani concrete beam shall include removal of deteriorated concrete, removal of rust from the existing reinforced steel, application of concrete patch material to the beam, application of rust preventing a bonding agent, and application of externally bonded reinforcement (FRP) as recommended by the FRP structural engineer who will provide structural calculations and design for strengthening the Zani concrete beam. The Contractor shall provide protective concrete encasement around the beam and connecting the Zani concrete beam to the new walls in order to transfer the loads to the pier and abutment walls as shown on the project plans.

Some of the requirements for repair of the Zani concrete beam using the externally bonded reinforcing (FRP):

- Surface Preparation
  - ➡ Repairs to damaged and delaminated concrete by means of removal and replacement by hand patching using patching material
  - ➡ Surface preparation to the existing concrete substrate by abrasive blasting and/or dustless abrasive grinding
  - ➡ Surface preparation shall achieve a CSP 2 or 3 to ensure proper bond between surface and FRP
  - ➡ Left over dust to be removed with pneumatic air and wiped clean prior to installation
- FRP Preparation
  - ➡ Application of protective coating over top of the externally bonded reinforcement
  - ➡ Protection of externally bonded reinforcement during curing period

Submittals:

(1) The Contractor shall submit concrete patch material, reinforcing steel shop drawings, and FRP materials shop drawings.

(2) The Contractor shall submit the concrete patch materials from the ADOT Approved Material List. Externally bonded reinforcement, and structural calculations shall be stamped and signed by an Arizona professional structural engineer.

(3) Product Information and Technical Data: the Contractor shall provide technical data and product information for the externally bonded reinforcement (FRP), that it has been successfully used to

strengthen existing concrete members along with test data and test results for the material. This technical information is to be provided by a certified material testing organization including application, long term use of product, and strength and durability when subjected to temperature, etc. The Contractor shall provide documentation that ADOT has approved the use of the externally bonded reinforcement.

(4) Structural Design of Zani Beam Repair: the Contractor shall retain the services of an Arizona Structural Engineer to prepare structural calculations for the design of the existing Zani concrete beam repair. The design shall be for a two span concrete beam reinforced with externally bonded reinforcement (FRP) with the entire load on the beam being supported by the FRP as the only reinforcement. The existing steel in the Zani concrete beam nor the reinforcing steel in the concrete protective encasement shall not be used in the strengthening of the Zani concrete beam. The Contractor shall provide structural calculations in determining the load capacity with loads which include 12" masonry wall, roof and floor liveloads from the Zani building, concrete beam loads and existing concrete channel slab. The Contractor shall submit structural calculations and structural details to the Bridge Engineer of Record for review and approval. All structural calculations shall be performed using the allowable stress design method.

(5) The Contractor shall provide the following information for the externally bonded reinforcement (FRP):

(a) Product Evaluation Report
(b) required inspection schedule
(c) a list of certified inspectors for the product

Method of Measurement:

The Miscellaneous Work (Zani Concrete Beam Repair) shall be measured as a lump sum.

Basis of Payment:

The accepted quantities for miscellaneous work, as provided above, will be paid for at the contract lump sum amount which includes additional temporary falsework and shoring to support the Zani concrete beam during construction, as needed, removal of deteriorated concrete from the Zani concrete beam, removal of rust from existing reinforcing steel, surface preparation of concrete beam, providing and installation of the externally bonded reinforcement (FRP), supported by the new pier and abutment walls, reinforcing steel, concrete protective encasement for Zani concrete beam, structural calculations for a two span concrete beam, and details for externally bonded reinforcement (FRP) for the Zani concrete beam, and miscellaneous related items, complete and in place as specified in these Special Provisions, complete in place.

Pay Item:	**Pay Unit:**
9240055: Zani Concrete Beam Repair	Lump Sum (LS)

APPENDIX B

Geotechnical Report Addendum No. 1, dated 8-8-18, and

Geotechnical Report, dated 9-8-17

August 8, 2018

Douglas Slover
City of Flagstaff
211 W. Aspen Ave.
Flagstaff, AZ 86001

RE: Project No.: 171323SF
Phoenix Avenue Box Culvert
107 W Phoenix Avenue
Flagstaff, AZ
Addendum No. 1

Dear Mr. Slover:

At the request of structural engineer Jerry Cannon, P.E., Speedie & Associates has revisited the idea of the box culvert being supported on the underlying soils as opposed to the underlying basalt bedrock. Clarification has been requested regarding the statement in the original geotechnical investigation report that "subsoils at the site are not suitable for support of the proposed structure".

Initial concerns placing the foundations on the underlying soils were related to scour and the potential for the soils to become saturated. Based on the relatively shallow depth to bedrock, it was our opinion that extending the excavations a few feet to bear on a very stable medium, out-weighed the risk of placing foundations on soil that could be subject to inundation and/or scour. It is our understanding that there are concerns regarding extending the foundation excavations to bear on the underlying basalt could compromise the foundations of adjacent structures. Mr. Cannon has proposed that the foundations would bear at an elevation of approximately 6891 and that there would be a concrete cutoff wall in front of the structure foundations. The cut-off wall would extend to a depth of 6 feet below the bottom of the channel (elevation 6888.5). This footing bottom elevation roughly corresponds to a depth of 9 feet on our boring logs since the borings were conducted on the roadway surface. Although placing a cutoff wall 6 feet deep at the leading edge of the box culvert results in excavations that could encounter the underlying basalt, it reduces the foundation excavations necessary adjacent to the structures to a depth of only 30 inches. At that elevation, the SPT values were greater than 50 blows per foot and drilling and was described as 'hard'. The boring logs are attached to this addendum and have been revised to include surface elevations of the boring locations that were not made available at the time of the report. A revision to the strata encountered at 7.5 feet and 8.0 feet for Borings B-1 and B-2 respectively has also been made.

Although bearing on the underlying basalt provides superior support of the structure when compared to the underlying soil, we also understand the concern of compromising the adjacent structure(s). Based on this

Information, it would be acceptable to raise the foundations to bear on the dense/hard underlying soils at the proposed footing bottom elevation provided that the foundation supporting soils remain unsaturated.

The structure may be founded on shallow spread footings bearing on undisturbed native soil at a minimum depth of 30 inches below finished exterior grade. A recommended allowable bearing capacity of 4,000 psf can be utilized for design. This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. The cut-off wall should be installed prior to the foundations and positive drainage away from the foundations must be maintained at all times during construction. If competent bedrock is encountered during excavation of the foundations or cut-off wall, this office should be contacted for revised recommendations that may result in a depth reduction and include pinning to the rock surface.

Estimated settlements under design loads are on the order of ½ to ¾ inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

It should be noted that two different bearing media, basalt bedrock and soil, maybe encountered at foundation elevation. This may result in differential settlement. Bearing on two different strata may result in differential settlement in excess of 1½ inches if the native supporting soils become saturated as the bedrock will not experience any significant settlement under the design loads. If differential settlement of this magnitude cannot be tolerated, then the foundations should bear on one media, i.e. bedrock OR undisturbed native soil. This may result in deepening some of the foundation elements to encounter rock.

We recommend that a representative of Speedie & Associates observe the foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this addendum. All recommendations contained in the original report are still valid. This addendum should be attached to the original geotechnical investigation report and made a part thereof.

Please give us a call if you have any questions or if we can be of further assistance.

Respectfully submitted,
SPEEDIE & ASSOCIATES

Registered Geologist
CERTIFICATE NO
50535
CLAY WARD SPENCER
Date Signed 8/8/18
ARIZONA U.S.A.
Expires 03/31/19

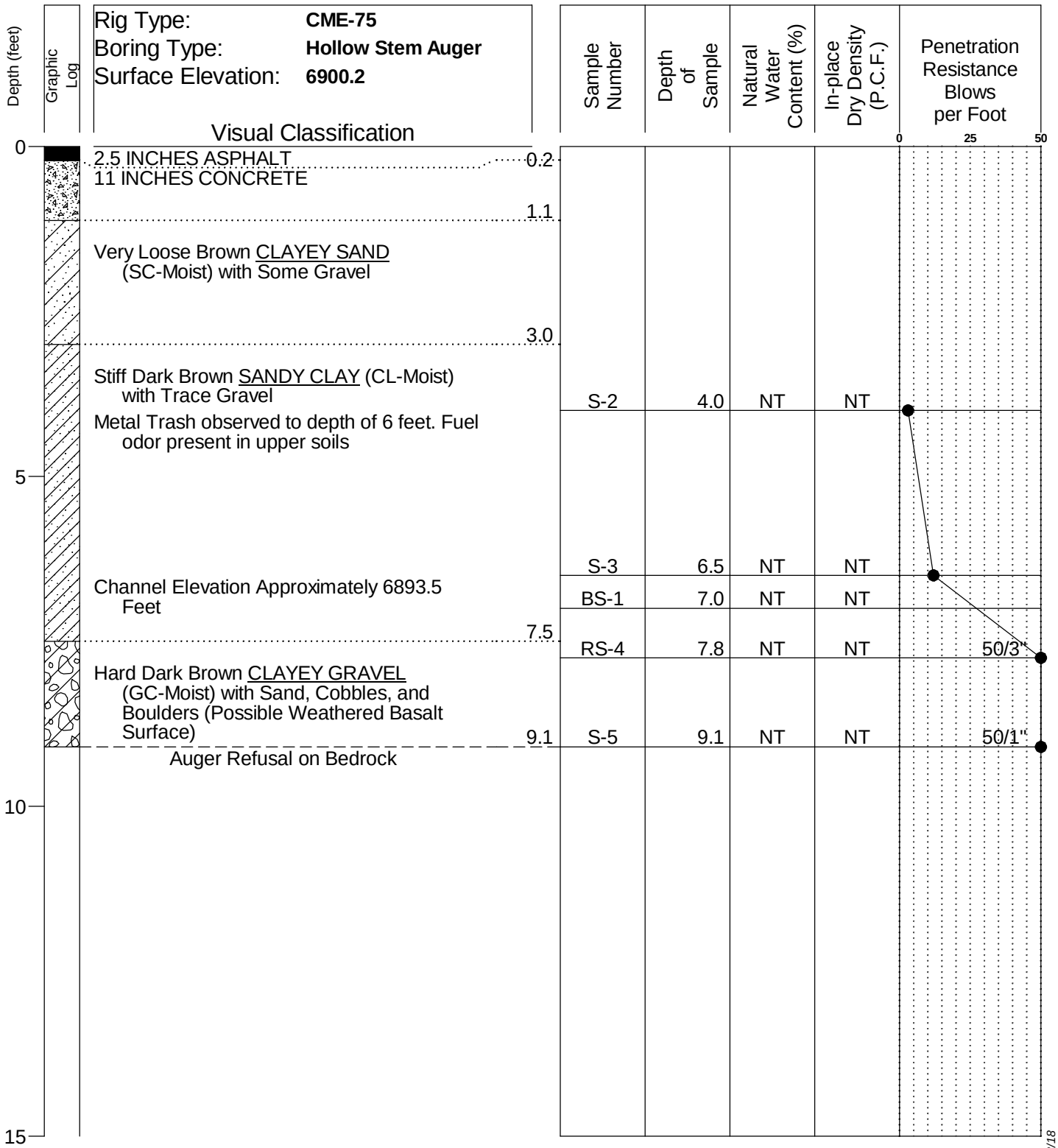
Clay W. Spencer, R.G.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
14388
GREGG ALAN CREASER
Date Signed 8/8/18
ARIZONA, U.S.A.
Expires 06/30/20

Gregg A. Creaser, P.E.

Attachments: Revised Boring Logs

Cc: The WLB Group, Inc. – Brian Joerger, P.E.
Cannon Consultants, LLC – Jerry Cannon, P.E. -



Boring Date: **7-26-17**
Field Engineer/Technician: **J. DeGeyter**
Driller: **B. Anderson**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 1**

Phoenix Avenue Box Culvert

107 W. Phoenix Avenue

Flagstaff, Arizona

Project No.: **171323SF**

_SPEEDIE 171323SF.GPJ GENGEO.GDT 8/8/18

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **6900.4**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	4 INCHES ASPHALT					
	0.3					
	Very Stiff Brown CLAYEY SAND (SC-Moist) with Little Gravel	S-2	4.0	NT	NT	
5	5.0					
	Stiff Dark Brown SANDY LEAN CLAY (CL-Moist) with Scattered Cobbles	RS-3	6.0	NT	NT	
	Channel Elevation Approximately 6893.5 Feet	BS-1	7.0	NT	NT	
		BS-4	7.5	NT	NT	
	8.0					
	Hard Dark Brown CLAYEY GRAVEL (GC-Moist) with Sand, Cobbles, and Boulders (Possible Weathered Basalt Surface)	RS-5	8.5	35.5	87.4	
10		RS-6	11.0	NT	NT	50/12"
		AS-7	12.5	NT	NT	
	14.0	S-8	14.0	NT	NT	50/12"
	Auger Refusal on Bedrock	S-9	14.2	NT	NT	50/2"
15						

Boring Date: **7-26-17**
Field Engineer/Technician: **G. Chott**
Driller: **B. Anderson**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 2**

Phoenix Avenue Box Culvert

107 W. Phoenix Avenue

Flagstaff, Arizona

Project No.: **171323SF**

_SPEEDIE 171323SF.GPJ GENGEO.GDT 8/8/18

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

www.speedie.net

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Phoenix Avenue Box Culvert Replacement

LOCATION: 107 W. Phoenix Avenue
Flagstaff, AZ

CLIENT: City of Flagstaff

PROJECT NO: 171323SF

DATE: September 8, 2017

3331 East Wood Street ▪ Phoenix, AZ 85040 ▪ Phone (602) 997-6391 ▪ Fax (602) 943-5508
4025 East Huntington Drive, Suite 140 ▪ Flagstaff, AZ 86004 ▪ Phone (928) 526-6681 ▪ Fax (928) 526-6685
3125 E. 47th Street ▪ Tucson, AZ 85713 ▪ Phone (520) 514-9411 ▪ Fax (520) 514-9474

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 GENERAL SITE AND SOIL CONDITIONS 1

2.1 Site Conditions 1
2.2 General Subsurface Conditions 1

3.0 ANALYSIS AND RECOMMENDATIONS 2

3.1 Analysis 2
3.2 Site Preparation 3
3.3 Foundation Design 3
3.4 Seismic Design Parameters 5
3.5 Lateral Pressures 5
3.6 Fill and Backfill 6
3.7 Utilities Installation 8
3.8 Permanent Cut/Fill Slope Limitations 8

4.0 GENERAL 9

APPENDIX – Field and Laboratory Data

1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of proposed box culvert/bridge replacement at the Phoenix Avenue crossing of the Rio De Flag channel, in Flagstaff, Arizona.

Preliminary information indicates that construction will consist of replacement of the existing box culvert and associated infrastructure on Phoenix Avenue. Adjacent pavement is expected to be reconstructed. Anticipated traffic volumes and types of vehicles are unknown at this time, but are assumed to consist of moderate volumes of passenger vehicles, buses, and light duty trucks. No structural loading or proposed designs for the new box culvert/bridge were available at the time of this investigation.

If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented hereafter are to apply.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The existing box culvert is located at 107 W. Phoenix Avenue. The box culvert is currently comprised of three structures: Bridge 1, Bridge 2, and "The Beam". Bridge 1 is currently used to support vehicular and pedestrian traffic and is located to the north side of Phoenix Avenue. Bridge 2 is directly adjacent on the south side and currently supports only pedestrian traffic as vehicular traffic has been barricaded to keep away from the severely deteriorated Beam that supports a structure currently housing the "Zani" retail store at the southern extent of the project. Current bearing conditions for the existing structures are unknown. The channel had standing water at the time of the investigation. Phoenix Avenue services primarily commercial/retail properties and is a bus route, located near the City of Flagstaff Downtown Bus Connection Center. Water, sanitary sewer, overhead electric, communications, and natural gas utilities run across or near the existing box culvert. The site is relatively flat and drainage is to the south and to the sides of the box culvert.

2.2 General Subsurface Conditions

The existing asphalt section ranges from 2.5 to 4.0 inches in thickness with no observed aggregate base below. The asphalt concrete at Boring B-1 was underlain by 11 inches of Portland Cement Concrete Pavement (PCCP). The asphalt in the area of the box culvert was observed to be in poor condition, with alligator and advanced block cracking throughout. The upper subgrade soils typically consist of Sandy Lean Clay/Clayey Sand, with subordinate amounts of gravel. Refusal on basalt bedrock was encountered in

Borings B-1 and B-2 at 9.1 and 14.0 feet, respectively. Occasional cobbles were observed in the soil profile. Standard Penetration Resistance Tests (SPT) values range from 3 to greater than 50 blows per foot (bpf) in the upper soils. The high blow counts occurred while driving samples through cobble layers and may not be representative of the surrounding soils. Based on visual and tactile observation, the upper soils were generally in a moist state at the time of investigation, typically above or near the plastic limit of the soil. The sample location labeled "CREEK", was located at the entrance to the eastern box culvert. The CREEK sample was obtained at the surface of the channel using a shovel. The current streambed at the box culvert was armored with a well graded gravel with silt and sand.

Laboratory testing indicates liquid limits ranging from 26 to 42 percent with plasticity indices ranging from non-plastic to 20 percent. Percent passing the #200 sieve ranged from 6 to 50 percent. It should be noted that the soil sample, BS-1, from boring B-1 exhibited a smell of fuel and during laboratory testing "oil" was observed in the sample. The odor was present in the soil samples and most notable at depths of 1 to 5 feet. Environmental analysis was not part of the scope of this investigation. Several miscellaneous metal trash pieces were encountered in Boring B-1 to depths of 6 feet.

While groundwater was not encountered at the time of our investigation it should be expected that excavations in the Rio De Flag drainage channel are likely to encounter seasonal groundwater. Measures will likely be needed to remove water from footing excavations during construction. Groundwater levels will depend on weather conditions preceding and during construction.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that **subsoils at the site are not suitable** for support of the proposed structure. Footings for the new box culvert/bridge should be extended in depth to the basalt bedrock underlying the existing subsoils. Additional rock investigation is recommended in accordance with AASHTO Bridge Design requirements ahead of foundation construction to establish final bearing elevations and to verify that adequate rock conditions are present within the zone of influence of the foundation element. Based on local experience at nearby sites, rock conditions in the area are highly variable and it is recommended that a minimum of 15 feet of rock coring be obtained to verify that adequate bearing conditions exist.

Gradation curves for the existing subsoils and current channel armor are presented in this report appendix for scour design analysis. However current foundation recommendations are to extend footings to rock, which would preclude the need for scour analysis of the existing soils.

As mentioned above, the soil sample, BS-1, from boring B-1 exhibited a smell of fuel and during laboratory testing "oil" was observed in the sample. The odor was present in the soil samples and most notable at depths of 1 to 5 feet. Environmental analysis was not part of the scope of this investigation. Several miscellaneous metal trash pieces were encountered in Boring B-1 to depths of 6 feet.

3.2 Site Preparation

The area for the new box culvert/bridge will require the complete removal of the existing structure, including adjacent asphalt surfaces and any aggregate base. Millings and aggregate base from the existing pavement may be reused in a subbase layer and as general fill if they meet the general intent of MAG/City of Flagstaff Standard Specifications and are selectively stockpiled. Subsoils should be excavated to expose the basalt bearing layer. Depending on the season of construction, groundwater and water in the drainage channel may be present and will require groundwater removal techniques during construction. Shoring and special construction considerations may be required during excavations.

Prior to placing structural backfill around the bridge structure, the grade should be scarified to a depth of 8 inches, moisture conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be treated in a similar manner. Bedrock does not require scarification.

3.3 Foundation Design

If site preparation is carried out as set forth herein, the following recommended safe allowable bearing capacity can be utilized for design:

Table 3.3.1: Foundation Bearing Capacity

Structure	Foundation Type	Bearing Medium	Bearing Depth[1] (feet)	Allowable Bearing Capacity (ksf)
Box Culvert, Abutments	Spread Footings	Undisturbed, clean Basalt Bedrock	2.5	10[2, 3]

Notes:

1. Bearing depth refers to the minimum depth below the lowest finished exterior grade within 5 feet of the structure.
2. Presumptive bearing resistance (capacity) value based on AASHTO LRFD Bridge Design Specifications Table C10.6.2.6.1-1
3. **Additional rock investigation is recommended in accordance with AASHTO Bridge Design requirements ahead of foundation construction to establish final bearing elevation and to verify that adequate rock conditions are present within the zone of influence of the foundation element. A minimum of 15 feet of rock should be cored to verify rock conditions.**

This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. They may be increased one-third for wind, seismic or other loads of short duration. All excavations should be level and cleaned of all loose or disturbed materials prior to concrete or precast placement.

Continuous wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure.

Estimated settlements under design loads are on the order of negligible to ½ inch for structures bearing on basalt bedrock, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. Reinforcement and control joints are suggested to allow slight movement and prevent minor slab cracking.

3.4 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low to moderate historical seismicity. The USGS database shows that there is a 25-30% chance of a major earthquake, magnitude greater than 5.0, within 50km of Flagstaff, AZ within the next 50 years. The largest recorded earthquake within 50km of Flagstaff, AZ was a 4.7 magnitude in 2014. The most recent earthquake within 30 miles of Flagstaff, AZ was a 2.7 Magnitude in April, 2017. Liquefaction is not considered a concern due to the shallow depth to bedrock.

Although soil borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the soil borings and geology in the area, Site Class Definition, Class B (Section 1613, 2012 IBC) may be used for design of the structures bearing on rock. In addition, the following seismic parameters may be used for design (based on 2008 USGS maps adopted by 2012 IBC):

Table 3.4.1 Seismic Parameters

MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.358g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.103g
Site coefficient, Fa:	1.0
Site coefficient, Fv:	1.0
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.358g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.103g
5% Damped spectral response acceleration, S_{DS}:	0.239g
5% Damped spectral response acceleration, S_{D1}:	0.068g
NOTES: 1. MCE = maximum considered earthquake	

3.5 Lateral Pressures

The following ultimate lateral (equivalent fluid) pressure values may be utilized for the proposed construction assuming drained conditions. Increase to full saturated values for wall backfill that is not drained.

Active Pressures (wall allowed to rotate 0.2% of wall height for loose backfill)

Unrestrained Walls (Free Draining)	35 pcf
Unrestrained Walls (**Saturated Condition**)	75 pcf

At-Rest Pressures	
Restrained Walls (Free Draining)	60 pcf
Restrained Walls (**Saturated Condition**)	85 pcf
Passive Pressures	
Continuous Footings	200 pcf
Spread Footings or Drilled Piers	250 pcf
Coefficient of Friction *(With Passive Pressure)*	0.35
Coefficient of Friction *(Without Passive Pressure)*	0.45
Coefficient of Friction *(Clean Basalt Bedrock/Cobbles)*	0.65

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive native soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

3.6 Fill and Backfill

Native soils, old aggregate base, and milled asphalt are suitable for use in roadway subgrade and utility trench backfill. In situ moisture contents may make the native soils difficult to work with if the moisture contents encountered are elevated. Oversized material (> 3 inches) should be removed or reduced in size.

Imported fill, if required, shall meet the following requirements:

Table 3.6.1 – Import Specifications

Specification	Common
Passing 3″/75mm	100%
Passing #200/.075mm	≤60%
Liquid Limit	<30%
Plasticity Index	<10%
Swell[1]	<1.5

Notes:
1. Swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Imported common fill for use in site grading should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material.

Although "clean" cinders often times meet these fill specifications for placement of common fill, they may pose difficulties during construction. Due to their granular nature and lack of sufficient fines, "clean" cinders are a free draining material. As a result, they may be difficult to properly moisture condition and water may infiltrate the cinders and saturate the underlying soils. This could result in an unstable support for pavement. Excess water, as a result of moisture conditioning, is often observed at the interface between the fill and underlying less permeable material. "Clean" cinders also pose difficulties in trenching operations due to the inability to excavate neat trenches. With the lack of fines and cohesive soils, the clean cinders generally slough and vertical walls are hard to maintain.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Granular fill (ASTM Classification GW, GP, SW, SP) can be placed on the dry side of optimum at the discretion of the geotechnical engineer on record. The clayey soils may be sensitive to excessive moisture content and may become unstable at elevated moisture contents. Accordingly, it may be necessary to compact soils on the dry side of optimum. The reduced moisture content under pavements should only be used upon approval of the engineer in the field.

Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 as set forth below. **Frozen material shall not be placed, nor shall fill be placed upon frozen grade.**

A.	Bridge/Sidewalk Subgrade or Fill	95
B.	Pavement Subgrade or Fill	95
C.	Utility Trench Backfill	
	1. More than 2.0' below finish subgrade	95
	2. Within 2.0' of finish subgrade (non-granular)	95
	3. Within 2.0' of finish subgrade (granular)	100
D.	Aggregate Base Course	
	1. Below concrete slabs	95
	2. Below asphalt paving	100
E.	Landscape Areas	
	1. Miscellaneous fill	90
	2. Utility trench - more than 1.0' below finish grade	85
	3. Utility trench - within 1.0' of finish grade	90

3.7 Utilities Installation

In general, trench excavations for utilities should be able to be accomplished by conventional trenching equipment except where there is concrete pavement. Only occasional cobbles were encountered in the borings at varying depths. Although not encountered in our borings, it is possible that shallow bedrock, large boulders, or concentrated cobble layers may be present at other locations. Deeper trenches will likely encounter groundwater. Due to soft wet soils, trench walls may not stand near-vertically for the short periods of time required to install utilities. Trench walls may experience some premature sloughing due to the relatively low density and moist condition. As the trench walls dry out, additional sloughing should be anticipated. Appropriate lay back or shoring of the trenches should be provided to protect workers entering the trenches. Depending upon the time of season and precipitation, surface flows due to runoff may impact construction.

Backfill of trenches above the bedding/shading zone may be carried out with native excavated material provided material greater than 8 inches is broken down or removed. Material up to 8 inches is allowed provided it does not impact the ability to properly compact the backfill lifts. Removing 3 to 8 inch material may make proper compaction more readily attainable. Material used for backfill of trenches should be moisture-conditioned, placed in 8 inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill and Backfill" section of this report.

3.8 Permanent Cut/Fill Slope Limitations

Care should be taken during excavation not to endanger nearby existing structures, roadways, utilities, etc. Depending on proximity, existing structures (including utilities) may require shoring, bracing or underpinning to provide structural stability and protect personnel working in the excavation.

Generally, permanent cut or fill slopes should be no steeper than 2 horizontal to 1 vertical (2:1). Where particular conditions make it appropriate to vary from these slopes, these must be addressed on a case by case basis, either in this report or at special request directed to a representative of this office. Steeper cut slopes in stable rock may be possible (depending on geology), but are not very likely in soils. Determination of acceptable steeper slope ratios is predicated on a stability analysis of the specific geometry, determinations of soil and groundwater characteristics, structure setbacks, surcharge loads and slope stabilization.

In accordance with Building Code requirements, all occupied structures should be set back from the crest (top edge) of the slope such that the outer edge of the nearest foundation is no closer than a distance equal to at least one third (⅓) of the total height of the slope. See specific building code requirements for additional detail and/or placement of structures at the bottom (toe) of slopes.

Where fills are made on hillsides or slopes, the slope of the original ground upon which the fill is to be placed shall be plowed or scarified deeply or where the slope ratio of the original ground is steeper than 5 horizontal to 1 vertical (5:1), the bank shall be stepped or benched to remove all loose soils and to provide a level surface for placement of fill. Ground slopes which are flatter than 5 to 1 may require benching when considered necessary by a representative of this office. The benches should be cut wide enough to remove loose surface soils and allow proper compaction of fills. A minimum bench width of 8 feet is typically recommended for the first lift (toe) of any fill placed on a slope. This width may be reduced at the direction of the field engineer depending on the presence of loose soils, slope steepness, exposed rock and lift thickness. A keyway shall also be constructed at the toe of the slope. The key width shall be ½ times the height of the slope or at least 1½ times the width of the compaction equipment. The key bottom shall be sloped 2% toward the slope. The key shall be excavated into dense soil or rock formation to a minimum depth of 18 inches unless approved otherwise by the engineer.

Placement and obtaining compaction of fill adjacent to fill slopes may be very difficult. Depending on soil type and final slope configuration, it may be necessary to over-build the slope and cut back to the final configuration to obtain the required degree of compaction.

4.0 GENERAL

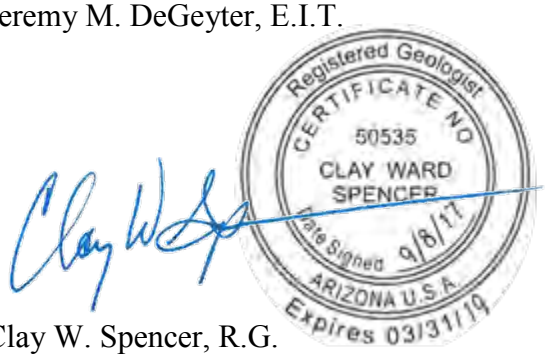
The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and grading portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Jeremy M. DeGeyter, E.I.T.



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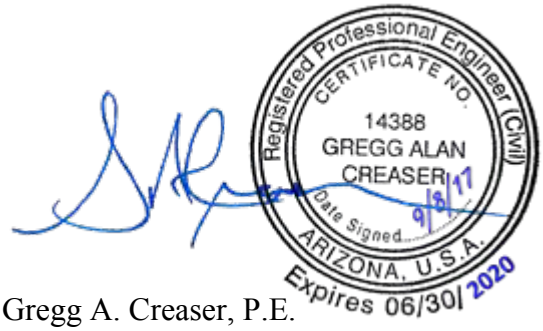


Gregg A. Creaser, P.E.

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

HYDROMETER GRADATION RESULTS

STREAMBED GRADATION CURVE

CONSOLIDATION TESTS

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

SPEEDIE AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

FIELD AND LABORATORY INVESTIGATION

On July 26th, 2017, two structural soil borings were excavated at the approximate locations shown on the attached Soil Boring Location Plan. An additional sample of the streambed material was obtained, by hand, at the northern entrance of the box culvert. All exploration work was carried out under the full-time supervision of our staff engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The borings were excavated with CME-75 drill rig utilizing 7-inch diameter hollow stem augers. Detailed information regarding the soil borings and samples obtained can be found on an individual Log of Test Boring prepared for each location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution, and plasticity (Atterberg Limits) tests for classification and bridge abutment scour design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring samples in order to estimate settlements and determine effects of inundation. All field and laboratory data are presented in this appendix.

⊕ – APPROXIMATE SOIL BORING LOCATIONS

Drawing Courtesy of Google

SOIL BORING LOCATION PLAN

DR:JMD	CHK:CWS	REV:	DATE: 08-31-17	PROJECT NO. 171323SF

Phoenix Ave Box Culvert
107 W Phoenix Ave.
Flagstaff, Arizona

SPEEDIE AND ASSOCIATES
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS
4025 E. HUNTINGTON, SUITE 140 FLAGSTAFF, ARIZONA 86004

TMPLT_2000.CAD 10/23/00

SOIL LEGEND

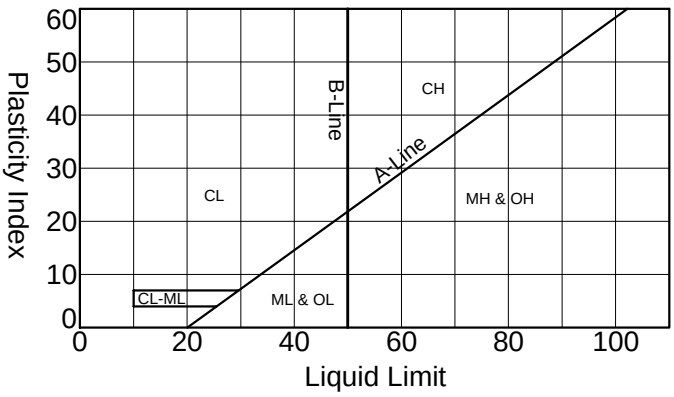
SAMPLE DESIGNATION		DESCRIPTION	
	AS	**Auger Sample**	A grab sample taken directly from auger flights.
	BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
	S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
	RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
	LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
	ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
	--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

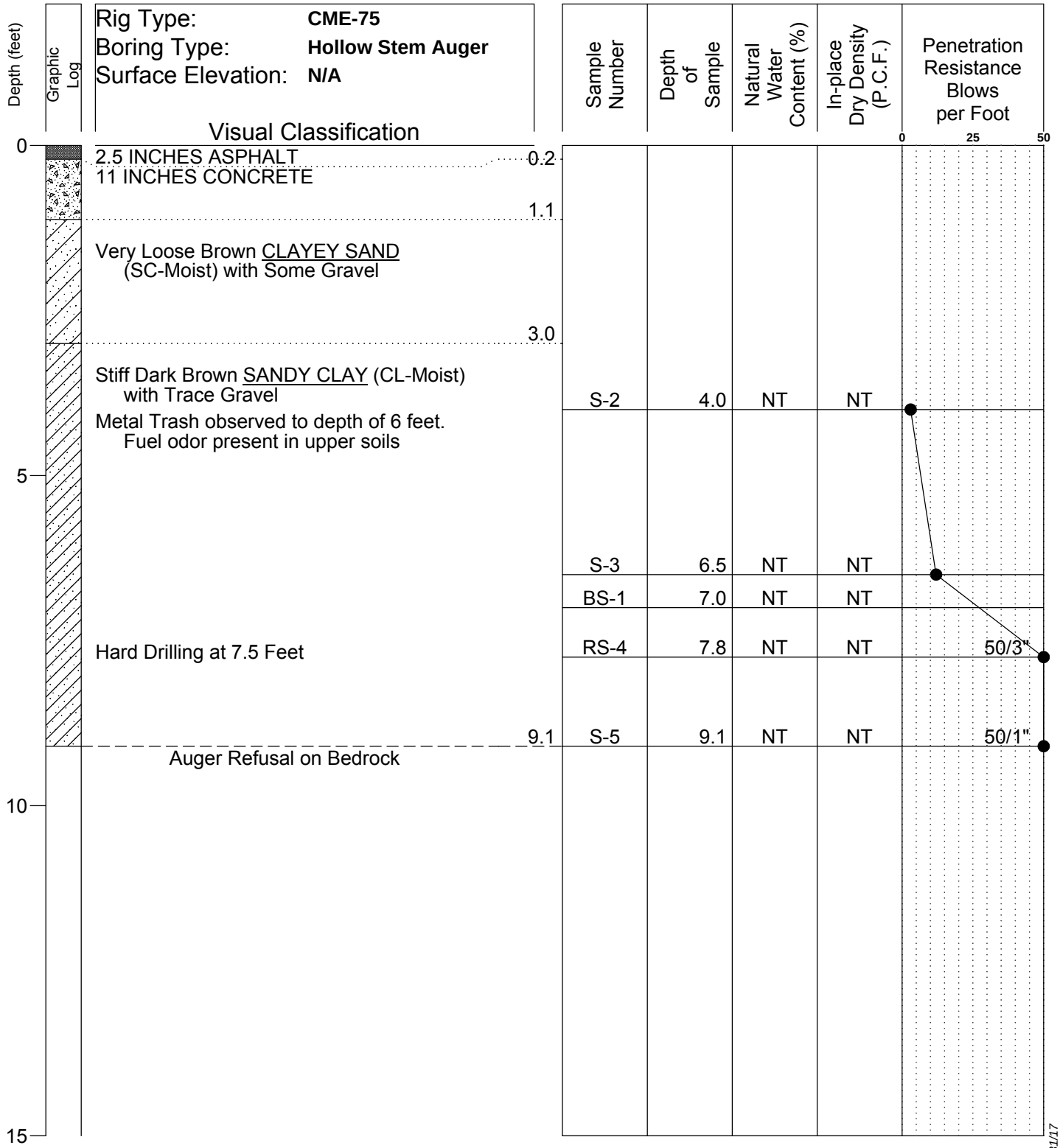
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×
◆U.S. Standard		×Clear Square Openings		





Boring Date: **7-26-17**
Field Engineer/Technician: **J. DeGeyter**
Driller: **B. Anderson**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 1**

Phoenix Avenue Box Culvert

107 W. Phoenix Avenue

Flagstaff, Arizona

Project No.: **171323SF**

_SPEEDIE 171323SF.GPJ GENGEO.GDT 8/31/17

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	4 INCHES ASPHALT					
0.3	Very Stiff Brown CLAYEY SAND (SC-Moist) with Little Gravel					
		S-2	4.0	NT	NT	
5.0	Stiff Dark Brown SANDY LEAN CLAY (CL-Moist) with Scattered Cobbles					
5		RS-3	6.0	NT	NT	
		BS-1	7.0	NT	NT	
		BS-4	7.5	NT	NT	
	Hard Drilling at 8 Feet					
		RS-5	8.5	35.5	87.4	
10		RS-6	11.0	NT	NT	50/12"
		AS-7	12.5	NT	NT	
14.0	Auger Refusal on Bedrock	S-8	14.0	NT	NT	50/12"
		S-9	14.2	NT	NT	50/2"
15						

Boring Date: **7-26-17**
Field Engineer/Technician: **G. Chott**
Driller: **B. Anderson**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 2**

Phoenix Avenue Box Culvert

107 W. Phoenix Avenue

Flagstaff, Arizona

Project No.: **171323SF**

_SPEEDIE 171323SF.GPJ GENGEO.GDT 8/30/17

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B- 1	BS-1	BULK	1.0 - 7.0	NT	NT	34.7	54	70	83	100	26	13	13	SC	CLAYEY SAND with GRAVEL
B- 2	BS-4	BULK	5.5 - 7.5	NT	NT	50.4	68	85	93	100	34	16	18	CL	SANDY LEAN CLAY
B- 2	RS-5	RING	7.5 - 8.5	35.5	87.4	15.5	22	33	43	100	42	22	20	GC	CLAYEY GRAVEL with SAND
CREEK	BS-1	BULK	0.0 - 1.0	NT	NT	6.1	12	22	40	100	NP	NP	NP	GW-GM	WELL-GRADED GRAVEL with SILT and SAND

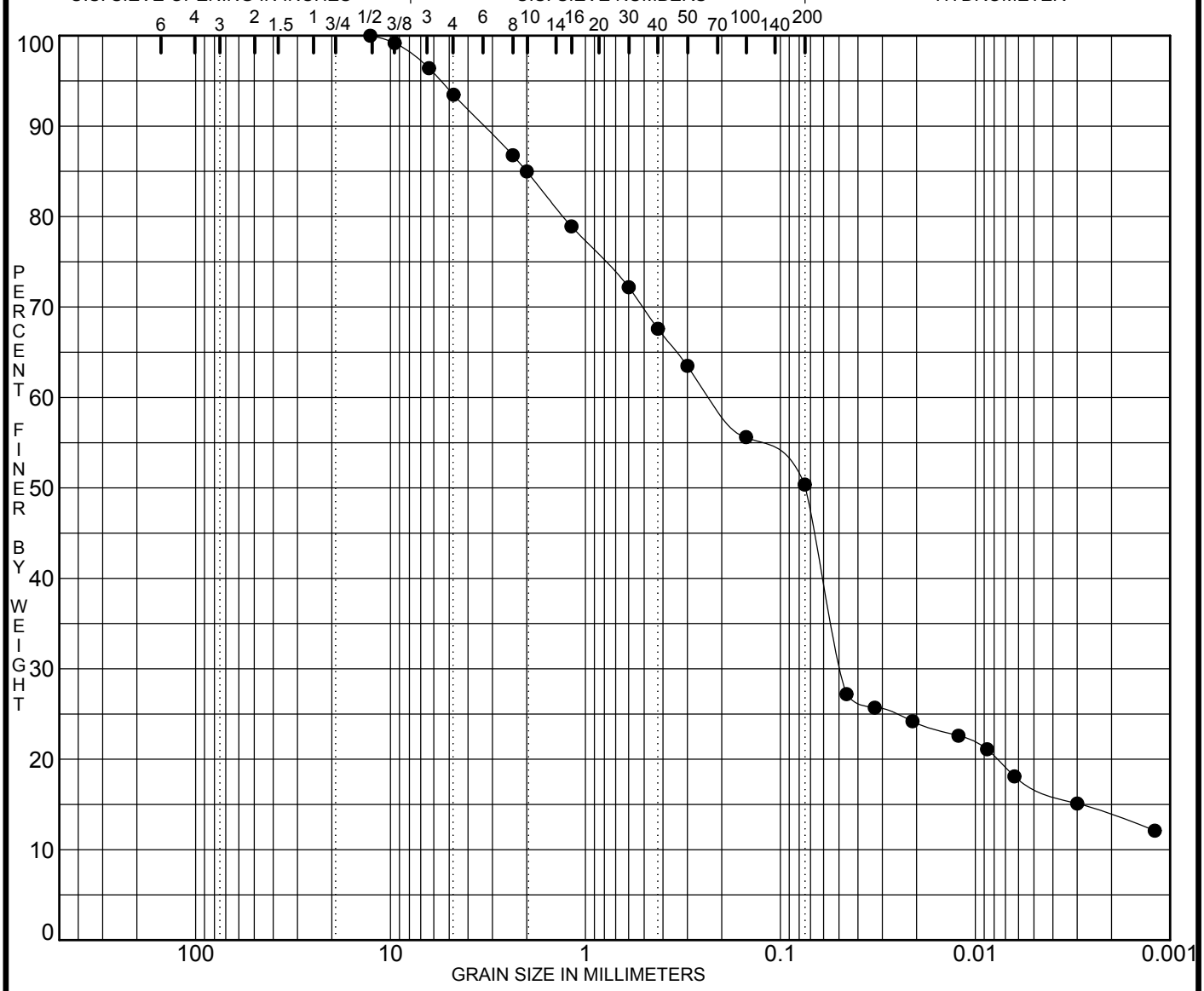
Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Phoenix Avenue Box Culvert
107 W. Phoenix Avenue
Flagstaff, Arizona
Project No. 171323SF

SPEEDIE AND ASSOCIATES

TABULATION OF TEST DATA 171323SF.GPJ GENGEO.GDT 8/30/17



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**B- 2**	**5.5**	**SANDY LEAN CLAY CL**		**34**	**16**	**19**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B- 2**	**5.5**	**12.70**	**0.22**	**0.049**		**6.5**	**43.1**	**33.2**	**17.2**

PROJECT **Phoenix Avenue Box Culvert - 107 W. Phoenix Avenue**

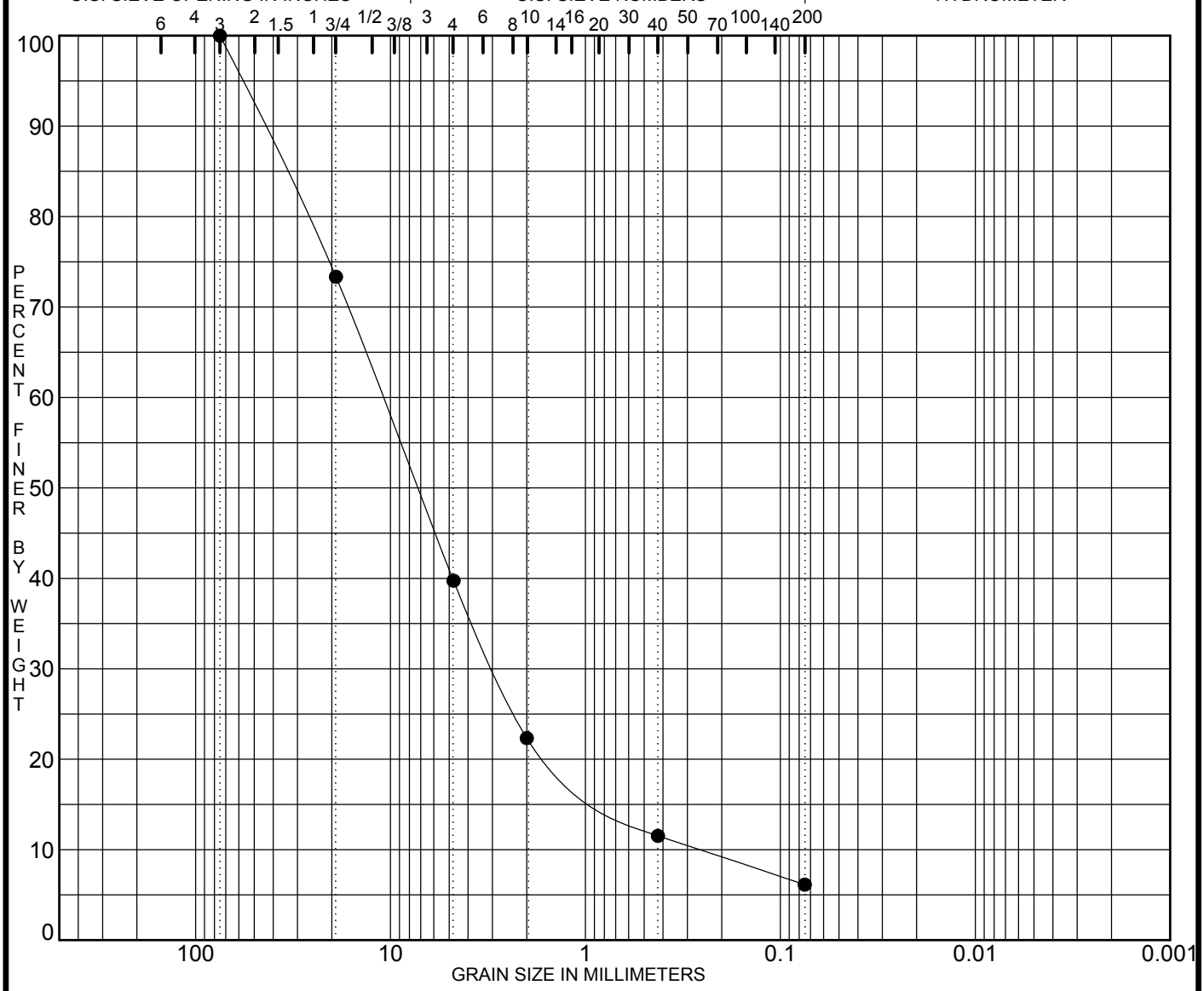
JOB NO. **171323SF**

DATE **7/26/17**

GRADATION CURVES

SPEEDIE AND ASSOCIATES

{GRSZLSZ 171323SF.GPJ 8/30/17}



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**CREEK 0.0**	**WELL-GRADED GRAVEL with SILT and SAND GW-GM**		**NP**	**NP**	**NP**	**3.00**	**42.2**

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**CREEK 0.0**	**75.00**	**10.98**	**2.928**	**0.2603**	**60.3**	**33.6**	**6.1**	

PROJECT **Phoenix Avenue Box Culvert - 107 W. Phoenix Avenue**

JOB NO. **171323SF**

DATE **7/26/17**

GRADATION CURVES

SPEEDIE AND ASSOCIATES

{GRSZLSZ 171323SF.GPJ 8/30/17}

CONSOLIDATION TEST

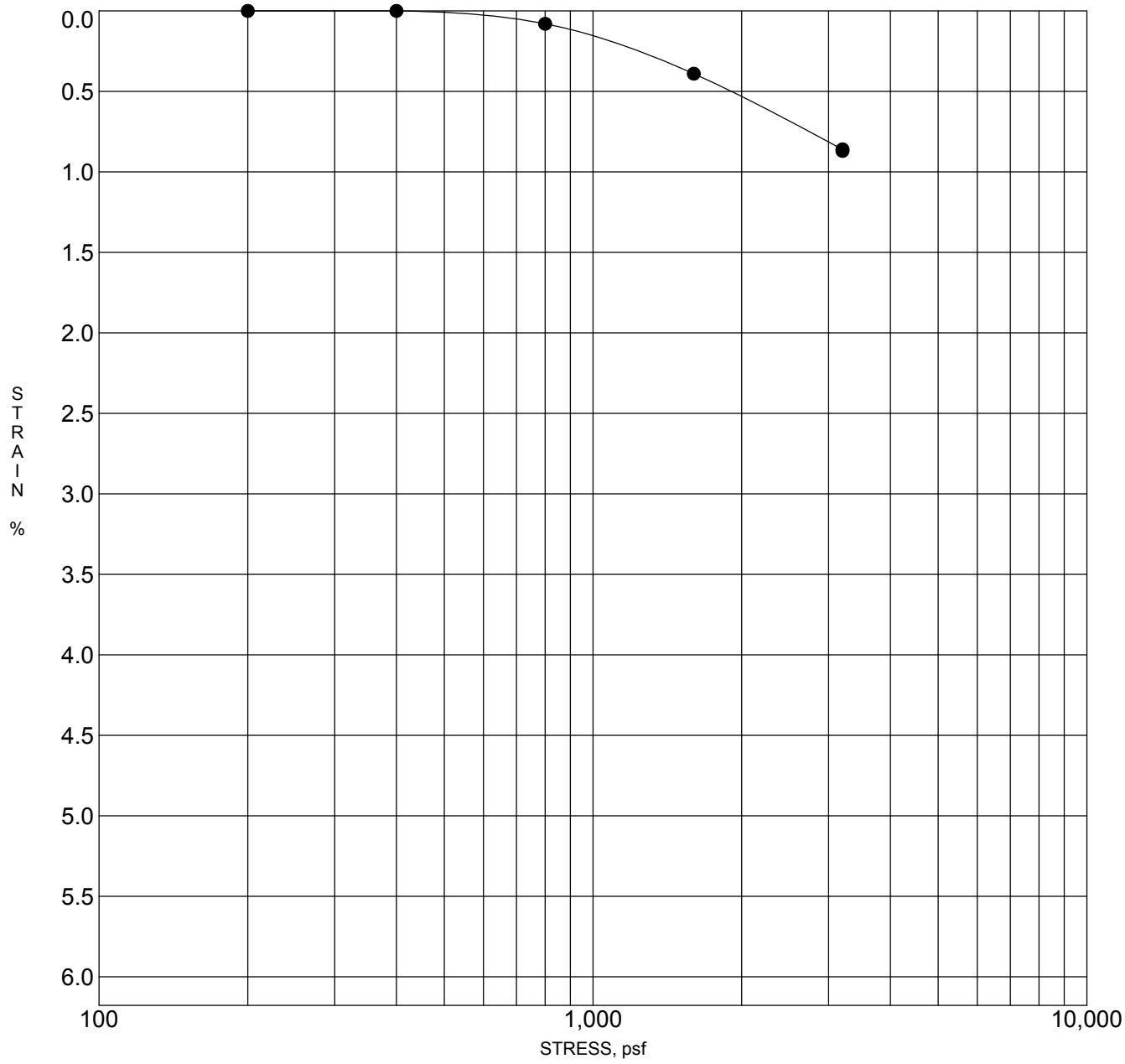
PROJECT: Phoenix Avenue Box Culvert **PROJECT NO.:** 171323SF

LOCATION: 107 W. Phoenix Avenue **DATE:** 7/26/17

BORING NO.: B- 2 **SAMPLE NO.:** RS-5 **SAMPLE DEPTH:** 7.5 to 8.5 **LABORATORY NO.:** VK158

LIQUID LIMIT: 42 **PLASTIC LIMIT:** 22 **PLASTICITY INDEX:** 19

CLASSIFICATION: GC **ASTM SOIL DESCRIPTION:** CLAYEY GRAVEL with SAND



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

GEOTECH CONSOLIDATION 171323SF.GPJ GENGEO.GDT 8/30/17

MOISTURE-DENSITY RELATIONS

PROJECT: Phoenix Avenue Box Culvert **PROJECT NO.: 171323SF**

LOCATION: 107 W. Phoenix Avenue **DATE: 7/26/17**

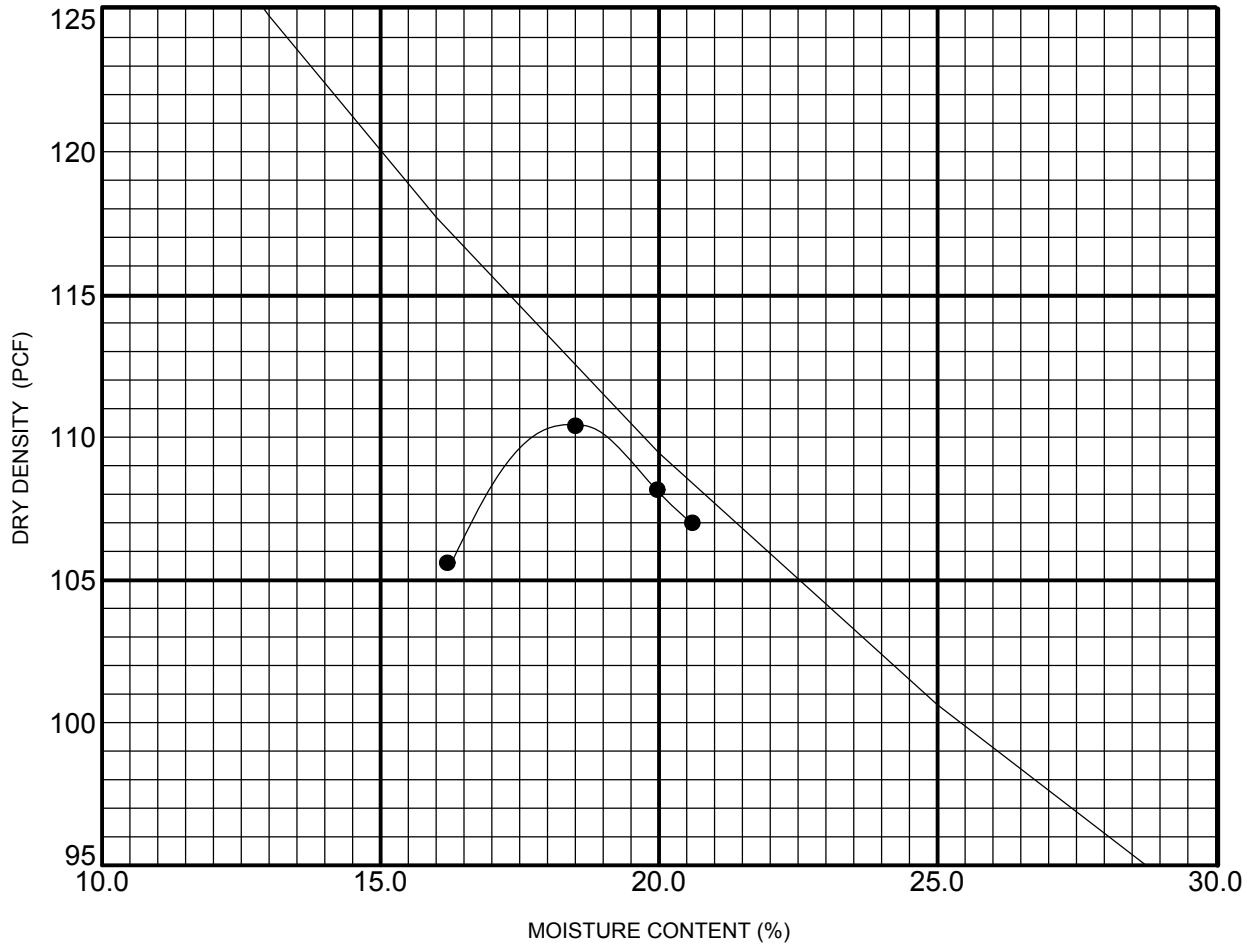
BORING NO.: B- 2 **SAMPLE NO.: BS-4** **SAMPLE DEPTH: 5.5 to 7.5** **LABORATORY NO.: VK157**

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 34 **PLASTIC LIMIT:** 16 **PLASTICITY INDEX:** 19

CLASSIFICATION: CL **ASTM SOIL DESCRIPTION:** SANDY LEAN CLAY

MAXIMUM DRY DENSITY: **110.4 PCF** OPTIMUM MOISTURE CONTENT: **18.5%**



SPEEDIE AND ASSOCIATES

GEOTECH PROCTOR 171323SF.GPJ 8/30/17

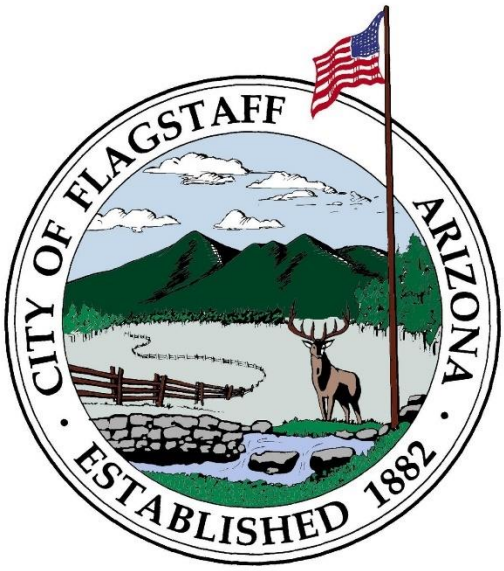
SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B- 2, BS-4	7.5	110.4	18.5	104.7	17.8	94.8	21	100	1.4

Phoenix Avenue Box Culvert
107 W. Phoenix Avenue
Flagstaff, Arizona
Project No. 171323SF

SPEEDIE AND ASSOCIATES

SWELL TEST 171323SF.GPJ GENGEO.GDT 8/30/17



CITY OF FLAGSTAFF
AMENDMENTS
to
MAG STANDARD SPECIFICATIONS
FOR PUBLIC WORKS CONSTRUCTION

(General Provisions)

The
MAG UNIFORM STANDARD SPECIFICATIONS
for
PUBLIC WORKS CONSTRUCTION
is hereby amended to include the following:

PART 100 - GENERAL CONDITIONS

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

102.1 ELIGIBILITY AND PREFERENCE:
(revise to include the following)

If requested by the City, a Bidder shall furnish satisfactory evidence of the Bidder's competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the Bidder's experience on similar work, a list of equipment that would be available for the work and a list of key personnel that would be available.

In addition, if requested, a Bidder shall furnish the City of Flagstaff with satisfactory evidence of the Bidder's financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the Bidder's financial resources and liabilities as of the last calendar year or the contractor's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the Bidder shall further certify whether the Bidder's financial responsibility is approximately the same as stated or reported by the public accountant. If the Bidder's financial responsibility has changed, the Bidder shall qualify the public accountant's statement or report to reflect the Bidder's true financial condition at the time such qualified statement or report is submitted to the City of Flagstaff.

The Bidder shall submit such "evidence of competency" and "evidence of financial responsibility" to the City of Flagstaff no later than five (5) working days after receipt of a written request by the City of Flagstaff.

Each bidder, contractor and subcontractor shall possess and maintain the appropriate contractor's license for the work included in this contract. The appropriate license shall be as required by the Arizona State Registrar of Contractors and as required by Arizona Revised Statutes Chapter 10, Title 32.

102.2 CONTENTS OF PROPOSAL PAMPHLET:
(revise to include the following)

The Plans, Specifications and other Documents designated in the Contract Documents shall be considered a part of the Contract whether attached or not.
The City of Flagstaff reserves the right to refuse to issue a proposal form or accept a proposal form from a prospective Bidder if they are in default for any of the following reasons:

(A) Failure to comply with any prequalification regulations of the City of Flagstaff, if such regulations are cited or otherwise included in the Proposal as a requirement for bidding;

(B) Failure to pay or satisfactorily settle all bills due for labor and materials on former contracts in force (with the City of Flagstaff) at the time the City of Flagstaff issues the Proposal to a prospective Bidder;

(C) Contractor, as a company owner, has defaulted under previous contract(s) with the City of Flagstaff in the prior five calendar years;

(D) Record of unsatisfactory work on previous contract(s) with the City of Flagstaff in the prior five calendar years.

102.2 CONTENTS OF PROPOSAL PAMPHLET:
(third paragraph, revise last sentence to read as follows)

The work embraced herein shall be done in accordance with the requirements of:

City of Flagstaff Amendments to MAG Standard Specifications for Public Works Construction (General Provisions).

City of Flagstaff (City) Engineering Standards (Current Version and adopted revisions).

Maricopa Association of Governments (MAG), *Uniform Standard Specifications for Public Works Construction*, Current Version (MAG Specifications).

MAG *Standard Details for Public Works Construction,* Current Version and adopted revisions (MAG Details).

Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, Current Version and adopted revisions.

In the case of conflict, the following order of precedence shall govern:

1. Special Provisions
2. Construction Plans and Addenda
3. General Provisions and MAG Revisions
4. City of Flagstaff Standards and Specifications
5. MAG Standards and Specifications
6. ADOT Standards and Specifications
7. FHWA Manual of Uniform Traffic Control Devices

102.4 EXAMINATION OF PLANS, SPECIAL PROVISIONS AND SITE OF WORK:
(revise to include the following)

Before submitting a bid, each bidder shall examine the site and obtain information that pertains to the physical conditions of the site that may affect the cost, progress or performance of the work. Any restrictions or difficulties relating to the completion of the work shall be considered in accordance with the terms and conditions of the contract documents.

102.7 IRREGULAR PROPOSALS:
(revise to include the following)

The City of Flagstaff reserves the right to reject any irregular Proposal and the right to waive technicalities for acceptance of Proposals, if such waiver is in the best interest of the City of Flagstaff and conforms to local laws and ordinances pertaining to the letting of construction contracts. Proposals shall be considered irregular for the following additional reasons:

(A) If the Proposal contains unit prices that are obviously unbalanced.

(B) If the Proposal is not accompanied by the proposal guaranty specified by the City.

102.12 DISQUALIFICATION OF BIDDERS:
(revise to include the following)

A Bidder shall also be considered disqualified if the Bidder is considered in default for any reason specified in Subsection 102.2 as amended by this MAG Amendment.

102.13 SUCCESSFUL BIDDERS:
(revise paragraph to read as follows)

The City of Flagstaff shall provide six (6) sets of plans and Contract Documents at no cost. A direct expense fee shall be charged for any additional copies.

SECTION 103 - AWARD AND EXECUTION OF CONTRACT

103.6 CONTRACTOR'S INSURANCE:

103.6.1 GENERAL:
(revise subsection to read as follows)

The Contractor and its Subcontractors, at Contractor's and Subcontractors' own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best, Inc. Rating of A-, 7, or approved by the City. The insurance company shall be licensed in the State of Arizona. Policies and forms shall be satisfactory to the City.

All insurance required herein shall be maintained in full force and effect until all work and/or services required to be performed, under the terms of the Contract, are satisfactorily completed and formally accepted. At the sole discretion of the City, failure to do so may constitute a material breach of this Contract.

The Contractor's insurance shall be primary insurance as respects the City. Any insurance or self-insurance maintained by the City shall not contribute to it.

Contractor shall not fail to comply with the claim reporting provisions of the insurance policies or cause a breach of any insurance policy warranty that would affect coverage afforded under insurance policies to protect the City.

The insurance policies (except Worker's Compensation) shall contain a waiver of transfer of rights of recovery (subrogation) against the City, its agents, representatives, directors, officers, and employees for any claims arising out of the Contractor's acts, errors, mistakes, omissions, work or service.

The insurance policies may provide coverage, which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the City under such policies. The Contractor shall be solely responsible for the deductible and/or self-insured retentions, and the City, at its option, may require the Contractor to secure payment of such deductibles or self-insured retentions by a Surety Bond or an irrevocable and unconditional letter of credit.

The City reserves the right to request and to receive, within 10 working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The City shall not be obligated, however, to review same or to advise Contractor of any deficiencies in such policies and endorsements, and such receipt shall not relieve Contractor from, or be deemed a waiver of the City's right to insist on, strict fulfillment of Contractor's obligations under this Contract.

Except for Worker's Compensation, the insurance policies, required by this Contract shall name the City, its agents, representatives, officers, directors, officials and employees as additional insureds.

Required Coverage

A. COMMERCIAL GENERAL LIABILITY

The Contractor shall maintain Commercial General Liability insurance with a limit of not less than $1,000,000 for each occurrence with a $2,000,000 Products/Completed Operations Aggregate and a $2,000,000 General Aggregate Limit. The Policy shall include coverage for bodily injury, broad form property damage, personal injury, products and completed operations and blanket contractual coverage. Coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 00011093 or any replacements thereof. The coverage shall not exclude X, C, U.

Such policy shall contain a severability of interest provision and shall not contain a sunset provision or commutation clause, nor any provision, which would serve to limit third party action over claims. The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc. Additional Insured, Form B, CG 20101185, and shall include coverage for Contractor's operations and products and completed operations.

B. OWNERS AND CONTRACTOR'S PROTECTIVE LIABILITY

The Contractor shall purchase and maintain, at all times during prosecution of the work, services or operations under this Contract, an Owner's and Contractor's Protective Liability insurance policy for bodily injury and property damage, including death, which may arise in the prosecution of the Work or Contractor's operations under this Contract. Coverage shall be on an occurrence basis with a limit not less than $1,000,000 per occurrence, and the policy shall be issued by the same insurance company that issues the Contractor's Commercial General Liability insurance.

C. AUTOMOBILE LIABILITY

Contractor shall maintain Commercial/Business Automobile Liability insurance with a combined single limit for bodily injury and property damage of not less than $1,000,000 each occurrence with respect to the Contractor's any auto, all owned autos, scheduled autos, hired autos, non-owned autos assigned to or used in performance of the Contractor's work. Coverage will be at least as broad as coverage code 1, "any auto", (Insurance Service Office, Inc. Policy CA 00011293, or any replacements thereof). Such insurance shall include coverage for loading and off-loading hazards. If hazardous substances, materials or wastes are to be transported, MCS 90 endorsement shall be included and $5,000,000 per accident limits for bodily injury and property damage shall apply.

D. WORKER'S COMPENSATION

The Contractor shall carry Worker's Compensation insurance to cover obligations imposed by federal and state statues having jurisdiction of Consultant's employees engaged in the performance of the work or services; and Employer's Liability insurance of not less than $100,000 for each accident, $100,000 disease for each employee, and $500,000 disease policy limit.

In case any work is subcontracted, the Contractor will require the Subcontractor to provide Worker's Compensation and Employer's Liability to at least the same extent as required of the Contractor.

E. BUILDER'S RISK (PROPERTY) INSURANCE (AS REQUIRED)

When the project includes construction of a new building, an addition to an existing building, modifications to an existing building, or as otherwise may be required by the contracting agency, the Contractor shall purchase and maintain, on a replacement cost basis, Builder's Risk insurance in the amount of the initial Contract Amount as well as subsequent modifications thereto for the entire work at the site. At a minimum, the policy limits of such insurance shall be equal in face amount to the full Contract Amount. Such Builder's Risk insurance shall be maintained until final payment has been made or until no person or entity other than the City has an insurable interest in the property required to be covered, whichever is earlier. This insurance shall include interests of the City, the Contractor, and all Subcontractors and Sub-Subcontractors in the work during the life of the Contract and course of construction, and shall continue until the work is completed and accepted by the City. For new construction projects, the Contractor agrees to assume full responsibility for loss or damage to the work being performed and to the buildings under construction. For renovation construction projects, the Contractor agrees to assume responsibility for loss or damage to the work being performed at least up to the full Contract Amount, unless otherwise required by the Contract Documents or amendments thereto.

Builder's Risk insurance shall be on an all-risk policy form and shall cover false work and temporary buildings. Builder's Risk insurance shall insure against risk of direct physical loss or damage from external causes including debris removal, demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Architect's service and expenses required as a result of such insured loss and other "soft costs" as required by the Contract.

Builder's Risk insurance must provide coverage from the time any covered property becomes Contractor's control and/or responsibility, and continue without interruption during construction or renovation or installation, including any time during which the covered property is being

transported to the construction installation site, and while on the construction or installation site awaiting installation. The policy will provide coverage while the covered premises or any part thereof is occupied. Builder's Risk insurance shall be primary and not contributory.
If the Contract requires testing of equipment or other similar operations, at the option of the City, the Contractor will be responsible for providing property insurance for these exposures under a Boiler Machinery insurance policy.

Required coverage may be modified by an amendment to the Contract Documents.

CERTIFICATES OF INSURANCE

Prior to commencing work or services under this Contract, Contractor shall furnish the City with Certificates of Insurance, or formal endorsements as required by the Contract, issued by Contractor's insurer(s), as evidence that policies providing the required coverage, conditions and limits required by this Contract are in full force and effect.

In the event any insurance policies required by this contract are written on a "claims made" basis, coverage shall extend for two years past completion and acceptance of the Contractor's work or services and as evidenced by annual Certificates of Insurance.
If a policy does expire during the life of the Contract, a renewal certificate must be sent to the City fifteen (15) days prior to the expiration date.

All Certificates of Insurance shall be identified with bid/project number and project name. A $25.00 administrative fee will be assessed for all certificates received without the appropriate bid serial number and title.

CANCELLATION AND EXPIRATION NOTICE

Insurance required herein shall not expire, be canceled, or materially changed without thirty (30) days written notice to the City.

SECTION 104 - SCOPE OF WORK

104.1.3 WATER SUPPLY:
(revise to include the following)

Potable water may not be used for major construction activity, such as dust control, soil compaction, or street cleaning. Reclaimed water is available at the Wildcat Hill Wastewater Treatment plant on East Highway 66 and at the south end of Babbitt Drive at the Rio De Flag Water Reclamation Plant. Additional reclaimed water bulk loading sites are located in other areas of the city. The contractor should obtain current locations from the Water Services Department. **Current rates for the**

reclaimed water shall apply. The Contractor is responsible for the cost of construction water and it is considered incidental to the cost of the contract.

Prior to loading, hauling and applying reclaimed water, the Contractor shall be required to obtain the necessary no fee permit at the Wildcat Hill Wastewater Treatment Plant or from the Rio De Flag plant and shall be responsible for complying with all permit and ADEQ requirements regarding the use of reclaimed water.

104.1.4 SPECIAL ACCESS REQUIREMENTS:
(revise to include the following)

The Contractor shall maintain access to all side streets, access roads, driveways, alleys, parking lots and to adjacent properties during their hours of operation. The Contractor shall coordinate with residents and ensure access to all driveways be provided during all non-working hours. Where a property has more than one driveway, no more than one access will be restricted or closed at one time. Should it be necessary to close access to private property, driveways or alley entrances, the closure must be for as short a time as possible and be restored at the end of the work shift. If primary business access cannot be restored, the Contractor shall provide an alternate access, which will be coordinated with the business and pre-approved by the Owner prior to any restrictions being implemented.

104.1.5 SANITATION PICKUP:
When construction activity interferes with pickup, the contractor shall provide for sanitation and recycling vehicle access to the affected properties or relocate the containers where access is acceptable.

104.1.6 EMERGENCY ACCESS:
Street closure information shall be submitted to the City's Project Representative who will forward the information to the Fire Department and Police Department. All notices shall be submitted at least 72 hours in advance of the closures.

104.1.7 POSTAL SERVICE ACCESS:
The contractor shall be responsible for maintaining access for Postal Service within the project area at all times.

104.1.8 SCHOOL BUS ACCESS:
The contractor shall be responsible for maintaining access for bus access within the project area.

104.2 ALTERATION OF THE WORK:

104.2.3 DUE TO EXTRA WORK:
(revise to include the following)

When Allowance and/or Contingency items are provided for in the contract, the funds are encumbered for use at the discretion of the Project Manager. The funds are to cover unanticipated costs to complete items of work not included in the Contract Documents or may be applied to any work deemed necessary by the Owner. Work would include, but not limited to, unanticipated conditions, scope changes, addressing errors or omissions, and/or construction changes that are warranted for project completion consistent with the purpose of the work.

The amount of the allowance item is determined by the City and is not subject to individual bid pricing. The allowance is not part of the bidding process and per the City of Flagstaff Procurement Manual, will be added to the contract amount, if approved by the City Council.

The allowance item provides an estimated funding to cover unforeseen changes that may be encountered and corresponding extra work needed to complete the contract. Any work which is to be paid out of this allowance shall be authorized in writing and approved by Field Order prior to proceeding with the work. Extra work shall be paid for in the following order of precedence:
1.) by extension of unit bid prices, 2.) by negotiated price or 3.) by a time and materials basis in accordance with MAG Section 109.5.

It shall be understood that the amount for this item in the proposal is an estimate only and no guarantee is given that the full amount or any portion thereof will be utilized. It shall not be utilized without first obtaining an approved Field Order signed by the Contractor and the Project Manager.

105.2.1 RECORD DRAWING PREPARATION AND COORDINATION
(revise to include new subsection as follows)

Record drawing preparation shall be the obligation of the Contractor whose purpose is to accurately record and depict the as-built conditions. During the construction phase and prior to backfilling or covering of improvements, the Contractor shall have the work surveyed and recorded for record drawing preparation.

The Contractor shall maintain a redline working copy of the project plans which shall include changes made in construction of the project. The redline copy of the plans shall be updated weekly.

105.2.2 RECORD DRAWING (As-Built Plans)

(revise to include new subsection as follows)

The Contractor shall retain an Arizona licensed civil engineer to record as-built information per Arizona Revised Statute § 32-152. Water and sewer record drawing certification shall comply with ADEQ R18-5-508 (drinking water) and ADEQ R18-9-E301 (sewage collection) requirements for as-built drawings. Unless otherwise noted, the City will complete and submit the Engineer's Certificate of Completion to ADEQ.

Prior to the City's final approval and acceptance of public improvements (sanitary sewer, water, storm sewer, streets) record drawings (as-built plans) must be submitted to the City for review and acceptance per Engineering Standard Specifications.

A redline submittal shall be a .pdf and/or two sets of blue or black line paper sets, copied from the originally approved plan set. Redline submittal will be reviewed by the City and returned with applicable comments. Comments are to be addressed and resubmitted for the City's final approval. A reference checklist is available from the Office of the City Engineer.

Upon City and ADEQ (when applicable) review and approval of the submittal, an electronic .pdf of the plans shall be submitted to the City as a permanent record. All record drawing plan sets shall contain a statement by a licensed professional engineer, currently registered to practice in Arizona, certifying that the drawings are per the as-built condition. The record set requires the seal and signature of the registrant per Arizona Revised Statutes § 32-152. All survey data given by the record drawings shall be performed by a land surveyor who is currently registered in the State of Arizona. Plans must show seal and signature of registrant.

Payment shall be lump sum for all work required to develop the necessary documents, including but not limited to coordination, field inspection, survey, drafting, printing and engineer's seal. The fee shall include as-built information for all record changes within the project area.

SECTION 105 - CONTROL OF WORK

105.8 CONSTRUCTION STAKES, LINES AND GRADES:
(revise entire subsection to read as follows)

The Contractor shall be responsible for all required construction staking, including preconstruction staking for relocation of existing utilities. All construction staking is to be done under the direct supervision of a Registered Land Surveyor or Civil Engineer. All costs associated with this work are to be included in the amount bid for the items of work to which it is incidental or appurtenant. No separate payment will be made for construction staking.

105.10 INSPECTION OF THE WORK

(revise to include the following)

The Contractor is responsible for Quality Control of the work. The City will perform Quality Assurance; frequency of testing will be determined by the City. The Contractor shall be responsible for coordinating and scheduling all inspections of the work and shall confirm that the required inspections and material testing are completed and accepted prior to proceeding with additional work. The Contractor is required to perform the work to a confidence level that the City's Quality Assurance will validate that the work meets specification(s).

105.11 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK:

(revise to include the following)

Any work and/or materials condemned by the Project Manager as inferior or not in compliance with the Contract, Specifications and Plans shall be immediately removed by the Contractor. Materials and/or work so condemned shall be removed and promptly replaced and executed in accordance with the Contract, Specifications and Plans without any expense to the Owner. The Contractor shall bear the expense of making good on all work of other contractors destroyed or damaged by such removal and replacement.

105.12 MAINTENANCE DURING CONSTRUCTION:

(revise to include the following)

The Contractor is responsible to provide adequate drainage for the construction area at all times. Damage to any portion of the work caused by the Contractor's failure to provide adequate drainage of the construction area shall be repaired at the Contractor's expense. A contract time extension will not be granted for any additional time required to make such repairs.

The Contractor shall control open excavations and stockpiling in a manner to prevent water from running into excavations. Obstructions of surface drainage shall be avoided and means shall be provided whereby storm water and wastewater can flow uninterrupted in existing or established pipes, flow courses, other surface drains, temporary drains or channels.

Material for backfill or for protection of excavations within public roads or easements shall be placed and shaped to cause the least possible interference to public travel. In no event shall any flows be allowed to enter private property.

105.16 MAINTENANCE DURING WINTER SUSPENSION OF WORK

(revise to include new subsection as follows)

The City retains the right to declare a winter shutdown, *for any reason*, on the Project including but not limited to adverse weather conditions. A winter shutdown period is typically December through March during which no work will be performed on the Project.

The Contractor shall shutdown, properly insulate and shelter the Project in a safe and workmanlike manner pursuant to local, state and federal laws.

If work has been suspended due to winter weather, the Contractor shall be responsible for maintenance and protection of the improvements and of partially completed portions of the work until final acceptance of the project. Winter suspension shall be by field order, change order or original contract. If repairs and/or maintenance are needed during the suspension, the Contractor is required to perform the repairs and/or maintenance within twenty-four (24) hours of notification from the City. If the needed repairs and/or maintenance are not addressed within the timeframe, the City will accomplish the work and deduct the cost from monies due or become due to the Contractor.

The City shall provide snow removal operations on active traffic lanes only. All other snow removal and maintenance operations shall be the responsibility of the Contractor. All cost associated with snow removal and proper disposal shall be considered incidental to the work including the repair of temporary surface improvements due to normal wear and snow removal operations during the Winter Shutdown.

SECTION 107 - LEGAL REGULATIONS AND RESPONSIBILITY TO THE PUBLIC

107.1 LAWS TO BE OBSERVED:
(revise to include the following)

(G) TAX EXEMPTION: Certain material, machinery and equipment to be installed in this project is exempt from sales tax or use tax as allowed in Arizona Revised Statutes Section 42-5061, 42-5009 and Section 42-5159 and by the Administrative Rules and Regulations of the Arizona Department of Revenue; ACC R15-5-608, R15-5-120 and R15-5-2314.

The City wishes to rely upon the expertise of the contractor in the purchase of items that qualify for the tax exemption. With respect to purchase of the qualifying items, the Contractor is authorized to act as an agent for the City. This agency agreement is strictly limited to the purchase of the qualifying items to be used in the construction of the project and will not otherwise affect or alter the respective rights, responsibilities and remedies of the parties as specified under this contract. The contractor shall furnish the City a list of suppliers and the material, machinery and equipment

to be furnished by each. The City will then issue the materials and equipment exemption certificate to each supplier pursuant to A.R.S. §42-5009 (A) (2). The contractor's applicable unit bid prices for items qualifying for this tax exemption should not include sales or use tax. The materials, machinery and equipment that are a part of this project and to which the exemption applies are listed below:

1. Pipes, valves and appurtenances four (4) inches in diameter or larger used to transport potable water,
2. Any additional material, machinery or equipment identified in the Special Provisions.

107.2.1 TEMPORARY USE PERMITS:
(revise to include new subsection as follows)

A Temporary Use Permit (and Above Ground Fuel Storage Permit if applicable) is required prior to the establishment of any temporary construction yard, material storage area or staging area located within City limits and outside the public right-of-way or project limits. The Contractor is responsible for obtaining the necessary Temporary Use Permit from the agency with jurisdictional authority.

The time required to process the Temporary Use Permit is approximately twelve (12) calendar days. The Contractor shall submit the necessary permit application no later than ten (10) calendar days following the Notice of Award. Any delays experienced by the Contractor in acquiring the Temporary Use Permit shall not necessarily be grounds for delaying the project Notice to Proceed.

107.2.2 DISPOSAL OF WASTE AND SURPLUS MATERIAL:
(revise to include the following)

All disposal costs, regardless of disposal site, shall be included in the bid unit price for the related item of work and no direct payment will be made for disposal of waste or surplus materials. This right of disposal does not apply to any substance or items that are regarded as toxic and/or hazardous by the City, the State of Arizona or the United States Government.

Alternate disposal sites may be proposed by the Contractor but are subject to all applicable local ordinances and codes. In addition to the property owner's written authorization, all disposal sites within the city limits are subject to review and approval by the Temporary Use Permit process. The disposal of material at alternate disposal sites will not be allowed without written authorization of the owner, approval of the appropriate jurisdictional authority, and the issuance of all necessary permits.

107.2.3 ABOVE GROUND FUEL STORAGE PERMIT:

(revise to include new subsection as follows)

If required, Above Ground Fuel Storage Permits may be obtained from the City of Flagstaff Fire Department, located at 211 West Aspen Avenue, Flagstaff, AZ. The Contractor is responsible for obtaining the permit.

107.5 SAFETY, HEALTH, AND SANITATION PROVISIONS:

107.5.4 HANDLING, REMOVAL AND DISPOSAL OF SURPLUS MATERIAL AND ASBESTOS CONTAINING MATERIALS (ACM)
(revise to include new subsection as follows)

The Contractor is responsible for handling, removal and disposal of all soil material generated by the project as described in the General Provisions.

The City requires compliance with Environmental Protection Agency (EPA), Arizona Department of Environmental Quality (ADEQ) and Occupational Safety and Health Administration (OSHA) asbestos regulations for all City projects.

Utility pipes constructed of materials other than metal or polyvinyl chloride (PVC) require testing prior to any disturbance of the pipes to determine if regulated levels of asbestos are present in the pipe material. Suspect pipe materials requiring testing typically include vitrified clay and cement pipe (transite). Asbestos testing is not required for metal pipes.

City Public Works/Sustainability & Environmental Management staff are available to collect samples and submit the samples for analyses. The City of Flagstaff will provide testing free of charge. If the pipe does not contain regulated levels of asbestos, the contractor may disturb and remove the piping. If utility piping contains regulated levels of asbestos, an asbestos abatement contractor must perform any disturbance/removal of the pipe materials. This is required to ensure workers are not exposed to any asbestos fibers.

Work may require the proper handling, removal and disposal of regulated asbestos piping and materials generated by cutting or breaking the pipe to remove it from the ground. If asbestos containing materials (ACM) removal is necessary on the project, the City of Flagstaff requirements for handling, removal and disposal are as follows:

- If an infrastructure or building material that is not either wood, glass or metal is encountered during the project and has not yet been either assumed or positively identified to be ACM then the material(s) must be sampled in accordance with regulations generated by the EPA Asbestos Hazard and Emergency Response Act (AHERA) 40 CFR 763 as well as OSHA 29 CFR 1910.1101, by a certified AHERA Building Inspector and sent to a National Voluntary Laboratory Accreditation Program (NVLAP) certified laboratory for analysis.

- Once materials of concern are assumed or properly identified to be ACM then material removal is required according to OSHA 29 CFR 1910-1926.1101 by a certified asbestos abatement worker, and NOT a general contractor (GC). However, if the GC holds the appropriate asbestos certifications (AHERA Asbestos Operations and Maintenance), which the City would need to verify is current, then the GC could perform the asbestos abatement.

The City requires the General Contractor arrange for abatement of assumed and/or identified ACM by a certified asbestos abatement contractor and to arrange area and/or clearance air monitoring by a third party certified asbestos consultant. If applicable to the project, copies of abatement activities and air monitoring shall be provided to City of Flagstaff Environmental Management staff.

In the event of large disturbances to ACM, compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart M shall be followed. Notification would be required the Arizona Department of Environmental Quality 10 working days in advance of the start of a large project. This notification is not typically required for utility pipe work, but could be required for a very large project involving numerous saw cuts of utility pipes. http://www.azdeq.gov/environ/air/asbestos/

If ACM removal is necessary on the project, the City of Flagstaff requirements for ACM disposal at the City's Cinder Lake Landfill are as follows:

Only non-friable asbestos waste is accepted for disposal at Cinder Lake Landfill. PRIOR to disposal of non-friable ACM, obtain the necessary forms, which are:

- Non-Friable Asbestos Waste Acceptance Application and accompanying instructions
- Non-Friable Asbestos Waste Shipment Record (WSR)

The Asbestos Waste Acceptance Application is available at the City of Flagstaff's website or by contacting the City of Flagstaff Environmental Management staff. A Waste Shipment Record is required to accompany each load of non-friable asbestos waste taken to the Cinder Lake Landfill.

Assure the non-friable ACM is properly handled and wrapped. Non-friable ACM must be thoroughly wetted using amended water PRIOR to being wrapped in 6-millimeter poly and be tightly sealed with duct tape. If the material is heavy (such as transite pipe), has sharp edges, or may easily puncture the poly wrap, a double layer of poly will be necessary. The Cinder Lake Landfill scale house attendant will inspect the load to ensure it is properly wrapped. Containers holding non-friable ACM shall be carefully unloaded and placed in a designated location. Dumping using a hydraulically lifted bed of a truck is not permitted (dump truck), as the poly wrap may be torn open.

If using a large bin for disposal, attach a copy of the Waste Shipment Record to the disposal bin. If not using a City of Flagstaff disposal bin, make sure the delivery driver takes a copy of the SIGNED Non-Friable Asbestos Waste Acceptance Application and the Waste Shipment Record to the Cinder Lakes Landfill with the waste delivery.

If using a City of Flagstaff disposal bin call City Environmental Services at (928) 774-0668 to schedule a pick-up for the disposal bin. Please be sure to provide the driver with the SIGNED Non-Friable Asbestos Waste Acceptance Application and the Waste Shipment Record and be sure to clarify if you would like the disposal bin emptied and removed, or emptied and returned to the work site. When disposal is completed, the Landfill Manager will sign the Waste Shipment Record and landfill staff will provide or mail a copy of the Waste Shipment Record.

Cutting of utility pipes generates Regulated Asbestos Containing Material (RACM). RACM requires disposal at the Joseph City Landfill or at other landfills located in southern Arizona.

All work relating to the removal and disposal of unknown and unanticipated hazardous materials as described above shall be paid per MAG 109.4.3.

107.8 107 USE OF EXPLOSIVES:

(first paragraph, revise second sentence to read as follows)

The Contractor shall submit a blasting plan for approval and obtain a Blasting Permit from the City of Flagstaff Fire Department, located at 211 W. Aspen Avenue, Flagstaff, Arizona.

(revise to include the following)

The Contractor shall submit a copy of the approved blasting plan to the Project Manager. The plan shall include as a minimum; safety layout, drilling pattern, size and depth of bore, weight and type of charge, delay sequence, contractor's anticipated peak particle velocity at the right-of-way line or nearest structure, and the proposed seismograph locations.

A record of each blast shall be kept and all records including seismograph reports shall be available for inspection. Each record shall provide as a minimum; location, date and time of blast, name of person in charge, number of holes burdened, spacing, diameter and depth of holes, boring logs to determine top of rock, type and total amount of explosives used, direction and distance to nearest building, type of detonators and delay periods used, and exact locations of seismographs.

When blasting operations are to be conducted within 200 feet of a water line, sewer line or other underground utility, the Contractor shall take additional precautionary measures. The Contractor shall also coordinate with Franchise Utilities prior to blasting operations. The Contractor shall notify the owner of the facility a minimum of two weeks in advance that such blasting operations are

intended. At their discretion, the Owner may perform pre-blast, post-blast pressure tests or other inspection of the facility. If any damage occurs because of blasting operations, the Contractor shall be responsible for the restoration of the facility to pre-blast conditions.

107.9 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE:
(revise to include the following)

The Contractor is responsible for replacing and/or restoring the site, landscaping and owner's improvements associated with the project to the pre-existing condition using in-kind materials. All cost shall be included in the bid as incidental to the work, unless otherwise specified in the bid schedule or plans.

Within easements, the Contractor is responsible for removing existing improvements and salvaging items (not identified for removal) for relocation after the public improvements are completed. Close coordination between the Contractor and property owners and/or residents is required.

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES:
(revise to include the following)

All power poles, pedestals, guy wires and underground facilities shall be removed and/or relocated by the respective owners of the facilities. The contractor is responsible for the notification and coordination with the utility companies to ensure that this work is accomplished in a manner consistent with the construction schedule. Payment for Franchise Utility coordination and location is incidental to the cost of the work.

The Contractor shall perform utility potholes and identify potential conflicts prior to trenching. The utility pothole information and identification of potential conflicts shall be provided to the Project Manager at least two weeks prior to performing trenching or pipeline construction.

SECTION 108 - COMMENCEMENT, PROSECUTION AND PROGRESS

108.1 NOTICE TO PROCEED:
(revise to include the following)

Time is of the essence in submitting the initial and revised construction schedule and traffic control plan. Each is a requirement that precedes the Contractor's right and the City's obligation to proceed with the agreement.

The Notice to Proceed shall be issued for a start date no later than twenty-seven (27) calendar days following receipt of the Notice of Award. The Contractor shall be required to submit a construction schedule and traffic control plan in accordance with the Contract Documents and the following:

The Contractor shall within seven (7) calendar days of receiving the Notice of Award, submit a construction schedule and traffic control plan to the Project Manager. The Project Manager shall promptly review the construction schedule and traffic control plan and either approve them, or provide a written list of the items that will require revision. The Contractor shall submit the revised construction schedule and traffic control plan within five (5) calendar days of receiving the Project Manager's list of required revisions. The corrected construction schedule and traffic control plan submittal shall address all comments from the Project Manager's list of required revisions.

108.3 CORRESPONDENCE TO THE CONTRACTOR:
(revise to include the following)

In addition to written communication to the Project Manager, the Contractor shall provide and maintain a contact located within ten miles of the job site at all times throughout the duration of the Contract. The designated contact shall be accessible by telephone at all times to respond to agency requirements and emergencies. The local location and phone number(s) shall be provided to the Project Manager prior to issuance of the Notice to Proceed. Any changes of the location or phone number(s) shall be reported immediately to the Project Manager.

If a response is needed, the Contractor is required to respond and perform the repairs and/or maintenance within two (2) hours of notification from the City. If the needed repairs and/or maintenance are not addressed within the timeframe, the City will accomplish the work and deduct the cost from monies due or become due to the Contractor.

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE:
(revise to include the following)

The Contractor's schedule shall include, as a minimum, the following:

- Identification of project tasks with assigned dates and durations, which reflect anticipated sequencing of construction activities on scheduled working days;
- All anticipated subcontractors that will be used during the course of the work;
- The anticipated number of crews to expedite the progress and ensure prompt completion of the work;

  Definition of a crew;
  - personnel *(e.g. operator, laborer)*
  - equipment *(e.g. Cat 325 Excavator, 950 Loader)*
  - workdays anticipated or scheduled per week (*e.g. Monday through Friday)*
  - work hours anticipated or scheduled per day *(e.g. 7:00 am to 3:30 pm)*

- Anticipated adverse weather days for weather dependent activities, weekends and holidays.
- Specific long lead times for delivery of equipment and materials;
- Critical path project schedules may be required as provided for by the Special Provisions or Project Addenda.

108.5 LIMITATION OF OPERATIONS:
(third paragraph, revise to read as follows)

Except in emergencies endangering life or property, written permission shall be obtained from the City prior to performing any work on weekends, legal holidays or after regular work hours (hereinafter defined as 7:00 a.m. to 5:00 p.m. - Monday through Friday). Work on Saturdays will be permitted with prior approval by the City's Engineering Inspection Supervisor. 72 hours advance notice will be required. Work on Sundays and legal City Holidays will not be permitted except in emergencies or as approved by the owner. Inspection and testing will not be provided on Sundays or City legal holidays without prior approval from the Project Manager (72-hour advance notice) and full compensation by the Contractor for any necessary personnel, equipment and services.

Overtime compensation for City personnel shall be as follows:

Construction Supervisor @ $ 43.00/hour
Inspector II @ $ 35.00/hour
Inspector I @ $30.00/hour
Lab Tech I @ $ 25.00/hour
Vehicle @ $1.80/hour

108.7 DETERMINATION AND EXTENSION OF CONTRACT TIME:
(revise to include the following)

The contract time, including final clean-up of the project site and storage areas, may be extended because of weather conditions that cannot be reasonably anticipated. The number of actual days that the scheduled work is impacted by adverse weather shall be recorded weekly during the construction period.

The Contractor will be entitled to a contract time extension if the actual adverse weather days experienced during the work exceed the anticipated adverse weather days shown. The following is the monthly schedule of adverse weather days that shall be anticipated by the Contractor in scheduling the work:

TABLE 108.7 MONTHLY CALENDAR DAYS for ANTICIPATED ADVERSE WEATHER

MONTH	*JANUARY*	*FEBRUARY*	*MARCH*	*APRIL*	*MAY*	*JUNE*
Monthly Calendar Days for Anticipated Adverse Weather	7 Days	7 Days	8 Days	6 Days	4 Days	3 Days
Average Monthly Precipitation	1.98”	1.96”	2.05”	1.34”	0.68”	0.51”
MONTH	*JULY*	*AUGUST*	*SEPTEMBER*	*OCTOBER*	*NOVEMEBER*	*DECEMBER*
Monthly Calendar Days for Anticipated Adverse Weather	12 Days	11 Days	7 Days	5 Days	5 Days	6 Days
Average Monthly Precipitation	2.78”	2.68”	1.82”	1.52”	1.49”	1.90”

The above schedule of anticipated adverse weather days establishes the base line for the project's monthly weather impacts based on historical records, as recorded by the National Weather Service at Pulliam Airport, for precipitation in excess of 0.01 of an inch per calendar day.
The number of actual days that scheduled work is impacted by adverse weather as defined above shall be recorded weekly during the contract period. It is the Contractor's responsibility to request in writing any adverse weather delays experienced during the prior week no later than the normally scheduled weekly project meeting. Any adverse weather day requests that are not received, as stated above, shall neither be considered nor approved. Once the number of approved actual adverse weather days exceeds the number of anticipated adverse weather days in the schedule above, the Contractor is entitled to a contract time extension.

Actual adverse weather days must also prevent work for fifty (50) percent or more of the Contractor's work day and delay scheduled work critical to the timely completion of the project. The City will convert any delays meeting the above requirements to calendar days and extend the contract period as necessary. No additional compensation will be allowed for direct and indirect overhead expenses associated with any such contract time extensions. The Contractor's schedule must include the above anticipated adverse weather delays for all weather dependent activities and shall show all weekends and holidays.

108.8 GUARANTEE AND WARRANTY PROVISIONS:
(revise to include the following)

If requested by the City, the Contractor shall return to the project site eleven months after acceptance of the project and visually inspect, in the presence of the Owner's Representative, all accessible construction items and appurtenances. All defective materials and/or workmanship shall be satisfactorily repaired or replaced at the sole expense of the Contractor.

All costs for the 11-month inspection and repair shall be borne by the Contractor and in figuring his or her bid, the Contractor shall include an appropriate amount for such inspection and possible required repair, and no additional payment will be allowed.

108.10 FORFEITURE AND DEFAULT OF CONTRACT:
(revise to include new section)

Due to Failure to Prosecute the Work

If the Contractor fails to prosecute the work in accordance with the contract, including requirements of the progress schedule, the City may correct these deficiencies after three days after providing written notice to the Contractor. The cost of these remedies shall be charged against the Contractor. A change order may be issued to make the necessary changes in the contract and to make an appropriate reduction in the contract price. Such a change order shall not require the signature or approval of the Contractor. The remedy shall not prejudice the City's use of any other remedy, which the City may be entitled to use.

108.12 AUTHORIZED SIGNATURES:
(revise to include new section)

The Contractor shall provide a notarized list of all authorized signatures for project related documents. Only those individuals listed by the Contractor on the project Authorized Signature form shall be authorized to sign the contract, contract change orders, time extensions, bonds, securities, pay requests, certifications or other documents that affect the execution of the Contract.

108.13 SUBSTANTIAL COMPLETION:
(revise to include new section)

The project is substantially complete within the contract time and liquidated damages will no longer be assessed when the following have occurred:

(A) All contract items of work have been substantially completed and pedestrian and vehicular traffic can move unimpeded through the project;

(B) The only work left for completion is incidental, causes no disruption to pedestrian and vehicular traffic, and does not affect the safety and convenience of the public;

The decision whether the project is substantially complete is within the sole discretion of the Project Manager. At that time, a *Substantial Completion* letter will be issued by the City to the Contractor.

The remaining incidental work shall be completed within 15 calendar days from the issuance of the *Substantial Completion* letter. Failure to prosecute the remaining work within this time-period will result in the resumption of time charges and the application of liquidated damages from the date scheduled for final acceptance and start of warranty.

The start of the project warranty period will be established in the *Notice of Final Acceptance* and does not begin with substantial completion.

The Contractor is responsible for correction and repair of any project deficiencies until the end of the warranty period established in the *Notice of Final Acceptance* at which time the City will accept the improvements for operation and maintenance.

108.14 SUSPENSION and TERMINATION:
(revise to include new section)

CITY'S RIGHT TO STOP WORK

The City may, at its discretion and without cause, order the Contractor in writing to stop and suspend the Work. Such suspension shall not exceed one hundred and eighty (180) consecutive days.

The Contractor may seek an adjustment of the Contract Price and/or Contract Time if its cost or time to perform the Work has been adversely impacted by any suspension or stoppage of Work by the City.

TERMINATION FOR CONVENIENCE

Upon receipt of written notice to the Contractor, the City may, at its discretion and without cause, elect to terminate this Agreement. In such event, the City shall pay the Contractor only the direct value of its completed Work and materials supplied as of the date of termination. The Contractor shall be entitled to profit and overhead on completed Work only but shall not be entitled to anticipated profit or anticipated overhead.

If the City suspends the Work for one hundred eighty-one (181) consecutive days or more, such suspension shall be deemed a termination for convenience.

Upon such termination, the Contractor shall proceed with the following obligations.

1. Stop Work as specified in the notice.
2. Place no further subcontracts or orders.
3. Terminate all subcontracts to the extent they relate to the work terminated. The Contractor shall ensure that all subcontracts contain this same termination for convenience provision.
4. At the City's sole discretion and if requested in writing by the City, assign to the City all right, title and interest of the Contractor under the subcontracts subject to termination.
5. Take any action that may be necessary for the protection and preservation of the property related to this Agreement that is in the possession of the Contractor and in which the City has or may acquire an interest.

6. The Contractor shall submit complete termination inventory schedules no later than one hundred twenty (120) days from the date of the notice of termination.

The City shall pay the Contractor the following:

1. The direct value of its completed Work and materials supplied as of the date of termination.
2. The reasonable and direct, actual costs and expenses attributable to such termination. Reasonable costs and expenses shall not include, among other things, anticipated profit, anticipated overhead, or costs arising from the Contractor's failure to perform as required under this Agreement.
3. The Contractor shall be entitled to profit and overhead on completed Work only but shall not be entitled to anticipated profit or anticipated overhead. If it is determined that the Contractor would have sustained a loss on the entire Work had they been completed, the Contractor shall not be allowed profit and the City shall reduce the settlement to reflect the indicated rate of loss.

The Contractor shall maintain all records and documents for three (3) years after final settlement. These records shall be maintained and subject to auditing as prescribed in Section 7.7.

THE CITY'S RIGHT TO PERFORM AND TERMINATE FOR CAUSE

If the City provides the Contractor with a written order to provide adequate maintenance of traffic, adequate cleanup, adequate dust control or to correct deficiencies or damage resulting from abnormal weather conditions and the Contractor fails to comply in a time frame specified, the City may have work accomplished by other sources at Contractor's sole expense.

If the Contractor persistently fails to

1. provide a sufficient number of skilled workers,
2. supply the materials required by the Contract Documents,
3. comply with applicable Legal Requirements,
4. timely pay, without cause, sub-consultants and/or subcontractors,
5. prosecute the Work with promptness and diligence to ensure that the Work is completed by the Contract Time, as such times may be adjusted, or
6. perform material obligations under the Contract Documents, then the City, in addition to any other rights and remedies provided in the Contract Documents or by law, shall have the rights set forth below.

Upon the occurrence of an event set forth above, the City may provide written notice to the Contractor that it intends to terminate this Agreement unless the problem cited is cured, or commenced to be cured, within seven (7) days of the Contractor's receipt of such notice.

If the Contractor fails to cure, or reasonably commence to cure, such problem, then the City may give a second written notice to the Contractor of its intent to terminate within an additional seven (7) day period.

If the Contractor, within such second seven (7) day period, fails to cure, or reasonably commence to cure, such problem, then the City may declare this Agreement terminated for default by providing written notice to the Contractor of such declaration.

Upon declaring this Agreement terminated and for the purpose of completing the Work, the City may enter upon the premises and take possession of all materials, equipment, scaffolds, tools, appliances and other items thereon, which have been purchased or provided for the performance of the Work. The Contractor hereby transfers, assigns and conveys all items, which have been purchased or provided for the performance of the Work to the City for such purpose and to employ any person or persons to complete the Work and provide all of the required labor, services, materials, equipment and other items.

In the event of such termination, the Contractor shall not be entitled to receive any further payments under the Contract Documents until the Work shall be finally completed in accordance with the Contract Documents. At such time, the Contractor shall be entitled to be paid only for Work performed and accepted by the City prior to its default.

If the City's cost and expense of completing the Work exceeds the unpaid balance of the Contract Price, then the Contractor shall be obligated to pay the difference to the City. Such costs and expenses shall include not only the cost of completing the Work, but also losses, damages, costs and expense, including attorneys' fees and expenses, incurred by the City in connection with the re-procurement and defense of claims arising from the Contractor's default.

If the City improperly terminates the Agreement for cause, the termination for cause shall be converted to a termination for convenience in accordance with the provisions of 108.14

SECTION 109 - MEASUREMENTS AND PAYMENTS

109.1 MEASUREMENT OF QUANTITIES:

(revise to include the following)

It is the responsibility of the Contractor to conform to the Contract Documents, including plans, typical sections and specifications including but not be limited to dimensions, materials, application rates and densities. The Contractor shall take all actions necessary to ensure that the work conforms to the contract documents. The Contractor shall cooperate fully with the Project Manager or Project Manager's representative to correct any known nonconformity to the contract documents.

109.1 MEASUREMENT OF QUANTITIES:
(delete the second paragraph)

Unless otherwise specified, longitudinal and surface (plane) measurements will be made in a horizontal plane.

PART 200 - EARTHWORK

SECTION 201 - CLEARING AND GRUBBING

201.3 CONSTRUCTION METHODS:
(revise to include the following)

The Contractor shall make every effort possible to avoid damaging existing trees. In the event that any trees suffer limb damage, the Contractor shall cut branches to the nearest branch crotch or to the branch collar at the trunk.

No separate payment will be made for trimming trees. The cost shall be considered incidental to the work.

SECTION 205 – ROADWAY EXCAVATION

205.1 DESCRIPTION
(revise to include the following)

The bid schedule unit cost for excavation, backfill and embankment work shall include the cost of rock excavation, handling rock or disposing of rock and no separate measurement or payment shall be made. Rock shall be defined as any highly cemented or hard material that may require additional efforts for removal, handling or disposal.

205.2 UNSUITABLE MATERIAL:
(third paragraph, revise to read as follows)

Should unsuitable material be encountered at subgrade elevation in cut areas or at existing grade in fill areas, the unsuitable material shall be removed and replaced with suitable fill material in accordance with MAG Section 210 and MAG Section 211.

Determination of unsuitable material and the limits and depths of required removal and replacement shall be at the sole discretion of the Project Manager. In no case shall any unsuitable material be removed without prior written consent of the Project Manager.

Measurement and payment for removal and replacement of unsuitable material will be by the cubic yard as shown in the proposal. Payment shall be compensation in full for the work complete and in-place including any borrow, permits, pit royalties, all excavation, hauling, placing, compacting, conditioning, watering and proper disposal, together with all appurtenant costs.

205.3 MEASUREMENT

(revise to include the following)

Earthwork is incidental to the roadway construction and no additional payment will be made for roadway excavation. The Contractor shall be responsible for estimating and accounting for earthwork import and haul off. It is recommended that the Contractor review the report on geotechnical investigation and sampling results.

PART 300 -- STREETS AND RELATED WORK

SECTION 301 - SUB-GRADE PREPARATION

301.1 DESCRIPTION:

(revise to include the following)

The untreated base or prepared subgrade shall be test rolled in the presence of the Project Manager prior to the placement of asphalt paving materials. The equipment used to perform the test roll shall be approved by the Project Manager. The Contractor shall be responsible for scheduling this test roll with the Inspector during regularly scheduled work. All costs associated with the test roll shall be considered incidental to and included in the cost of sub-grade preparation.

SECTION 336 - PAVEMENT MATCHING AND SURFACING REPLACEMENT

336.1 DESCRIPTION:

(first paragraph, revise to include the following)

The exact points of pavement matching shall be determined in the field by the Project Manager.

336.2 MATERIALS AND CONSTRUCTION METHODS:

336.2.1 PAVEMENT WIDENING OR EXTENSIONS:

(first paragraph, revise second sentence to read as follows)

The minimum depth of cut shall be four (4) inches or Depth/4, whichever is greater.

PART 400 -- RIGHT-OF-WAY AND TRAFFIC CONTROL

SECTION 401 - TRAFFIC CONTROL

401.5 GENERAL TRAFFIC REGULATIONS:
(revise to include the following)

Within seven (7) calendar days following receipt of the Notice of Award and in accordance with Section 108.1 of these General Provisions, the Contractor shall submit to the Project Manager a traffic control plan that shows the control of traffic in accordance with Part VI of the FHWA Manual on Uniform Traffic Control Devices for all phases of the work. The plan should include nights, weekends, shut down periods and an approximate schedule of street closures and detours.

The Traffic Control Plan is to detail the Contractor's proposal for routing traffic and pedestrians around the areas of construction. The Plan shall be coordinated with the proposed construction schedule and show how the locations of the various traffic and pedestrian control devices will change as construction progresses. The Plan shall allow for complete detours around the work areas.

Private and commercial driveways shall not be closed for any period exceeding eight hours during any twenty-four-hour period. The affected resident and the City shall be notified 48 hours in advance of any closure. Convenient access to driveways, houses and buildings along the line of work shall be maintained and temporary crossings or alternate access shall be provided and maintained in good condition, except during that period mentioned above. **Business access shall be maintained at all times by at least one driveway.**

(eleventh paragraph, revise to read as follows)

The Contractor will reinstall all permanent traffic control devices as required by the approved construction plans and specifications.

(twelfth paragraph, delete the last sentence)

Delete - The Traffic Engineering Department will reinstall all traffic signs.

401.7 PAYMENT:
(revise paragraph to read as follows)

Payment for all work and materials required to prepare a traffic control plan and provide traffic control during construction shall be made at the lump sum price shown on the Bid Schedule. Full compensation for any required traffic control devices, flaggers, uniformed off-duty law enforcement

officers, pilot cars and drivers shall be included in the lump sum contract price and no additional payment shall be allowed. Progress payments shall be made based on the Contractor's estimate for percent complete as approved by the Owner.

SECTION 425 TOPSOIL

425.2 MATERIALS:
(revise to read as follows)

Overburden topsoil shall be salvaged and reused when possible. All topsoil, whether overburden or imported, shall be free of roots, heavy clay, clods, noxious weed seeds, coarse sand, large rocks, sticks, brush, litter and other deleterious material and meet the requirements of MAG Section 795. The Project Manager's approval of the proposed topsoil shall be obtained before delivery to the project.

425.4 MEASUREMENT:
(revise paragraph to read as follows)

Topsoil shall be measured lump sum, complete and in place unless indicated otherwise by the bid schedule.

425.5 PAYMENT:
(revise to read as follows)

Topsoil will be paid for in accordance with the contracted price for furnishing and placing topsoil, as described and specified. Progress payment shall be made based on the Contractor's estimate for percent complete as approved by the Owner.

SECTION 430 – LANDSCAPING AND PLANTING
(revise to include section as follows)

430.3 LAWN AREAS

430.3.1 Preparation of In Place Soil
(delete the second paragraph and revise to read as follows)

After clearing, grubbing and initial cultivation has been completed, a slow release chemical fertilizer shall be mechanically spread over the turfgrass area at an average rate of 1 pound of actual nitrogen per 1000 square feet. After spreading, the fertilizer shall be cultivated into the top four inches of soil using suitable equipment. The resulting soil shall be in a friable condition suitable for planting. (Actual nitrogen is determined by using the nitrogen ratio number x weight of the bag/100).

430.3.2 Seeding

(delete the first and second paragraph revise to read as follows)

The rate of seeding shall be three pounds of seed per 1000 square feet using the following seed mixture;

Poa pratensis	Kentucky Bluegrass (mix of three varieties)	70%
Lolium perenne	Perennial Rye Grass	10%
Festuca rubra	Creeping Red Fescue	20%

Alternative species may be acceptable but are subject to prior approval from the City Project Manager or duly authorized representative.

SECTION 431 – EROSION CONTROL

(revise to include new section as follows)

431.1 DESCRIPTION

Erosion control applies to improvements within the city and as part of the erosion control section of a Storm Water Pollution Prevention Plan (SWPPP). Materials, means and methods for erosion control and stabilization, Best Management Practices (BMPs), Erosion Control Plans (ECPs) and SWPPPs are described in the City of Flagstaff Stormwater Design Manual.

The Contractor shall stabilize all disturbed areas within the project site and as shown on the plans. Work shall be performed according to the provisions of this Section and shall include but not be limited to the furnishing, hauling, placement and application of erosion control materials.

The Contractor is responsible for complying with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit program. This generally includes submittal of a Notice of Intent to the Arizona Department of Environmental Quality (ADEQ) and Notice of Termination to ADEQ for the project. Preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for the site is required per ADEQ and City of Flagstaff standards.

The cost for complying with the NPDES permit and the SWPPP, including the erosion control devices, shall be included in the NPDES & SWPPP Requirements portion of the Contractor's bid. It is recommended that contractors see the ADEQ Smart NOI (Notice of Intent) program website (http://az.gov/webapp/noi/main.do) for information and processes.

Progress payment shall be made based on the Contractor's estimate for percent complete as approved by the Owner.

432.1 NATIVE SEEDING

All areas to be seeded that are accessible to machinery shall be tilled to a minimum depth of four (4) inches. Areas inaccessible to machinery shall be hand tilled and prepared to a minimum depth of two (2) inches. Cut slopes of 2:1 or steeper do not require tilling. Cultivation on sloping terrain shall run perpendicular to the direction to the slope. If weeds or herbaceous plant material interferes with proper seedbed preparation, the contractor shall remove them from the seedbed.

Contractor shall remove and dispose of all debris and other objectionable material that may interfere with seeding operations.

The area to be seeded shall be relatively smooth and all surface irregularities (e.g. rills, tire marks) shall be filled and firmed to conform to the desired cross sections. The seedbed shall be rolled both before and after the seeding operation with a minimum of one pass of a cultipacker or drag harrow.

Seed shall be sown when conditions will promote germination and growth. Normal non-irrigated permanent native seed application dates are between April 1 and June 15, between August 15 and September 20 and after the first frost (recurring overnight temperature of 28 degrees F) until snowfall. Seeding work shall be performed only after planting and other work affecting ground surface is complete.

To assist in establishment of the permanent seed mix, a nurse crop shall be used for this work. Preapproved nurse crop seed shall be one of the following, incorporated with the specified permanent seed mix;

Annual ryegrass	*(Lolium multiflorum)*	30 lbs/acre
Oats	(*Avena sativa)*	60 lbs/acre
Regreen©	(*Triticum aestivum x Elytrigia elongata)*	30 lbs/acre

Alternative species may be acceptable but are subject to prior approval from the City Project Manager or duly authorized representative.

When cut or fill slopes are greater than six (6) feet in height and steeper than 3H:1V, the seeded area shall be covered with American Excelsior Company straw/coconut blanket or an approved equal. Installation shall be per the manufacturer's written directions.

440.10. (D) SEQUENCING

(add the following section)

The irrigation system shall be installed, inspected, approved and operable prior to the installation of plant materials, landscape fabric and ground plane treatments (*decomposed granite, landscape rock, mulch, etc.)*

PART 600 - WATER AND SEWER

SECTION 601 - TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.2 EXCAVATION:

601.2.1 GENERAL:
(revise to include the following)

All excavation, including trench excavation, shall be performed in any substance and material encountered. The cost is considered incidental to and is to be included in the price for the bid item to be constructed or installed. No special payment shall be made for trench excavation other than rock excavation as specified under Trench Rock Excavation.

Trench Rock Excavation
Trench rock is defined as consolidated igneous, metamorphic and/or sedimentary material in the original bed and/or in well-defined ledges that cannot be removed by a mechanical method and therefore requires pneumatic hammering, drilling or blasting for removal. Example of mechanical methods include hand tools, trenching machine, backhoe, ≥195 horsepower hydraulic excavator with ripping teeth or equivalent.

Boulders and pieces of rock having a volume of more than 27 cubic feet (1 cubic yard) shall be considered rock.

For projects where trench rock excavation is anticipated, the estimated contingent quantity is shown in the proposal under the applicable bid item. The contingency quantity is an estimate only and no guaranty is given that any portion will be utilized. Trench rock excavation will be paid for separately at the unit price bid per cubic yard for Trench Rock Excavation.

Measurement of Trench Rock Excavation shall be per cubic yard in place. This volume of rock will be measured by the City representative, using the maximum trench width allowed in accordance with MAG Table 601-1, the lineal footage of actual rock excavation required and the actual depth of rock as determined by inspection of the trench after rock excavation and before backfilling.

SECTION 611 – WATER, SEWER AND STORM DRAIN TESTING

611.2 DISINFECTING WATER MAINS:

611.2.13 Fire Flow Testing:
(revise to include the following new section)

All water lines that have new fire hydrants shall require a fire flow test per CoF Engineering Standard 13-09-006-0006.1.

Fire flow testing shall be performed by a certified tester. Results shall be sealed by an Arizona Professional Engineer.

The City Water Services Section requires a 72-hour notice via e-mail to schedule hydrant operation and testing observation. A digital copy of the test results shall be submitted to the City Project Manager.

SECTION 631 WATER TAPS AND METER SERVICE CONNECTIONS
(revise to add the following)

631.3 INSTALLATION:

New water service lines shall be installed to replace the existing water service lines. Construction includes replacement of all water services to COF Engineering Standards, including the service saddle at the main, corporation stop, pipe and curb stop to the meter and adjust the customers' service to the new outlet meter coupling elevation. The lines shall be extended to the new polymer meter box location and a new meter box shall be installed and shall connect to the existing meter. If the existing meter is not at the City's standard depth; the contractor shall adjust the elevation of the meter. In cases where the meter box moves, the contractor shall salvage the existing meter and shift it to the proposed location. At each of these locations the contractor is required to connect the existing water services on the private side of the meter. The Contractor shall coordinate with each homeowner where private construction is required to verify the water line rerouting and to restore landscaping to its original condition.

The City will provide the contractor with Temporary Rights of Entry for the water service connection, replacement/adjustment of water meter boxes and associated work. If the contractor needs to go outside the Temporary Right of Entry limits they will have to provide the City with written permission from the property owner prior to conducting the work.

A residential plumber's license will be required for all work that is done on the private service side of the meter.

City of Flagstaff utility tapping fees are the responsibility of the contractor. The contractor shall perform all work and coordinate payment directly with the City Water Services Department. All costs for utility tap work and fees shall be included in the line item for installation of the new service, including but not limited to all labor and materials for complete installation. Repair associated within any abandoned or new tap shall be included in the contract bid item.

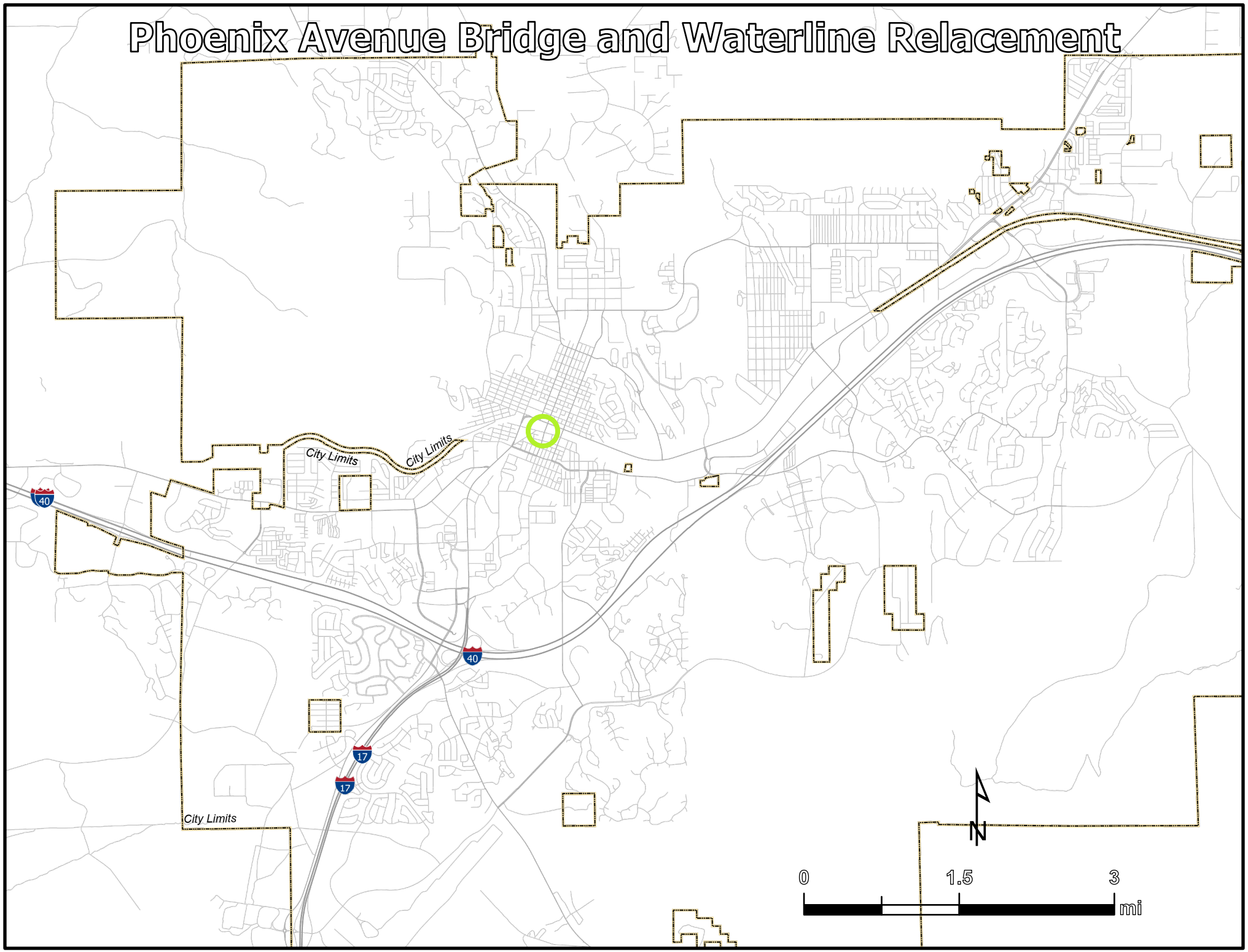
SECTION 710 - ASPHALT CONCRETE

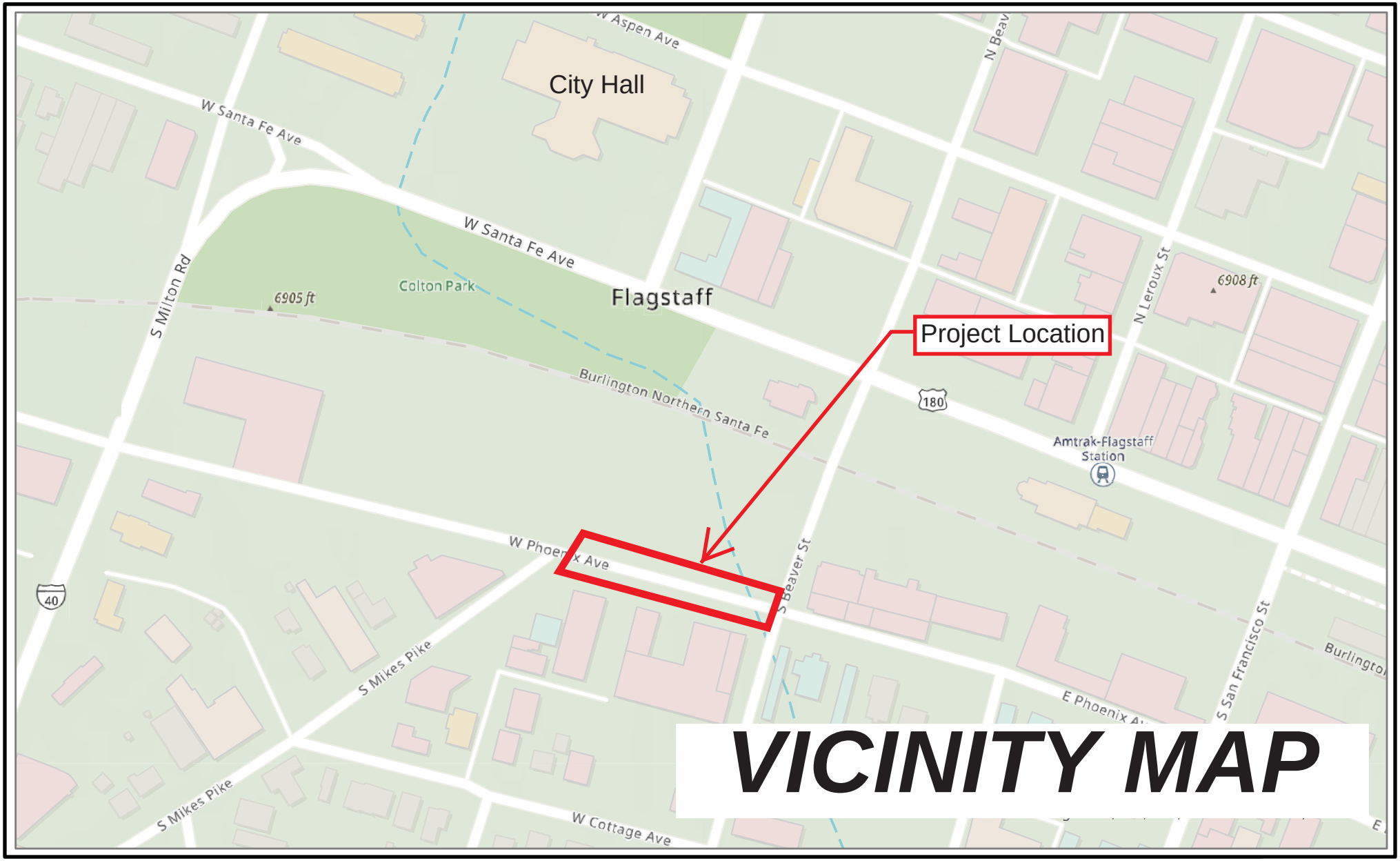
710.1 GENERAL:
(revise to include the following)

The asphaltic concrete designation shall be 3/4 inch, except as required by the project plans or Special Provisions.

End of Document

Phoenix Avenue Bridge and Waterline Relacement





Phoenix Avenue Bridge and Waterline Replacement Project

0 0.02 0.04 0.09 0.14 0.18

mi

City of Flagstaff maps and data are updated on a regular basis from data obtained from various sources. The City of Flagstaff endeavors to provide accurate information, but accuracy is not guaranteed. You are strongly encouraged to obtain any information you need for a business or legal transaction from a surveyor, engineer, title company, or other licensed professional as appropriate. Information is provided subject to the express condition that you knowingly waive any and all claims for damages against the City of Flagstaff relating to use of this information.

5/13/2021 4:52 PM

CITY OF FLAGSTAFF
CONTRACT SUPPLEMENTARY JUSTIFICATION

[X] CONTRACT ALLOWANCE
[X] ADMINISTRATIVE CHANGE ORDER

PROJECT NO. WA 3476 **PROJECT NAME:** Phoenix Avenue Bridge & Waterline Replacement

FILE NO. 03-20004 **Project Manager:** Mac McNamara / Trevor Henry

CONTRACTOR/CONSULTANT: Jud Co. LLC

PROJECT DESCRIPTION: The Project consists of installing a new 2 cell concrete bridge culvert, 11 feet by 4 feet, 20 LF of 18" CMP with riprap and gabion baskets, 350 LF of new 12" PVC and 6" ductile iron waterline, 20 LF of new 8" ductile sewer line with manholes , 675 SY of new asphalt and 2,100 SF of new concrete sidewalk. Included will be a new air release valve, new manholes, drainage improvements and driveways. This project will remove the existing box culvert and the existing 12" and 6" watermains as part of the City's ongoing aging water infrastructure replacement program

JUSTIFICATION FOR USE AND AMOUNT:
Contract Allowance (CA) Justification and Amount:

A $57,235.50 CA is recommended to compensate Jud Co. LLC for costs associated with potential unforeseen items of work where details could not be determined at the time of contracting such as:

- Owner directed increases to Project scope for items not identified to need repair at the time of design or contracting.
- Non-compliant bridge work or water services that may be identified outside of the project scope.

The low bid amount is *$763,140.00* plus a CA of *$57,235.50* or 7.5% of the low bid amount of *$763,140.00* (excluding a CA), equals the total Contract Amount of *$820,375.50*

Administrative Change Order (ACO) Justification and Amount:

A *$76,314.00* ACO is recommended to compensate Jud Co. LLC for the associated costs on items such as:

- Unforeseen trench rock excavation, unsuitable soil, subgrade stabilization, utility conflicts and bridge conflicts.
- Increase in the Project scope due to additional funding becoming available or oversight during Project scoping.

The *$76,314.00* ACO is *10%* of the low bid amount of *$763,140.00*, which is the Contract Price of $820,375.50 excluding the *$57,235.50 CA.* This ACO amount is per the April 16, 2019 Procurement Code revisions.

The Procurement Code Manual for Design/Bid/Build contracts allows for up to a 7.5% Contract Allowance for contracts of this value.

COST/BUDGET/FUNDING SOURCE ANALYSIS:
Contract Allowance Justification and Amount:

The CA is recommended to be included in the Contract Amount and will be funded by the total budget appropriations, $1,597,949, remaining in FY 21 and proposed FY 22 for account numbers 202-08-370-3476-0 and 202-08-370-3437-0-4463.

Administrative Change Order Justification and Amount:

The ACO is recommended to be approved and can be funded by the total budget appropriations, $1,597,949, remaining in FY 21 and proposed FY 22 for account numbers 202-08-370-3476-0 and 202-08-370-3437-0-4463.

APPROVAL:	**Signature**		**Date:**
Project Manager	Trevor Henry	**Approval Recommended**	5/17/21
~~**Program Manager**~~		~~**Approval Recommended**~~	
Section Head		**Approval Recommended**	5/17/21
Division Head	Richard A. Barrett	**Approval Recommended**	5/17/2021

10. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Dan Symer, Zoning Code Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-32 and Ordinance No. 2021-16: A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the existing Accessory Dwelling Unit and Accessory Structure Encroachment Requirements.

STAFF RECOMMENDED ACTION:

At the June 15, 2021, Council Meeting:
1) Read Resolution No. 2021-32 by title only
2) City Clerk reads Resolution No. 2021-32 by title only (if approved above)
3) Read Ordinance No. 2021-16 by title only for the first time
4) City Clerk reads Ordinance No. 2021-16 by title only (if approved above)

At the July 6, 2021, Council Meeting:
5) Adopt Resolution No. 2021-32
6) Read Ordinance No. 2021-16 by title only for the final time
7) City Clerk reads Ordinance No. 2021-16 by title only (if approved above)
8) Adopt Ordinance No. 2021-16

Executive Summary:

The proposed amendment (Exhibit A to Resolution No. 2021-32) includes multiple changes to the Zoning Code. The objective of the proposed amendment is to add additional flexibility to the existing Accessory Dwelling Units (ADU) requirements to encourage the development of Accessory Dwelling Units. To allow for the additional flexibility, the new and modified provisions include allowing: Detached Accessory Dwelling Units to encroach in the rear and interior side yards; Attached and Interior Accessory Dwelling Units to be constructed to the height allowed by the property's zone; and property owners the ability to rent or lease both the Accessory Dwelling Unit and the Single-Family Dwelling Unit that are on the same lot/ provided that the property owner enters into an agreement/covenant prohibiting the renting or leasing of the structures for less than 30 days. In addition, the amendment includes the consolidation of the accessory structure requirements into one table.

The Planning and Zoning Commission reviewed and provided a recommendation of approval at the May 26, 2021, Planning and Zoning Commission meeting.

Financial Impact:

There are no anticipated financial impacts affiliated with the proposed Zoning Code Text Amendment.

Policy Impact:

No policy impacts are anticipated by this amendment.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

- Actively support attainable & affordable housing through City projects & opportunities with developers.
- Implement innovative local government programs, new ideas & best practices; be recognized as a model for others to follow.
- Achieve a well-maintained community through comprehensive & equitable code compliance, & development that, is compatible with community values.

City Council Goal:

- Revise the Zoning Code to remove ambiguities, and ensure it is consistent with community values and with the Regional Plan.
- Support development and increase the inventory of public and private affordable housing for renters and home owners throughout the community.

Regional Plan

Below is a list of the Goals and Policies that the proposed Zoning Code Text Amendment complies with.

Chapter VIII - Community Character

- Policy CC.3.1. Encourage neighborhood design to be respectful of traditional development patterns and enhance the overall community image.
- Policy CC.3.2. Maintain and enhance existing buildings and blend well-designed new buildings into existing neighborhoods

Chapter IX - Growth Areas & Land Use

- Policy LU.1.6. Establish greater flexibility in development standards and processes to assist developers in overcoming challenges posed by redevelopment and infill sites.
- Goal LU.3. Continue to enhance the region’s unique sense of place within the urban, suburban, and rural context.
- Policy LU.5.3. Promote compact development appropriate to and within the context of each area type: urban, suburban, and rural.
- Goal LU.13. Increase the variety of housing options and expand opportunities for employment and neighborhood shopping within all suburban neighborhoods.
- Policy LU.13.4. Plan suburban development to include a variety of housing options

Chapter XIII - Neighborhoods, Housing, & Urban Conservation

- Goal NH.3. Make available a variety of housing types at different price points, to provide housing opportunity for all economic sectors.
- Policy NH.3.1. Provide a variety of housing types throughout the City and region, including purchase and rental options, to expand the choices available to meet the financial and lifestyle needs of our diverse population.
- Policy NH.3.2. Promote accessory dwelling units, where appropriate.
- Policy NH.3.5. Encourage and incentivize affordable housing.

Staff's analysis of the Regional Plan's goals and policies is included below under the Zoning Code Text Amendment Criteria heading, Finding #1 of the report. In addition, the staff's narrative and Regional Plan and Specific Plan analysis are included as Attachment 2.

Has There Been Previous Council Decision on This:
There has not been a previous City Council decision on this ordinance.

Options and Alternatives:

1. Approve the amendment with no changes;
2. Approve the amendment with modifications; or
3. Deny the amendment.

Proposed Amendment:
The proposed amendment (Attachment 2) includes multiple changes to the Zoning Code. The objective of the proposed amendment is to add additional flexibility to the existing Accessory Dwelling Units (ADU) requirements to encourage the development of Accessory Dwelling Units. To allow for additional flexibility, new provisions are being added, and several existing regulations are being modified. The most significant of the modifications include:

- Allowing Detached Accessory Dwelling Units to be located in the required setbacks of a property zone;
- Allowing detached accessory structures constructed prior to February 16, 2016, that are within the required Detached Accessory Dwelling Unit setbacks to be converted to an Accessory Dwelling Unit [Note: "Garage" was changed to "accessory structure" after the Planning and Zoning Commission recommendation in order to broaden the reach of the provision.];
- Establishing a maximum building height (16 feet) of a Detached Accessory Dwelling Unit that encroaches into the required setbacks of a property's zone;
- Modifying the allowed building height of an Attached and Interior Accessory Dwelling Unit to be the same as the maximum building height permitted by the property's zone; and
- Allowing the Single-family Dwelling Unit and the Accessory Dwelling Unit to both be rented or leased if the property owner enters into a restrictive covenant affirming that the property owner will not rent or lease either of the dwelling units for a period of fewer than 30 days.

Summary of the Staff Revisions to the Zoning Code:
1. Accessory Structures (Section 10-40.60.020):

- Table 10-40.60.020.B.7.d.: Allowed Accessory Structure Encroachments into Setbacks have been deleted, and the related provisions have been incorporated into Table 10-50.40.020.A.: Allowed Encroachments into Setbacks and Heights.
- The reference to Table 10-40.60.020.B.7.d. for encroachments into the required setbacks has been modified to refer to Table 10-50.40.020.A.

2. Accessory Dwelling Units (ADUs) (Section 10-40.60.030):

- Table 10-40.60.030.C.: Accessory Dwelling Unit Design, Development, and Exceptions Standards has been modified as follows:
    - Minimum setbacks have been established that would allow a Detached Accessory Dwelling Unit to encroach into the required setbacks of a property's zone;
    - The required setbacks of a property's zone have been maintained and clarified for Attached and Interior Accessory Dwelling Units;
    - The allowed building height (currently 24 feet) of an Attached and Interior Accessory Dwelling Unit has been modified to be the same as the maximum building height permitted by the property's zone;
    - Encroachments (awnings, bay windows, canopies, fireplaces and chimneys, open eaves, window sills, etc.) allowed in combination with Attached, Detached, and Interior Accessory Dwelling Units have been modified; and
    - The existing provisions pertaining to a detached accessory structure constructed prior to February 16, 2016, have been modified to allow the accessory structure to be converted to a

Detached Accessory Dwelling Unit.

- Subsection E. of Section 10-40.60.030. Restrictive Covenant has been modified to allow the property owner to participate in the Rental Dwelling Unit Incentive of subsection G which would allow both the Single-family Dwelling Unit and the Accessory Dwelling Unit to be rented or leased.
- Subsection G. of Section 10-40.60.030. Rental Dwelling Unit Incentive has been added. This subsection has been added to incentive and allow both Single-family Dwelling Unit and the Accessory Dwelling Unit to be rented or leased if the property owner enters into a restrictive covenant affirming that the property owner will not rent or lease either of the dwelling units for a period of less than 30 days.

3. Encroachments into Minimum Required Setbacks (Section 10-50.40.020):

- Table 10-50.40.020.A.: Allowed Encroachments into Setbacks and Heights has been modified to incorporate the provisions of Table 10-40.60.020.B.7.d. for accessory structures. In addition, a cross-reference to the walls and fence encroachments has been included in Table 10-50.40.020.A.

Zoning Code Text Amendment

A Zoning Code Text Amendment shall be evaluated based on the following findings:

A. Finding #1:
The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;

The proposed amendment (Attachment 2) includes multiple changes to the Zoning Code. The objective of the proposed amendment is to add additional flexibility to the existing Accessory Dwelling Units (ADU) requirements to encourage the development of ADUs. The proposed provisions address multiple goals and policies of the Regional Plan. These include:

- Providing additional flexibility in the Zoning Code to allow property owners to construct Accessory Dwelling Units (Regional Plan Goal LU.1.6.);
- Allowing Detached Accessory Dwelling Units to be constructed in the rear and interior side yard at same height and location that is currently allowed for other accessory structures (e.g.. garages, sheds, etc) will assist in maintaining the traditional and compact patterns of development that is prevalent in existing neighborhoods while contributing to Flagstaff's unique sense of place (Regional Plan Goal LU.3., and Policies CC.3.1., CC.3.2., and LU.5.3 and Southside Community Plan S.2.4, La Plaza Vieja Neighborhood Specific Plan Goal #6N);
- Allowing Interior and Attached Accessory Dwelling Units to be the same height that is allowed by the properties zone (Regional Plan Goal LU.3., and Policies CC.3.1., CC.3.2., and LU.5.3 and Southside Community Plan S.2.4.; La Plaza Vieja Neighborhood Specific Plan Goal #6N); and,
- Encourage the development of Accessory Dwelling Units on detached single-family lots by providing additional flexibility in the locations and heights of the structures. Also, allowing property owners to rent both the Single-family Dwelling Unit and the Accessory Dwelling Units (Regional Plan Goal LU.13. NH.3.2., Policies NH3.1, NH3.5. and Southside Community Plan Policies S.2.4., SLW 1.1. and SNC 1.1.; La Plaza Vieja Neighborhood Specific Plan Goal #6N).

B. Finding #2
The proposed amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City;

The provisions of the amendment are not anticipated to be detrimental to the public interest, health, safety, convenience, or welfare of the city. The proposed modification is intended to allow Detached Accessory Dwelling Units in the rear and side yards which are consistent with other accessory structures (e.g. a garage, storage shed, etc.). In addition, the proposed maximum allowed height (16 feet) of a Detached Accessory Dwelling Unit is the same height as other accessory structures that are allowed in setbacks of a property's zone. Also, the Attached and Interior Detached Accessory Dwelling Unit

connected to a primary Single-family Dwelling Unit is proposed to have a building height that is equal to the height allowed by the property's zone. Typically, the modification to a Single-family Dwelling Unit to incorporate an Attached or Interior Detached Accessory Dwelling Unit is indistinguishable from modifications to enlarge a Single-family Dwelling Unit without the accessory dwelling units.

C. Finding #3
The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.

The amendment is internally consistent, utilizes the existing format, and does not conflict with other Zoning Code provisions. It maintains the Zoning Code's purpose as a comprehensive contemporary set of land uses and requirements that are straightforward, usable, and easily understood.

Citizen Participation
Persons of interest on file with the Planning and Development Services section of the Community Development Division were notified of the Planning and Zoning Commission and City Council work sessions and public hearing via first-class mail. Moreover, notification of the work sessions and public hearings were published on the City's Facebook and Flagstaff Community Forum web pages and in the Arizona Daily Sun. The public comments received are included as Attachment 3. At the May 26, 2021, Planning and Zoning Commission meeting, a member of the public expressed support for the proposed amendment.

Planning and Zoning Commission Work Session
At the Planning and Zoning Commission Work Session of May 12, 2021, staff reviewed the proposed Zoning Code Text Amendment with the Commission. The Commission had a general question regarding the amendment to clarify their understanding of the proposed regulations.

City Council Work Session
At the City Council Work Sessions of May 11, 2021, staff reviewed the proposed Zoning Code Text Amendment with the City Council. Members of the City Council had a general question regarding the amendment to clarify their understanding of the proposed regulations. In addition, the City Council provided direction to allow property owners the ability to rent both the Single-family Dwelling Unit and the Accessory Dwelling Unit provided that the owner(s) enters into a restrictive covenant affirming that the property owner will not rent or lease both of the dwelling units for a period of fewer than 30 days (definition of a Short-Term Rental).

Planning and Zoning Commission Hearing
On May 26, 2021, the Planning and Zoning Commission reviewed the application and had general questions. These questions include:

- What are the short-term rental time periods? How will the City monitor and be able to enforce Accessory Dwelling Units from being used as short-term rentals?
    - *Short-term rentals are generally considered the leasing or renting of a dwelling unit for less than 30 days. The recordation of the proposed covenant is intended to assist the City to enforce Accessory Dwelling Units from being used as a short-term rental. Also, the City requires owners of short-term rentals to obtain a license. In addition, the City has software (LODGINGRevs) to monitor the location of the short-term rentals.*
- Has staff heard from property owners regarding the allowance to rent both the Single-family Dwelling Unit and Accessory Dwelling Unit?
    - Staff has heard from two property owners that would like, or in the process of constructing, an Accessory Dwelling Unit, and they support the proposed amendment.
- How this affects history overlay zones?
    - The development of an Accessory Dwelling Unit would be required to comply with the

requirements of the applicable history overlay zones

In addition, public comment was received in support of the amendment. The Planning and Zoning Commission unanimously recommended approval of the proposed Zoning Code Text Amendment (Motioned by Commissioner Nolan, and seconded by Commissioner Mandino).

Attachments:

Res. 2021-32
Exhibit A to Resolution No. 2021-32
Ord. 2021-16
2. Application Narrative and Regional Plan Analysis
3. Public Comments
Presentation

RESOLUTION NO. 2021-32

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT FILED WITH THE CITY CLERK AND ENTITLED "CASE NO. PZ-21-00066 UPDATES TO ZONING CODE 2021 – ACCESSORY DWELLING UNIT AND ACCESSORY STRUCTURE ENCROACHMENTS REQUIREMENTS"

RECITALS:

WHEREAS, pursuant to A.R.S. § 9-802 a municipality may enact or amend provisions of the City Code by reference to a public record, provided that the adopting ordinance is published in full; and

WHEREAS, the City of Flagstaff wishes to incorporate by reference amendments to the Flagstaff Zoning Code, Ordinance No. 2021-16, by first declaring said amendments to be a public record.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General.

That certain document known as *"Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements"* attached hereto as Exhibit A is hereby declared to be a public record, and one (1) paper copy and one (1) electronic copy shall remain on file with the City Clerk in compliance with A.R.S. § 44-7041, and said copies shall remain on file with the City Clerk.

SECTION 2. Effective Date.

This resolution shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____

CITY ATTORNEY

Exhibits:

A. Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

Amendment for Adoption into the Flagstaff Zoning Code

HOW TO READ THIS DOCUMENT

Unless otherwise stated, provisions that are being deleted are shown in bold red strikethrough text, like this: ~~**Provisions that are being deleted are shown with a bold red strikethroughs text.**~~

Provisions that are being added are shown in bold blue text, like this: **Provisions that are being added are shown in bold blue text.**

Section 1. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, 10-40.60.020 Accessory Structures, Subsection B. Approvals and Standards., paragraph 7, list d., as follows:

10-40.60.020 Accessory Structures

B. Approvals and Standards.

7. All other accessory structures shall comply with the property development standards of the property's zone, except as specified below:

   d. ~~**Allowed**~~ Encroachments into the required setbacks ~~**in addition to Section 10-50.40.020. A nonhabitable structure (e.g., garage, workshop, carport, shed, greenhouse, etc.) may encroach into the property's required zone setbacks in accordance with Table 10-40.60.020.B.7.d.**~~ **are allowed in accordance with Table 10-50.40.020.A.**

Section 2. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.020 Accessory Structures, Table 10-40.60.020.B.7.d., to delete the table, as follows:

~~**Table 10-40.60.020.B.7.d.**~~ ~~**Allowed Accessory Structure Encroachments into Setbacks**~~	
~~**Yard of Encroachment**~~	~~**Minimum Setback**~~
~~**Rear yard abutting a public alley right-of-way or private alley tract:**~~	~~**0 feet.**~~
~~**Rear yard abutting another lot or parcel:**~~	~~**5 feet.**~~
~~**Interior side yard:**~~	~~**5 feet.**~~

~~Table 10-40.60.020.B.7.d.~~ ~~Allowed Accessory Structure Encroachments into Setbacks~~	
~~Yard of Encroachment~~	~~Minimum Setback~~
~~Street side yard:~~	~~No encroachment allowed.~~
~~Front yard:~~	~~No encroachment allowed.~~
~~Notes~~	
~~1. Refer to Section 10-50.50.030, Siting and Building Standards, regarding the locations and heights of walls and fences.~~	

Section 3. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.030 Accessory Dwelling Units (ADUs), Table 10-40.60.030.C., rows (5), as follows:

Table 10-40.60.030.C. Accessory Dwelling Unit Design, Development and Exceptions Standards		
(5)	Building Form and Property Development Standards	(a) ~~Setbacks. An ADU shall comply with the setback requirements of the property's zone and as allowed in (d) and 14 of this table.~~ **Setbacks.** **(i) A Detached ADU structure may be located in the rear and interior side setbacks, provided that the following are maintained:** **(i.1) Minimum rear setback abutting a public alley right-of-way or private alley tract: 0 feet.** **(i.2) Minimum rear setback abutting another lot or parcel: 5 feet.** **(i.3) Minimum interior side setback: 5 feet.** **(ii) An Attached or Interior ADU shall comply with the required setbacks of a lot's or parcel's zone.** **(iii) Alternative setbacks and placements are allowed in accordance with Section 10-40.60.030.D.** **(b) (i) Detached ADU Encroachments. Only the encroachments in subsection (7) of Table 10-50.40.020.A. are allowed in the setbacks of subsection (5)(a)(i) of this Table. The other encroachments of Table 10-50.40.020.A. are not allowed as part of a Detached ADU.** **(ii) Attached and Interior Encroachments. The encroachment of Table 10-50.40.020.A. are allowed.** **(iii) A detached accessory structure constructed prior to February 16, 2016 that is located in the minimum setback(s) of subsection (5)(a)(i) of this Table or in the street side setback may be converted to an ADU or have an ADU as a second floor, provided that there is no exterior addition or increase in building height within the minimum setback(s).**

Table 10-40.60.030.C. Accessory Dwelling Unit Design, Development and Exceptions Standards	
	~~(b)~~ **(c)** Building Height. ~~The maximum height of an Attached and Detached ADU, measured in accordance with Section 10-50.30.030: 24 feet~~ **(i) Attached and Interior ADU: Maximum height allowed by the lot's or parcel's zone.** **(ii) Detached ADU within the required setbacks of a lot's or parcel's zone: 24 feet.** **(iii) Any portion of a Detached ADU that encroaches into the required setbacks of the property's zone: 16 feet.**
	~~(c)~~ **(d)** Lot Coverage. The lot coverage requirements of a property's zone shall: (i) Not apply to Attached and Detached ADU; and (ii) Apply to a dwelling unit containing an interior ADU.
	~~(d) Encroachment into setbacks.~~ ~~(i) The encroachments specified in Section 10-50.40.020 are allowed.~~ ~~(ii) The development of a Detached ADU on the second floor of a garage that was developed prior to February 16, 2016, and is in the required setback(s), shall be allowed, provided that no exterior additions or an increase in building height was developed to accommodate the ADU.~~

Section 4. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.030 Accessory Dwelling Units (ADUs), Table 10-40.60.030.C., row (12), as follows:

Table 10-40.60.030.C. Accessory Dwelling Unit Design, Development and Exceptions Standards		
(12) Required Occupancy	(a)	The property owner, which includes title holders and contract purchasers, shall occupy either the primary ~~residence~~ **dwelling unit** or the ADU as their principal ~~residence.~~ **residence, unless the primary dwelling unit and ADU are allowed to be separately leased or rented in accordance with subsection G of this Section.** ~~The residence or ADU that is not occupied by the property owner that is rented or leased shall be for a period of no less than 30 days.~~
	(b)	**The primary dwelling unit or the ADU that is not occupied by the property owner that is rented or leased shall be for a period of no less than 30 days.**

Section 5. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.030 Accessory Dwelling Units (ADUs), Table 10-40.60.030.C., row (17), as follows:

(17) Utility Service	(a) An ADU ~~shall~~ **shall** be connected to ~~**the utilities**~~ **utilities** (except internet, telephone and television), ~~**(except internet, telephone and television)**~~ **either through** ~~**main of**~~ the primary dwelling unit, or ~~**and may not have**~~ separate **utility** services.

Section 6. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.030 Accessory Dwelling Units (ADUs), to amend subsection E. Restrictive Covenant., as follows:

Section 10-40.60.030 Accessory Dwelling Units (ADUs)

E. Restrictive Covenant.

1. The following shall be required, unless the property owner participates in the Rental Dwelling Unit Incentive of subsection G of this section:

~~**1.**~~ **a.** The property owner shall sign before a notary public a restrictive covenant that runs with the land on a form prepared by the City **Attorney or designee** affirming that the property owner shall:

~~**a.**~~ **i.** Occupy either the primary residence or the ADU; or

~~**b.**~~ **ii.** If the property owner rents or leases a property with both a primary residence and an ADU to a third party, then neither the primary residence nor the ADU shall be sub-leased.

~~**2.**~~ **b.** The restrictive covenant shall be submitted to the City prior to the issuance of a building permit for the ADU. The City shall record the restrictive covenant after the building permit has been issued.

Section 7. Amend Title 10 Flagstaff Zoning Code, Division 10-40.60 Specific to Uses:, Section 10-40.60.030 Accessory Dwelling Units (ADUs), to add subsection G in alphabetical order, as follows:

Section 10-40.60.030 Accessory Dwelling Units (ADUs)

G. Rental Dwelling Unit Incentive.

1. As an incentive to property owners to construct ADUs and to increasing the number of long-term rental dwelling units that are available in the Flagstaff area, the primary residential dwelling unit and the ADU a may be rented or leased separately if the property owner agrees to and signs before a notary public a restrictive covenant on a form prepared by the City Attorney or designee affirming that the property owner will not rent or lease either of the

dwelling units for a period of less than 30 days. The restrictive covenant shall be submitted to the City prior to the issuance of a building permit for the ADU, or before the property owner rents or leases the primary residential dwelling unit and the ADU, whichever is earlier. The restrictive covenant shall run with the land.

Section 8. Amend Title 10 Flagstaff Zoning Code, Division 10-50.40: Encroachments, Section 10-50.40.020 Encroachments into Minimum Required Setbacks, Table 10-50.40.020.A., as follows – including table format and shading:

Table 10-50.40.020.A.: Allowed Encroachments into Setbacks ~~and Heights~~		
(1)	Arbors, Awnings, Canopies, Court Yards, Decks, Patios, Pergolas, Porches, Stoops, Trellis, Hooded Entries, Carports and ~~Balconies[1,2,3]~~ **Balconies**	
	Standard	**Maximum Encroachment in Setback**
	Front, Rear, Street Side Setback ~~(max.)~~	**5 feet[1,2,3] ~~5 feet~~**
	Interior Side Setback ~~(max.)~~	**3 feet[1,2,3] ~~3 feet~~**
(2)	Accessory Dwelling Units ~~(ADUs)[1]~~ **(ADUs)**	
	See Section 10-40.60.030	
~~Accessory Buildings and Structures[1]~~ **(3) Accessory Buildings and Structures, Excluding Walls and Fences**		
	~~See Section 10-40.60.020~~	
	Standard	**Minimum Setback from Property Line**
	Rear setback abutting a public alley right-of-way or private alley tract	**0 feet**
	Rear setback abutting another lot or parcel	**5 feet[2,3]**
	Interior side setback	**5 feet[2,3]**
	Street side setback	**No encroachment allowed**
	Front setback	**No encroachment allowed**
(4)	**Walls and Fences**	
	Refer to Section 10-50.50.030, Siting and Building Standards, regarding the allowed locations of walls and fences.	
(5)	Ground Mounted Solar Panels	
	Standard	**Maximum Encroachment in Setback**
	Front, Rear, Street Side Setback ~~(max.)~~	5 feet

Table 10-50.40.020.A.: Allowed Encroachments into Setbacks ~~and Heights~~		
	Interior Side Setback ~~(max.)~~	3 feet
(6)	Open Stairways	
	Standard	**Maximum Encroachment in Setback**
	Rear and Exterior Side Setback	5 feet[2,3]
	Interior Side Setback	3 feet[2,3]
(7)	Bay Windows, Open Eaves, Cornices, Fireplaces and Chimneys, and Window Sills	
	Standard	**Maximum Encroachment in Setback**
	All Setbacks ~~(max.)~~	2 feet
End Notes:		
1. In no case shall the permitted encroachment exceed 50 percent of the required setback.		
2. Refer to applicable Building Code sections for permitted projections into setback areas and ensure that a 3' space is maintained between an open stairway and the property line.		
3. Refer to applicable Building Code sections for construction less than 5' from a property line.		

ORDINANCE NO. 2021-16

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF FLAGSTAFF, AMENDING THE FLAGSTAFF CITY CODE, TITLE 10, FLAGSTAFF ZONING CODE, BY ADOPTING BY REFERENCE THAT CERTAIN DOCUMENT ENTITLED "CASE NO. PZ-21-00066 UPDATES TO ZONING CODE 2021 – ACCESSORY DWELLING UNIT AND ACCESSORY STRUCTURE ENCROACHMENTS REQUIREMENTS"; PROVIDING FOR PENALTIES, REPEAL OF CONFLICTING ORDINANCES, SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

RECITALS:

WHEREAS, the City of Flagstaff wishes to amend Title 10 Flagstaff Zoning Code of the Flagstaff City Code, to incorporate modifications and additions to the Accessory Dwelling Units and accessory structure encroachment provisions of the Flagstaff Zoning Code; and

WHEREAS, a citizen review session was held at the Planning Commission work session on May 12, 2021, to discuss the proposed Zoning Code text amendment in accordance with Section 10-20.50.040 of the Flagstaff Zoning Code; and

WHEREAS, the Planning and Zoning Commission held public hearing on May 26, 2021, and provided a recommendation to City Council on proposed Zoning Code text amendment; and

WHEREAS, the City Council has read and considered the staff report prepared by the Planning and Development Services section of the Community Development division and all attachments to those reports, and the City Council finds that the proposed Zoning Code text amendment is in conformance with the General Plan, and the findings of Section 10- 20.50.040 of the Flagstaff Zoning Code have been met; and

WHEREAS, that certain document known as *"Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements"*, one (1) paper copy and one (1) electronic copy of which are on file with the City Clerk in compliance with A.R.S. § 44-7041, was declared to be a public record by Resolution No. 2021-32.

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. The foregoing recitals are incorporated as if fully set forth herein.

SECTION 2. That certain document known as "*Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements*", one (1) paper copy and (1) electronic copy are on file in the office of the City Clerk of the City of Flagstaff, Arizona, which document is declared a public record by Resolution No. 2021-32 of the City of Flagstaff, Arizona, is hereby referred to, adopted and made a part hereof as if fully set out in this ordinance and its provisions are hereby declared to amend the Flagstaff City Code,

replacing and superseding the existing relevant provisions of the City Code, as set forth therein.

SECTION 3. The amendment is consistent with and conforms to the goals of the Regional Plan (General Plan).

SECTION 4. The amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City, and will add to the public good as described in the General Plan.

SECTION 5. The amendment is internally consistent with other applicable provisions of this Zoning Code.

SECTION 6. Repeal of Conflicting Ordinances

All ordinances and parts of ordinances in conflict with the provisions of the code adopted herein are hereby repealed.

SECTION 7. Severability

If any section, subsection, sentence, clause, phrase or portion of this ordinance or any part of the code adopted herein by reference is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 8. Clerical Corrections

The City Clerk is hereby authorized to correct clerical and grammatical errors, if any, related to this ordinance, and to make formatting changes appropriate for purposes of clarity, form, or consistency with the Flagstaff City Code.

SECTION 9. Effective Date

This Ordinance shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Case No. PZ-21-00066 Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

Narrative and Regional Plan and Specific Plan Conformance Analysis

Narrative

To encourage the development of Accessory Dwelling Units on detached single-family lots, the objective of the proposed amendment is to add additional flexibility and remove barriers that are contained within the existing Accessory Dwelling Unit provisions. To achieve this objective, new provisions are proposed to be added and existing provisions are proposed to be modified to allow additional flexibility. The proposed modifications include allowing Detached Accessory Dwelling Units to be located in the required rear and interior setbacks, provided that the building height of the structure does not exceed a maximum building height of 16 feet. In addition, the maximum building height of the Attached and Interior Accessory Dwelling Units are proposed to be increased from 24 feet to the maximum height allowed by a property's zone. Also, the proposed modifications include allowing detached garages that were constructed prior to February 16, 2016, and are within the required setbacks to be converted to an Accessory Dwelling Unit. Furthermore, the proposed modifications include provisions to allow both the Accessory Dwelling Unit and the Single-family Dwelling Unit to be rented separately, as long as the property owner records a restrictive covenant that prohibits renting any unit as a short-term/vacation rental (i.e., less than 30 days).

In addition to the above modifications, the proposed Zoning Code Text Amendment includes consolidating the accessory structure encroachment allowances of Table 10-40.60.020.B.7.d. into Table 10-50.40.020.A.: Allowed Encroachments into Setbacks.

Regional Plan Conformance

Chapter VIII - Community Character

- Policy CC.3.1. Encourage neighborhood design to be respectful of traditional development patterns and enhance the overall community image.
- Policy CC.3.2. Maintain and enhance existing buildings and blend well-designed new buildings into existing neighborhoods.

The proposed modifications of the Accessory Dwelling Unit requirements are intended to maintain building heights and setbacks that match the provisions for other accessory structures (e.g., garage, sheds, etc.) and the allowed height of a property's zone. The proposed revisions are intended to maintain a consistent development pattern that blends newly constructed Accessory Dwelling Units in a manner that is compatible with the existing traditional neighborhood environment.

Chapter IX - Growth Areas & Land Use

- Policy LU.1.6. Establish greater flexibility in development standards and processes to assist developers in overcoming challenges posed by redevelopment and infill sites.
- Goal LU.3. Continue to enhance the region's unique sense of place within the urban, suburban, and rural context.

- Policy LU.5.3. Promote compact development appropriate to and within the context of each area type: urban, suburban, and rural.
- Goal LU.13. Increase the variety of housing options and expand opportunities for employment and neighborhood shopping within all suburban neighborhoods.
- Policy LU.13.4. Plan suburban development to include a variety of housing options.

The proposed modifications of the Accessory Dwelling Unit provisions will assist in maintaining Flagstaff's unique sense of place that is consistent with the older and historic neighborhoods throughout the city. The revised standards are intended to provide property owners additional flexibility to develop Accessory Dwelling Units on single-family lots to promote compact and intensified development that is compatible within new and existing neighborhoods. Furthermore, the modified standards are intended to allow for an increase in housing options within new and existing neighborhoods in a manner that is consistent with the older and historic neighborhoods.

Chapter XIII - Neighborhoods, Housing, & Urban Conservation

- Goal NH.3. Make available a variety of housing types at different price points, to provide housing opportunity for all economic sectors.
- Policy NH.3.1. Provide a variety of housing types throughout the City and region, including purchase and rental options, to expand the choices available to meet the financial and lifestyle needs of our diverse population.
- Policy NH.3.2. Promote accessory dwelling units, where appropriate.
- Policy NH.3.5. Encourage and incentivize affordable housing.

One of the primary purposes of the proposed modifications to the Zoning Code is to remove barriers to developing Accessory Dwelling Units and to increase the variety of housing options available to a diversity of income ranges. In addition, the proposed modifications are intended to incentivize Accessory Dwelling Units by providing additional flexibility in the locations that Detached Accessory Dwelling Units are allowed. Also, the revised provisions increase the allowed height of an Attached and Interior Accessory Dwelling Unit to match a property's zone. Furthermore, the modifications include provisions that would allow both the Accessory Dwelling Unit and the Single-family Dwelling Unit to be rented to separate households. To rent both the Accessory Dwelling Unit and the Single-family Dwelling Unit to separate households, the property owner would need to agree to record a restrictive covenant prohibiting the units from being rented as short term/vacation rentals (i.e., less than 30 days).

Specific Plans

Southside Community Plan

- Policy S 4.1. Encourage housing types and prices for people with a variety of income levels and housing needs.
- Policy SLW 1.1. The appropriate mix of uses in the Live/Work Neighborhood are:
  - Single family homes and duplexes with accessory dwelling units,
  - Multiunit clusters, often including a cottage in front with medium to high density on site and one to two story buildings,
  - Clusters of apartment buildings on lots less than one-half block in size,

    - Live/work units, and
    - Small studios and shops that support self-employment and neighborhood services.
- Policy S 2.4. Replicate patterns, materials, and architectural features of historic building in new construction.
- Policy SNC 1.1. The appropriate mix of uses in the Southside Neighborhood Core are:
    - Single family homes and duplexes with or without accessory dwelling units,
    - Small shops with housing in the rear or above,
    - Home occupation, and
    - Neighborhood uses compatible with a residential setting.

La Plaza Vieja Neighborhood Specific Plan

- Goal #6N: Preserve the neighborhood core as a predominantly single-family neighborhood. Single-family residential cottages with yards are the primary building type in the Neighborhood Core with compatibly-designed accessory dwelling units and duplexes that do not dominate the block or street as an element of the urban neighborhood.

To encourage the development of Accessory Dwelling Units on detached single-family lots, the objective of the proposed amendment is to add additional flexibility and remove barriers that are contained within the existing Accessory Dwelling Unit provisions. In addition, the proposed modification to the Accessory Dwelling Units provisions are intended to assist in providing a diversity of housing options that are available to a variety of income ranges.

Daniel Symer

From: Charlie Silver <cws720@gmail.com>
Sent: Tuesday, May 11, 2021 10:37 AM
To: Mayor and Council
Cc: Daniel Symer
Subject: Fwd: Case No. PZ-21-00066

Follow Up Flag: Follow up
Flag Status: Flagged

Hello,
I also thought it prudent to send this directly to you as well. Sorry if it's duplicative.
Thank you.

---------- Forwarded message ---------
From: **Charlie Silver** <cws720@gmail.com>
Date: Tue, May 11, 2021 at 12:25 AM
Subject: Case No. PZ-21-00066
To: <publiccomment@flagstaffaz.gov>

RE: Proposed amendment to the Zoning Code to modify the existing Accessory Dwelling Unit (ADU) and accessory structure requirements (Case No. PZ-21-00066)

I oppose the request by the City to amend the Zoning Code to incorporate provisions to allow a Detached Accessory Dwelling Unit to encroach into a property's required interior and rear setback, even attempting to ensure that the maximum height of the structure does not exceed 16 feet. First, regarding code enforcement I often hear that the system is complaint driven. In other words the burden is placed on neighbors/individuals to monitor, interprete, and report (complain) to the City that something "appears" to be a code violation. This is not right - it pits neighbor against neighbor. And, if someone were to go above 16 feet, I have very little faith that the City would enforce the height limit, i.e., make someone tear down something that was in the process of being built or was already built. Secondly, encroaching into setbacks reduces light for growing food (sustainability issue); it is also depressing and intrusive to neighbors. And fundamentally setbacks should not be diluted/eliminated by encroachments - then why have them at all? Because people need some elbow room. Especially, most likely, in the areas that would experience an ADU rush, i.e., those with small lots already. I seriously doubt there will be an ADU rush in areas that have large lots with an abundance of elbow room.

Also, I oppose the request by the City to remove barriers to homeowners building Accessory Dwelling Units on their property – particularly to the removal of requirements related to the property owner occupying either the single-family dwelling unit or the Accessory Dwelling Unit as their principal residence.
I understand the purpose of eliminating this requirement is to allow a property owner to construct an Accessory Dwelling Unit on the same lot as a single-family dwelling unit and rent both units. Without the property owner on site, by virtue of them occupying one of the units as their principal residence, is a recipe for unacceptable change to neighborhoods by potentially increasing the proportion of short-term rentals. Neighborhoods and neighborhood character throughout the entire City is very important. Short-term rentals eat away at neighborhoods through increased light and noise pollution because of a party mentality by a lot of these

renters. Yes, there is a party ordinance; but once again, the burden is placed on neighbors to lodge a complaint. I do believe there should be rules in place regarding short-term rentals. Additionally, I do not think it's right to turn neighborhoods into commercial districts exacerbated by short-term rental monetary motivation.

Thank you,
Charlie Silver
Flagstaff

Updates to Zoning Code 2021 – Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

City's Request to Amend the Zoning Code Case PZ-21-00066

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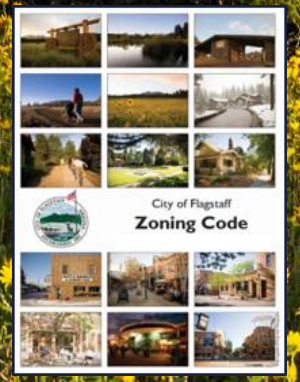
Dan Symer, AICP
Zoning Code Manager



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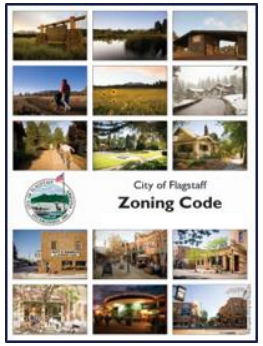
City's Proposed Zoning Code Text Amendment

Purpose:

Amend the Zoning Code to

- **Modify the existing Accessory Dwelling Unit provisions to address the location and height allowances for Attached, Detached, and Interior Accessory Dwelling Units**
- **Consolidate the accessory structure encroachments provision into one table**



Accessory Dwelling Units and Accessory Structure Encroachments Requirements

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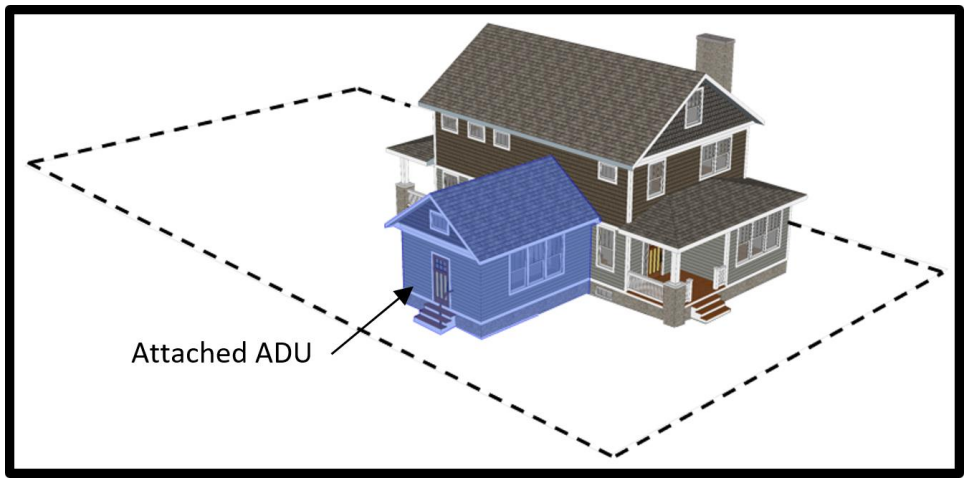
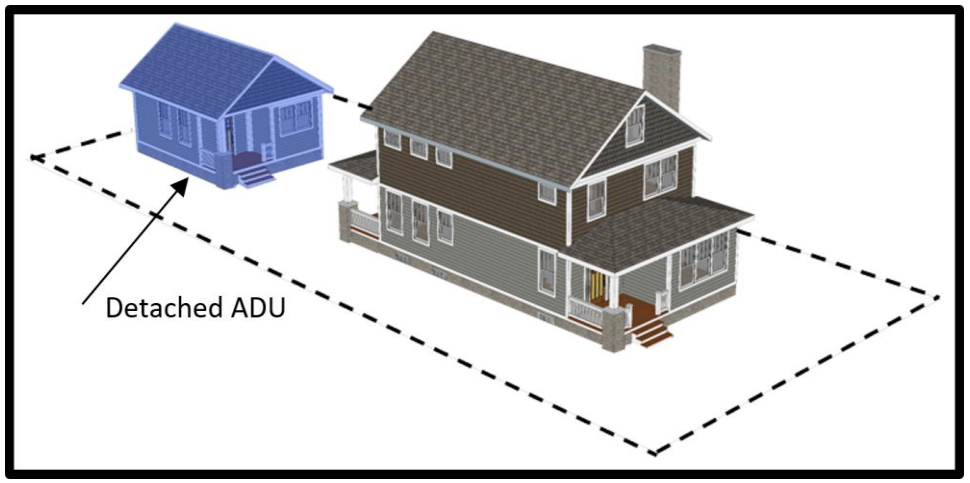
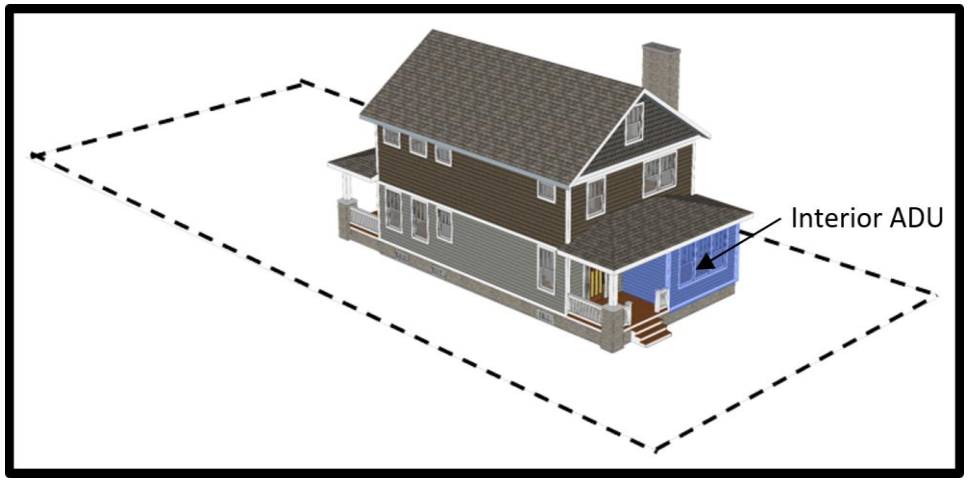
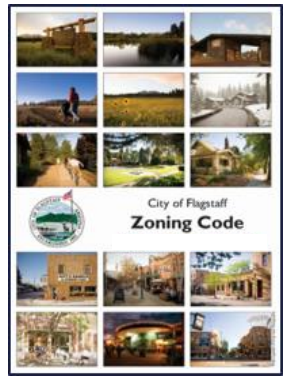
Types of Accessory Dwelling Units









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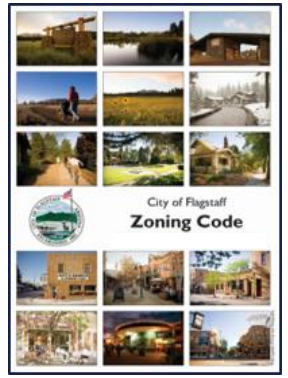
City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

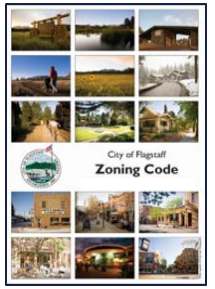
- **Detached Accessory Dwelling Units to encroach into the required interior and rear setback**
- **Proposed Allowance**
  - **Five foot setback from interior side property**
  - **Five foot setback from rear property line, except allow a zero foot setback adjacent to public or private alley**
  - **Sixteen foot building height allowance**
  - **Allow the first floor of a existing garages to be used in as Detached Accessory Dwelling Unit**



City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **A detached ~~garage~~ ACCESSORY STRUCTURE constructed prior to February 16, 2016 that is in the minimum setback(s) of subsection (5)(a)(i) of this Table or in the street side setback may be converted to an ADU or have an ADU ~~above the garage~~ as a second floor, provided that THERE IS no exterior additions or ~~an~~ increase in building height ~~is developed to accommodate the ADU~~ WITHIN THE MINIMUM SETBACK(S).**

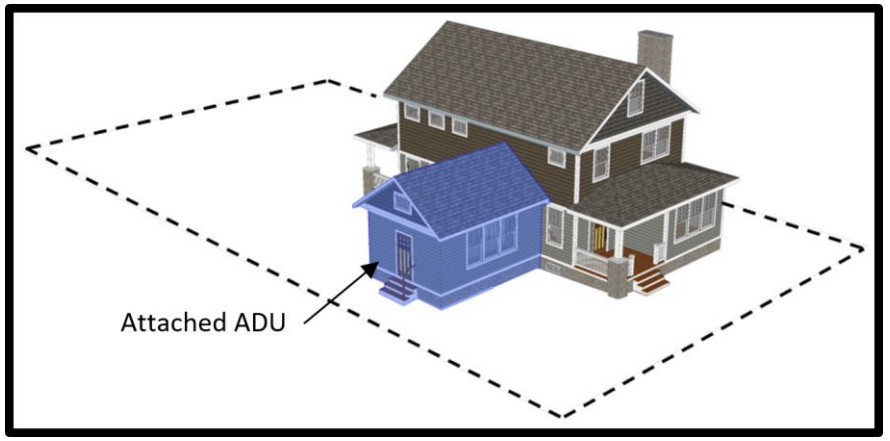


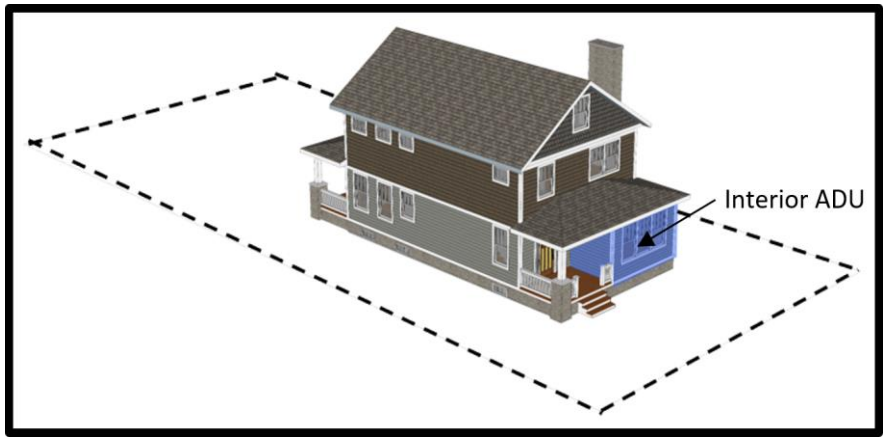
Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **Interior and Attached Accessory Dwelling Unit**
  - **Maintain the existing setback requirements**
  - **Proposed to allow Interior and Attached Accessory Dwelling Unit to be constructed to the height allowed by the property's zoning**



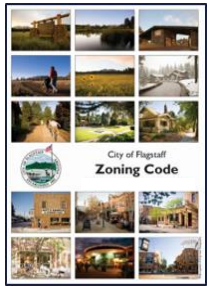


City's Proposed Zoning Code Text Amendment

Overview of Proposed Amendment:

- **Incentive the development of an Accessory Dwelling Unit by allowing the property owner to lease both the Accessory Dwelling Unit and the Single-Family Dwelling Unit if they agree to restrictive covenant or agreement prohibiting the units from being leased less than 30 days**

- **Consolidate the accessory structure encroachments provision into one table**



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Staff Recommendation

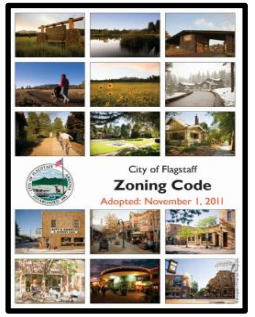
Findings for Zoning Code Text Amendments:

(1) The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;

(2) The proposed amendment will not be detrimental to the public interest, health, safety, convenience or welfare of the City; and

(3) The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.

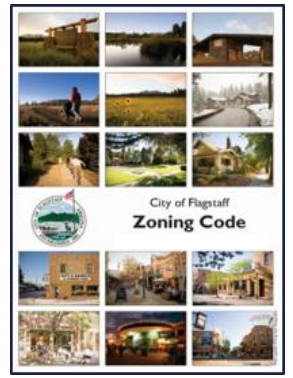
Planning and Zoning Commission and Staff recommends approval



Accessory Dwelling Unit and Accessory Structure Encroachments Requirements

TEAM FLAGSTAFF
WE MAKE THE CITY BETTER

Questions and Comments



10. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Dan Symer, Zoning Code Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-33 and Ordinance No. 2021-17: A Resolution of the City Council of the City of Flagstaff, Coconino County, Arizona, declaring as a public record that certain document filed with the City Clerk and entitled "Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial;" and, an Ordinance of the City Council of the City of Flagstaff, Coconino County, Arizona, amending the Flagstaff City Code, Title 10, Flagstaff Zoning Code, to modify the Zoning Code to include a new zone called Neighborhood Community Commercial (NCC).

STAFF RECOMMENDED ACTION:

At the June 15, 2021 Council Meeting:

1) Read Resolution No. 2021-33 by title only
2) City Clerk reads Resolution No. 2021-33 by title only (if approved above)
3) Read Ordinance No. 2021-17 by title only for the first time
4) City Clerk reads Ordinance No. 2021-17 by title only (if approved above)

At the July 6, 2021, Council Meeting:

5) Adopt Resolution No. 2021-33
6) Read Ordinance No. 2021-17 by title only for the final time
7) City Clerk reads Ordinance No. 2021-17 by title only (if approved above)
8) Adopt Ordinance No. 2021-17

Executive Summary:

The proposed amendment (Exhibit A to Resolution No. 2021-33) modifies the Zoning Code to create a new zone Neighborhood Community Commercial (NCC). This zone is to provide the City Council and property owners a zone to implement the High Occupancy Housing Specific Plan's implementation strategy (Strategies to be implemented by 2019, bullet 5, page 102) and the Southside Community Plan's policy (Policies SMS 1.2. and SLW 1.2.) to lower the building height in the Community Commercial (CC) zone in the North End and Sunnyside Neighborhoods, and in the Southside Main Streets and Live/Work Neighborhood areas from 60 feet to 45 feet. The proposed Neighborhood Community Commercial (NCC) is identical to the Community Commercial (CC) zone, except that the maximum building height is limited to 45 feet.

The Planning and Zoning Commission reviewed and provided a recommendation of approval at the May 26, 2021, Planning and Zoning Commission meeting.

Financial Impact:

There are no anticipated financial impacts affiliated with the proposed Zoning Code Text Amendment.

Policy Impact:

The proposed code amendment to create a new Neighborhood Community Commercial (NCC) zoning district implements policies and strategies adopted in the High Occupancy Housing Plan and the Southside Neighborhood Plan. Rather than change the permitted height in the existing Community Commercial zone, which would impact a much larger part of the community, the creation of the new district allows it to be requested by property owners. Staff will be completing additional public outreach to determine if there are areas recommended for city-initiated rezonings. However, the creation of the new NCC district does not rezone anyone's property.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

- Implement innovative local government programs, new ideas & best practices; be recognized as a model for others to follow.
- Achieve a well-maintained community through comprehensive & equitable code compliance, & development that, is compatible with community values.
- Enhance community involvement, education & regional partnerships to strengthen the level of public trust.

City Council Goals

- Revise the Zoning Code to remove ambiguities, and ensure it is consistent with community values and with the Regional Plan.

The proposed Zoning Code Text Amendment is intended to implement the public's input and the High Occupancy Housing Specific Plan's implementation strategy (Strategies to be implemented by 2019, bullet 5, page 102) and the Southside Community Plan's policy (Policies SMS 1.2. and SLW 1.2.) to lower the building height in the Community Commercial (CC) zone in the North End and Sunnyside Neighborhoods, and the Southside Main Streets and Live/Work Neighborhood areas from 60 feet to 45 feet. The current ordinance will create the new NCC district, but does not rezone anyone's property.

Regional Plan

Below is a list of the Goals and Policies that the proposed Zoning Code Text Amendment complies with.

Chapter IX - Growth Areas & Land Use

- Policy LU.2.2. Design new development to coordinate with existing and future development, in an effort to preserve viewsheds, strengthen connectivity, and establish compatible and mutually supportive land uses.
- Goal LU.3. Continue to enhance the region's unique sense of place within the urban, suburban, and rural context.
- Policy LU.3.1. Within the urban, suburban, and rural context, use neighborhoods, activity centers, corridors, public spaces, and connectivity as the structural framework for development.
- Policy LU.5.3. Promote compact development appropriate to and within the context of each area type: urban, suburban, and rural.
- Policy LU.10.3.Value the traditional neighborhoods established around downtown by maintaining and improving their highly walkable character, transit accessibility, diverse mix of land uses, and historic building form.
- Policy LU.10.5. Consider vacant and underutilized parcels within the City's existing urban neighborhoods as excellent locations for contextual redevelopment that adds housing, shopping, employment, entertainment, and recreational options for nearby residents and transit patrons.
- Policy LU.18.2. Strive for activity centers and corridors that are characterized by contextual and distinctive identities, derived from history, environmental features, a mix of uses, well-designed public spaces, parks, plazas, and high-quality design.

- Policy LU.18.9. Plan activity centers and corridors appropriate to their respective regional or neighborhood scale.
- Policy LU.19.2. Establish the context and regional or neighborhood scale of each corridor prior to design with special consideration for those intended to remain residential or natural in character.

Chapter XIII - Neighborhoods, Housing, & Urban Conservation

- Policy NH.1.2. Respect traditions, identifiable styles, proportions, streetscapes, relationships between buildings, yards, and roadways; and use historically appropriate and compatible building and structural materials when making changes to existing neighborhoods, especially in historic neighborhoods.
- Policy NH.1.8. Prioritize the stabilization of a neighborhood's identity and maintain cultural diversity as new development occurs.
- Goal NH.6. Neighborhood conservation efforts of revitalization, redevelopment, and infill are compatible with and enhance our overall community character.
- Policy NH.6.1. Promote quality redevelopment and infill projects that are contextual with surrounding neighborhoods. When planning for redevelopment, the needs of existing residents should be addressed as early as possible in the development process.

Staff's analysis of the Regional Plan's goals and policies is included below under the Zoning Code Text Amendment Criteria heading, Finding #1 of the report. In addition, the staff's narrative and Regional Plan and Specific Plan analysis are included as Attachment 2.

Has There Been Previous Council Decision on This:

There has not been a previous City Council decision on this ordinance.

Options and Alternatives:

1. Approve the amendment with no changes;
2. Approve the amendment with modifications; or
3. Deny the amendment.

Proposed Amendment:

The proposed amendment (Exhibit A to the Resolution No. 2021-33) incorporates a new zone called Neighborhood Community Commercial (NCC). The Neighborhood Community Commercial (NCC) zone is identical to the Community Commercial (CC), except that the allowed building height is 45 feet.

The primary purpose of the Neighborhood Community Commercial (NCC) zone is to provide the City Council and property owners a zone to implement the High Occupancy Housing Specific Plan's implementation strategy (Strategies to be implemented by 2019, bullet 5, page 102) and the Southside Community Plan's policy (Policies SMS 1.2. and SLW 1.2.) to lower the building height in the Community Commercial (CC) zone in the North End and Sunnyside Neighborhoods, and the Southside Main Streets and Live/Work Neighborhood areas from 60 feet to 45 feet. Since the Neighborhood Community Commercial (NCC) zone would be a new zone, it will allow the City Council the flexibility to determine which areas of Flagstaff with the Community Commercial (CC) zone should maintain the currently allowed maximum building height of 60 feet, such as certain properties adjacent to commercial corridor streets, and which areas should have a maximum building height of 45 feet.

It should be noted that no property will be rezoned to the Neighborhood Community Commercial (NCC) with this application.

Zoning Code Text Amendment

The Planning Director shall provide a recommendation to the Planning and Zoning Commission for its review. The Director's recommendation shall be transmitted to the Planning and Zoning Commission in the form of a staff report prior to a scheduled public hearing. The recommendation shall include the following: an evaluation of the consistency and conformance of the proposed amendment with the goals

and policies of the General Plan and any applicable specific plans; the grounds for the recommendation based on the standards and purposes of the zones set forth in Division 10-40.20 (Establishment of Zones) of the Zoning Code; and a recommendation on whether the amendment should be granted or denied.

A Zoning Code Text Amendment shall be evaluated based on the following findings:

A. Finding #1:
The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;

The amendment's primary purpose is to implement the High Occupancy Housing Specific Plan and the Southside Community Plan to limit the allowed building height to 45 feet on properties currently zoned Community Commercial (CC) and in the Southside Main Streets and Live/Work Neighborhood areas of the Southside in accordance with the strategy and policies referenced in Section I of this report. Furthermore, the adoption of the amendment would address multiple goals and policies of the Regional Plan and related specific plans. Staff's narrative and comprehensive Regional Plan and Specific Plan conformance analysis is included as Exhibit A to Resolution No. 2021-33. A summary of the goals and policies that the proposed Zoning Code Text Amendment is consistent and conforms with include:

- Providing a building height of 45 feet that is compatible with the older and historic neighborhoods and building forms, consistent with traditional development patterns of the "Historic" activity centers, assists in mitigating new development impacts on heritage resources, promotes compact development appropriate to the neighborhood framework and scale, and preserves viewsheds (Goals CC.3., LU.3., NH.6., S 2., and S 4. and Policies CC.2.3., CC.2.7., CC.2.8, CC.3.1., CC.3.2., LU.2.2., LU3.1, LU5.3, LU 10.3, LU18.9, LU19.2., N.H.1.2., NH.1.8., NH.6.1., HOH.1.2., HOH.2.1., S 2.4., SMS 1.2., and SLW 1.2.); and
- Providing a mix of residential and non-residential land uses that are compatible, mutually supportive, and assist in promoting a walkable environment that is derived from traditional and historic land use patterns that contribute to the overall community character (Goal LU.3., NH.6., and S 4. and Policies LU.2.2. LU.10.3., LU.10.5., and LU.18.2).

B. Finding #2
The proposed amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City;

The provisions of the amendment are not anticipated to be detrimental to the public interest, health, safety, convenience, or welfare of the city. With the exception of the allowed building height, the proposed Neighborhood Community Commercial (NCC) zone is identical to the existing Community Commercial (CC) zone. The allowed building height in the proposed zone is 45 feet. The purpose of the 45-foot building height of the proposed Neighborhood Community Commercial (NCC) zone is to implement the public's interest identified in the High Occupancy Housing Specific Plan and the Southside Community Plan's goals, policies, and strategies.

C. Finding #3
The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.

The amendment is internally consistent, utilizes the existing format, and does not conflict with other Zoning Code provisions. It maintains the Zoning Code's purpose as a comprehensive contemporary set of land uses and requirements that are straightforward, usable, and easily understood.

Citizen Participation
Public outreach was conducted in August 2019 as it pertains to modifying the Community Commercial (CC) zone building height from 60 feet to 45 feet, and additional public outreach was conducted in July

2020 pertaining to the proposed Neighborhood Community Commercial (NCC) zone. Over 210 people, including emails, letters, meetings, and visits to the Flagstaff Community Forum topic web page, have participated. The public comments on the Community Forum web page were split up by general public comments and property owner comments. In summary, approximately 83% of the general public that responded to the Community Forum topic supported the 45-foot building height. If the proposed Neighborhood Community Commercial (NCC) zone is adopted, it will allow the City Council and property owners to rezone areas of the North End, Southside, and Sunnyside neighborhoods to the proposed zone.

At the May 26, 2021 Planning and Zoning Commission meeting, a member of the public expressed opposition to proposed amendment since it has a lower building height (45-feet). An additional detailed summary of the public outreach and separate email messages received are included in Attachment 3.

Planning and Zoning Commission Work Session
On August 12, 2020, the Planning and Zoning Commission reviewed the proposed Neighborhood Community Commercial (NCC) zone and supported its creation. At the time, the Commission had general questions and comments regarding the locations where the proposed zone could be implemented.

City Council Work Session
At the City Council Work Session of August 25, 2020, the City Council reviewed the proposed Neighborhood Community Commercial (NCC) zone and requested staff conduct additional public outreach as it pertains to the locations that the zone would be applied. On April 27, 2021, the City Council reviewed and supported creating the Neighborhood Community Commercial (NCC) zone and the methodology to conduct a neighborhood-by-neighborhood public outreach strategy after the zone's adoption to determine the locations and support to rezone areas of the North End, Southside, and Sunnyside neighborhoods to the proposed zone. At the April 27, 2021 City Council meeting, a member of the public expressed opposition to proposed amendment since it has a lower building height (45-feet). An additional detailed summary of the public outreach and separate email messages received are included in Attachment 3.

Planning and Zoning Commission Hearing
On May 26, 2021, the Planning and Zoning Commission reviewed the application and had general questions. A summary of the questions specific to the proposed Zoning Code Text Amendment include:

- Is the proposed amendment just adding a new zone to the Zoning Code, or does it include the rezoning of the property at this time?
  - *The amendment is only to create the new Neighborhood Community Commercial (NCC) zone. No property's existing zoning will be affected by the adoption of the proposed Zoning Code Text Amendment to add Neighborhood Community Commercial (NCC) zone.*
- Will the comments received pertaining to the rezoning of the properties to the Neighborhood Community Commercial (NCC) zone be carried over to future discussions to amend the Zoning Map to incorporate the zone?
  - *Yes. The comment's received regarding property rezoning will be carried over.*
- *What is the process to implement the* Neighborhood Community Commercial (NCC) zone?
  - *After the Zoning Code has been adopted and effective, additional public outreach will be conducted regarding the possible rezoning of property. The findings of the public outreach will be presented to the City Council for direction as they pertain to a potential City initiated rezoning application.*

Two public comments were received in opposition of the proposed Zoning Code Text Amendment. The Planning and Zoning Commission unanimously recommended approval of the proposed Zoning Code Text Amendment (Motioned by Commissioner Jones, and seconded by Commissioner Paul).

Attachments: Res. 2021-XX
Exhibit A to Res. 2021-33
ORD2021-17
2. Narrative and Regional Plan Conformance Analysis
3. Public Comments
Staff Presentation

RESOLUTION NO. 2021-XX

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT FILED WITH THE CITY CLERK AND ENTITLED "CASE NO. PZ-19-00123 UPDATES TO ZONING CODE 2019 – NEIGHBORHOOD COMMUNITY COMMERCIAL (NCC)"

RECITALS:

WHEREAS, pursuant to A.R.S. § 9-802 a municipality may enact or amend provisions of the City Code by reference to a public record, provided that the adopting ordinance is published in full;

WHEREAS, the City of Flagstaff wishes to incorporate by reference amendments to the Flagstaff Zoning Code, Ordinance No. 2021-17, by first declaring said amendments to be a public record.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General.

That certain document known as *"Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)"* attached hereto as Exhibit A is hereby declared to be a public record, and one (1) paper copy and one (1) electronic copy shall remain on file with the City Clerk in compliance with A.R.S. § 44-7041, and said copies shall remain on file with the City Clerk.

SECTION 2. Effective Date.

This resolution shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____

CITY ATTORNEY

Exhibits:

A. Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)

Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)

Amendment for Adoption in Flagstaff Zoning Code

HOW TO READ THIS DOCUMENT

Unless otherwise stated, provisions that are being deleted are shown in bold red strikethrough text, like this: ~~**Provisions that are being deleted are shown with a bold red strikethrough text.**~~

Provisions that are being added are shown in bold blue text, like this: **Provisions that are being added are shown in bold blue text.**

Section 1. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.20: Establishment and Designation of Zones, Section 10-40.20.020 Zones, Table 10-40.20.020.A: Zones, to add Neighborhood Community Commercial (NCC), as follows – including the format of the table:

Table 10-40.20.020.A: Zones	
Zone Symbol	**Name of Zone**
Non-Transect Zones	
Residential Zones	
RR	Rural Residential
ER	Estate Residential
R1	Single-Family Residential
R1N	Single-Family Residential Neighborhood
MR	Medium Density Residential
HR	High Density Residential
MH	Manufactured Housing
Commercial Zones	
SC	Suburban Commercial
CC	Community Commercial
NCC	**Neighborhood Community Commercial**
HC	Highway Commercial
CS	Community Service
CB	Central Business
Industrial Zones	
RD	Research and Development

Table 10-40.20.020.A: Zones	
Zone Symbol	**Name of Zone**
LI	Light Industrial
LI-O	Light Industrial Open
HI	Heavy Industrial
HI-O	Heavy Industrial Open
Resource and Open Space Zones	
PF	Public Facility
PLF	Public Lands Forest
POS	Public Open Space
Transect Zones	
T1	T1 Natural
T2	T2 Rural
T3N.1	T3 Neighborhood 1
T3N.2	T3 Neighborhood 2
T4N.1	T4 Neighborhood 1
T4N.2	T4 Neighborhood 2
T5	T5 Main Street
T6	T6 Downtown
TND	Traditional Neighborhood District
Overlay Zones	
AO	Airport Overlay
DO	Downtown Overlay
LO	Landmark Overlay
TO	Townsite Overlay
RPO	Resource Protection Overlay

Section 2. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30: Non-Transect Zones, Section 10-40.30.040 Commercial Zones, to add Neighborhood Community Commercial (NCC) zone, and format Table 10-40.30.040.B., as follows:

10-40.30.040 Commercial Zones

A. **Intent.**

1. **SC.** The Suburban Commercial (SC) zone applies in areas with suburban character that are appropriate for neighborhood commercial uses. This zone allows retail and service establishments that supply commodities or perform services meeting the needs of adjacent residential neighborhoods. The SC zone encourages the orderly development of dispersed commercial areas and diverse housing choices. The standards of this zone ensure that such commercial zones will be compatible with adjacent, noncommercial development and will minimize the undesirable effects of heavy traffic, type of activity, and site development requirements.

2. **CC.** The Community Commercial (CC) zone applies to areas of the City appropriate for dispersed commercial areas designed to serve communitywide needs. Such areas provide a wide variety of goods and services in predominately established, built up areas and must be consistent with the overall development of the City and its environs. The development of residential uses in addition to commercial uses is also encouraged in this zone to provide diversity in housing choices. The provisions of this zone are intended to ensure that such commerce will be compatible with adjacent, noncommercial development and to minimize the undesirable effects of heavy traffic, commercial activity, and site requirements.

3. NCC. The Neighborhood Community Commercial (NCC) zone applies to pre-World War II urban areas, intense suburban areas, and new neighborhood-scale activity centers and urban neighborhoods of the City, which are appropriate for a mixed composition of live/work opportunities in a walkable neighborhood environment. The property development standards of this zone provide for a variety of densities and intensities in varying scales, while maintaining a building height that is compatible to older and historic structures within the City. The uses of this zone provide for a diversity of housing options and commercial opportunities that serve the neighborhood and the larger community. The specific provisions of the zone are intended to achieve a neighborhood of moderate sized compatible uses, while minimizing the undesirable effects of more intense commercial activities, large-scale high occupancy housing, and heavy traffic.

~~3.~~ **4. HC.** The Highway Commercial (HC) zone applies to areas of the City appropriate for a full range of automobile-oriented services. The development of commercial uses in addition to residential uses is encouraged in the HC zone to provide diversity in housing choices; provided, that residential uses are located above or behind commercial buildings so that they are buffered from adjoining highway corridors. The provisions of this zone are also intended to provide for convenient, controlled access and parking, without increasing traffic burdens upon the adjacent streets and highways. This zone is designated primarily at the commercial corridors of the City, with the intention of making the City more attractive as a tourist destination while providing needed commercial activity.

~~4.~~ 5. **CS.** The Commercial Service (CS) zone applies to areas of the City appropriate for those service industries and support activities necessary to maintain viable commercial retail trade centers. The development of residential uses in addition to commercial uses is encouraged in this zone; provided, that residential uses are located above or behind the primary commercial service use.

~~5.~~ 6. **CB.** The Central Business (CB) zone applies to the central core area which is appropriate for accommodating retail commercial, personal services, and governmental, business, financial, professional, and general offices. The uses in this area require a central location accessible to all routes entering the City and grouped so that the shopper or user can park once and visit a number of stores and offices on foot. The development of residential uses in addition to commercial uses is encouraged in this zone; provided, that residential uses are located on the second story or above or behind on the first floor.

B. **Commercial Zones – Allowed Uses.** The allowed land uses of each of the Commercial zones are shown in Table 10-40.30.040.B., as follows – including the format of the table:

Table 10-40.30.040.B.
Commercial Zones – Allowed Uses

Primary Land Use[1]	Specific Use Regulations	Commercial Zones					
		SC	CC	NCC	HC	CS	CB
Industrial, Manufacturing, Processing and Wholesaling							
Carpenter or Cabinet Shops		--	--	--	--	P	-
Flammable Liquid, Gas, and Bulk Fuel – Storage and Sale		--	--	--	UP	--	
Machine or Metal Working Shops		--	--	--	--	P	--
Manufacturing and Processing – Incidental		--	P	P	P	P	P
Micro-brewery or Micro-distillery	10-40.60.240	--	P	P	P	P	P
Mini-storage Warehousing	10-40.60.250	--	--	--	UP[2]	P	--
Research and Development Uses	10-40.60.300	--	--	--	UP	--	--
Transportation or Trucking Yards		--	--	--	--	P	--
Vehicle Towing/Impound Yard		--	--	--	P[4]	--	--
Warehousing		--	P[3]	P[3]	P[3]	--	P[3]
Wholesaling and Distribution		--	--	--	--	P	P[3]

Table 10-40.30.040.B. Commercial Zones – Allowed Uses							
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**					
		SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Recreation, Education and Assembly							
Automobile, Go-kart, Miniature Automobile Racing	10-40.60.080	--	UP	**UP**	UP	--	--
Commercial Campgrounds	10-40.60.130	--	--	**--**	P	--	--
Commercial Recreation Facilities, Indoor		P	P	**P**	P	--	P
Commercial Recreation Facilities, Outdoor	10-40.60.270	--	UP	**UP**	UP	--	--
Libraries, Museums		P	P	**P**	P	P	P
Meeting Facilities, Public or Private	10-40.60.230						
Regional		--	P/UP[5]	**P/UP[5]**	P/UP[5]	P/UP[5]	P/UP[5]
Neighborhood		P[5]	P/UP[5]	**P/UP[5]**	--	--	--
Outdoor Public Uses, General		P	P	**P**	P	--	--
Places of Worship		P/UP[10]	P/UP[10]	**P/UP[10]**	P/UP[10]	P/UP[10]	P/UP[10]
Schools – Public and Charter		P	P	**P**	P	P	P
Schools – Private		P	P	**P**	P	P	P
Theaters		P	P	**P**	P	--	P
Trade Schools		--	UP	**UP**	UP	UP	UP
Residential[7]							
Co-housing	10-40.60.120	P[6]	P[6]	**P[6]**	P[6]	P[6]	P[6]
Congregate Care Facilities		UP	P	**P**	P	P	UP
Day Care, Centers	10-40.60.150.B	P	P	**P**	P	UP	UP
Day Care, Home	10-40.60.150.A	P	P	**P**	P	P	P
Development, Duplex		P[6]	P[6,9]	**P[6,9]**	P[6]	P[6]	P[6]
Development, Multiple-Family		P[6]	P[6]	**P[6]**	P[6]	P[6]	P[6]
Development, Single-Family		--	P[9]	**P[9]**	--	--	--

Table 10-40.30.040.B. Commercial Zones – Allowed Uses								
Primary Land Use[1]		**Specific Use Regulations**	**Commercial Zones**					
			SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Dormitories			UP[6]	UP[6]	**UP[6]**	UP[6]	UP[6]	UP[6]
Fraternities and Sororities			UP[6]	UP[6]	**UP[6]**	UP[6]	UP[6]	UP[6]
Group Homes			P[6]	P[6]	**P[6]**	P[6]	P[6]	P[6]
High Occupancy Housing Development, Single-Family		10-40.60.175	--	UP	**UP**	--	--	--
High Occupancy Housing Development, Two-units		10-40.60.175	UP[6]	UP[6]	**UP[6]**	UP[6]	UP[6]	UP[6]
High Occupancy Housing Development, Three-units		10-40.60.175	UP[6]	UP[6]	**UP[6]**	UP[6]	UP[6]	UP[6]
High Occupancy Housing Development, Four-units and Greater		10-40.60.175	UP[6]	UP[6]	**UP[6]**	UP[6]	UP[6]	UP[6]
Home Occupation		10-40.60.180	P[6]	P[6]	**P[6]**	P[6]	P[6]	P[6]
Institutional Residential								
	Custodial Care Facilities		P[8]	P[8]	P[8]	P[8]	P[8]	P[8]
	Homeless Shelters	~~10-40.60.190~~						
	Emergency Shelters	**10-40.60.190**	P[8]	P[8]	P[8]	P[8]	P[8]	P[8]
	Short Term Housing		P[8]	P[8]	P[8]	P[8]	P[8]	P[8]
	Transitional Housing		P	P	P	P	P	P
	Sheltered Care Homes		P	P	**P**	P	P	P
	Nursing Homes		UP	UP	UP	UP	UP	UP
Live/Work		10-40.60.200	P	P	**P**	P	P	P
Planned Residential Development		10-40.60.280	P/UP	P/UP[9]	**P/UP[9]**	UP	UP	UP
Residence for Owner, Caretaker or Manager			P[6]	P[6]	**P[6]**	P[6]	P[6]	P[6]
Single Room Occupancy			UP	--	**--**	P	--	P

Table 10-40.30.040.B. Commercial Zones – Allowed Uses							
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**					
		SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Retail Trade							
Bars/Taverns		P	P	**P**	P	P	P
Crematorium		P	P	**P**	P	P	--
Drive-through Retail	10-40.60.160	P	P	**P**	P	--	--
Drive-through Service		P	P	**P**	P	--	--
Farmers Markets and Flea Markets		--	P	**P**	P	P	P
General Retail Business		P	P	**P**	P	P	P
Mixed Use	10-40.60.260	P	P	**P**	P	P	P
Mixed-Use High Occupancy Housing Development	10-40.60.175 and 10-40.60.260	UP	UP	**UP**	UP	UP	UP
Restaurant or Cafe		P	P	**P**	P	P	P
Services							
Bed and Breakfast Establishments	10-40.60.110	P	P	**P**	P	P	P
Cemeteries		UP	UP	**UP**	UP	UP	--
Dry-cleaning, Processing		P	P	**P**	P	--	--
Equipment Rental Yard		--	UP	**UP**	P	P	--
Funeral Homes, Chapels and Mortuaries		--	P	**P**	P	--	UP
General Services		P	P	**P**	P	P	P
Hospital		UP	UP	**UP**	UP	UP	UP
Kennel, Animal Boarding	10-40.60.195	--	--	**--**	UP[11]	--	--
Medical Marijuana Dispensary	10-40.60.220	--	--	**--**	P	--	--
Office		P	P	**P**	P	P	P
Public Services							
Public Services Major		--	--	**--**	--	--	--
Public Services Minor		P	P	**P**	P	P	P
Emergency Services		UP	UP	**UP**	UP	UP	UP

Table 10-40.30.040.B. Commercial Zones – Allowed Uses							
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**					
		SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Travel Accommodations		UP	--	--	P	--	P
Veterinary Clinics		P	P	P	P	P	--
Veterinary Hospitals		--	--	--	UP	UP	--
Telecommunication Facilities							
AM Broadcasting Facilities	10-40.60.310	UP	UP	UP	UP	UP	UP
Antenna-Supporting Structure	10-40.60.310	UP	UP	UP	UP	UP	UP
Attached Telecommunication Facilities	10-40.60.310	P	P	P	P	P	P
Collocation Facility	10-40.60.310	P	P	P	P	P	P
FM/DTV/Low Wattage AM Broadcasting Facilities	10-40.60.310	P	P	P	P	P	P
Stealth Telecommunication Facilities	10-40.60.310	P	P	P	P	P	P
Transportation and Infrastructure							
Accessory Wind Energy Systems	10-40.60.040	P	P	P	P	P	P
Garages, Off-Street		P	P	P	P	P	P
Parking Lots, Off-Street	10-50.80	P	P	P	P	P	P
Passenger Transportation Facilities		--	--	--	UP	UP	UP
Urban Agriculture							
Community Gardens	10-40.60.140	P	P	P	P	P	P
Food Production		--	--	--	UP[2]	UP[2]	--
Vehicle Sales and Services							
Automobile Service Station and Convenience Store	10-40.60.090	P	P	P	P	P	--
Automobile and Trailer Rental		--	--	--	P	P	--

Table 10-40.30.040.B. Commercial Zones – Allowed Uses							
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**					
		SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Automobile/Vehicle Sales and Service, New and Used		--	UP	**UP**	P	P	UP
Automobile/Vehicle Repair Garages – Major	10-40.60.100	--	--	**--**	P	P	--
Automobile/Vehicle Repair Garages – Minor	10-40.60.100	--	UP	**UP**	P	P	--
Car Washes		P	P	**P**	P	--	--
Mobile Homes and Recreational Vehicles, Sales, and Service		--	--	**--**	P	--	--
End Notes							
1. A definition of each listed use type is in Chapter 10-80, Definitions.							
2. Only allowed on lots that do not have highway frontage or behind existing/new commercial uses.							
3. Only permitted when incidental to permitted use.							
4. This use shall be screened. See Division 10-50.50, Fences and Screening, for fencing and screening requirements.							
5. A conditional use permit is required if liquor is sold or if facilities exceed 250 seats.							
6. Residential uses with more than two units are allowed as part of a mixed-use development located above or behind the commercial uses, or as a planned residential development.							
7. Residential uses in the CC, HC, CS and CB zones, and residential uses and properties listed on the National Historic Registry or within the Landmarks overlay zone existing prior to the effective date of this Zoning Code are considered legal, nonconforming uses. Residential uses in the CC, HC, CS and CB zones shall be subject to the development standards established in the HR zone.							
8. Conditional use permit is required if proximity between shelter facilities is less than one-quarter mile.							
9. Single-family and duplex land uses are permitted by right on lots ≤9,000 sf and existing prior to November 1, 2011, subject to the building placement and building form requirements of the MR zone.							
10. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.							
11. Outdoor kenneling of animals is prohibited.							
Key							
P = Permitted Use							
UP = Conditional Use Permit Required							

Table 10-40.30.040.B. Commercial Zones – Allowed Uses							
Primary Land Use[1]	**Specific Use Regulations**	**Commercial Zones**					
		SC	**CC**	**NCC**	**HC**	**CS**	**CB**
-- = Use Not Allowed							

C. **Commercial Zones – Building Form and Property Development Standards.** The building form and property development standards shown in Table 10-40.30.040.C. shall apply to all property with the corresponding commercial zones.

Table 10-40.30.040.C. Commercial Zones – Building Form and Property Development Standards						
		Commercial Zones				
	SC	**CC**	**NCC**	**HC**	**CS**	**CB**
Building Placement Requirements						
Setback from property line						
Front (Also see Section 10-50.60.040.B)	15'[1]	0'	**0'**	0'[2]	0'	0'
Side						
Adjacent to Residential Use		---------- 15' min.[6] ----------				
Street Side (min.)	10'[3]	10'[3]	**10'[3]**	10'[3]	10'[3]	0'
All Other Sides		---------- 0' ----------				
Rear						
Adjacent to Residential		---------- 15' min. ----------				
All Other Rears		---------- 0' ----------				
Building Form Requirements						
Building Height (max.)[8, 9, 10]	35'	60'[4, 7]	**45' [7, 14]**	60'[4]	60'[4]	60'[4]
Gross FAR (max.)	0.8	2.5	**2.5**	3.0	2.0	No max.
Density Requirements						
Gross Density (units/acre)						
Maximum without the Resource Protection Overlay (RPO)	13[11]	---------- 29[11] ----------				
Maximum with the RPO, inside of a pedestrian	13[11]	---------- 29[11] ----------				

Table 10-40.30.040.C. Commercial Zones – Building Form and Property Development Standards							
		Commercial Zones					
	SC	CC	NCC	HC	CS	CB
shed of an activity center[13]						
Maximum with the RPO, outside of a pedestrian shed of an activity center[13]	13[11]	---------- 22[11]----------				
Maximum Bedroom Requirements						
Bedrooms per Acre on a Development Site with Four Dwelling Units or More						
Maximum without the RPO for a development	35[12]	---------- 72.5[12]----------				
Maximum with the RPO inside of a pedestrian shed of an activity center[13]	35[12]	---------- 72.5[12]----------				
Maximum with the RPO outside of a pedestrian shed of an activity center[13]	35[12]	---------- 55[12]----------				
Lot Requirements						
Area (Gross sf) (min.)[5]	6,000	9,000	**9,000**	9,000	9,000	7,000
Width (min.)[5]	50'	60'	**60'**	60'	60'	50'
Depth (min.)[5]	100'	100'	**100'**	100'	100'	--
Open Space						
Developments with Two or More Dwelling Units	---------- 15 percent of the net lot area ----------					
Other Requirements						
Fences and Screening	See Division 10-50.50					
Landscaping	See Division 10-50.60					
Outdoor Lighting	See Division 10-50.70					
Parking	See Division 10-50.80					
Signs	See Division 10-50.100					
End Notes						
1. Front setbacks shall be equal to 15' or match adjacent residential development, whichever is less.						

Table 10-40.30.040.C. Commercial Zones – Building Form and Property Development Standards						
		Commercial Zones				
	SC	CC	NCC	HC	CS	CB
2. No front setback required, except when required by the adoption of building setback lines along specified streets.						
3. Setback may be reduced to 5' min., if the landscape street buffer is reduced in accordance with Section 10-50.60.040(B), Nonresidential Zone Buffers.						
4. Conditional use permit required for structures over 60' in height.						
5. Within a planned residential development, the minimum area, width, and depth of a lot may vary based on the minimum lot standards applicable to the building types selected for application within a planned residential development (see Section 10-40.60.280, Planned Residential Development).						
6. Except that the setback from a proposed residential use in a commercial zone to other residential uses shall be 5' min.						
7. Single-family dwellings and duplexes in the CC **and NCC** ~~**zone**~~ **zones** shall be limited to a maximum height of 35 feet consistent with the height standard for the MR zone.						
8. Primary structures, excluding accessory structures, with a roof pitch greater than, or equal to, 6:12 shall be allowed an additional five feet above the maximum building height.						
9. The elevator and stairwell bulkheads shall be architecturally integrated with the building. Elevator and stairwells bulkheads are allowed an additional 15 feet above the maximum building height. The Director may approve a height greater than 15 feet when the additional height is necessary to accommodate an elevator or stairwell bulkhead, related equipment, or the requirements of the Building or Fire Code.						
10. Steeples, solar collectors, towers and other unoccupied architectural features are allowed an additional height above the maximum building height equal to 20 percent multiplied by the maximum building height allowed for property's zone. The total area of the referenced allowances above the building height shall not exceed 20 percent of the total roof area.						
11. Additional density may be approved with an HOHD or MHOHD Conditional Use Permit.						
12. Additional bedrooms per acre may be approved with an HOHD or MHOHD Conditional Use Permit.						
13. Activity centers are delineated on the General Plan or applicable Specific Plan.						
14. Conditional Use Permit required for structures over 45' in height.						

D. **Miscellaneous Requirements – All Commercial Zones.**

1. In accordance with Chapter 11-20, Subdivision and Land Split Regulations, and Title 13, Engineering Design Standards and Specifications for New Infrastructure, of the City Code, all land subdivided into lots or parcels shall abut a public right-of-way or private street tract, and have water and sewer infrastructure service.

2. All products incidental to a permitted use which are manufactured or processed on the premises shall be sold on the premises and at retail only, and shall be further limited as follows:

    a. In the CC and CB zones, such activity shall be restricted to not over 25 percent of ground floor area of the building or buildings.

    b. In the CS zone, such activity shall be restricted to not over 50 percent of ground floor area of the building or buildings.

    c. In the CC and CB zones, not more than five employees shall be engaged in such activity.

    d. In the CS zone, not more than 10 employees shall be engaged in such activity.

3. Every development in the commercial zones shall have a refuse storage area constructed and provided in accordance with City standards.

4. Temporary uses shall be permitted in compliance with Section 10-20.40.150, Temporary Use Permits.

5. **Accessory Uses.**

    a. An Accessory Dwelling Unit (ADU) use is allowed in commercial zones on a lot containing a single-family dwelling unit as the primary use.

    b. All other accessory uses are allowed in accordance with Section 10-40.60.025.

6. **Accessory Structures.**

    a. An Accessory Dwelling Unit (ADU) structure that complies with Section 10-40.60.030 is allowed in Community Commercial (CC) and **Neighborhood Community Commercial (NCC)** ~~**zone**~~ **zones** on a lot containing a detached single-family dwelling.

    b. All other accessory structures are allowed in accordance with Section 10-40.60.020.

ORDINANCE NO. 2021-17

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF FLAGSTAFF, AMENDING THE FLAGSTAFF CITY CODE, TITLE 10, FLAGSTAFF ZONING CODE, BY ADOPTING BY REFERENCE THAT CERTAIN DOCUMENT ENTITLED "CASE NO. PZ-19-00123 UPDATES TO ZONING CODE 2019 – NEIGHBORHOOD COMMUNITY COMMERCIAL (NCC)"; PROVIDING FOR PENALTIES, REPEAL OF CONFLICTING ORDINANCES, SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

RECITALS:

WHEREAS, the City of Flagstaff wishes to amend Title 10 Flagstaff Zoning Code of the Flagstaff City Code, to incorporate a new zone called the "Neighborhood Community Commercial (NCC)" zone into the Flagstaff Zoning Code regulations; and

WHEREAS, a citizen review session was held at the Planning and Zoning Commission work session on August 12, 2020, to discuss the proposed Zoning Code text amendment in accordance with Section 10-20.50.040 of the Flagstaff Zoning Code; and

WHEREAS, the Planning and Zoning Commission held public hearing on May 26, 2021, and provided a recommendation to City Council on proposed Zoning Code text amendment; and

WHEREAS, the City Council has read and considered the staff report prepared by the Planning and Development Services section of the Community Development division and all attachments to those reports, and the City Council finds that the proposed Zoning Code text amendment is in conformance with the General Plan, and the findings of Section 10- 20.50.040 of the Flagstaff Zoning Code have been met; and

WHEREAS, that certain document known as *"Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)"*, one (1) paper copy and one (1) electronic copy of which are on file with the City Clerk in compliance with A.R.S. § 44-7041, was declared to be a public record by Resolution No. 2021-33.

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. The foregoing recitals are incorporated as if fully set forth herein.

SECTION 2. That certain document known as "*Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)*", one(1) paper copy and (1) electronic copy are on file in the office of the City Clerk of the City of Flagstaff, Arizona, which document is declared a public record by Resolution No. 2021-33 of the City of Flagstaff, Arizona, is hereby referred to, adopted and made a part hereof as if fully set out in this ordinance and its provisions are hereby declared to amend the Flagstaff City Code, replacing and superseding the existing relevant provisions of the City Code, as set forth therein.

SECTION 3. The amendment is consistent with and conforms to the goals of the Regional Plan (General Plan).

SECTION 4. The amendment will not be detrimental to the public interest, health, safety, convenience, or welfare of the City, and will add to the public good as described in the General Plan.

SECTION 5. The amendment is internally consistent with other applicable provisions of this Zoning Code.

SECTION 6. Repeal of Conflicting Ordinances

All ordinances and parts of ordinances in conflict with the provisions of the code adopted herein are hereby repealed.

SECTION 7. Severability

If any section, subsection, sentence, clause, phrase or portion of this ordinance or any part of the code adopted herein by reference is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 8. Clerical Corrections

The City Clerk is hereby authorized to correct clerical and grammatical errors, if any, related to this ordinance, and to make formatting changes appropriate for purposes of clarity, form, or consistency with the Flagstaff City Code.

SECTION 9. Effective Date

This Ordinance shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Case No. PZ-19-00123 Updates to Zoning Code 2019 – Neighborhood Community Commercial (NCC)

Narrative and Regional Plan and Specific Plan Conformance Analysis

Narrative

The proposed amendment is to create a new zone called the Neighborhood Community Commercial (NCC) zone. This new zone will be identical to the existing Community Commercial (CC) zone as it pertains to the allowed land uses and property development standards (setbacks, Floor Area Ratio, lot sizes, etc.), except that the allowed maximum building height would be limited to 45 feet.

In February 2018, the City Council adopted the citywide High Occupancy Housing Specific Plan. The High Occupancy Housing Specific Plan was developed in response to the community's dialogue about the previously proposed high-intensity mid-rise developments near historic neighborhoods that primarily catered to college students. The High Occupancy Housing Specific Plan is intended to provide direction in the form of goals, policies, and strategies to accommodate various housing options in areas of the city that can support infill, redevelopment, and mixed-use activities. The Plan's goals, policies, and implementation strategies address a broad spectrum of topics (see Chapters 4 and 5 of the HOH Plan). Specific to this application, the Plan's implementation strategies include lowering the building height in the Community Commercial (CC) zone from 60-feet tall to 45-feet tall (Strategies to be implemented by 2019, bullet 5, page 102).

The concept to have a separate zone to address the HOH Plan implementation strategy to change the building height of the Community Commercial (CC) zone from 60 feet to 45 feet is a result of the comments received at the public open house meetings, the Planning and Zoning Commission's Work Session that occurred in August 2019, and the City Council's Work Session that occurred in October 2019. In summary, instead of limiting the Community Commercial (CC) zone to a maximum building height of 45 feet, the comments received suggested restricting the locations where the 45-foot maximum building height would be applied. As a result of these comments, it became apparent that a separate zone would be an appropriate mechanism to implement the above-mentioned HOH Plan implementation strategy. A different zone would allow the option to rezone specific areas of the city to the Neighborhood Community Commercial (NCC) zone and maintain the existing Community Commercial (CC) zone in other areas. This approach would allow the City Council to determine which areas of the city with the Community Commercial (CC) zone should have a maximum building height of 45 feet and which areas should maintain the currently allowed maximum building height of 60 feet.

Regional Plan Conformance

Chapter VIII - Community Character

- Policy CC.2.3. Mitigate development impacts on heritage resources.
- Policy CC.2.7. Protect existing historic districts from encroachment by land uses that compromise the historic characteristics of the district.
- Policy CC.2.8. In "Historic" activity centers (Downtown and Five Points), prioritize Community Character (CC) and Downtown (LU.11 and LU.12) goals and policies over the Activity Center goals and policies found in LU.18, when considering cases for rezoning.
- Goal CC.3. Preserve, restore, enhance, and reflect the design traditions of Flagstaff in all public and private development efforts.

- Policy CC.3.1. Encourage neighborhood design to be respectful of traditional development patterns and enhance the overall community image.
- Policy CC.3.2. Maintain and enhance existing buildings and blend well-designed new buildings into existing neighborhoods.

The proposed Neighborhood Community Commercial (NCC) zone is intended to be used to replace the existing Community Commercial (CC) zoning on the properties in Flagstaff that are primarily located in older and historic neighborhoods (Southside, North End, and Sunnyside). These neighborhoods typically consist of a variety of residential and non-residential uses that primarily exist in lower-scale one-, two-, and three-story buildings. To assist in maintaining the mix of land uses in these areas, the Neighborhood Community Commercial (NCC) zone's allowed uses are identical to the Community Commercial (CC) zone. In addition, the Neighborhood Community Commercial (NCC) zone's property development standards are identical to the Community Commercial (CC) zone, except that the allowed building height is limited to 45 feet instead of 60 feet that is allowed in the Community Commercial (CC) zone. The lower building height in the Neighborhood Community Commercial (NCC) zone is intended to assist in mitigating the heights between new and older developments. Also, the lower building height encourages designs that are contextually compatible and blend into the neighborhoods.

Chapter IX - Growth Areas & Land Use

- Policy LU.2.2. Design new development to coordinate with existing and future development, in an effort to preserve viewsheds, strengthen connectivity, and establish compatible and mutually supportive land uses.
- Goal LU.3. Continue to enhance the region's unique sense of place within the urban, suburban, and rural context.
- Policy LU.3.1. Within the urban, suburban, and rural context, use neighborhoods, activity centers, corridors, public spaces, and connectivity as the structural framework for development.
- Policy LU.5.3. Promote compact development appropriate to and within the context of each area type: urban, suburban, and rural.
- Policy LU.10.3.Value the traditional neighborhoods established around downtown by maintaining and improving their highly walkable character, transit accessibility, diverse mix of land uses, and historic building form.
- Policy LU.10.5. Consider vacant and underutilized parcels within the City's existing urban neighborhoods as excellent locations for contextual redevelopment that adds housing, shopping, employment, entertainment, and recreational options for nearby residents and transit patrons.
- Policy LU.18.2. Strive for activity centers and corridors that are characterized by contextual and distinctive identities, derived from history, environmental features, a mix of uses, well-designed public spaces, parks, plazas, and high-quality design.
- Policy LU.18.9. Plan activity centers and corridors appropriate to their respective regional or neighborhood scale.

- Policy LU.19.2. Establish the context and regional or neighborhood scale of each corridor prior to design with special consideration for those intended to remain residential or natural in character.

The proposed Neighborhood Community Commercial (NCC) zone is intended to be used in the Southside, North End, and Sunnyside neighborhoods. However, the zone could be used in areas of Flagstaff that are desired to have a lower building height. The Neighborhood Community Commercial (NCC) zone consists of a mix of land uses, residential and non-residential, that match the existing Community Commercial (CC) zone. These land uses will assist in contributing to a traditional neighborhood environment consisting of a diverse mix of uses that are mutually supportive and establish a unique sense of place within the urban environment.

In addition to the land uses, the Neighborhood Community Commercial (NCC) zone's property development standards are identical to the Community Commercial (CC) zone, except that the allowed building height is limited to 45 feet instead of 60 feet. The lower building height in the Neighborhood Community Commercial (NCC) zone is intended to maintain the contextual and distinctive identities of the North End, Southside, and Sunnyside neighborhoods by promoting smaller, more compact development that is appropriate for the existing neighborhood scale. In addition, the lower building height is more appropriate for the smaller lot sizes that exist in these neighborhoods, which will assist in providing and maintaining a height and lot size structural framework that contributes to the mitigation of scale between new and older developments and encourages designs that are contextually compatible. Furthermore, the lower building height may contribute to assisting in maintaining the existing smaller lots that make up these neighborhoods since lot consolidation to achieve the taller building heights and associated development standards may not be necessary. It should be noted that the lower building height within the neighborhoods and adjacent to corridor streets will assist in preserving viewsheds.

Chapter XIII - Neighborhoods, Housing, & Urban Conservation

- Policy NH.1.2. Respect traditions, identifiable styles, proportions, streetscapes, relationships between buildings, yards, and roadways; and use historically appropriate and compatible building and structural materials when making changes to existing neighborhoods, especially in historic neighborhoods.
- Policy NH.1.8. Prioritize the stabilization of a neighborhood's identity and maintain cultural diversity as new development occurs.
- Goal NH.6. Neighborhood conservation efforts of revitalization, redevelopment, and infill are compatible with and enhance our overall community character.
- Policy NH.6.1. Promote quality redevelopment and infill projects that are contextual with surrounding neighborhoods. When planning for redevelopment, the needs of existing residents should be addressed as early as possible in the development process.

The primary purpose of the proposed Neighborhood Community Commercial (NCC) zone is to maintain similar building heights within existing older and historic neighborhoods. Limited to 45 feet instead of 60 feet that is allowed in the Community Commercial (CC) zone, the proposed building height of the Neighborhood Community Commercial (NCC) zone will assist in preserving the existing proportions and scales of these areas. In addition, the lower building height may contribute to assisting in maintaining smaller lots since lot consolidation will not be needed to achieve greater heights and comply with the related property development standards. In combination with maintaining the existing lot sizes, the

lower building height will assist in contributing to new development that is compatible with the existing context, which will also assist in maintaining the neighborhood's identity and overall community character.

High Occupancy Housing Specific Plan

- HOH.1.2. Remove policy barriers to new development replicating the patterns of compatible historic districts and historic neighborhoods in order to promote historic context, parking, street patterns, and pedestrian connectivity, through small- and medium-scale buildings.
- HOH.2.1. Ensure that the proportions and design of HOH projects in terms of architecture, connectivity, and public spaces are tied to the activity centers type (urban, suburban), scale (regional, neighborhood, historic), and proximity of historic districts and neighborhoods.
    - Small-scale HOH is preferred in historic activity centers. Medium-scale HOH may be appropriate in the commercial core of Downtown when designed with consideration to the historic context.

Strategy

□
Commercial (CC) zone to 45 feet (see Map 18).

The primary purpose of the proposed Neighborhood Community Commercial (NCC) zone is to implement the above-referenced strategy of the High Occupancy Housing Specific Plan. The concept of having a new zone to address the High Occupancy Housing Specific Plan implementation strategy to change the building height of the Community Commercial (CC) zone from 60 feet to 45 feet is a result of the comments received at the public open house meetings, the Planning and Zoning Commission's Work Session that occurred in August 2019, and the City Council's Work Session that occurred in October 2019. The primary purpose of this strategy is to allow the City Council to determine the appropriate locations to implement the 45-foot maximum building height and enable property owners to rezone into the Neighborhood Community Commercial (NCC) zone.

The lower building height in the Neighborhood Community Commercial (NCC) zone is intended to maintain the contextual and distinctive identities of older and historic neighborhoods by promoting smaller, more compact development that is appropriate for the existing neighborhood scale. In addition, the lower building height (45 feet) of the Neighborhood Community Commercial (NCC) zone will assist in preserving the existing small- and medium-scale building patterns, proportions, and scale of these neighborhoods where most of the Community Commercial (CC) zone is located.

Southside Community Plan

- Goal S 2. Protect the landmarks and historic character that make Southside a unique community in Flagstaff.
- Policy S 2.4. Replicate patterns, materials, and architectural features of historic building in new construction.
- GOAL S 4. Support a diversity of buildings and mix of uses that are compatible with the scale and architecture of historic landmarks and area character.

- Policy SMS 1.2. New buildings in the Southside Main Streets are designed to increase gradually in scale and intensity in the context of the historic urban fabric. Building heights should not exceed 45 feet.
- Policy SLW 1.2. Design new buildings in the Live/Work Neighborhood that include hidden density to the existing urban form, while preserving the patterns and shapes of the residential streets. Building heights should not exceed 45 feet.

The proposed Neighborhood Community Commercial (NCC) zone with the maximum building height of 45 feet will assist in implementing the above referenced Southside Community Plan Goal and Policies. The zone will assist in maintaining building heights that contribute to a pattern of development that is compatible with the historic character and scale that is compact and appropriate for the Southside and the neighborhood's historic buildings. Also, the proposed allowed land uses of the Neighborhood Community Commercial (NCC) zone are identical to the Community Commercial (CC) zone. These land uses will assist in contributing to a traditional neighborhood environment consisting of a diverse mix of uses that are mutually supportive and establish a unique sense of place.

Conflicting Regional Plan Goals and Policies

- Policy ED.4.2. Promote variety and flexibility in land use and development options within the urban growth boundary.
- Policy LU.1.6. Establish greater flexibility in development standards and processes to assist developers in overcoming challenges posed by redevelopment and infill sites.

The proposed Neighborhood Community Commercial (NCC) zone is intended to implement the High Occupancy Housing Specific Plan and Southside Community Plan goals and policies. The zone itself does not provide additional variety or flexibility to the existing development standards and processes allowed in the Zoning Code. Also, the proposed zone does not provide assistance for developers in overcoming challenges posed by redevelopment and infill sites. It should be noted that the proposed Neighborhood Community Commercial (NCC) zone is intended to be used to replace the existing Community Commercial (CC) zone that is located in older and historic neighborhoods. The proposed building height of the proposed zone (45 feet) will limit development flexibility and preclude taller building heights that may be needed to overcome challenges posed by redevelopment and infill sites.

Summary of Comments and Questions Specific to Neighborhood Community Commercial (NCC) Amendments from the July 15, 2020, Virtual Open House Meeting

1. I am opposed to down-zoning property that is applied as a broad stroke. Although, I am refreshed to see that you're open to the idea of making the process a mapping exercise, such as the example that was shown for Sunnyside with the 4th Street corridor maintaining the existing Community Commercial (CC) zone. It is recommended to allow properties adjacent to the street corridors the option to redevelop to their maximum potential. There are some corridors on the Southside that could use the same considerations as 4th Street. Most progressive communities around the country right now are up-zoning and raising their building heights so that they can solve issues with affordable housing, including minimizing the impacts on the infrastructure, transportation, and all things that lead to global warming. It's a little odd for our community to be considering to down-zone property. I'm sensitive to the idea that there are people wrapped up in the same community commercial (CC) zone that are in historic districts; and, for several years they have requested the City find a way to protect their neighborhood. I think you could find more broad support for a Zoning Map Amendment that is based on a mapping exercise rather than a blanket rezoning specific to certain areas.

2. It seems that the reduction in building height will reduce my property value by 25 percent. The reduction in building height could affect certain properties' developability, although 60 feet may be impractical on small properties.

3. The reduction in building height will make developing affordable housing on some sites a little more challenging.

4. A more appropriate approach to changing the zoning on properties would be based on an area-by-area and corridor-by-corridor analysis. Otherwise, a series of Prop 207 claims may result in a patchwork of 45-foot tall and 60-foot tall building allowances.

5. How does the existing traffic capacity of the streets, such as Humphreys and San Francisco, assist in addressing the Zoning Map's modification?

   Staff response: A street's existing traffic capacity may be considered as part of a Zoning Map Amendment. At this time, the street network compacity is not being utilized as a determining factor.

6. Will the Neighborhood Community Commercial (NCC) zone be an opt-in zone?

   Staff Response: The zone is being proposed to be added to the Zoning Code. Where the zone will be located, and its application, opt-in or not, will be based on the City Council's direction.

7. If a property is rezoned to the Neighborhood Community Commercial (NCC) zone, will they still have the ability to opt-in to their floating transect zone?

   Staff response: Yes, a property owner will still have the option of opting into the floating transect zone.

From: Eve Ross <everossaz@gmail.com>
Sent: Thursday, July 2, 2020 3:34 PM
To: CD Front Counter <CDFrontCounter@flagstaffaz.gov>
Subject: Proposed Text Amendment to Zoning Code CC

I write to ask that my comments be read from the dais at the P& Z meeting considering amending the City of Flagstaff Zoning Code Community Commercial to Neighborhood Community Commercial by changing the maximum building height from 60 feet to 45 feet.

My comments are as follows:

We purchased our property many years ago in reliance on the zoning of CC and the 60ft height restriction. The property is commercial property and its assessed value has been based in part on the ability, under the zoning code, to increase the intensity of use by expanding the building footprint to 60 ft of height. This zoning code text change adversely impacts our ability to use the property as allowed under the current zoning code, which diminishes property value; we would regard such a change as a taking of partial value of the property.

This is not a situation where a zoning change that adversely impacts the neighborhood is being sought. Instead, every property owner is or could have been aware of the 60 ft height limitation via due diligence before purchasing.

When I served on the Regional Planning effort some years ago, the value of downtown density (infill) was repeatedly stressed because it was economical and sustainable. Downtown infrastructure is in place, downtown density reduces the need for sprawl and infrastructure extensions. New roadways, infrastructure, traffic and pollution are avoided by using downtown spaces to their utmost.

We are opposed to the proposed change to the text of the CC Zoning Code Text.
Please do not hesitate to contact me if you have any questions.

Eve Ross
everossAz@gmail.com
928.607.1778

Cedar West Capital, LLC
10 E. Dale Ave
Flagstaff, AZ 86001

July 21, 2020

Dan Symer
Zoning Code Manager
City of Flagstaff
211 W. Aspen
Flagstaff, AZ 86001

RE: CC Zoning, Proposed Amendment

I am the authorized member/spokesperson for Cedar West Capital, LLC.

Cedar West Capital owns two contiguous parcels of CC zoned property in east Flagstaff. (109-05-081-A; 109-05-001-G). This property is 6.6 acres and is currently developed as a shopping center. It is northeast of the intersection of Cedar Avenue and West Street.

This shopping center has worked well for 40 years. However, no one knows what the best use of the property will be in the future. There is a significant possibility that some day this property may be a high-rise office, housing, retail or even a campus like a hospital, medical facility.

This property is one of a handful of CC zoned properties located north of Forest/Cedar/Lockett. It is, by far, the largest.

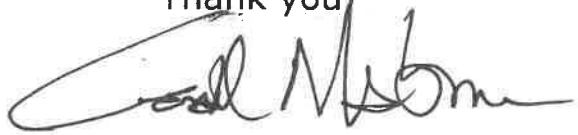
With this in mind, Cedar West objects to the proposed reduction in allowed height which would result from a change from CC to NCC zoning.

This property is large enough to handle a 60 foot high building quite easily. In that regard, it is one of the few properties in the area that could accommodate such a building. Therefore, the current 60 foot height allowance is a valuable entitlement of this property.

There are certainly CC parcels throughout the city that should be restricted to 45 feet. This property is not one of them.

If this property is re-zoned against our will we will seek a waiver of the height restriction or compensation for the loss in value.

Thank you



Gerald W. Nabours
(928) 525-6128
gnabours@gmail.com

Law Office of

TEVIS REICH PLLC

July 9, 2020

Via Regular Mail

Dan Symer, AICP, Zoning Code Manager
Planning and Developmental Services
211 West Aspen Avenue
Flagstaff, AZ 86001

RE: Zoning Code Amendment

I am the manager for D&L Property, LLC which owns property at 6 E. Dale Avenue, Flagstaff. I received a letter from the City indicating a zoning code text amendment (PZ 19-00123) and Map amendment (PZ 20-00211) for the property at the address.

First, I would like to request a copy of both of the proposed amendments.

Second, I absolutely oppose any amendment which would reduce or further restrict the development rights related to the property. This includes the proposed height restriction from 60 to 45 feet. Should any amendment pass restricting my vested development rights, I would either opt out (to the extent allowed, as the City usually allows) or bring an appropriate claim against the City for a regulatory taking by abrogating my vested development rights without compensation (i.e. prop 207 claim).

Sincerely,

Tevis Reich

6 East Dale Avenue, Flagstaff, Arizona 86001
office 928-213-1800 fax 928-779-0447 toll free 877-616-1800
www.TReichLaw.com • Tevis@TReichLaw.com

From: David Carpenter <dc@hopeaz.com>
Sent: Tuesday, August 11, 2020 10:13 AM
To: Daniel Symer <Daniel.Symer@flagstaffaz.gov>; Sara Dechter <SDechter@flagstaffaz.gov>
Cc: Daniel Folke <DFolke@flagstaffaz.gov>; Tiffany Antol <TAntol@flagstaffaz.gov>; Alaxandra Pucciarelli <APucciarelli@flagstaffaz.gov>
Subject: Regional Plan Amendment Required for NCC Downzoning

Dan/Sara-

I think the council should have to do a major regional plan amendment to down zone 1000 +/- CC properties in the central core of the city. The net affect could be the reduction of hundreds of housing units in the Flagstaff core. This not only flies in the face of several goals and policies of the plan but the entire guiding principal of the plan itself. The citizens overwhelmingly choose infill urban form vs. sprawl, suburbs, and exurbs.

If the council wants to reduce housing options in the center of the city, and go back on our commitment to slowing climate change under the vail of historic preservation, they should need to overtly chose that in a public forum. The process should not be as easy as one or two meetings cloaked as historic preservation. This is a wholesale reversal of the public will. I realize that historic preservation and environmental responsibility are competing progressive goals, but unfortunately they can't have it both ways.

How can we demand as the public that this happens?

Thank You,

David Carpenter

HOPE
CONSTRUCTION
GENERAL CONTRACTING & CONSTRUCTION MANAGEMENT

Hope Construction
495 S River Run Rd.
Suite 100
Flagstaff, AZ 86001

P 928-527-3159
F 928-527-0357
C 928-380-5808

From: Sara Dechter <SDechter@flagstaffaz.gov>
Sent: Tuesday, August 11, 2020 10:34 AM
To: David Carpenter <dc@hopeaz.com>; Daniel Symer <Daniel.Symer@flagstaffaz.gov>
Cc: Daniel Folke <DFolke@flagstaffaz.gov>; Tiffany Antol <TAntol@flagstaffaz.gov>; Alaxandra Pucciarelli <APucciarelli@flagstaffaz.gov>
Subject: RE: Regional Plan Amendment Required for NCC Downzoning

Hi David,

If you will remember, when the City adopted the High Occupancy Housing Specific Plan, we also amended the Regional Plan concurrently to change the activity centers in the downtown area from Regional to Historic and explicitly called out the strategy of the NCC zoning as an implementation of that policy change. So the City Council has already amended the Regional Plan to allow for the Zoning Code amendments that Dan is working on now. I am uncertain what we would be amending after that or why it would be a major amendment.

As you know from other rezoning cases, having a conflicting policy is not necessarily a reason to require a plan amendment. However, the policy you are pointing to is certainly something we will disclose to Council when we present the Regional Plan conformance analysis for these rezoning updates. I agree it is a conflicting policy.

If there is more detail about this that I am missing, please let me know.

All the best,
Sara Dechter

Sara Dechter, AICP, CP3
Comprehensive Planning Manager
City of Flagstaff, AZ
928-213-2631

www.flagstaff.az.gov/comprehensiveplanning
Leearn about the 2020 Census at: iCount2020.info

From: David Carpenter <dc@hopeaz.com>
Sent: Thursday, August 13, 2020 2:46 PM
To: Sara Dechter <SDechter@flagstaffaz.gov>; Daniel Symer <Daniel.Symer@flagstaffaz.gov>
Cc: Daniel Folke <DFolke@flagstaffaz.gov>; Tiffany Antol <TAntol@flagstaffaz.gov>; Alaxandra Pucciarelli <APucciarelli@flagstaffaz.gov>
Subject: RE: Regional Plan Amendment Required for NCC Downzoning

Sara-

Im not sure that the HOH specific plan even conforms with the regional plan. Myself an others will be doing all that we can in the future to stop the implementation of those code amendments when they come. However, since NCC and building height are the first takings on the docket it is where our energy is currently focused.

Unlike a specific case where competing goals and polices can be mitigated on a case by case basis for their impacts on adjacent parcels, you are proposing a truly massive taking on over 1,000 parcels simultaneously. This is unprecedented in scale and represents a fundamental direction change from what the citizens of Flagstaff voted for with their current regional plan.

I think the main detail that is missing is that you (the government) are proposing to take away development rights, property value, and the future of our city to be able to grow inward and adapt to climate change with a few quick Zoom meetings. This is way too big for that and the process needs to happen in public. This should require a plan amendment so that the citizens can chime back in on whether they want to reverse course on the voted and implemented plan to build our city inward and upward. It took 5 years and hundreds of meetings, and then a vote of over 5,000 people to decide for urban infill vs. sprawl. This is not a conflicting goal or policy. The entire regional plan is based on the infill development pattern. We had a choice when we wrote the plan for Urban v. Exurb v. Suburb and the citizens choose Urban. That is why a plan amendment is required. It's a complete reversal of course from the current progressive policy of building our city. This is so big it might even need to wait until the next rewrite in 2030!

I think you have all done a great job adapting to our current situation. I give accolades for switching to online and working from home to keep the city running. Thanks! But this is different than processing a development case or a permit, and 5 people in a Zoom meeting does not represent the will of the people. The city should table this until we are out of this current emergency and people can focus on this issue with a clear lens. This is too massive to do on Zoom.

I hope you give this the consideration it deserves, and when COVID ends draft a regional plan amendment that honors the magnitude of this direction change, that is honest about what it means to the redevelopment of the entire core of the city for the next 20-50 years, and debate it in person in City Hall when we are out of the current crisis!

Thank You,

David Carpenter

HOPE
CONSTRUCTION
GENERAL CONTRACTING & CONSTRUCTION MANAGEMENT

Hope Construction
495 S River Run Rd.
Suite 100
Flagstaff, AZ 86001

P 928-527-3159
F 928-527-0357
C 928-380-5808

From: Daniel Folke <DFolke@flagstaffaz.gov>
Sent: Friday, August 14, 2020 10:04 AM
To: David Carpenter <dc@hopeaz.com>; Sara Dechter <SDechter@flagstaffaz.gov>; Daniel Symer <Daniel.Symer@flagstaffaz.gov>
Cc: Tiffany Antol <TAntol@flagstaffaz.gov>; Alaxandra Pucciarelli <APucciarelli@flagstaffaz.gov>
Subject: RE: Regional Plan Amendment Required for NCC Downzoning

Good morning David,
I appreciate your comments and questions. Internally we have also discussed the proposed zoning code amendments that are coming out of the HOH plan and the most recent Council action declaring a Climate Emergency. This will certainly be part of the discussion as these amendments proceed.

In regards to the benefit of in person hearings vs. virtual participation. I believe we would all prefer to be in the chambers holding a traditional public meeting. What has been interesting is that we have seen better participation for some meetings held virtually compared to what we have traditionally seen for in person. Some topics will fill city hall, others it seems may draw better virtually. It seems to depend on the issue.

City Council has emphasized the importance of the HOH amendments and ask about them with regularity. Because we don't know how long City Hall will be closed, it is difficult for staff to put these important matters on hold. In either case, we will certainly include your comments as part of the record on this amendment and Council can consider your request.

Hope you are well.
Dan Folke
Community Development Director
City of Flagstaff

City Wide Public Survey

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

July 22, 2020, 7:11 PM

Contents

i.	Summary of registered responses	2
ii.	Survey questions	4
iii.	Individual registered responses	5

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Summary Of Registered Responses

As of July 22, 2020, 7:11 PM, this forum had:	
Attendees:	144
Registered Responses:	60
Hours of Public Comment:	4.2

Topic Start
June 23, 2020, 8:27 PM

QUESTION 1

Do you support changing the zoning designation of properties with the Community Commercial (CC) that allows a maximum building height of sixty (60) feet to the new Neighborhood Community Commercial (NCC) zone with a maximum building height of forty-five (45) feet?

		%	Count
Yes		81.7%	49
No		16.7%	10
Neutral		1.7%	1

QUESTION 2

What neighborhoods properties with the existing Community Commercial (CC) zone should be limited to forty-five (45) feet?

		%	Count
Northend, Southside, and Sunnyside properties		81.7%	49
Sunnyside properties only		1.7%	1
No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.		16.7%	10

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

QUESTION 3

Do you support keeping certain properties that abut and/or are adjacent to commercial corridor streets, e.g. N Fourth St, E Cedar Ave etc, zoned Community Commercial (CC) with a maximum building height of sixty (60) feet?
(Please note that specific streets and properties have not been determined.)

		%	Count
Yes		23.3%	14
No		68.3%	41
Neutral		8.3%	5

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

Answered	43
Skipped	17

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Survey Questions

QUESTION 1

Do you support changing the zoning designation of properties with the Community Commercial (CC) that allows a maximum building height of sixty (60) feet to the new Neighborhood Community Commercial (NCC) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 2

What neighborhoods properties with the existing Community Commercial (CC) zone should be limited to forty-five (45) feet?

- Northend, Southside, and Sunnyside properties
- Northend and Southside properties only
- Northend and Sunnyside properties only
- Southside and Sunnyside properties only
- Northend properties only
- Southside properties only
- Sunnyside properties only
- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

QUESTION 3

Do you support keeping certain properties that abut and/or are adjacent to commercial corridor streets, e.g. N Fourth St, E Cedar Ave etc, zoned Community Commercial (CC) with a maximum building height of sixty (60) feet?
(Please note that specific streets and properties have not been determined.)

- Yes
- No
- Neutral

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Individual Registered Responses

Alan Perersen
inside City Limits
July 1, 2020, 5:06 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Yes - large student housing projects such as the the Hub, and the Standard (I know some of the names have changed) are a visual blight in our community and should NEVER have been built as large as they are. They are a disgrace as was the process and zoning that allowed them.

Name not shown
inside City Limits
July 1, 2020, 5:10 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

We are not Phoniex and do not need high rise properties. We have mountains and other beautiful views which have been destroyed by past codes. Let's get this right for we the people now.

Name not available
inside City Limits
July 1, 2020, 6:01 AM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Neutral

Question 4

We need to support infill as a community and by reducing the size of the building will drastically reduce occupancy. 45 feet is only enough for 4 stories in areas where infill should be happening to help with the cost of housing. The community needs to understand that there are trade offs and if we are serious about affordable housing then we need. To let infill happen where it needs to.

Name not shown
inside City Limits
July 1, 2020, 6:04 AM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

Question 2 doesn't allow a more nuanced answer. I don't want to see

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

existing housing be demolished for large projects however in each of the areas there a great properties to allow 60 foot structures. For example, I support tall and dense redevelopment along 4th Street, the Bashas shopping center and sling the tracks East of San Fran to name a few. Density is the only way we will develop truely walkable neighborhoods, lack of housing and climate action.

Melissa Felder
inside City Limits
July 1, 2020, 6:17 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

I think Flagstaff needs to decrease and limit all growth. There should not be high density housing at all.
If there does need to be some high density housing, it should be for low income and not to serve NAU.
What a shame to watch our sweet town grow at such a horrendous rate!

Name not available
inside City Limits
July 1, 2020, 6:37 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

No response

Name not shown
inside City Limits
July 1, 2020, 6:47 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not shown
inside City Limits
July 1, 2020, 6:49 AM

Question 1

- Neutral

Question 2

- Sunnyside properties only

Question 3

- Yes

Question 4

No response

Name not shown
inside City Limits

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

July 1, 2020, 6:56 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

The livability of our city is being diminished by the scale of buildings, lack of set backs from the sidewalk and inadequate parking requirements. Also, views of the Peaks and natural beauty are being eliminated. The development of our City should preserve beauty, not eliminate it.

Name not shown
inside City Limits
July 1, 2020, 7:29 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

All this overdevelopment is stealing our views of where we live. Despicable.
There are shadows from these monster buildings that create the formation of ice nearly year-long, causing significant dangers to all travelers, all of us.
I truly hope that all, yes all, of these out of town, out of state developers go bankrupt and the units are seized and turned into low income housing.

It's way past time to stop giving developers exemptions from full taxes, modification to parking and occupancy rules. It's time for all new projects to demonstrate that they have independent water sources, and solid plans for reducing congestion. Any one of these errors should and shall cancel all permits to build anything. Stop coddling developers. There should be an end to corporate welfare; require developers to pay the full cost of their intrusion and to act to reduce (not add to) congestion, traffic, water and sewage issues, and cancer cell ideology growth.

Name not shown
inside City Limits
July 1, 2020, 7:57 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Neutral

Question 4

The reason I support changing the maximum building height to 45 feet is that:
1) The San Francisco Peaks, it's beautiful and it's the view that all Flagstaff residents love to see. Lowering the maximum building heights will allow us and future generations to see more mountain views instead of building views. We have something special here worth protecting. Once it's gone, it's gone.
2) Taller buildings mean higher density: more parking will be needed, more water will be needed, and there will be more traffic in these three already congested areas.

Name not available
inside City Limits
July 1, 2020, 8:00 AM

Question 1

- Yes

Question 2

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

We all love the views our city has of the peaks and Elden but we need to be able to house the members of our community affordably and safely. Allowing the 60ft limit to remain will jeopardize some views but the benefit of true high density housing outweighs some views being obscured. Planning for these high buildings should be strategic to minimize the visual impact caused by their construction, but it's the right thing to do to allow for more vertical infill within our city.

Wade Thorson
inside City Limits
July 1, 2020, 8:06 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No neighborhood should have to endure an oversized out of character building next door. It harbors resentment and ire toward developers and city planning entities. Citizens in large part should not be at the odds of the entities that serve them.

Name not shown
inside City Limits
July 1, 2020, 8:20 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Neutral

Question 4

No response

Jackie Thomas
inside City Limits
July 1, 2020, 8:39 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

AS a cyclist, the taller the buildings next to thoroughfare roads, the greater the chance of ice on the roads all winter due to the shadowing. I noticed on immediate change after the Radisson hotel went up downtown. I suspect the new Courthouse will do the same to Beaver. In addition, the viewsheds are being dramatically impacted by the 3+story building going in on Butler now. And the Hub also impacted what we can see. Those skylines views are a very important part of the beauty of Flagstaff but also provide the distant view that is important for sanity. I also noticed how the Barnes and Nobel store changed what we can see.

Name not available
inside City Limits
July 1, 2020, 8:44 AM

Question 1

- Yes

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

let's keep this city in harmony with its beautiful natural setting and not make a metropolis out of it. High-rises belong in large cities, not in bucolic Flagstaff.

L. Reuter
inside City Limits
July 1, 2020, 8:47 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Please reduce height and density of development and keep FILG from becoming PHX. Too many huge developments. Soon to be known as NauTown

---

Name not shown
inside City Limits
July 1, 2020, 8:48 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

No response

Name not shown
inside City Limits
July 1, 2020, 8:52 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

The quality of this mountain town needs to be preserved by allowing the view of the natural surroundings as much as possible. 45 feet height is a good balance between needing to allow growth and keeping the small town feel of Flagstaff. Folks don't choose to live here or visit here - to feel like they never left Urban environments.

Name not shown
inside City Limits
July 1, 2020, 9:35 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Question 4

No response

Matt Mitchell
inside City Limits
July 1, 2020, 9:47 AM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

I do not understand the conflict with building height to match our existing Native Ponderosa Pine tree heights. We are surrounded by public lands. One must walk less then a mile in any direction to gain a vast view of the horizon. We are limited geographically to grow our town, plus any fans of cheaply developed urban sprawl need not travel more then 100 miles south to exsperience the beauty of that disaster. I like the phase "Flagstaff its time to grow up; we don't have the option to grow out". I watched a movie on Architecture years ago when I was a student in college, which pointed out how the most important things to a community could be seen from their skyline and tallest building. Long ago it was a church steeple, then shifted to Court Houses being the tallest, and sometime during the 80 & 90s it was Banks and corporate building. Currently in Flagstaff our tallest building is the BANK south of the county court house. I would like to envision in the future Flagstaffs tallest building be an affordable house type structure that would send the message to outside visitors that people are the foucus of are community, not self centered private home owners that care more about their bathroom window view, then the homeless living in their back alley. I feel building height is a waste of our planning and zoning commission and Councils time and energy. We have far more important issues to discuss. I don't see this as something that is broken.

Name not shown
inside City Limits
July 1, 2020, 10:30 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

They should all be reduced to 45 feet.

Mike Purcell
inside City Limits
July 1, 2020, 10:44 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

This should have been done years ago !!!

Name not shown
inside City Limits
July 1, 2020, 10:46 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Question 3

- No

Question 4

Anything that can be done to reduce the height / size of the buildings in Flagstaff would have my support. The scale of recent buildings in the city is frankly disgusting.

Ed Dunn
inside City Limits
July 1, 2020, 10:50 AM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

It would go against the recently passed climate change resolution to decrease density. Higher density is environmentally sound way to decrease carbon footprint because mass transit and walkability work better. Social justice and citizen involvement work better when folks are able to interact more in densely populated neighborhoods. I'm not talking about NYC style but a plan with a lot of green space for people and less cars. Beauty should be the guiding principle in design, not ugliness like the Hub. If the city or a citizen group could acquire land and hold competitions for development that meet our climate goals, places of people and beautification we would see a very positive change. As for peak views, a 45' building does not do a better job than a 60' building. I can't see the peaks from any point on my property and I live in a neighborhood of single story homes.

Name not shown
inside City Limits
July 1, 2020, 11:05 AM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Neutral

Question 4

No response

Name not available
inside City Limits
July 1, 2020, 11:16 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Flagstaff isn't a metropolis & we don't need to turn our neighborhoods into one. Although these areas are Zoned Community Commercial they are still primarily Neighborhoods where people live, 1st and commercial 2nd. Allowing 60 foot/6 story buildings to infiltrate these areas, in my opinion, will diminish the quality of life for the residents of these neighborhoods rather than improve it. Yes, Flagstaff needs affordable housing, but #1. is that what developers would Really build with the freedom of 60'? Or would the door be swung wide open for more over-priced NAU student housing projects to infect the rest of the Southside & spread to the Northend? #2. Do we need to eliminate one of the primary reasons people choose to live in Flagstaff...the views of the mountains?

Name not available

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

outside City Limits
July 1, 2020, 11:42 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Taller building ruin Flagstaff.

KEN PHILLIPS
inside City Limits
July 1, 2020, 11:44 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

The proliferation of high occupancy "podium construction" multi-story buildings is now a blight on the Flagstaff community. The ground floor retail spaces go unoccupied. These have been built to support off-campus housing for NAU students, along high traffic corridors creating additional congestion. Stop this repeated mistake. Make NAU build on-campus housing and/or limit their enrollment. This is a vicious circle of development that only supports the University.

Uncle Don Fanning
inside City Limits
July 1, 2020, 12:28 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Neutral

Question 4

The only reason I marked the last question as "neutral" is that I do not understand its wording and intention. The footprints of these three districts are still *WAY* too large as is even the amended 45 foot building height limitation. Just because I did not tag some questions as neutral does not mean that I support either the 45 or 60 foot height limit or the zoning footprints which put districts within the CC zone. A more community scale height limit is 35 feet and no more than three stories in height. Existing residential and small business/small profile character styled blocks must be removed from CC zoning entirely so that the character of the community does not continue to be altered in a negative fashion. My support for elected and appointed officials continues to degrade when equally untenable alternatives such as the above are repeatedly presented in a T.I.N.A. ("There is no alternative.") way.

Sherman Stephens
inside City Limits
July 1, 2020, 12:57 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

The more residential an area is, the more important it is to preserve a low density residential. It is important to not revert to previous height guidelines to allow an already taller building, or commercial development to encroach on the surrounding neighborhood.

Name not shown
inside City Limits
July 1, 2020, 12:57 PM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

This looks like a solution in search of a problem. Everything about it strikes me as arbitrary. Why change the height limit for buildings in this area? If we reduce the height limit, why change it to 45 feet instead of 50 feet or 55 feet? The impact of any such change will likely be to increase the cost of housing per dwelling unit, or the cost per square foot for commercial space. Does Flagstaff really need more expensive property?The purpose of these changes can't be to preserve views, because there are no meaningful views remaining in these developed areas. If there are existing viewsheds to be preserved, why not define them and focus an ordinance on them. At least that would have a meaningful effect, although it would also result in more expensive property. Instead, I would like to see the Staff and Council really buckle down to the task of proposing an ordinance that would permit development of more affordable owner-occupied housing in Flagstaff. The proposed zoning amendment will have the opposite effect,

---

Name not available
inside City Limits
July 1, 2020, 1:44 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Stop building for NAU and not considering the impact on the lifelong resident population

---

Name not shown
inside City Limits
July 1, 2020, 2:07 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not shown
inside City Limits
July 1, 2020, 2:18 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

- No

Question 4

No response

Name not available
inside City Limits
July 1, 2020, 4:02 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not shown
inside City Limits
July 1, 2020, 7:53 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Jose Dominguez
inside City Limits
July 1, 2020, 7:59 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

I would like to see all areas of Flagstaff that currently allow the 60' to be changed to the 45' max

---

Name not shown
inside City Limits
July 1, 2020, 10:46 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Stop allowing buildings higher than 45 feet or three stories. It's absolutely disgusting that you've allowed so many tall, worthless buildings to be built. It's even worse that the reason they are built is to support the University which is not supporting Flagstaff. If we wanted to live in a big urban town we would. The only reason people Want this town to grow so much is because they're greedy. We're not under some sort of moral obligation to build a bunch of crappy buildings so more people can move here.

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Name not available
inside City Limits
July 2, 2020, 1:45 PM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- No

Question 4

Flagstaff has become a true city with its population. The city has run out of land to support the population so the only possible with to expand is to allow skyscrapers to be built. I would say that 60 feet will work for now but Flagstaff may need to change the limits to more than 100 feet.

Brittain Davis
inside City Limits
July 2, 2020, 2:25 PM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

I would rather see infill with taller multifamily and commercial developments than look to expanding development outward.

Name not available
inside City Limits
July 2, 2020, 5:21 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not shown
inside City Limits
July 3, 2020, 8:24 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- Yes

Question 4

60' height for N Fourth Street, because it's already all commercial. 45' height for all of the other areas currently zoned CC.

Name not available
inside City Limits
July 3, 2020, 11:30 AM

Question 1

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not shown
inside City Limits
July 4, 2020, 3:55 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not available
inside City Limits
July 5, 2020, 5:12 PM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

- Yes

Question 4

The community made a decision during the regional planning process to grow up not out. All the affordable housing talk while bagging density/tall buildings is double talk and childish. Its time for a staff and council that can make the hard trade off decisions this commitment entails. Every action currently contemplated by council increases the cost of housing in FLG. Go learn from Bend, OR where they are increasing density. Who can see the peaks with a 45' neighbor but not a 60' neighbor? You don't get views and affordable housing. You have to choose, rather the owner of the property owner chooses. This is the USA, we have private ownership not central planners. Municipal governments are the great equalizers and they are not HOA's. When they act as such, we get sued and it's then the citizens paying the settlements, not the officials who have long since moved on to other goals.

Name not shown
inside City Limits
July 8, 2020, 7:17 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Other than Milton Ave and portion W. Rt 66 corridor, keep citywide building heights at 45'. I support the reduction to 45' in DT, but why would City think it appropriate to pose 45' limits in DT and then allow for 60' in eastside corridor area (Cedar/N 4th) that abuts established neighborhoods that actually have semi-affordable single family homes and schools. Seems like this proposed zoning policy favors protecting wealthy DT neighborhood property owners from congested high density development but encourages this type of development to take place adjacent to lower socio-economic area of town. What the heck will be use of a strip of 60' buildings? Commercial? Residential? Fewer people in future will be working in an office and most people that grow roots here

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

would prefer to raise a family in a home not a crammed apartment.

Name not shown
inside City Limits
July 8, 2020, 7:38 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

The value of Flagstaff is the nature and wild lands. The taller structures obstruct views from everyone.

Name not shown
inside City Limits
July 9, 2020, 9:36 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

Clearly there is a balance sought between limiting sprawl and Flagstaff's image of a town nestled in the forests and mountains that residents and visitors appreciate and treasure. Views are part of that image and everyday experience if even subliminal. This code change will help a little in years to come.

Marc Murison
inside City Limits
July 9, 2020, 10:57 AM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

60-foot building heights are destroying the fundamental character of Flagstaff. If we want Flagstaff to be the charming, beautiful, welcoming city that we love, building heights *must* be reduced. Five storeys is utterly absurd and cannot be made to look anything but horrible; it is a destructive blight on our city. Four storeys, if well done, can work more or less harmoniously *in certain places*. Three storeys is much, much more generally acceptable and consistent with longstanding Flagstaff identity and character.

Name not shown
inside City Limits
July 9, 2020, 12:58 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

The north Bashas area should be kept at 60 ft.

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

Name not available
outside City Limits
July 9, 2020, 3:03 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

Name not available
inside City Limits
July 11, 2020, 3:08 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

First, at this time 60' buildings in Flagstaff would not be medium height. They are tall so your language is possibly leaning toward where the City wants the community character to GO, not where we are (though the buildings are quickly getting tall, which no one is happy to see rather than the Peaks). The survey questions seem to imply that there will be blanket determinations, which is not a proper approach as areas differ. The character of existing residential areas need to be taken into consideration. People live in these residential areas and residents' quality of life needs to be respected. I doubt people want their neighborhood urbanized with buildings built to the sidewalk, taller than the neighborhood character, less green space, etc. Your area designations include parts of the area called "Townsite" as "Northend," which is not accurate and so can be misleading. There is also no mention of the Townsite Historic Overlay which limits height in the included "commercial" areas, so that is inaccurate--unless the City is changing the Overlay without property owner knowledge and permission.

Charlie Silver
inside City Limits
July 11, 2020, 3:11 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

This proposed reduction in building height is long overdue. Thank you for listening and figuring out a way to act. I am in full support.

Name not shown
inside City Limits
July 12, 2020, 1:22 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

marcus ford
inside City Limits
July 15, 2020, 5:42 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

No response

April Smith
inside City Limits
July 15, 2020, 6:55 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

The 60' height limit should be changed to 45' where ever that limit was established by code. Lower building heights are in keeping with Flagstaff architectural standards. If I had my way no buildings over 2 stories would be permitted in perpetuity throughout the entire town of Flagstaff. Failing the control to enact my wishes NO BUILDINGS OVER 45' PERMITTED IN PERPETUITY THROUGHOUT OUR TOWN. This should be written so that no "Executive Order" emanating from ANY city government entity could override this limit. This should be written so NO entity from AZ state government could override this limit. You know the state will try to control local autonomy on this issue-their need to control dissenting governing voices from local town governments is to be recognized and responded to on a "pre-need" basis. Remember the plastic bag ban and Phx dictates on that issue? Take heed.

Name not shown
inside City Limits
July 20, 2020, 2:53 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

I agree with the statement above that there should be "NO BUILDINGS OVER 45' PERMITTED IN PERPETUITY THROUGHOUT OUR TOWN." We are quickly losing Flagstaff's character. We should be thinking about beauty and how buildings fit into their surroundings when we think about developments. It's unforgivable to plunk something like the Hub into a neighborhood of small, family homes. Not only is it WAY out of scale, but introducing all those students into a neighborhood is just wrong. No more catering to NAU by rezoning properties for student housing.

Name not shown
inside City Limits
July 21, 2020, 5:04 PM

Question 1

- No

Question 2

- No property should be limited to forty-five (45) feet. Keep the existing allowed sixty (60) feet.

Question 3

45-foot Building Height Maximum in the Northend, Southside, Sunnyside

The Community Commercial (CC) zone allows for a maximum building height of sixty (60) feet. Do you support changing the allowed height to forty-five (45) foot maximum building height in the Northend, Southside and/or Sunnyside neighborhoods?

- Yes

Question 4

It seems that the main arguments in support of such a change largely come down to wanting to maintain privileges for some (views, subjective notions of urban beauty) at the expense of basic affordable accommodations for our poorest residents, along with animosity toward the understandably callous NAU growth. Given current developments, the latter issue is unlikely to persist (enrollment is dropping and for the short-term, more students will be attending remotely), so this really will only perpetuate the social injustices that are the true blight to our town.

Rick Moore
inside City Limits
July 22, 2020, 12:42 PM

Question 1

- Yes

Question 2

- Northend, Southside, and Sunnyside properties

Question 3

- No

Question 4

I strongly support creating a Neighborhood Community Commercial zone with a 45' height limit. Much of the Community Commercial Zone was created when older homes were not nearly as highly valued as they are today and it makes sense to develop a new zone that helps protect their value as residences that are not surrounded by towering multi-family buildings.

I agree that infill is important from a walkability and climate change perspective. However, there are certain areas of our community with historic/traditional neighborhood character that need to be preserved and the Neighborhood Community Commercial zone would help do that.

I'd also like to suggest that the city planning staff develop maps that show how ALL zoning applies to the Community Commercial and the potential Neighborhood Commercial Community zones. For instance, some of the Community Commercial zone is also subject to Transect Zoning, including T-5 and T-6 zones, which allow building to 60 feet. A developer with a property in a Community Commercial zone that is also zoned as T-5 or T-6, could simply choose transect zoning and still build to 60 feet. I think that the city should include the possibility of limiting T-5 and T-6 heights if any properties zoned that way are in potential Neighborhood Community Commercial area. More information is needed to truly understand the impacts of a new zone and lower height limit.

North End Property Owner Survey

45-foot Building Height Maximum on Your Property in North End

July 22, 2020, 7:29 PM

Contents

i.	Summary of responses	2
ii.	Survey questions	4
iii.	Individual responses	5

Topic Registration Type: No registration

45-foot Building Height Maximum on Your Property in North End

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the North End neighborhood?

Summary Of Responses

Topic Registration Type: No registration

As of July 22, 2020, 7:29 PM, this forum had:	
Attendees:	15
Responses:	3
Minutes of Public Comment:	9

Topic Start
June 25, 2020, 9:41 PM

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

		%	Count
No		100.0%	3

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

		%	Count
No		100.0%	3

QUESTION 3

What is the current use of your property?

		%	Count
Commercial		100.0%	3

45-foot Building Height Maximum on Your Property in North End

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the North End neighborhood?

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

Answered	2
Skipped	1

45-foot Building Height Maximum on Your Property in North End

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the North End neighborhood?

Survey Questions

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 3

What is the current use of your property?

- Residential
- Commercial
- Mixed-use (Commercial and Residential)
- Vacant Lot (Undeveloped)
- Other

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

45-foot Building Height Maximum on Your Property in North End

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the North End neighborhood?

Individual Responses

Topic Registration Type: No registration

Name not available
July 1, 2020, 12:51 PM

Question 1

- No

Question 2

- No

Question 3

- Commercial

Question 4

The proposed zoning change limits what we can do with the property thus reducing its value.

Name not available
July 2, 2020, 3:11 PM

Question 1

- No

Question 2

- No

Question 3

- Commercial

Question 4

I oppose this change. When I served on the REgional Planning effort a number of years ago, the value of "infill" was repeatedly stressed - to make maximum use of existing infrastructure, and to prevent sprawl and attendant costs of roads, infrastructure extensions, and wider roadways. Limiting building height reduces the density of urban property use and is inappropriate for the reasons stated above. All properties in this area were purchased with knowledge of the 60 ft height and therefore it would be a taking to reduce the height, as well as counter to the principle of denser downtown development, to make this change. The city does not need to court expensive litigation on this matter. I oppose this change.

Name not available
July 4, 2020, 10:42 AM

Question 1

- No

Question 2

- No

Question 3

- Commercial

Question 4

No response

Sunnyside Property Owner Survey

45-foot Building Height Maximum on Your Property in Sunnyside

July 22, 2020, 7:36 PM

Contents

i.	Summary of responses	2
ii.	Survey questions	4
iii.	Individual responses	5

Topic Registration Type: No registration

45-foot Building Height Maximum on Your Property in Sunnyside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Sunnyside neighborhood?

Summary Of Responses

Topic Registration Type: No registration

As of July 22, 2020, 7:36 PM, this forum had:	
Attendees:	18
Responses:	6
Minutes of Public Comment:	18

Topic Start
June 25, 2020, 9:43 PM

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

	%	Count
Yes	83.3%	5
No	16.7%	1

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

	%	Count
Yes	83.3%	5
No	16.7%	1

QUESTION 3

What is the current use of your property?

45-foot Building Height Maximum on Your Property in Sunnyside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Sunnyside neighborhood?

		%	Count
Residential		66.7%	4
Commercial		16.7%	1
Mixed-use (Commercial and Residential)		16.7%	1

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

Answered	2
Skipped	4

45-foot Building Height Maximum on Your Property in Sunnyside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Sunnyside neighborhood?

Survey Questions

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 3

What is the current use of your property?

- Residential
- Commercial
- Mixed-use (Commercial and Residential)
- Vacant Lot (Undeveloped)
- Other

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

45-foot Building Height Maximum on Your Property in Sunnyside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Sunnyside neighborhood?

Individual Responses

Topic Registration Type: No registration

Name not available
June 30, 2020, 2:55 PM

Question 1

- Yes

Question 2

- Yes

Question 3

- Residential

Question 4

No response

Name not available
July 2, 2020, 5:14 PM

Question 1

- No

Question 2

- No

Question 3

- Commercial

Question 4

No response

Name not available
July 2, 2020, 7:00 PM

Question 1

- Yes

Question 2

- Yes

Question 3

- Residential

Question 4

Is building height the only change?

Name not available
July 3, 2020, 8:38 AM

Question 1

- Yes

Question 2

- Yes

Question 3

- Residential

Question 4

No response

Name not available
July 3, 2020, 10:01 AM

Question 1

- Yes

Question 2

- Yes

45-foot Building Height Maximum on Your Property in Sunnyside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Sunnyside neighborhood?

Question 3

- Mixed-use (Commercial and Residential)

Question 4

60' always seemed pretty tall for this area. I think that there should be an exemption for current owners who would want to exercise the right to build that high, but it should not be transferred to future owners. For the record, my property is built, and well under 45', so this doesn't affect me personally. After seeing some of the buildings that have gone up on the West side of town, it doesn't seem like structures of that size are a good fit for the Sunnyside area.

Name not available

July 19, 2020, 8:55 AM

Question 1

- Yes

Question 2

- Yes

Question 3

- Residential

Question 4

No response

Southside Property Owner Survey

45-foot Building Height Maximum on Your Property in Southside

July 22, 2020, 7:41 PM

Contents

i.	Summary of responses	2
ii.	Survey questions	3
iii.	Individual responses	4

Topic Registration Type: No registration

45-foot Building Height Maximum on Your Property in Southside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Southside neighborhood?

Summary Of Responses

Topic Registration Type: No registration

As of July 22, 2020, 7:41 PM, this forum had:	
Attendees:	12
Responses:	0
Minutes of Public Comment:	0

Topic Start
June 25, 2020, 9:45 PM

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet in the Southside neighborhood?

No response

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

No response

QUESTION 3

What is the current use of your property?

No response

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

No response

45-foot Building Height Maximum on Your Property in Southside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Southside neighborhood?

Survey Questions

QUESTION 1

Do you support the proposed Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet in the Southside neighborhood?

- Yes
- No
- Neutral

QUESTION 2

Do you support changing the zoning designation of your property from Community Commercial (CC) with a maximum building height of sixty (60) feet to the new Community Commercial Neighborhood (CCN) zone with a maximum building height of forty-five (45) feet?

- Yes
- No
- Neutral

QUESTION 3

What is the current use of your property?

- Residential
- Commercial
- Mixed-use (Residential and Commercial)
- Vacant lot (undeveloped)
- Other

QUESTION 4

Do you have any additional comments that you would like to share with the City Staff, Planning and Zoning Commission and City Council?

45-foot Building Height Maximum on Your Property in Southside

Your property is zoned Community Commercial (CC), which allows for a maximum building height of sixty (60) feet. Do you support a forty-five (45) foot maximum building height on your property in the Southside neighborhood?

Individual Responses

Topic Registration Type: No registration

Daniel Symer

From: Shane Dille
Sent: Wednesday, April 28, 2021 8:10 AM
To: Daniel Folke; Daniel Symer; Tiffany Antol
Subject: FW: Height Restrictions Zone Amendment

Follow Up Flag: Follow up
Flag Status: Flagged

FYI

From: Joe Galli <jgalli@flagstaffchamber.com>
Sent: Tuesday, April 27, 2021 6:04 PM
To: Mayor and Council <council@flagstaffaz.gov>
Cc: Greg Clifton <Greg.Clifton@flagstaffaz.gov>
Subject: Height Restrictions Zone Amendment

Dear Mayor and Council,

I will not be available to speak in person this evening to your agenda item on height restrictions in certain community neighborhoods as a zoning code amendment.

Therefore, just a quick note to let you know the Chamber has had prior presentations on the item from City Zoning Code Admin, Dan Symer. We have consistently opposed this idea for several reasons, not the least of which is the result will be less density in the urban core which goes against making housing more affordable in Flagstaff, and goes against sustainability goals of creating higher density with less car trips, more walkable neighborhoods, and more biking.

The Chamber also opposes this zoning change because it likely violates state law known as Prop 207, and would be considered a downzone or taking of private property rights, and then subject city taxpayers to potential financial settlements with aggrieved property owners.

We appreciate your consideration of opposition to this item.

Sincerely,

Joe G.

--
Joe Galli
Senior Advisor, Public Policy
Greater Flagstaff Chamber of Commerce
(928) 774-4505

Daniel Symer

From: David Carpenter <dc@hopeaz.com>
Sent: Monday, May 10, 2021 4:50 PM
To: Mayor and Council
Cc: Daniel Folke; Daniel Symer; Tiffany Antol; Alaxandra Pucciarelli; Leah Bloom; Sara Dechter; Sarah Darr; Nicole Antonopoulos
Subject: NCC Down Zoning Discussion

Follow Up Flag: Follow up
Flag Status: Flagged

Mayor and Council-

I wanted to send you a note on the newly proposed Neighborhood Commercial Zone (NCC) that is being proposed for the purpose of downzoning large areas of the city and reducing building height. Most of you know me but for the new Mayor and Council members I am a local infill developer, green builder, and environmentalist. This is a bad idea for a number of reasons. The community overwhelmingly voted in 2011 for a new zoning code that promoted a denser, walkable, urban core in lieu of exurbs and suburbs. This was a conscious choice made by over 6,000 voters after 5 years of input to try and embrace the ideas promoted by new urbanism. I was the chairman of the planning and zoning commission at the time and I remember dozens and dozens of meetings, design charrettes, community open halls, and thousands of comments and input that spanned years during the rewrite of the code. It has only been more recently that a very few vocal opponents of that vison were able to lobby the previous mayor and council to start dismantling that vison. It is not necessarily incumbent upon you to just arbitrarily continue along that trajectory.

We are in the midst of a housing crisis and a global warming crisis we can no longer afford to kowtow to the NIMBY's of the world. I realize this is hard as they are literally everywhere. However, they do represent the masses. I'll point out that this problem is not unique to our community. NIMBYism and overreaching zoning regulations are cited in every real estate and building publication that I read as the number one hurdles to providing more housing across the entire country. It is only in the really progressive cites where they are starting to get it and starting to increase density. Places like Seattle, Portland, Austin and Minneapolis. Click here for a thoughtful article about Minneapolis, who recently up zoned their entire city: https://archive.curbed.com/2018/11/27/18113208/minneapolis-real-estate-rent-development-2040-zoning Even Sedona recently up zoned by reducing the required parking for small units and incentivizing the specific types of housing that they desperately need.

The community needs the flexibility to continue to add density in the Southside and Sunnyside as solutions to our housing crisis. These areas contain a lot of hosing stock that is beyond their useful lives and should be where density and urban renewal take place. Land owners on the Southside have literally been waiting 100 years to get their flood problem solved and unlock their lands full potential. Redevelopment there just seems obvious to most and we hope you give this some serious thought before you knock the wind out of their sails.

I am currently sitting on three brain trust commissions in the city with all the smartest people we have in the room. Dozens of city staffers, affordable housing experts, business owners, engineers, and builders. Zoning and overregulation continues to top the list as the things that need to move in the other direction if we want to get serious about our housing problems. Not only are these commissions calling for an end to the continued backwards trajectory of our land use laws, but you will see at the end of these processes a request to undo the past zoning regulations that limit density. And we will be forced to ask ourselves serous questions in the future about opportunities for up zonings not down zonings as we run out of land.

Please take a moment to take in the totality of this decision as it relates to the communities desire to build more walkable urban place types, climate adaptation goals, and affordable housing goals. There is more at stake here than at first glance.

Thank You,

David Carpenter

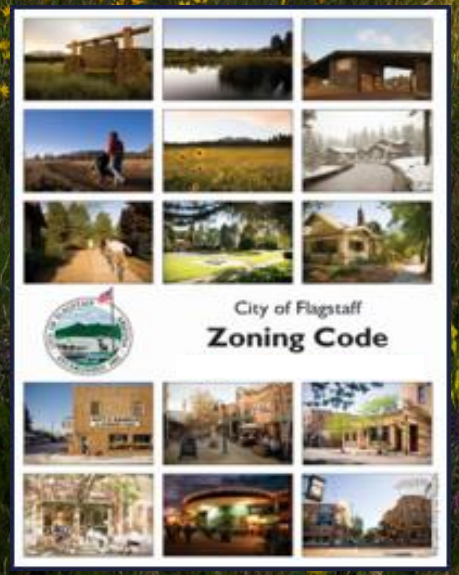
HOPE
CONSTRUCTION
GENERAL CONTRACTING & CONSTRUCTION MANAGEMENT

Hope Construction
495 S River Run Rd.
Suite 100
Flagstaff, AZ 86001

P 928-527-3159
F 928-527-0357
C 928-380-5808

Neighborhood Community Commercial (NCC) Zone

Zoning Code Text Amendment



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Dan Symer, AICP
Zoning Code Manager

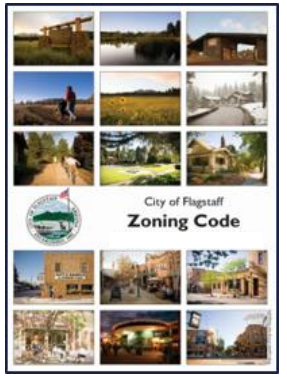
Reason for the Proposed Zoning Code Text Amendment

Request:

- **Amend the Zoning Code to create the Neighborhood Community Commercial (Adopt the Neighborhood Community Commercial (NCC) zone**

Note: This amendment does not affect the Transect zones

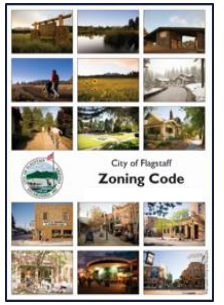
A property's existing zoning will not be affected by the adoption of the zone

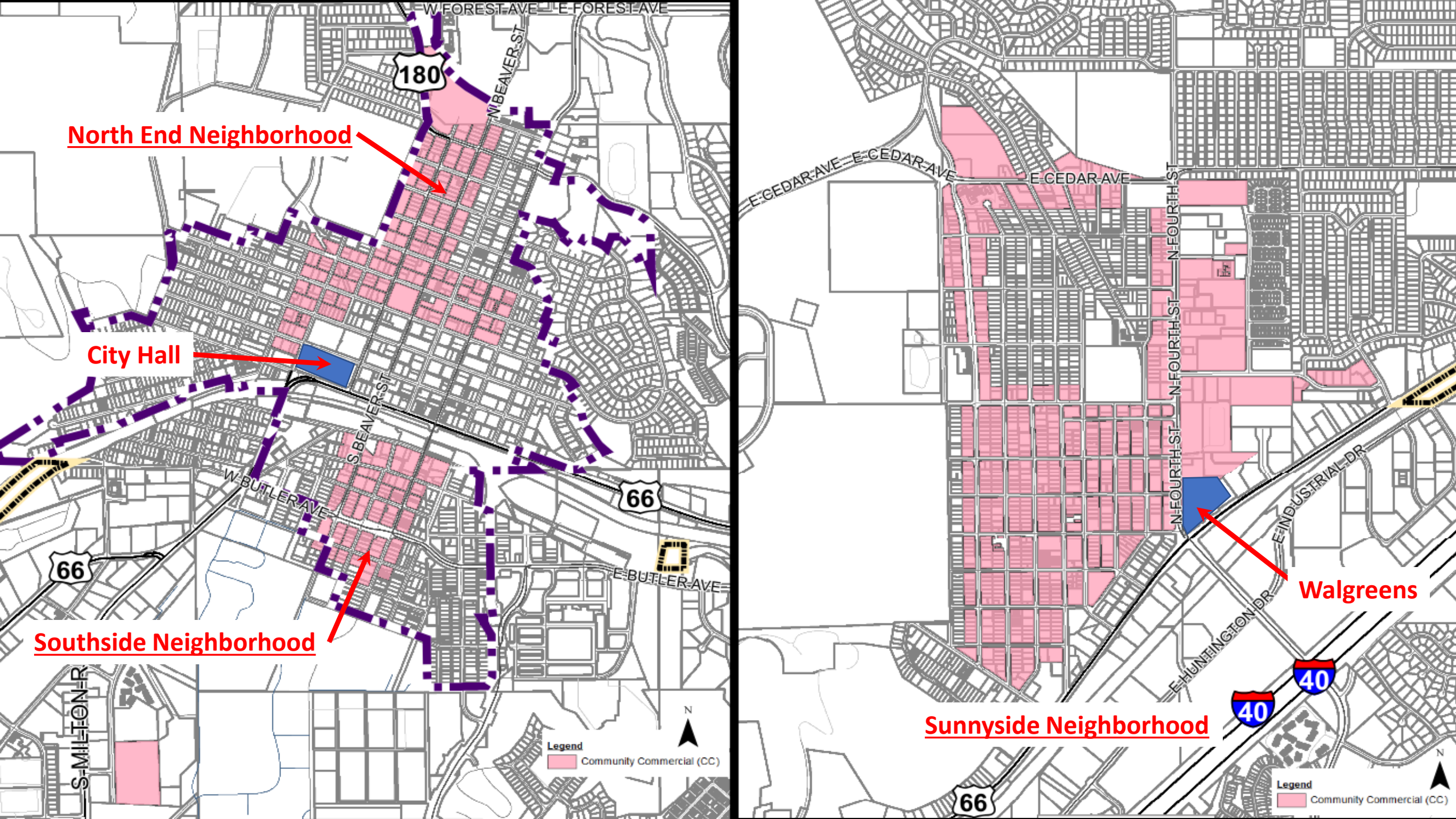


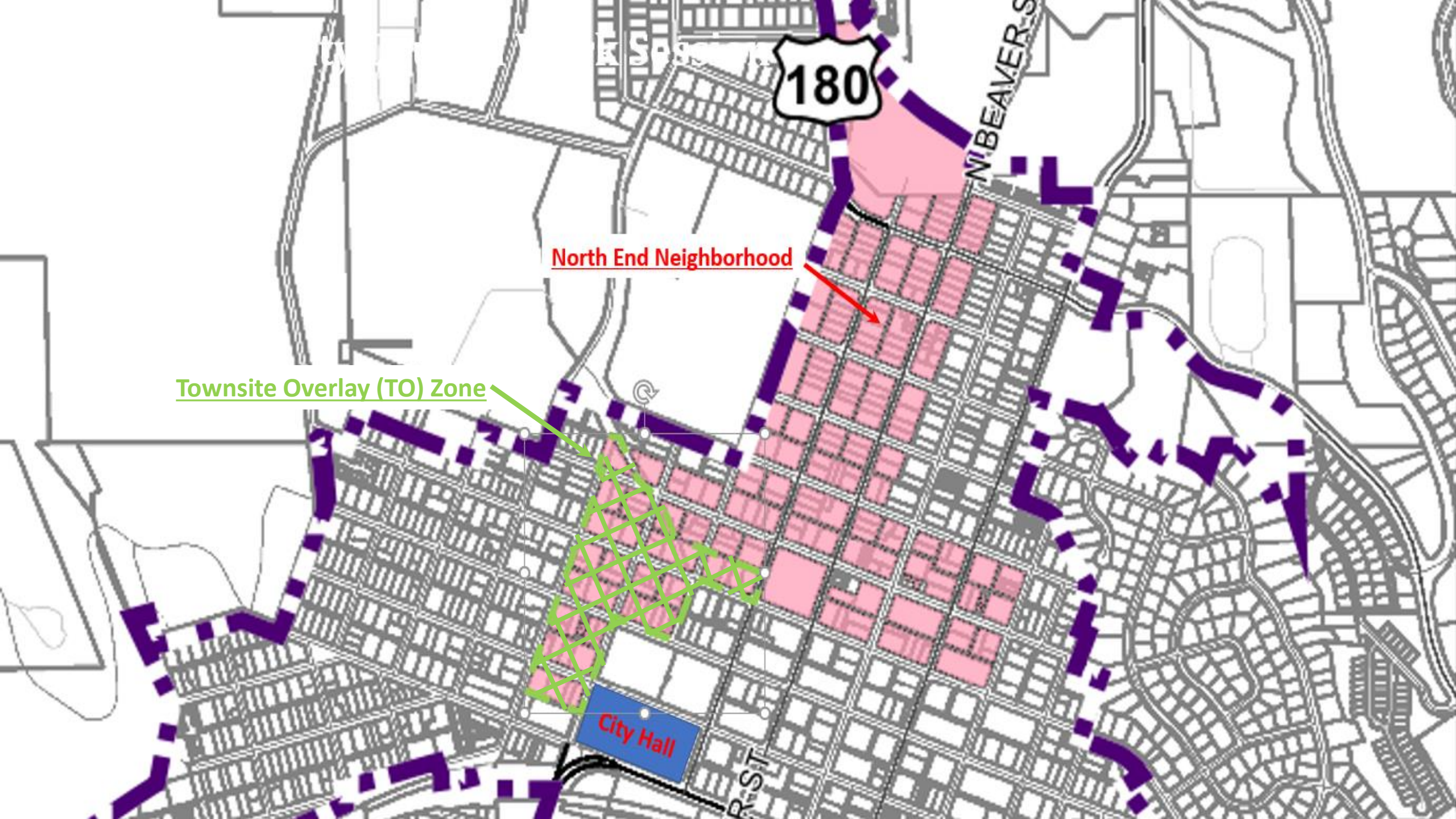
Reason for the Proposed Zoning Code Text Amendment

Purpose:

- **To assist in implementing:**
  - **High Occupancy Housing Plan (Strategies to be Implemented, bullet 5, Page 102) to modifying the building height in the Community Commercial (CC) zone from 60 feet to 45 feet**



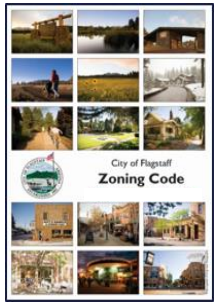

North End Neighborhood
City Hall
Southside Neighborhood
Sunnyside Neighborhood
Walgreens
W FOREST AVE
E FOREST AVE
N BEAVER ST
180
S BEAVER ST
W BUTLER AVE
E BUTLER AVE
66
E CEDAR AVE
N FOURTH ST
E INDUSTRIAL DR
E HUNTINGTON DR
40
S MILTON R
Legend
Community Commercial (CC)
N


180
N BEAVER ST
North End Neighborhood
Townsite Overlay (TO) Zone
City Hall
R ST

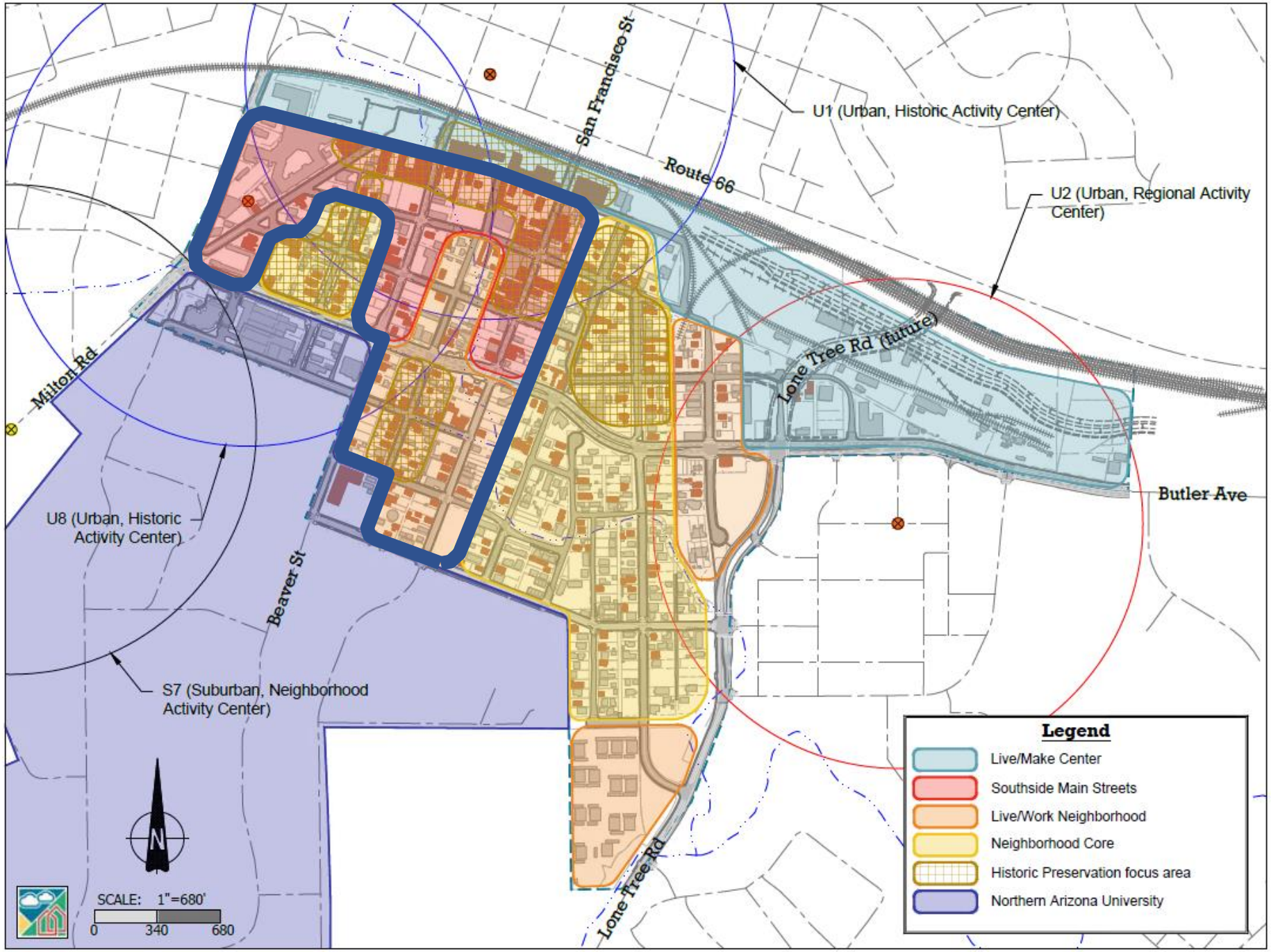
Reason for the Proposed Zoning Code Text Amendment

Purpose:

- **To assist in implementing:**
  - **To assist in implementing Southside Community Plan that areas of the Southside should not exceed 45-feet (Policies SMS 1.2. and SLW 1.2., pages 43 and 44)**



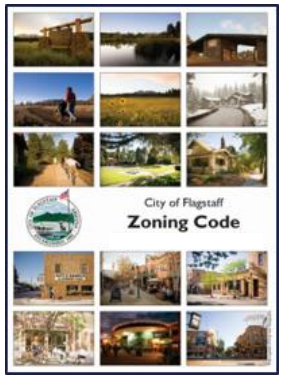
Southside Subareas



Proposed Zoning Code Text Amendment

Purpose:

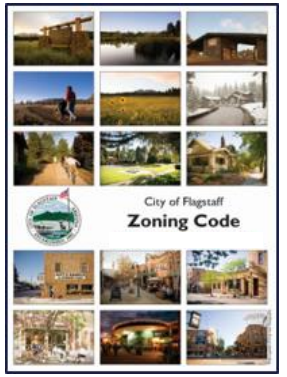
- **Amend the Zoning Code to create the Neighborhood Community Commercial (Adopt the Neighborhood Community Commercial (NCC) zone**
  - **Maximum Building Height: 45 feet**
  - **Remainder of NCC zone is identical to the Community Commercial (CC) zone**



Neighborhood Community Commercial (NCC) Zone

- **Neighborhood Community Commercial (NCC) allowed building height: 45 feet**

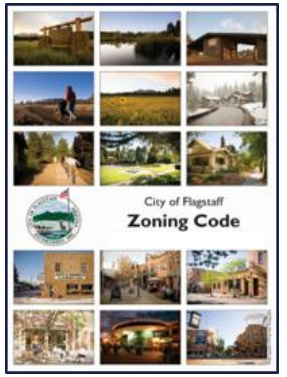
Southeast corner of E Butler Ave and S Agassiz St



Neighborhood Community Commercial (NCC) Zone

- **Neighborhood Community Commercial (NCC) allowed building height: 45 feet**

Southeast corner of E Benton Ave and S San Francisco St



Proposed Zoning Code Amendment

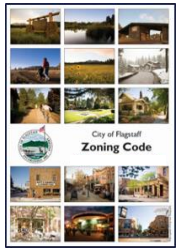
Steps:

1. **Adopt the Neighborhood Community Commercial (NCC) zone**

   Note. A property's existing zoning will not be affected by the adoption of the zone

Future

2. **Conduct individual neighborhood focused public outreach**
3. **City Council work session to discuss the results of the public outreach and possible initiation of a Zoning Map Amendment that is specific to each neighborhood**
4. **Conduct public outreach, and process the Zoning Map Amendment**
5. **Planning and Zoning Commission recommendation**
6. **City Council decision on Zoning Map Amendment**



Required Findings and Recommendation

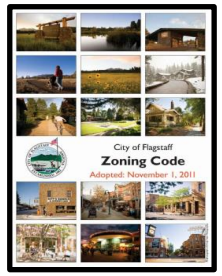
- **Findings for Zoning Code Text Amendments:**

  (1) The proposed amendment is consistent with and conforms to the objectives and policies of the General Plan and any applicable specific plan;

  (2) The proposed amendment will not be detrimental to the public interest, health, safety, convenience or welfare of the City; and

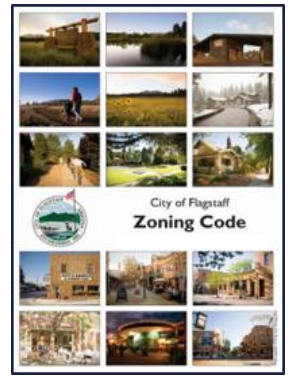
  (3) The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.

- **Staff and the Planning and Zoning Commission recommend that the findings have been met and to approve the Zoning Code Text Amendments.**



Neighborhood Community Commercial (NCC) Zone

Questions and Comments



10. C.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Rick Tadder, Management Services Director
Co-Submitter:	Brandi Suda, Finance Director; Heid Derryberry, Assistant Finance Director
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Public Hearing: Fiscal Year 2021-2022 Budget and Property Tax Levy

STAFF RECOMMENDED ACTION:

1) Open the public hearing
2) Receive citizen input
3) Close the public hearing
4) Convene Special Meeting

Executive Summary:

This public hearing is being held to comply with law. Arizona budget laws require a public hearing on the proposed final budget and property tax levy, A.R.S. Section 42-17104.

Financial Impact:

Upon adopting the final Fiscal Year (FY) 2021-2022 Budget, the City may commit and spend funds for community needs as described in the budget. The budget is funded through numerous revenue sources, including property tax.

The FY 2020-2021 primary property tax levy was $6,952,496. The City is proposing a flat levy on the existing property. The total levy related to new construction is $86,167 for a total levy of $7,038,663 in FY 2021-2022. The primary property tax rate to support this levy is 0.7189 per $100 of net assessed valuation (a decrease from the prior fiscal year).

The City is proposing a secondary property tax levy of $7,739,745 on existing properties, plus a levy of $96,229 on new construction, for a total secondary property tax levy in FY2021-2022 of $7,835,974. The proposed secondary property tax rate is 0.8000 per $100 of net assessed valuation (same as the prior fiscal year).

Policy Impact:

The FY 2021-2022 Budget is the financial plan of the City for the upcoming fiscal year.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

The adoption of the Annual Budget and Financial Plan provides direction and financial resources to support the Key Community Priorities, Regional Plan and Team Flagstaff Strategic Plans.

Has There Been Previous Council Decision on This:

- December Budget Retreat December 17, 2020
- February Budget Retreat on February 1, 2021
- Council Budget Work Session on April 22, 2021 and April 23, 2021
- Tentative Budget Adoption on June 1, 2021

Options and Alternatives:

1. Conduct the public hearing; or,
2. Delay the public hearing

Background/History:

Budget adoption:
The budget was presented for tentative adoption on June 1, 2021. The tentative adoption established the maximum appropriation for the City for the FY 2021-2022 budget year. The budget legal schedules were published in the Arizona Daily Sun on June 3, 2021, and June 10, 2021.

Property tax levy:
Primary property taxes are accumulated in the General Fund and pay for general services which include but are not limited to public safety, parks and recreation, other public work services, and general administrative and management functions within the City.

Secondary property taxes support debt service payments on numerous city capital projects including the Aquaplex, fire stations, open space, street/utility projects, forest restoration, the core services facility, and courthouse.

The current and proposed property tax rates are shown in the "Expanded Financial Consideration" section below.

Truth in Taxation legislation:
Every year, the Truth in Taxation legislation requires that the county assessor, on or before February 10, transmit to each city and town an estimate of the total net assessed valuation of the city, including new property added to the tax roll. If the proposed primary tax levy amount, excluding amounts attributable to new construction, is greater than the levy amount in the previous year, the City must go through the Truth in Taxation procedures. It is important to note that it is the levy amount and not the rate which triggers the Truth in Taxation procedure . The City of Flagstaff has not triggered the Truth in Taxation notification and hearing for FY 2021-2022 and no additional notifications are required.

Key Considerations:

The adoption of the tentative budget set forth into motion a legally mandated time sequence of actions of which the Council must adhere to adopt a final budget and to levy property taxes. If this time sequence is not met as required by statute, the tentative budget adoption, the final budget adoption, the property tax levy actions, and related publications must be started over. The final budget adoption must occur after a public hearing and Council must convene into a Special Meeting to adopt the final budget. The budget must be adopted by the third week of July. The County will adopt the property tax levy the first week of August. The key dates in the process have been presented as part of the action summary.

June 1, 2021 Tentative adoption of the budget by Council
June 15, 2021 Proposed budget and property tax levy public hearing

June 15, 2021 Final budget adoption (In a Special meeting)
June 15, 2021 First reading property tax ordinance
July 6, 2021 Final reading and adoption of the property tax ordinance

Expanded Financial Considerations:

The City has proposed a flat primary property tax levy in FY 2021-2022 of $7,083,663. The maximum allowable primary property revenue under state law for FY 2021-2022 is $7,322,717. The primary property tax rate will decrease from $0.7510 in FY 2020-2021 to $0.7186 in FY 2021-2022 due to a total valuation of all existing properties which are increasing 4.5%. Five years of historical data is shown below:

Property Tax Rates	FY 2017-2018	FY 2018-2019	FY 2019-2020	FY 2020-2021	FY 2021-2022 Proposed
Primary	0.8233	0.8334	0.7933	0.7510	0.7186
Secondary	0.8366	0.8366	0.8366	0.8000	0.8000
Total	1.6599	1.6700	1.6299	1.5510	1.5186

The final budget adoption allows the City to commit and expend resources as determined to be needed through the FY 2021-2022 budget process. There have been no changes in the final budget recommended for adoption from that presented as the tentative budget. The recommended City of Flagstaff appropriation for FY 2021-2022 is $XXX,XXX,XXX.

Community Benefits and Considerations:

The budget process has allowed for public participation which is vital for the City Council in determining the current year goals and objectives. The budget translates Key Community Goals and Objectives into a fiscal plan. Timely budget adoption allows the City to commit expenditures as related to the FY 2021-2022 Budget as needed for ongoing operational consistency to the citizenry. The FY 2021-2022 Budget is balanced.

Community Involvement:

Inform/Involve: This is the public hearing in the budget adoption process and it is open to public comment on the property tax levy and the final budget adoption. Budget legal schedules were published in the June 3, 2021, and June 10, 2021, Arizona Daily Sun to allow for additional community review. In addition, the legal and other budget schedules were made available at City Hall, at both Flagstaff Public Libraries, and on the official city website. The final opportunity for community involvement for budget adoption is at this public meeting. The final opportunity for public input on the tax levy will be at the July 6, 2021, Council Meeting.

Attachments: Presentation

City of Flagstaff FY 2021-2022 Budget and Property Taxes

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June 15, 2021

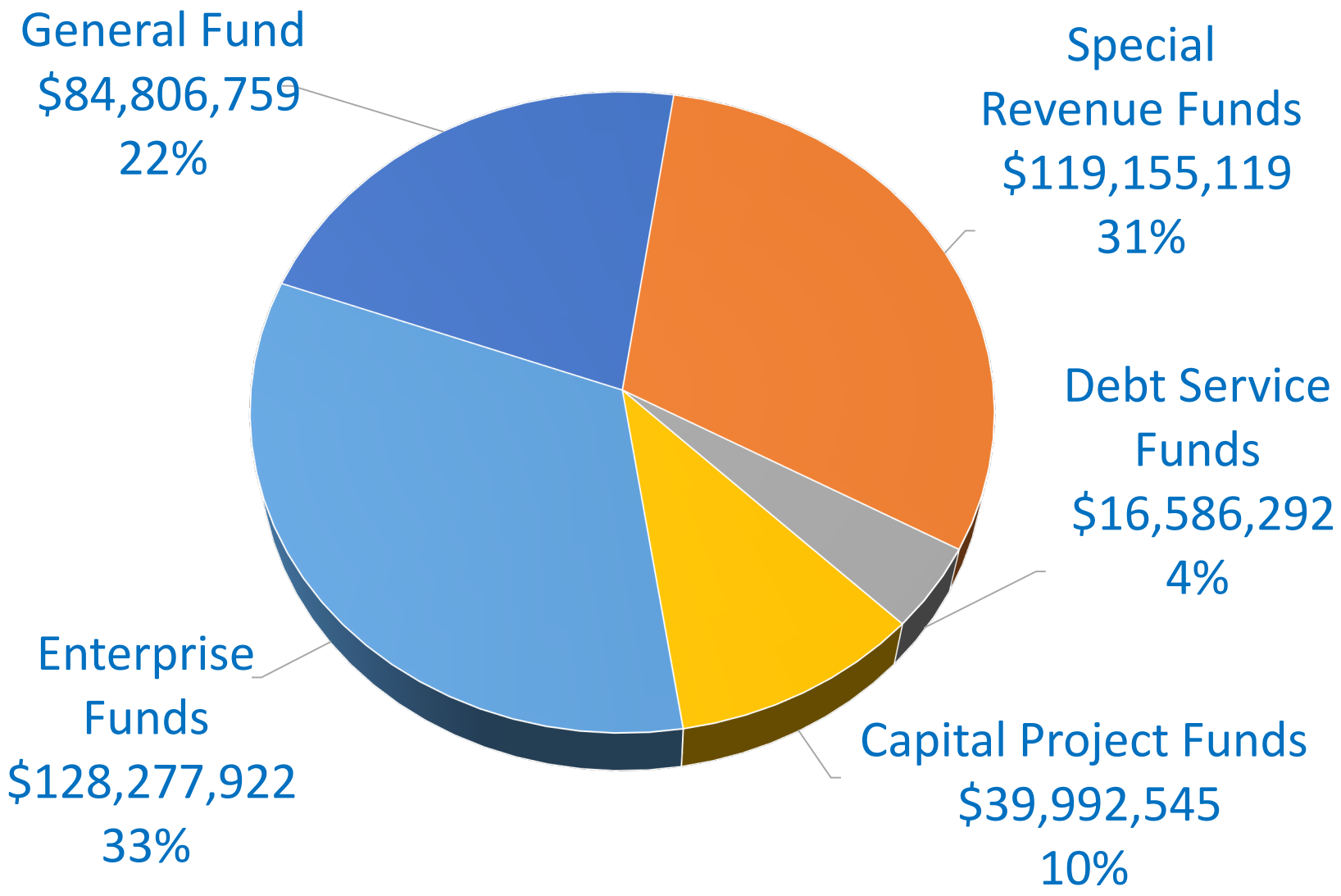
Budget Timeline

- ✓ **June 1st – Tentative Budget Adoption**
- **June 15th**
  - Public Hearing for Budget and Tax Levy
  - Final Budget Adoption
  - 1st Reading of Property Tax Ordinance
- **July 6th**
  - 2nd Reading and Adoption of Property Tax Ordinance

Legal Schedule A

Total
FY 2021-2022
Budget:
$388,818,634

$61.9M (14%) decrease over FY 2020-2021



FY 21-22 Approved CAAP Requests

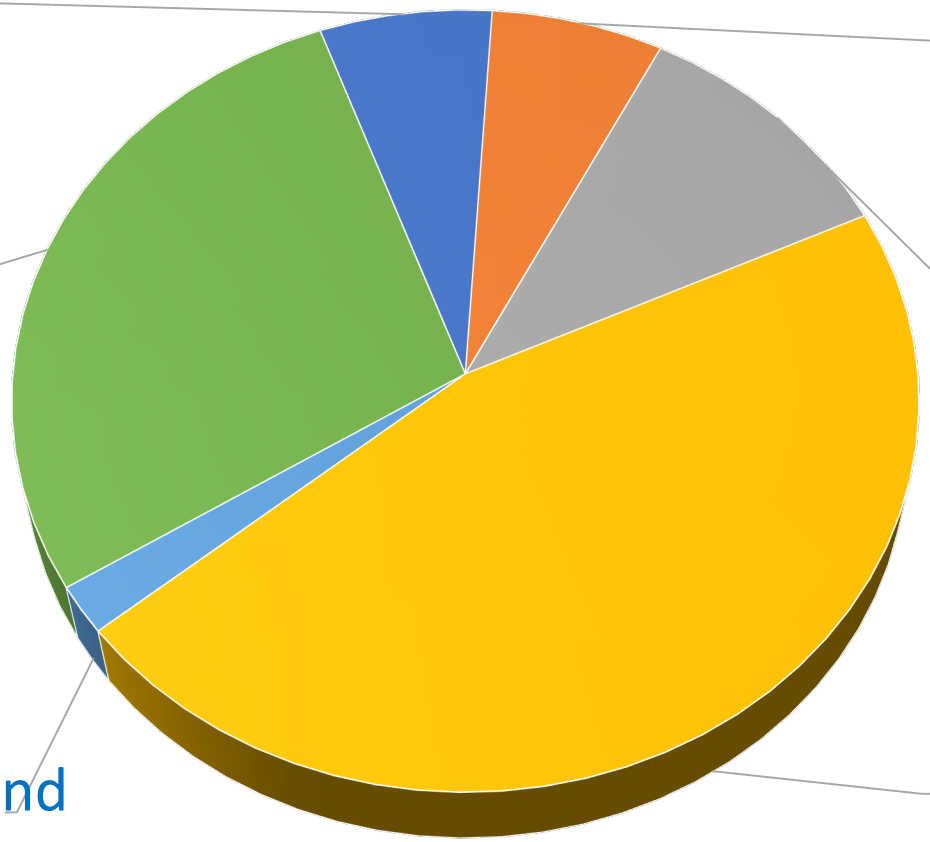
FY 21-22 Approved Budget Requests		
Climate and Equity Both	$3,651,613	10%
Climate Only	$6,039,264	17%
Equity Only	$535,065	2%
N/A	$25,352,248	71%
Total	$35,578,190	100%

29% of FY 21/22 requests have **potential** to advance strategies in the Climate Action and Adaptation Plan and advance equity

Climate Related Approved Requests

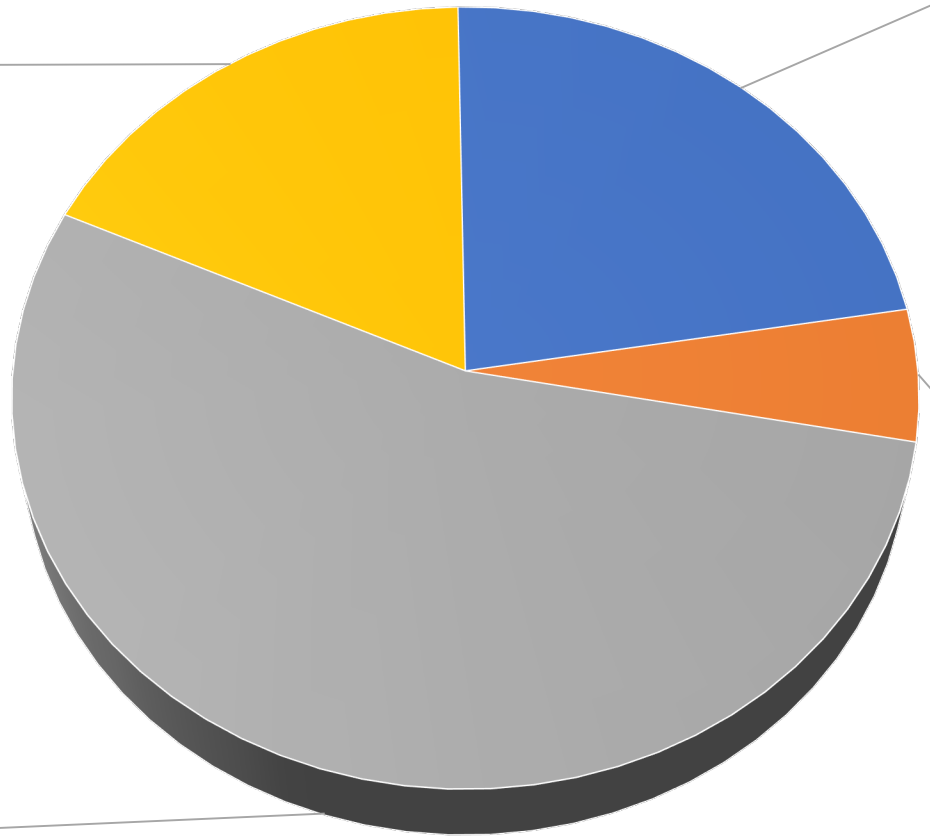
Climate:

$9,690,877



Equity Related Approved Requests

Equity:
$4,186,678



Proposed Property Tax

Total Proposed Primary Tax Levy: $7,038,663

- New construction revenue totals $86,167
- Assessed values increased 4.5% on average
- Proposed tax rate of 0.7186 per $100/AV
- Rate decrease from 0.7510 in the prior year
- Unrestricted per state statutes

Total Proposed Secondary Tax Levy: $7,835,974

- Proposed tax rate of $0.8000 per $100/AV, same as prior year
- 5.8% levy increase
- Cannot exceed the estimated general obligation debt service payments for FY 2021-2022

Property Tax Rate History

Property Tax	FY 2017-2018	FY 2018-2019	FY 2019-2020	FY 2020-2021	FY 2021-2022 Proposed
Primary	0.8233	0.8334	0.7933	0.7510	0.7186
Secondary	0.8366	0.8366	0.8366	0.8000	0.8000
Total	1.6599	1.6700	1.6299	1.5510	1.5186

- Primary Property Tax Rate (FY 2021-2022)
  - Proposed: 0.7186 per $100/AV
  - Flat Levy: 0.7186 per $100/AV
  - Maximum: 0.7476 per $100/AV

Property Assessed Values

	Budget FY 2019-20 (Tax Year 2020)	Budget FY 2021-22 (Tax Year 2021)	% Increase
Limited Net AV	$ 925,765,090	$ 979,496,706	5.8%
Full Cash Net AV	$ 1,123,106,392	$ 1,187,412,636	5.7%

- Determined by the County Assessor's Office
- New construction 1.2%, $12M assessed value
- Values based on valuation done in late 2019 for Tax Year 2021
- Limited assessed value is used to calculate both the primary and secondary property tax per State Statutes
- Limited assessed value is limited to maximum 5% increase per year for most real property

City Property Tax Impact

Residential:

	$100,000 Property in 2020		$100,000 Property in 2021	
City Taxing Authority	Rate	Taxes	Rate	Taxes
Primary Property Tax	0.7510	$ 75.10	0.7186	$ 71.86
Secondary Property Tax	0.8000	$ 80.00	0.8000	$ 80.00
Total: City Taxing Authority	1.5510	$ 155.10	1.5186	$ 151.86
			Change	$ (3.24)

In FY 2021, City property taxes were approximately 22% of the total residential property tax bill

City Property Tax Impact

Commercial:

	$1,000,000 Property in 2020		$1,000,000 Property in 2021	
City Taxing Authority	Rate	Taxes	Rate	Taxes
Primary Property Tax	0.7510	$ 1,351.80	0.7186	$ 1,293.48
Secondary Property Tax	0.8000	$ 1,440.00	0.8000	$ 1,440.00
Total: City Taxing Authority	1.5510	$ 2,791.80	1.5186	$ 2,733.48
			Change	$ (58.32)

Questions

Brandi Suda, Finance Director

bsuda@flagstaffaz.gov

928-213-2217

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

11. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Rick Tadder, Management Services Director
Co-Submitter:	Brandi Suda, Finance Director; Heidi Derryberry, Assistant Finance Director
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-28: A resolution of the Council of the City of Flagstaff, Arizona, adopting the Budget for the City of Flagstaff for Fiscal Year 2021-2022.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-28 by title only
2) City Clerk reads Resolution No. 2021-28 by title only (if approved above)
3) Adopt Resolution No. 2021-28
4) Reconvene Regular Meeting

Executive Summary:

Each municipality is required to adopt a budget as prescribed by A.R.S. Title 42, Chapter 17, Articles 1 through 5. As published in the tentative adoption of the budget, the final budget is to be adopted on June 15, 2021, (during a Special Meeting), and following a public hearing to receive citizen comments.

Financial Impact:

The final budget adoption allows the City to commit and spend funds for community needs as described in the Fiscal Year (FY) 2021-2022 Budget. This will set the maximum allowable expenditures for FY 2021-2022.

Policy Impact:

The FY 2021-2022 budget is the financial plan of the City for the upcoming fiscal year.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

The adoption of the Annual Budget and Financial Plan provides direction and financial resources to support the Key Community Priorities and Objectives, Regional Plan and Team Flagstaff Strategic Plan.

Has There Been Previous Council Decision on This:

- December Budget Retreat on December 17, 2020
- February Budget Retreat on February 1, 2021
- Council Budget Work Session on April 22, 2021 and April 23, 2021
- Tentative Budget Adoption on June 1, 2021

Options and Alternatives:

- Approve the budget as presented: As the City adopted the tentative budget on June 1, 2020, the maximum appropriation for FY 2021-2022 has been set.
- Amend and approve the budget: The Council could choose to make adjustments within that maximum appropriation or make reductions in the maximum appropriation.

Background/History:

The budget was presented for tentative adoption on June 1, 2021. The tentative adoption established the maximum appropriation for the City for FY 2021-2022. The budget legal schedules were published in the Arizona Daily Sun on June 3, 2021, and June 10, 2021.

Key Considerations:

The adoption of the tentative budget set forth into motion a legally mandated time sequence of actions of which the Council must adhere to adopt a final budget. If this time sequence is not met as required by statute, the tentative budget adoption, final budget adoption, and related publications must be started over. The final budget adoption must occur after a public hearing and Council must convene into a Special Meeting to adopt the final budget. The budget must be adopted by the third week of July.

June 1, 2021	Tentative adoption of the budget by Council
June 15, 2021	Public hearing on FY 2020-2021 Budget and Property Tax Levy
June 15, 2021	Final budget adoption (In a Special meeting)

Expanded Financial Considerations:

Funds must be appropriated to allow for expenditures to occur. The City can spend less than the adopted budget, however, we cannot exceed the budget even if revenues are higher than what was adopted.

The City Council adopted an Economic Recession Plan ("Recession Plan") which provides guidance in expenditure reduction measures to ensure we stay within the revenue resources we receive as a result changes in economic conditions. The City monitors financial revenue data throughout the year.

Community Benefits and Considerations:

The budget process has allowed for public participation which is vital for the City Council in determining the current year priorities and objectives. The budget assists in translating the community's priorities and objectives into fiscal reality. Timely budget adoption allows the City to commit expenditures as related to the FY 2021-2022 Budget as needed for ongoing operational consistency to the citizenry. The FY 2021-2022 Budget is balanced.

Community Involvement:

Inform/Involve: Earlier this evening there was a public hearing to receive any last public comments prior to final budget adoption. Budget legal schedules were published in the June 3, 2021, and June 10, 2021, Arizona Daily Sun to allow for community review. In addition, the legal and other budget schedules were made available at City Hall, at both Flagstaff Public Libraries, and on the official city website.

Attachments: Res. 2021-28

FY 2021-2022 Budget Schedules
Compensation Presentation

RESOLUTION NO. 2021-28

A RESOLUTION OF THE COUNCIL OF THE CITY OF FLAGSTAFF, ARIZONA ADOPTING THE BUDGET FOR THE CITY OF FLAGSTAFF FOR FISCAL YEAR 2021-2022.

RECITALS:

WHEREAS, in accordance with the provisions of A.RS. Title 42, Chapter 17, Articles 1 - 5, the City Council did, on June 1, 2021 make an estimate of the different amounts required to meet the public expenditures/expenses for the ensuing year, also an estimate of revenues from sources other than direct taxation, and the amount to be raised by taxation upon real and personal property within the City of Flagstaff; and

WHEREAS, in accordance with said sections of said Title, and following due public notice, the Council met on June 1, 2021, at which meeting any taxpayer was privileged to appear and be heard in favor of or against any of the proposed expenditures/expenses or tax levies; and

WHEREAS, it appears that publication has been duly made as required by law, of said estimates together with a notice that the City Council would meet on June 15, 2021, in the City Council Chambers at City Hall for the purpose of hearing taxpayers and making tax levies as set forth in said estimates; and

WHEREAS, it appears that the sums to be raised by taxation, as specified therein, do not in the aggregate amount exceed that amount as computed in A.RS. 42-17051 (A).

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

That said estimates of revenues and expenditures shown on the accompanying schedules as now increased, reduced, or changed, are hereby adopted as the budget of the City of Flagstaff for Fiscal Year 2021-2022.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Exhibits:

Schedule A – Summary schedule of Estimated Revenues and Expenditures/Expenses
Schedule B – Tax Levy and Tax Rate Information
Schedule C – Revenues Other Than Property Taxes
Schedule D – Other Financing Sources/(Uses) and Interfund Transfers
Schedule E – Expenditures/Expenses by Fund
Schedule F – Expenditures/Expenses by Division (as applicable)
Schedule G – Full-Time Employees and Personnel Compensation

Official Budget Forms
City of Flagstaff
Fiscal Year 2021-2022

City of Flagstaff

Table of Contents

Fiscal Year 2021-2022

Resolution for the Adoption of the Budget

Schedule A – Summary schedule of Estimated Revenues and Expenditures/Expenses

Schedule B – Tax Levy and Tax Rate Information

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City of Flagstaff
Summary Schedule of Estimated Revenues and Expenditures/Expenses
Fiscal Year 2021-2022

The final opportunity for public input on the City of Flagstaff Fiscal Year 2021-2022 budget will occur on June 15, 2021 at the 3:00 PM City Council meeting
In-person audiences have been suspended until further notice - public participation comments can be submitted to publiccomment@flagstaffaz.gov
The budget may be reviewed at the City of Flagstaff in the City Clerks Office, 211 West Aspen Avenue, Flagstaff, AZ 86001
or the official website "flagstaff.az.gov" or by request

Fiscal Year		Sch	Funds							
			General Fund	Special Revenue Funds	Debt Service Funds	Capital Project Funds	Permanent Fund	Enterprise Funds	Internal Service Funds	Total All Funds
2021	Adopted/Adjusted Budgeted Expenditures/Expenses*	E	81,689,749	94,938,326	129,380,836	20,346,181	0	124,333,224	0	450,688,316
2021	Actual Expenditures/Expenses**	E	66,426,429	44,282,505	127,889,303	6,677,919	0	74,642,378	0	319,918,534
2022	Fund Balance/Net Position at July 1***		44,999,542	76,612,872	21,513,913	5,272,387	366,929	64,682,042	0	213,447,685
2022	Primary Property Tax Levy	B	7,038,663	0	0	0		0	0	7,038,663
2022	Secondary Property Tax Levy	B	0	0	7,835,974	0		0	0	7,835,974
2022	Estimated Revenues Other than Property Taxes	C	63,633,187	79,761,142	107,000	2,601,676	14,366	88,282,861	0	234,400,232
2022	Other Financing Sources	D	0	0	0	27,900,000	0	18,000,000	0	45,900,000
2022	Other Financing (Uses)	D	0	0	0	0	0	0	0	0
2022	Interfund Transfers In	D	11,781,522	23,146,025	16,586,292	4,218,482	0	5,781,152	0	61,513,473
2022	Interfund Transfers (Out)	D	18,984,720	30,385,247	7,388,402	0	0	4,755,104	0	61,513,473
2022	Reduction for Amounts Not Available									
Less:	Amounts for Future Debt Retirement									0
										0
										0
										0
2022	Total Financial Resources Available		108,468,194	149,134,792	38,654,777	39,992,545	381,295	171,990,951	0	508,622,554
2022	Budgeted Expenditures/Expenses	E	84,806,756	119,155,119	16,586,292	39,992,545	0	128,277,922	0	388,818,634

Expenditure Limitation Comparison	2021	2022
1. Budgeted Expenditures/Expenses	$ 450,688,316	$ 388,818,634
2. Add/Subtract: Estimated Net Reconciling Items	0	0
3. Budgeted Expenditures/Expenses Adjusted for Reconciling Items	450,688,316	388,818,634
4. Less: Estimated Exclusions	282,359,084	191,167,222
5. Amount Subject to the Expenditure Limitation	$ 168,329,232	$ 197,651,412
6. EEC Expenditure Limitation	$ 168,625,388	$ 197,894,236

☐ The city/town does not levy property taxes and does not have special assessment districts for which property taxes are levied. Therefore, Schedule B has been omitted.

* Includes expenditure/expense adjustments approved in the current year from Schedule E.
** Includes actual amounts as of the date the proposed budget was prepared, adjusted for estimated activity for the remainder of the fiscal year.
*** Amounts on this line represent fund balance/net position amounts except for amounts not in spendable form (e.g., prepaids and inventories) or legally or contractually required to be maintained intact (e.g., principal of a permanent fund).

City of Flagstaff
Expenditure Limitation and
Tax Levy Information
Fiscal Year 2021-2022

	Estimate* FY 2020-2021	Budget FY 2021-2022
Expenditure Limitation [Economic Estimates Commission]		$ 197,894,236
Total Estimated Expenditures Subject to Expenditure Limitation		
1. Maximum Allowable Primary Property Tax Levy [ARS 42-17051.A] rev 6/06 HB 2876	$ 7,091,361	$ 7,322,717
2. Amount Received from Primary Property Taxation in FY 2020-2021 in Excess of the Sum of that Year's Maximum Allowable Primary Property Tax Levy [ARS 42-17102.A.18]	$ -	
3. Property Tax Levy Amounts		
A. Primary Property Taxes	$ 6,952,496	$ 7,038,663
B. Secondary Property Taxes	7,406,121	7,835,974
C. Total Property Tax Levy Amount	$ 14,358,617	$ 14,874,637
4. Property Taxes Collected (Estimated)		
A. Primary Property Taxes:		
(1) FY 2020-2021 Levy	$ 6,852,496	
(2) Prior Years' Levies	100,000	
(3) Total Primary Property Taxes Collected	6,952,496	
B. Secondary Property Taxes:		
(1) FY 2020-2021 Levy	7,406,121	
(2) Total Secondary Property Taxes Collected	7,406,121	
C. Total Property Taxes Collected	$ 14,358,617	
5. Property Tax Rates		
A. City of Flagstaff Tax Rate:		
(1) Primary Property Tax Rate	0.7510	0.7186
(2) Secondary Property Tax Rate	0.8000	0.8000
(3) Total City Tax Rate	1.5510	1.5186

B. Special Assessment District Tax Rates:
As of the date of the proposed budget, the City was operating one special assessment district for which secondary property taxes are levied. For information pertaining to this district and its tax rates, please contact the City Finance section.

* Includes actual property taxes collected as of the date the proposed budget was prepared plus estimated property tax

City of Flagstaff
Summary by Fund of Revenues Other Than Property Taxes
Fiscal Years 2020-2021 and 2021-2022
(With Actuals for Fiscal Year 2019-2020)

Source of Revenues	Actual Revenues 2019-2020	Budgeted Revenues 2020-2021	Estimated Revenues 2020-2021	Budgeted Revenues 2021-2022	Change (Bdgt-Bdgt)	% Change
General Fund						
Local Taxes						
City Sales Tax	$ 22,630,096	22,146,670	23,419,000	23,563,400	1,416,730	6.40%
Franchise Tax	2,366,918	2,471,500	2,173,300	2,447,298	(24,202)	(0.98%)
Excise Tax	-	-	-	272,798	272,798	100.00%
Licenses and Permits						
Business Licenses	28,882	30,000	30,000	30,000	-	0.00%
Building Permits	3,327,189	1,702,500	3,024,000	1,868,100	165,600	9.73%
Other Licenses and Permits	1,580,955	1,153,764	1,134,000	996,880	(156,884)	(13.60%)
Intergovernmental						
State Income Tax Sharing	7,649,078	7,486,395	8,244,000	8,285,200	798,805	10.67%
State Shared Sales Tax	9,564,616	10,669,590	10,723,980	9,790,000	(879,590)	(8.24%)
Auto Lieu Tax	3,450,585	3,540,863	3,833,300	3,718,300	177,437	5.01%
Federal Grants	1,752,177	3,744,504	5,517,979	3,269,668	(474,836)	(12.68%)
State/Local Grants	193,280	1,826,978	1,784,615	3,071,419	1,244,441	68.11%
Local Intergovernmental Agreements	1,209,206	1,133,160	1,133,160	1,154,418	21,258	1.88%
Charges for Services						
Community Development	1,060,032	745,500	745,557	745,500	-	0.00%
Parks and Recreation	1,064,804	1,610,870	-	542,870	(1,068,000)	(66.30%)
Public Safety	608,978	741,506	791,506	745,780	4,274	0.58%
Cemetery/General Government	200,253	182,937	182,937	184,741	1,804	0.99%
Fines and Forfeits	1,217,309	1,458,855	838,800	1,145,194	(313,661)	(21.50%)
Rents	1,108,741	1,402,602	1,232,754	1,154,008	(248,594)	(17.72%)
Investment Earnings	573,320	422,751	379,149	372,426	(50,325)	(11.90%)
Miscellaneous	1,183,816	364,009	309,841	275,187	(88,822)	(24.40%)
Total General Fund	60,770,235	62,834,954	65,497,878	63,633,187	798,233	1.27%
Special Revenue Funds						
Housing and Community Services Fund						
Intergovernmental						
Federal Grants	409,731	1,359,953	643,040	2,315,356	955,403	70.25%
State Grants	18,110	900,000	900,000	900,000	-	0.00%
Investment Earnings	16,567	4,000	9,734	4,000	-	0.00%
Miscellaneous	205,835	-	740,951	-	-	0.00%
Total Housing and Comm Svcs Fund	650,243	2,263,953	2,293,725	3,219,356	955,403	42.20%
COVID Relief Fund						
Intergovernmental						
Federal Grants	-	-	-	15,238,257	15,238,257	100.00%
Total COVID Relief Fund	-	-	-	15,238,257	15,238,257	100.00%
Library Fund						
Intergovernmental						
Federal Grants	15,873	55,000	55,000	45,000	(10,000)	(18.18%)
State/Local Grants	25,000	-	-	-	-	0.00%
Library District Taxes	3,721,854	3,738,235	3,738,235	3,836,302	98,067	2.62%
Investment Earnings	61,635	67,158	39,332	39,529	(27,629)	(41.14%)
Miscellaneous	64,273	41,000	922	41,000	-	0.00%
Total Library Fund	3,888,635	3,901,393	3,833,489	3,961,831	60,438	1.55%
Highway User Revenue Fund						
Intergovernmental						
Highway User Tax	8,589,536	8,958,305	8,388,653	8,556,425	(401,880)	(4.49%)
Licenses and Permits	196,180	-	-	-	-	0.00%

City of Flagstaff
Summary by Fund of Revenues Other Than Property Taxes
Fiscal Years 2020-2021 and 2021-2022
(With Actuals for Fiscal Year 2019-2020)

Source of Revenues	Actual Revenues 2019-2020	Budgeted Revenues 2020-2021	Estimated Revenues 2020-2021	Budgeted Revenues 2021-2022	Change (Bdgt-Bdgt)	% Change
Highway User Revenue Fund - Continued						
Marijuana Excise Tax	$ -	-	-	80,000	80,000	100.00%
Investment Earnings	84,573	18,000	47,000	40,000	22,000	122.22%
Miscellaneous	85,601	2,336,458	-	1,790,000	(546,458)	(23.39%)
Total Highway User Revenue Fund	8,955,890	11,312,763	8,435,653	10,466,425	(846,338)	(7.48%)
Transportation Fund						
Transportation Tax	27,184,606	26,058,162	27,708,030	28,053,400	1,995,238	7.66%
Intergovernmental						
Federal Grants	-	451,656	-	6,041,624	5,589,968	1,237.66%
State/Local Grants	-	100,000	-	100,000	-	0.00%
Investment Earnings	645,770	174,000	219,315	239,000	65,000	37.36%
Miscellaneous	642,456	-	-	546,458	546,458	100.00%
Total Transportation Fund	28,472,832	26,783,818	27,927,345	34,980,482	8,196,664	30.60%
FUTS Fund						
Investment Earnings	63,961	15,000	16,625	8,000	(7,000)	(46.67%)
Total FUTS Fund	63,961	15,000	16,625	8,000	(7,000)	(46.67%)
Beautification Fund						
BBB Tax	1,699,413	1,865,500	1,587,600	1,756,700	(108,800)	(5.83%)
Intergovernmental						
Federal Grants	-	-	-	50,000	50,000	100.00%
Investment Earnings	114,685	37,000	37,000	38,000	1,000	2.70%
Miscellaneous	2,405	-	-	-	-	0.00%
Total Beautification Fund	1,816,503	1,902,500	1,624,600	1,844,700	(57,800)	(3.04%)
Economic Development Fund						
BBB Tax	807,858	886,113	754,110	834,400	(51,713)	(5.84%)
Investment Earnings	13,684	8,279	7,740	6,437	(1,842)	(22.25%)
Rents	339,480	419,804	302,783	380,686	(39,118)	(9.32%)
Miscellaneous	2,569	-	-	-	-	0.00%
Total Economic Development Fund	1,163,591	1,314,196	1,064,633	1,221,523	(92,673)	(7.05%)
Tourism Fund						
BBB Tax	2,550,938	2,798,250	2,381,400	2,635,000	(163,250)	(5.83%)
Intergovernmental						
Federal Grants	113	-	-	-	-	0.00%
Retail Sales	101,210	119,893	123,360	124,594	4,701	3.92%
Investment Earnings	23,425	4,988	10,166	2,778	(2,210)	(44.31%)
Miscellaneous	30,330	13,774	20,327	16,026	2,252	16.35%
Total Tourism Fund	2,706,016	2,936,905	2,535,253	2,778,398	(158,507)	(5.40%)
Arts and Science Fund						
BBB Tax	636,825	699,563	595,350	658,800	(40,763)	(5.83%)
Investment Earnings	14,828	5,000	5,000	4,000	(1,000)	(20.00%)
Total Arts and Science Fund	651,653	704,563	600,350	662,800	(41,763)	(5.93%)
Recreation - BBB Fund						
BBB Tax	2,805,668	3,078,075	2,619,540	2,898,500	(179,575)	(5.83%)
Investment Earnings	11,683	5,000	5,000	5,000	-	0.00%
Total Recreation - BBB Fund	2,817,351	3,083,075	2,624,540	2,903,500	(179,575)	(5.82%)
Parking District Fund						
Parking	1,130,846	1,254,378	320,094	1,230,850	(23,528)	(1.88%)
Investment Earnings	24,277	23,100	5,000	13,800	(9,300)	(40.26%)

City of Flagstaff
Summary by Fund of Revenues Other Than Property Taxes
Fiscal Years 2020-2021 and 2021-2022
(With Actuals for Fiscal Year 2019-2020)

Source of Revenues	Actual Revenues 2019-2020	Budgeted Revenues 2020-2021	Estimated Revenues 2020-2021	Budgeted Revenues 2021-2022	Change (Bdgt-Bdgt)	% Change
Parking District Fund - Continued						
Miscellaneous	$ 67	-	-	-	-	0.00%
Total Parking District Fund	1,155,190	1,277,478	325,094	1,244,650	(23,528)	(1.84%)
Water Resource and Infrastructure Protection Fund						
Water Resource Protection Fee	-	1,120,000	1,120,000	1,228,220	108,220	9.66%
Investment Earnings	-	-	500	3,000	3,000	100.00%
Total WRIP Fund	-	1,120,000	1,120,500	1,231,220	108,220	9.66%
Total Special Revenue Funds	52,341,865	56,615,644	52,401,807	79,761,142	23,151,798	40.89%
Debt Service Funds						
Secondary Property Tax Fund						
Investment Earnings	42,403	10,000	36,000	36,000	26,000	260.00%
Total Secondary Property Tax Fund	42,403	10,000	36,000	36,000	26,000	260.00%
Pension Debt Service Fund						
Investment Earnings	-	-	-	71,000	71,000	100.00%
Total Pension Debt Service Fund	-	-	-	71,000	71,000	100.00%
Total Debt Service Funds	42,403	10,000	36,000	107,000	97,000	970.00%
Permanent Funds						
Perpetual Care Fund						
Contributions	17,590	9,884	9,884	10,082	198	2.00%
Investment Earnings	5,669	4,242	4,242	4,284	42	0.99%
Total Perpetual Care Fund	23,259	14,126	14,126	14,366	240	1.70%
Total Permanent Funds	23,259	14,126	14,126	14,366	240	1.70%
Capital Project Funds						
Non GO Bonds Projects Fund						
Real Estate Proceeds	-	2,000,000	-	2,000,000	-	0.00%
Investment Earnings	50,379	3,000	6,000	-	(3,000)	(100.00%)
Total Non GO Bonds Projects Fund	50,379	2,003,000	6,000	2,000,000	(3,000)	(0.15%)
GO Bonds Projects Fund						
Intergovernmental						
State Grants	1,000,000	889,000	287,324	601,676	(287,324)	(32.32%)
Investment Earnings	39,524	-	-	-	-	0.00%
Total GO Bonds Projects Fund	1,039,524	889,000	287,324	601,676	(287,324)	(32.32%)
Total Capital Projects Funds	1,089,903	2,892,000	293,324	2,601,676	(290,324)	(10.04%)
Enterprise Funds						
Drinking Water Fund						
Intergovernmental						
Federal Grants	741	-	-	-	-	0.00%
Water Fees	19,248,438	18,985,295	18,915,340	18,939,698	(45,597)	(0.24%)
Investment Earnings	415,533	120,101	126,841	134,424	14,323	11.93%
Rents	10,300	5,150	5,150	5,150	-	0.00%

City of Flagstaff
Summary by Fund of Revenues Other Than Property Taxes
Fiscal Years 2020-2021 and 2021-2022
(With Actuals for Fiscal Year 2019-2020)

Source of Revenues	Actual Revenues 2019-2020	Budgeted Revenues 2020-2021	Estimated Revenues 2020-2021	Budgeted Revenues 2021-2022	Change (Bdgt-Bdgt)	% Change
Drinking Water Fund - Continued						
Miscellaneous	$ 22,828	800,000	800,000	-	(800,000)	(100%)
Total Drinking Water Fund	19,697,840	19,910,546	19,847,331	19,079,272	(831,274)	(4.18%)
Wastewater Fund						
Intergovernmental						
Federal Grants	4,452	-	-	-	-	0.00%
Wastewater Fees	11,661,456	12,243,546	11,843,546	11,981,398	(262,148)	(2.14%)
Investment Earnings	298,496	163,311	166,862	202,857	39,546	24.22%
Miscellaneous	169,838	-	-	-	-	0.00%
Total Wastewater Fund	12,134,242	12,406,857	12,010,408	12,184,255	(222,602)	(1.79%)
Reclaimed Water Fund						
Reclaimed Water Fees	1,143,183	1,036,539	1,036,539	1,046,439	9,900	0.96%
Investment Earnings	21,553	7,953	8,793	9,933	1,980	24.90%
Miscellaneous	3,152	-	-	-	-	0.00%
Total Reclaimed Water Fund	1,167,888	1,044,492	1,045,332	1,056,372	11,880	1.14%
Stormwater Fund						
Intergovernmental						
Federal Grants	34,784	659,180	67,068	1,480,630	821,450	124.62%
Stormwater Fees	4,299,109	4,242,341	4,333,301	4,311,858	69,517	1.64%
Investment Earnings	56,852	18,776	3,850	-	(18,776)	(100.00%)
Total Stormwater Fund	4,390,745	4,920,297	4,404,219	5,792,488	872,191	17.73%
Solid Waste Fund						
Solid Waste	11,806,809	12,368,625	12,235,962	13,053,187	684,562	5.53%
Investment Earnings	349,082	449,292	123,660	81,821	(367,471)	(81.79%)
Miscellaneous	2,145	-	(794)	840,000	840,000	100.00%
Total Solid Waste Fund	12,158,036	12,817,917	12,358,828	13,975,008	1,157,091	9.03%
Sustainability and Environmental Management Fund						
Intergovernmental						
Federal Grants	13,079	86,407	86,407	-	(86,407)	(100.00%)
State Grants	7,966	4,077	4,077	-	(4,077)	(100.00%)
Environmental Services	1,023,927	1,041,804	1,205,978	1,213,478	171,674	16.48%
Investment Earnings	9,060	3,177	5,982	5,000	1,823	57.38%
Miscellaneous	2,543	3,041	-	-	(3,041)	(100.00%)
Total Sustainability and Env Mgmt Fund	1,056,575	1,138,506	1,302,444	1,218,478	79,972	7.02%
Airport Fund						
Intergovernmental						
Federal Grants	2,241,386	10,976,082	5,805,150	20,746,132	9,770,050	89.01%
State Grants	32,971	953,726	138,934	1,847,392	893,666	93.70%
Airport	1,266,455	1,634,129	757,380	1,158,025	(476,104)	(29.14%)
Rents	738,124	913,195	498,449	1,407,096	493,901	54.08%
Investment Earnings	42,294	1,500	4,000	7,000	5,500	366.67%
Miscellaneous	418	1,000	1,000	1,000	-	0.00%
Total Airport Fund	4,321,648	14,479,632	7,204,913	25,166,645	10,687,013	73.81%

City of Flagstaff
Summary by Fund of Revenues Other Than Property Taxes
Fiscal Years 2020-2021 and 2021-2022
(With Actuals for Fiscal Year 2019-2020)

Source of Revenues	Actual Revenues 2019-2020	Budgeted Revenues 2020-2021	Estimated Revenues 2020-2021	Budgeted Revenues 2021-2022	Change (Bdgt-Bdgt)	% Change
Flagstaff Housing Authority Fund						
Intergovernmental						
Federal Grants	$ 5,202,207	8,532,570	6,317,320	8,140,331	(392,239)	(4.60%)
Rents and Other Tenant Income	1,386,652	1,447,000	1,300,000	1,275,000	(172,000)	(11.89%)
Miscellaneous	833,842	397,698	406,561	395,012	(2,686)	(0.68%)
Total Flagstaff Housing Authority Fund	7,422,701	10,377,268	8,023,881	9,810,343	(566,925)	(5.46%)
Total Enterprise Funds	62,349,675	77,095,515	66,197,356	88,282,861	11,187,346	14.51%
Total Revenues	$ 176,617,340	199,462,239	184,440,491	234,400,232	34,944,293	17.52%

City of Flagstaff
Summary by Funding of Other Financing Sources
and Interfund Transfers
Fiscal Year 2021-2022

Fund	Proceeds from Other Financing Sources	Interfund Transfers In	Interfund Transfers Out
General Fund	$ -	11,781,522	18,984,720
Special Revenue Funds			
COVID Relief	-	-	9,066,292
Library	-	1,596,313	-
Highway User Revenue	-	9,549,555	513,000
Transportation	-	6,118,985	13,033,877
Flagstaff Urban Trails System	-	1,000,000	2,648,052
Beautification	-	450,800	499,872
Economic Development	-	686,175	343,757
Tourism	-	670,000	-
Arts and Science	-	169,075	-
Recreation	-	743,750	4,096,439
Housing and Community Services	-	753,000	-
Water Resource and Infrastructure Protection	-	-	183,958
Parking District	-	1,408,372	-
Total Special Revenue Funds	-	23,146,025	30,385,247
Debt Service Funds			
General Obligation Bonds	-	7,388,402	-
Secondary Property Tax	-	-	7,388,402
Pension Debt Service	-	9,197,890	-
Total Debt Service Funds	-	16,586,292	7,388,402
Capital Project Funds			
Non General Obligation Bond Funded Projects	27,900,000	3,718,482	-
General Obligation Bond Funded Projects	-	500,000	-
Total Capital Projects Funds	27,900,000	4,218,482	-
Enterprise Funds			
Drinking Water	-	1,943,387	84,945
Wastewater	-	-	1,798,013
Reclaimed Water	-	-	138,228
Stormwater	18,000,000	-	7,146
Solid Waste	-	-	100,835
Sustainability and Environmental Management	-	1,056,543	-
Airport	-	2,781,222	2,625,937
Total Enterprise Funds	18,000,000	5,781,152	4,755,104
Total All Funds	$ 45,900,000	61,513,473	61,513,473

City of Flagstaff
Summary by Division of Expenditures/Expenses within Each Fund
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Fund/Division	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
General Fund						
General Administration	$ 8,090,790	12,256,688	11,888,073	16,816,843	4,560,155	37.2%
Management Services	6,706,020	4,596,113	4,331,309	5,002,102	405,989	8.8%
Fire	13,734,246	20,263,632	16,659,901	17,488,590	(2,775,042)	(13.7%)
Police	20,030,101	25,655,337	21,668,801	21,887,143	(3,768,194)	(14.7%)
Community Development	5,184,563	6,030,172	5,656,296	4,581,233	(1,448,939)	(24.0%)
Public Works	8,976,374	11,618,249	8,600,821	14,978,665	3,360,416	28.9%
Economic Vitality	140,310	107,265	107,265	202,834	95,569	89.1%
Non-Departmental	(3,078,586)	(365,457)	(3,428,037)	(1,346,977)	(981,520)	268.6%
Engineering and Capital Improvements	-	-	-	1,999,513	1,999,513	100.0%
Contingency	(194,281)	1,527,750	942,000	3,196,810	1,669,060	109.2%
Total General Fund	59,589,537	81,689,749	66,426,429	84,806,756	3,117,007	3.8%
Special Revenue Funds						
Housing and Community Service Fund						
Community Development	753,164	2,886,877	2,005,923	4,971,337	2,084,460	72.2%
Non-Departmental	38,241	48,668	48,668	48,668	-	0.0%
	791,405	2,935,545	2,054,591	5,020,005	2,084,460	71.0%
COVID Relief Fund						
Fire	3,052,399	-	889,748	-	-	100.0%
Police	3,628,410	-	1,044,298	-	-	100.0%
Non-Departmental	-	-	-	6,171,965	6,171,965	100.0%
	6,680,809	-	1,934,046	6,171,965	6,171,965	100.0%
Library Fund						
General Administration	212,985	253,764	253,764	272,459	18,695	7.4%
Management Services	139,996	139,996	139,996	187,931	47,935	34.2%
Public Works	44,483	43,397	43,397	40,058	(3,339)	(7.7%)
Economic Vitality	5,145,679	6,849,779	3,587,815	7,495,180	645,401	9.4%
Non-Departmental	75,872	71,752	71,752	61,878	(9,874)	(13.8%)
Contingency	-	100,000	-	100,000	-	0.0%
	5,619,015	7,458,688	4,096,724	8,157,506	698,818	9.4%
Highway User Revenue Fund						
General Administration	152,508	256,750	256,750	280,797	24,047	9.4%
Management Services	184,020	83,032	83,032	78,002	(5,030)	(6.1%)
Community Development	8,056,810	14,744,813	2,434,135	-	(14,744,813)	(100.0%)
Public Works	7,547,131	15,256,833	8,789,511	12,177,155	(3,079,678)	(20.2%)
Economic Vitality	3,901	2,706	2,706	220	(2,486)	(91.9%)
Non-Departmental	75,170	126,879	126,879	190,920	64,041	50.5%
Engineering and Capital Improvements	-	-	-	9,439,638	9,439,638	100.0%
Contingency	-	100,000	-	100,000	-	0.0%
	16,019,540	30,571,013	11,693,013	22,266,732	(8,304,281)	(27.2%)
Transportation Fund						
General Administration	86,333	72,462	72,462	68,686	(3,776)	(5.2%)
Management Services	255,780	188,863	188,863	132,446	(56,417)	(29.9%)
Community Development	2,701,592	24,756,222	6,211,113	-	(24,756,222)	(100.0%)
Public Works	4,865,973	1,184,126	1,989,807	1,293,477	109,351	9.2%
Economic Vitality	1,395	748	748	86	(662)	(88.5%)
Non-Departmental	11,494,783	10,996,625	8,464,589	9,579,751	(1,416,874)	(12.9%)
Engineering and Capital Improvements	-	-	-	50,918,527	50,918,527	100.0%
	19,405,856	37,199,046	16,927,582	61,992,973	24,793,927	66.7%
FUTS Fund						
General Administration	1,271	-	-	-	-	100.0%
Management Services	11,306	-	-	-	-	100.0%
Community Development	1,758,069	3,042,599	1,162,312	-	(3,042,599)	(100.0%)

City of Flagstaff
Summary by Division of Expenditures/Expenses within Each Fund
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Fund/Division	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
FUTS Fund - Continued						
Economic Vitality	$ 100	-	-	-	-	100.0%
Non-Departmental	431	-	-	-	-	100.0%
	1,771,177	3,042,599	1,162,312	-	(3,042,599)	(100.0%)
Beautification Fund						
Economic Vitality	566,007	4,722,707	669,203	6,127,867	1,405,160	29.8%
Contingency	-	10,000	-	10,000	-	0.0%
	566,007	4,732,707	669,203	6,137,867	1,405,160	29.7%
Economic Development Fund						
Economic Vitality	1,235,142	1,494,089	1,146,818	1,742,551	248,462	16.6%
Contingency	-	45,000	-	45,000	-	0.0%
	1,235,142	1,539,089	1,146,818	1,787,551	248,462	16.1%
Tourism Fund						100.0%
Economic Vitality	2,826,390	3,262,717	2,770,757	3,156,284	(106,433)	(3.3%)
Contingency	-	50,000	-	50,000	-	0.0%
	2,826,390	3,312,717	2,770,757	3,206,284	(106,433)	(3.2%)
Arts and Science Fund						
Economic Vitality	618,991	1,249,998	636,277	1,340,007	90,009	7.2%
Contingency	-	10,000	-	10,000	-	0.0%
	618,991	1,259,998	636,277	1,350,007	90,009	7.1%
Recreation Fund						
Public Works	251,569	7,500	7,500	10,400	2,900	38.7%
	251,569	7,500	7,500	10,400	2,900	38.7%
Parking District Fund						
General Administration	18,070	44,282	44,282	40,596	(3,686)	(8.3%)
Management Services	24,445	6,603	6,603	11,338	4,735	71.7%
Public Works	1,112	567	567	4,063	3,496	616.6%
Economic Vitality	773,919	1,749,484	637,213	2,014,028	264,544	15.1%
Non-Departmental	7,479	10,367	10,367	8,325	(2,042)	(19.7%)
Contingency	-	30,000	-	30,000	-	0.0%
	825,025	1,841,303	699,032	2,108,350	267,047	14.5%
Water Resource & Infrastructure Protection Fund						
Fire	-	1,038,121	484,650	945,479	(92,642)	(8.9%)
	-	1,038,121	484,650	945,479	(92,642)	(8.9%)
Total Special Revenue Funds	56,610,926	94,938,326	44,282,505	119,155,119	24,216,793	25.5%
Debt Service Funds						
General Obligation Bonds Fund						
Non-Departmental	7,014,985	7,378,336	7,309,850	7,388,402	10,066	0.1%
	7,014,985	7,378,336	7,309,850	7,388,402	10,066	0.1%
Pension Debt Service Fund						
Non-Departmental	-	122,002,500	120,579,453	9,197,890	(112,804,610)	(92.5%)
	-	122,002,500	120,579,453	9,197,890	(112,804,610)	(92.5%)
Total Debt Service Funds	7,014,985	129,380,836	127,889,303	16,586,292	(112,794,544)	(87.2%)

City of Flagstaff
Summary by Division of Expenditures/Expenses within Each Fund
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Fund/Division	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
Capital Project Funds						
Non GO Bond Funded Projects Fund						
Non-Departmental	$ 12,247,949	17,845,193	5,530,373	34,303,906	16,458,713	92.2%
	12,247,949	17,845,193	5,530,373	34,303,906	16,458,713	92.2%
GO Bonds Funded Projects Fund						
Non-Departmental	1,440,441	2,500,988	1,147,546	5,688,639	3,187,651	127.5%
	1,440,441	2,500,988	1,147,546	5,688,639	3,187,651	127.5%
Total Capital Project Funds	13,688,390	20,346,181	6,677,919	39,992,545	19,646,364	96.6%
Enterprise Funds						
Drinking Water Fund						
General Administration	253,298	412,028	412,028	395,960	(16,068)	(3.9%)
Management Services	1,154,806	1,031,554	1,031,554	1,102,524	70,970	6.9%
Community Development	-	-	-	50,436	50,436	100.0%
Public Works	69,641	105,173	105,173	149,725	44,552	42.4%
Economic Vitality	9,258	5,640	5,640	543	(5,097)	(90.4%)
Water Services	16,383,019	33,585,725	18,161,449	36,955,509	3,369,784	10.0%
Non-Departmental	165,696	157,666	157,666	148,373	(9,293)	(5.9%)
Contingency	-	1,000,000	-	1,000,000	-	0.0%
	18,035,718	36,297,786	19,873,510	39,803,070	3,505,284	9.7%
Wastewater Fund						
General Administration	246,462	241,162	241,162	232,368	(8,794)	(3.6%)
Management Services	300,710	360,381	360,381	327,001	(33,380)	(9.3%)
Community Development	-	-	-	16,812	16,812	100.0%
Public Works	62,532	19,939	19,939	23,859	3,920	19.7%
Economic Vitality	3,896	2,383	2,383	209	(2,174)	(91.2%)
Water Services	11,150,787	13,658,719	6,207,672	16,580,973	2,922,254	21.4%
Non-Departmental	72,894	65,901	65,901	55,653	(10,248)	(15.6%)
Contingency	-	800,000	-	800,000	-	0.0%
	11,837,281	15,148,485	6,897,438	18,036,875	2,888,390	19.1%
Reclaimed Water Fund						
General Administration	21,696	28,900	28,900	21,139	(7,761)	(26.9%)
Management Services	40,811	32,038	32,038	42,806	10,768	33.6%
Public Works	1,026	-	-	-	-	100.0%
Economic Vitality	499	240	240	20	(220)	(91.7%)
Water Services	390,962	1,904,108	643,599	1,779,601	(124,507)	(6.5%)
Non-Departmental	10,571	8,161	8,161	6,569	(1,592)	(19.5%)
Contingency	-	50,000	-	50,000	-	0.0%
	465,565	2,023,447	712,938	1,900,135	(123,312)	(6.1%)
Stormwater Fund						
General Administration	25,324	54,758	54,758	84,847	30,089	54.9%
Management Services	91,772	88,129	88,129	146,630	58,501	66.4%
Public Works	9,241	108	108	529	421	389.8%
Economic Vitality	701	397	397	37	(360)	(90.7%)
Water Services	4,476,068	23,973,012	17,044,682	10,813,591	(13,159,421)	(54.9%)
Non-Departmental	15,546	13,450	13,450	12,059	(1,391)	(10.3%)
Contingency	-	300,000	-	300,000	-	0.0%
	4,618,652	24,429,854	17,201,524	11,357,693	(13,072,161)	(53.5%)
Solid Waste Fund						
General Administration	282,932	376,772	376,772	400,506	23,734	6.3%
Management Services	564,536	444,427	444,427	449,680	5,253	1.2%

City of Flagstaff
Summary by Division of Expenditures/Expenses within Each Fund
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Fund/Division	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
Solid Waste Fund - Continued						
Public Works	$ 10,054,270	16,743,681	12,116,683	17,994,694	1,251,013	7.5%
Economic Vitality	8,475	5,332	5,332	480	(4,852)	(91.0%)
Non-Departmental	163,034	177,790	177,790	187,937	10,147	5.7%
Contingency	2,081	500,000	-	500,000	-	0.0%
	11,075,328	18,248,002	13,121,004	19,533,297	1,285,295	7.0%
Sustainability and Environmental Management Fund						
General Administration	36,224	1,039,860	916,738	1,970,635	930,775	89.5%
Management Services	91,588	82,015	82,015	110,619	28,604	34.9%
Public Works	758,386	174,081	124,081	25,665	(148,416)	(85.3%)
Economic Vitality	831	444	444	39	(405)	(91.2%)
Non-Departmental	20,898	15,465	15,465	11,138	(4,327)	(28.0%)
Contingency	-	30,000	-	30,000	-	0.0%
	907,927	1,341,865	1,138,743	2,148,096	806,231	60.1%
Airport Fund						
General Administration	60,258	109,853	109,853	122,351	12,498	11.4%
Management Services	143,107	116,371	116,371	134,383	18,012	15.5%
Public Works	70,008	76,177	76,177	109,899	33,722	44.3%
Economic Vitality	4,230,019	16,168,180	7,397,866	25,201,385	9,033,205	55.9%
Non-Departmental	27,622	29,338	29,338	38,183	8,845	30.1%
Contingency	-	100,000	-	100,000	-	0.0%
	4,531,014	16,599,919	7,729,605	25,706,201	9,106,282	54.9%
Flagstaff Housing Authority Fund						
Community Development	7,295,935	9,242,616	7,967,616	8,791,305	(451,311)	(4.9%)
Contingency	-	1,001,250	-	1,001,250	-	0.0%
	7,295,935	10,243,866	7,967,616	9,792,555	(451,311)	(4.4%)
Total Enterprise Funds	58,767,420	124,333,224	74,642,378	128,277,922	3,944,698	3.2%
Total All Funds	$ 195,671,258	450,688,316	319,918,534	388,818,634	(61,869,682)	(13.7%)

City of Flagstaff
Budget Summary by Division of Expenditures
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Division/Fund	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses * 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
General Administration						
General Fund	$ 8,090,790	12,256,688	11,888,073	16,816,843	4,560,155	37.2%
Library	212,985	253,764	253,764	272,459	18,695	7.4%
HURF	152,508	256,750	256,750	280,797	24,047	9.4%
Transportation	86,333	72,462	72,462	68,686	(3,776)	(5.2%)
FUTS	1,271	-	-	-	-	100.0%
Parking District	18,070	44,282	44,282	40,596	(3,686)	(8.3%)
Drinking Water	253,298	412,028	412,028	395,960	(16,068)	(3.9%)
Wastewater	246,462	241,162	241,162	232,368	(8,794)	(3.6%)
Reclaimed Water	21,696	28,900	28,900	21,139	(7,761)	(26.9%)
Stormwater	25,324	54,758	54,758	84,847	30,089	54.9%
Solid Waste	282,932	376,772	376,772	400,506	23,734	6.3%
Sustainability and Environmental Mgmt	36,224	1,039,860	916,738	1,970,635	930,775	89.5%
Airport	60,258	109,853	109,853	122,351	12,498	11.4%
	9,488,151	15,147,279	14,655,542	20,707,187	5,559,908	36.7%
Community Development						
General Fund	5,184,563	6,030,172	5,656,296	4,581,233	(1,448,939)	(24.0%)
HURF	8,056,810	14,744,813	2,434,135	-	(14,744,813)	(100.0%)
Transportation	2,701,592	24,756,222	6,211,113	-	(24,756,222)	(100.0%)
FUTS	1,758,069	3,042,599	1,162,312	-	(3,042,599)	(100.0%)
Housing and Community Services	753,164	2,886,877	2,005,923	4,971,337	2,084,460	72.2%
Drinking Water	-	-	-	50,436	50,436	100.0%
Wastewater	-	-	-	16,812	16,812	100.0%
Flagstaff Housing Authority	7,295,935	9,242,616	7,967,616	8,791,305	(451,311)	(4.9%)
	25,750,133	60,703,299	25,437,395	18,411,123	(42,292,176)	(69.7%)
Management Services						
General Fund	6,706,020	4,596,113	4,331,309	5,002,102	405,989	8.8%
Library	139,996	139,996	139,996	187,931	47,935	34.2%
HURF	184,020	83,032	83,032	78,002	(5,030)	(6.1%)
Transportation	255,780	188,863	188,863	132,446	(56,417)	(29.9%)
FUTS	11,306	-	-	-	-	100.0%
Parking District	24,445	6,603	6,603	11,338	4,735	71.7%
Drinking Water	1,154,806	1,031,554	1,031,554	1,102,524	70,970	6.9%
Wastewater	300,710	360,381	360,381	327,001	(33,380)	(9.3%)
Reclaimed Water	40,811	32,038	32,038	42,806	10,768	33.6%
Stormwater	91,772	88,129	88,129	146,630	58,501	66.4%
Solid Waste	564,536	444,427	444,427	449,680	5,253	1.2%
Sustainability and Environmental Mgmt	91,588	82,015	82,015	110,619	28,604	34.9%
Airport	143,107	116,371	116,371	134,383	18,012	15.5%
	9,708,897	7,169,522	6,904,718	7,725,462	555,940	7.8%
Fire						
General Fund	13,734,246	20,263,632	16,659,901	17,488,590	(2,775,042)	(13.7%)
COVID Relief Fund	3,052,399	-	889,748	-	-	100.0%
Water Resource & Infrastructure Fund	-	1,038,121	484,650	945,479	(92,642)	(8.9%)
	16,786,645	21,301,753	18,034,299	18,434,069	(2,867,684)	(13.5%)
Police						
General Fund	20,030,101	25,655,337	21,668,801	21,887,143	(3,768,194)	(14.7%)
COVID Relief Fund	3,628,410	-	1,044,298	-	-	100.0%
	23,658,511	25,655,337	22,713,099	21,887,143	(3,768,194)	(14.7%)
Public Works						
General Fund	8,976,374	11,618,249	8,600,821	14,978,665	3,360,416	28.9%
Library	44,483	43,397	43,397	40,058	(3,339)	(7.7%)
HURF	7,547,131	15,256,833	8,789,511	12,177,155	(3,079,678)	(20.2%)
Transportation	4,865,973	1,184,126	1,989,807	1,293,477	109,351	9.2%

City of Flagstaff
Budget Summary by Division of Expenditures
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Division/Fund	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses * 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
Public Works - Continued						
Recreation	$ 251,569	7,500	7,500	10,400	2,900	38.7%
Parking District	1,112	567	567	4,063	3,496	616.6%
Drinking Water	69,641	105,173	105,173	149,725	44,552	42.4%
Wastewater	62,532	19,939	19,939	23,859	3,920	19.7%
Reclaimed Water	1,026	-	-	-	-	100.0%
Stormwater	9,241	108	108	529	421	389.8%
Solid Waste	10,054,270	16,743,681	12,116,683	17,994,694	1,251,013	7.5%
Sustainability and Environmental Mgmt	758,386	174,081	124,081	25,665	(148,416)	(85.3%)
Airport	70,008	76,177	76,177	109,899	33,722	44.3%
	32,711,746	45,229,831	31,873,764	46,808,189	1,578,358	3.5%
Economic Vitality						
General Fund	140,310	107,265	107,265	202,834	95,569	89.1%
Library	5,145,679	6,849,779	3,587,815	7,495,180	645,401	9.4%
HURF	3,901	2,706	2,706	220	(2,486)	(91.9%)
Transportation	1,395	748	748	86	(662)	(88.5%)
FUTS	100	-	-	-	-	100.0%
Beautification	566,007	4,722,707	669,203	6,127,867	1,405,160	29.8%
Economic Development	1,235,142	1,494,089	1,146,818	1,742,551	248,462	16.6%
Tourism	2,826,390	3,262,717	2,770,757	3,156,284	(106,433)	(3.3%)
Arts and Science	618,991	1,249,998	636,277	1,340,007	90,009	7.2%
Parking District	773,919	1,749,484	637,213	2,014,028	264,544	15.1%
Drinking Water	9,258	5,640	5,640	543	(5,097)	(90.4%)
Wastewater	3,896	2,383	2,383	209	(2,174)	(91.2%)
Reclaimed Water	499	240	240	20	(220)	(91.7%)
Stormwater	701	397	397	37	(360)	(90.7%)
Solid Waste	8,475	5,332	5,332	480	(4,852)	(91.0%)
Sustainability and Environmental Mgmt	831	444	444	39	(405)	(91.2%)
Airport	4,230,019	16,168,180	7,397,866	25,201,385	9,033,205	55.9%
	15,565,513	35,622,109	16,971,104	47,281,770	11,659,661	32.7%
Water Services						
Drinking Water	16,383,019	33,585,725	18,161,449	36,955,509	3,369,784	10.0%
Wastewater	11,150,787	13,658,719	6,207,672	16,580,973	2,922,254	21.4%
Reclaimed Water	390,962	1,904,108	643,599	1,779,601	(124,507)	(6.5%)
Stormwater	4,476,068	23,973,012	17,044,682	10,813,591	(13,159,421)	(54.9%)
	32,400,836	73,121,564	42,057,402	66,129,674	(6,991,890)	(9.6%)
Non-Departmental						
General Fund	(3,078,586)	(365,457)	(3,428,037)	(1,346,977)	(981,520)	268.6%
COVID Relief Fund	-	-	-	6,171,965	6,171,965	100.0%
Library	75,872	71,752	71,752	61,878	(9,874)	(13.8%)
HURF	75,170	126,879	126,879	190,920	64,041	50.5%
Transportation	11,494,783	10,996,625	8,464,589	9,579,751	(1,416,874)	(12.9%)
FUTS	431	-	-	-	-	100.0%
Housing and Community Services	38,241	48,668	48,668	48,668	-	0.0%
Parking District	7,479	10,367	10,367	8,325	(2,042)	(19.7%)
General Obligation Bonds	7,014,985	7,378,336	7,309,850	7,388,402	10,066	0.1%
Pension Debt Service Fund	-	122,002,500	120,579,453	9,197,890	(112,804,610)	(92.5%)
GO Bond Funded Projects	1,440,441	2,500,988	1,147,546	5,688,639	3,187,651	127.5%
Non GO Bond Funded Projects	12,247,949	17,845,193	5,530,373	34,303,906	16,458,713	92.2%
Drinking Water	165,696	157,666	157,666	148,373	(9,293)	(5.9%)
Wastewater	72,894	65,901	65,901	55,653	(10,248)	(15.6%)
Reclaimed Water	10,571	8,161	8,161	6,569	(1,592)	(19.5%)
Stormwater	15,546	13,450	13,450	12,059	(1,391)	(10.3%)
Solid Waste	163,034	177,790	177,790	187,937	10,147	5.7%
Sustainability and Environmental Mgmt	20,898	15,465	15,465	11,138	(4,327)	(28.0%)

City of Flagstaff
Budget Summary by Division of Expenditures
Comparison of Fiscal Year 2020-2021 and 2021-2022
(With Actual for Fiscal Year 2019-2020)

Division/Fund	Actual Expenditures/ Expenses 2019-2020	Adopted Budgeted Expenditures/ Expenses 2020-2021	Estimated Expenditures/ Expenses * 2020-2021	Proposed Budgeted Expenditures/ Expenses 2021-2022	Change (Budget-Budget)	% Change
Non-Departmental - Continued						
Airport	$ 27,622	29,338	29,338	38,183	8,845	30.1%
	29,793,026	161,083,622	140,329,211	71,753,279	(89,330,343)	(55.5%)
Engineering and Capital Improvements						
General Fund	-	-	-	1,999,513	1,999,513	100.0%
HURF	-	-	-	9,439,638	9,439,638	100.0%
Transportation	-	-	-	50,918,527	50,918,527	100.0%
	-	-	-	62,357,678	62,357,678	100.0%
Reserves/Contingencies						
General Fund	(194,281)	1,527,750	942,000	3,196,810	1,669,060	109.2%
Library	-	100,000	-	100,000	-	0.0%
HURF	-	100,000	-	100,000	-	0.0%
Beautification	-	10,000	-	10,000	-	0.0%
Economic Development	-	45,000	-	45,000	-	0.0%
Tourism	-	50,000	-	50,000	-	0.0%
Arts and Science	-	10,000	-	10,000	-	0.0%
Parking District	-	30,000	-	30,000	-	0.0%
Drinking Water	-	1,000,000	-	1,000,000	-	0.0%
Wastewater	-	800,000	-	800,000	-	0.0%
Reclaimed Water	-	50,000	-	50,000	-	0.0%
Stormwater	-	300,000	-	300,000	-	0.0%
Solid Waste	2,081	500,000	-	500,000	-	0.0%
Sustainability and Environmental Mgmt	-	30,000	-	30,000	-	0.0%
Airport	-	100,000	-	100,000	-	0.0%
Flagstaff Housing Authority	-	1,001,250	-	1,001,250	-	0.0%
	(192,200)	5,654,000	942,000	7,323,060	1,669,060	29.5%
All Funds Total	$ 195,671,258	450,688,316	319,918,534	388,818,634	(61,869,682)	(13.7%)

*Includes actual expenditures/expenses recognized on the modified accrual or accrual basis as of the date the proposed budget was prepared, plus estimated expenditures/expenses for the remainder of the fiscal year.

City of Flagstaff
Full-Time Employee and Personnel Compensation
Fiscal Year 2021-2022

Fund	Full-Time Equivalent (FTE) 2021-2022	Employee Salaries and Hourly Costs 2021-2022	Retirement Costs 2021-2022	Healthcare Costs 2021-2022	Other Benefit Costs 2021-2022	Total Estimated Personnel Compensation 2021-2022
General Fund	612.43	$ 39,432,605	$ 4,870,275	$ 5,611,694	$ 3,235,187	$ 53,149,761
Special Revenue Funds						
Housing and Community Services	1.00	58,330	7,239	7,972	5,312	78,853
Library	55.76	2,590,200	285,092	509,851	197,735	3,582,878
HURF	35.27	1,791,177	212,622	323,426	298,879	2,626,104
Beautification	1.70	142,799	17,766	10,670	11,589	182,824
Economic Development	2.75	199,213	24,789	27,826	16,300	268,128
Tourism	17.50	989,515	115,857	162,777	80,349	1,348,498
Arts and Science	0.40	47,471	5,914	4,019	3,915	61,319
Parking District	6.00	253,503	31,341	67,798	23,219	375,861
Water Resource & Infrastructure Protection	10.00	477,849	70,225	200,572	34,173	782,819
Total Special Revenue Funds	130.38	6,550,057	770,845	1,314,911	671,471	9,307,284
Enterprise Funds						
Drinking Water	54.16	3,461,089	415,092	476,308	305,010	4,657,499
Wastewater	16.00	1,330,988	165,178	205,602	122,919	1,824,687
Reclaimed Water	6.00	122,735	15,233	17,764	11,238	166,970
Stormwater	7.00	502,966	62,418	67,937	40,922	674,243
Solid Waste	47.50	2,501,647	310,605	446,492	249,410	3,508,154
Sustainability and Environmental Mgmt	8.00	415,576	51,572	65,812	32,711	565,671
Airport	13.75	877,237	126,741	125,486	44,457	1,173,921
Flagstaff Housing Authority	23.00	1,364,126	169,286	239,214	120,264	1,892,890
Total Enterprise Funds	175.41	10,576,364	1,316,125	1,644,615	926,931	14,464,035
Total All Funds	918.22	$ 56,559,026	$ 6,957,245	$ 8,571,220	$ 4,833,589	$ 76,921,080

FY 21-22 Budget Compensation Data

June 15, 2021

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

Background

- As stated in February Budget Retreat, the Compensation Study process was commenced over two years ago
- Needed to ensure that compensation throughout the organization is competitive
- Issues with recruitment, retention, and morale (2019 Survey) have validated the need for the study
- The organization needs to reduce the multiple pay structures now in place and ensure more equity throughout the divisions (two structures rather than four)

Transition Solutions

- New Plan has been budgeted and is largely ready for implementation

- Proceed with July 11 implementation (first full pay period of new fiscal year) of new market pay ranges and compression adjustments
  - Range minimum for almost every position is increasing, making it more competitive for recruitment
  - Employees are looking forward to overdue compensation adjustments (these are adjustments to pay based upon market analyses; not merit or COLA)
  - Police and Fire public safety plans are finalized

- Continue to work with Divisions and City Managers to finalize range placements, job descriptions, and classifications.
  - A small number of positions are still in flux; most are resolved
  - Correction adjustments will be made if necessary

Transition Solutions (Continued)

- Two primary concerns have been expressed throughout this process:
  1. New Plan does not adequately support Multi-Skilled Workers (MSWs) in Water Services
  2. Loss of higher earning potential if new range maximums are lower for Broadband employees

- Solutions:
  1. MSWs:
     - Delay MSWs for three months and develop new “step plan” to substitute for Skill Block Plan, continue Skill Block Plan in the interim; new “step plan” will mirror the plan being used by Fire and Police, allowing for step variability and faster progression through the range

Transition Solutions (continued)

2. “Grandfather” the range maximums for current broadband employees
   a. Allows adoption of new ranges for new hires and position changes
   b. Does not limit earning potential for existing broadband employees
   c. New hires would not be hired into grandfathered ranges
   d. Grandfather ranges will be retired over time, resulting in only two pay structures across the organization
   e. Rezones will be discontinued immediately. Employees will move through their respective pay range through the merit increase system as approved by Council

- These solutions were discussed with Extended Leadership and evaluated by Employee Advisory Committee, which endorsed the solutions unanimously

Who Is Benefitting?

- Current total estimated cost of implementation is $1.4M

Plan	Expense	# Employees	Average Increase
Regular	$850,000	369	3.6%
Police	$235,000	101	3.5%
Fire	$305,000	89	5.9%

Who Is Benefitting

- Regular Pay Plan

Ranges	Type of Position	Average Adjustment	Notes
00R – 30R	Entry level, administrative-Lead	4.6%	Most 00R wages adjusted for min. wage 1/1/21
30R – 50R	Professional exempt, specialists, supervisors, manager	4.1%	
55R – 75R	Manager, Program & Section Director	3.3%	
80R – E2R	Senior ranking professionals, Division Directors, Dep CM	2.4%	

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Brandi Suda, Finance Director
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Ordinance No. 2021-14: An ordinance levying upon the assessed valuation of the property within the City of Flagstaff, Arizona, subject to taxation a certain sum upon each one hundred dollars ($100.00) of valuation sufficient to raise the amount estimated to be required in the Annual Budget, less the amount estimated to be received from other sources of revenue; providing funds for various bond redemptions, for the purpose of paying interest upon bonded indebtedness and providing funds for general municipal expenses, all for the Fiscal Year ending the 30th day of June 2022. **(Primary and secondary property tax levies for FY 2021-2022)**

STAFF RECOMMENDED ACTION:

At the June 15, 2021 Council Meeting:
1) Read Ordinance No. 2021-14 by title only for the first time
2) City Clerk reads Ordinance No. 2021-14 by title only (if approved above)
At the July 6, 2021 Council Meeting:
3) Read Ordinance No. 2021-14 by title only for the final time
4) City Clerk reads Ordinance No. 2021-14 by title only (if approved above)
5) Adopt Ordinance No. 2021-14

Executive Summary:

The City Council is required to fix and levy the amount to be raised from property taxation after the adoption of the final budget, per A.R.S. Section 42-17151. The final budget is anticipated to be adopted on June 15, 2021.

Financial Impact:

The City is proposing a flat primary property tax levy of $6,952,496 on existing properties, plus a levy of $86,167 on new construction, for a total primary property tax levy in Fiscal Year (FY) 2021-2022 of $7,038,663. The primary property tax rate to support this levy is $0.7186 per $100 of assessed valuation (lower than the prior fiscal year). The proposed levy is less than the maximum allowable primary property tax levy allowed for FY 2021-2022, which is $7,322,717.

The City is proposing a secondary property tax levy of $7,739,745 on existing properties, plus a levy of $96,229 on new construction, for a total secondary property tax levy in FY 2021-2022 of $7,835,974. The proposed secondary property tax rate is $0.8000 per $100 of assessed valuation (same as the prior fiscal year).

Policy Impact:

Adoption of the proposed property tax levies will generate revenues to help fund the community needs as identified in the FY 2021-2022 Final Budget and policies reflected therein.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

The FY 2021-2022 budget is the guiding document for the financial plan of the City. The property tax adoption is part of the overall City budget adoption.

Has There Been Previous Council Decision on This:

Property tax information has been discussed or presented at the following public meetings:

- Council Retreat on December 17, 2020
- Budget Retreat on February 1, 2021
- Discussion on posting 60 day notice for potential property tax increase on April 13, 2021
- Council Budget Work Session on April 22, 2021 and April 23, 2021
- Tentative Budget Adoption on June 1, 2021

Options and Alternatives:

1) Adopt the primary and secondary property tax rates as proposed.
2) Adopt lower primary and secondary property tax rates than proposed.
3) Adopt higher tax rates than proposed, however, this action may be barred by Truth in Taxation Notice publication deadlines or other legal considerations.

Background/History:

Primary property tax revenues may be used for all purposes. Primary property tax levies are limited, per A.R.S. Section 42-17051. The City has the ability to increase the amount received from the primary property tax levy by a maximum of 2% each year excluding new construction. The maximum allowable increase for FY 2021-2022 is 4.0%. FY 2021-2022 proposed primary property tax levy is set at $7,038,663, which is less than the maximum allowable levy of $7,322,717.

Primary property tax levies are also subject to "Truth in Taxation" notice and hearing requirements, per A.R.S. Section 42-17107. On or before February 10 of each year, the county assessor must transmit to each city and town an estimate of the total net assessed valuation of the city, including new property added to the tax roll. If the proposed primary tax levy amount, excluding amounts attributable to new construction, is greater than the levy amount in the previous year, the city must follow the "Truth in Taxation" procedures. It is important to note that it is the levy amount and not the rate which triggers the "Truth in Taxation" procedures. The proposed FY2021-2022 primary tax levy amount did not trigger the "Truth in Taxation" procedures.

Secondary property tax revenues may only be used by cities and towns to retire the principal and interest or redemption charges on general obligation bonds issued to pay for capital projects. Secondary property tax levies are not limited.

The adoption of the property tax levy is the final step in the entire budget approval process.

Key Considerations:

The key dates for budget and property tax levy adoption have been determined and have been followed throughout this process. The County will adopt the property tax levy as approved by the City in August 2021.

Expanded Financial Considerations:

The City is budgeting primary property tax revenues of $6,996,000 in its FY 2021-2022 Budget. This budgeted amount is less than the levy amount because the City is allowing for approximately 1.2% in bad debt (taxes not able to be collected). The City anticipates an overall 1.3% increase in primary property tax revenues in FY 2021-2022, due to the increase from new construction (properties added to tax roll). Primary property tax revenues may be used for any general purpose use of the City government. Statutorily, the maximum allowable primary property levy for FY 2021-2022 is $7,322,717.

The City has budgeted a total of $7,835,974 in FY 2020-2021 secondary property tax, an approximate 2% increase over the FY 2020-2021 budget ($7,406,121). The increase is directly related to the increased assessed valuation (increase in property values) and new construction. Secondary property tax revenues are used to pay general obligation debt issued for City capital projects.

Five years of historical data is shown below:

Property Tax Rates	FY 2017-2018	FY 2018-2019	FY 2019-2020	FY 2020-2021	FY 2021-2022 Proposed
Primary	0.8233	0.8334	0.7933	0.7510	0.7186
Secondary	0.8366	0.8366	0.8366	0.8000	0.8000
Total	1.6599	1.6700	1.6299	1.5510	1.5186

Primary property taxes account for XX% of the General Fund revenues budgeted for FY 2021-2022.

Community Benefits and Considerations:

Primary property taxes help support a number of City services including public safety, parks and recreation, other public works services, and general administrative and management functions within the City.

Secondary property taxes support the debt service payment on numerous city capital projects including Aquaplex, Fire Stations, Open Space, numerous street/utility projects, Forest Restoration, Core Services Facility, and the Courthouse.

Community Involvement:

Inform & Involve: Budget legal schedules were published in the June 3, 2021, and June 10, 2021, Arizona Daily Sun to allow for additional community review. In addition, the legal and other budget schedules were made available at City Hall, and on the official city website or by request. At a public hearing on June 15, 2021, the final budget adoption and the property tax levy is open for public comment and allows citizens to provide input. The final opportunity for public input on the tax levy will be at the July 6, 2021, Council Meeting.

Attachments: Ord. 2021-14

ORDINANCE NO. 2021-14

AN ORDINANCE LEVYING UPON THE ASSESSED VALUATION OF THE PROPERTY WITHIN THE CITY OF FLAGSTAFF, ARIZONA, SUBJECT TO TAXATION A CERTAIN SUM UPON EACH ONE HUNDRED DOLLARS ($100.00) OF VALUATION SUFFICIENT TO RAISE THE AMOUNT ESTIMATED TO BE REQUIRED IN THE ANNUAL BUDGET, LESS THE AMOUNT ESTIMATED TO BE RECEIVED FROM OTHER SOURCES OF REVENUE; PROVIDING FUNDS FOR VARIOUS BOND REDEMPTIONS, FOR THE PURPOSE OF PAYING INTEREST UPON BONDED INDEBTEDNESS AND PROVIDING FUNDS FOR GENERAL MUNICIPAL EXPENSES, ALL FOR THE FISCAL YEAR ENDING THE 30TH DAY OF JUNE, 2022

RECITALS:

WHEREAS, by the provisions of State law, the ordinance levying taxes for fiscal year 2021-2022 is required to be finally adopted not later than the third Monday in August; and

WHEREAS, the County of Coconino is the assessing and collecting authority for the City of Flagstaff.

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. There is hereby levied on each one hundred dollars ($100.00) of the assessed value of all property, both real and personal within the corporate limits of the City of Flagstaff, except such property as may be by law exempt from taxation, a primary property tax rate of 0.7186 for the fiscal year ending on the 30th day of June 2022. If this tax rate exceeds the maximum levy allowed by law, the Board of Supervisors of the County of Coconino is hereby authorized to reduce the levy to the maximum allowable by law after providing notice to the City.

SECTION 2. In addition to the rate set in Section 1 hereof, there is hereby levied on each one hundred dollars ($100.00) of the assessed value of all property, both real and personal within the corporate limits of the City of Flagstaff, except such property as may be by law exempt from taxation, a secondary property tax rate of 0.8000 for the fiscal year ending June 30, 2022.

SECTION 3. Failure by the county officials of Coconino County, Arizona, to properly return the delinquent list, any irregularity in assessments or omissions in the same, or any irregularity in any proceedings shall not invalidate such proceedings or invalidate any title conveyed by any tax deed; failure or neglect of any officer or officers to timely perform any of the duties assigned to him or to them shall not invalidate any proceedings or any deed or sale pursuant thereto, the validity of the assessment or levy of taxes or of the judgment of sale by which the collection of the same may be enforced shall not affect the lien of the City of Flagstaff upon such property for the delinquent taxes unpaid thereon; overcharge as to part of the taxes or of costs shall not invalidate any proceedings for the collection of taxes or the foreclosure of the lien thereon or a sale of the property under such foreclosure; and all acts of officers de facto shall be valid as if performed by officers de jure.

SECTION 4. All ordinances and parts of ordinances in conflict herewith are hereby repealed.

SECTION 5. That the Clerk is hereby directed to transmit a certified copy of this ordinance to the County Assessor and the Board of Supervisors of the County of Coconino, Arizona.

SECTION 6. Effective Date. The tax levies imposed by this Ordinance shall take effect August 5, 2021.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

12. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Bryce Doty, Real Estate Manager
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Ordinance No. 2021-15: An ordinance of the City Council of the City of Flagstaff, authorizing the acquisition of real property for the Lone Tree Overpass Project; providing for delegation of authority, subsequent council approvals, severability, and establishing an effective date

STAFF RECOMMENDED ACTION:

At the June 15th, 2021 Council Meeting:
1) Read Ordinance No. 2021-15 by title only for the first time
2) City Clerk reads Ordinance No. 2021-15 by title only (if approved above)
At the July 6th, 2021 Council Meeting:
3) Read Ordinance No. 2021-15 by title only for the final time
4) City Clerk reads Ordinance No. 2021-15 by title only (if approved above)
5) Adopt Ordinance No. 2021-15

Executive Summary:

Adoption of this ordinance will authorize the acquisition of the real property interests required for Lone Tree Overpass project.

Financial Impact:

The Lone Tree Overpass Project is currently budgeted in FY2020-2021 in the amount of $5,862,375 in the Transportation Fund, Account Number 047-05-112-3054-6. The Lone Tree Corridor Project is currently budgeted in FY2021-2022 in the amount of $250,000 in the Transportation Fund, Account Number 048-05-118-3495-6. Both funds will be utilized to complete the attached project scope from Route 66 to Sawmill Road.

Policy Impact:

None

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives
Safe and Healthy Community -

- Foster a safe, secure, and healthy community.
- Ensure the built environment is safe through the use of consistent standards, rules and regulations, and land use practices.

Inclusive and Engaged Community -

- Advance social equity and social justice in Flagstaff.

Sustainable, Innovative Infrastructure -

- Deliver outstanding services to residents through a healthy, well maintained infrastructure system.
- Utilize existing long-range plans that identify the community's future infrastructure needs and all associated costs.
- Identify smart traffic management, multi modal transportation, and alternative energy opportunities.

Environmental Stewardship -

- Implement sustainable building practices and alternative energy and transportation options.
- Implement, maintain and further the Climate Action and Adaptation Plan.

Regional Plan: Goal T.2 -

- Improve transportation safety and efficiency for all modes**.**

Has There Been Previous Council Decision on This:

During the February 2nd, 2021 Council meeting, Council awarded the Design-Build Services Agreement for Phase I of the project development to Ames Construction. The agreement provided services for parcel acquisition coordination.

Previous City Council reviewed options for the Lone Tree Overpass bond project and directed staff to prepare ballot language for a $73M bond project to be funded through secondary property tax in the 2018 election, which was passed by the Flagstaff voters.

Options and Alternatives:

1. Approve ordinance with option 1: All purchase contracts for a Property in an amount exceeding $50,000 are subject to subsequent City Council approval;
2. Approve ordinance with option 2: The City Council gives its prior approval and the City Manager is delegated authority to enter into all purchase contracts for the Properties, so long as the purchase price for a Property is reasonably consistent with the appraisal of just compensation to be paid.
3. Do not approve property acquisitions, and provide other direction.

Background/History:

The Lone Tree Overpass has been a planned project for over a decade in the Flagstaff community. The Lone Tree Overpass Study, which evaluated conceptual design options for the bridge was completed in 2010. The goal of the project is to provide better connectivity for our transportation network and provide a grade-separated crossing that increases safety and convenience for commuters.

The Overpass also coordinates with the future planned improvements of the Lone Tree Corridor reconstruction which was studied in a report completed in 2006. The Lone Tree Corridor and Overpass serves to connect the southern area of town with the Route 66 corridor and provides an option that reduces congestion on other roadway corridors.

A portion of the Lone Tree Corridor from Sawmill Road to Butler Avenue is included in this Overpass design. This section of the corridor was included at this time to provide a coordinated improvement north and south of the Butler Avenue Intersection.

In November 2018, the voters were asked to approve a ballot measure to fund the Overpass (Proposition 420) and a separate ballot measure to fund the Corridor Improvements (Proposition 419). Both

propositions passed.

On August 21, 2020, the City posted a Request for Statements of Qualifications (RSOQ) from Arizona Registered Contractors on the City's PlanetBids electronic bidding platform, and advertised it in the Arizona Daily Sun on August 23 and 30, 2020. The Design-Build solicitation will evaluate contractors based on their qualifications and experience with providing similar Design-Build projects. The Design-Builder will provide design and construction services for the Overpass.

On September 24, 2020, the City received four responses to the Request for Statements of Qualifications (RSOQ). A seven-person evaluation committee was formed consisting of five staff members and two outside individuals (one officer of a registered contractor and one certified design professional in the industry). The Statements of Qualifications (SOQs) received were evaluated and the evaluation committee selected three firms for interviews. Upon the completion of the interviews, the evaluation committee selected Ames as the most qualified Design-Builder to perform the work.

On February 2, 2021, City Council awarded the Design-Build Services Agreement for Phase I of the project development to Ames Construction. The agreement provided services for parcel acquisition coordination.

Community Benefits and Considerations:

The Lone Tree Overpass will provide a new roadway corridor and bridge over the BNSF Railway and the future Rio de Flag Flood Control Project, providing connectivity between Butler Avenue and Route 66 in central Flagstaff. Multimodal transportation and alternative intersection design will be included in this project to enhance all modes of transportation. This project will also be designed with consideration of goals from the City's Climate Action and Adaptation Plan and the Southside Neighborhood Plan. An Economic Impact Analysis will also be developed to evaluate impacts for changes in transit behavior which will help identify future needs or mitigation.

Community Involvement:

There was extensive public coordination with the development of both the Overpass concept study and the Corridor Study in the late 2000s. There was also outreach performed for Proposition 419 and 420. This contract with Ames includes public participation meetings, neighborhood outreach, development of a website to provide information, project renderings to improve understanding of the proposed project elements, and general public coordination throughout the design and construction of the project.

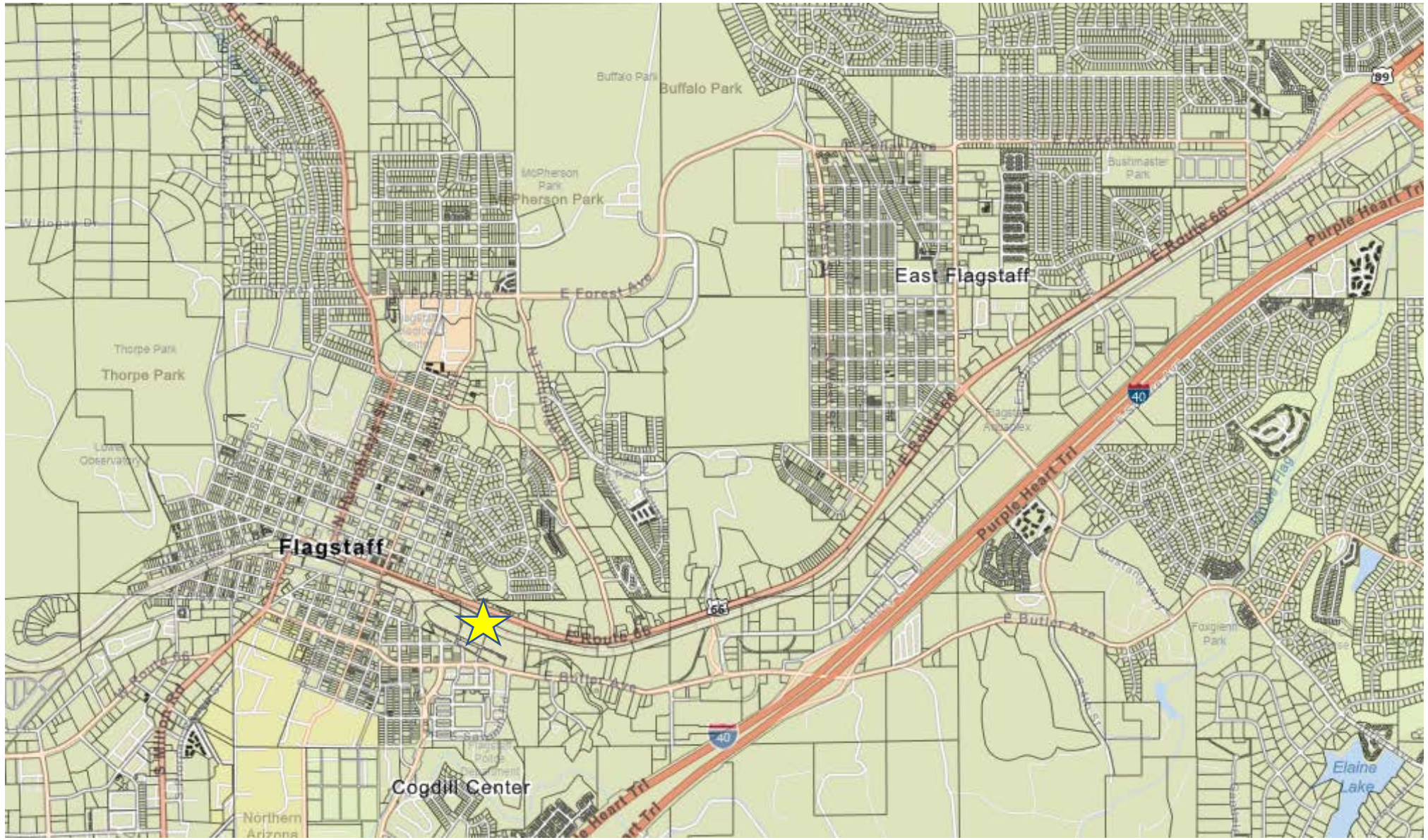
Attachments: Presentation
Ord. 2021-15
Exhibit A
Exhibit B

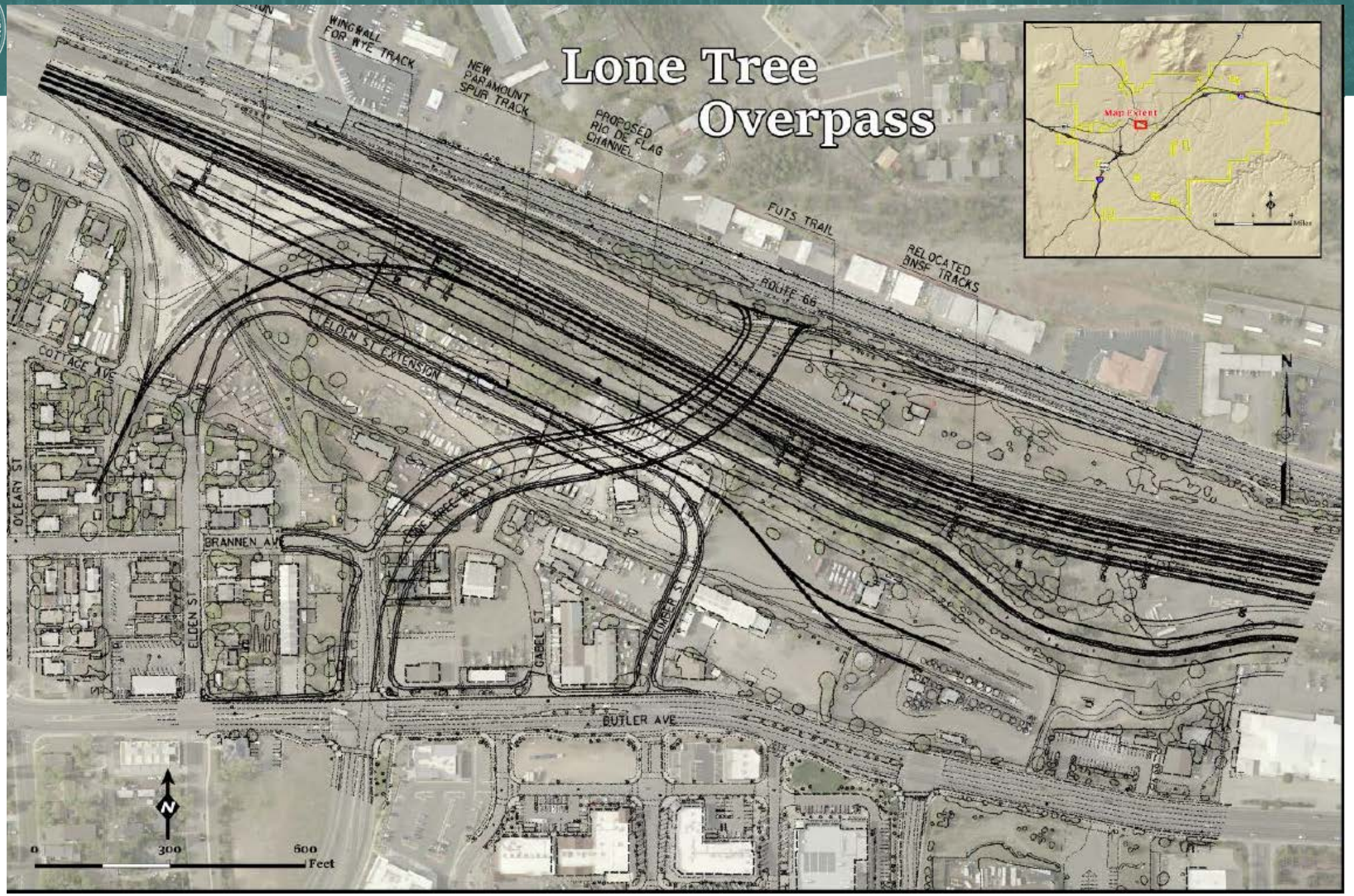
Lone Tree Overpass Property Acquisition

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

Vicinity Map




Lone Tree Overpass
WINGWALL FOR WYE TRACK
NEW PARAMOUNT SPUR TRACK
PROPOSED RIO DE FLAG CHANNEL
FUTS TRAIL
RELOCATED BNSF TRACKS
ROUTE 66
ELDEN ST EXTENSION
COTTAGE AVE
O'LEARY ST
BRANNEN AVE
ELDEN ST
GABEL ST
LUMMIS ST
BUTLER AVE
Map Extent
N
0
300
600
Feet

Parcel Map

LT-16
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LT11
LT-21
LT-19
LT-20
LT-22
LT-23
Priority 1
Priority 2
Priority 3
Priority 4
Priority 5
E PHOENIX AVE
E COTTAGE AVE
S ELDEN ST
S ONEAVY ST
S COLORADO ST
E BRANNEN AVE
E BUTLER AVE
E HILLTOP AVE
Coconino County GIS | USDA FSA, Maxar

Uniform Act Process

Purpose / Benefits

- Minimize Hardships
- Identify replacement housing and 90 day move-out notice
- Provide moving expenses
- Account for increased cost, if any, of replacement housing
- Following Uniform Act protects City's ability to continue to receive Federal and State funds

Uniform Act Process

Steps

- Notice of eligibility
- Appraisal
- Appraisal Review
  - Approved Offer Amount
- Written Offer and Determination of Relocation Benefits,
- Acquisition (purchase or condemnation)
- Relocation

Timeline

Priority 1 Parcels

BNSF Parcels

- Acquisition efforts progressing in same discussions as Rio de Flag flood control project

Priority 2 Parcels

Full Parcel Acquisitions

- Right of Way limits of the LoneTree Overpass will require full acquisition for these parcels
- Offers and Relocation Determinations are being presented

Priority 3-5 Parcels

Partial Acquisitions

- Design work has not fully delineated Right of Way needs. We may not need acquisitions on all parcels.
- Once design is finalized and legal descriptions prepared, we will acquire what is needed

Questions
or
Discussion?

ORDINANCE NO. 2021-15

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF FLAGSTAFF, AUTHORIZING THE ACQUISITION OF REAL PROPERTY FOR THE LONE TREE OVERPASS PROJECT; PROVIDING FOR DELEGATION OF AUTHORITY, SUBSEQUENT COUNCIL APPROVALS, SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

RECITALS:

WHEREAS, Article VII, Section 5 of the Flagstaff City Charter provides that the City acquire real property by ordinance; and

WHEREAS, the City of Flagstaff desires to acquire certain real property for the Lone Tree Overpass Project; and

WHEREAS, in November, 2018 Flagstaff voters passed Proposition 420, to establish a 0.23% local transaction privilege tax (sales) tax rate for a 20 year period, on the gross revenues derived from engaging in business activities within the city of Flagstaff, and dedicating use of the revenues to pay for the costs of a Lone Tree Railroad Overpass from Butler Avenue to Route 66, along with related pedestrian, bicycle, and street connections ("Lone Tree Overpass Project"); and

WHEREAS, the City of Flagstaff has programmed funding for the Lone Tree Overpass Project in its 5-year Capital Improvement Program; and

WHEREAS, the City Council has approved a contract with Ames Construction, Inc., a Minnesota corporation, which includes an option for property acquisition services for the Lone Tree Overpass Project ("agent").

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General

The City of Flagstaff shall acquire real property for the Lone Tree Overpass Project as generally described in Exhibit A and located as shown in Exhibit B, and per the civil engineering plans approved by the City Engineer ('the Properties").

SECTION 2. Delegation of Authority.

The Mayor, City Manager, City Attorney, City Clerk, Finance Director, City Engineer, Real Estate Manager, or their delegates or agents, are hereby authorized and directed to take all steps and execute all documents necessary to acquire the Properties and to carry out the purpose and intent of this ordinance, and to acquire the Properties through purchase, exchange, gift, donation, or dedication.

SECTION 3. Subsequent Council Approvals.

The City Council may approve any condemnation necessary for public use, including site access, by resolution referencing this ordinance, and including a legal description and map of the properties sought to be condemned, which resolution shall be immediately effective.

> [OPTION 1: Any purchase contract for a Property in an amount of $50,000 or more is subject to City Council approval at a future council meeting.]
>
> [OPTION 2: City Council hereby gives its prior approval, and City Manager is hereby delegated authority to approve any purchase contract for a Property in an amount of $50,000 or more without subsequent Council approval, so long as the purchase price shall be reasonably consistent with the City's appraisal of just compensation to be paid for the Property.]

Any deed or other transfer of real property acquired pursuant to this ordinance will be presented to the City Council at a future council meeting for formal acceptance.

SECTION 4. Repeal of Conflicting Ordinances

All ordinances and parts of ordinances in conflict with the provisions of the code adopted herein are hereby repealed.

SECTION 5. Severability

If any section, subsection, sentence, clause, phrase or portion of this ordinance or any part of the code adopted herein by reference is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 6. Effective Date

This Ordinance shall be effective thirty (30) days following adoption by the City Council.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 6th day of July, 2021.

_____
MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Exhibits:
Exhibit A—Description of properties to be acquired
Exhibit B—Map

EXHIBIT A
LEGAL DESCRIPTIONS OF PROPERTIES TO BE ACQUIRED

FLAGSTAFF Parcel No.	Assesor's Parcel Number and/or Legal Description	Owner Site Address/ Owner Address	Property Type
LT-01	Total Acquisition of Coconino County Assessor Parcel Number: 104-04-011D	**Arizona Materials Property LLc** 633 E. Brannen, Flag 86001/ 21838 N20th Str, Phx Az 85024	Industrial
LT-02	A Portion of or All of Coconino County Assessor Parcel Numbers: 104-01-017A, 104-01-018	**High Desert Investment Co** 504 E Butler Ave, Flag 86001/ PO Box 1170 Queen Creek 85142	Commercial
LT-03	Total Acqusition of Coconino County Assessor Parcel Number 104-01-019: THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF COCONINO, STATE OF ARIZONA, AND IS DESCRIBED AS FOLLOWS: Lot 11, Block 24, BRANNEN ADDITION, as shown on the plat thereof recorded in Book 1 of Maps, Page 12, and amended in Book 1 of Maps, Page 42, records of Coconino County, Arizona; EXCEPTING THEREFROM the Northerly 10.25 feet thereof.	**Fred and Jennie Baca** 3 S Colorado Street, Flag 86001	Residential
LT-04	Total Acquisition of Coconino County Assessor Parcel Number 104-01-020D: THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF COCONINO, STATE OF ARIZONA, AND IS DESCRIBED AS FOLLOWS: The Northerly 10.25 feet of LOT 11 and all of LOT 12, BLOCK 24, BRANNEN ADDITION, as shown on the plat thereof, recorded in Book 1 of Maps, Page 12, records of Coconino County, Arizona.	**Watkins, Michael & Eileen** 51 E Brannen, Flag 86001/ 7360 Crater View, Flag 86004	Residential
LT-05	A Portion of or All of of Coconino County Assessor Parcel Number 104-01-016C	**Tantiyatyanon Preeda & Madeleine** 522 E. Butler Ave, Flag 86001/5655 E Forest Dr, Flagstaff, 86004	Commercial

FLAGSTAFF Parcel No.	Assesor's Parcel Number and/or Legal Description	Owner Site Address/ Owner Address	Property Type
LT-06	Total Acquisiton of Coconino County Assessor Parcel Number: 104-01-097D: THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF COCONINO, STATE OF ARIZONA, AND IS DESCRIBED AS FOLLOWS: A parcel of land situated in Section 22, Township 21 North, Range 7 East of the Gila & Salt River Base and Meridian, Coconino County, Arizona, lying within the Burlington Northern and Santa Fe Railway Company's (formerly Atchison, Topeka and Santa Fe Railway Company) Yard Property at Flagstaff, Arizona, more particularly described as follows: COMMENCING at a T-rail monument 1 foot below ground level at the Southwest corner of said Yard Property, being on the Southerly extension of the Easterly line of Block 32 and 17.4 feet Westerly from the centerline of Cottage Avenue, as shown on the Revised Plat of Brannen Addition, a Subdivision of record in Book 1 of Maps, Page 42, records of Coconino County, Arizona; THENCE South 68° 20' 09" East along the Southerly line of said Yard Property, a distance of 596.89 feet to a point of curve; THENCE continuing Southeasterly along said Southerly property line, along a curve concave Southwesterly having a radius of 2270.66 feet, a central angle of 03° 40' 04", an arc length of 145.36 feet to the most Southerly corner of that certain parcel of land described in Quit Claim Deed dated August 11, 1992 from the Atchison, Topeka and Santa Fe Railway Company to Guifford W. Moore and Georgia M. Moore d/b/a G&G Company, and the TRUE POINT OF BEGINNING; THENCE continuing Southeasterly along said Southerly property line and along said curve, an arc length of 178.68 feet; THENCE South 60° 09' 34" East, a distance of 51.55 feet; THENCE North 24° 40' 23" East, a distance of 122.02 feet to a point 10.00 feet Southwesterly, as measured at right angles from the centerline of an existing spur track; THENCE North 65° 18' 31" West, parallel with said spur track centerline, a distance of 235.30 feet to the Easterly line of said parcel of land described in Quit Claim Deed dated August 11, 1992 from the Atchison, Topeka and Santa Fe Railway Company to Guifford W. Moore and Georgia M. Moore d/b/a G&G Company; THENCE South 21° 44' 02" West, a distance of 108.52 feet to the TRUE POINT OF BEGINNING.	**Hanson, Kelly & Liberty** 510 E Brannen, Flag 86001/ 580 E Flat Rock Ridge, Flag 86001	Commercial/Industrial
LT-07	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-022B	**SV Dirt Works** 410 E. Butler Ave, Flag 86001/ 1165 Mountainaire Rd, Flag 86005	Industrial
LT-08	Total Acquisition of Coconino County Assessor Parcel Number 104-01-093: THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF COCONINO, STATE OF ARIZONA, AND IS DESCRIBED AS FOLLOWS: A portion of the Northwest quarter of the Northwest quarter of Section 22, Township 21 North, Range 7 East, Gila & Salt River Base and Meridian, Coconino County, Arizona, more particularly described as follows: BEGINNING at the intersection of the North line of Brannen Avenue and the East line of Colorado Street; THENCE Northerly along the East line of Colorado Street to the South right-of-way line of the BNSF (formerly Atchison, Topeka and Santa Fe) Railroad Station grounds; THENCE Southeasterly along said South right-of-way of the Station grounds to the intersection with the North line of Brannen Avenue; THENCE West along the North line of Brannen Avenue to the POINT OF BEGINNING.	**Martyn Investments** 502 E Brannen, Flag 86001/ 140 N George Street, Flag 86001	Commercial
LT-09	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-024	**Hundelty, Gary & Mary Eileen** 422 E Butler Ave, Flag 86001/ 3219 E Camelback R, No 268, Phx, Az 85018	Commercial

FLAGSTAFF Parcel No.	Assesor's Parcel Number and/or Legal Description	Owner Site Address/ Owner Address	Property Type
LT-10	ACQUIRED via Ordinance 2020-20 All of Coconino County Assessor Parcel Number: 104-01-023	**City of Flagstaff, prior owner** Ginsberg 424 E Butler Ave, Flag 86001/ 832 N Wakando St, Flag 86004	Residential
LT-11	A Portion of or All of Coconino County Assessor Parcel Number: 104-04-012C	**R66R Commercial Properties** 524 E Brannen Ave, Flag 86001/ PO Box 65, Flag 86002	Industrial
LT-12	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-097B	**Steely, Jan LLC** 500 E Breannen/ 2532 N Fourth St, No 241, Flagstaff	Commercial/Industrial
LT-13	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-094E	**David, James & Caryl** 108 S Elden St, Flag 86001/ 4955 N Yarrow Trail, Flag 86001	Commercial
LT-14	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-071B	**Buzzard, Brian & Rachel** NWC Brannen Ave,& Colorado St, Flag 86001/1140 W Cox Ave, Flag 86005	Commercial
LT-15	A Portion of or All of Coconino County Assessor Parcel Number: 104-01-026B	**Splendid Fire Cat LLC** 400 E Butler, Flag 86001/5094 N Agave Trl, Flag 86001	Commercial
LT-16	A Portion of or All of Coconino County Assessor Parcel Number: 104-04-002	**Stilley Peter & Molly** 620 E .Rte 66, Flag 86001/17 N Leroux, #203 86001	Commercial
LT-17	A Portion of or All of Coconino County Assessor Parcel Number: 104-15-002, 00?	**RW Boulders LLC** 622E Route 66, Flag 86001/1918 E Winter Dr Phx, 85020	Commercial
LT-18	A Portion of or All of Coconino County Assessor Parcel Number: 104-15-003	**Stilley, Peter & Molly** 624 E .Rte 66, Flag 86001/17 N Leroux, #203 86001	Commercial
LT-19	A Portion of or All of Coconino County Assessor Parcel Number: 104-04-012D	**WIN OIL, CO** 700 E. Butler Ave, Flag 86001/ 989 S Main St, No 616 Cottonwood, Az 86326	Commercial
LT-20	A Portion of or All of Coconino County Assessor Parcel Number: 104-04-009C	**Island Creek Properties** 620 E Butler Ave, Flag 86001/260 E Butler Ave, Flag 86001	Commercial
LT-21	A Portion of or All of Coconino County Assessor Parcel Number: 104-04-008A	**Purcell, Michael** 602 E Butler Ave, Flag 86001/ PO Box 22215, Flag 86002	Commercial

FLAGSTAFF Parcel No.	Assesor's Parcel Number and/or Legal Description	Owner Site Address/ Owner Address	Property Type
LT-22	A Portion of or All of Coconino County Assessor Parcel Numbers: 104-04-011C, 104-04-013B, 104-04-013C, 104-04-014, 104-01-094D, 104-01-097C, 104-01-098A	**BNSF Railroad** 520 E Brannen & 840 E Butler, Flag 86001/Property Tax Dept, PO Box 961089, Fort Worth Tx 76161-0089	Comm/Ind
LT-23	A Portion of or All of Coconino County Assessor Parcel Number: 104-07-008	**LN Real Estete LLC** 1200 E Butler, 86001/PO Box 460069 Houston Tx 77056	Industrial

EXHIBIT B
ACQUISITION PARCEL PRIORITIES

12. C.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Frank Higgins, Deputy Police Chief
Co-Submitter:	Stacey Brechler-Knaggs
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-31: Consideration of an Intergovernmental Agreement (IGA) between the City of Flagstaff and the Arizona Board of Regents, for and on behalf of, Northern Arizona University (NAU) to share resources, information, and proportional costs for continued operation of a Public Safety Radio System.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-31 by title only
2) City Clerk reads Resolution No. 2021-31 by title only (if approved above)
3) Adopt Resolution No. 2021-31

Executive Summary:

Policy Decision or Reason for Action:

- Approving the new IGA will allow the City of Flagstaff and NAU to continue a partnership to share resources, information, and costs of operation which has existed for the past ten years. This partnership has benefited the City of Flagstaff by allowing the Police, Fire, and Public Works Divisions the use of NAU's radio system backbone infrastructure. In exchange, the IGA authorizes NAU continued access to the Hexagon Safety & Infrastructure Computer Aided Dispatch (CAD), Records Management System (RMS), and Jail Management System (JMS), that are jointly owned by the City of Flagstaff and Coconino County.

Decision Points:

- Does the City of Flagstaff derive a tangible benefit from continuing this IGA?

Yes. Without the IGA, the City of Flagstaff would not be able to share and thus reduce its financial burden, for the radio system backbone infrastructure, System Manager salary, system maintenance, and Federal Communications Commission (FCC) licensing that are jointly used by both the City of Flagstaff and NAU. Additionally, through this IGA, the City of Flagstaff can reduce the costs associated with operation and maintenance of the CAD and RMS by allowing NAU to share in this

Financial Impact:

The IGA allows the City of Flagstaff to realize an approximate benefit of $94,348 per year in shared expenses with NAU. This breaks down to an estimated $51,480 for CAD/RMS maintenance and $42,868 for 50% of the System Manager's salary. The loss of these funds provided through the IGA would not result in a corresponding reduction in actual CAD/RMS maintenance costs to the City of Flagstaff. This IGA is budgeted in the Police budget in account number 001-04-061-0224-2-4290.

Without the IGA, the City of Flagstaff would need to staff the full financial burden of a System Manager at an estimated cost of $85,736 per year. The net financial impact of losing the shared expense revenue while increasing the personnel costs to the City of Flagstaff is estimated at approximately $137,216 per year.

Policy Impact:

None

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

Safe and Healthy Community

Has There Been Previous Council Decision on This:

Yes, The Flagstaff City Council approved the previous IGA with NAU in March 2011. This IGA will expire in July 2021 if not terminated beforehand by either party in accordance with the provisions outlined in the IGA.

Options and Alternatives:

1. Approve the Intergovernmental Agreement.
2. Reject the Intergovernmental Agreement.

Attachments: Res. 2021-31
IGA
IGA Change Summary
Staff Summary

RESOLUTION NO. 2021-31

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL, APPROVING AN INTERGOVERNMENTAL AGREEMENT BETWEEN THE CITY OF FLAGSTAFF AND THE ARIZONA BOARD OF REGENTS, FOR AND ON BEHALF OF, NORTHERN ARIZONA UNIVERSITY (NAU) TO SHARE RESOURCES, INFORMATION, AND PROPORTIONAL COSTS FOR CONTINUED OPERATION OF A PUBLIC SAFETY RADIO SYSTEM

RECITALS:

WHEREAS, the Arizona Board of Regents, for and on behalf of, Northern Arizona University is empowered by Arizona Revised Statutes A.R.S. §§ 11-952 and 15-1625 and Arizona Board of Regents Policy 3-808 and the City is empowered by Arizona Revised Statutes §§ 11-952 and 41-2632 to enter into the Intergovernmental Agreement to share resources, information, and proportional costs for continued operation of a Public Safety Radio System; and

WHEREAS, the City Council has read and considered the staff summary report and proposed Intergovernmental Agreement to share resources, information, and proportional costs for continued operation of a Public Safety Radio System attached thereto and finds that it is in the best interests of the City to enter into the Agreement.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General.

The Flagstaff City Council hereby authorizes the Mayor to execute the Intergovernmental Agreement between the Arizona Board of Regents, for and on behalf of, Northern Arizona University and the City of Flagstaff, Arizona, attached hereto ("IGA"), which shall become effective June 15, 2021 ("Effective Date").

SECTION 2. Effective Date.

This resolution shall be immediately effective upon adoption.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June 2021.

_____

MAYOR

ATTEST:

_____
CITY CLERK

APPROVED AS TO FORM:

_____
CITY ATTORNEY

Exhibits:
Intergovernmental Agreement

City Clerk
City of Flagstaff
211 W. Aspen Avenue
Flagstaff, AZ 86001

INTERGOVERNMENTAL AGREEMENT

City of Flagstaff
And
Arizona Board of Regents
for and on behalf of
Northern Arizona University

This Agreement is made this ____ day of _____, 2021 by and between the City of Flagstaff (the "City"), an Arizona municipal corporation with offices at 211 West Aspen Avenue, Flagstaff, Arizona 86001, and the Arizona Board of Regents, a body corporate with perpetual succession pursuant to the laws of the State of Arizona, for and on behalf of Northern Arizona University ("NAU"), a state university duly organized and existing pursuant to Arizona Revised Statutes §15-1601.A, with an address of Box 4130, Flagstaff, Arizona 86011. NAU and the City may be referred to as a party or, collectively, as the parties in this Agreement.

RECITALS

A. The City and County jointly own and maintain a public safety software system ("City/County System");

B. The City and County have entered into an IGA to operate the City/County System;

C. The City is authorized and desires to extend services of the City/County System to NAU pursuant to its IGA with the County;

D. NAU will purchase and maintain a voice-trunked radio system ("Radio System");

E. The City desires to purchase and maintain a proportional share of the Radio System, which will be used for Public Safety, Public Works, administrative and other two-way voice radio operations as may be appropriate through this Agreement;

F. It is in the best interest of the State of Arizona and the citizens of Flagstaff for NAU and the City to share resources, information and costs of operation to provide more efficient and cost effective solutions for the Radio System.

G. The City has authority to enter into this Agreement pursuant to Arizona Revised Statutes ("A.R.S.") §§ 11-952 and 41-2632;

H. NAU has authority to enter into this Agreement pursuant to A.R.S. §§ 11-952 and 15-1625 and Arizona Board of Regents Policy 3-808.

NOW, THEREFORE, in consideration of the premises and mutual covenants contained herein, the parties agree as follows:

1. <u>City Responsibilities.</u>

1.1. <u>Automated Information Systems.</u> The City will provide NAU access to the City/County System, which consists of the Intergraph Corporation- Hexagon Safety & Infrastructure Computer Aided

Dispatch (CAD), Records Management System (RMS), Jail Management System (JMS), and other modules that NAU may have an interest in using. City will make all interfaces and technical support available, twenty-four (24) hours a day, seven (7) days per week except during unanticipated downtime and during system backups/upgrades.

1.1.1. Training. Should City/County System operator training be necessary, the City agrees to provide instruction to NAU at an hourly rate as listed in Exhibit A.

1.1.2. Back-up Procedures. City will maintain regular back-up procedures to ensure the integrity of data on the City/County System.

1.1.3. Network and Database Administration. City will provide all network services required to maintain 24 hour/day, 365 day/year operability. City will provide CAD and RMS database administration services, CAD map maintenance, and identification and reporting of software issues to the RMS vendor.

1.2. Radio System.

1.2.1. The City will provide all subscriber units (control, mobile and portable/handheld) to be used by City employees. NAU will be responsible for programming and maintenance by its System Manager as described in section 5.1.4.

1.2.2. The City will provide two console positions in the Flagstaff Dispatch Center should the NAU Police Department Dispatch have to relocate on a short-term basis. Since both agencies will be operating the same radio and CAD consoles, no special equipment will be required. Rerouting of telephone service will require pre-planning with telephone providers as a third party.

1.2.3. The City will assign one person from the Police Department to act as liaison and project manager ("Project Manager") with NAU.

2. NAU Responsibilities.

2.1. Automated Information Systems.

2.1.1. NAU will supply and maintain all equipment required to provide CAD and RMS to the demarcation point established as the connection to the City's computer center. NAU agrees to pay for the installation and cost of any computer equipment or telecommunication circuits which are added to the City computer or telecommunications equipment and are required to complete and/or continue service to NAU. The City will maintain all equipment beyond the demarcation point necessary to maintain operations to NAU.

2.2. Maintenance of Radio System.

2.2.1. NAU will provide access to the Radio System for use by the City.

2.2.2. NAU will procure and maintain a service agreement with an approved service center to maintain, to manufacturer's specifications, the Radio System and any other components or appurtenances necessary for normal operation. The City will pay its pro rata share of

maintenance costs. NAU will invoice the City for its pro rata share of maintenance as needed.

2.3. NAU will maintain in force and effect its FCC license for the Radio System. The City will pay a share of the cost of licensing fees as outlined in Exhibit B.

3. Term and Termination.

3.1. This Agreement shall become effective upon adoption and signature by the parties (the "Effective Date") and shall continue in force for a period of ten (10) years.

3.2. This Agreement may be terminated by either party giving the other party no less than six (6) months prior written notice. In the event this Agreement is terminated both parties shall pay any amounts owed up to the termination date to the other party. Additionally, the City shall be responsible for payment in full of remaining principal and accrued interest as indicated on Exhibit C, at which time the City will own a proportional share of the system.

3.3. At least six (6) months prior to the termination or expiration of this Agreement, the parties will begin negotiations to enter into an agreement for the continued use and maintenance of the Radio System.

3.4. In the event any part of the jointly owned portion of the Radio System is disposed of, the parties agree to share the proceeds from the sale in the same pro rata share as the purchase.

4. Costs/Ownership of Equipment.

4.1. NAU will have sole ownership of the Radio System until the City pays the Purchase Costs, at which time the City will own a proportional share of the Radio System.

4.2. NAU will reimburse the City for the costs outlined in Exhibit A. The City will update Exhibit A annually for budgeted amounts and adjusted for actual cost differences from the prior fiscal year, should there be a difference from budget. Updates to Exhibit A shall be documented through an amendment to this Agreement and signed by authorized signatories of both parties. City shall notify NAU no later than March 1 in each fiscal year of any estimated adjustment for the following fiscal year, which shall be applied prospectively. Adjustment for actual expenses for the prior fiscal year will occur no later than August 15, with any additional refund or payment processed by September 15.

4.3. The City will reimburse NAU for the costs outlined in Exhibit B. NAU will update Exhibit B annually for budgeted amounts and adjusted for actual cost differences from the prior fiscal year, should there be a difference from budget. Updates to Exhibit B shall be documented through an amendment to this Agreement and signed by authorized signatories of both parties. NAU shall notify the City no later than March 1 in each fiscal year of any estimated adjustment for the following fiscal year, which shall be applied prospectively. Adjustment for actual expenses for the prior fiscal year will occur no later than August 15, with any additional refund or payment processed by September 15.

4.4. City will pay NAU, without demand, the final interest and principal as outlined in Exhibit C on or before July 1, 2021.

4.5. All costs for maintenance and supervision of systems, controllers, servers, repeaters or related system hardware and software will remain the responsibility of the owner of that portion of the system. Each party is responsible for user workstations, licensing, mobile and handheld radios, remotes and any related antennas power supplies or support equipment.

4.6. Each party owns the equipment, software, hardware and other property that it has previously procured, and, unless subsequently agreed to by written modification to this Agreement, no transfers of ownership will occur when such property is added to either system. Unless otherwise provided in this Agreement, each party will be responsible for all costs of operations, repair and replacement for the property that party owns.

5. <u>System Management.</u>

5.1. NAU will designate a System Manager who will have the authority and responsibility to:

5.1.1. Direct the day-to-day operations and use of the Radio System;

5.1.2. Develop, in consultation with Radio System users, the protocols and policies for the operation and use of the Radio System, and distribute written copies of such protocols and policies to the City;

5.1.3. Review and approve plans for additions to the Radio System;

5.1.4. Maintain the security of the Radio System through control of system programming codes and other reasonable means and to coordinate all requests for equipment reprogramming.

5.2. The parties agree that the order of priority for access to and use of the Radio System shall be as follows:

5.2.1. Law Enforcement operations;

5.2.2. Public works, NAU and City, as they relate to public safety and emergency situations;

5.2.3. Routine public works, transportation, maintenance operations;

5.2.4. Administration.

5.3. The City agrees to comply with the protocols and policies for Radio System operations and use developed by the System Manager.

5.4. The City agrees to fund a proportional share of a System Manager position at NAU as outlined in Exhibit B. Such cost shall include the System Manager's salary and employee-related expenses; employee salary-related expenses may be adjusted at any time during this Agreement as necessary to cover salary adjustments by mutual written agreement of the contract administrator for the City and the duly authorized representative of NAU.

5.5. NAU will maintain a database of subscriber information and make this information available to the City Project Manager as needed for coordination of programming and to avoid operational conflicts. NAU will maintain the security access codes for programming in a secure manner to prevent unauthorized access to the radio network.

5.6. NAU and the City will jointly plan for replacements, enhancements and expansion of the Radio System as needed.

6. **Shared Information.** The City and NAU will share access to each other's incident-based information stored on the City/County System. This does not include internal information, personnel records or student records. Both parties recognize the requirements of the Family Educational Rights and Privacy Act, 20 U.S.C. §1232g (1968), as amended, and no exchange of information shall violate those provisions. Neither party may release any information received from or concerning the other party without prior written permission of that party, except as may be legally required. Such releases must be in compliance with State laws, Arizona Criminal Justice Information System rules, and each party's internal policies and procedures.

7. **NAU and City Employees.** Employees of the respective parties shall not be considered employees or agents of the other party, and the parties agree that they shall retain sole responsibility and authority over their respective employees.

8. **Liability.** Each party (as "Indemnitor") agrees to indemnify, defend, and hold harmless the other party (as "Indemnitee") from and against any and all claims, losses, liability, costs, or expenses (including reasonable attorney fees) (collectively referred to as "Claims") arising out of bodily injury of any person (including death) or property damage, but only to the extent that such Claims which result in vicarious/derivative liability to the Indemnitee are caused by the act, omission, negligence, misconduct, or other fault of the Indemnitor, its officers, official, agents, employees, or volunteers.

9. **Inspection of Records.** All books, accounts, reports, files and other records relating to this Agreement shall be subject at all reasonable times to inspection or audit by the Arizona Board of Regents, Northern Arizona University, the Auditor General of the State of Arizona, the City of Flagstaff, or their agents for five (5) years after completion of this Agreement. Such records shall be produced at Northern Arizona University; the City of Flagstaff or such other reasonable location as designated by the requesting party.

10. **Notices.** Unless otherwise specified herein, any notice or other communication required or permitted to be given under this Agreement shall be in writing and sent to the address given below for the party to be notified, or to such other address, notice of which is given in compliance with this section:

If to the City:

Dan Musselman, Chief of Police
City of Flagstaff
911 E. Sawmill Road
Flagstaff, AZ 86001

Patrick Brown, Purchasing Director
City of Flagstaff
211 W. Aspen Avenue
Flagstaff, AZ 86001

City Contract Administrator

If to NAU:

Melissa Freshour , Interim Chief of Police
Northern Arizona University
Box 5602
Flagstaff, AZ 86011

Contracts, Purchasing and Risk Management
PO Box 4124
Flagstaff, AZ 86011

11. **Insurance.**

11.1. NAU shall maintain adequate insurance (through the State's Risk Management Division, which is a self-insurance program) to cover any liability arising from the acts and omissions of NAU's agents and employees arising out of the performance of this Agreement. NAU shall not be responsible for maintaining insurance coverage for liability arising from the acts or omissions of the City's employees or agents.

11.2. The City shall maintain adequate insurance to cover any liability arising from the acts or omissions of the City's employees or agents arising out of the performance of this Agreement. The City shall not be responsible for maintaining insurance to cover liability arising from the acts or omissions of employees or agents of NAU.

12. Authority to Contract. Each party represents and warrants that it has full power and authority to enter into this Agreement and perform its obligations hereunder and has taken all required acts or actions necessary to authorize the Agreement.

13. Integration; Modification. The parties acknowledge and agree that they have not relied upon any statements, representations, agreements or warranties except as expressed in this Agreement, and that this Agreement constitutes that parties' entire agreement with respect to the matters addressed herein. All prior or contemporaneous agreements and understandings, oral or written, with respect to such matters are hereby superseded and merged in this Agreement. This Agreement may be modified or amended only by written agreement executed by authorized representatives of both parties.

14. Waiver. No failure to enforce any condition or covenant of this Agreement shall imply or constitute a waiver of the right to insist upon performance of such condition or covenant, or of any other provision hereof, nor shall any waiver by either party of any breach of any one or more conditions or covenants of this Agreement constitute a waiver of any succeeding or other breach hereunder.

15. Severability. In the event that a court of competent jurisdiction shall hold any part or provision of the Agreement void or of no effect, the remaining provisions of this Agreement shall remain in full force and effect, to the extent that the continued enforcement of such remaining terms shall continue to reflect substantially the intent of the parties hereto.

16. Dispute Resolution. The parties to this Agreement agree to resolve all disputes arising out of or relating to this Agreement through arbitration, after exhausting applicable administrative review, to the extent required by A.R.S. § 12-1518 except as may be required by other applicable statutes.

17. Compliance with All Laws. Both parties shall comply with all federal and state laws, rules, regulations, standards and Executive Orders, as applicable, without limitation to those designated within this Agreement. Any changes in the governing laws, rules and regulations during the term of this Agreement shall apply but do not require an amendment.

18. Non-Discrimination. The parties agree to comply with all applicable state and federal laws, rules, regulations and executive orders governing equal employment opportunity, immigration (Executive Order 13465 – Employment Eligibility Verification, E-Verify; 73 FR 67704), nondiscrimination (Executive Order 11246), and affirmative action. The parties shall abide by the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a) and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on race, color, religion, sex, or national origin. Moreover, these regulations require that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, national origin, protected veteran status or disability.

19. **ADA.** Each party shall comply with applicable provisions of the Americans with Disabilities Act (Public Law 101-336, 42 United States Code. 12101-12213) and all applicable federal regulations under the Act, including 28 Code of Federal Regulation Parts 35 and 36.

20. **Conflict of Interest.** The requirements of A.R.S. § 38-511 apply to this Agreement. The parties may cancel this Agreement, without penalty or further obligation, if any person significantly involved in initiating, negotiating, securing, drafting or creating this Agreement on behalf of a party is, at any time while this Agreement or any extension is in effect, an employee, agent or consultant of the other party with respect to the subject matter of this Agreement.

21. **Non-appropriation.** Every payment obligation of the parties under this Agreement is conditioned upon the availability of funds appropriated and allocated for the payment of such obligation. If funds are not appropriated, allocated and available or if the appropriation is changed by the legislature resulting in funds no longer being available for the continuance of this Agreement, this Agreement may be terminated by the parties at the end of the period for which funds are available. No liability shall accrue to the parties in the event this provision is exercised, and the parties shall not be obligated or liable for any future payments or for any damages as a result of termination under this paragraph.

22. **No Third-Party Beneficiaries.** Nothing in the provisions of this Agreement is intended to create duties or obligations to or rights in third parties not parties to this Agreement or affect the legal liability of any party to the Agreement by imposing any standard of care different from the standard of care imposed by law.

SIGNATURE PAGE FOLLOWS

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized officials.

City of Flagstaff	**Northern Arizona University**
_____	_____
Paul Deasy	Name: _____
Mayor	Title: _____
Dated: _____	Dated: _____
Attest:	Attest:
_____	_____
City Clerk	
Dated: _____	Dated: _____
Approved as to form and as being within the powers and authority granted under the laws of the State of Arizona to the City of Flagstaff:	Approved as to form as being within the powers and authority granted under the laws of the State of Arizona to the Arizona Board of Regents:
_____	_____
City Attorney	University Counsel
Dated: _____	Dated: _____

Exhibit A

City of Flagstaff Costs to be Reimbursed by NAU

Estimated

Contract for IT Services with CCSO	@ 4%, currently estimated at $38,000
RMS capital replacement (annual)	@ 18% of RMS positions = see below
RMS Maintenance (annual)	
RMS upgrades (as scheduled)	
CAD capital replacement (annual)	@ 14% of CAD positions = see below
CAD Maintenance (annual)	
CAD upgrades (as scheduled)	

NETWORK BREAKDOWN*

	NAU #	**TOTAL**	**NAU %**
RMS Positions	33	**183**	**18%**
CAD Positions	2	**14**	**14%**
TOTAL	**35**	**197**	**18%**

*Estimated figures reflect the current number of CAD related positions for NAU. It is understood and accepted that "seat" numbers may change, either increase or decrease, and the percentage for associated line-item costs will also be adjusted based on total CAD seats and actual user numbers.

2021 cost breakdown

CAD/RMS Maintenance @ $286,000 annually (estimate)
Annual maintenance costs are split between partner agencies based on actual software use
CAD/RMS Upgrades @ proportional % of cost at the time of upgrade

ADDITIONAL COSTS TO BE BILLED AS INCURRED

1. Training at $25 per hour

Exhibit B

NAU Costs to be Reimbursed by the City

Estimated based upon the current employee and position status at NAU.

System Manager Salary @ 50%	$35,535.00
System Manager ERE @ 50%	$ 7,333.00
Total 2021 Cost	$42,868.00

Additional Costs to be billed as incurred

1. Costs Exceeding covered maintenance.

2. Federal Communications Commission (“FCC”) licensing fees.

EXHIBIT C
FINALIZED

→ file: Emergency Communications System

Schedule C

PUBLIC SAFETY COMMUNICATIONS SYSTEM (NAU)

Maturity	Principal	Interest Rate	Interest	Total Debt Service	Total FY Debt Service
1/1/2012			$28,456.47	$28,456.47	
7/1/2012	$289,955.86	2.40%	47,427.44	337,383.30	$365,839.77
1/1/2013			43,947.97	43,947.97	
7/1/2013	369,403.77	2.40%	43,947.97	413,351.74	457,299.71
1/1/2014			39,515.13	39,515.13	
7/1/2014	378,269.46	2.40%	39,515.13	417,784.59	457,299.72
1/1/2015			34,975.89	34,975.89	
7/1/2015	387,347.93	2.40%	34,975.89	422,323.82	457,299.71
1/1/2016			30,327.72	30,327.72	
7/1/2016	396,644.28	2.40%	30,327.72	426,972.00	457,299.72
1/1/2017			25,567.99	25,567.99	
7/1/2017	406,163.74	2.40%	25,567.99	431,731.73	457,299.72
1/1/2018			20,694.02	20,694.02	
7/1/2018	415,911.67	2.40%	20,694.02	436,605.69	457,299.71
1/1/2019			15,703.08	15,703.08	
7/1/2019	425,893.55	2.40%	15,703.08	441,596.63	457,299.71
1/1/2020			10,592.36	10,592.36	
7/1/2020	436,114.99	2.40%	10,592.36	446,707.35	457,299.71
1/1/2021			5,358.98	5,358.98	
7/1/2021	446,581.75	2.40%	5,358.98	451,940.73	457,299.71
	$3,952,287.00		529,250.19	4,481,537.19	4,481,537.19

Barbara Goodrich
Management Services Director
City of Flagstaff

9/2/11
Date

Jennus Burton
Vice President for Finance and Administration
Northern Arizona University

09-SEP-11
Date

Text Comparison

Initial Document:
IGA Public Safety Radio System (Final Draft 5.26.21).pdf

Changed Document:
IGA Public Safety Radio System (Final Draft 6.8.21).pdf

Summary
Differences exist between the documents.

1 word(s) added
1 word(s) deleted
3478 word(s) matched

1 page(s) replaced

Insert	Word(s) inserted
~~Delete~~	Word(s) deleted
Move	Word(s) moved
Different	Word(s) different only in style

Exhibit A

City of Flagstaff Costs to be Reimbursed by NAU

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RMS Maintenance (annual)	
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CAD Maintenance (annual)	
CAD upgrades (as scheduled)	

NETWORK BREAKDOWN*

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CAD Positions	2	**14**	**14%**
TOTAL	~~**36**~~	**197**	**18%**

*Estimated figures reflect the current number of CAD related positions for NAU. It is understood and accepted that “seat” numbers may change, either increase or decrease, and the percentage for associated line-item costs will also be adjusted based on total CAD seats and actual user numbers.

2021 cost breakdown

CAD/RMS Maintenance @ $286,000 annually (estimate)
Annual maintenance costs are split between partner agencies based on actual software use
CAD/RMS Upgrades @ proportional % of cost at the time of upgrade

ADDITIONAL COSTS TO BE BILLED AS INCURRED

1. Training at $25 per hour

Exhibit A

City of Flagstaff Costs to be Reimbursed by NAU

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NETWORK BREAKDOWN*

	NAU #	**TOTAL**	**NAU %**
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Annual maintenance costs are split between partner agencies based on actual software use
CAD/RMS Upgrades @ proportional % of cost at the time of upgrade

ADDITIONAL COSTS TO BE BILLED AS INCURRED

1. Training at $25 per hour

Item No._____

CITY OF FLAGSTAFF
STAFF SUMMARY REPORT

To: The Honorable Mayor and Council

From: Frank P. Higgins
Flagstaff Police Department, Deputy Chief
556-2207

Date: May 27, 2021

Meeting Date: June 15, 2021

Title:
Consideration of an Intergovernmental Agreement (IGA) between the City of Flagstaff and the Arizona Board of Regents, for and on behalf of, Northern Arizona University (NAU) to share resources, information, and proportional costs for continued operation of a Public Safety Radio System.

Recommended Action:
Approve the Intergovernmental Agreement between the City of Flagstaff and NAU.

ACTION SUMMARY:
Policy Decision or Reason for Action:

- Approving the new IGA will allow the City of Flagstaff and NAU to continue a partnership to share resources, information, and costs of operation which has existed for the past ten years. This partnership has benefited the City of Flagstaff by allowing the Police, Fire, and Public Works Divisions the use of NAU's radio system backbone infrastructure. In exchange, the IGA authorizes NAU continued access to the Hexagon Safety & Infrastructure Computer Aided Dispatch (CAD), Records Management System (RMS), and Jail Management System (JMS), that are jointly owned by the City of Flagstaff and Coconino County.

Decision Points:

- Does the City of Flagstaff derive a tangible benefit from continuing this IGA?
    - Yes. Without the IGA, the City of Flagstaff would not be able to share, and thus reduce its financial burden, for the radio system backbone infrastructure, System Manager salary, system maintenance, and Federal Communications Commission (FCC) licensing that are jointly used by both the City of Flagstaff and NAU. Additionally, through this IGA, the City of Flagstaff can reduce the costs associated with operation and maintenance of the CAD and RMS by allowing NAU to share in this

expense.

DISCUSSION:

Financial Implications:
The IGA allows the City of Flagstaff to realize an approximate benefit of $94,348 per year in shared expenses with NAU. This breaks down to an estimated $51,480 for CAD/RMS maintenance and $42,868 for 50% of the System Manager's salary. The loss of these funds provided through the IGA would not result in a corresponding reduction in actual CAD/RMS maintenance costs to the City of Flagstaff.

Without the IGA, the City of Flagstaff would need to staff the full financial burden of a System Manager at an estimated cost of $85,736 per year. The net financial impact of losing the shared expense revenue while increasing the personnel costs to the City of Flagstaff is estimated at approximately $ 137,216 per year.

Options and Alternatives:
(1) Approve the Intergovernmental Agreement.
(2) Reject the Intergovernmental Agreement.

Attachments/Exhibits:
Intergovernmental Agreement between the City of Flagstaff and the Arizona Board ofRegents for and on behalf of Northern Arizona University

Department Head **(Acknowledgment that all reviews have been completed and required approvals initialed below.)**

Initials	Responsibility	Date	Initials	Responsibility	Date
	Buds/Purchases			Finance/Budget	
	Grants			Contracts	
	Legal			IGAS	

12. D.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Christina Rubalcava, Senior Assistant City Attorney CR
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-35: A resolution approving a Binding Waiver of Enforcement between the City of Flagstaff and Northgate Holdings, LLC related to properties owned by Northgate generally located north of Ellery Avenue and south of Dupont Avenue on South San Francisco Street.

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-35 by title only
2) City Clerk reads Resolution No. 2021-35 by title only (if approved above)
3) Adopt Resolution No. 2021-35

Executive Summary:

Northgate Holdings, LLC ("Northgate") is the owner of six parcels of land located north of Ellery Avenue and south of Dupont Avenue on South San Francisco Street in Flagstaff, with Assessor Parcel Numbers 103-15-023, 103-15,024, 103-15-025, 103-15-026, 103-15-002, and 103-15-003 ("Northgate Properties"). The Northgate Properties are zoned Community Commercial (CC) and also have the option to elect T4 Neighborhood 1 (T4N.1) transect zoning.

On November 17, 2020, the Flagstaff City Council adopted a land use law, Ordinance 2020-28, generally referred to as the High Occupancy Housing amendments, which made various amendments to the Flagstaff Zoning Code. Northgate was the owner of the Northgate Properties on November 17, 2020.

Arizona Revised Statutes §12-1134 ("Prop 207") allows a property owner to seek just compensation when a city adopts a land use law that reduces the property owner's existing rights to use, divide, sell, or possess private real property and such action reduces the fair market value of the property. On March 30, 2021, Northgate filed a claim for just compensation under Prop 207, asserting that the amendments to the Flagstaff Zoning Code adopted by Ordinance 2020-28 reduced its rights to use the Northgate Properties and thereby reduced the fair market value of the Northgate Properties. Northgate is seeking $2 million in just compensation for the alleged reduction in market value of the Northgate Properties.

In response to a claim for just compensation under Prop 207, a city may reach an agreement with the property owner on the demanded compensation, deny the demanded compensation and defend such denial in litigation, amend the use law, repeal the land use law, or issue to the property owner a binding waiver of enforcement of the land use law on the owner's specific parcels.

If the City Council approves and adopts the attached resolution approving a Binding Waiver of

Enforcement between the City and Northgate, the Northgate Properties would not be subject to the High Occupancy Housing amendments adopted by Ordinance 2020-28.

Financial Impact:

Adoption of the resolution and approval of the Binding Waiver of Enforcement will moot Northgate's claim for $2 million in just compensation.

Policy Impact:

None.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

None.

Has There Been Previous Council Decision on This:

No.

Attachments:

Res. 2021-35
Binding Waiver of Enforcement
Northgate Properties Map
Ord. 2020-28
Res. 2020-59
Presentation

RESOLUTION NO. 2020-35

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL, APPROVING A BINDING WAIVER OF ENFORCEMENT BETWEEN THE CITY OF FLAGSTAFF AND NORTHGATE HOLDINGS, LLC, RELATING TO ASSESSOR PARCEL NUMBERS 103-15-023, 103-15-024, 103-15-025, 103-15-026, 103-15-002, AND 103-15-003, GENERALLY LOCATED NORTH OF ELLERY AVENUE AND SOUTH OF DUPONT AVENUE ON SOUTH SAN FRANCISCO STREET WITHIN THE CORPORATE LIMITS OF THE CITY OF FLAGSTAFF

RECITALS:

WHEREAS, Northgate Holdings, LLC ("Northgate") is the owner of six parcels of land located north of Ellery Avenue and south of Dupont Avenue on South San Francisco Street in Flagstaff, with Assessor Parcel Numbers 103-15-023, 103-15-024, 103-15-025, 103-15-026, 103-15-002, and 103-15-003 ("Northgate Properties"); and

WHEREAS, the Northgate Properties are zoned Community Commercial (CC) and also have the option to elect T4 Neighborhood 1 (T4N.1) transect zoning; and

WHEREAS, on November 17, 2020, the Flagstaff City Council adopted a land use law, Ordinance 2020-28, which made various amendments to the Flagstaff Zoning Code; and

WHEREAS, Northgate was the owner of the Northgate Properties on November 17, 2020; and

WHEREAS, Arizona Revised Statutes §12-1134 ("Prop 207") allows a property owner to seek just compensation when a city adopts a land use law that reduces the property owner's existing rights to use, divide, sell, or possess private real property and such action reduces the fair market value of the property; and

WHEREAS, on March 30, 2021, Northgate filed a claim for just compensation under Prop 207, asserting that the amendments to the Flagstaff Zoning Code adopted by Ordinance 2020-28 reduced its rights to use the Northgate Properties and thereby reduced the fair market value of the Northgate Properties; and

WHEREAS, Northgate is seeking $2 million in just compensation for the alleged reduction in market value of the Northgate Properties; and

WHEREAS, in response to a claim for just compensation under Prop 207, a city may reach an agreement with the property owner on the demanded compensation, deny the demanded compensation and defend such denial in litigation, amend the use law, repeal the land use law, or issue to the property owner a binding waiver of enforcement of the land use law on the owner's specific parcels; and

WHEREAS, the City and Northgate acknowledge and agree that the Northgate Properties shall not be subject to the amendments adopted by Ordinance 2020-28 and that a binding waiver of enforcement will be executed by the City to that effect.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. That the Binding Waiver of Enforcement by and between the City of Flagstaff and Northgate Holdings, LLC, which is attached hereto, is hereby approved and the Mayor is authorized to execute the Binding Waiver of Enforcement.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June, 2021.

MAYOR

ATTEST:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

Exhibits:
Binding Waiver of Enforcement

WHEN RECORDED, MAIL TO:

Flagstaff City Clerk
Stacy Saltzburg
211 W. Aspen Avenue
Flagstaff, AZ 86001

Gammage & Burnham
Attn: Cameron Artigue, Esq.
40 North Central Avenue, 20th Floor
Phoenix, Arizona 85004

BINDING WAIVER OF ENFORCEMENT

THIS BINDING WAIVER OF ENFORCEMENT (this "Waiver") is made and entered into this __ day of_____2021, by and between the City of Flagstaff, an Arizona municipal corporation (the "City"), and Northgate Holdings, LLC, an Arizona limited liability company ("Northgate").

RECITALS:

A. Northgate Holdings, LLC ("Northgate") is the owner of six parcels of land located north of Ellery Avenue and South of Dupont Avenue on South San Francisco Street in Flagstaff, with Assessor Parcel numbers 103-15-023, 103-15,024, 103-15-025, 103-15-026, 103-15-002, and 103-15-003 ("Northgate Properties").

B. The Northgate Properties are zoned Community Commercial (CC) and also have the option to elect T4 Neighborhood 1 (T4N.1) transect zoning.

C. On November 17, 2020, the Flagstaff City Council adopted a land use law, Ordinance 2020-28, which made various amendments to the Flagstaff Zoning Code.

D. Northgate was the owner of the Northgate Properties on November 17, 2020.

E. Arizona Revised Statutes §12-1134 ("Prop 207") allows a property owner to seek just compensation when a city adopts a land use law that reduces the property owner's existing rights to use, divide, sell, or possess private real property and such action reduces the fair market value of the property.

F. On March 30, 2021, Northgate filed a claim for just compensation under Prop 207, asserting that some of the amendments to the Flagstaff Zoning Code adopted by Ordinance 2020-28 reduced its rights to use the Northgate Properties and thereby reduced the fair market value of the Northgate Properties.

G. In response to a claim for just compensation under Prop 207, a city may reach an agreement

with the property owner on the demanded compensation, deny the demanded compensation and defend such denial in litigation, amend the use law, repeal the land use law, or issue to the property owner a binding waiver of enforcement of the land use law on the owner's specific parcels.

H. The City and Northgate acknowledge and agree that the Northgate Properties shall not be subject to certain amendments adopted by Ordinance 2020-28 and that a binding waiver of enforcement will be executed by the City to that effect.

NOW, THEREFORE, for and in consideration of the premises above and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the City and Northgate state, confirm, and agree as follows:

1) Incorporation of Recitals. The recitals stated above are true and correct and are incorporated herein.

2) Binding Waiver of Enforcement. The City and Northgate agree and declare that the amendments to the Flagstaff Zoning Code adopted by Ordinance 2020-28 shall not be enforced nor applicable to the entirety, or any portion of the Northgate Properties, and as result, are not triggered by the Ordinance.

3) Recordation. This Waiver shall be adopted by Resolution of the Flagstaff City Council and recorded in its entirety in the Official Records of Coconino County, Arizona, not later than ten (10) days after this Waiver takes effect in recordable form by each of the City of Flagstaff and Northgate.

4) Covenants Running with Land; Inurement. The covenants, conditions, terms, and provisions of this Waiver relating to use of the Northgate Properties shall run with the properties and shall be binding upon and shall inure to the benefit of the Parties and their respective permitted successors and assigns with respect to such properties.

5) Governing Law. This Waiver, and all rights and obligations created hereby, shall be determined and governed by the laws of the State of Arizona.

IN WITNESS WHEREOF, the Parties have executed this Waiver to be effective 30 days after the date and time a resolution approving and adopting this Waiver is approved by the Flagstaff City Council.

City of Flagstaff

_____
Mayor

Attest:

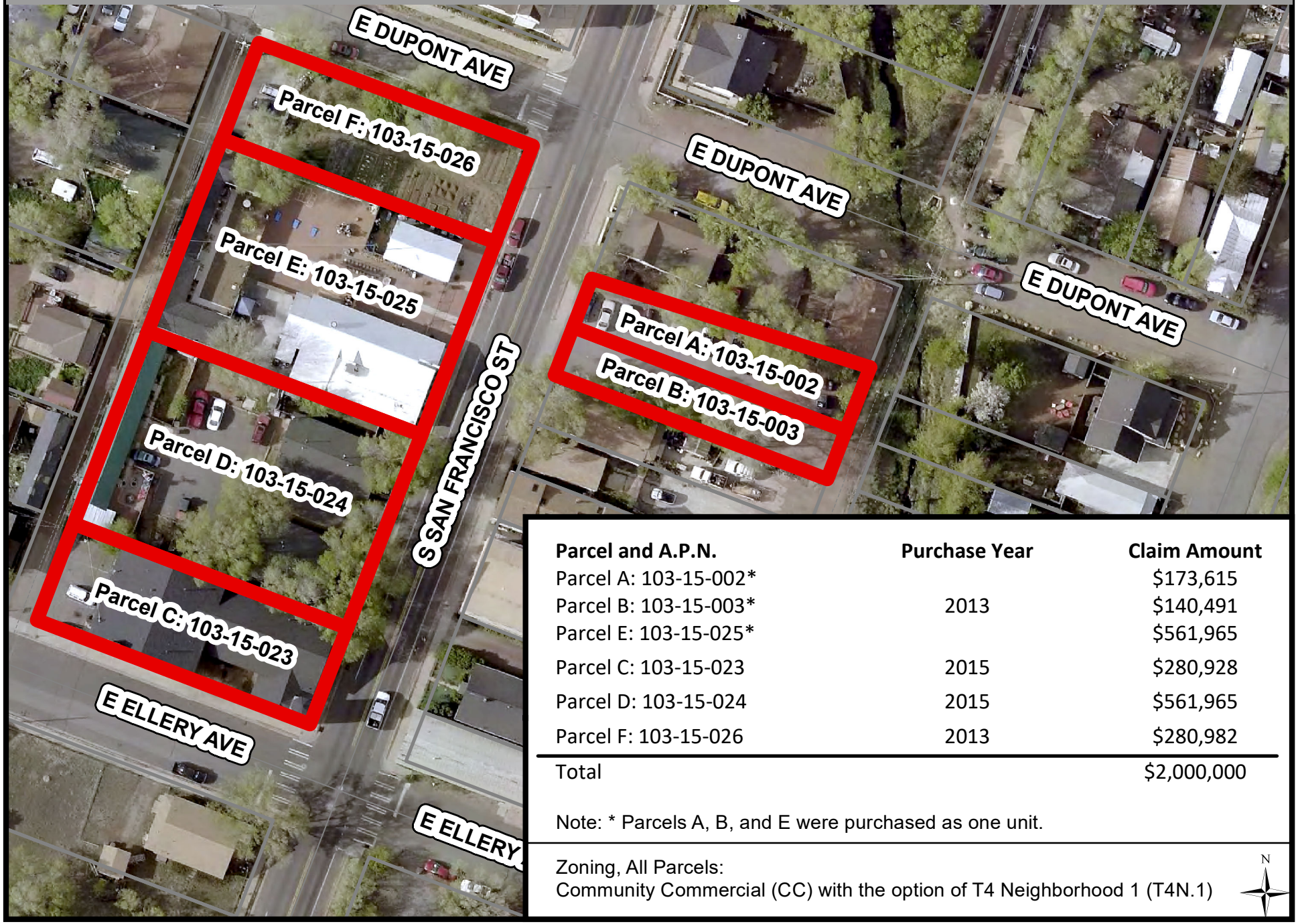
_____
City Clerk

_____
City Attorney

Owner:

By:_____
Its:_____

Location Map



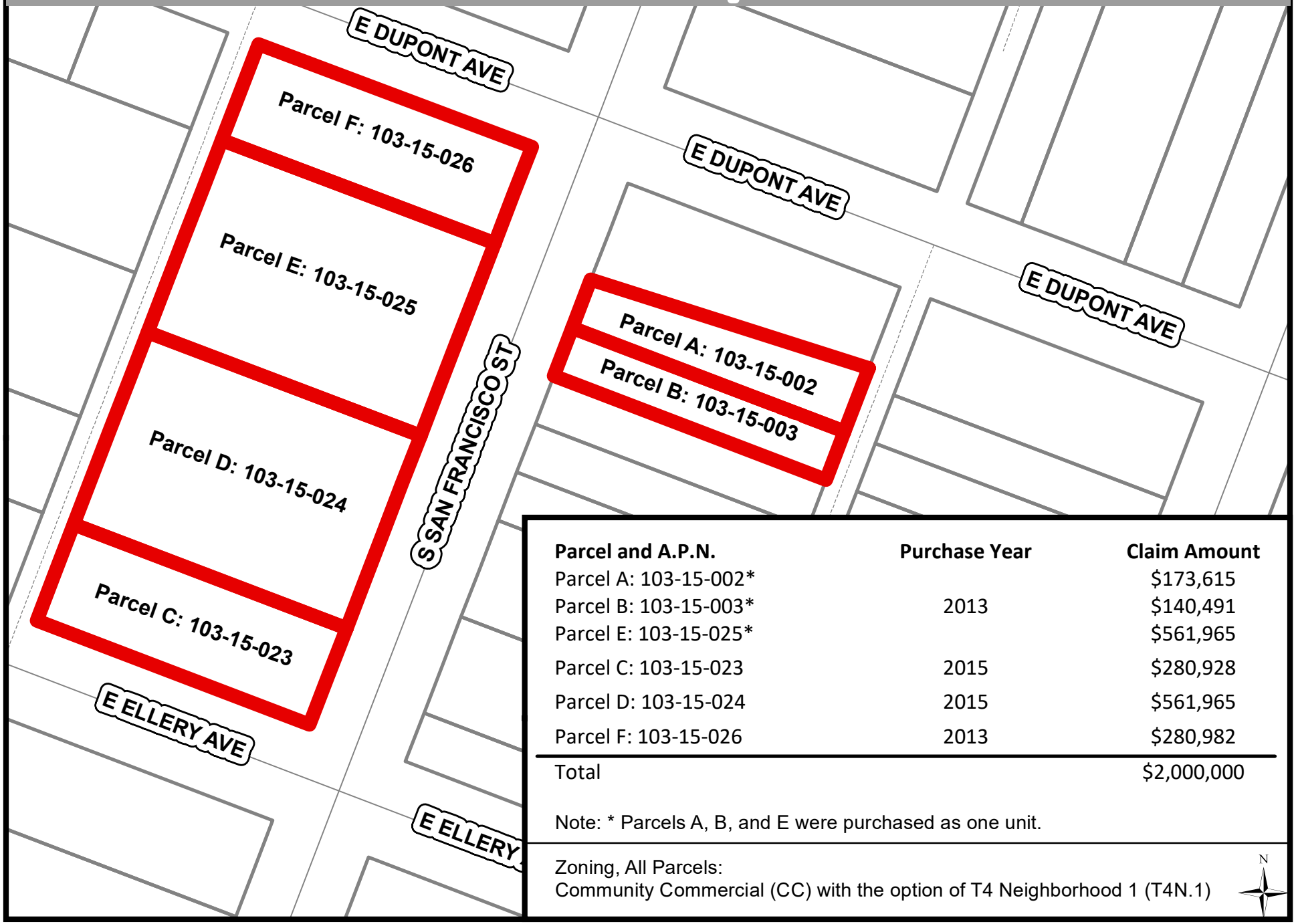
Parcel and A.P.N.	Purchase Year	Claim Amount
Parcel A: 103-15-002*		$173,615
Parcel B: 103-15-003*	2013	$140,491
Parcel E: 103-15-025*		$561,965
Parcel C: 103-15-023	2015	$280,928
Parcel D: 103-15-024	2015	$561,965
Parcel F: 103-15-026	2013	$280,982
Total		$2,000,000

Note: * Parcels A, B, and E were purchased as one unit.

Zoning, All Parcels:
Community Commercial (CC) with the option of T4 Neighborhood 1 (T4N.1)

N

Location Map



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Total		$2,000,000

Note: * Parcels A, B, and E were purchased as one unit.

Zoning, All Parcels:
Community Commercial (CC) with the option of T4 Neighborhood 1 (T4N.1)

N

ORDINANCE NO. 2020-28

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF FLAGSTAFF, AMENDING THE FLAGSTAFF CITY CODE, TITLE 10, FLAGSTAFF ZONING CODE, BY ADOPTING BY REFERENCE THAT CERTAIN DOCUMENT ENTITLED *"CASE NO. PZ-19-00125 UPDATES TO ZONING CODE 2020 – HIGH OCCUPANCY HOUSING LAND USE"*; PROVIDING FOR PENALTIES, REPEAL OF CONFLICTING ORDINANCES, SEVERABILITY, AND ESTABLISHING AN EFFECTIVE DATE

RECITALS:

WHEREAS, the City of Flagstaff wishes to amend Title 10 Flagstaff Zoning Code of the Flagstaff City Code, to implement the High Occupancy Housing Plan by adopting modifications to the land use and property development tables, specific to use standards, parking standards, definitions, and the appendixes; and

WHEREAS, a citizen review session was held at the Planning Commission work session on September 23, 2020, to discuss the proposed Zoning Code text amendment in accordance with Section 10-20.50.040 of the Flagstaff Zoning Code; and

WHEREAS, the Planning and Zoning Commission held public hearing on October 28, 2020, and provided a recommendation to City Council on proposed Zoning Code text amendment; and

WHEREAS, the Council has read and considered the staff report prepared by the Planning and Development Services section of the Community Development division and all attachments to those reports, and the Council finds that the proposed Zoning Code text amendment is in conformance with the General Plan, and the findings of Section 10- 20.50.040 of the Flagstaff Zoning Code have been met; and

WHEREAS, that certain document known as "*Case No. PZ-19-00125 Updates to Zoning Code 2020 - High Occupancy Housing Land Use*", one (1) paper copy and one (1) electronic copy of which are on file with the City Clerk in compliance with A.R.S. § 44-7041, was declared to be a public record by Resolution No. 2020-59.

ENACTMENTS:

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. The foregoing recitals are incorporated as if fully set forth herein.

SECTION 2. That certain document known as "*Case No. PZ-19-00125 Updates to Zoning Code 2020 - High Occupancy Housing Land Use*", one(1) paper copy and (1) electronic copy are on file in the office of the City Clerk of the City of Flagstaff, Arizona, which document is declared a public record by Resolution No. 2020-59 of the City of Flagstaff, Arizona, is hereby referred to, adopted and made a part hereof as if fully set out in this ordinance.

SECTION 3. The Zoning Code text amendment is consistent with and conforms to the goals of the Regional Plan.

SECTION 4. The amendment requested in the application will not be detrimental to the public interest, health, safety, convenience, or welfare of the City, and will add to the public good as described in the General Plan.

SECTION 5. The proposed amendment is internally consistent with other applicable provisions of this Zoning Code.

SECTION 6. Repeal of Conflicting Ordinances

All ordinances and parts of ordinances in conflict with the provisions of the code adopted herein are hereby repealed.

SECTION 7. Severability

If any section, subsection, sentence, clause, phrase or portion of this ordinance or any part of the code adopted herein by reference is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions thereof.

SECTION 8. Clerical Corrections

The City Clerk is hereby authorized to correct clerical and grammatical errors, if any, related to this ordinance, and to make formatting changes appropriate for purposes of clarity, form, or consistency with the Flagstaff City Code.

SECTION 9. Effective Date

This resolution shall be effective on March 1, 2021.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 17th day of November, 2020.

MAYOR

ATTEST:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

RESOLUTION NO. 2020-59

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL DECLARING AS A PUBLIC RECORD THAT CERTAIN DOCUMENT FILED WITH THE CITY CLERK AND ENTITLED "*CASE NO. PZ-19-00125 UPDATES TO ZONING CODE 2020 – HIGH OCCUPANCY HOUSING LAND USE*"

RECITALS:

WHEREAS, pursuant to A.R.S. § 9-802 a municipality may enact or amend provisions of the City Code by reference to a public record, provided that the adopting ordinance is published in full;

WHEREAS, the City of Flagstaff wishes to incorporate by reference amendments to the Flagstaff Zoning Code, Ordinance No. 2020-59, by first declaring said amendments to be a public record.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1. In General.

That certain document known as *"Case No. PZ-19-00125 Updates to Zoning Code 2020 - High Occupancy Housing Land Use"* attached hereto as Exhibit A is hereby declared to be a public record, and one (1) paper copy and one (1) electronic copy shall remain on file with the City Clerk in compliance with A.R.S. § 44-7041, and said copies shall remain on file with the City Clerk.

SECTION 2. Effective Date.

This resolution shall be effective on March 1, 2021.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 17th day of November, 2020.

MAYOR

ATTEST:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

Exhibits:
A. Case No. PZ-19-00125 Updates to Zoning Code 2020 - High Occupancy Housing Land Use

Case No. PZ-19-00125 Updates to Zoning Code 2020 - High Occupancy Housing Land Use

Amendment for Adoption in Flagstaff Zoning Code

HOW TO READ THIS DOCUMENT

Unless otherwise stated, existing provisions that are being deleted are shown in bold red strikethrough text, like this: ~~**Provisions that are being deleted are shown with a bold red strikethrough text.**~~

Provisions that are being added are shown in bold blue text, like this: **Provisions that are being added are shown in bold blue text.**

Graphics/Figures that are being deleted are indicated with an "X" over the graphic/figure.

Graphics/Figures that are being added are indicated with a border around the graphic/figure.

Tables that are being deleted are indicated with an "X" over the Tables.

Tables that are being added are indicated with a thick border around the Tables.

Bold blue capitalized text, **BOLD BLUE CAPITALIZED TEXT LIKE THIS**, are additions that the City Council made at the November 17, 2020 City Council Meeting

Section 1. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.030 Residential Zones, Subsection B. Residential Zones – Allowed Uses, as follows:

Section 10-40.30.030 Residential Zones

B. Residential Zones – Allowed Uses. The allowed land uses of each of the Residential Zones are shown in Table 10-40.30.030.B.

Table 10-40.30.030.B.
Residential Zones – Allowed Uses.

Primary Land Use[1]	Specific Use Regulations	Residential Zones						
		RR	ER	R1	R1N	MR	HR	MH
Ranching, Forestry and Animal Keeping								
Animal Keeping	10-40.60.070	P[6]	P[6]	--	--	--	--	--
Recreation, Education and Assembly								
Commercial Campgrounds	10-40.60.130	UP	--	--	--	--	--	--
Equestrian Recreational Facilities		UP	UP	UP	--	--	--	--
Golf Courses and Facilities		UP	UP	UP	--	--	--	--

Libraries, Museums		UP	UP	UP	UP	UP	UP	UP
Meeting Facilities, Public and Private	10-40.60.230							
Regional		--	--	--	--	--	--	--
Neighborhood		P/UP[2]	P/UP[2]	P/UP[2]	P/UP[2]	P/UP[2]	P/UP[2]	P/UP[2]
Outdoor Public Uses, General		P	P	P	--	P	P	P
Places of Worship		P/UP[5]	P/UP[5]	P/UP[5]	P/UP[5]	P/UP[5]	P/UP[5]	P/UP[5]
Schools – Private		P	P	P	P	P	P	P
Schools – Public and Charter		P[3]	P[3]	P[3]	P[3]	P	P	P[3]
Trade Schools		--	--	--	--	--	--	--
Residential								
Co-housing	10-40.60.120	P	P	PRD	--	P	P	--
Congregate Care Facilities		UP	UP	UP	UP	P	P	UP
Day Care, Centers	10-40.60.150.B	UP	UP	UP	UP	UP	UP	UP
Day Care, Home	10-40.60.150.A	P	P	P	P	P	P	P
Development, Duplex		PRD	PRD	PRD	P	P	P	--
Development - Cluster, Single-Family	10-40.60.170	P	P	— PRD	--	--	--	--
Development, Multiple-Family		PRD	PRD	PRD	--	P	P	--
Development, Single-Family		P	P	P	P	PRD[4]	PRD[4]	P
Dormitories		--	--	--	--	UP	UP	--
Group Home		P	P	P	P	P	P	P
High Occupancy Housing Development, Single-Family	**10-40.60.175**	**UP**	**UP**	**UP**	**UP**	**UP/PRD**	**UP/PRD**	**UP**
High Occupancy Housing Development, Two-units	**10-40.60.175**	**UP/PRD**	**UP/PRD**	**UP/PRD**	**UP**	**UP**	**UP**	**--**
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP/PRD**	**UP/PRD**	**UP/PRD**	**--**	**UP**	**UP**	**--**

High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP/PRD**	**UP/PRD**	**UP/PRD**	**--**	**UP**	**UP**	**--**
Home Occupation	10-40.60.180	P	P	P	P	P	P	P
Institutional Residential								
Custodial Care Facilities		UP	UP	UP	UP	UP	UP	UP
Homeless Shelters	10-40.60.190							
Emergency Shelters		UP	UP	UP	UP	UP	UP	UP
Short Term Housing		UP	UP	UP	UP	UP	UP	UP
Transitional Housing		UP	UP	UP	UP	UP	UP	UP
Sheltered Care Homes		UP	UP	UP	UP	UP	UP	UP
Nursing Homes		--	UP	UP	UP	UP	UP	UP
Live/Work	10-40.60.200	--	--	--	--	UP/PRD	UP/PRD	--
Manufactured Home	10-40.60.210	--	--	--	--	--	--	P
Manufactured Home Park	10-40.60.210.D	--	--	--	--	--	--	P
Manufactured Home Subdivision	10-40.60.210.C	--	--	--	--	--	--	P
Mobile Home		--	--	--	--	--	--	P
Planned Residential Development	10-40.60.280	P	P	P	P	P	P	--
~~**Rooming and Boarding Facilities**~~		~~--~~	~~**UP**~~	~~--~~	~~--~~	~~**UP**~~	~~**UP**~~	~~**UP**~~
Single Room Occupancy, Fraternities and Sororities		--	--	--	--	UP	UP	--
Retail Trade								
Neighborhood Market								
≤ 1,500 sf		--	--	UP	--	--	--	UP
≤ 2,500 sf		--	--	--	--	UP	--	--
≤ 5,000 sf		--	--	--	--	--	UP	--
Offices		--	--	--	--	--	UP	--

Services								
Bed and Breakfast Establishments	10-40.60.110	P	P	P	P	P	P	P
Cemeteries		UP	UP	UP	--	UP	UP	UP
Hospitals		UP	UP	UP	UP	UP	UP	UP
Public Services								
Emergency Services		UP	UP	UP	UP	UP	UP	UP
Public Services Minor		P	P	P	P	P	P	P
Public Services Major		--	--	--	--	--	--	--
Telecommunications Facilities								
AM Broadcasting Facilities	10-40.60.310	UP	UP	UP	UP	UP	UP	UP
Antenna-supporting Structure	10-40.60.310	UP	UP	UP	UP	UP	UP	UP
Attached Telecommunication Facilities	10-40.60.310	P	P	P	P	P	P	P
Colocation Facility	10-40.60.310	P	P	P	UP	P	P	P
FM/DTV/Low Wattage AM Broadcasting Facilities	10-40.60.310	UP	UP	UP	UP	UP	UP	UP
Stealth Telecommunication Facilities	10-40.60.310	P	P	P	P	P	P	P
Transportation and Infrastructure								
Accessory Wind Energy Systems	10-40.60.040	P	P	P	--	P	P	P
Urban Agriculture								
Community Garden	10-40.60.140	P	P	P	P	P	P	P
Nurseries		UP	--	--	--	--	--	--

End Notes
1. A definition of each listed use type is in Chapter 10-80, Definitions.
2. A conditional use permit is required if liquor is sold or if facilities exceed 250 seats.
3. Charter schools proposed in existing single-family residences shall be located on residential lots one acre or greater. Charter schools shall be subject to the review processes established in A.R.S. §15-189.01., as amended.

4.	Existing single-family uses and lots recorded in MR and HR, prior to the effective date of this Zoning Code, are considered legal, conforming uses.
5.	A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.
6.	Use is allowed only on a lot or parcel with a net lot area of five acres, or greater.
Key	
P	= Permitted Use
UP	= Conditional Use – Requires the Approval of a Conditional Use Permit
PRD	= Allowed Use only when part of a Planned Residential Development (see Section 10-40.60.280)
UP/PRD	= Conditional Use – Requires the Approval of a Conditional Use Permit, and the use shall be part of a Planned Residential Development (see Section 10-40.60.280)
- -	= Use Not Allowed

Section 2. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.030 Residential Zones, Subsection C. Residential Zones – Building Form Standards and Property Development Standards, as follows:

10-40.30.030 Residential Zones

C. Residential Zones – Building Form Standards and Property Development Standards. The building form and property development standards shown in Table 10-40.30.030.C. shall apply to all property within the corresponding residential zone.

Table 10-40.30.030.C.
Residential Zones – Building Form and Property Development Standards.

	Residential Zones						
	RR	**ER**	**R1**	**R1N**	**MR**	**HR**	**MH**
Residential development subdivided by a plat that was recorded before December 5, 2011							
Lot sizes	(1) Lot sizes and setbacks shall be provided in accordance with the requirements delineated on the final plat approved by the City Council and recorded. When a recorded plat does not have setbacks delineated, the Building Placement Requirements of this table shall govern. (2) Any lot(s) created or reconfigured in accordance with the subdivision code shall conform with the current requirements of						
Setbacks							

	the property's zone, unless alternate lot sizes and setbacks are approved by the City Council on a final plat that is recorded.						
Building Placement Requirements							
Setbacks							
Front (min.)							
2nd Floor and Below	75'	50'	15'	15'	10'	10'	15'
Above 2nd Floor	75'	50'	15'	15'	15'	15'	15'
For Parking	--	--	25'[1]	--	--	--	--
Side (min.)							
Side Yard	10'	20'min./ 45'total	8'	6'	5'	5'	8'
Street Side Yard	25'	20'	15'	6'	5'	5'	12'
Rear (min.)	10'	60'	25'[2]	15'	15'[3]	15'[3]	10'
Building Form Requirements							
Building Height (max.)[12,13, and 14]	35'	35'	35'	35'	35'	60'[4]	30'
Coverage (max.)	20%	17%	35%	35%	40%	50%	43%
Density Requirements (See Division 10-30.20, Affordable Housing Incentives)							
Gross Density (units/acre)							
Min.	--	--	2	2	6	10	--
~~**Max. Outside the RPO**~~	~~**1**~~	~~**1**~~	~~**6**~~	~~**14**~~	~~**14**~~	~~**29**[5]~~	~~**11**~~
Maximum without the Resource Protection Overlay (RPO)	**1**	**1**	**6**	**14**	**14**	**29**[5]	**11**
Maximum with the RPO, inside of a pedestrian shed of an activity center[(18)]	**1**	**1**	**6**	**14**	**14**	**29**[5]	**11**
~~**Max. Within the RPO**~~ **Maximum with the RPO, outside of a pedestrian shed of an activity center**[(18)]	1	1	5	--	9	22	4
Multiple-Family Developments with four dwelling units or more, Bedrooms per Acre							
Maximum without the RPO	**---End note 15---**		**15**	**--**	**35**	**72.5**	**--**
Maximum without the RPO with a Conditional Use Permit for a High Occupancy Housing Development inside of a	**---End note 16---**		**21**	**--**	**49**[17]	**101.5**[17]	**--**

pedestrian shed of an activity center[18]							
Maximum with the RPO	**---End note 15---**	**12.5**	**--**	**22.5**	**55**	**--**
Maximum with the RPO and a Conditional Use Permit for a High Occupancy Housing Development inside of a pedestrian shed of an activity center[18]	**---End note 16---**	**17.5**	**--**	**31.5[17]**	**77[17]**	**--**
Lot Requirements							
Area							
Gross (min.)	1 ac[6]	1 ac	6,000 sf	6,000 sf	6,000 sf	6,000 sf	5 ac
Per Unit (min.)	1 ac[6]	1 ac	6,000 sf	3,000 sf	End note 5	End note 5	4,000 sf
Width							
Interior Lots (min.)	100'[7]	149'[8]	60'[8,9]	50'	50'[8,9]	50'[8,10]	--
Corner Lots (min.)	100'[7]	149'[8]	60'[8,9]	50'	50'[8,9]	50'[8,10]	--
Depth (min.)	200'[7]	--	100'[8]	100'	100'[8]	75'[8,10]	--
Other Requirements							
Open Space (% of Development Site Area)[11]	--	--	--	--	See Table 10-40.30.030.A		
Fences and Screening	See Division 10-50.50						
Landscaping	See Division 10-50.60						
Lighting	See Division 10-50.70						
Parking	See Division 10-50.80						
Signs	See Division 10-50.100						

End Notes

1. 15' for side entrance garages, where the garage is designed as an integral element of the primary dwelling (i.e., doors and windows are consistent with the overall architectural character).
2. One or two story residential buildings and decks attached to those buildings may be built to 15' from the rear property line; provided, that any portion of the structure located closer than 25' to the rear property line does not exceed 50% of the lot width.
3. May be reduced for zones not subject to the Resource Protection Overlay when a minimum of 350 sf of open yard area per unit is provided, see Section 10-40.30.030(H).
4. Building height can be exceeded with approval of a Conditional Use Permit.
5. The maximum number of units for each lot is based on the following:

Area of Lot	Required Lot Area Per Dwelling Units
5,000 to 14,000 square feet	2,500 square feet
14,001 to 24,000 square feet	2,000 square feet
24,001 square feet and over	1,500 square feet

6. Five-acre minimum where public water supply and public streets are not available to serve the property.

7. Where public water supply and public streets are not available to serve the property a minimum lot width of 200' and lot depth of 250' are required.

8. Within a Planned Residential ~~Development~~ **Development,** the minimum width and depth of a lot may vary based on the minimum lot standards applicable to the building types selected for application within a Planned Residential Development (See Section 10-40.60.280, Planned Residential Development).

9. Lot width measured at the setback line.

10. On lots greater than 9,000 sf: 70' minimum width on interior lots, 75' minimum width on corner lots and 100' minimum depth on all lots.

11. ~~Any required common~~ **Common** open space as required in Division 10-50.110, Specific to Building Types, and areas set aside for resource preservation such as floodplains, slopes and forests (Division 10-50.90, Resource Protection Standards) may be used to satisfy this standard. In this context, **"open space" includes active and passive recreation uses, landscape areas, and community gardens.**

12. Primary structures, excluding accessory structures, with a roof pitch greater than, or equal to, 6:12 shall be allowed an additional five feet above the maximum building height.

13. The elevator and stairwell bulkheads shall be architecturally integrated with the building. Elevator and stairwells bulkheads are allowed an additional 15 feet above the maximum building height. The Director may approve a height greater than 15 feet when the additional height is necessary to accommodate an elevator or stairwell bulkhead, related equipment, or the requirements of the Building or Fire Code.

14. Steeples, solar collectors, towers and other unoccupied architectural features are allowed an additional height above the maximum building height equal to 20 percent multiplied by the **maximum building height allowed for property's zone. The total area of the referenced** allowances above the building height shall not exceed 20 percent of the total roof area.

15. Multiple-Family Developments are allowed 3 bedrooms for the first acre of a Development Site and 2.5 bedrooms per acre for each additional acre of a Development Site.

16. Multiple-Family Developments are allowed 4 bedrooms for the first acre of a Development Site and 3.5 bedrooms per acre for each additional acre of a Development Site.

17. Additional bedrooms per acre may be approved on a lot or parcel inside of a pedestrian shed of a Regional Activity Center delineated on the General Plan or applicable Specific Plan with an HOHD Conditional Use Permit.

18. Activity centers are delineated on the General Plan or applicable Specific Plan.

Key
- - Not Applicable

Section 3. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.040 Commercial Zones, Subsection B. Commercial Zones – Allowed Uses., as follows:

10-40.30.040 Commercial Zones

B. **Commercial Zones – Allowed Uses.** The allowed land uses of each of the Commercial zones are shown in Table 10-40.30.040.B.

Table 10-40.30.040.B.

Commercial Zones – Allowed Uses

Primary Land Use[1]	Specific Use Regulations	Commercial Zones				
		SC	CC	HC	CS	CB
Industrial, Manufacturing, Processing and Wholesaling						
Carpenter or Cabinet Shops		--	--	--	P	-
Flammable Liquid, Gas, and Bulk Fuel – Storage and Sale		--	--	UP	--	
Machine or Metal Working Shops		--	--	--	P	--
Manufacturing and Processing – Incidental		--	P	P	P	P
Micro-brewery or Micro-distillery	10-40.60.240	--	P	P	P	P
Mini-storage Warehousing	10-40.60.250	--	--	UP[2]	P	--
Research and Development Uses	10-40.60.300	--	--	UP	--	--
Transportation or Trucking Yards		--	--	--	P	--
Vehicle Towing/Impound Yard		--	--	P[4]	--	--
Warehousing	10-40.60.330	--	P[3]	P[3]	--	P[3]

Wholesaling and Distribution		--	--	--	P	P[3]
Recreation, Education and Assembly						
Automobile, Go-kart, Miniature Automobile Racing	10-40.60.080	--	UP	UP	--	--
Commercial Campgrounds	10-40.60.130	--	--	P	--	--
Commercial Recreation Facilities, Indoor		P	P	P	--	P
Commercial Recreation Facilities, Outdoor	10-40.60.270	--	UP	UP	--	--
Libraries, Museums		P	P	P	P	P
Meeting Facilities, Public or Private	10-40.60.230					
Regional		--	P/UP[5]	P/UP[5]	P/UP[5]	P/UP[5]
Neighborhood		P[5]	P/UP[5]	--	--	--
Outdoor Public Uses, General		P	P	P	--	--
Places of Worship		P/UP[10]	P/UP[10]	P/UP[10]	P/UP[10]	P/UP[10]
Schools – Public and Charter		P	P	P	P	P
Schools – Private		P	P	P	P	P
Theaters		P	P	P	--	P
Trade Schools		--	UP	UP	UP	UP
Residential[7]						
Co-housing	10-40.60.120	P[6]	P[6]	P[6]	P[6]	P[6]
Congregate Care Facilities		UP	P	P	P	UP
Day Care, Centers	10-40.60.150.B	P	P	P	UP	UP
Day Care, Home	10-40.60.150.A	P	P	P	P	P
Development, Duplex		P[6]	P[6,9]	P[6]	P[6]	P[6]
Development, Multiple-Family		P[6]	P[6]	P[6]	P[6]	P[6]
Development, Single-Family		--	P[9]	--	--	--

Dormitories		UP[6]	UP[6]	UP[6]	UP[6]	UP[6]
Fraternities and Sororities		UP[6]	UP[6]	UP[6]	UP[6]	UP[6]
Group Homes		P[6]	P[6]	P[6]	P[6]	P[6]
High Occupancy Housing Development, Single-Family	**10-40.60.175**	--	**UP**	--	--	--
High Occupancy Housing Development, Two-units	**10-40.60.175**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**	**UP[6]**
Home Occupation	10-40.60.180	P	P	P	P	P
Institutional Residential						
Custodial Care Facilities		P[8]	P[8]	P[8]	P[8]	P[8]
Homeless Shelters	10-40.60.190					
Emergency Shelters		P[8]	P[8]	P[8]	P[8]	P[8]
Short Term Housing		P[8]	P[8]	P[8]	P[8]	P[8]
Transitional Housing		P	P	P	P	P
Nursing Homes		UP	UP	UP	UP	UP
Sheltered Care Homes		P	P	P	P	P
Live/Work	10-40.60.200	P	P	P	P	P
Planned Residential Development	10-40.60.280	P/UP	P/UP[9]	UP	UP	UP
Residence for Owner, Caretaker or Manager		P[6]	P[6]	P[6]	P[6]	P[6]
~~**Rooming and Boarding Facilities**~~		~~**UP[6]**~~	~~**UP[6]**~~	~~**UP[6]**~~	~~**UP[6]**~~	~~**UP[6]**~~

Single Room Occupancy		UP	--	P	--	P
Retail Trade						
Bars/Taverns		P	P	P	P	P
Crematorium		P	P	P	P	--
Drive-through Retail	10-40.60.160	P	P	P	--	--
Drive-through Service		P	P	P	--	--
Farmers Markets and Flea Markets		--	P	P	P	P
General Retail Business		P	P	P	P	P
Mixed Use	10-40.60.260	P	P	P	P	P
Mixed-Use High Occupancy Housing Development	**10-40.60.175 and 10-40.60.260**	**UP**	**UP**	**UP**	**UP**	**UP**
Restaurant or Cafe		P	P	P	P	P
Services						
Bed and Breakfast Establishments	10-40.60.110	P	P	P	P	P
Cemeteries		UP	UP	UP	UP	--
Dry-cleaning, Processing		P	P	P	--	--
Equipment Rental Yard		--	UP	P	P	--
Funeral Homes, Chapels and Mortuaries		--	P	P	--	UP
General Services		P	P	P	P	P
Hospital		UP	UP	UP	UP	UP
Kennel, Animal Boarding	10-40.50.195			UP [11]		
Medical Marijuana Dispensary	10-40.60.220	--	--	P	--	--
Office		P	P	P	P	P
Public Services						
Public Services Major		--	--	--	--	--

	Public Services Minor		P	P	P	P	P
	Emergency Services		UP	UP	UP	UP	UP
Travel Accommodations			UP	--	P	--	P
Veterinary Clinics			P	P	P	P	--
Veterinary Hospitals			--	--	UP	UP	--
Telecommunication Facilities							
AM Broadcasting Facilities		10-40.60.320	UP	UP	UP	UP	UP
Antenna-Supporting Structure		10-40.60.320	UP	UP	UP	UP	UP
Attached Telecommunication Facilities		10-40.60.320	P	P	P	P	P
Collocation Facility		10-40.60.320	P	P	P	P	P
FM/DTV/Low Wattage AM Broadcasting Facilities		10-40.60.320	P	P	P	P	P
Stealth Telecommunication Facilities		10-40.60.320	P	P	P	P	P
Transportation and Infrastructure							
Accessory Wind Energy Systems		10-40.60.040	P	P	P	P	P
Garages, Off-Street			P	P	P	P	P
Parking Lots, Off-Street		10-50.80	P	P	P	P	P
Passenger Transportation Facilities			--	--	UP	UP	UP
Urban Agriculture							
Community Gardens		10-40.60.140	P	P	P	P	P
Food Production			--	--	UP[2]	UP[2]	--
Vehicle Sales and Services							
Automobile Service Station and Convenience Store		10-40.60.090	P	P	P	P	--

Automobile and Trailer Rental		--	--	P	P	--
Automobile/Vehicle Sales and Service, New and Used		--	UP	P	P	UP
Automobile/Vehicle Repair Garages – Minor	10-40.60.100	--	UP	P	P	--
Automobile/Vehicle Repair Garages – Major	10-40.60.100	--	--	P	P	--
Car Washes		P	P	P	--	--
Mobile Homes and Recreational Vehicles, Sales, and Service		--	--	P	--	--

End Notes

1. A definition of each listed use type is in Chapter 10-80, Definitions.
2. Only allowed on lots that do not have highway frontage or behind existing/new commercial uses.
3. Only permitted when incidental to permitted use.
4. This use shall be screened. See Division 10-50.50, Fences and Screening, for fencing and screening requirements.
5. A conditional use permit is required if liquor is sold or if facilities exceed 250 seats.
6. Residential uses with more than two units are allowed as part of a mixed-use development located above or behind the commercial uses, or as a planned residential development ~~(Section 10-40.60.280)~~.
7. Residential uses in the CC, HC, CS and CB zones, and residential uses and properties listed on the National Historic Registry or within the Landmarks overlay zone existing prior to the effective date of this Zoning Code are considered legal, nonconforming uses. Residential uses in the CC, HC, CS and CB zones shall be subject to the development standards established in the HR zone.
8. Conditional use permit is required if proximity between shelter facilities is less than one-quarter mile.
9. Single-family and duplex land uses are permitted by right on lots ≤9,000 sf and existing prior to November 1, 2011, subject to the building placement and building form requirements of the MR zone.
10. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.
11. Outdoor kenneling of animals is prohibited.

Key

P = Permitted Use
UP = Conditional Use Permit Required
-- = Use Not Allowed

Section 4. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.30 Non-Transect Zones, Section 10-40.30.040 Commercial Zones, Subsection C. Commercial Zones – Building Form Standards., as follows:

Section 10-40.30.040 Commercial Zones

C. Commercial Zones – Building Form and Property Development Standards. The building form and property development standards shown in Table 10-40.30.040.C. shall apply to all property with the corresponding commercial zones.

Table 10-40.30.040.C.
Commercial Zones – Building Form and Property Development Standards

	Commercial Zones				
	SC	**CC**	**HC**	**CS**	**CB**
Building Placement Requirements					
Setback from property line					
Front (Also see Section 10-50.60.040.B)	15'[1]	0'	0'[2]	0'	0'
Side					
Adjacent to Residential Use	---------- 15' min.[6] ----------				
Street Side (min.)	10'[3]	10'[3]	10'[3]	10'[3]	0'
All Other sides	---------- 0' ----------				
Rear					
Adjacent to Residential	---------- 15' min. ----------				
All Other rears	---------- 0' ----------				
Building Form Requirements					
Building Height (max.)[8, 9, 10]	35'	60'[4, 7]	60'[4]	60'[4]	60'[4]
Gross FAR (max.)	0.8	2.5	3.0	2.0	No max.
Density Requirements					
Gross Density (units/acre) ~~(max.) (Not Applicable to Mixed Use)~~					
~~Areas of the City without the Resource Protection Overlay (RPO)~~ **Maximum without the Resource Protection Overlay (RPO)**	~~13~~ **13**[11]	---------- ~~29~~ **29**[11] ----------			
~~Areas of the City inside of a pedestrian shed of an activity center delineated on the General Plan, with or without the RPO~~ **Maximum with the RPO, inside of a pedestrian shed of an activity center**[(13)]	~~13~~ **13**[11]	---------- ~~29~~ **29**[11] ----------			
~~Areas of the City with RPO, excluding areas of the City inside of a pedestrian shed of an activity center delineated on the General Plan~~	~~13~~ **13**[11]	---------- ~~22~~ **22**[11] ----------			

	Maximum with the RPO, outside of a pedestrian shed of an activity center[13])					
Maximum Bedroom Requirements						
Bedrooms per Acre on a Development Site with Four Dwelling Units or More						
	Maximum without the RPO for a development	**35[12]**	---------- **72.5[12]**----------			
	Maximum with the RPO inside of a pedestrian shed of an activity center[13]	**35[12]**	---------- **72.5[12]**----------			
	Maximum with the RPO inside of a pedestrian shed of an activity center[13]	**35[12]**	---------- **55[12]**----------			
Lot Requirements						
Area (Gross sf) (min.)[5]		6,000	9,000	9,000	9,000	7,000
Width (min.)[5]		50'	60'	60'	60'	50'
Depth (min.)[5]		100'	100'	100'	100'	--
Open Space						
Developments with Two or More Dwelling Units		---------- 15 percent of the net lot area ----------				
Other Requirements						
Fences and Screening		See Division 10-50.50				
Landscaping		See Division 10-50.60				
Outdoor Lighting		See Division 10-50.70				
Parking		See Division 10-50.80				
Signs		See Division 10-50.100				

End Notes

1. Front setbacks shall be equal to 15' or match adjacent residential development, whichever is less.
2. No front setback required, except when required by the adoption of building setback lines along specified streets.
3. Setback may be reduced to 5' min., if the landscape street buffer is reduced in accordance with Section 10-50.60.040(B), Nonresidential Zone Buffers.
4. Conditional use permit required for structures over 60' in height.
5. Within a planned residential development, the minimum area, width, and depth of a lot may vary based on the minimum lot standards applicable to the building types selected for application within a planned residential development (see Section 10-40.60.280, Planned Residential Development).
6. Except that the setback from a proposed residential use in a commercial zone to other residential uses shall be 5' min.
7. Single-family dwellings and duplexes in the CC zone shall be limited to a maximum height of 35 feet consistent with the height standard for the MR zone.
8. Primary structures, excluding accessory structures, with a roof pitch greater than, or equal to, 6:12 shall be allowed an additional five feet above the maximum building height.
9. The elevator and stairwell bulkheads shall be architecturally integrated with the building. Elevator and stairwells bulkheads are allowed an additional 15 feet above the maximum building height. The Director may approve a height greater than 15 feet when the additional

	height is necessary to accommodate an elevator or stairwell bulkhead, related equipment, or the requirements of the Building or Fire Code.
10.	Steeples, solar collectors, towers and other unoccupied architectural features are allowed an additional height above the maximum building height equal to 20 percent multiplied by the maximum building height allowed for property's zone. The total area of the referenced allowances above the building height shall not exceed 20 percent of the total roof area.
11. Additional density may be approved with an HOHD or MHOHD Conditional Use Permit.	
12. Additional bedrooms per acre may be approved with an HOHD or MHOHD Conditional Use Permit.	
13. Activity centers are delineated on the General Plan or applicable Specific Plan.	

Section 5. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.050 T3 Neighborhood I (T3N.1) Standards, H. Allowed Uses, as follows:

10-40.40.050 T3 Neighborhood I (T3N.1) Standards

H. Allowed Uses					
Land Use[1]	**Specific Use Regulations**	**T3N.1**	**Land Use[1]**	**Specific Use Regulations**	**T3N.1**
Residential			Places of Worship		P/UP[6]
Accessory Buildings and Structures	10-40.60.020	P	Schools – Private		P
Accessory Dwelling Unit	10-40.60.040	P	Schools – Public and Charter		P[5]
Co-Housing	10-40.60.120	P	Retail Trade		
Congregate Care Facilities		UP	**Neighborhood Market ≤ 1,500 sf**		UP
Dormitories and Fraternities/Sororities		UP	Services		
Dwelling: Multiple-Family		P[2]	Bed and Breakfast	10-40.60.110	P
Dwelling: Single-Family		P	Cemeteries		UP
Duplex		P[2]	Daycare	10-40.60.150	
Group Home		P	Home		P
Home Occupation	10-40.60.180	P	Centers		UP
High Occupancy Housing Development, Single-Family	**10-40.60.175**	**UP**	Public Services		

H. Allowed Uses					
Land Use[1]	**Specific Use Regulations**	**T3N.1**	**Land Use[1]**	**Specific Use Regulations**	**T3N.1**
Institutional Residential	10-40.60.190	UP	Public Services Minor		P
~~**Rooming and Boarding Facilities**~~		~~**UP**~~	Emergency Services		UP
Recreation, Education and Public Assembly			Telecommunication Facilities		
Dance or Music Studio ≤ 650 sf		P[3]	Stealth Telecommunication Facilities	10-40.60.310	P
Libraries, Museums			Transportation and Infrastructure		
≤ 2,500 sf		P	Accessory Wind Energy Systems	10-40.60.040	P
> 2,500 sf		UP	Urban Agriculture		
Meeting Facilities, Public and Private	10-40.60.230	P/UP[4]	Community Gardens	10-40.60.140	P
Outdoor Public Use, General		P			

End Notes

1. See Chapter 10-80, Definitions, for use type definitions.
2. Permitted only if the use exists at the effective date of this code.
3. Not allowed on the ground floor unless behind an allowed ground-floor use.
4. UP required if liquor is sold or if facilities exceed 250 seats.
5. Charter schools proposed in existing single-family residences shall be located on residential lots 1 acre or greater.
6. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.

Key

P	Permitted Use
UP	Permitted Use

Section 6. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.060 T3 Neighborhood 2 (T3N.2) Standards, H. Allowed Uses, as follows:

10-40.40.060 T3 Neighborhood 2 (T3N.2) Standards

H. Allowed Uses					
Land Use[1]	**Specific Use Regulations**	**T3N.2**	**Land Use[1]**	**Specific Use Regulations**	**T3N.2**
Residential			Services		
Accessory Buildings and Structures	10-40.60.020	P	Bed and Breakfast	10-40.60.110	P
Accessory Dwelling Unit	10-40.60.030	P	Cemeteries		UP
Co-Housing	10-40.60.120	P	Crematoriums		UP
Congregate Care Facilities		UP	Daycare	10-40.60.150	
Dormitories and Fraternities/Sororities		UP	Home		P
			Centers		UP
Dwelling: Multiple-Family		P	Public Services		
Dwelling: Single-Family		P	Public Services Minor		P
Duplex		P	Emergency Services		UP
Group Home		P	Telecommunication Facilities		
Home Occupation	10-40.60.180	P	Stealth Telecommunication Facilities	10-40.60.310	P
High Occupancy Housing Development, Single-Family	**10-40.60.175**	**UP**			
High Occupancy Housing Development, Two-units	**10-40.60.175**	**UP**			
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP**			
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP**			
Institutional Residential	10-40.60.190	UP			
Live/Work		P	Transportation and Infrastructure		
~~**Rooming and Boarding Facilities**~~		~~**UP**~~	Accessory Wind Energy Systems	10-40.60.040	P

H. Allowed Uses		

Land Use[1]	Specific Use Regulations	T3N.2
Recreation, Education and Public Assembly Uses		
Dance or Music Studio ≤ 650 sf		P[2]
Libraries, Museums		
≤ 2,500 sf		P
> 2,500 sf		UP
Meeting Facilities, Public and Private	10-40.60.230	P/UP[3]
Outdoor Public Use, General		P
Places of Worship		P/UP[5]
Schools – Private		P
Schools – Public and Charter		P[4]
Retail Trade		
Neighborhood Market ≤ 1,500 sf		P

Land Use[1]	Specific Use Regulations	T3N.2
Urban Agriculture		
Community Gardens	10-40.60.140	P

End Notes
1. See Chapter 10-80, Definitions, for use type definitions. 2. Not allowed on the ground floor unless behind an allowed ground-floor use. 3. UP required if liquor is sold or if facilities exceed 250 seats. 4. Charter schools proposed in existing single-family residences shall be located on residential lots 1 acre or greater. 5. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.

Key	
P	Permitted Use
UP	Permitted Use

Section 7. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.070 T4 Neighborhood 1 (T4N.1) Standards, I. Allowed Uses, as follows:

10-40.40.070 T4 Neighborhood 1 (T4N.1) Standards

I. Allowed Uses							
Land Use[1]	**Specific Use Regulations**	**T4N.1**	**T4N.1-O**	**Land Use[1]**	**Specific Use Regulations**	**T4N.1**	**T4N.1-O**
Residential				Services			
Accessory Buildings and Structures	10-40.60.020	P[2]	P[2]	ATM		-	P
				Bed and Breakfast	10-40.60.110	P	p
Accessory Dwelling Unit	10-40.60.030	P	P	Cemeteries		UP	UP
Co-Housing	10-40.60.120	P	P	Crematorium		-	UP
Congregate Care Facilities		P	P	Daycare	10-40.60.150		
Dormitories, Fraternities/Sororities and SRO (≤15 rooms)		UP	UP	Home		P	P
				Centers		UP	UP
Dwelling: Multiple-Family		P	P	Funeral Homes, Chapels, Mortuaries		-	P
Dwelling: Single-Family		P	P	General Services		-	P
Duplex		P	P	Lodging			
Group Home		P	P	**≤ 15 rooms**		-	P
High Occupancy Housing Development, Single-Family	**10-40.60.175**	**UP**	**UP**	Offices		-	P
High Occupancy Housing Development, Two-units	**10-40.60.175**	**UP**	**UP**	Public Services			
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP**	**UP**	Public Services Minor		P	P
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP**	**UP**	Emergency Services		UP	UP

I. Allowed Uses

Land Use[1]	Specific Use Regulations	T4N.1	T4N.1-O
Home Occupation	10-40.60.180	P	P
Institutional Residential	10-40.60.190	UP	UP
Live/Work		-	P
~~Rooming and Boarding Facilities~~	-	~~UP~~	~~UP~~
Recreation, Education and Public Assembly			
Libraries, Museums			
≤ 2,500 sf		P	P
> 2,500 sf		UP	UP
Meeting Facilities, Public and Private	10-40.60.230	P[3]	P[3]
Places of Worship		P/UP[4]	P/UP[4]
Schools – Private		P	P
Schools – Public and Charter		P	P
Retail Trade			
Bars/Taverns		-	P
General Retail Businesses, except with any of the following features		-	P
Drive-Through		-	-
Floor Area ≥ 3,500 sf		-	UP
Markets			
Neighborhood Market ≤ 2,500 sf		-	P

Land Use[1]	Specific Use Regulations	T4N.1	T4N.1-O
Veterinary Clinic		-	P
Telecommunication Facilities			
Stealth Telecommunication Facilities	10-40.60.310	P	P
Transportation and Infrastructure			
Accessory Wind Energy Systems	10-40.60.040	P	P
Urban Agriculture			
Community Gardens	10-40.60.140	P	P

End Notes

1. See Chapter 10-80, Definitions, for use type definitions.
2. Not allowed on the ground floor unless behind an allowed ground-floor use.
3. UP required if liquor is sold or if facilities exceed 250 seats.
4. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.

Key	
P	Permitted Use
UP	Conditional Use Permit Required
-	Use Not Allowed

I. Allowed Uses							
Land Use[1]	Specific Use Regulations	T4N.1	T4N.1-O	Land Use[1]	Specific Use Regulations	T4N.1	T4N.1-O
Micro-brewery/Micro-distillery	10-40.60.240	-	P				
Restaurant, or Cafes		-	P				

Section 8. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.070 T4 Neighborhood 2 (T4N.2) Standards, I. Allowed Uses, as follows:

10-40.40.080 T4 Neighborhood 2 (T4N.2) Standards

I. Allowed Uses							
Land Use[1]	Specific Use Regulations	T4N.2	T4N.2-O	Land Use[1]	Specific Use Regulations	T4N.2	T4N.2-O
Residential				Services			
Accessory Buildings and Structures	10-40.60.020	P[2]	P[2]	ATM		-	P
				Bed and Breakfast	10-40.60.110	P	p
Accessory Dwelling Unit	10-40.60.030	P	P	Cemeteries		UP	UP
Co-Housing	10-40.60.120	P	P	Crematorium		-	UP
Congregate Care Facilities		P	P	Daycare	10-40.60.150		
Dormitories, Fraternities/Sororities and SRO (≤15 rooms)		UP	UP	Home		P	P
				Centers		UP	UP
Dwelling: Multiple-Family		P	P	Funeral Homes, Chapels, Mortuaries		-	P
Dwelling: Single-Family		P	P	General Services		-	P
Duplex		P	P	Lodging		UP	UP
Group Home		P	P				

I. Allowed Uses			
Land Use[1]	Specific Use Regulations	T4N.2	T4N.2-O
High Occupancy Housing Development, Single-Family	**10-40.60.175**	**UP**	**UP**
High Occupancy Housing Development, Two-units	**10-40.60.175**	**UP**	**UP**
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP**	**UP**
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP**	**UP**
Home Occupation	10-40.60.180	P	P
Institutional Residential	10-40.60.190	UP	UP
Live/Work		-	P
~~**Rooming and Boarding Facilities**~~	-	~~**UP**~~	~~**UP**~~
Recreation, Education and Public Assembly			
Libraries, Museums			
≤ 2,500 sf		P	P
> 2,500 sf		UP	UP
Meeting Facilities, Public and Private	10-40.60.230	P[3]	P[3]
Places of Worship		P/UP[4]	P/UP[4]
Schools – Private		P	P
Schools – Public and Charter		P	P
Retail Trade			
Bars/Taverns		-	P

Land Use[1]	Specific Use Regulations	T4N.2	T4N.2-O
Offices		-	P
Public Services			
Public Services Minor		P	P
Emergency Services		UP	UP
Veterinary Clinic		-	P
Telecommunication Facilities			
Stealth Telecommunication Facilities	10-40.60.310	P	P
Transportation and Infrastructure			
Accessory Wind Energy Systems	10-40.60.040	P	P
Urban Agriculture			
Community Gardens	10-40.60.140	P	P
End Notes			
1. See Chapter 10-80, Definitions, for use type definitions. 2. Not allowed on the ground floor unless behind an allowed ground-floor use.			

I. Allowed Uses			
Land Use[1]	**Specific Use Regulations**	**T4N.2**	**T4N.2-O**
General Retail Businesses, except with any of the following features		-	P
Drive-Through		-	-
Floor Area ≥ 3,500 sf		-	UP
Markets			
Neighborhood Market ≤ 2,500 sf		-	P
Micro-brewery/Micro-distillery	10-40.60.240	-	P
Restaurant, or Cafes		-	P

Land Use[1]	Specific Use Regulations	T4N.2	T4N.2-O
3. UP required if liquor is sold or if facilities exceed 250 seats. 4. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.			
Key			
P	Permitted Use		
UP	Conditional Use Permit Required		
-	Use Not Allowed		

Section 9. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.090 T5 Main Street (T5) Standards, I. Allowed Uses, as follows:

10-40.40.090 T5 Main Street (T5) Standards

I. Allowed Uses			
Land Use[1]	**Specific Use Regulations**	**T5**	**T5-O**
Industrial, Manufacturing			
Manufacturing and Processing, Incidental		P	P
Residential			
Accessory Buildings and Structures	10-40.60.020	P[2]	P
Accessory Dwelling Unit	10-40.60.030	P[2]	P

Land Use[1]	Specific Use Regulations	T5	T5-O
Retail Trade			
Bars/Taverns		P	P
General Retail Businesses, except with any of the following features		P	P
Drive-Through		-	-
Floor Area ≥ 5,000 sf		UP	UP
Mixed Use		P	P

I. Allowed Uses							
Land Use[1]	Specific Use Regulations	T5	T5-O	Land Use[1]	Specific Use Regulations	T5	T5-O
Co-Housing	10-40.60.120	P[2]	P	**Mixed-Use High Occupancy Housing Development**	**10-40.60.175**	**UP**	**UP**
Congregate Care Facilities		UP[2]	UP	Micro-brewery/Micro-distillery	10-40.60.240	P	P
Dormitories, Fraternities/Sororities and SROs		UP[2]	UP	Restaurants or Cafes		P	P
Dwelling: Multiple-Family		P[2]	P	Services			
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP[2]**	**UP**				
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP[2]**	**UP**	ATM		-	P
Group Home		P[2]	P	Bed and Breakfast	10-40.60.110	P	p
Home Occupation	10-40.60.180	P	P	Cemeteries		UP	UP
Institutional Residential				Crematoriums		UP	UP
Custodial Care Facilities		UP[2, 3]	UP	Daycare	10-40.60.150		
Nursing Homes		UP[2, 3]	UP	Home		P	P
Homeless Shelter	10-40.60.190	UP[2, 3]	UP	Centers		UP	UP
Sheltered Care Home		UP[2, 3]	UP	Funeral Homes, Chapels, Mortuaries		P	P
Live/Work		P	P	General Services		P	P
~~**Rooming and Boarding Facilities**~~		~~**UP**~~	~~**UP**~~	Lodging		P	P
Recreation, Education and Public Assembly Uses				Office		P[2]	P
Commercial Recreation Facility, Indoor				Public Services			
				Public Services Minor		P	P
≤ 5,000 sf		P	P	Emergency Services		UP	UP
> 5,000 sf		UP	UP	Veterinary Clinic		P[2]	P

I. Allowed Uses							
Land Use[1]	**Specific Use Regulations**	**T5**	**T5-O**	**Land Use[1]**	**Specific Use Regulations**	**T5**	**T5-O**
Libraries, Museums		P	P	Transportation and Infrastructure			
Meeting Facilities, Public and Private	10-40.60.230	P[3]	P[3]	Accessory Wind Energy Systems	10-40.60.040	P	P
Places of Worship		P/UP[6]	P/UP[6]	Garages, Off Street		P[2]	P[2]
Schools – Private		P	P				
Schools – Public and Charter		P	P	Parking Lots, Off Street		P[2]	P[2]
Theaters, Walk-in		P	P				
Telecommunication Facilities				Urban Agriculture			
AM Broadcasting Facilities	10-40.60.310	UP	UP	Community Gardens	10-40.60.140	P	P
Antenna-Supporting Structure	10-40.60.310	UP	UP	Vehicle Sales and Services			
				Automobile/Vehicle Sales, New and Used		P	P
Attached Telecommunication Facilities	10-40.60.310	P	P	Automobile/Vehicle Repair Garage	10-40.60.100		
Collocation Facility	10-40.60.310	P	P	Minor		P[2]	P[2]
FM/DTV/Low Wattage AM Broadcasting Facilities	10-40.60.310	P	P	Major		UP[2]	UP[2]
Stealth Telecommunication Facilities	10-40.60.310	P	P				
End Notes							

1. See Chapter 10-80, Definitions, for use type definitions.
2. Not allowed on the ground floor unless behind an allowed ground-floor use.
3. Conditional use permit is required if proximity between shelter facilities is less than 1/4 mile.
4. UP required if liquor is sold or if facilities exceed 250 seats.
5. Residential uses, and residential properties listed on the National Historic Registry or within the Landmarks overlay zone, in T5 and T5-O zones existing prior to the effective date of this Zoning Code are considered legal, conforming uses.
6. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.

Key	
P	Permitted Use
UP	Conditional Use Permit Required
-	Use Not Allowed

Section 10. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.40 Transect Zones, Section 10-40.40.100 T6 Downtown (T6) Standards, H. Allowed Uses, as follows:

10-40.40.100 T6 Downtown (T6) Standards

H. Allowed Uses					
Land Use[1]	**Specific Use Regulations**	**T6**	**Land Use[1]**	**Specific Use Regulations**	**T6**
Residential5			Services		
Accessory Buildings and Structures	10-40.60.020	P[2]	ATM		P
Accessory Dwelling Unit	10-40.60.030	P[2]	Bed and Breakfast	10-40.60.110	P
Co-Housing	10-40.60.120	P[2]	Cemeteries		UP
Congregate Care Facilities		UP[2]	Crematorium		UP
Dormitories, Fraternities/Sororities and SROs		UP[2]	Daycare	10-40.60.150	
			Home		P
Dwelling: Multiple-Family		P[2]	Centers		UP
High Occupancy Housing Development, Three-units	**10-40.60.175**	**UP[2]**	Dry-cleaning, Pick-up Only		P

H. Allowed Uses					
Land Use[1]	Specific Use Regulations	T6	Land Use[1]	Specific Use Regulations	T6
High Occupancy Housing Development, Four-units and Greater	**10-40.60.175**	**UP[2]**			
Group Home		P[2]	Funeral Homes, Mortuaries		UP
Home Occupation	10-40.60.180	P			
Homeless Shelter	10-40.60.190	UP	General Services		P
Institutional Residential			Hospitals		UP
Custodial Care Facilities		UP[2, 3]	Lodging		P
Nursing Homes		UP[2]	Office		P
Homeless Shelter		UP[2, 3]	Public Services		
Sheltered Care Home		UP[2, 3]	Public Services Minor		P
Live/Work		P	Emergency Services		UP
Mixed Use		P	Transportation and Infrastructure		
Mixed-Use High Occupancy Housing Development	**10-40.60.175**	**UP**	Accessory Wind Energy Systems	10-40.60.040	P
~~**Rooming and Boarding Facilities**~~		~~**UP**~~			
Recreation, Education and Public Assembly Uses			Garages, Off Street		P[2]
Commercial Recreation Facility, Indoor			Parking Lots, Off Street		P[2]
			Passenger Transportation Facilities		P6
≤ 5,000 sf		P	Industrial, Manufacturing, Processing and Wholesaling		
> 5,000 sf		UP	Manufacturing/Processing – Incidental		P
Libraries, Museums		P	Manufacturing/Processing – Incidental		P
Meeting Facilities, Public and Private	10-40.60.230	P[3, 4]	Telecommunication Facilities		
Places of Worship		P/UP[7]	AM Broadcasting Facilities	10-40.60.310	UP
Schools – Private		P	Antenna-Supporting Structure	10-40.60.310	UP

H. Allowed Uses					
Land Use[1]	Specific Use Regulations	T6	Land Use[1]	Specific Use Regulations	T6
Schools – Public and Charter		P	Attached Telecommunication Facilities	10-40.60.310	P
Theaters, Walk-in		P	Collocation Facility	10-40.60.310	P
Retail Trade			FM/DTV/Low Wattage AM Broadcasting Facilities	10-40.60.310	P
Bars/Taverns		P	Stealth Telecommunication Facilities	10-40.60.310	P
General Retail Businesses, except with any of the following features		P	Vehicle Sales and Services		
Drive-Through		-	Automobile/Vehicles Sales, new and used		UP
Floor Area ≥ 5,000 sf		UP	Urban Agriculture		
Micro-brewery/Micro-distillery	10-40.60.240	P	Community Gardens	10-40.60.140	P
Restaurants or Cafes		P			

End Notes
1. See Chapter 10-80, Definitions, for use type definitions. 2. Not allowed on the ground floor unless behind an allowed ground-floor use. 3. Conditional use permit is required if proximity between shelter facilities is less than 1/4 mile. 4. UP required if liquor is sold or if facilities exceed 250 seats. 5. Residential uses, and residential properties listed on the National Historic Registry or within the Landmarks overlay zone, in the T6 zone existing prior to the effective date of this Zoning Code are considered legal, conforming uses. 6. Passenger facilities shall be on the ground floor with access to a public street or a public space. 7. A conditional use permit is required if the facility exceeds 250 seats and/or if the facility is located adjacent to a toxic use.

Key	
P	Permitted Use
UP	Conditional Use Permit Required
–	Use Not Allowed

Section 11. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.60: Specific to Uses, to add Section 10-40.60.175 High Occupancy Housing Developments and Mixed-Use High Occupancy Housing Developments, to list of sections of the Division, in numerical order, as follows:

Division 10-40.60: Specific to Uses

10-40.60.175 High Occupancy Housing Developments and Mixed-Use High Occupancy Housing Developments

Section 12. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.60: Specific to Uses, to add Section 10-40.60.175 High Occupancy Housing Developments and Mixed-Use High Occupancy Housing Developments, in numerical order, as follows:

Division 10-40.60: Specific to Uses

10-40.60.175 High Occupancy Housing Developments and Mixed-Use High Occupancy Housing Developments

A. General Requirements.

1. **The applicant of an HOHD or MHOHD with four dwelling units or more shall submit typical floor plans or a typical residential unit study that illustrates how the residential units of an HOHD or MHOHD could be converted to a residential unit that is no longer an HOHD or MHOHD with minimal structural or minimal plumbing modifications. The required study shall be designed and sealed by an Arizona Registrant.**
2. **An HOHD or MHOHD with four or more dwelling units shall be located inside of a pedestrian shed of an activity center delineated in the General Plan or applicable Specific Plan.**
3. **An HOHD or MHOHD with four dwelling units or more, and that has more than 29 dwelling units per acre or more than 72.5 bedrooms per acre shall have:**
   a. **A minimum of 20% of the bedrooms contained in studio and/or one-bedroom dwelling units; and**
   b. **A maximum of 30% of bedrooms contained in dwelling units with four bedrooms or more.**
4. **An HOHD or MHOHD with four dwelling units or more, and that has 29 dwelling units per acre or less or 72.5 bedrooms per acre or less shall not exceed a Bedroom-to-Dwelling Unit Ratio greater than 3.5.**
5. **The maximum number of bedrooms in a two-unit HOHD or MHOHD: 10.**
6. **The maximum number of bedrooms in a three-unit HOHD or MHOHD: 12.**
7. **Inside of a pedestrian shed of a Regional Activity Center, an HOHD or MHOHD in a commercial zone may contain more than 50 dwelling units per acre and/or 125 bedrooms per acre.**
8. **An HOHD in a Commercial Zone shall be:**

a. On a lot or parcel that is setback at least 300 feet from the centerline of a street classified as a Commercial Corridor identified on the General Plan; and

b. There shall be an existing primary mixed-use development or commercial use(s), excluding primary transportation and infrastructure uses, on the lot(s) or parcel(s) between the HOHD and the Commercial Corridor street.

9. An MHOHD shall comply with the mixed-use development standards of Section 10-40.60.260.

10. Prior to the final approval of a land division that creates one or more lots or parcels with a development that conforms to the definition of an HOHD or MHOHD, the property owner shall obtain approval of a Conditional Use Permit for the Development Site that will contain the HOHD or MHOHD.

11. An MHOHD shall be on a lot or parcel that:

a. Abuts a street classified as a commercial corridor shown on the General Plan; and

b. Is located inside of a pedestrian shed of an activity center delineated on the General Plan or applicable Specific Plan.

B. Building Footprint[(1)] Sizes and Separation Requirements.

1. Maximum building footprint[(1)] inside a pedestrian shed of a Historic Activity Center delineated in the General Plan or applicable Specific Plan, excluding properties zoned Commercial Business (CB): Equal to, or less than, 5,000 square feet.

2. Maximum building footprint[(1)] inside a pedestrian shed of a Historic Activity Center delineated in the General Plan or applicable Specific Plan, and on a property zoned Commercial Business (CB): Equal to, or less than, 22,000 square feet.

3. Maximum building footprint[(1)] inside a pedestrian shed of a Regional Activity Center delineated in the General Plan or applicable Specific Plan: No Maximum.

4. Maximum building footprint[(1)] inside a pedestrian shed of an activity center in all other areas not described in subsection B.1., B.2., and B.3. of this section: Equal to, or less than, 22,000 square feet.

5. Excluding the Commercial Business (CB) zone, the minimum separation between the building footprints of structures on the same lot or parcel, and structures on an abutting lot or parcel, shall be separated by a distance that is the greater of 10 feet, or 1/3 the height of the taller structure.

6. Where the area of a pedestrian shed of an activity center intersects with the area of a pedestrian shed of another activity center, the pedestrian shed with the more restrictive maximum building footprint requirement shall govern the intersecting area. The locations of the pedestrian sheds of the activity centers are identified in the General Plan, including any applicable Specific Plans.

Note 1. For the purpose of the requirements of subsection B of this section, the maximum allowable building footprint is equal to the largest floor plate of a structure, including interior courtyards, abutting and interior, or partial interior, podium and above ground parking structure(s), and structures connected with a continuous roof.

C. Waste Management Plan.

1. The property owner of an HOHD or MHOHD with four dwelling units or more shall obtain approval of a waste management plan from the City's Public Works Director, or designee, prior to the approval of the site plan.

2. Prior to the issuance of any building permit, the property owner shall incorporate into the construction documents the improvements required to comply with the approved waste management plan.

3. If a Certificate of Occupancy is not required, the property owner shall provide all necessary apparatus, equipment, and improvements within 182 days from the date of the approval of the CUP, or another date specified in the Conditions of Approval for the CUP.

   a. The Director may approve a one-time 91-day extension, for no-more than 273 days from the date of the CUP approval, to allow the property owner to complete the improvements. The property owner shall request an extension at least 14 days prior to the date indicated in subsection C.3. of this section.

4. The HOHD or MHOHD shall be maintained in compliance with the approved Waste Management Plan.

D. Crime Free Multi-Housing Program.

1. The property owner of an HOHD or MHOHD shall maintain compliance with the Flagstaff Police Department's Crime Free Multi-Housing Program, unless exempted by the Police Department's Crime Free Multi-Housing Program representative.

2. Prior to the issuance of the Conditional Certificate of Occupancy, or Certificate of Occupancy, whichever is first, or within 63 days of the approval of the Conditional Use Permit if a Certificate of Occupancy is not required, the property owner of a HOHD or MHOHD shall enter into an agreement with the City to comply with the Flagstaff Police Department's Crime Free Multi-Housing Program.

3. The property owner, or agent, shall:

   a. Utilize a Crime Free Lease Addendum, or an alternative approved by the Flagstaff Police Department's representative, as part of each tenant lease;

   b. Obtain written verification as part of a tenant lease that each tenant has received and agreed to the Crime Free Lease Addendum or the approved alternative; and

   c. Have completed the Flagstaff Police Department's Crime Free Multi-Housing Program required training within the Program's required time frames.

4. Within 182 days from the date of the agreement, the property owner, or managing agent, shall have completed the first phase requirements of the Flagstaff Police Department's Crime Free Multi-Housing Program.

5. **A new Flagstaff Police Department's Crime Free Multi-Housing Program first phase training and related requirements shall be completed within 182 days from the date of a change of ownership, management company, or a site manager of an existing HOHD or MHOHD.**

6. **Every two years from the date of the agreement, the property owner, or managing agent, shall complete the required training that complies with the Flagstaff Police Department's Crime Free Multi-Housing Program.**

E. Additional Conditional Use Permit Criteria. In addition to the criteria of Section 10-20.40.050.E., the Planning and Zoning Commission shall not approve a Conditional Use Permit unless:

1. **For the properties subject to Division 10-30.30 Heritage Preservation, the City's Historic Preservation Officer or the Heritage Preservation Commission has made a determination that the proposed HOHD or MHOHD has no adverse effect or has appropriately mitigated its effects on the historic cultural resource .**

2. **Adequate transit service is available to the Development Site containing four dwelling units or more. Adequate transit service from a Development Site to a permanent transit stop is:**

   a. **Less than or equal to 1,320 feet; or**

   b. **A distance greater than 1,320 feet when the Planning and Zoning Commission finds that the route to the permanent transit stop has adequate nighttime lighting and does not have a significant grade change, and the distance does not impede reasonable access to transit.**

   The distance between the permanent transit stop to the Development Site shall be measured following a continuously improved sidewalk and/or public paved trail.

Section 13. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-40.60: Specific to Uses, 10-40.60.260 Mixed Use, subsection D. Site Layout and Development Design Standards., to delete paragraph 2, as follows:

10-40.60.260 Mixed Use

D. **Site Layout and Development Design Standards.**

~~**2. There is no density limitation established for residential uses in mixed-use developments. Instead, applicable floor area ratio, building height, parking, landscaping, etc., standards will apply to provide a control on the bulk and mass of the development and the number of residential units permitted.**~~

Section 14. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, to add 10-50.80.061 Transit Pass Parking Reduction Pilot Program, to the list of sections in numerical order, as follows:

Division 10-50.80:

Parking Standards

Sections:

10-50.80.010 Purpose

10-50.80.020 Applicability

10-50.80.030 General Parking Standards

10-50.80.040 Number of Motor Vehicle Parking Spaces Required

10-50.80.050 Bicycle Parking

10-50.80.060 Parking Adjustments

10-50.80.061 Transit Pass Parking Reduction Pilot Program

10-50.80.070 Parking Alternatives

10-50.80.080 Parking Spaces, Parking Lot Design and Layout

10-50.80.090 Development and Maintenance

Section 15. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, Section 10-50.80.040 Number of Motor Vehicle Parking Spaces Required, subsection C. General to All Zones., Table 10-50.80.040.A: Number of Motor Vehicle Parking Spaces Required, as follows:

Section 10-50.80.040 Number of Motor Vehicle Parking Spaces Required

C. General to All Zones.

Table 10-50.80.040.A: Number of Motor Vehicle Parking Spaces Required

Use	Number of Required Spaces
Residential	
~~**Market Rate (all dwelling classifications)**~~ Single-Family Dwelling ~~**(Attached and Detached)**~~[1] **(Attached and Detached)**[1]	2.0 **spaces, plus 1 space for each additional bedroom above four bedrooms. The maximum number of required parking spaces shall not exceed 8 spaces.**

~~Multifamily, Dwelling Duplex[1] and Triplex~~ **Multiple-Family Development and Duplex[1] Developments**	
Unit Type	
Studio **per unit**	1.25
1 Bedroom **per unit**	1.5
2 – 3 Bedrooms **per unit**	2.0
4 Bedrooms **per unit**	2.5
5+ Bedrooms **per unit**	~~2.5~~ **3.0** spaces for the first **4 5** bedrooms plus 0.5 space for each additional bedroom
Guest Spaces ~~for Multifamily Dwelling Duplex and Triplex~~ (Includes spaces for boats and RVs)	0.25 ~~per~~ **spaces for** each ~~2+ bedroom~~ unit **with two bedrooms and greater**
Affordable (All Dwelling Classifications)	
Studio	1.0
1 Bedroom	1.0
2 – 3 Bedrooms	1.5
4+ Bedrooms	2.0
Guest Spaces for Multifamily Dwelling (Includes Boats and RVs)	0.25 per each 2+ bedroom unit
High Occupancy Housing Development	
a. Single-Family - Attached and Detached, Duplex, and Development Sites with three units or less	**1 space per bedroom**
b. Developments Sites with four units or more	**The sum of:** **1 to 75 bedrooms = 1 space per bedroom, plus** **76 to 325 bedrooms = 0.90 spaces per bedroom, plus** **326 to 650 bedrooms = 0.80 spaces per bedroom, plus** **Greater than 650 bedrooms = 0.70 spaces per bedroom**
~~Rooming and Boarding Facilities~~	
~~Private Rooms~~	~~1 per bedroom or sleeping room plus 1 for owner or manager~~
~~No Private Rooms~~	~~1 per 100 gsf plus 1 for owner or manager~~
Mixed-Use Developments	
Mixed-Use	**1. 1 per 300 gsf of non-residential floor area, plus** **2. One dwelling unit: 2 spaces** **3. Two or more dwelling units: The spaces required for a Multiple-Family Development**
Mixed-Use High Occupancy Housing Development	**1. 1 per 300 gsf of non-residential floor area, plus** **2. The spaces required for a High Occupancy Housing Development**

End Notes
[1] Parking reductions allowed in Section 10-50.80.060, Parking Adjustments, shall not apply to single-family dwellings and duplexes.

Section 16. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, Section 10-50.80.050 Bicycle Parking., subsection B. Required Spaces., and add subsection C. Bicycle Parking Space Design., as follows:

10-50.80.050 Bicycle Parking

B. Required Bicycle Parking Spaces.

~~1. Two bicycle parking spaces, or five percent of required off-street parking spaces, whichever is greater, are required for all uses other than single-family uses.~~

~~2. Bicycle spaces shall be provided in accordance with the following requirements:~~

~~a. Bicycle parking shall consist of either a lockable enclosure (locker) in which the bicycle is stored or a rack to which the bicycle can be locked;~~

~~b. Lockers and racks shall be securely anchored to the pavement or a structure;~~

~~c. Racks shall be designed and installed to support the bicycle upright by its frame in two places in a manner that will not cause damage to the wheels and to permit the frame and one or both wheels to be secure;~~

~~Figure 10-50.80.050A~~

~~Correctly Designed Bicycle Rack~~

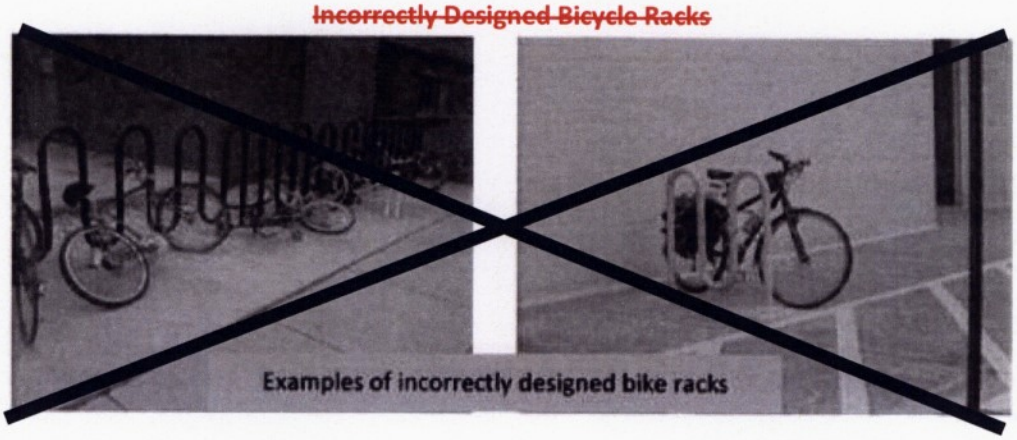
~~d. Areas containing bicycle spaces shall be surfaced with impervious surfaces such as concrete or pavers. Pervious pavements or gravel may be used where appropriate as determined by the Director;~~

~~e. When located within a parking area: curbs, fences, planter areas, bumpers, or similar barriers shall be installed and maintained for the mutual protection of bikes, motor vehicles, and pedestrians, unless determined by the Director to be unnecessary; and~~

~~f. Bicycle parking shall be placed in a convenient, highly visible, active, and well-lit location not more than 100 feet walking distance from the main entrance, but shall not interfere with pedestrian movements.~~

~~Figure 10-50.80.050B~~

~~Incorrectly Designed Bicycle Racks~~



Examples of incorrectly designed bike racks

~~C. Motor Vehicle Reduction. The Director may allow a reduction of motor vehicle parking spaces as established in Section 10-50.80.060(F).~~

~~D. Bicycle Parking Space Dimensions. All bicycle parking shall meet the following minimum dimensions:~~

~~1. Each bicycle parking space shall include a minimum area of 72 inches in length and 24 inches in width that is clear of obstructions;~~

~~2. No part of the rack shall be located closer than 30 inches to a wall or other obstruction;~~

~~3. The front or back of the rack shall be located no less than 48 inches from a sidewalk or pedestrian way; and~~

~~4. A minimum of 30 inches shall be provided between adjoining racks.~~

1. All uses, excluding a High Occupancy Housing Development and a Mixed-Use High Occupancy Housing Development.
   a. Minimum standard bicycle parking spaces required: The greater of two bicycle spaces, or 5% of the required vehicle parking.
   b. Maximum standard bicycle parking spaces required: 100 bicycle spaces.
   c. Location: Within 50 feet of the primary pedestrian entrance to the development and in accordance with the provisions of Appendix 1.4. The bicycle parking spaces shall be distributed throughout a Development Site that has multiple primary pedestrian entrances.
   d. Exceptions. Attached and Detached Single-Family and Duplex Developments are not required to provide standard bicycle parking spaces .
2. High Occupancy Housing Developments.
   a. Standard bicycle parking spaces.
      i. Minimum spaces required: Two bicycle spaces, or equal to 5% of the total number of bedrooms, whichever is greater.

ii. **Maximum spaces required: 40 bicycle spaces.**

iii. **Location: Within 50 feet of the primary resident pedestrian entrance to the development and in accordance with the provisions of Appendix 1.4.**

b. **Secure bicycle parking spaces.**

i. **Minimum spaces required: Equal to 15% of the total number of bedrooms.**

ii. **Location: A maximum of 20 secure bicycle parking spaces may be provided outside in secure bicycle lockers. The remainder of the required secure bicycle parking spaces shall be provided in a bicycle storage room or cage within a building or parking structure.**

c. **Exceptions. Single-Family and duplex High Occupancy Housing Developments are not required to provide standard or secure bicycle parking spaces .**

3. **Mixed-Use High Occupancy Housing Developments.**

a. **Minimum outdoor non-residential standard bicycle parking spaces required: Two bicycle spaces, or 5% of the required non-residential vehicle parking spaces, whichever is greater.**

b. **Location of non-residential standard bicycle parking spaces: Within 50 feet of the primary pedestrian entrance to the non-residential development and in accordance with the provisions of Appendix 1.4. The bicycle parking spaces shall be distributed throughout a Development Site that has multiple primary pedestrian entrances.**

c. **Minimum residential bicycle parking spaces required: Compliance with the High Occupancy Housing Developments requirements, subsection B.2. of this section.**

C. Bicycle Parking Space Design.

1. **Secure Bicycle Parking Spaces.**

a. **All indoor required secure bicycle parking spaces provided in a building or parking structure shall be designed in accordance with the provisions of Appendix 1.4., except as allowed in subsections C.1.b. of this section.**

b. **Bicycle lockers shall be designed in accordance with the provisions of Appendix 1.4.**

2. **Standard Bicycle Rack Design.**

a. **All required bicycle racks shall be designed in accordance with the provisions of Appendix 1.4.**

Section 17. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, Section 10-50.80.060 Parking Adjustments, as follows:

10-50.80.060 Parking Adjustments

A. Transit. In all zones, a parking reduction of up to 10 percent may be approved by the Director for any use within ~~one-quarter of a mile~~ **1,320 feet** of a ~~bus stop~~ **permanent transit stop, except for a High Occupancy Housing Development (HOHD) or a Mixed-Use High Occupancy Housing Development (MHOHD). The distance between the permanent transit stop to the Development Site shall be measured following a continuously improved sidewalk and/or public paved trail.**

B. **Shared On-Site Parking.** Where two or more uses on the same site or adjacent parcels have distinct and differing peak parking usage periods (e.g., a theater and a bank), a reduction in the required number of parking spaces as determined by the Director may be allowed in the following manner:

1. The reduction in number of required parking spaces shall be based on a parking demand study. The parking demand study shall be in accordance with established professional practices.
2. Approval shall also require a recorded covenant running with the land, recorded by the owner of the parking lot, guaranteeing that the required parking will be maintained exclusively for the uses served and remain for the duration of the use.

C. Parking Demand Study – Reduced Parking. ~~**Based on the completion and submittal of a parking demand study, the Director may approve a reduction in the amount of parking from that otherwise required by this division. The parking demand study shall be in accordance with established professional practices.**~~

1. **The property owner shall submit a study/plan prepared in accordance with the established professional traffic and parking practices by a registrant licensed to practice in the State of Arizona. The study/plan shall document how any reductions are calculated and the assumptions utilized in the calculations.**
2. **The Director may approve a reduction equal to, or less than, 30 percent of the total parking spaces required by this Division, except as required in subsection C.3. of this section. Any request greater than 30 percent requires the approval of the City Council.**
3. **Any request to use a Parking Demand Study to reduce the required parking for an HOHD or MHOHD shall be approved by the City Council.**

D. Traffic Management Plan Parking Reduction. The Director shall have the ability to reduce the parking requirements for office and other uses in Section 10-50.80.040, Number of Motor Vehicle Parking Spaces Required**, except for an HOHD or MHOHD**. A traffic management plan shall be submitted with an application for site plan review. A reduction may be granted if the following standards are met:

1. The amount of the reduction shall be no more than 90 percent of the proposed reduction in employee motor vehicle trips.
2. The buildings shall have a single user/owner who can effectively exercise control over compliance with the plan.
3. The traffic management plan shall be submitted by a registered traffic engineer and shall include data on the effectiveness of similar plans elsewhere.
4. The traffic management plan shall contain information on the strategies, designated parking, **incentives, company vehicles, staggered work hours, and information indicating the owner's** ability to provide and enforce these elements over time.
5. The Director may impose conditions that are needed to ensure the long-term compliance to the plan, including but not limited to a reserve parking area, phasing, or contributions to transit or other alternative means of transportation.

E. Parking Reduction for Forest Resources. The number of parking spaces required for a new development may be reduced by no more than five percent if existing native trees such as ponderosa pine trees are located within parking areas (but not circulation areas) and these trees are required to be preserved to satisfy the requirements for forest resource protection as defined in Division 10-50.90, Resource Protection Standards**, except for an HOHD or MHOHD**. An applicant shall demonstrate to the satisfaction of the Director that by incorporating these existing native trees

within the parking area, adequate measures are taken during construction to ensure that the trees are protected from construction activity.

F. Bicycle Parking Reduction. The Director may allow a reduction of one required motor vehicle parking space for each four bicycle parking spaces provided to a maximum of five percent of the required motor vehicle parking ~~spaces.~~ **spaces, except for an HOHD or MHOHD.**

G. Motorcycle Parking Reduction. A reduction of one parking space for multifamily residential and nonresidential uses may be allowed by the Director if one motorcycle parking space for every 25 required motor vehicle spaces is provided, subject to the following standards:

1. Each motorcycle space shall be easily accessible and have adequate space for a standard-size motorcycle, i.e., a minimum dimension of four feet by nine feet.
2. Motorcycle parking areas shall be clearly identified with appropriate striping.

Section 18. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, to add Section 10-50.80.061 Transit Pass Parking Reduction Pilot Program, as follows:

Division 10-50.80: Parking Standards

10-50.80.061 Transit Pass Parking Reduction Pilot Program

A. The purpose of the Transit Pass Parking Reduction Pilot Program (TPPR) is to allow:

1. Property owners the option to reduce a development's vehicle parking requirements by providing annual transit passes to tenants and employees; and

2. The City to determine the effectiveness of the program to reduce a development's parking demand, and to determine if the tenants and employees are utilizing transit.

B. Program Term. Unless otherwise extended by a separate ordinance approved by the City Council, the TPPR shall terminate at 11:59 p.m. on December 31, 2026.

C. Maximum Parking Reduction. The Director may approve up to a 20 percent reduction in the parking requirements of Section 10-50.80.040 in accordance with the minimum requirements of subsection D of this section, and the approval of a transit pass agreement specified in subsection E of this section.

1. This reduction shall not be approved on a site that utilizes any reduction specified in 10-50.80.060.

D. Minimum Requirements.

1. The TPPR is only available to HOHD and MHOHD developments.

2. This reduction may only be approved for an HOHD or MHOHD that has a vehicle parking requirement equal to, or greater than, 100 spaces.

3. The total residential parking requirement shall not be reduced to an amount less than 0.65 spaces per bedroom. The required parking for a development shall be calculated in accordance with Table 10-50.80.040.A. before any reduction is applied.

4. The TPPR is only available to a Development Site within 1,320 feet of a permanent transit stop. The distance between the permanent transit stop to the Development Site shall be measured following a continuously improved sidewalk and/or public paved trail..

5 The property owner shall make available annual transit passes to all tenants and employees of the HOHD or MHOHD. The transit pass(es) shall be provided at no cost to the tenants and employees. No tenant and employee shall be refused a transit pass.

6. The requirement to provide the transit passes shall be perpetual, unless the property owner provides the minimum number of parking spaces required (without any TPPR parking reduction) by the Zoning Code for the Development Site, and the Transit Pass Agreement of subsection E of this section is terminated.

7. The termination of the TPPR does not alleviate a property owner from providing the transit passes that are required for participation in the TPPR until the Transit Pass Agreement is terminated and the minimum parking spaces are provided as set forth herein.

E. Transit Pass Agreement.

1. The Director may enter into a Transit Pass Agreement with the property owner to allow a reduction in the required number of residential parking spaces in accordance with the provisions of this section. The agreement shall be in a form satisfactory to the City Attorney, or designee.

2. The agreement shall be perpetual unless terminated in accordance with the provisions of this section and the agreement.

3. The agreement shall include, but is not limited to:

   a. The type of transit passes to be provided;

   b. Notification requirements to tenants and employees of the availability of transit passes to them at no cost;

   c. A requirement to obtain, maintain, and provide the City with the following information:

      i. The number and types of transit passes requested and provided;

      ii. Utilization frequency reports from the transit provider;

      iii. Documentation of the annual transit pass proof of purchase;

      iv. Bedroom occupancy rates; and

      v. The number of tenant vehicles stored onsite and offsite within the city of Flagstaff.

   d. An agreement to assist the City of Flagstaff employee(s) and/or City contractor(s) in the collection of vehicle and/or transit usage data, and other City studies to determine the effectiveness of the TPPR;

   e. Reasonable access for City of Flagstaff employee(s) and/or City contractor(s) to study and count onsite parking utilization rates upon delivery of a written notice;

   f. Annual reporting requirements;

   g. Violations and remedies; and

   h. Any other provision necessary as determined by the City Attorney, Director, or designee to document the requirements and enforcement of this section and the agreement.

4. **The agreement shall be approved by the Director and property owner prior to the issuance of any building permit for the Development Site.**
5. **The City shall record the approved Transit Pass Agreement against the real property of the Development Site. Recordation fees shall be paid by the property owner prior to the issuance of any building permit for the Development Site.**

Section 19. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.80: Parking Standards, 10-50.80.080 Parking Spaces, Parking Lot Design and Layout, subsection K, as follows:

10-50.80.080 Parking Spaces, Parking Lot Design and Layout

K. Tandem Parking. ~~**Tandem parking is permitted in all zones for single-family residences, accessory dwelling units, and duplexes as follows:**~~

1. **Tandem parking is allowed in all:**
   a. **Zones for single-family attached and detached dwelling units, and accessory dwelling units; and**
   b. **Non-Transect Residential Zones for duplex developments.**

~~**1.**~~**2.** Both tandem parking spaces satisfy the parking requirement of ~~**one**~~ **one-dwelling unit.** ~~**residential unit; and**~~

2. 3. Neither of the tandem parking spaces shall be for required accessible parking spaces.

Section 20. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.110: Specific to Building Types, Section 10-50.110.080 Bungalow Court, subsection F, as follows:

10-50.110.080 Bungalow Court

F. Vehicle Access and Parking
Parking spaces may be enclosed, covered or open.
Spaces may be individually accessible by the units and/or via a common parking area located at the rear or side of the lot.
~~**Tandem parking is allowed for off-street parking to meet the requirements for a residential unit.**~~

Section 21. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.110: Specific to Building Types, Section 10-50.110.090 Duplex, Side-by-Side, subsection F, as follows:

10-50.110.090 Duplex, Side-by-Side

F. Vehicle Access and Parking
Parking spaces may be enclosed, covered or open.
~~Tandem parking is allowed for off-street parking to meet the requirements for a residential unit.~~

Section 22. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.110: Specific to Building Types, Section 10-50.110.100 Duplex Stacked, subsection F, as follows:

10-50.110.100 Duplex, Stacked

F. Vehicle Access and Parking
Parking spaces may be enclosed, covered or open.
~~Tandem parking is allowed for off-street parking to meet the requirements for a residential unit.~~

Section 23. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.110: Specific to Building Types, Section 10-50.110.110 Duplex, Front-and-Back, subsection F, as follows:

10-50.110.110 Duplex, Front-and-Back

F. Vehicle Access and Parking
Parking spaces may be enclosed, covered or open.
~~Tandem parking is allowed for off-street parking to meet the requirements for a residential unit.~~

Section 24. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-50.110: Specific to Building Types, Section 10-50.110.120 Stacked Triplex, subsection F, as follows:

10-50.110.120 Stacked Triplex

F. Vehicle Access and Parking
Where an alley is present, parking and services shall be accessed from the alley.
Parking spaces may be enclosed, covered or open.
~~Tandem parking is allowed for off-street parking to meet the requirements for a residential unit.~~

Section 25. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-80.20: Definition of Specialized Terms, Phrases, and Building Functions, Section 10-80.20.080 Definitions, "H", to add the term "High Occupancy Housing Development (HOHD)" and related terms, as follows:

Section 10-80.20.080 Definitions, "H"

High Occupancy Housing Development (HOHD): Means any of following: High Occupancy Housing Development, Single-Family; High Occupancy Housing Development, Two-units; High Occupancy Housing Development, Three-units; and High Occupancy Housing Development, Four-units and Greater (see definitions below). HOUSING DEVELOPMENT, EITHER FOR RENTAL OR PURCHASE, IN WHICH ALL DWELLING UNITS ARE PERMANENTLY AFFORDABLE AND OFFERED AT 60 PERCENT OF THE AREA MEDIAN INCOME (AMI) IN COMPLIANCE WITH THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT REGULATIONS SHALL NOT BE CATEGORIZED AS HIGH OCCUPANCY HOUSING DEVELOPMENT, REGARDLESS OF THE NUMBER UNITS, BEDROOMS, OR ZONING.

High Occupancy Housing Development, Single-Family: A single-family attached or detached dwelling unit with:

a. **Seven or more bedrooms; or**
b. **Five or more sanitation facilities.**

High Occupancy Housing Development, Two-units: A lot or parcel containing two dwelling units, excluding an Accessory Dwelling Unit, with:

a. **More than a total of seven bedrooms; or**
b. **One or more dwelling unit(s) containing four or more sanitation facilities.**

High Occupancy Housing Development, Three-units: A lot or parcel containing three dwelling units with:

a. **More than a total of nine bedrooms; or**

b. **One or more dwelling unit(s) containing four or more sanitation facilities.**

High Occupancy Housing Development, Four-units and Greater: A Development Site containing four or more dwelling units where:

a. **More than 20 percent of the total dwelling units have four bedrooms or more;**

b. **One or more of the dwelling unit(s) containing four or more sanitation facilities; or**

c. **The total number of dwelling units per acre, or bedrooms per acre, requires a Conditional Use Permit for an HOHD in accordance with the building form and property development standards of the property's designated Non-Transect Zone; or, if the property owner has elected a Transect Zone, the density is greater than 29 dwelling units per acre or 72.5 bedrooms per acre.**

Section 26. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-80.20: Definition of Specialized Terms, Phrases, and Building Functions, Section 10-80.20.130 Definitions, "M", to add the term "Mixed-Use High Occupancy Housing Development (MHOHD)", as follows:

10-80.20.130 Definitions, "M"

Mixed-Use High Occupancy Housing Development (MHOHD):

1. **A mixed-use development with:**

   a. **More than 20 percent of the total dwelling units have four bedrooms or more;**

   b. **One or more dwelling unit(s) containing four or more sanitation facilities; or**

   c. **The total number of dwelling units per acre, or bedrooms per acre, requires a Conditional Use Permit for an MHOHD in accordance with the building form and property development standards of the property's designated Non-Transect Zone; or, if the property owner has elected a Transect Zone, the density is greater than 29 dwelling units per acre or 72.5 bedrooms per acre.**

2. **MIXED-USE HOUSING DEVELOPMENT, EITHER FOR RENTAL OR PURCHASE, IN WHICH ALL DWELLING UNITS ARE PERMANENTLY AFFORDABLE AND OFFERED AT 60 PERCENT OF THE AREA MEDIAN INCOME (AMI) IN COMPLIANCE WITH THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT REGULATIONS SHALL NOT BE CATEGORIZED AS HIGH OCCUPANCY HOUSING DEVELOPMENT, REGARDLESS OF THE NUMBER OF UNITS, BEDROOMS, OR ZONING.**

Section 27. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-80.20: Definition of Specialized Terms, Phrases, and Building Functions, Section 10-80.20.180 Definitions, "R", to add the terms "Ratio, Bedroom-to-Dwelling Unit," and "Ratio, Bedroom-to-Sanitation Facility" as follows:

Section 10-80.20.180 Definitions, "R

Ratio, Bedroom-to-Dwelling Unit: The total number of bedrooms divided by the total number of dwelling units.

Examples: An HOHD has a total number of 1160 bedrooms and 350 dwelling units. The Bedroom-to-Dwelling Unit Ratio is:

$$\frac{\text{1160 bedrooms}}{\text{350 dwelling units}} = 3.31$$

Section 28. Amend Title 10 FLAGSTAFF ZONING CODE, Division 10-80.20: Definition of Specialized Terms, Phrases, and Building Functions, Section 10-80.20.190 Definitions, "S", to modify the term "Sanitation Facilities," as follows:

Section 10-80.20.190 Definitions, "S"

Sanitation ~~Facilities~~ **Facility:** A **delineated area for bathing** ~~bathroom~~ that contains ~~any combination of, or individually,~~ a toilet, ~~shower,~~ sink, and a shower or~~,~~ tub ~~or related bathing and sanitation fixtures~~. **The fixtures** (toilet, sink, **and a shower or** tub) **may be located in a room or in close proximity that functions as a** Sanitation **Facility as determined by the Zoning Administrator.**

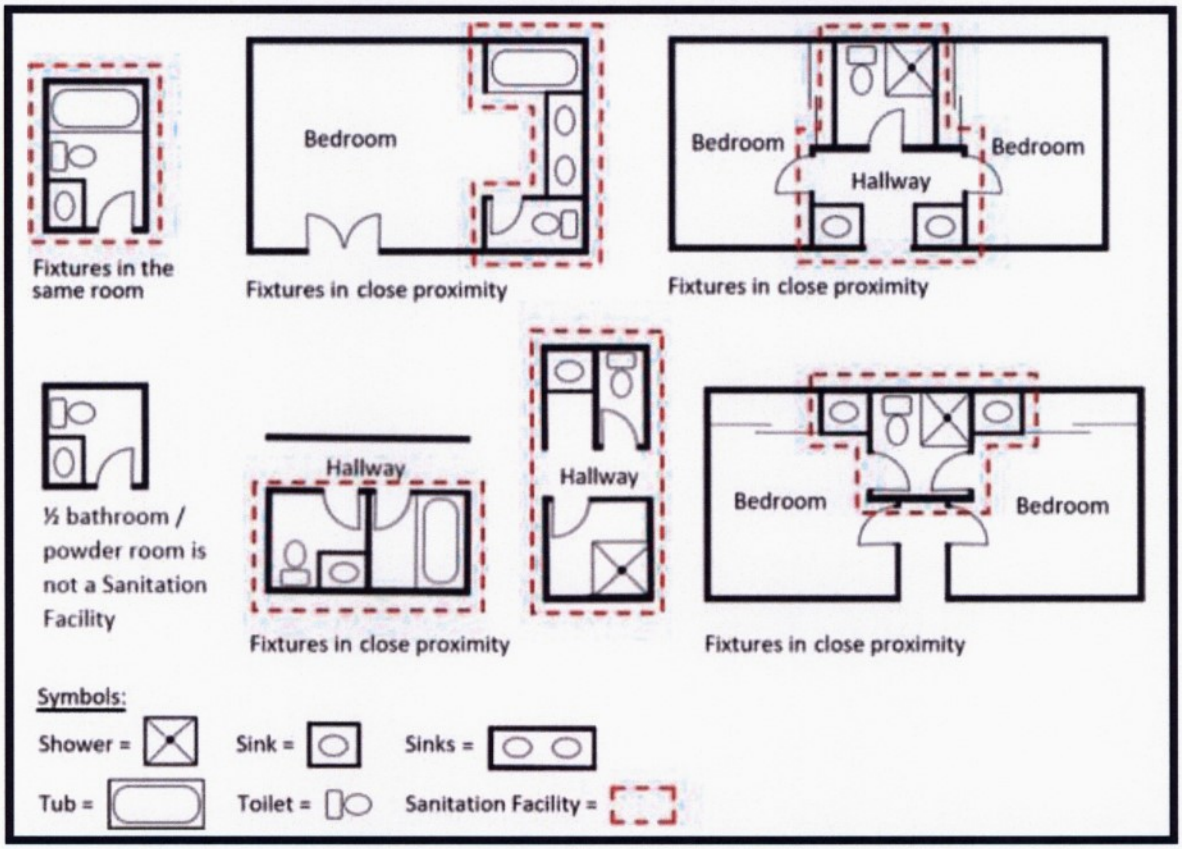


Figure 10-80.20.190 Sanitation Facility Examples

Section 29. Amend Title 10 FLAGSTAFF ZONING CODE, APPENDICES to add Appendix 1.4 Bicycle Parking Space Design Requirements, to the list, as follows:

APPENDICES

Appendix 1.1	Design Guidelines
Appendix 1.2	Additional Information on Smart Growth and Traditional Neighborhood Developments
Appendix 1.3	Sustainability Guidelines
Appendix 1.4	**Bicycle Parking Space Design Requirements**
Appendix 2	Planning Fee Schedule
Appendix 3	City of Flagstaff Landscape Plant List
Appendix 4	Outdoor Lighting Reference Material
Appendix 5	Additional Information Applicable to Division 10-50.90, Resource Protection Standards
Appendix 6	Additional Information on Affordable Housing
Appendix 7	List of Major Arterial Streets

Section 30. Amend Title 10 FLAGSTAFF ZONING CODE, APPENDICES, to add Appendix 1.4 Bicycle Space Design Requirements, as follows:

APPENDICES

Appendix 1.4
Bicycle Space Design Requirements

1.4.010 Purpose

A. It is the purpose of this Appendix to establish the minimum acceptable standards for bicycle parking spaces that are required by the Zoning Code.

1.4.020 Applicability

A. Requirements of this Appendix shall apply to all bicycle parking spaces provided on a Development Site within the Flagstaff city limits.

1.4.030 Standard Bicycle Rack Design Requirements

A. Rack Design.

1. Each rack shall be provided in accordance with one of the designs indicated in Figure 1.4.030.A., unless an alternative design is allowed in accordance with subsection C of this section.

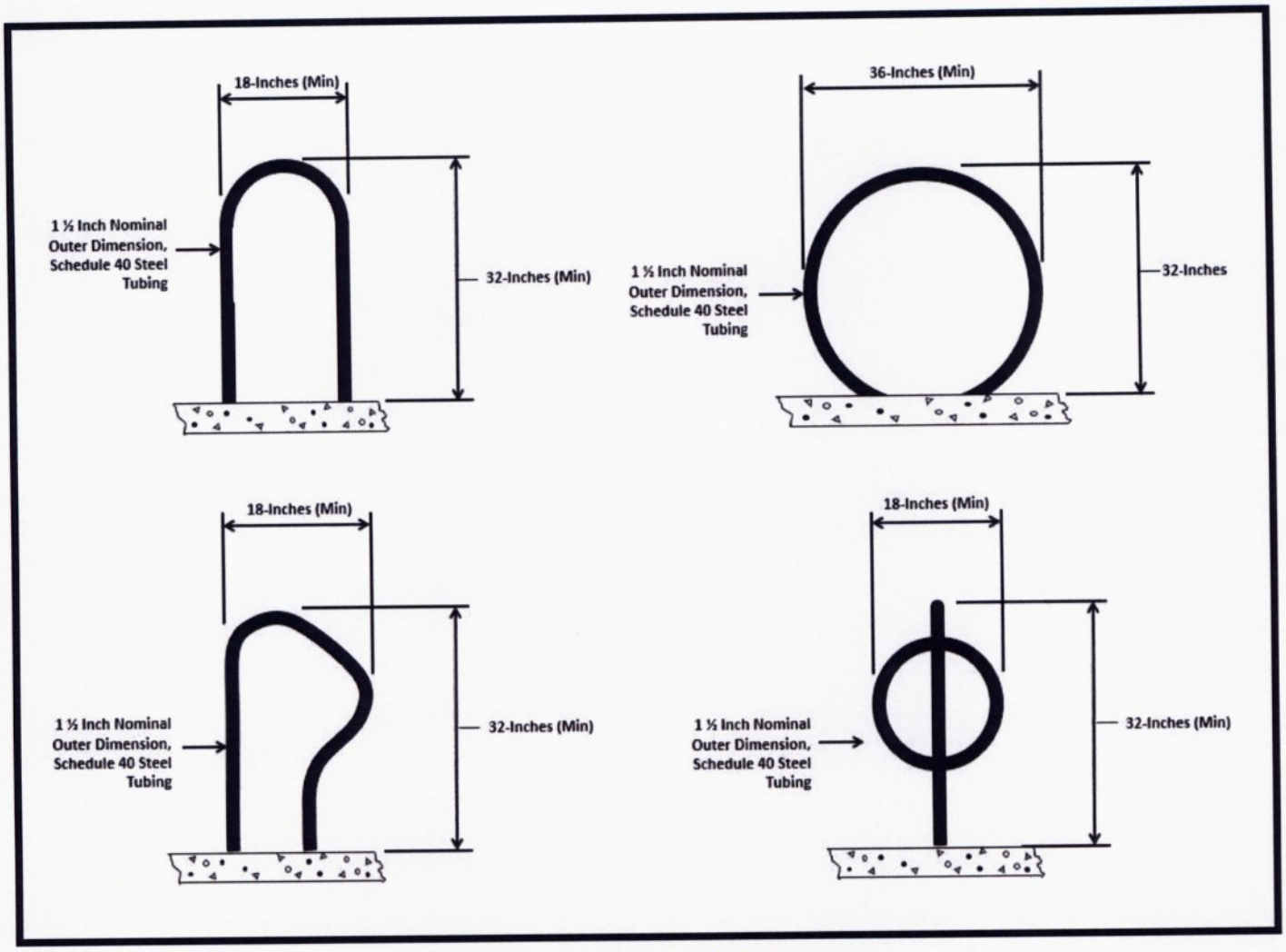


Figure 1.4.030.A. Rack Designs

B. Rack Placement.

1. The bicycle rack(s) shall be:

a. Placed in an area that complies with the location provisions of Section 10-50.80.050.B., is highly visible, well-illuminated, has frequent pedestrian activity, and is in accordance with Figure 1.4.030.B.1.;and

b. Securely mounted with a tamper-proof mounting technique to an impervious concrete, paver, or asphalt surface, unless an alternative surface is approved by the Director.

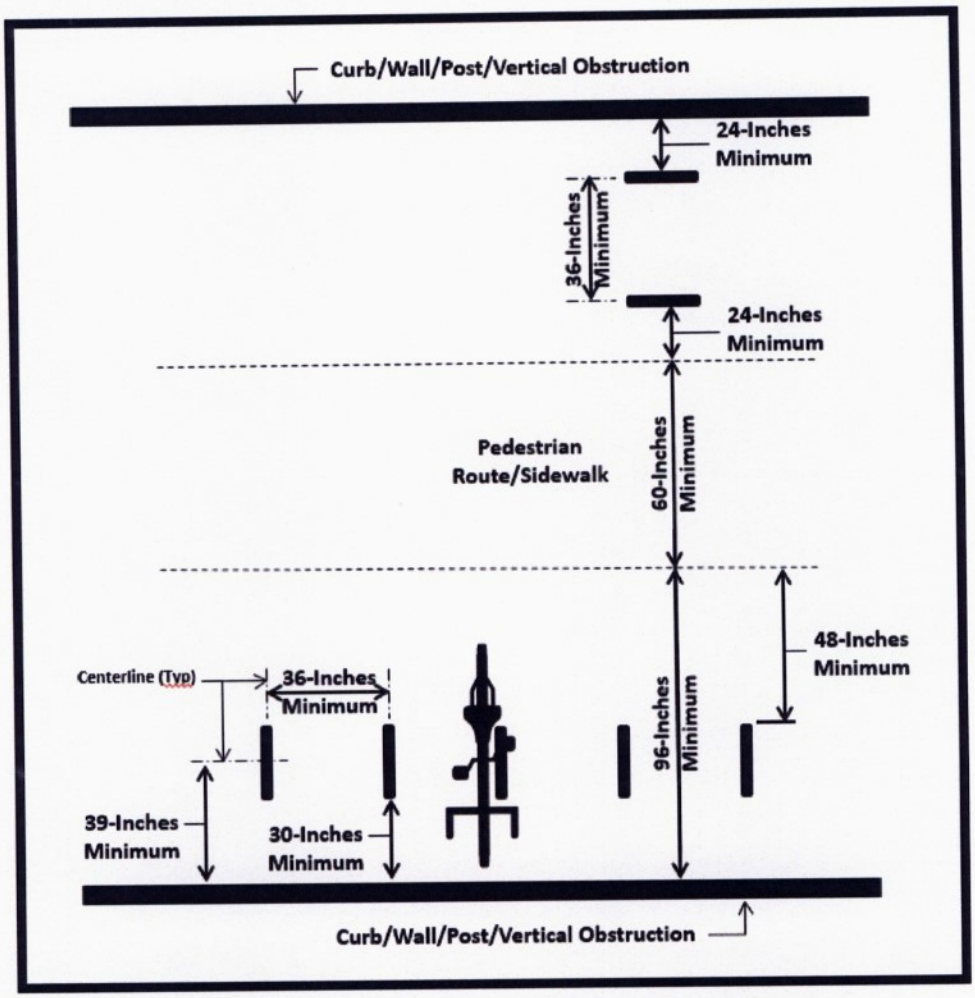


Figure 1.4.030.B.1. Bicycle Rack Placement

2. The placement of a bicycle rack shall not interfere with pedestrian movements.
3. Any bicycle rack(s) located within a parking area shall be within a barrier consisting of bollards, curbs, curb-bumpers, fences, planting areas, or a similar barrier approved by the Director.

C. Alternative Bicycle Rack Designs. The Director may approve an alternative rack design that complies with the following requirements:

1. The rack shall allow the bicycle frame and one or both wheels to be secured with a standard U-lock;
2. The rack shall be designed to support a bicycle frame in two places in a manner that does not cause damage to the wheels or allow the bicycle to tip over;
3. The rack shall be constructed of a material of sufficient strength that resists cutting, rust, bending, and deformation (Schedule 40 metal pipe is the minimum standard); and
4. The rack is not a design similar to types indicated in Figure 1.4.030.C.4.

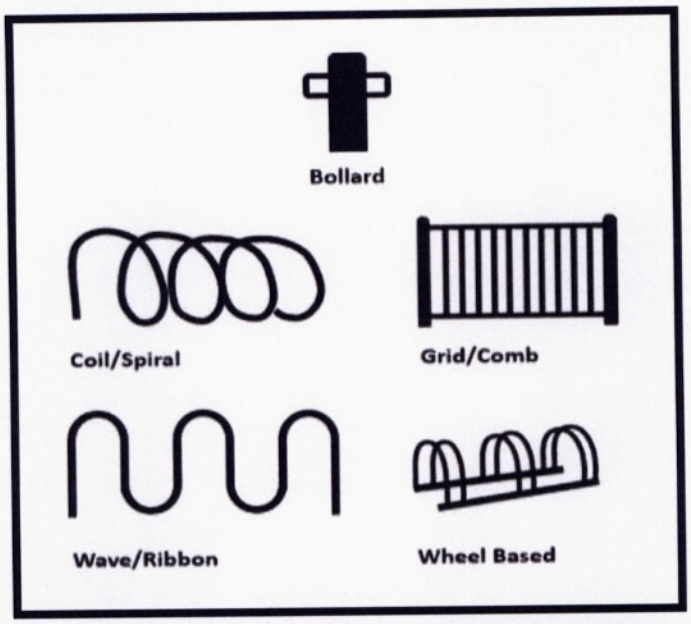


Figure 1.4.030.C.4. Unacceptable Bicycle Rack Designs

1.4.040 Standards for Indoor Secure Bicycle Parking Spaces

A. Secure Bicycle Parking Space Design.

1. The required secure bicycle parking spaces shall be in separate room(s) or cage(s) (the "Facilities") designed for bicycle storage within a building or parking structure.
2. The Facilities shall be:
    a. On the ground level, or another level that has elevator access, provided that the elevator has an interior width or depth of at least six feet;
    b. Accessed through a door or gate that utilizes an electronic keypad and code, security pass card, or a similar electronic system approved by the Director;
    c. In a location that is illuminated in accordance with the Illuminating Engineering Society (IES) of North America (IESNA) standards for security;
    d. Limited to the storage of bicycles; and
    e. Include bicycle racks or lockers.
3. The bicycle rack(s) shall:
    a. Conform with Section 1.4.030.A., unless an alternative design is allowed in accordance with Section 1.4.030.C.;
    b. Be securely mounted with a tamper-proof mounting technique to an impervious concrete, paver, or asphalt surface; and
    c. Be placed in accordance with Figure 1.4.040.A.3.c., unless an alternative configuration is approved by the Director.

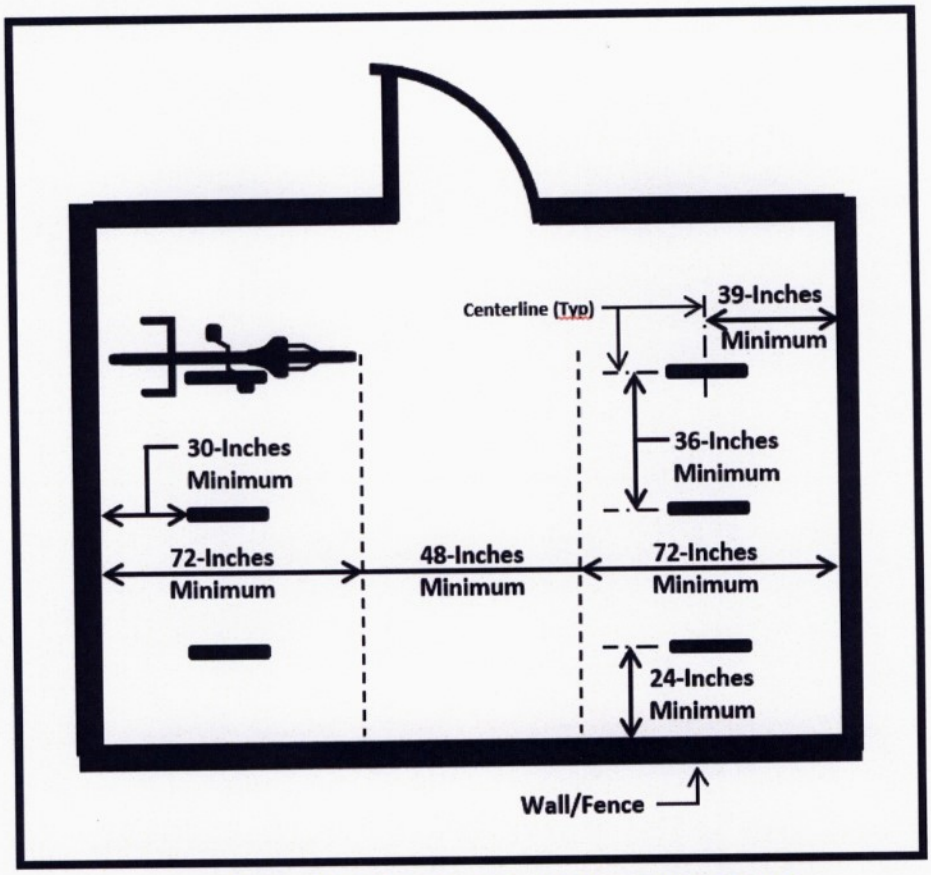


Figure 1.4.040.A.3.c. Bicycle Storage Room/Cage

1.4.050 Standards for Bicycle Lockers

A. Bicycle Locker Design and Location Requirements.

1. The lockers shall be constructed of metal. If windows are provided in the locker, the windows shall be constructed with unbreakable material. Plastic lockers are prohibited.
2. The lockers shall utilize an integral mechanical or digital ("smart") locking mechanism. Lockers that use hasp or mechanisms that allow the use of user locks is prohibited.
3. Stacked lockers shall have a wheel track to guide the bicycle into the locker.
4. Lockers located within a parking area shall be within a barrier consisting of bollards, curbs, curb-bumpers, fences, planting areas, or similar barriers approved by the Director.
5. Lockers placed outdoors shall be within 50 feet of a primary resident entry to a building. The locker(s) shall not be placed between a building and a street.
6. The lockers shall be in a location that is illuminated in accordance with the Illuminating Engineering Society (IES) of North America (IESNA) standards for security.
7. Lockers placed in a building or parking structure shall be on the ground level, or another level that has elevator access, provided that the elevator has an interior width or depth of at least six feet.
8. The placement of a locker shall not interfere with pedestrian movements.

9. **The size and placement of the lockers shall conform with Figure 1.4.050.A.9., unless an alternative configuration is approved by the Director.**

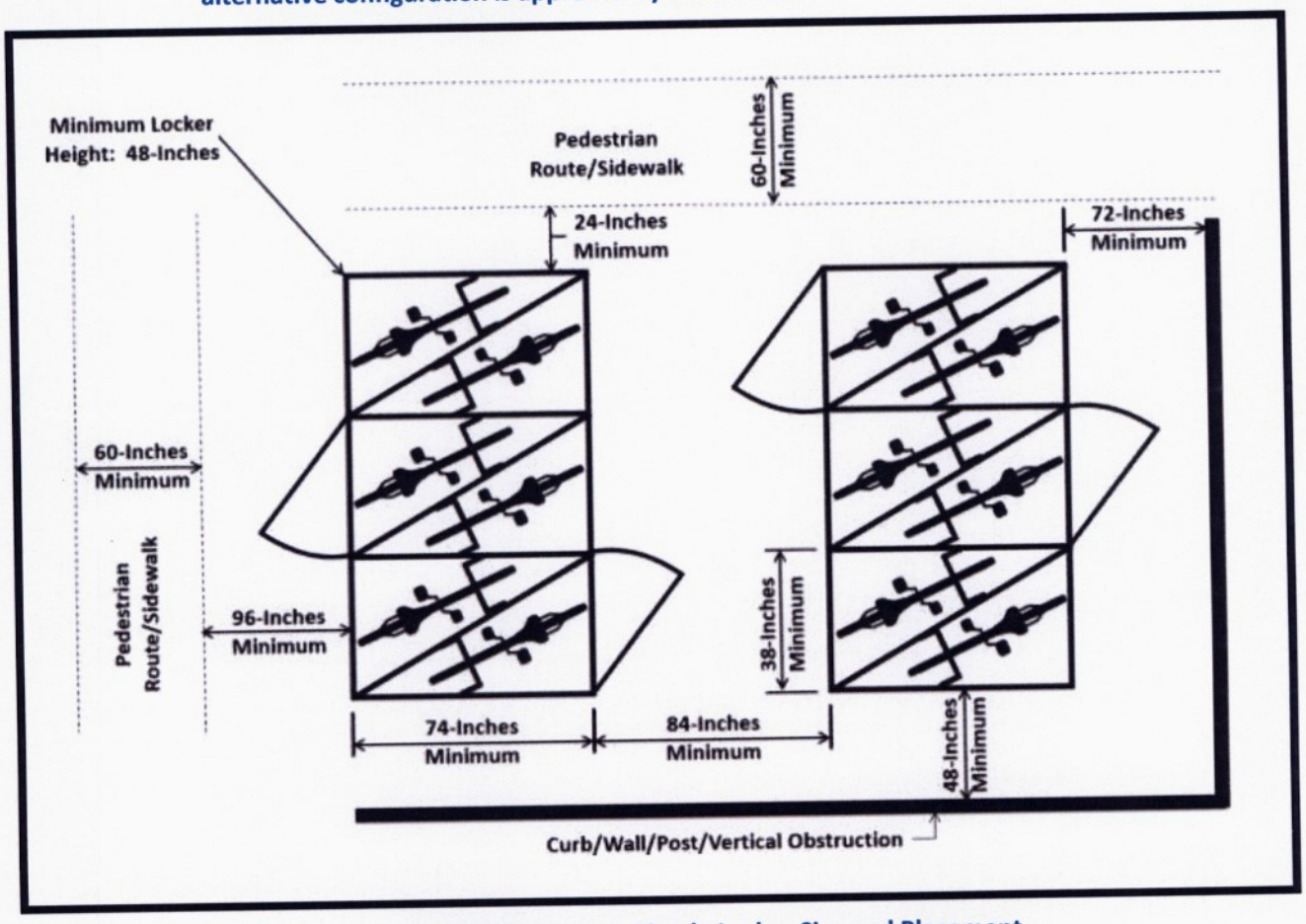


Figure 1.4.050.A.9. Bicycle Locker Size and Placement

Northgate Holdings Prop 207 Claim

Binding Waiver of Enforcement

Christina Rubalcava

Senior Assistant City Attorney

TEAM FLAGSTAFF

WE MAKE THE CITY BETTER

Background

Ordinance 2017-31

- On November 17, 2020, the Flagstaff City Council adopted Ordinance 2020-28, which made various amendments to the Flagstaff Zoning Code.
- The amendments made certain changes regulating High Occupancy Housing ("HOH"), including:
  - Creating a definition of HOH
  - Restricting HOH of 4 units or more to the pedestrian shed of an activity center
  - Adding parking, bedroom/bathroom, and other HOH regulations

Background

Northgate's Claim

- On March 30, 2021, Northgate Holdings filed a Prop 207 claim with the City regarding six parcels of land on S. San Francisco Street in the Southside neighborhood.
- These six parcels are zoned Community Commercial with the option to elect the T4N.1 transect overlay.
- Northgate claims that, as the result of the November 2020 code amendments, its properties have lost a collective $2 million in value.

Background

Map of Northgate Properties

Overview of Prop 207

- A.R.S. § 12-1134 (also known as Prop 207) provides that if "the existing rights to use, divide, sell or possess private real property are reduced by the enactment or applicability of any land use law enacted after the date the property is transferred to the owner and such action reduces the fair market value of the property the owner is entitled to just compensation from this state or the political subdivision of this state that enacted the land use law."
- The landowner must make a written demand for a specific amount of just compensation.
- The city has 90 days to pay, amend the law, or permanently waive enforcement of the new land use law on the landowner's parcel.

Overview of Prop 207

- If the city does not act, the landowner may file a claim for just compensation in superior court within three years of the date the land use law took effect.
- Just compensation for diminution in value is the reduction in fair market value for the property resulting from the land use law.
- Fair market value is the most likely price which the land would bring if exposed for sale in the open market by a purchaser who buys with knowledge of all the uses and purposes to which it is adapted and for which it is capable.

Binding Waiver of Enforcement

- If approved by Council, the City will agree and declare that the HOH Zoning Code amendments will not be enforced nor applicable to the entirety, or any portion of the Northgate properties.

Questions?

Any questions?

12. E.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Nicole Antonopoulos, Sustainability Director
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Adoption of Resolution No. 2021-34: A resolution adopting the Flagstaff Carbon Neutrality Plan

STAFF RECOMMENDED ACTION:

1) Read Resolution No. 2021-34 by title only
2) City Clerk reads Resolution No. 2021-34 by title only (if approved above)
3) Adopt Resolution No. 2021-34

Executive Summary:

In response to community appeals, in June 2020, the Flagstaff City Council unanimously adopted Resolution 2020-09 endorsing a Declaration of a Climate Emergency for the City of Flagstaff. The Climate Emergency Declaration outlines the following priorities for the mobilization of resources. The City of Flagstaff will:

- Dramatically increase its ambition to combat climate change through bold action.
- Ensure this mobilization effort is City-wide, spanning all sectors of the Flagstaff economy and community.
- Prioritize appropriate funding for the implementation of climate goals and action.
- Engage and educate our residents about the current climate emergency and inspiring action, especially Flagstaff's youth.
- Strive for full community participation and leadership by residents of Flagstaff, community organizations and other allies.
- Keep the concerns of vulnerable and historically underserved communities central to all climate emergency mobilization efforts and facilitate their active participation in this work.
- Develop and reinforce respectful collaborations with surrounding Tribal nations, traditional agricultural communities, regional governments, the State of Arizona, and the U.S. Government.
- Prioritize adaptation and mitigation in all City decision-making processes.
- Prioritize the creation of high-quality, good-paying jobs with comprehensive benefits for those who will be impacted by this transition.

These priorities guided the drafting of the Flagstaff Carbon Neutrality Plan (the Plan). The Plan establishes a vision for how Flagstaff will create a carbon-neutral future. Achieving this goal will require reducing greenhouse gas emissions through drastic shifts in how we heat and power our buildings, travel from place to place, and manage our waste. These shifts must occur at multiple levels within the community, as well as across the state, the country, and the world. This Plan includes nine target areas for reducing our community's emissions, each with specific strategies to guide Flagstaff's work. They include:

- Community Resilience
- Equitable Systems
- Decreased Dependence on Cars
- Electric Mobility
- Clean Electricity
- Building Fuel Switching
- Reduced Building Energy Use
- Sustainable Consumption and Waste Management
- Carbon Dioxide Removal

This Plan will guide the City of Flagstaff as it works to achieve carbon neutrality and respond to the climate emergency.

This Plan sets a vision, overarching goals, and specific strategies to reach carbon neutrality and other elements of Flagstaff's Climate Emergency Declaration. This Plan will guide the City of Flagstaff's decisions about policies, funding, investments, and program development.

This Plan is also a communication tool, to help Flagstaff community members understand the City's goals, strategies, and potential actions. This Plan identifies areas for action by individuals, opportunities for collaboration with businesses, and how these issues are interconnected.

Financial Impact:

Funding for the implementation of Plan strategies will need to come from within the City budget, agency grants, and new revenue sources. Some actions in the Plan require capital investment in City infrastructure. Others will require increases in annual operating budgets. Some actions are potential candidates for state, federal, or foundation funding.

Funding options include:

- Increase existing City fees on certain activities, such as increasing the Environmental Management Fee.
- Propose a new sales tax that would have to be approved by voters, similar to how Cities pay for road projects, municipal buildings, and other large city investments.
- Issue bonds, a mechanism for the City to pay for large infrastructure projects.
- Apply for grants from the federal government and private organizations or foundations.
- Allocate City resources to climate-focused initiatives.
- Establish a local emissions reduction fund, to allow individual donations to fund emissions-reducing projects.

Staff are developing a financial impact and avoided cost plan and will return to City Council in the fall.

Policy Impact:

The Plan includes several strategies that will have long-term impacts on City policy, including but not limited to the Zoning Code, Engineering Standards, and the Solid Waste Code. Each of these policy recommendations will be vetted among stakeholders and then brought to City Council for discussion and consideration.

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Council Goals:
Take meaningful climate change action.

Regional Plan:
Goal E.1. Increase energy efficiency.
Goal E.2. Expand production and use of renewable energy.
Goal E&C.1. Proactively improve and maintain the region's air quality.
Goal E&C.2 Reduce Greenhouse gas emissions.
Goal E&C.3 Strengthen community and natural environment resiliency through climate adaptation efforts.
Goal E&C.4. Integrate the best available science into all policies governing the use and conservation of Flagstaff's natural resources.

Has There Been Previous Council Decision on This:

Yes, on June 23, 2020 the City Council unanimously adopted the Climate Emergency Declaration.

Options and Alternatives:

Option A. Adopt Resolution 2021-34 as submitted and adopt the Plan to guide City staff.
Option B. Recommend changes to Resolution 2021-34.
Option C. Not adopt Resolution 2021-34 and not establish goals and a planning framework to take meaningful climate action.

Background/History:

In 2017 the City Council established a goal to take meaningful climate action. As part of this goal, staff were directed to develop a climate action plan.

Key Considerations:

Global greenhouse gas (GHG) emissions are changing the climate in ways that threaten Flagstaff's unique amenities and way of life. Projected changes in temperature, snowpack, water availability, and wildfire risk exacerbate existing challenges and introduce new challenges to Flagstaff's natural resources, economy, infrastructure systems, and quality of life. While we can work to reduce Flagstaff's contributions to those climate changes, preparing for inevitable impacts of these changes in Flagstaff is necessary.

By taking action now to reduce the community's emissions and prepare for climate risks, the City of Flagstaff can better protect the wellbeing of its residents for decades to come. There are many community benefits to climate action, while the cost of inaction is incredibly high.

Expanded Financial Considerations:

While there are proposed initiatives in the Plan that have financial implications, these initiatives will still be subject to review and approval through the regular budget process in the future. Initiatives will be evaluated against greenhouse gas emission reductions, benefits to the community, return on investment, and financial impact.

Community Benefits and Considerations:

Many of the strategies and actions in the Flagstaff Climate Action and Adaptation Plan will enhance quality of life for Flagstaff residents. For example, the introduction of energy-saving equipment and behaviors not only addresses climate goals but can also lower energy costs. This plan prioritizes these "win-win" solutions that benefit both the climate and other facets of the Flagstaff community. Some co-benefits include the following: Support for low-income and disadvantaged communities. When implemented carefully and correctly, actions such as local green job training and subsidy programs for energy efficiency upgrades can be especially helpful for low-income and disadvantaged communities.

Public health. Some actions that reduce greenhouse gas emissions also promote healthier lifestyles, such as supporting more people walking and biking and eating less carbon-intensive foods.

Quality of life and well-being. Many climate actions can also improve quality of life for Flagstaff residents, such as benefits from green jobs to the local economy and creation of more comfortable and inviting homes through energy efficiency improvements. Local habitat, recreation, and aesthetics. In addition to enhancing ecosystem resilience, minimizing heat impacts, and storing carbon, actions that improve natural habitat can also enhance natural beauty and provide recreation opportunities for visitors and residents. Economic stability. Looking ahead can help the Flagstaff community prepare for potential shifts in both climate and visitation. Climate action can help existing businesses be more resilient amidst change, while emerging businesses capitalizing on the need for climate solutions can create high-quality jobs.

Community Involvement:

CONSULT:
Staff utilized used a number of different strategies to engage more than 1,000 community members in this Plan.

- Four Open House series in January, April, July and October helped staff to update the community on Plan progress and help residents learn about climate change. At these events we asked community members for their concerns, and what type of actions they want to see Flagstaff take.
- Four community forum surveys were posted. We also worked with a Steering Committee to hear differing perspectives from the community.
- Staff spoke at events around the community, hosted informational tables, did radio interviews, and earned media coverage, to expand engagement.

Attachments: Res. 2021-34
Carbon Neutrality Plan
Presentation

RESOLUTION NO. 2021-34

A RESOLUTION OF THE FLAGSTAFF CITY COUNCIL, ADOPTING THE CARBON NEUTRALITY PLAN

RECITALS:

WHEREAS, the Flagstaff City Council recognizes the threat climate change poses to Flagstaff's infrastructure, economy, public health, natural environment, community well being and the City's ability to deliver services; and

WHEREAS, the City of Flagstaff has experienced significant damage from natural and human caused hazards such as flooding, wildfire, drought, resulting in loss of life and property, economic hardships, and threats to public health and safety; and

WHEREAS, in March 2010, Flagstaff adopted Resolution 2010-16 which committed Flagstaff to increased energy efficiencies and renewable energy production and purchases for city facilities and properties; and

WHEREAS, in July 2011, Flagstaff launched its Municipal Sustainability Plan, which strove to increase energy efficiency and energy performance and reduce greenhouse gas emissions of municipal operations; and

WHEREAS, in June 2012, Flagstaff adopted the Resiliency and Preparedness Study, which commits to prioritizing and integrating resiliency throughout City decisions, operations, and processes; and

WHEREAS, in May 2014, Flagstaff voters ratified the Flagstaff Regional Plan, which establishes goals to reduce greenhouse gas emissions, to expand production and use of renewable energy, and to proactively improve and maintain the region's air quality; and

WHEREAS, in February 2017, Flagstaff City Council established a goal to achieve a 100% renewable energy portfolio for municipal operations: and

WHEREAS, in November 2018, Flagstaff adopted a Climate Action & Adaptation Plan, which calls for a community-wide reduction in greenhouse gas emissions of 80% by 2050; and

WHEREAS, in response to community appeals, in June 2020, Flagstaff adopted Resolution 2020-09 endorsing a Declaration of a Climate Emergency for the City of Flagstaff, and requesting regional collaboration on an equitable transition and urgent mobilization effort to restore a safe climate; and

WHEREAS, the City of Flagstaff will lead by example and take the necessary climate action to prepare the community for the impacts of climate change; and

WHEREAS, the Flagstaff Carbon Neutrality Plan sets three overarching goals:

1) Achieve carbon neutrality by 2030 - Flagstaff will arrive at carbon neutrality, also known as net-zero community greenhouse gas emissions, by 2030.

2) Prepare Flagstaff's communities, systems, and resources to be more resilient to climate change impacts.
3) Address climate change in a manner that prioritizes those most impacted and ensures the costs and benefits of climate adaptation and mitigation are equitably distributed.

ENACTMENTS:

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FLAGSTAFF AS FOLLOWS:

SECTION 1: The City of Flagstaff hereby adopts the Flagstaff Carbon Neutrality Plan, attached hereto as Exhibit A.

SECTION 2: That the Mayor and City Council hereby commit to implementation of the strategies and actions detailed in the Flagstaff Carbon Neutrality Plan to achieve its stated goals.

SECTION 3: The City of Flagstaff recognizes that climate change affects people differently. Vulnerable communities, including low-income families, communities of color, and the elderly, will face the greatest challenges from climate change. Equity and climate justice will be foundational elements of the Plan, to avoid harm to underserved groups and to ensure the benefits of climate action are distributed fairly.

SECTION 4: That the Flagstaff Carbon Neutrality Plan outlines how the Flagstaff community will respond to the climate emergency. The path to carbon neutrality will require leadership, bold action, perseverance, and creativity. Each step closer to carbon neutrality offers hope for a healthy, prosperous, and equitable future for the Flagstaff community—and the world.

PASSED AND ADOPTED by the City Council of the City of Flagstaff this 15th day of June, 2021.

MAYOR

ATTEST:

CITY CLERK

APPROVED AS TO FORM:

CITY ATTORNEY

Exhibits:
Carbon Neutrality Plan

The Flagstaff Carbon Neutrality Plan

An evolving framework for action

June 2021

Table of Contents

I. Taking Action 5
Goals 6
Our Path to Carbon Neutrality 7
About this Plan 13
II. Our Approach 16
Carbon Neutrality Is … 17
Flagstaff Will… 23
Climate Action in Flagstaff Will: 30
III. Implementation 35
IV. The Path to Carbon Neutrality 43
Focus One: Our Neighborhoods 45
Community Resilience 46
Equitable Systems 49
Decreased Dependence on Cars 53
Focus Two: Our Energy Sources 65
Electric Mobility 66
Clean Electricity 71
Building Fuel Switching 77
Focus Three: Our Consumption 84
Reduced Building Energy Use 85
Sustainable Consumption and Waste Management 91
Focus Four: Our Commitment 96
Carbon Dioxide Removal 97
V. BACKGROUND 102
Climate Change in Flagstaff 104
Flagstaff's Greenhouse Gas Emissions 106
THANK YOU 109
Appendix A 110

Cover image: Flagstaff students protest for climate action in the fall of 2018. Photo credit: Jake Bacon.

Letter from the Flagstaff City Council

To the Flagstaff community,

Thank you. Flagstaff's climate action is rooted in the efforts and energy of the community members that hold us to the climate leadership goals we set for ourselves. Community members initiated the Climate Emergency Declaration, which is the foundation for this document. The community helped to develop the Flagstaff Carbon Neutrality Plan and will be integral in achieving Flagstaff's climate goals.

This document represents Flagstaff's hopeful, ambitious, and necessary approach to climate action. It is Flagstaff's contribution to the international effort to restore a safe climate, protect the earth's diversity of culture and life, and prioritize vulnerable communities. This Plan outlines nine target areas and accompanying strategies to proactively reduce emissions, build a stronger community, and prepare for coming change.

We take on this work with the knowledge that climate change will challenge Flagstaff and will negatively affect Flagstaff's vulnerable community members, including low-income families, communities of color, and the elderly. Equity and climate justice will be foundational elements of our work, to avoid harm to underserved groups and to ensure the benefits of climate action are fairly distributed.

The path to carbon neutrality will require leadership, bold action, perseverance and creativity. Each step closer to carbon neutrality offers hope for a healthy, prosperous, and equitable future for the Flagstaff community—and the world.

We invite all community members to remain involved as we work to achieve the goals of this Plan. Community voices will be needed to assist in our efforts – to create creative partnerships, to bring more residents into the conversation, to ensure we act equitably, and to help us remain accountable to our goals. Residents can receive assistance in home energy retrofits, join a neighborhood clean-up, review our greenhouse gas emissions reports, or learn how to talk to their neighbors about climate change. Find out more ways to get involved at www.flagstaff.az.gov/CNP.

In partnership,

The Flagstaff City Council

KEY TERMS

Climate terms used throughout this Plan are defined below to clarify their meaning in the context of Flagstaff's work.

The fundamentals of climate action:

- Climate change: A shift in long-term, average weather patterns fueled by increased greenhouse gas emissions into the atmosphere. Globally, climate change is leading to increased temperatures and instability in the atmosphere, causing extreme weather events like drought, rising sea levels, and catastrophic wildfires.
- Greenhouse gas emissions: Greenhouse gas (GHG) emissions include carbon dioxide, methane, nitrous oxide, and fluorinated gases that are released into the atmosphere naturally or through human activities. The increased concentration of GHG emissions in the atmosphere causes climate change. GHG emissions are often standardized and reported in metric tons of carbon dioxide equivalent (MT CO2E).
- Carbon neutrality: A state where an entity has achieved a net zero GHG emissions footprint. This is achieved by balancing every ton of human-caused GHG emissions produced with an equivalent amount of GHG emissions removed from the atmosphere, on an annual basis.

There are three types of climate action:

- Adaptation: Actions that increase the ability to withstand, respond to, or cope with climate change impacts.
- Mitigation: Actions that decrease GHG emissions, which cause climate change.
- Equity: The just distribution of the benefits of climate protection and alleviation of unequal burdens created by climate change.

These terms represent emerging types of climate action:

- Carbon dioxide removal (CDR): Refers to techniques and processes that remove carbon dioxide from the atmosphere.
- Clean electricity: Electricity generated from sources that do not produce GHG emissions.
- Fuel switching: Converting appliances, machines, and systems that rely on fossil fuels like natural gas, oil, or coal to another power source. This includes electrification, which is switching fuels to electricity.
- Electric mobility: The use of modes of transportation that are fueled by electricity instead of fossil fuels, including electric buses, electric bikes, small electric devices like scooters and hoverboards (electric micro-mobility), and electric vehicles (EVs).

I. TAKING ACTION

Climate change, accelerated by human-caused greenhouse gas emissions, is disrupting global weather patterns and threatening communities across the world. While climate shifts have occurred in the past, current climate change is happening at a faster rate than any recorded in history. If the increasing amount of greenhouse gases in the atmosphere is not reduced, life as we understand it will be altered irreversibly. On June 23, 2020, the Flagstaff City Council declared a climate emergency, calling on each of us to do all we can to protect the earth's diversity of culture and life. See page 103 for a copy of the Climate Emergency Declaration.

The Flagstaff Carbon Neutrality Plan (the Plan) establishes a vision for how Flagstaff will create a carbon-neutral future. Achieving this goal will require reducing our greenhouse gas emissions through drastic shifts in how we heat and power our buildings, travel from place to place, and manage our waste. These shifts must occur at multiple levels within our community, as well as across the state, our country, and the world. This Plan includes nine target areas for reducing our community's emissions, each with specific strategies to guide Flagstaff's work. This Plan updates the 2018 Flagstaff Climate Action and Adaptation Plan (CAAP) and draws upon its goals of adaptation and equity.

Climate action can create a stronger Flagstaff and reduce the negative economic, social and environmental costs of climate change – reducing the amount of global warming will pay dividends for generations. Yet our work to reduce emissions and prepare for change isn't just about avoiding costs – it is about improving life here in Flagstaff. Climate action can have co-benefits ranging from lower home energy costs and air that's easier to breathe, to healthier forests, neighbors who can rely on each other, and more enjoyable ways to get to work.

The voice of the Flagstaff community will provide critical guidance to the City of Flagstaff as we work together to reach carbon neutrality. The path to carbon neutrality will not be easy: it will require perseverance and creativity. Yet each step closer to carbon neutrality offers hope for a healthier, safer, and more prosperous future for the Flagstaff community—and the world.

VISION FOR THE FUTURE

The Flagstaff community takes ambitious action to reduce greenhouse gas emissions and build community resilience, resulting in a higher quality of life for all residents. This transformation involves the entire community, is supported by collaborations with regional and tribal partners, provides opportunities, and centers vulnerable communities in an equitable transition towards carbon neutrality.

Overarching Goals

Goal One: **Achieve carbon neutrality by 2030.**

Flagstaff will arrive at carbon neutrality, also known as net-zero community greenhouse gas emissions, by 2030. Carbon neutrality will be achieved through a combination of emissions reductions and carbon dioxide removal (CDR) initiatives. For more information on carbon neutrality, see the Approach Chapter starting on page 16.

Mitigation target: Reduce greenhouse gas emissions by 44% by 2030, from the business as usual emissions projection.

Flagstaff will reduce greenhouse gas emissions as much as possible: this Plan aims to reduce Flagstaff's annual community emissions by 44% compared to the business as usual (BAU) scenario - our predicted emissions if we took no climate action.

Carbon dioxide removal (CDR) target: Balance any remaining greenhouse gas emissions with carbon dioxide removal, to achieve carbon neutrality by 2030.

To achieve carbon neutrality, we will measure the emissions produced each year by the Flagstaff community on an annual basis, and then balance those emissions with an equivalent amount of carbon dioxide removal (CDR). In 2030, Flagstaff will need to remove approximately 471,000 tons of carbon dioxide from the atmosphere – equivalent to our 2030 emissions.

Goal Two: **Prepare Flagstaff's communities, systems, and resources to be more resilient to climate change impacts.**

Climate changes have already taken place in northern Arizona; natural and societal shifts will continue to occur. The Flagstaff community must begin to respond to climate change through adaptation, or preparing for change and strengthening our community's social, economic, and infrastructure systems. Adaptation actions will ensure Flagstaff is better equipped for and can thrive amidst both short-term disruptions and long-term change.

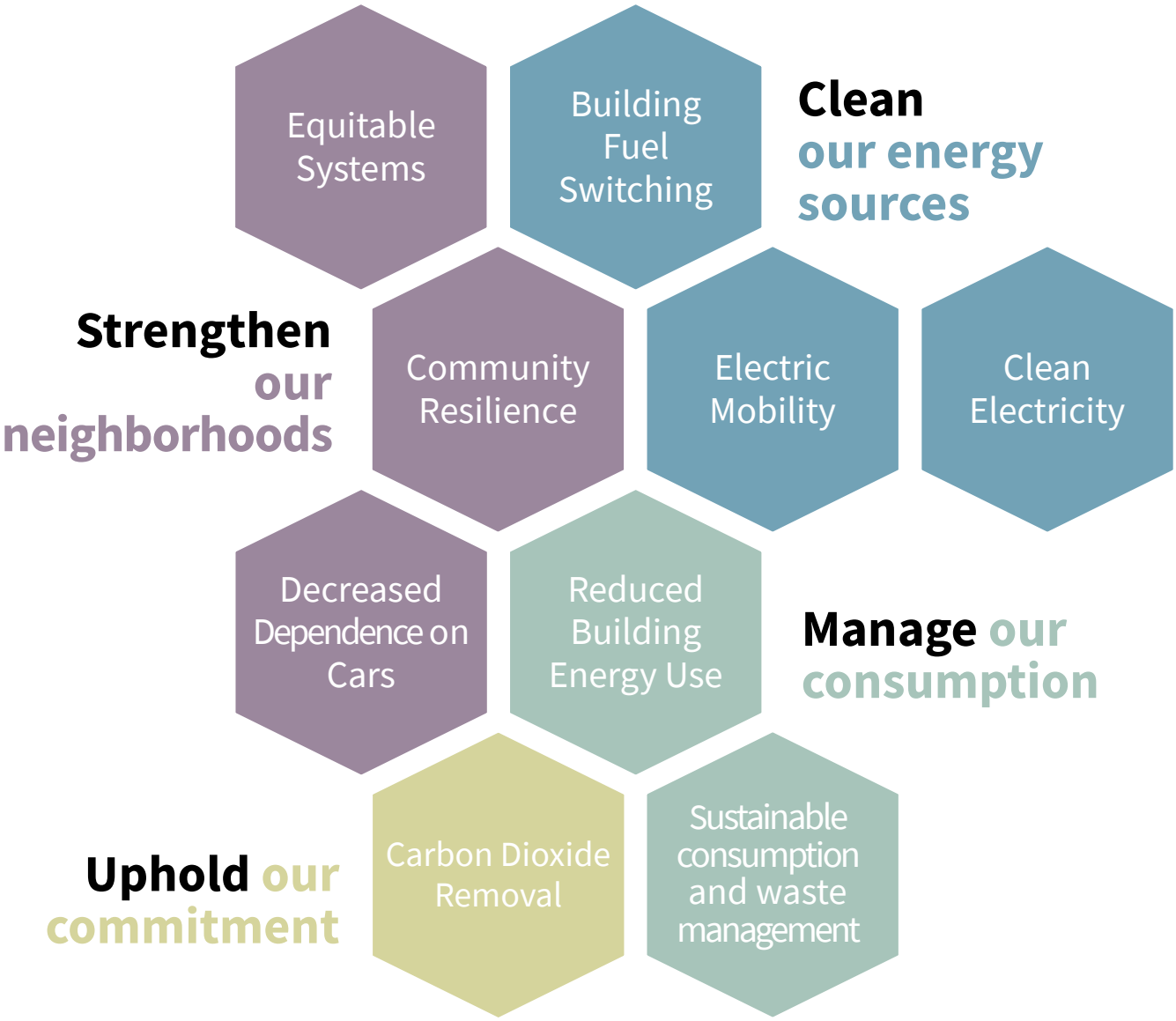
Goal Three: **Address climate change in a manner that prioritizes those most impacted and ensures the costs and benefits of climate adaptation and mitigation are equitably distributed.**

Climate change disproportionally impacts vulnerable communities like older adults, people of color and low-income neighborhoods. As we act, we must consider how both climate change and climate action can affect people differently. The City of Flagstaff will center equity in its climate action decisions to ensure all communities in Flagstaff can benefit from a carbon neutral future.

The Climate Emergency Declaration calls for ambitious action on adaptation and equity alongside mitigation. Goals two and three reflect the adaptation and equity goals established in the 2018 Flagstaff Climate Action and Adaptation Plan. Read more about these principles on page 27.

Our Path to Carbon Neutrality

To reach carbon neutrality, we will…



TARGET AREAS AND STRATEGIES

Flagstaff will achieve carbon neutrality by taking action in the following target areas:

- Community Resilience
- Equitable Systems
- Decreased Dependence on Cars
- Electric Mobility
- Clean Electricity
- Building Fuel Switching
- Reduced Building Energy Use
- Sustainable Consumption and Waste Management
- Carbon Dioxide Removal

Target areas and their supporting actions are detailed starting on page 43.

1. FOCUS ONE: WE WILL STRENGTHEN OUR NEIGHBORHOODS

Community resilience

- **CR-1:** Ensure all mitigation actions improve Flagstaff's ability to adapt to the future.
- **CR-2:** Strengthen existing community systems to create resilience to both short-term shocks and long-term change.

Equitable systems

- **ES-1:** Incorporate equity as a foundational element of every climate action the City develops and implements.
- **ES-2:** Proactively engage community members on an ongoing basis.
- **ES-3:** Design targeted climate policies and programs to serve vulnerable communities first.
- **ES-4:** Actively seek to recognize past harms, repair trust, and build deeper relationships with community members.

Decreased Dependence on Cars

- **DD-1:** Encourage vibrancy, appropriate density, and attainability in existing neighborhoods, so that more residents live within walking distance of their daily needs.
- **DD-2:** Create inclusive networks for walking and biking that are continuous, attractive, safe, comprehensive, and convenient for people of all ages.
- **DD-3:** Encourage Flagstaff residents and visitors to walk, bike, roll and take the bus.
- **DD-4:** Transform transportation policies and planning to incorporate greenhouse gas emissions analysis and reduce dependence on driving.
- **DD-5:** Invest in comprehensive and equitable transit.
- **DD-6:** Proactively invest to protect Flagstaff's clean air status.

2. FOCUS TWO: WE WILL CLEAN OUR ENERGY SOURCES

Electric Mobility

- **EM-1:** Advance the electrification of buses across Flagstaff.
- **EM-2:** Welcome electric micro-mobility devices as legitimate, healthy, affordable, and low-carbon modes of transportation.
- **EM-3:** Support residents, businesses and institutions in the transition to electric vehicles.

Clean electricity

- **CE-1:** Produce 100% renewable electricity to cover all City of Flagstaff municipal electricity needs.
- **CE-2:** Increase renewable energy installations and usage in new buildings.
- **CE-3:** Support solar installations on existing residential and commercial buildings.

Building Fuel Switching

- **FS-1:** Reduce or remove natural gas usage in municipal buildings
- **FS-2:** Encourage new buildings to rely on the electric grid as their main energy source.
- **FS-3:** Support fuel switching in existing residential and commercial buildings.
- **FS-4:** Provide training and education on fuel switching.

3. FOCUS THREE: WE WILL MANAGE OUR CONSUMPTION

Reduced Building Energy Use

- **BE-1:** Achieve net zero energy City of Flagstaff facilities.
- **BE-2:** By 2030, require new homes in Flagstaff to be net zero energy homes.
- **BE-3:** Reduce energy use in existing buildings.

Sustainable Consumption and Waste Management

- **MM-1:** Manage emissions from the Cinder Lake Landfill.
- **MM-2:** Encourage sustainable consumption.
- **MM-3:** Divert more waste from the landfill.
- **MM-4:** Reduce organic waste going to the landfill and feed hungry people.

4. FOCUS FOUR: WE WILL UPHOLD OUR COMMITMENT

Carbon Dioxide Removal

- **CD-1:** Develop a portfolio of local and regional carbon dioxide removal initiatives to meet Flagstaff's commitment to carbon neutrality.
- **CD-2:** If local carbon dioxide removal projects are insufficient, obtain high-quality carbon offsets and CO2 Removal Certificates (CORCs).

THE PATH TO CARBON NEUTRALITY STARTS WITH A 44% REDUCTION IN EMISSIONS

Carbon neutrality involves two core actions: first one must reduce emissions by as much as possible, and then balance the remaining emissions with carbon dioxide removal.

The City's carbon neutrality strategy starts with significant emissions reductions. Without action, we project that the Flagstaff community will produce approximately 846,000 metric tons of greenhouse gas emissions in 2030 – this is called the **business as usual scenario**. Compared to this scenario, the strategies and outcomes envisioned by the Plan will lead to a 44% reduction in emissions. While significant, our community will still produce an estimated 471,000 tons of greenhouse gasses in 2030 (MTCO2e).

To achieve carbon neutrality, Flagstaff will need to pursue carbon dioxide removal initiatives at an equivalent scale. If 471,000 tons of greenhouse gasses are still produced over the course of a year, then 471,000 tons will need to be removed.

The two graphs below, Image A and Image B, display these emission reductions, in different ways.

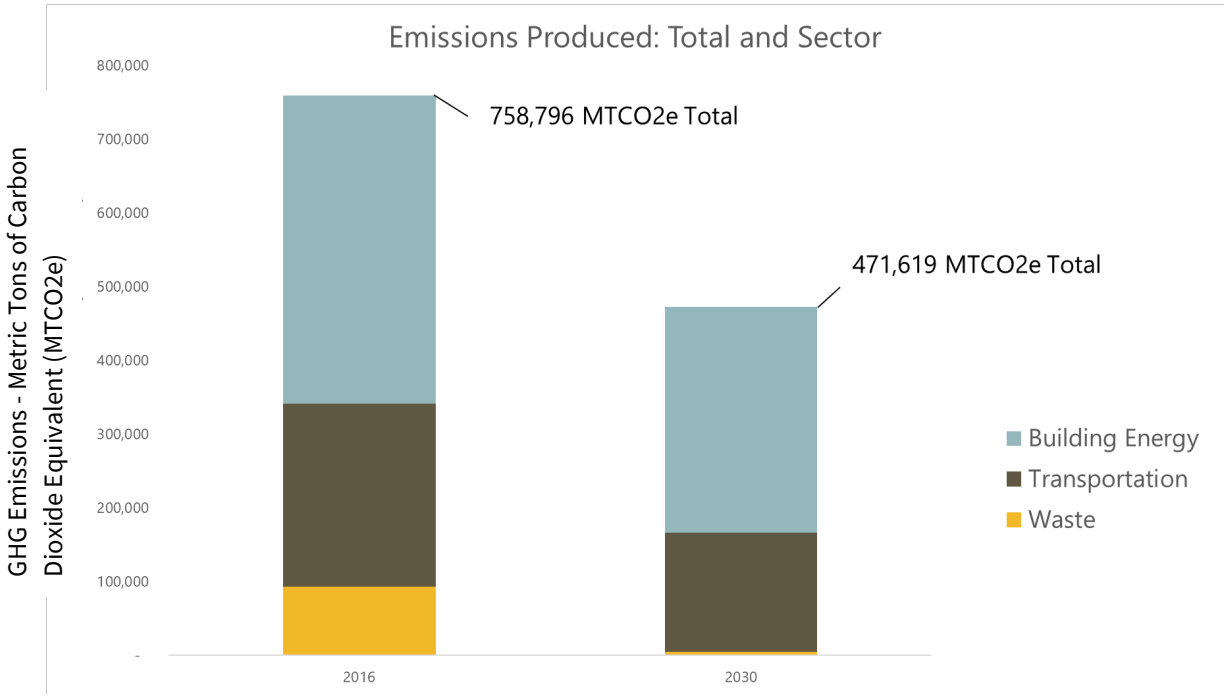
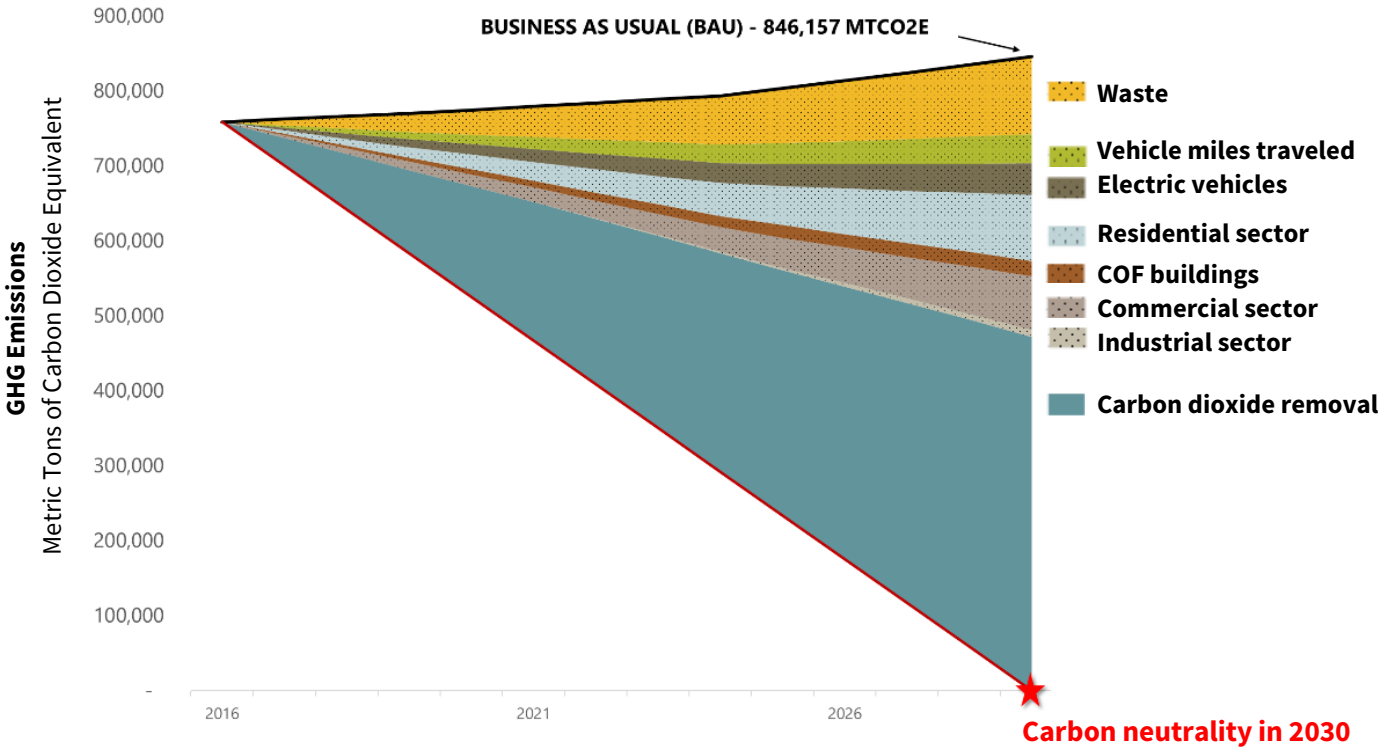


Figure 1: Remaining emissions still produced in 2016 (measured) and 2030 (projected). This bar graph only considers the emissions produced and does not consider the net impact that carbon dioxide removal (CDR) initiatives would have.



Reductions from waste
Flaring and diversion

Reductions in vehicle miles traveled (VMT)
Maintain 2019 VMT levels

Reductions from electric vehicles
30% of vehicle miles will come from electric vehicles

Reductions from residential sector
43% reductions in total energy use. 62% reduction in emissions from natural gas. 72% of electricity is zero-emissions.

Reductions from COF Buildings
28% from reductions in total energy use. 60% reduction in emissions from natural gas. 100% renewable electricity.

Reductions from commercial sector
11% reduction in total energy use. 20% reduction in emissions from natural gas. 69% of electricity is zero-emissions.

Reductions from industrial sector
68% of electricity is zero-emissions.

Carbon dioxide removal
471,619 MTCO2e

Figure 2: Wedge graphic of carbon neutrality. This graph shows the emissions reductions and carbon dioxide removal required to achieve net-zero emissions by 2030.

GETTING TO NET-ZERO: KEY SHIFTS TO REACH CARBON NEUTRALITY

Flagstaff needs to commit to substantive change in our community to reach carbon neutrality. We will need to collectively and individually take big and bold actions on an aggressive timeline. The table below describes some of the outcomes Flagstaff will need to reach.

Significant reductions in the miles we travel by passenger vehicles	- Vehicle **Miles Traveled (VMT).** Hold internal VMT measured steady at 2019 levels, even amidst community growth. Internal VMT = trips that start and end within the Flagstaff community.
	- 30% of our internal VMT will be in **electric vehicles** (or have zero tailpipe emissions).
Rapid solar energy development	- **2,000 new home solar systems** are installed by 2030 - **15 Megawatts (MW) of new solar** on commercial and industrial buildings/lots
Extensive building retrofits and electrification	- **Retrofit ~50% of existing homes** (12,500 total residential retrofits) to reduce energy use and electrify homes. - 25% of all commercial buildings get a **deep energy efficiency retrofit**. - 15% of commercial buildings **fully electrify**.
City of Flagstaff: Renewable Energy + Energy Use	- **100% renewable electricity** for the municipality by 2025: 50MW solar installation at **Red Gap Ranch**; 10MW solar installation at the **landfill**. - Energy efficiency and fuel switching in **municipal buildings**.
Low-impact new buildings	- By 2030, ensure new buildings use **net-zero energy**, meaning they contribute to the creation of as much energy as they use.
Carbon Dioxide Removal	Removing approximately 471,000 tons of carbon dioxide from the atmosphere per year by developing and supporting a **portfolio of carbon dioxide removal initiatives.** Potential projects include biomass, bioenergy or biochar initiatives on City land and Open Space.

What is a megawatt?

A megawatt is how we measure large amounts of power. One megawatt (MW) = 1,000,000 watts. For reference an LED lightbulb uses about 8 watts.

A typical home rooftop solar system is about 5 kilowatt (kW) in size. One MW is equivalent to 200 typical home systems. The solar array at the Flagstaff City Hall is 150 kW in size – so to get 15 MW we would need about 100 additional systems of this size.

About this Plan

What this Plan does

This Plan will guide the City of Flagstaff as it works to achieve carbon neutrality and respond to the climate emergency.

This Plan sets a vision, overarching goals, and specific strategies to reach carbon neutrality and other elements of Flagstaff's Climate Emergency Declaration. This Plan will guide the City of Flagstaff's decisions about policies, funding, investments, and program development.

This Plan is also a communication tool, to help Flagstaff community members understand the City's goals, strategies, and potential actions. This Plan identifies areas for action by individuals, opportunities for collaboration with businesses, and how these issues are interconnected.

The science is clear

As the climate changes, Flagstaff will continue to experience warmer temperatures, an increase in aridity or dryness, lower snowpack levels, and increased wildfire risk.

These changes will have cascading impacts on Flagstaff's natural environment, residents, and community systems. Just a few of the impacts include:

- The forests surrounding Flagstaff will become drier and more stressed, increasing their vulnerability to severe wildfire and disease.
- Visitation and tourism to Flagstaff will change. Snow in winter will become less predictable, and the Phoenix metro area will see increasingly extreme summer temperatures. This will have impacts on Flagstaff's economy, infrastructure, housing systems, and land use.
- Flagstaff will experience more days with temperatures above 90 degrees, increased allergens, and more days with poor air quality due to smoke, negatively impacting residents with health vulnerabilities.

All Flagstaff residents will need to adapt to these and other changes. Some changes will bring opportunity and others will bring challenges, particularly for vulnerable community members like older adults, families with low incomes, or communities of color.

For more information on the anticipated changes to Flagstaff's climate and resulting impacts on its community: See Appendix A of this document, or find even more detail in the Flagstaff Climate Profile, available through the City of Flagstaff Climate website: www.flagstaff.az.gov/climate.

Systemic change versus individual action

In conversations about climate action, there tends to be extensive conversation around the value of systemic and individual change. This Plan utilizes both! As a municipality, the City of Flagstaff works on systemic, structural changes to decrease greenhouse gas emissions and improve quality of life. However, these systemic changes help make individual action easier! Think about transportation, for example. If you live in a walkable neighborhood, you're more likely to leave your car at home, since the system and infrastructure is set up for you to make that choice more easily. Systemic change and individual action are not mutually exclusive. Instead, they complement and support one another.

How this document relates to the 2018 Climate Action and Adaptation Plan

The Flagstaff Carbon Neutrality Plan builds on the 2018 Climate Action and Adaptation Plan – also known as the CAAP – and replaces the mitigation goals and actions of the CAAP.

The 2018 CAAP was developed over a year and a half of community conversations to create the first climate plan for Flagstaff. It was adopted unanimously, and was the first community-wide climate plan in Arizona. It established broad goals for reducing emissions, preparing for change, and ensuring that we act equitably, prioritizing our most vulnerable community members.

The 2018 CAAP aligned with the best available science that formed the foundation for the Paris Climate Agreement. One month before the CAAP adoption, the Intergovernmental Panel on Climate Change (IPCC) published a report: Global Warming of 1.5° C, stating that urgent action was needed across the globe to hold warming to 1.5° C, which is equal to 2.7° F. When the Flagstaff City Council adopted the CAAP in late 2018, the CAAP acknowledged that this was a first step and that community conversations around this IPCC report were needed.

This Plan will replace the mitigation portion of the 2018 CAAP. While we have a new mitigation goal – carbon neutrality by 2030 – we will continue to reference the 2018 CAAP for the overarching adaptation and equity goals.

The Climate Emergency Declaration calls for more aggressive action on equity and adaptation, too. After we adopt this Carbon Neutrality Plan, we will start conversations with the community about bold action on adaptation and equity, and will revise our plans to reflect the Climate Emergency Declaration's calls for greater resilience and a focus on climate equity.

How this document relates to the Flagstaff Regional Plan 2030

The Flagstaff Carbon Neutrality Plan supports the vision, goals, objectives and policies of the Flagstaff Regional Plan 2030. The Regional Plan sets forth a vision for a Sustainable Flagstaff, connecting development decisions to environmental impact and the need to plan for the future. It envisions active stewardship and vitality for both the current population and future generations – ideals that are supported by reducing greenhouse gas emissions, resilience-building and support for vulnerable community members.

This document builds upon the climate change and adaptation goals outlined in the Flagstaff Regional Plan 2030 – Goal E&C.2. and Goal E&C.3.This document also furthers many other goals of the Regional Plan, such as but not limited to:

- Goal E.1. Increase energy efficiency.
- Goal E.2. Expand production and use of renewable energy.
- Goal LU.1. Invest in existing neighborhoods and activity centers for the purpose of developing complete connected places.
- Goal LU.5. Encourage compact development principles to achieve efficiencies and open space preservation.
- Goal LU.6. Provide for a mix of land uses.
- Goal NH.3. Make available a variety of housing types at different price points, to provide housing opportunity for all economic sectors.
- Goal T.5. Increase the availability and use of pedestrian infrastructure, including FUTS, as a critical element of a safe and livable community.
- Goal T.6. Provide for bicycling as a safe and efficient means of transportation and recreation.
- Goal T.7. Provide a high-quality, safe, convenient, accessible public transportation systems, where feasible, to serve as an attractive alternative to single-occupant vehicles.

The Flagstaff Carbon Neutrality Plan will also inform potential priority areas for the next update to the regional plan.

While the Regional Plan and this document are supportive of each other, there is an 'ambition gap' between the Regional Plan's broad goal of reducing greenhouse gasses and the commitment to carbon neutrality. This gap reflects the strength of the international consensus on the need for immediate and aggressive climate action, compared to 2014 when the Regional Plan was passed and the growth in the urgency of climate action. In 2021, City staff are proposing are major Regional Plan amendment to update the climate change and adaptation pages, goals, and policies of the Flagstaff Regional Plan 2030. This amendment will go through an extensive public review process, including community open houses, presentations to City commissions, and conversations with the Flagstaff City Council.

II. OUR APPROACH

This document is a framework for action; it outlines broad strategies for how to achieve carbon neutrality. The principles below illustrate the approach the City will take as it works within the community to achieve its carbon neutrality goals.

OUR WORK IS INFORMED BY THE FOLLOWING PRINCIPLES:

Carbon neutrality is:

- 1. Community-driven
- 2. Motivated by urgency
- 3. Prescriptive
- 4. A commitment to accountability
- 5. An investment in our future
- 6. Supported by market leaders

Flagstaff will:

- 7. Be a leader
- 8. Embrace the Big Shift
- 9. Balance community tensions and create opportunities
- 10. Center equity and adaptation

Climate action in Flagstaff will:

- 11. Produce co-benefits
- 12. Rely on partnerships
- 13. Prioritize incentives
- 14. Iterate and adapt over time

Carbon neutrality is …

- Community-driven
- Motivated by urgency
- Prescriptive
- A commitment to accountability
- An investment in our future
- Supported by market leaders

1. CARBON NEUTRAILTY IS COMMUNITY-DRIVEN

On September 20th, 2019, Flagstaff community members gathered on the City Hall lawn for the Global Climate Strike. At the gathering, community activists and organizers gathered signatures for a citizen petition, calling on Flagstaff City Council to declare a climate emergency. This Citizen Petition was submitted to the City Council on September 24th, 2019. Hundreds of Flagstaff community members organized into coalitions from farmers and doctors to students and grandparents. At the January 28th, 2020 City Council Meeting, they provided over three hours of public comment requesting a Climate Emergency Declaration and urgent action. On June 23rd, 2020, the Flagstaff City Council unanimously adopted the Climate Emergency Declaration.

Community organizers and residents led the creation of the Climate Emergency Declaration, and their involvement has continued throughout the development process. This Plan was created based on technical analysis, best practices from peer cities, and feedback from Flagstaff community members. A Steering Committee of community members was formed to guide Plan development and incorporate resident voices from the start.

Over the course of 10 months, more than 2,500 residents engaged and contributed to the development of this Plan. Community members contributed to six surveys, attended 12 virtual open house forums, and contributed videos for the Climate Emergency Open House website. City staff made 50 carbon neutrality presentations to City Commissions and community groups. Community partners played an integral role in advising the Plan and inviting their networks to provide input.

2. CARBON NEUTRALITY IS DRIVEN BY URGENCY

The climate emergency is causing change in Flagstaff today and threatens to cause catastrophic events across the world in the coming decades. Urgent and bold action is necessary to take advantage of a small window of opportunity to avoid the worst effects of irreversible climate change. The IPCC's Special Report: Global Warming of 1.5°C states that limiting warming to 1.5 degrees Celsius (which equal to 2.7 degrees Fahrenheit), compared to 2 degrees Celsius, will allow 10 million people to avoid the health impacts of sea level rise, save the world approximately $30 trillion in damages, and avoid up to 2,000 heat-related deaths annually.

The severe impacts of climate change and the need to keep global warming below 1.5°C was a vital driving principle behind the June 2020 Climate Emergency Declaration, available on page 103.

Local governments are first responders to the climate emergency, like most other emergencies. Thus, local governments across the world have a responsibility to prepare for this looming threat, to reduce the potential harm, and to protect vulnerable communities.

Like other emergencies, action must be swift, decisive, collaborative, and effective, while being rooted in community values and priorities.

3. CARBON NEUTRALITY IS PRESCRIPTIVE

To restore a safe climate for future generations, communities across the world must drastically reduce the amount of fossil fuels used in buildings, transportation, and consumption. Within the United States, getting to carbon neutrality looks similar across all cities undertaking this goal, and relies on several common strategies:

- Reducing the energy we use for buildings, transportation and consumption.
- Creating energy from renewable and clean sources.
- Switching buildings and vehicles to run on clean electricity or other renewable sources.

In this way, carbon neutrality is prescriptive: there is an agreed upon course of action to achieve the emission reductions necessary. These actions may be re-packaged or reframed from city to city, but the necessary high-level strategies are known. Flagstaff is no different – the necessary actions are pre-determined by where our emissions come from. We still rely on national best practices to dramatically reduce emissions from our buildings, transportation, and consumption.

Because there are only minor deviations from the standard pathway to achieve carbon neutrality, Flagstaff's actions will be similar to all other cities striving for carbon neutrality. There is still ample opportunity for creativity and innovation in *how* Flagstaff achieves these goals: policies and programs will be developed to meet Flagstaff's unique characteristics, population, economic drivers and climate.

4. CARBON NEUTRALITY REQUIRES ACCOUNTABILITY

Carbon neutrality is a framework of accountability. To be carbon neutral, each year we will measure the emissions produced by the Flagstaff community – those we were not able to avoid through emissions reductions (mitigation). We must then remove an equal amount of carbon dioxide from the atmosphere in order to arrive at carbon neutrality, or net-zero emissions.

In this way, the carbon neutrality framework has a built-in accountability feature: regardless of the City's success at reducing emissions, the City can still meet the goal of carbon neutrality through carbon dioxide removal (CDR). The City must use a combination of emissions reductions and carbon dioxide removal to get to net-zero emissions, balancing both sides of the scale, as seen below in Figure 3. If we fail to meet our emissions reduction goals, then our removal obligation will increase proportionately. Similarly, if we exceed our emissions reduction goals, then our removal obligation will decrease. Read more about our plans for CDR on page 97.

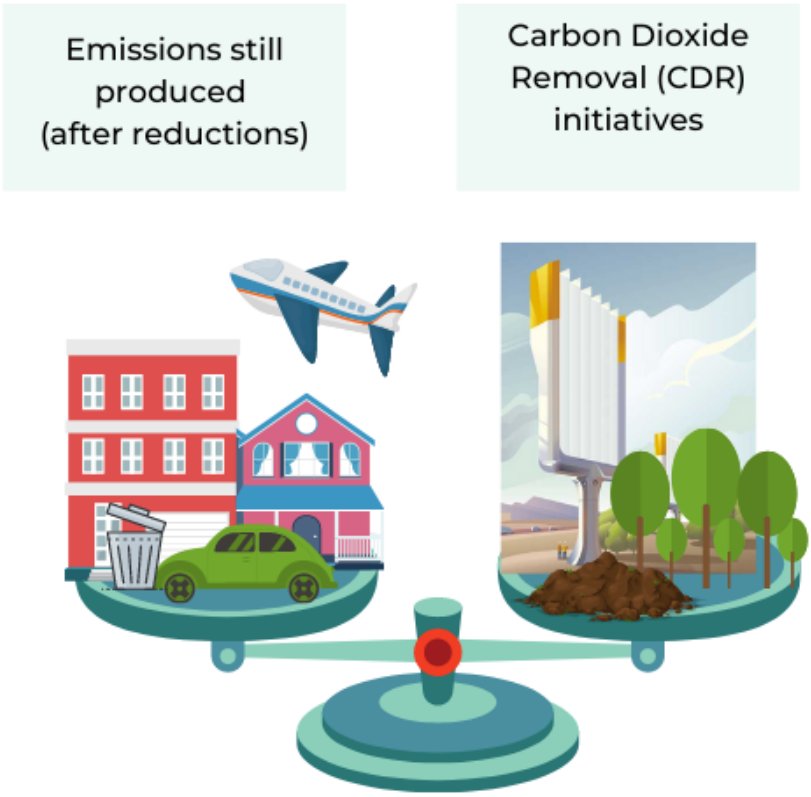


Figure 3. The two sides of the carbon neutrality scale: On the left side are the remaining emissions still produced (after reductions). On the right side is carbon dioxide removal. The two sides of the scale must balance out to achieve carbon neutrality. (Note: the mechanical tree illustration on right side of scale is courtesy of the Arizona State University Center for Negative Carbon Emissions.)

5. CARBON NEUTRALITY IS AN INVESTMENT IN OUR FUTURE

Taking climate action and avoiding the worst impacts of climate change makes sense economically and morally. Action is far less expensive and far more beneficial than inaction. Like forest health measures taken to avoid catastrophic wildfire, climate action is an investment in our future.

> In Flagstaff, forest protection provides a sobering example of the need for preparation: The 2010 Schultz wildfire and post-fire flooding had a total impact between $133 and $147 million.[1] By comparison, the phase one of the Flagstaff Watershed Protection Project (FWPP) required a $10 million investment from Flagstaff residents. This down payment on forest health will help Flagstaff avoid high-severity fires that could cause devastating flooding, and is projected to help the Flagstaff area avoid between an estimated $573 million and $1.2 billion in damages.[2]

Just as individuals prepare for retirement, climate action takes intentional preparation. It is said that the best time to start investing for retirement is 15 years ago, and the next best time is now. Like retirement, it may be helpful to approach the spending that will be required on climate action with an investment mindset. Investments require spending, but they also produce returns and benefits. The earlier someone starts investing, the easier and less expensive it will be for them to meet their retirement goals. The longer someone delays investing, the more difficult and expensive it becomes.

Investments in climate action are no different, and these investments produce returns for ourselves and future generations. The 2019 UN Gap Report shows that if governments worldwide had started 10 years ago, we could have made relatively modest and gradual investments to achieve annual emissions reductions of just 3.3%. Figures 4 and 5 show the reductions required based on different action timeframes.

Because of our collective delay, the necessary investments will need to be more significant and rapid to achieve the annual global reductions of over 7.6% per year that are now required.[3] That trend only continues with further delay. Indeed one recent study concluded that if the U.S. starts investing now in efforts to reach net-zero emissions by 2050, the total spending required would be nearly half as much compared to delaying our investments until 2030.[4] When it comes to making investments to achieve goals, the amount of time remaining can be either the greatest asset or biggest liability. There may still be enough time to meet our climate stabilization and adaptation goals, but only if we accelerate our ambition and start making the necessary investment contributions.

It is said that an ounce of prevention is worth a pound of cure. Part of the investment mindset is evaluating both the cost of action as well as the cost of inaction. Choosing to avoid oil changes only appears to save a

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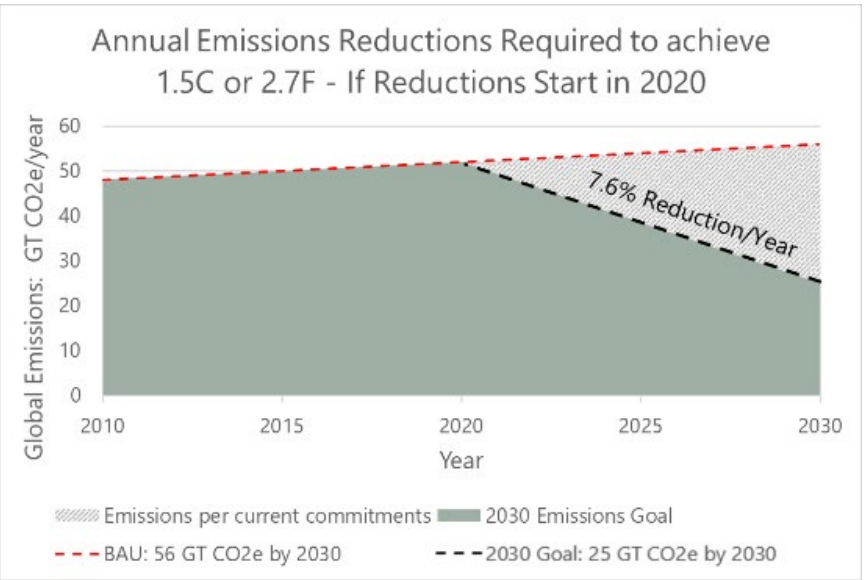
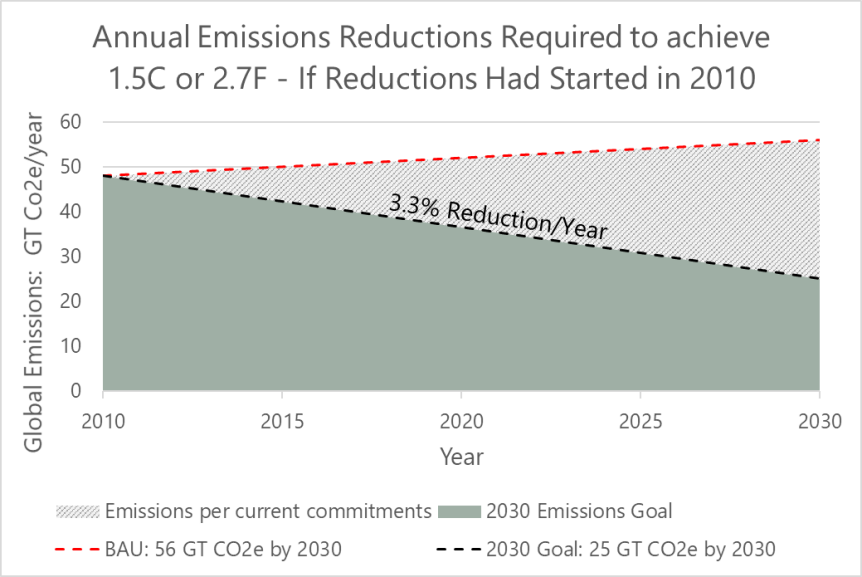
[1] Full Cost Accounting of the 2010 Schultz Fire: http://openknowledge.nau.edu/1282/1/Combrink_EtAl_2013_ERIWhitePaper_SchultzFullCostAccounting.pdf
[2] The Cost of Inaction: Flagstaff Watershed Protection Project Cost Avoidance Study: https://arizonastatelawjournal.org/wp-content/uploads/2016/04/Fox_Final.pdf
[3] https://www.unep.org/interactive/emissions-gap-report/2019/
[4] https://energyinnovation.org/wp-content/uploads/2021/01/Cost_of_Delay.pdf





Figures 4 and 5: Depictions of the worldwide greenhouse gas reductions needed to achieve 1.5C (2.7F). Graphs reproduced from 2019 UN Gap Report Interactive Dashboard

car owner money until their engine seizes. Likewise, avoiding investments in climate action only gives the appearance of saving money until it clearly, irreversibly, and perhaps quite suddenly, doesn't. While there is a high level of uncertainty about what the exact cost of the required level of climate action will be on a global scale, there is a high level of agreement that **the risks and cost of inaction will be far greater**.[5] This consensus on the cost of inaction comes despite the fact that there are many externalities that economic models often struggle to measure (See the Social Cost of Carbon section on page 41). The City's Climate Emergency Declaration recognizes that the time to invest in our future is now.

[5] https://policyintegrity.org/files/publications/Economic_Consensus_on_Climate.pdf

6. CARBON NEUTRALITY IS SUPPORTED BY MARKET LEADERS

The market is moving towards climate action. Private companies and institutions across the world are acting based on scientific data to protect their investments and ensure their own financial health into the future. Climate action can represent a financial opportunity – from electric cars to solar systems, new companies have already made a global impact and large profits from providing climate solutions.

Market conditions are changing quickly, and the cost of climate action is falling as investment ramps up. Solar panel technology represents a telling example. Investments and advancements have caused the price of solar to fall 82% from 2010 to 2018.[6] Just ten years ago, we could not have anticipated that solar would now be the least expensive form of energy in history, according to the International Energy Agency.[7]

Technology is rapidly advancing in electric vehicles, home electrification, and carbon dioxide removal, too. The market will assist in climate action in these areas, bringing down the cost of beneficial technologies that make climate-friendly investments the obvious choice, simply on short term return on investment scenarios.

These market trends have three central implications for this Plan:

- Advances in technology will continue to bring down costs for climate action, resulting in savings for governments, businesses, and residents.
- Developing cost estimates for strong climate action has significant uncertainty, due to the rapidly changing market conditions. Action may not be as expensive as it looks today, and it will certainly be less expensive than inaction.
- This Plan must be flexible to adapt to the changing market conditions and take advantage of new technology.

The global move towards climate action in the private sector will create opportunities for the City of Flagstaff and its residents. The City of Flagstaff will be ready to partner with local, regional and national businesses in taking climate action.

[6] https://www.pv-magazine.com/2018/01/13/8th-irena-assembly-report-finds-utility-scale-solar-lcoe-falls-73-since-2010/
[7] https://webstore.iea.org/world-energy-outlook-2020

Flagstaff will…

- Be a leader
- Embrace the Big Shift
- Balance community tensions and create opportunities
- Center equity and adaptation

7. FLAGSTAFF WILL BE A LEADER

Although climate change is one of the more important challenges the world has ever faced, the international community has not taken necessary action. Due to inaction, climate change will cause coastline loss, crop failure, mass migration, and famine. The consequences for the world's poor are dire.

Leadership is needed both worldwide and in Flagstaff. Flagstaff is a part of the global community of cities and so Flagstaff's actions, along with the actions of every other city, contribute to the global fight against climate change.

Flagstaff will see both negative impacts and opportunity from climate change – the coming climate changes and related impacts to our community are outlined starting on Page 104. We must make the investments needed to avoid the worst scenarios of global temperature rise, while preparing for a future in a changing climate.

Leadership in climate action will require courage, bold action, and investment to ensure a safe future. Leaders are needed throughout the Flagstaff community: we need leaders in the business sector, within regional public agencies, among developers, throughout our neighborhood organizations, and in our schools.

As of spring 20201, examples of leadership can be found both near and far:

- In April 2021, **the federal government** established a goal to reduce greenhouse gas emissions from 2005 levels by 50% to 52% by 2030 – a goal that is strongly aligned with this Plan's mitigation goal. This goal reflects the need for urgent action and the benefits of acting on climate. It also provides significant opportunity for local governments who are ready to partner with the federal government to develop programs with local benefits.
- **Businesses** are reading the same reports, coming to the same conclusions, urging governments to set align their targets with the urgency that is needed this decade, and committing to climate action and investment themselves.
- The **We Mean Business coalition**, comprised of over 1,776 companies that "recognize the transition to a zero-carbon economy is the only way to secure sustainable economic growth and prosperity for all," sent an open letter to the Biden administration supporting the 50 to 52% reduction by 2030 goals, calling the target "ambitious and attainable."
- Over 1,300 businesses and investors joined 165 local and tribal governments, including Flagstaff, as part of the **America is All In** campaign to support the same national targets.

- **Arizona Public Service (APS)**, which is Flagstaff's electric utility company, has committed to transitioning to a 100% carbon-free electric grid by 2050. Salt River Project (SRP) recently committed to doubling its renewable electricity capacity by 2050, driven by demand from business customers.
- **Arizona Forward** has membership from over 150 public and private organizations across the state that recognize the need to "address the increasingly harmful climate impacts and shape Arizona's long-term future… This is why we focus on brining local businesses and municipalities together to work toward actionable solutions – because inaction is not an option."
- Over 545 companies have become signatories to the **Business Ambition for 1.5C** commitment.
- Numerous companies from all sectors of business are recognizing the need for innovation and investment in solutions this decade, to bring down the costs and bring up the volume of necessary strategies that are not yet mature. Many companies - from Stripe to Microsoft to Shopify and others - are **voluntarily putting their assets to work** to accelerate the development of these necessary technologies and approaches.
- Cities across the world are moving forward. **Tucson** recently declared a climate emergency and set a goal of carbon neutrality by 2030. **Phoenix** has a carbon neutrality goal of 2050. Over 80 U.S. cities have committed to 100% renewable energy, from Moab, Utah and Orlando, FL to St. Louis, MO, and Fayetteville, AR to Denver, CO and Norman, OK.

Flagstaff is well-positioned to lead in Arizona.

Flagstaff is on the forefront of climate action in Arizona. This leadership stance will require bold action, risk, and even discomfort as we challenge the status quo and chart new paths for small cities. Flagstaff's leadership can help to move the needle, opening the way for other communities to make strong commitments and taken aggressive action.

8. FLAGSTAFF WILL EMBRACE THE BIG SHIFT

The framework of carbon neutrality establishes the 'rules of the game' for our work. Going forward, our community and our leadership will need to continuously evaluate and determine the 'gameplan.'

As we began developing this inaugural Carbon Neutrality Plan, we asked what level of emissions reductions might be possible in Flagstaff, before relying on carbon dioxide removal initiatives. This question resulted in an initial maximum reduction scenario that suggested that Flagstaff might be able to reduce local emissions by as much as 80% if we committed to ambitious, transformative change, and if favorable supporting actions and policies were quickly implemented at the utility, State and Federal levels.

Many of the actions in this initial maximum reduction scenario might be framed as being 'technological substitutions' or 'behind the scenes' actions that are critical but not especially noticeable in terms of how they might impact someone's daily life. For example, when someone turns on the faucet and feels warm water, they cannot tell whether that water is heated by a fossil fuel like natural gas or by a clean energy source like renewable electricity. Likewise, an electric car is still a car, and the way that car functions on a

daily basis is not very different whether it is an electric vehicle (EV) or a car fueled with gasoline. These technological solutions don't cause much disruption to daily life in Flagstaff.

Other actions and outcomes in the initial maximum reduction scenario would be more noticeable, disruptive, and ultimately transformative. This sense of disruption can be especially heightened if thinking about the outcome taking effect today, overlooking the years-long transition and the supporting actions that have yet to be implemented. Many of the actions and outcomes related to the key strategy of decreasing dependence on cars are likely to be some of the most noticeable. Imagine being able to dramatically cut the total miles driven in Flagstaff while people are still able to socialize, shop, and otherwise meet all daily needs. This outcome can only be realized if we fundamentally shift our approach to neighborhood design and transportation. We would build our transportation corridors with various forms of micro-mobility as primary goal, rather than supporting the continued growth of automobile travel. We would build our neighborhoods so they are more connected and complete; people wouldn't have to travel across town as often because they can get most of what they need nearby. This would require increasing the housing options, density, and businesses or services available in and around our neighborhoods. These 'noticeable' actions that maximize local emissions reductions by changing aspects of our community design and transportation systems are what we call the "Big Shift."

This Plan involves elements of both technological substitution as well as the "Big Shift." While the initial maximum reduction scenario was deemed to be infeasible due to various constraints, this Plan envisions a 44% reduction in emissions before carbon dioxide removal. This Plan includes the goal of maintaining the same level of vehicle miles traveled (VMT) that Flagstaff drivers traveled in 2019. Historically, VMT has steadily increased over time, and given that the Flagstaff's population is expected to continue growing, flattening this metric over the next 9 years will be large undertaking that will require a new approach – The "Big Shift." **For more information on VMT and detailed actions required to make the Big Shift**, see the Decreased Dependence on Cars target area on page 53.

9. FLAGSTAFF WILL BALANCE COMMUNITY TENSIONS AND CREATE OPPORTUNITIES

Flagstaff, like other communities, faces a multitude of community challenges and competing priorities. While there are strong benefits to carbon neutrality, there are also areas where climate action goals may seem to conflict with other community priorities. To achieve carbon neutrality and create a stronger community, Flagstaff must acknowledge the tensions between issues and seek to find common ground and mutual benefit. Tensions can arise between seemingly innocuous issues – as the City searches for the best fit for lighting that achieves both dark sky preservation and energy efficiency, or as residents grapple with the need for more housing and less driving or changes to how our community looks.

The tensions between climate goals and other community priorities must be met with open dialogue, innovative thinking, and good faith that we can find creative solutions that help Flagstaff move forward a vision for a healthier, more inclusive community.

Flagstaff's Housing Crisis is one example of the complexity of community challenges. Affordable and additional housing in Flagstaff has been a documented need for more than 50 years and has reached a crisis level in recent years. In December 2020, the City Council declared a Housing Emergency, and set in

motion the need to make housing a leading priority for the City organization and Flagstaff community, similar to carbon neutrality. Balancing these priorities is achievable, when approached holistically.[8]

Diving deeper into this discussion, is building electrification. Building electrification is gaining attention as one of the most affordable and effective tools to reduce greenhouse gas emissions from homes and buildings. While electrification has promising benefits for residents, it must be pursued equitably. It will require intentional policymaking and a planned transition for Flagstaff residents to gain access to the major benefits of electrification, including cleaner air, healthier homes, good jobs and empowered workers, and greater access to affordable clean energy and energy efficiency to reduce monthly energy bills.

- Building electrification means eliminating use of fossil fuels for functions like heating and cooking and replacing gas appliances with alternatives that use electricity. In Flagstaff, 50 percent of our greenhouse gas emissions come from the buildings we live and work in. As our electric grid gets steadily cleaner, building electrification can play a big role in fighting climate change.
- Electrifying our homes also has major health benefits. Burning gas releases nitrogen oxides and particulates, which can have serious health consequences.

Building electrification must focus first and primarily on the goal of improving the health and resilience of the people rather than the goal of decarbonizing our building stock. To do so, programs that promote electrification must integrate with energy and non-energy programs alike. An equitable transition will meet people where they are. Instead of adding one more problem for families to solve, an equitable transition will position electrification as a solution to existing household difficulties —one that lowers bills, improves health, and makes homes more comfortable.

Renters Have Limited Control - Today, 55 percent of Flagstaff residents are renters. Even if they do not bear the direct cost of electrification, low-income renters, especially low income renters, nevertheless face barriers to electrification because they lack the property rights to make the decisions required to electrify their homes, such as switching out water heaters, stoves, or other appliances and upgrading the building's electrical lines and panels. Even if these residents wish to live in healthier, cleaner homes, the decision to electrify their building is out of their control and is up to the property owner.

Owners Have Few Incentives to Invest When Renters Pay the Utility Bill - Improvements to energy use, like solar, energy efficiency, and building electrification, primarily produce benefits for the person paying the bills even though the cost of improvement falls to the owner. This creates a split incentive which requires countervailing incentives to correct. This effect is exacerbated by Flagstaff's ongoing housing crisis, in which the demand for housing outstrips the supply, giving landlords little incentive to make clean energy investments. Renters rightly fear that an upgrade could cause their landlords to increase their rent, or convert the property to a short-term rental that could be more lucrative for the property owner. Currently, no regulatory or statutory protections ensure that Flagstaff renters who live in building that receive energy

[8] https://greenlining.org/wp-content/uploads/2019/10/Greenlining_EquitableElectrification_Report_2019_WEB.pdf

upgrades can remain in their homes with no increased rents after the upgrades are performed, or require that rent for upgraded properties remain at a price affordable to low-income residents.

Electrification will be the most effective with a whole-systems building approach, prioritizing energy efficiency, electrification then on-site renewable energy systems.

There are no quick fixes, addressing our housing and climate emergencies require on-going collaboration, hard conversation, and collective action.

10. FLAGSTAFF WILL CENTER EQUITY AND ADAPTATION

Equity and adaptation are two of the three core goals of this Plan. The importance of these principles was established in the 2018 Flagstaff Climate Action and Adaptation Plan, and their importance is maintained in our Carbon Neutrality work.

Adaptation and resilience

Adaptation refers to actions that increase the ability to withstand, respond to, or cope with climate change impacts.

As we work to reduce greenhouse gas emissions, Flagstaff must continue to prepare for climate change. Adaptation, or adapting to the changing climate and preparing for its impacts, is critical for any forward-looking organization. While we work to avoid the severe temperature changes that will cause irreversible damage to our ecosystem, we must accept that climate changes are already occurring and will continue to occur. Global action must be taken to reduce the amount the climate changes and lessen the catastrophic consequences. At this point change cannot be avoided.

For local governments, adaptation must be part of its emergency planning and hazard mitigation, its economic development forecasting, and its housing and land use planning.

For every mitigation action we take to reduce greenhouse gas emissions, the City and its partners must consider the adaptation impacts and opportunities. The City must not take actions that result in a reduced ability to adapt in the future or make it more difficult to thrive among the temperature and aridity changes that Flagstaff will see.

Adaptation is achieved by building **resilience** – strengthening community systems to create stronger networks, more connected community members, and flexible systems that are prepared for change. **This Plan will work to advance community resilience by analyzing all actions through** an adaptation lens, to ensure that the action is helping to increase resilience and will help residents thrive amidst future changes.

Specific strategies to advance adaptation are discussed in the Community Resilience target area - see page 46 for more information.

Community Equity

The City of Flagstaff seeks to serve community members equitably through all of its work in the Flagstaff community, from ensuring children from low-income families can access recreational programming to filling gaps in the sidewalk network to serve more residents. Because climate change will cause such disproportionate impacts to our vulnerable community members, it is even more important to act equitably.

Equity is defined as the just distribution of the benefits of climate protection and alleviation of unequal burdens created by climate change.

Climate change affects people differently. While all populations are at risk of being impacted by climate change, certain groups are more vulnerable than others. Factors that influence climate vulnerability include:

- Age
- Education level
- Gender and sexual orientation
- Health, ability, and disability
- Immigration Status
- Language abilities
- Level of housing security
- Neighborhood or physical location
- Race and ethnicity
- Social ties
- Socioeconomic status and income
- Technology and internet access
- Working conditions, including exposure to the elements

Inequity in our society means that some individuals are better able to respond to change or stressors than others. Today, different groups in Flagstaff have different levels of resilience, or ability to withstand challenges like a power outage, school closure, or a medical emergency. One's financial security, housing security, social network, job flexibility, or access to internet might impact their ability to adjust to changes in circumstances. Already, low-income residents, communities of color, and Indigenous individuals disproportionately experience environmental harm and health impacts from pollution. Existing advantages and disadvantages will be exacerbated by the stresses, hazards and long-term shifts that result from climate change.

While Flagstaff takes action to reduce emissions and prepare for climate change, it must consider vulnerable communities and pre-existing inequities. Flagstaff must ensure that those most at risk are protected and avoid negative impacts that would increase inequities. Flagstaff must also ensure that the

benefits of climate action are equitably distributed across all groups, and that all groups can access climate programs. The City will work to advance community equity by analyzing all actions through an equity lens.

Specific strategies to ensure equity are detailed in the Equitable Systems target area. See page 49 for more information.

Relationships among the three goals

The three overarching goals of this Plan - mitigation, adaptation, and equity - are deeply interconnected. Since the framework of carbon neutrality is specific and quantitative in nature, attention to the numeric mitigation impacts has been spotlighted. However, the focus on mitigation to satisfy the quantitative framework should not overshadow these other goals.

In many cases, actions that reduce emissions often have adaptation and equity co-benefits. This can be particularly apparent when mitigation actions serve disadvantaged communities first while also increasing individual, family, and community resilience. For example, a large-scale effort to retrofit homes of low-income residents has the following benefits:

- Reduced energy demand, leading to reduced emissions (**mitigation**),
- Increased resilience of the homes, the community, and the energy infrastructure to withstand shocks (**adaptation**), and
- Improvements in affordability for the occupants, through greater comfort and lower monthly operating expenses of the homes (**equity**).

Home retrofits offer obvious benefits for all three goals. However, some mitigation actions offer few adaptation and equity co-benefits. These actions, with minimal benefits to adaptation and equity, should be given less emphasis and fewer resources. For example, transitioning to electric vehicles (EV) is a piece of the puzzle for lower emissions from transportation. However, too strong an emphasis on supporting EV adoption by individuals can be a distraction from more impactful, equitable strategies that would be accessible to the larger community and not only those who can afford a new electric car. Rather than thinking about how to subsidize getting another car on the road, electric or not, the City's focus and resources should prioritize transforming our community with infrastructure and policy to support biking, walking, public transit, and other forms of micro-mobility. This guidance is reflected in the framing and actions within this Plan's Target Areas related to transportation: Decreased Dependence on Cars and Electric Mobility.

The goals of equity and adaptation were used to evaluate all proposed mitigation strategies; actions with a high level of co-benefits will receive greater emphasis and more resources in Plan implementation. Going forward, this Plan will be reviewed by an Equity Advisory Committee, as will every subsequent annual update.

Climate action in flagstaff will:

- Produce co-benefits
- Rely on partnerships
- Prioritize incentives
- Be an iterative and adaptive process

11. CLIMATE ACTION IN FLAGSTAFF WILL PRODUCE CO-BENEFITS

In addition to reducing our emissions, carbon neutrality can lead to healthier air quality, more secure water resources, more accessible and affordable transportation options, and a more diverse and robust economy. A carbon neutral city is one where neighbors help neighbors, people have multiple options for getting around town, and families have access to clean air and healthy homes.

Climate action has extensive co-benefits that can improve quality of life in Flagstaff and strengthen our community. During Plan implementation, the City will prioritize actions that have multiple co-benefits, from resilience and equity to return on investment and improvements in health.

The table below describes some potential benefits of climate action:

Mitigation action	Benefits
A new FUTS path	Low-emissions ways to get to work Healthy ways to travel to the store or to see friends New opportunities for socializing and meeting neighbors
Energy efficiency retrofit in a local office building	Lower emissions from heating space and water Reduced energy costs Healthier indoor air quality
A new community garden	Lower emissions food Access to healthy and delicious food Mental, social and physical health improvement opportunities for neighborhood residents
Reduced parking requirements in a new apartment building	Less space dedicated to parking, leading to decreased stormwater impacts and increased walkability Reduce vehicle miles traveled Lower total cost of the apartment building construction, leading to lower cost of housing De-coupling of rent and parking fees, so that renters who do not need parking don't have to pay for it

12. CLIMATE ACTION IN FLAGSTAFF WILL RELY ON PARTNERSHIPS

This Plan illustrates what the City of Flagstaff will do to reach carbon neutrality. However, the City will not be able to achieve its goals without collaborating with residents, businesses, and organizations. The City will create high-quality and high-impact support for businesses and residents as we move towards carbon neutrality. Local, regional, federal, and state partnerships are necessary to move Flagstaff in the right direction.

- The City will engage residents and partner with community organizations to change behavior and develop creative local projects, to complement work on systemic shifts and policy change.
- While this Plan's strategies focus on actions the City can take, it highlights areas where legislative change is needed, and where community engagement can lead to positive climate and resilience impacts. The City looks forward to working with the state legislature to capitalize on opportunities for action, investment and benefits for all of Arizona.
- The Federal Government will be an important partner in climate action. The U.S. Government has set a goal to reduce greenhouse gas emissions by 50% by 2030 and to achieve 100% renewable energy by 2035.[9] Due to this Plan and its carbon neutrality goal, the City will be well-positioned to take advantage of federal programming and opportunities for investment.
- Regulatory organizations will also play a key role in shifting energy sources from natural resources (e.g., coal, oil, natural gas) to renewable and more sustainable options (e.g., solar, wind, hydroelectric, electric).
- Local businesses will be perhaps the City's most important partners when transforming our systems. Climate action creates jobs, and local companies can assist with taking rapid action. Examples of projects already creating jobs in Flagstaff include home weatherization, appliance electrification, rooftop solar installations and native landscaping projects. Larger opportunities might include infrastructure improvements to prepare for increased flooding, innovations in forest products, new bike trails and pedestrian crossings, and net zero building construction.

Climate Action Among Flagstaff Businesses

Economic health is an important aspect of climate action, and so collaboration with local businesses will be vital in implementing this Plan. City staff will provide support to businesses in decreasing their greenhouse gas emissions and adapting to expected climate changes, as well as creating a Business and Climate Working Group to improve communication between local businesses and the Sustainability Section, to ensure that the Section is appropriately providing support for local businesses.

[9] https://www.reuters.com/business/sustainable-business/exclusive-white-house-pushing-80-clean-us-power-grid-by-2030-2021-04-26/

Businesses across Flagstaff are taking climate action, and seeing results both in operational savings, community support and revenue. A few examples:

- Flagstaff is home to operations and retail locations of several national corporations that have goals to significantly reduce greenhouse gas emissions. Purina has corporate goals to achieve net-zero greenhouse gas emissions by 2050. REI and Walmart are part of the We Mean Business coalition working to reach net zero emissions by 2050, referenced on page 23.
- Rooftop Solar and Prometheus Solar, local Flagstaff companies, were selected by the Northern Arizona Solar Co-op to install solar for more than 80 households across Flagstaff, Sedona, and Coconino County. In partnership with the City, the Northern Arizona Coop was organized through Solar United Neighbors, a non-profit organization that seeks to increase the access and affordability of solar energy.
- Hotels across Flagstaff are taking climate action. The Flagstaff Drury Inn & Suites is the first LEED-certified hotel in Arizona. The DoubleTree by Hilton Flagstaff has already seen significant energy, water and waste savings from its environmental initiatives; Hilton , the global hospitality company, has committed to cutting its environmental impact in half by 2030, including a 60% reduction in emissions by 2030.
- W.L. Gore & Associates, a large Flagstaff employer, has set a corporate goal to reduce their greenhouse gas (GHG) emissions from manufacturing sites and offices by 60% 2030, and work towards carbon neutrality by 2050.

These are just a few examples of the many Flagstaff businesses working to reduce their impact and create climate solutions.

The City will work to partner with local businesses to learn about barriers and opportunities, and help them to ramp up their climate action efforts. The City will encourage businesses, institutions and even individual households to set their own carbon neutrality goals and create plans for how to get to net zero GHG emissions. The City can lend support, share resources, create connections to help share lessons learned opportunities, and highlight success stories. A carbon neutral Flagstaff will be a community effort, buoyed by the efforts of residents, businesses and organizations all working on their own carbon neutral journeys.

13. CLIMATE ACTION IN FLAGSTAFF WILL PRIORITIZE EDUCATION AND INCENTIVES

The City of Flagstaff will not be able to reach carbon neutrality alone – as discussed elsewhere in this document, many actors are needed to reach our climate goals. The City will seek to encourage behavior change like it works to shape behaviors in many different areas, from water conservation to courteous driving to recycling and shoveling snow off sidewalks. The City supports community oriented behavior through multiple approaches – from, encouragement campaigns on social media, educational events, to incentives and mandated codes.

The City will fist provide educational resources, incentives, and behavior change programs to encourage community members to take climate action. In some instances, it may make sense to set minimum

standards that provide wide community benefits, through City codes or ordinances. The City's pursuit of carbon neutrality will use education and incentives as a first step towards behavior change whenever possible.

Residential energy use provides an instructive example. Today, the City works to reduce emissions and expenses from residential energy use through a multi-pronged approach:

- Encouragement via social media and public events.
- Education through tips and resources on the City's energy web site.
- Support through the free Home Energy Efficiency workshop series, which is offered both live and at-your own pace, and in both English and Spanish, and provides attendees with a free bag of supplies to make small changes in their own homes.
- Incentives for energy efficient appliance upgrades via the Home Energy Retrofit Rebate Program.
- Minimum energy efficiency standards through building codes for new buildings.

The City will use this multi-pronged model to develop programs that help residents and businesses reduce their emissions, relying first on education, engagement, and incentives to facilitate action and behavior change. When larger scale changes are needed that provide significant benefits to health, safety and welfare and build a stronger Flagstaff, the City will look to code changes and ordinances.

14. CLIMATE ACTION IN FLAGSTAFF WILL BE AN ITERATIVE AND ADAPTIVE PROCESS

The climate emergency is an evolving state, with the possibility for new challenges and opportunities. The pace of change is accelerating, and technologies are rapidly advancing. The coming years will see improved batteries and new approaches to carbon sequestration. Changes in federal and state policies can be expected, as well as shifts in markets and significant cost reductions. Conditions on the ground are changing as well: Flagstaff's monsoons are more variable, wildfire patterns are shifting, and our community is adjusting as housing, employment opportunities and tourism evolve.

Accordingly, the Carbon Neutrality Plan must be a **living document** – grounded in core principles but flexible in its approach. To reflect changing conditions and an expanding knowledge base, the Plan is a framework for action, not a detailed list of exact actions that the City of Flagstaff will take. This framework provides the broad strategies the City will undertake to achieve carbon neutrality: the strategies of decreasing dependence on cars and using clean electricity, for instance, illustrate the general direction that Flagstaff must go.

Achieving the target of climate stabilization has often been compared to the Moonshot target of the 1960s, though with considerably higher stakes. Similar to this effort, there was less than a decade to act and when President Kennedy declared in 1962 that "we choose to go to the moon this decade and do the other things…" Similar to this effort, when Kennedy made his speech it was acknowledged that "To be sure, we are behind, and will be behind for some time in manned flight. But we do not intend to stay behind, and in

this decade, we shall make up and move ahead." Nobody at the time could say *exactly* how the goal would be achieved – it was known that we would need to learn things that were at the time unknown, that a preliminary plan would be developed but that the plan would need to constantly evolve. And while it may not have been known *exactly* how we would get there, setting and committing to the goal spurred the action, innovation and investment that was necessary to make it happen.

How will this living document work?

- The City will continuously work with the community during Plan implementation. There will be a continuous loop for feedback, development, refinement, and adjustment. City staff will regularly communicate with the City Council, the Flagstaff community, and local organizations to provide updates on our work and solicit feedback.
- This Plan will be available in an online format for easy review of its strategies and actions.
- This Plan will be updated on an annual basis to allow for shifts in tactics, capitalizing on new technologies, opportunities and creative partnerships to meet the City's goals. This annual process will provide for increased transparency so the public is informed of how the City's actions are evolving and can provide feedback to influence the City's work.

Carbon neutrality is a goal that will involve creativity, learning, and leadership, in addition to continual adjustment to adapt to new obstacles and opportunities. The City will keep the community involved in this iterative process, through regular communications, community conversations to assess priorities and address tensions, and annual reporting.

III. IMPLEMENTATION

IN THIS CHAPTER:

1. Flagstaff's mobilization will be guided by the Climate Emergency Declaration
2. Priority action steps: years one through three
3. City of flagstaff actions needed
4. Advancing state policy
5. Community actions
6. Community engagement and education
7. Accountability
8. Funding

FLAGSTAFF'S MOBILIZATION IS GUIDED BY THE CLIMATE EMERGENCY DECLARATION

The Climate Emergency Declaration outlines the following priorities for the mobilization of resources. These priorities will guide the implementation of this Plan.

The City of Flagstaff will:

- Dramatically increase its **ambition** to combat climate change through **bold action.**
- Ensure this mobilization effort is City-wide, spanning all sectors of the Flagstaff **economy and community.**
- **Prioritize appropriate funding** for the implementation of climate goals and action.
- **Engage and educate** our residents about the current climate emergency and inspiring action, **especially Flagstaff's youth**.
- **Strive for full community participation and leadership** by residents of Flagstaff, community organizations and other allies.
- Keep the concerns of **vulnerable and historically underserved communities** central to all climate emergency mobilization efforts and facilitate their active participation in this work.
- Develop and reinforce **respectful collaborations** with surrounding Tribal nations, traditional agricultural communities, regional governments, the State of Arizona, and the U.S. Government.
- Prioritize adaptation and mitigation **in all City decision-making processes**.
- Prioritize the creation of **high-quality, good-paying jobs** with comprehensive benefits for those who will be impacted by this transition.

PRIORITY ACTION STEPS: YEARS ONE THROUGH THREE

Below are initial action steps to implement this Plan.

Items that are bolded have received funding. Items with an asterisk (*) are items that have been applied for funding. The implementation of other actions will depend on funding and policy decisions in the next year.

Target Area	Initial action steps
Community Resilience	Expand the Flagstaff HEPA Purifier Program
	Expand the Resilient Neighborhoods Network
	Incorporate of adaptation elements into the CNP
	Support community-led resilience project through the Neighborhood Sustainability Microgrant Program
Equitable Systems	Launch a wood stove rebate program*
	Launch youth Advisory Committee
	Launch Equity Advisory Committee
	City leadership racial equity trainings
Decreased Dependence on Cars	**Adopt and implement the Active Transportation Master Plan**
	Launch the protected bike lane pilot
	Improve City of Flagstaff codes and regulations to allow for more infill housing and greater density
	Analyze and update City of Flagstaff street engineering standards to consider how street design affects travel choices and contribute to greenhouse gas (GHG) emissions
	Analyze and update the City of Flagstaff traffic impact analysis process to incorporate consideration of GHG emissions and transportation demand management analysis
	Policy changes to remove barriers and incentivize accessory dwelling units (ADUs)
	Analyze and reduce or remove parking requirements
	Adopt and implement the 2021-2031 Flagstaff Housing Plan
	Adopt an air quality protection ordinance for idling and loading zones
Electric Mobility	Facilitate an E-bike collective purchasing cooperative
	Launch new micro-mobility share program
	Provide 14 new EV charging stations at City of Flagstaff facilities
	Adopt a City of Flagstaff electric vehicle procurement policy
	Complete an audit of City of Flagstaff policies

Clean Electricity	**Facilitate a solar panel purchasing co-op for businesses and residents**
	Install solar and battery back-up power microgrids for Flagstaff fire stations*
	Develop and install a solar project at Red Gap Ranch
Fuel switching	Develop a building electrification information hub website
	Provide electrification incentives for homes and businesses
	Highlight businesses and residents successfully electrifying buildings
Reduced Building Energy Use	Launch a residential energy efficiency retrofit incentives*
	Refine and expand the residential energy rebate program
	Provide small business energy efficiency building retrofit incentives
	Launch a Building Code Advisory Group
	Complete an energy audit of City of Flagstaff buildings
	Implement energy retrofits and conservation projects identified by the energy audit
	Update the Sustainable Building Resolution for City of Flagstaff buildings
	Implement a City of Flagstaff electricity rate optimization program
Sustainable Consumption and Waste Management	**Launch the pay as you throw recycling and trash collection pilot**
	Launch Community compost drop-off pilot
	Expand the Neighborhood Sustainability Grant program
	Transition the Materials Recovery Facility (MRF) to a transfer station
Carbon Dioxide Removal	Carbon dioxide removal feasibility analysis
	Develop or support a pilot carbon dioxide removal project in Northern Arizona
Partnerships	Launch a Business Sector Advisory Committee
	Finalize the new NAU Climate Action Plan
	Design and deliver business support tools to assist with advancing climate action
	Recognize local businesses showing climate leadership
Internal City of Flagstaff actions	Develop and encourage a City of Flagstaff Remote Work Policy
	Develop a long-term investment plan for carbon neutrality goals and avoided cost for City Council consideration
	Consider developing a climate bond for voter approval

CITY OF FLAGSTAFF ACTION NEEDED

Flagstaff City Council

The success of this Plan is contingent on the Flagstaff City Council continuing to demonstrate leadership on climate action. Plan implementation also relies on continued public support for climate action.

The Flagstaff City Council will have oversight responsibility for this Plan. They will receive annual updates on Plan progress and make policy decisions, budgetary appropriations, and workplan approvals that will facilitate implementation.

Actions specific to the Flagstaff City Council include:

- Identify goals for the upcoming City Council term that will support Plan implementation.
- Identify City Council budget priorities to support Plan implementation.
- Identify state and federal legislative priorities that support the goals of the Plan and enable implementation of Plan strategies and actions.
- Create policies that reflect the ambition, urgency and need for transformative change required by Flagstaff's Climate Emergency Declaration and its carbon neutrality goal.
- Provide leadership in community conversations around the tensions among competing priorities. See the discussion of balancing tensions on Page 25.

City Leadership

For a city to achieve carbon neutrality, it is critical that every part of the municipal organization is involved in implementation. Leaders at the City of Flagstaff—from the City Manager's Office to division directors and individual supervisors—must proactively consider climate action when conducting City operations.

The City Manager's Office will actively support the Council's climate commitment by requiring the involvement of all City divisions in Plan implementation. Opportunities to incorporate climate action into internal decision-making processes include:

- The budget process
- Procurement decisions
- Division strategic planning
- Facility management

ADVANCING STATE POLICY

The Biden administration has committed to a historically ambitious climate agenda. This will likely result in a profound shift in U.S. federal climate policy. This is critical, as it is not possible to address the climate challenge without federal leadership, and time is running out to avert catastrophic levels of global warming.

At the same time, state-level climate action will remain essential. History has shown that even an engaged U.S. federal government faces obstacle to progressive regulatory and legislative action. In the face of federal gridlock and inaction, state and local governments have played a crucial role in advancing climate action, reducing greenhouse gas emissions, and supporting the continued maturation of key low-carbon technologies.

Greater collaboration across Arizona is needed in order to advance local and federal climate commitments. The City will continue its work with Arizona cities and tribes to develop state-wide climate policies that ensure equitable access to resources, clean energy, climate related quality jobs, healthier air quality, more secure water resources, affordable transportation options, and a more diverse and robust economy.

COMMUNITY ACTION, ENGAGEMENT AND EDUCATION

Community organizing, leadership, activism and enthusiasm led to the Climate Emergency Declaration. Sustained community energy and action will be needed to achieve carbon neutrality in an equitable manner to build a stronger Flagstaff.

This Plan outlines actions that the City of Flagstaff will take to reach carbon neutrality. However, carbon neutrality will require transformational change across our community, and City actions alone will not be sufficient. Action by residents across the community will also be needed. To reach more people, the City will encourage and provide resources for those who are working in their own businesses, schools, and neighborhoods to take climate action as our community works to reach carbon neutrality. The City of Flagstaff will work with many different parties to encourage, support, and activate all segments of the Flagstaff community to take individual, daily actions that contribute to the goals of reducing community greenhouse gas (GHG) emissions, and increasing community resilience and equity.

The City will work with community partners to build capacity and encourage climate action in the community on a daily basis, through social media platforms, events, community conversations, volunteer opportunities, and training. Distinctive opportunities for action include:

- **Highlights of Climate Leaders**: The City will raise up local businesses, schools, and organizations that are taking climate action and developing their own plans to reach carbon neutrality. The City will support those who want to take climate action by providing resources and areas of action.
- **Ideas for Action**: The City will provide information to residents on the best ways to get involved in carbon neutrality. The City will provide extensive information on actions such as: electrifying home appliances, taking trips without personal vehicles, completing energy efficiency retrofits, and decreasing the amount of trash sent to the landfill.

- **Climate Education**: The City will continue designing and providing climate change curriculum for teachers to encourage youth participation in climate action. Additionally, the City will continue to provide and enhance climate-oriented educational programs, building off of the existing Home Energy Efficiency 1010 workshop, the Flagstaff Climate Ambassadors training, and the Sustainability Leaders program.

ACCOUNTABILITY

Accountability will be ensured through consistent and transparent reporting to the community and the Sustainability Commission, which will monitor implementation progress.

A living document

This section presents a structure for ongoing monitoring, evaluation and reporting on Plan progress. Investing in data collection and consistent reporting increases transparency and is a key aspect of implementation. City staff will regularly track and report on Plan indicators, greenhouse gas emissions and notable progress on implementing strategies.

Reporting

The City of Flagstaff has been annually monitoring and reporting both municipal and community greenhouse gas emissions since 2008. These inventories provide insight into Flagstaff's progress and trends in emissions. The City will continue to update the municipal and community greenhouse gas inventories on an annual basis.

Regular reporting will ensure transparency and continued progress. City staff will measure progress on key performance indicators and report to the community regularly. On an annual basis, the City Manager will request that City staff produce a Plan progress report that includes:

- Progress of each Plan strategy.
- Key performance indicator updates, including an annual greenhouse gas inventory.

Evaluation

The Flagstaff City Council and the Sustainability Commission will evaluate the progress of Plan implementation on an annual basis through review of the annual Carbon Neutrality Plan progress report. Informal progress reports will be provided by City Staff at regular Sustainability Commission meetings.

The Social Cost of Carbon

As discussed within the Climate Change in Flagstaff section (page 104), the recent acceleration of climate change is largely attributed to burning fossils fuels and the subsequent release of greenhouse gases into Earth's atmosphere. Climate change poses severe adverse long-term consequences for all sectors of society, including but not limited to disruption of the food supply, higher societal expense for human health, and broad environmental degradation. The damages caused by emitting greenhouse gases are not reflected in the price of fossil fuels or the products powered by them, thus creating externalities, or impacts that are external to any accounting within the economic system.

Climate change is a market failure that burdens society with the costs associated with greenhouse gas emissions while the benefits are accrued by those burning fossils fuels, including the City of Flagstaff. In order to address and correct this market failure, the social cost of carbon (SCC) can be utilized by the City. The social cost of carbon is an estimate, in dollars, of the damages that would result from emitting one additional ton of greenhouse gases into the atmosphere. The SCC puts the effects of climate change into economic terms to help policymakers and other decision-makers understand the economic impacts of decisions that would increase or decrease emissions. Emissions-related damages are expected to occur many decades into the future. However, those damages must be represented using present-day dollar values. The SCC therefore represents the present value of future harm, and the estimated dollar value must be discounted through a specific discount rate.

The City of Flagstaff can incorporate the SCC into its practices to better account for environmental and social concerns when making financial decisions. The prevailing trend for cities and states that move to consider and account for their greenhouse gas emissions is to incorporate a proxy carbon price into their decision making. A proxy carbon price includes the SCC as a hypothetical cost within large, highly-carbon intensive financial decisions. This shadow price will help the City identify and prioritize low carbon production methods, which ideally will become more cost-effective over time. If greenhouse gas emissions were priced to reflect their total cost to society, economic efficiency could be reached through the profit-maximizing behaviors of emitters and consumers. The proxy carbon price would also help the City of Flagstaff ensure that long-lived projects and procurements would become increasingly "future-proof" when it comes to potential future carbon legislation. By considering the social cost of carbon through a proxy carbon price, the City can future-proof their investments against future carbon prices, save money across the lifecycle, avoid locking in long-term emissions, alleviate the burdens of greenhouse gases placed unfairly onto society, and send a clear signal that the City takes efficiency and GHG emissions seriously.

FUNDING

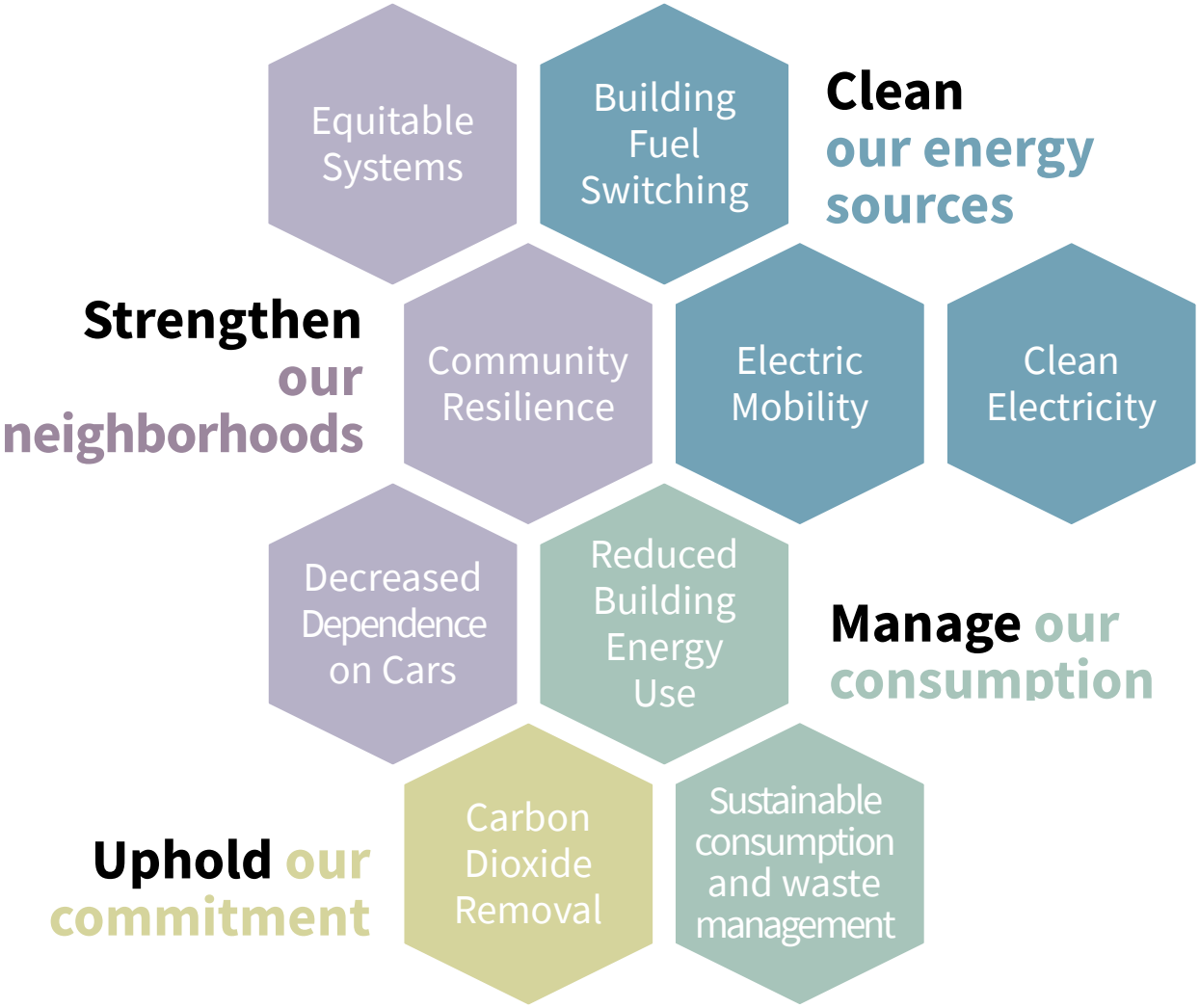
Financial investments are necessary for Flagstaff to reach carbon neutrality. Investing in climate action throughout Flagstaff has many benefits, financial and otherwise. The benefits of adaptation include the costs we avoid by reducing or averting the negative local impacts of climate change, while mitigation helps us avoid damage from larger changes in the climate. Climate action can also be used to strengthen local businesses, support vulnerable community members, and improve quality of life.

Funding for the implementation of Plan strategies will need to come from within the City budget, agency grants, and new revenue sources. Some actions in the Plan require capital investment in City infrastructure. Others will require increases in annual operating budgets. Some actions are potential candidates for state, federal, or foundation funding.

Funding options include:

- Increase existing City fees on certain activities, such as increasing the Environmental Management Fee.
- Propose a new sales tax that would have to be approved by voters, similar to how Cities pay for road projects, municipal buildings, and other large city investments.
- Issue bonds, a mechanism for the City to pay for large infrastructure projects.
- Apply for grants from the federal government and private organizations or foundations.
- Allocate City resources to climate-focused initiatives.
- Establish a local emissions reduction fund, to allow individual donations to fund emissions-reducing projects.

IV. THE PATH TO CARBON NEUTRALITY



To achieve carbon neutrality, we will work through nine target areas of action:

Focus One: Our Neighborhoods

- Community Resilience
- Equitable Systems
- Decreased Dependence on Cars

Focus Two: Our Energy Sources

- Clean Electricity
- Building Fuel Switching
- Electric Mobility

Focus Three: Our Consumption

- Reduced Building Energy Use
- Sustainable Consumption and Waste Management

Focus Four: Our Commitment

- Carbon Dioxide Removal

ABOUT OUR TARGET AREAS

This Plan defines nine target areas of action to reach carbon neutrality. The first two target areas – **Community Resilience** and **Equitable Systems** - reflect overall goals that need to be incorporated into all actions outlined in this plan.

The following six target areas focus on reducing emissions through *prevention*: **Decreased Dependence on Cars**, **Clean Electricity**, **Building Fuel Switching**, **Electric Mobility**, **Reduced Building Energy Use,** and **Sustainable Consumption and Waste Managemen**t.

The last target area, **Carbon Dioxide Removal**, aims to balance community emissions by *extracting and storing* carbon dioxide from the atmosphere.

These target areas are deeply interconnected, with some even being required to unlock the power of others. We will examine these connections further in the sections that follow

Target Area Structure

Each of the nine Target Areas follow the same structure:

- A "Flagstaff will" statement, describing our vision for action in this area.
- What it means
- How we'll get there
- Equity and Adaptation Considerations
- Goals
- Strategies
- Opportunities for action: these provide examples of how the City may achieve this strategy and contribute to the target area's goals. These are provided as EXAMPLES only, to illustrate what actions to active this strategy would look like.
- Legislative change: these areas provide information about legislative policy changes needed at the state or Federal level to support the achievement of the target area goals.
- Connections to the 2018 Climate Action and Adaptation Plan.

FOCUS ONE: OUR NEIGHBORHOODS

We will strengthen our neighborhoods through:

- Community resilience
- Equitable systems
- Decreased dependence on cars

Community Resilience

Flagstaff will increase our ability to anticipate, accommodate, and positively adapt to and thrive amidst changing climate conditions or hazard events while enhancing quality of life, reliable systems, economic vitality, and conservation of resources.

WHAT IT MEANS

Resilience is a community's ability to thrive amidst change. It involves a community's anticipation of and preparation for changing conditions, whether that is short term stressors like a wildfire or severe weather, or longer-term changes like declines in forest health or shifts in the Flagstaff housing market. Resilience requires that communities analyze their vulnerabilities against expected or possible changes, and then proactively adapt to these changing conditions or hazards in a way that actually *enhances* quality of life and builds reliable systems and economic vitality, social cohesion, and resource conservation. Resilience is often grouped with a similar concept, adaptation.

Resilience is reflected in this Plan's overarching adaptation goal:

Goal 2: **Prepare the City's communities, systems, and resources to be more resilient to climate change impacts.**
This preparation will help the City and its residents to be better equipped and prepared to handle both short-term shocks (such as flooding or a wildfire) and long-term change (such as rising housing prices or reduced snowfall). A resilient community is one that can bounce *forward* after a challenge, not only recovering but improving on the status quo.

HOW WE'LL GET THERE

Building community resilience is a long-term process that requires assessment, investment, and relationships building within communities. The City will work in the following areas to build adaptive capacity:

- **A vulnerability analysis** will help the City better understand the extent to which climate changes will affect Flagstaff and different populations within our community. The City will build off of the vulnerability assessment and Climate profile completed for the 2018 Climate Action and Adaptation Plan.
- **Resilience planning** will work across broad stakeholder groups to address the vulnerabilities identified in the vulnerability analysis. This will involve work across City divisions and existing Plans.
- **Education** about the impacts of climate change is a vital aspect of community resilience. The Climate Emergency Declaration calls for education of all Flagstaff residents as well as a focus on

youth education around the impacts of climate change and the actions we can take as a community.

- **Community workshops** with residents and businesses can help community members to better understand Flagstaff's vulnerabilities and risks, and how they can help strengthen their homes, businesses, and neighborhoods.
- **Partnerships** strengthen our community cohesion and capacity for response. There are a variety of opportunities for partnership on resilience initiatives. Other City of Flagstaff departments, like the Fire Department and Water Conservation, will be important partners in building community resilience. Additionally, community organizations and neighborhood groups provide interaction between residents that helps foster the sense of community needed in building resilience.

The activities above will help Flagstaff build capacity, sense risks, respond to disruption, learn and transform – all elements of a resilience engineering approach proposed by Erik Hollnagel – see Figure 6 below. Flagstaff will undertake resilience-building as an ongoing project, continually adjusting as conditions change and our knowledge grows.

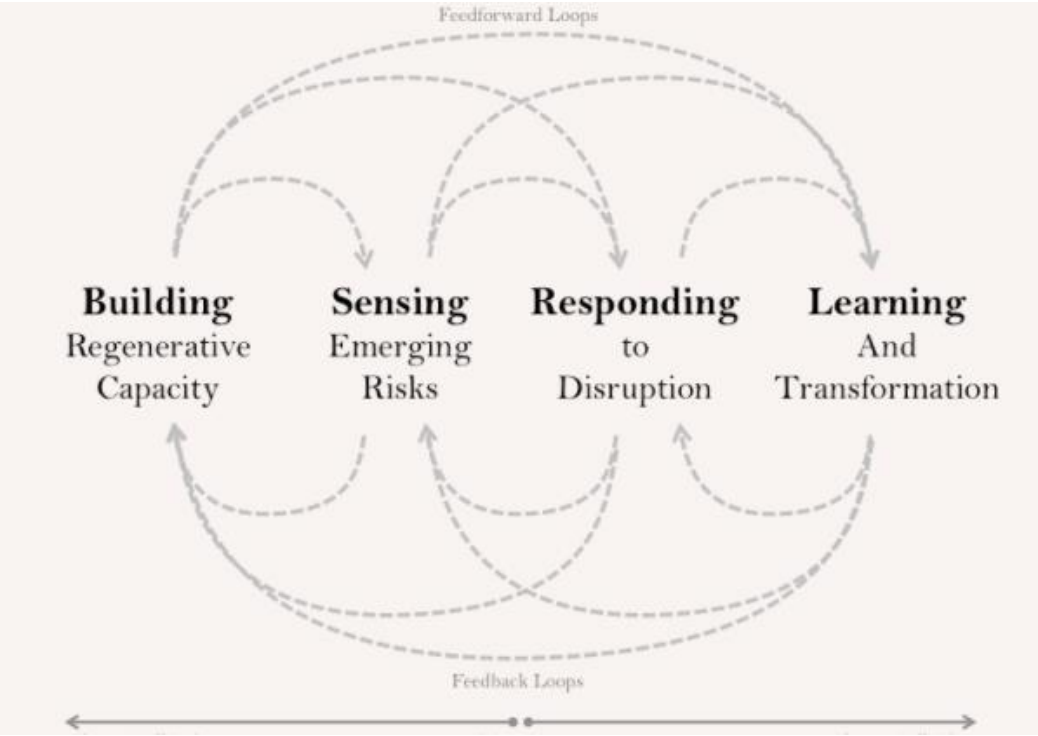


Figure 6: The feedback loops involved in resilience building. Image Credit: Erik Hollnagel

EQUITY AND ADAPTATION CONSIDERATIONS

Equity is interdependent with adaptation and resilience: an equitable community must be adaptable and resilient, in order to ensure well-being for residents through stressors and change. A resilient community must be equitable, because if some residents are disproportionately vulnerable or unable to thrive amongst change, the overall community suffers.

As the City works to increase resilience and prepare for change, the City must look to include residents from all groups. Vulnerable communities often have less ability to adapt to sudden changes or stressors – low-income families may have little disposable income to use if evacuation is needed for wildfires, or a person whose disability prevents them from driving may have difficulty navigating the streets during severe storms. The City should analyze community vulnerabilities and how they relate to resilience and preparedness, and consider vulnerable communities first for programs that improve our ability to thrive.

STRATEGIES TO ACHIEVE COMMUNITY RESILIENCE

CR-1: **Ensure all** mitigation actions improve Flagstaff's ability to adapt to the future.

Opportunities for action:

1. Analyze each climate action that the City takes through an adaptation lens, to ensure that mitigation actions do not decrease Flagstaff's ability to respond to stressors and thrive in the future.

CR-2: Strengthen existing community systems to create resilience to both short-term shocks and long-term change.

Opportunities for action:

1. Host community adaptation forums to discuss expected climate change impacts and how to prepare.
2. Implement and increase involvement in the Resilient Neighborhoods Network to encourage and reward neighborhood-level resilience building.
3. Expand the Flagstaff HEPA Purifier Program to increase resilience to smoke and low air quality, especially for the most vulnerable.
4. Incorporate adaptation-oriented actions from the 2018 Flagstaff Climate Action and Adaptation Plan into this Carbon Neutrality Plan.
5. Incorporate climate change adaptation principles into various other City plans, like the Flagstaff Regional Plan and the Utilities Integrated Master Plan.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Overarching goal 2: Prepare the city's neighborhoods, systems, and resources to be more resilient to climate change impacts.

Equitable Systems

Flagstaff will ensure the fair and just distribution of the benefits of climate action and strive to reduce the unequal burdens created by climate change.

WHAT IT MEANS

Equity is defined as the just distribution of the benefits of climate protection and alleviation of unequal burdens created by climate change. This plan defines vulnerable communities in Flagstaff within the Approach chapter of this Plan on page 28.

Acting equitably requires identifying vulnerable communities, analyzing impacts on these communities, and proactively working to protect them from negative impacts of climate change. These communities contribute the least to greenhouse gas emissions but suffer the greatest effects of climate change and its turbulent impacts. Historical and political systems play a significant role in creating this disparity and will not be easily dismantled.

Equity is an overarching principle that must be integrated into the implementation of this Plan. These principles are located in the *Our Neighborhoods* action umbrella because the necessary changes are not limited to one sector. They must be community-wide, integrated throughout our neighborhoods and the way we do business.

Equity is reflected in the third overarching goal of this plan:

Goal 3: **Address climate change in a manner that prioritizes those most impacted and ensures the costs and benefits of climate adaptation and mitigation are equitably distributed.**
Climate change disproportionally impacts communities of color and low-income neighborhoods. These communities contribute the least to greenhouse gas emissions but suffer the greatest effects of climate change and its turbulent impacts.

HOW WE'LL GET THERE

Considering equity when implementing carbon neutrality goes beyond merely distributing resources equally. Providing equitable access requires meeting community needs in the context of existing vulnerabilities and inequalities. Equity is a guiding principle throughout the Plan implementation process through the following practices:

- Design policies and programs that serve disadvantaged communities first. Target policies and programs at communities experiencing high pollution burdens, low-income, poverty, health issues, and exposure to climate hazards.
- Engage with the community. Proactively engage community leaders on an ongoing basis.

- Use the "operationalizing equity checklist" of the 2018 Flagstaff Climate Action and Adaptation Plan when implementing actions.

Ensuring that participation in climate action is accessible to the entire Flagstaff community will require considering equity in policy, outreach, and infrastructure development. City staff will work to involve diverse community voices from the start of any new initiative and will track progress towards advancing equity.

The most effective climate initiatives achieve greenhouse gas emissions reductions, reduce vulnerabilities, and serve disadvantaged communities. Taking climate action can create opportunities for underserved communities and accelerate the development of market-based solutions. For example, some cities have begun selling used electric fleet vehicles to members of their communities to ensure lower-cost electric vehicles are available to a wider spectrum of the community.

It is also possible that climate action strategies may lead to adverse, unintended impacts. For example, improving bike lanes and adding open space could increase the speed of gentrification and displacement, while additional City fees could add new burdens for low-income communities. The potential for unforeseen impacts to the community will be considered during Plan implementation, and efforts will be made to anticipate and address any such impacts or burdens as they arise.

The City will rely on the concept of **targeted universalism** – defined as "setting universal goals pursued by targeted processes to achieve those goals. Within a targeted universalism framework, universal goals are established for all groups concerned. The strategies developed to achieve those goals are targeted, based upon how different groups are situated within structures, culture, and across geographies to obtain the universal goal. Targeted universalism is goal oriented, and the processes are directed in service of the explicit, universal goal."[10] Target universalism involves supporting the needs of specific groups, in order to achieve our overall goals. Flagstaff will use a targeted universalism approach to ensure that ALL groups can benefit from climate action, from the most underserved populations to the general population.

To further the goals of the Climate Emergency Declaration, the City will dive deep into equity and resilience over the next year. We will host conversations with the community about these elements of climate action, and how we can create systems of accountability as we implement our carbon neutrality goals.

EQUITY AND ADAPTATION CONSIDERATIONS

Adaptation is incredibly important to building equitable systems. Adapting to and preparing for climate change will make Flagstaff more equitable by decreasing the negative impacts of climate change for all residents, and especially for the most vulnerable. If equity is advanced without consideration for future changes and setting the foundations for resilience, the gains in community equity could be lost during a short-term event or over time as the community faces widespread change.

[10] https://belonging.berkeley.edu/targeteduniversalism

STRATEGIES TO ACHIEVE EQUITABLE SYSTEMS

ES-1: Incorporate equity as a foundational element of every climate action the City develops and implements.

Opportunities for action:

1. Analyze each climate action through an equity lens, to ensure that mitigation actions (1) do not have detrimental effects on Flagstaff's vulnerable populations; (2) are targeted to serve vulnerable community members, and therefore are accessible to the larger community; and (3) distribute the benefits of climate action equitable.
2. Provide equity training opportunities for City staff and leadership.

ES-2: Proactively engage community members on an ongoing basis.

Opportunities for action:

1. Launch an equity advisory committee to provide feedback on the City's climate action programming and engagement strategies.
2. Host community conversations to identify and begin to address community vulnerabilities and how different groups are at risk as a result of climate change.

ES-3: Design targeted climate policies and programs to serve vulnerable communities first.

Opportunities for action:

1. For each climate action, identify vulnerable communities that the programming is targeted to serve, as well as any barriers to accessing both City programs and the benefits of the action.

ES-4: Actively seek to recognize past harms, repair trust, and build deeper relationships with community members.

Opportunities for action:

1. Build relationships with organizations and community leaders serving vulnerable communities.
2. Identify areas where vulnerable groups have already been affected by climate change, and where gaps in trust might exacerbate existing disparities in the community.

The Lived Black Experience in Flagstaff

In 2020, the Lived Black Experience CommUnity Coalition hosted a series of community dialogues to highlight the experiences of black residents of Flagstaff and create and to build a strategic framework for truth, justice, and racial reconciliation.

The Lived Black Experience Strategic Plan highlights the need for greater engagement and work to address the needs and concerns of Flagstaff's Black community. The Plan begins by recognizing past and current narratives:

> "Where does the story of Black Flagstaff begin? The answer to this seemingly simple question is complicated by decades of lost or forgotten history, conflicting narratives, and a marked lack of engagement with the stories of Black Flagstaffians whose legacies speak of the enduring capacity for hope, the richest pursuits of positive change and cultural unity among the poorest citizenry and oft-forgotten neighborhoods."[11]

This statement reflects the need for engagement with Flagstaff's underserved community members and community leaders. Community outreach and relationship building is a necessary part of climate action and achieving our goals. The City will work to incorporate the recommendations of the Lived Black Experience Strategic Plan into the implementation of this Carbon Neutrality Plan.

The City will look to build relationships with other underserved community groups and access similar resources to shape its policies and programming.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Overarching goal 1: address climate change in a manner that prioritizes those most impacted and ensures the costs and benefits of climate adaptation and mitigation are equitably distributed.

[11] Access the Flagstaff's Lived Black Experience Strategic Plan at https://www.southsideflagstaff.com/black-lived-experience-town-halls

Decreased Dependence on Cars

Flagstaff will transform our transportation and land use systems so that we depend far less on cars, reducing vehicle miles traveled (VMT) and shifting trips to walking, biking, and the bus.

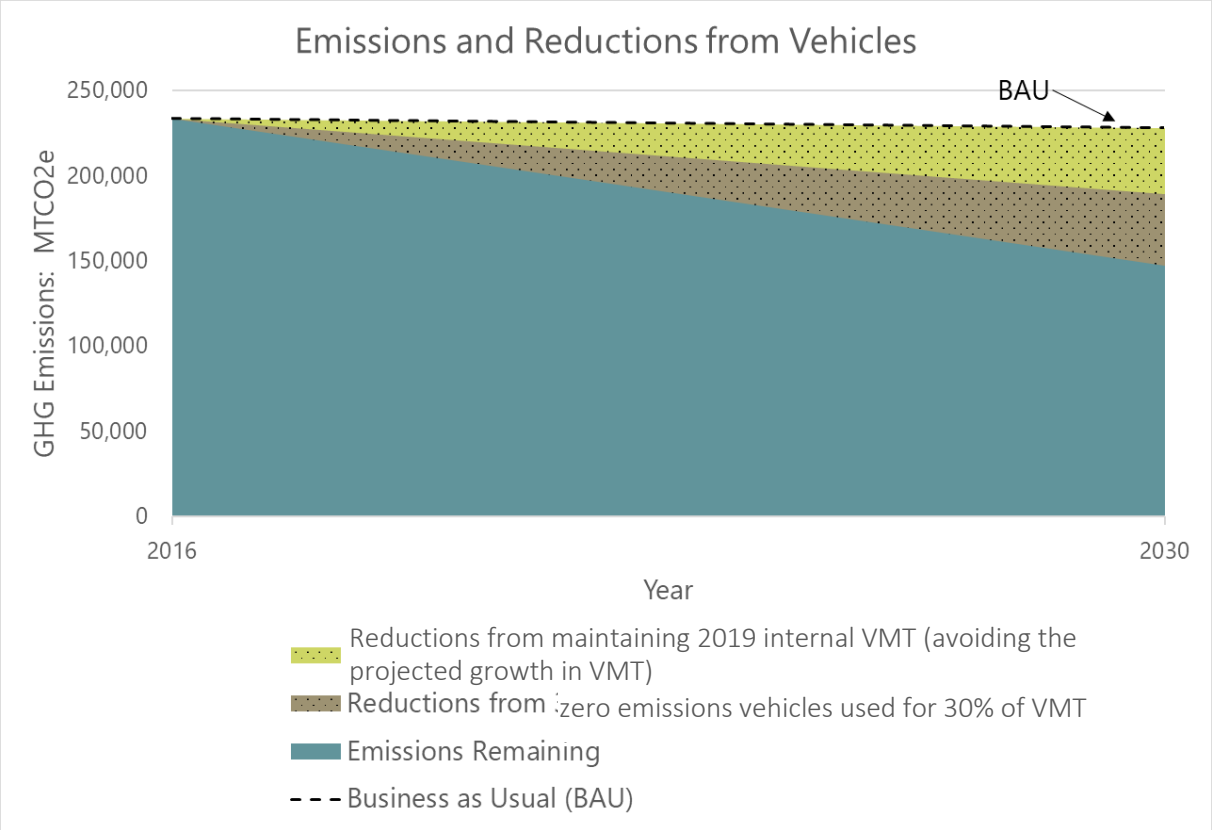


Figure 7: Projected emissions reductions from electric mobility and decreasing dependence on cars, compared to the emissions in the business as usual scenario..

WHAT IT MEANS

Reductions in greenhouse gas (GHG) emissions from the transportation sector will require enhancing community mobility and decreasing community-wide vehicle miles traveled (VMT) – or the miles Flagstaff residents travel in cars every day. This reduction in VMT must be simultaneously accomplished with a transition to clean, low- and zero-emission vehicles (see Electric Mobility Target Area on page 66). Because emissions from transportation account for around 30% of Flagstaff's community GHG emissions, reducing commuting miles and increasing equitable access to goods and services are essential to effective action.

How do we account for transportation by visitors? Or for through-traffic?

There are multiple types of car travel in Flagstaff: some trips are made by residents, going from home to a local store. Other trips are made through Flagstaff without stopping at all. The City accounts for these trips differently.

Starting with the 2019 Greenhouse Gas Inventory the City starting using the "internal vehicle miles traveled (VMT)" metric when quantifying emissions from vehicle travel in our community. This is different from the "total VMT" metric, which considers all vehicle miles travelled on our roads, including "through trips" – i.e. vehicles on I-40 that pass by Flagstaff on their way to other destinations. The "internal VMT" metric considers only trips that both start and end within the community boundary. Both the internal and total VMT metrics are determined each year by Metroplan Flagstaff.

The decision to use the "internal VMT" metric was based on considerations relating to the City's sphere of influence – the actions we can take to make our community more connected and less dependent on cars while in town will have little to no effect on the traffic simply passing through. Our community also has a unique form of "through trip" transportation in the 100+ BNSF trains passing through town daily. Finally, as a community with an economy that is largely based on tourism we want to welcome people to our City – and once here, tourists, like locals, will be able take advantage and utilize the systems put in place to make our town less dependent on cars for getting around during their stay.

HOW WE'LL GET THERE

Vehicle emissions are a result of a combination of factors: vehicle fuel efficiency, the carbon content of the fuel, and vehicle miles traveled (VMT). Gains in the first two areas may be potentially offset by losses in the third (VMT). Transitioning to electric vehicles (EVs) does not reduce transportation sector emissions enough in the near-term. Therefore, it is important that while Flagstaff adopts EVs, action is taken to simultaneously reduce VMT through climate-conscious land use planning and encouraging switching trips from single-occupancy to transit, walking, and biking.

Transportation costs are a significant expense for households. Car ownership can often be a burden for low-income families: AAA calculates that in 2020 car ownership cost $9,561 per year.[12] Promoting the adoption of personal single-occupancy electric vehicles does nothing to address these existing inequities. Land use decisions can also increase both transportation and housing costs. Transportation costs tend to be lower for those living in neighborhoods where it is safe and accessible to walk, bike, or take transit. Parking requirements add to the cost of housing, and single-family neighborhoods have an exclusionary history that in many ways continues today. Promoting these modes of transportation and reducing VMT both reduces emissions and is more equitable.

[12] https://magazine.northeast.aaa.com/daily/life/aaa/costs-more-than-ever-to-own-a-car/

The City can reduce dependence on cars on multiple fronts: prioritizing pedestrian and bicycle infrastructure development and enhancements can help make walking and biking an easy choice for many trips. This will happen through alignment with and implementation of the forthcoming Active Transportation Master Plan. The City of Flagstaff will collaborate with Mountain Line, Flagstaff's transit agency, to maintain and enhance multi-modal transit services and related facilities, including better access to and from transit.

There are several transportation projects that are already considered in Flagstaff's transportation future, which will likely increase VMT. Road expansion projects and greenfield development, like the John Wesley Powell Boulevard extension, align with the goals of the most recent Regional Transportation Plan (2017), which projects VMT more than doubling over the next 70 years. Mutliple new neighborhoods are planend on the edges of Flagstaff that are suburban in nature and will increase Flagstaff's VMT. These already-planned projects will increase the difficulty of holding VMT to 2019 levels. Flagstaff will need to balance these baked-in projects with its climate goals to envision a transportation and land use agenda for the coming decades. Two upcoming Plan processes, the Flagstaff 2040 Regional Transportation Plan and the Flagstaff 2040 Regional Plan will present opportunities for Flagstaff to weigh its carbon neutrality goals with other community priorities.

What would it take?

As part of the development of this Plan, we surveyed over 800 community members about what factors would convince them to choose biking, walking, or transit in favor of their single occupancy vehicle when they visit friends or go to work. There were common themes in these responses: shorter distances to travel, more robust and connected bicycle and pedestrian infrastructure, increased transit frequency, and increased feelings of comfort and safety when using the existing infrastructure. Some responses were from people who already bike, walk, and take the bus to do these things! Even those responses included improvements in infrastructure and shorter distances to get to daily needs.

These responses shaped the Decreased Dependence on Cars section; we know that more people will choose to leave their cars at home as infrastructure continues to improve and multi-modal transportation becomes more of a priority throughout Flagstaff. Most of these changes will require a big shift, especially in our infrastructure. To create more connected and robust bike and pedestrian infrastructure, lanes will need to be taken away from cars. To decrease the distance needed to travel for daily needs, we will need to increase density and mixed use development. These actions will require a shift in priorities, and they are possible.

The Big Shift: Rethinking mobility

Flagstaff must commit to a fundamental shift in the way we think about our road systems and how we move around our community. This is necessary to both achieve our climate goals and to improve quality of life, health, and affordable living in Flagstaff.

The emphasis of our transportation planning must pivot from congestion mitigation to mobility improvement to improve the way community members move around town, outside of their cars. As Flagstaff grows, we have a choice: we can invest in building more roads and more lanes to attempt to reduce traffic, knowing that adding more vehicle lanes rarely improves traffic flow. Alternatively, we can manage demand, decreasing the demand for car trips and car infrastructure - thus helping people to choose active, healthy, enjoyable transportation while reducing the number of cars on the road. We must reimagine how our transportation can work, and shift our approach in the City's policies, processes, and plans, from the Regional Plan and the Regional Transportation Plan to our policies that currently encourage driving and parking.

At the same time, our community must better utilize our limited space by accepting and celebrating appropriate density in our neighborhoods and activity centers. In order to maintain the 2019 vehicle miles traveled (VMT) levels observed while our community grows, it is expected that actions will need to be taken to increase residential density by at least 20%.[13] Density reduces emissions from building energy use and transportation, while also contributing to more lively, welcoming, and diverse neighborhoods. Land use solutions are complementary to our transportation actions and impact our ability to achieve our transportation and emissions goals. Increases in density must be accompanied by efforts to make our neighborhoods more complete, reductions in the distance to transit stops, increases the frequency of transit buses, and the development of protected bike infrastructure and complete sidewalk networks.

Flagstaff is growing and will continue to do so. To welcome new neighbors to Flagstaff, we need to create homes for those who live here. To add more homes in our limited land area, we must increase the number of homes in our existing and new neighborhoods – from allowing backyard cottages to welcoming small and mid-sized apartment buildings and tall buildings where appropriate.

Flagstaff can learn from some of the most successful cities in the world, who are focusing on converting car space into more effective streets and public spaces that accommodate people outside of their cars walking, biking, gathering, recreating, or shopping. Flagstaff's peer cities are also recognizing the high cost of parking, both in its contributions to housing costs as well as the way that it

Flagstaff is Growing

Flagstaff is projected to grow significantly in the coming decades. We must prepare for greater than expected growth as the population center of Phoenix – now exceeding five million people – continues to grow, and as summers in central Arizona become hotter. We can expect visitation and migration to Flagstaff to increase, with domino effects on Flagstaff's housing market and land use.

[13] https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Residential_Density_on_Passenger_Vehicle_Use_and_Greenhouse_Gas_Emissions_Policy_Brief.pdf

shapes our neighborhoods around cars. Cities across the country are allowing buildings to be built without parking or charging more for parking on the street and within buildings, making a trade-off between ample parking and a walkable and affordable community. Flagstaff can reduce the amount of space dedicated to parking and car storage in our community in order to improve affordability, better utilize limited space, and reduce automobile subsidies.

Flagstaff residents deserve what are called **15-minute neighborhoods**: places to live where you can meet most of your daily needs with a simple walk. Some of our neighborhoods already function this way: someone living in the Townsite neighborhood can reach office buildings, a grocery store, the post office, ten restaurants and even a park within a 15-minute walk. Sunnyside and Southside similarly have access to jobs, small neighborhood stores, dining, and community centers within their neighborhoods. Townsite, Southside and Downtown Flagstaff all were built before car dependence – meaning that they were built for a people to meet their needs without use of a personal automobile. While Sunnyside is a comparatively newer neighborhood, its street grid, flexible zoning and moderate density all contribute to walkability, vibrancy and a variety of businesses and retail establishments. Flagstaff can choose to allow our neighborhoods to evolve in ways that could mimic these traditional neighborhood designs, providing for a higher quality of life for Flagstaff residents.

The Big Shift to Decrease Dependence on Cars will require Flagstaff to change its policies to:

- Reduce or eliminate parking requirements across all building types.
- Increase density in residential neighborhoods by 20%.
- Increase the amount of accessory dwelling units in neighborhoods.
- Integrate density into residential neighborhoods through more flexible zoning codes that allow more housing options including duplexes, triplexes and potentially even small retail stores or apartment buildings.
- Convert some car lanes into micro-mobility zones.
- Allow neighborhoods to reclaim their streets through slow ‘safe and social’ zones that allow for play areas, socializing space, areas for businesses to operate, and safe travel for all modes.
- Prioritize transit over car movements in transportation operations and planning.
- Shift City transportation policies to actively manage transportation demand and reduce vehicle miles traveled.

These changes will require significant revisions to Flagstaff’s zoning codes, transportation engineering standards, and other policies. The City must invest in analysis and staffing to undertake this big shift. Through these changes, we will be better equipped to achieve deep reductions in greenhouse gas emissions from our transportation sector while improving livability, health, and community resilience in Flagstaff.

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: Working to decrease our dependence on cars can help improve community equity. Owning a car is expensive. By offering robust, diverse transportation options at lower costs, low and middle-income residents will have more affordable mobility options.

The City will also consider how transportation policies will affect other groups: Due to disability, age, or other factors, some community members may be unable to walk, bike or take the bus; others are unable to drive. These factors will be considered when designing and implementing policies.

Adaptation: Density and robust, diverse transportation systems inherently increase community resilience by providing multiple transportation options, as opposed to designing around one mode – cars. By building densly in areas that are less prone to flooding and fire, Flagstaff can be better prepared for an increase in these events.

GOALS

Goal	Year
Hold vehicle miles traveled (VMT) in the community to 2019 levels. This is a 17% reduction from our business as usual projections in VMT growth.	2030
54% of all trips will be taken by biking, walking, or taking the bus.	2030
34% of all work commute trips will be taken by biking, walking, or taking the bus.	2030
Reduce vulnerability of new developments to fire and flooding, by encouraging development to locate in areas of lower vulnerability.	2030

STRATEGIES TO ACHIEVE DECREASED DEPENDENCE ON CARS

DD-1: Encourage vibrancy, appropriate density, and attainability in existing neighborhoods, so that more residents live within walking distance of their daily needs.

Opportunities for action:

1. Incorporate more flexibility and appropriate density into residential neighborhoods, such as accessory dwelling units, duplexes, triplexes, small apartment buildings and other housing options to provide more diverse and attainable housing opportunities, create vibrant neighborhoods, and decrease travel distances.
2. Lower or eliminate parking minimums for new developments to decrease housing costs, promote decoupling rent from parking costs, reduce impervious surfaces, and create more walkable neighborhoods.
3. Change City policies to increase transit-supportive density, redevelopment, infill development, mixed housing types, multiple story buildings, and mixed-use transit nodes throughout Flagstaff.
4. Encourage the rapid development of carbon-neutral Accessory Dwelling Units (ADUs) to increase the housing stock.

DD-2: Create inclusive networks for walking and biking that are continuous, attractive, safe, comprehensive, and convenient for people of all ages.

Opportunities for action:

1. Adopt, fund, and implement the Active Transportation Master Plan (ATMP).
2. Fully fund bike and pedestrian infrastructure capital improvements to create complete and comfortable bike and pedestrian networks, safe routes to school improvements, and a complete and comfortable system of pedestrian crossings and sidewalks.
3. Convert appropriate streets to multi-modal and complete streets through road diets or creating multi-modal lanes. When right-of-way is limited, redistribute the available space to accommodate more users and better reflect climate priorities.
4. Create an integrated system of protected lands, the Flagstaff Urban Trail System, and trail corridors that support mode shift, public health, and affordable living.

DD-3: Encourage Flagstaff residents and visitors to walk, bike, roll and take the bus.

Opportunities for action:

1. Significantly increase funding for programming to increase biking and walking, improve micro-mobility options, provide encouragement programming and infrastructure improvements in school zones, and increase transportation demand management (TDM) programming.
2. The City will improve support to incentivize City employees to commute by walking, biking, and transit, such as employee showers at work, benefits to employees for walking, biking and taking transit, or support for carpool coordination.
3. Reconsider how and where we allow pedestrian crossings to create safe and convenient crossings based on land use, activity centers, transit stops, and trails.

Investing in walking and biking

A one-time investment of $90 million is needed to build comprehensive walking and biking networks. These networks are necessary to get people to walk, bike and take the bus. We cannot ask people to change their behavior if those behaviors are not easy, safe, comfortable and even fun. To further support these choices, the City will need to provide $600,000 to $1,000,000 per year for programming.

While these investments seem large, from an infrastructure perspective creating these networks will cost similarly to a large roadway project. The recently approved Lone Tree Bridge over the railroad tracks will cost a projected $72 million, and simply designing a highway interchange can cost $3 million. We must invest in biking, walking and transit with the same level that we invest in supporting infrastructure for cars.

What is electric micro-mobility?

Micro-mobility technology is a rapidly-evolving category of light-weight individual transportation devices. Examples include electric bikes (e-bikes), electric scooters, Segways, electric skateboards, and hoverboards.

Electric micro-mobility provide easy and affordable transportation for many. These devices are a necessary part of our work to reduce VMT: people can easily substitute many short car trips with a trip on scooter or an e-bike. The City can encourage folks to use these devices to travel: benefits go beyond just the individual user's cost savings and health benefits, since these devices reduce the need for car parking, reduce air pollution, and reduce traffic on our roads. See the Electric Mobility Target Area on page 66 for more information.

DD-4 Transform transportation policies and planning to incorporate greenhouse gas emissions analysis and reduce dependence on driving.

Opportunities for action:

1. Incorporate transportation demand management (TDM) philosophy and policies into transportation and development engineering and planning processes, by changing internal policies and potentially hiring a TDM manager.
2. Evaluate the greenhouse gas emissions and vehicle miles traveled (VMT) of transportation capital infrastructure projects, transportation system operations, and new development planning, and update the Traffic Impact Analysis (TIA) process to incorporate greenhouse gas emissions impacts into the decision-making process.
3. Actively work to lower emissions and VMT created by new developments, shifting to mobility enhancement strategies rather than congestion reduction.
4. Require large new buildings and new neighborhood developments to submit carbon neutrality alignment statements, to increase collaboration between developers and the City and to communicate how developments contribute to the City's carbon neutrality goals and how the property will work to manage transportation demand.
5. Involve more stakeholders in City capital and infrastructure project planning by bringing projects to citizen commissions and interdepartmental staff review, enabling review through the lens of other community objectives including public health, sustainability, and economic vitality.
6. When working with developers on large new developments, analyze and balance community priorities when making requests for infrastructure improvements.

How Could We Account for Greenhouse Gas Emissions in Transportation Planning?

Municipalities across the country are beginning to incorporate greenhouse gas (GHG) emissions into transportation planning projects. Fully accounting for GHG emissions allows us to understand the true impact of transportation projects, which often lead to more driving.

Fortunately, accounting for GHG emissions can be simple – most transportation analyses include a consideration of vehicle miles traveled or how a project will increase car trips. These measures are proportionally related to greenhouse gas emissions – incorporating greenhouse gas emission analysis into a traffic impact analysis (TIA), for instance, can be as simple as applying a greenhouse gas co-efficient to the number of new trips we anticipate.

The City will work with transportation and development stakeholders to identify the best way to include greenhouse gas emissions in transportation planning and engineering processes and decisions.

What is Transportation Demand Management (TDM)?

Transportation demand management, often called TDM, is a well-established concept defined as a transportation policy approach that reduces demand for single-occupant vehicle use, while simultaneously encouraging use of more sustainable travel modes, including walking, biking, and transit. TDM is described in the Flagstaff Regional Transportation Plan Blueprint 2040 as follows: "TDM enhances the utilization of roads by reducing overall demand through mode shift from single occupant vehicles to other means of transportation that can equally or better meet their needs... With TDM serving as an organizing principle, physical transportation infrastructure and land use will be designed so that alternative transportation is naturally encouraged and the maximum efficiency of the transportation network is realized."

Why is TDM important? An efficient and equitable transportation system offers individuals multiple feasible options for moving around their community whether it be by biking, walking, public transit, driving, or another mode. Unfortunately, most U.S. transportation systems have been built centered around one mode of transportation above all others: single-occupancy vehicles. Many policies and land-use decisions often favor single-occupancy vehicles and deprioritize all other modes of transport. This is problematic as increases in use of single-occupancy vehicles are often associated with increases in roadway congestion, air pollution, greenhouse gas (GHG) emissions, and annual vehicle-related costs.

TDM can maximize traveler options. What if instead of continuing to build infrastructure that encourages the use of vehicles, our transportation planning focused instead on making alternate modes of transportation more desirable and feasible options? This is exactly what TDM strategies seek to do. Another way to think about TDM is maximizing traveler options or systematic mobility management. TDM helps to make our transportation systems function more efficiently in a way that is cost-effective and impactful in the long-term. More than a specific set of solutions, TDM is a philosophical approach that can be incorporated into decisions made related to city zoning, land-use, development, and much more.

TDM at work. TDM strategies can be numerous and diverse allowing every city the opportunity to focus on options that work best for their unique setting. Some examples of TDM include: increasing the amount and accessibility of information on local alternate modes of transport, creating successful rideshare and carpooling programs, disincentivizing driving by increasing parking costs, providing incentives for using transit or other alternate modes, or restricting the number of parking spaces new developments can build. Like most cities, Flagstaff is already implementing multiple actions that can be considered components of TDM; examples include the use of parking pricing downtown, provision of online maps and resources for the FUTS and other urban bike routes, and the ecoPASS program which offers annual bus passes at reduced rates. TDM actions become even more effective when centralized under a comprehensive TDM program with a designated workforce. Successful TDM programs already exist in many states and an increasing number of cities (such as the City of Tempe) are working to develop comprehensive programs of their own.

Potential for local implementation. One example of a highly effective TDM strategy that has potential for implementation in Flagstaff is unbundled parking. Oftentimes at residential rental properties, costs of parking are automatically added into tenant rental costs. An alternate option would be to "unbundle" parking and rental costs allowing tenants to choose exactly how many parking spaces they want to pay for. Having parking costs as a separate fee allows tenants to better conceptualize the costs associated with having a car or multiple cars. This strategy also disincentivizes developers from building an excess amount of parking, the cost of which would ultimately be placed on tenants. Unbundled parking is already being utilized in Arlington County, Virginia and has been highly successful at promoting alternate transportation options as reported in a 2018 Mobility Lab study. San Francisco, Berkeley, and Seattle are examples of other cities that have also made the move to unbundle parking costs from rent.

DD-5: **Invest in comprehensive and equitable transit**.

Opportunities for action:

1. Implement the transit-supportive recommendations of the Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA) Five-Year Transit Plan for the Mountain Line to increase ridership and transit frequency on the permanent transit network.
2. Prioritize transit trips over car trips and the movement of buses over cars to improve bus operations on Flagstaff's road network, through mechanisms such as signal prioritization, bus slip lanes, and dedicated bus lanes.
3. Improve how the City incorporates transit needs and requests into the transportation analysis performed for large new developments.

DD-6: **Proactively invest to protect Flagstaff's clean air status.**

Opportunities for action:

1. Create a local ordinance to protect air quality and prevent National Ambient Air Quality Standards (NAAQS) non-attainment status and to support and fund mobility enhancement.
2. Incorporate greenhouse gas impact analysis, based on greenhouse gas emissions estimates, into Flagstaff area transportation strategic planning and routine analysis.
3. Create anti-idling loading zones to reduce congestion, maintain access to parking and allow public safety access.

What is NAAQS Non-attainment?

The State of Arizona monitors air quality for pollutants above the National Ambient Air Quality Standards (NAAQS), as outlined in the Clean Air Act. NAAQS non-attainment classification occurs when pollutants exceed the NAAQS standards.[14] Once a county receives reaches non-attainment classification, communities must make investments to reduce and control pollutants.

Coconino County is currently in attainment of the NAAQS. However, the Arizona Department of Transportation has noted that the expected growth of Coconino County could threaten Coconino's current attainment status.[15] Flagstaff can invest in keeping its air quality clean *now*, to avoid future regulation and mandates.

[14] Learn more about Arizona Departhttp://azdeq.gov/nonattainment_areas
[15] Air Quality Sustainability Program in Coconino County: https://www.flagstaff.az.gov/ArchiveCenter/ViewFile/Item/1501

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Transportation and Land Use Strategy 1: Advance land use planning that minimizes the distance people have to travel by car and that increases community resiliency.

Transportation and Land Use Strategy 2: Prioritize, incentivize, and promote transportation by biking, walking, and transit.

Transportation and Land Use Strategy 5: Manage transportation demand and reduce the frequency with which people drive alone.

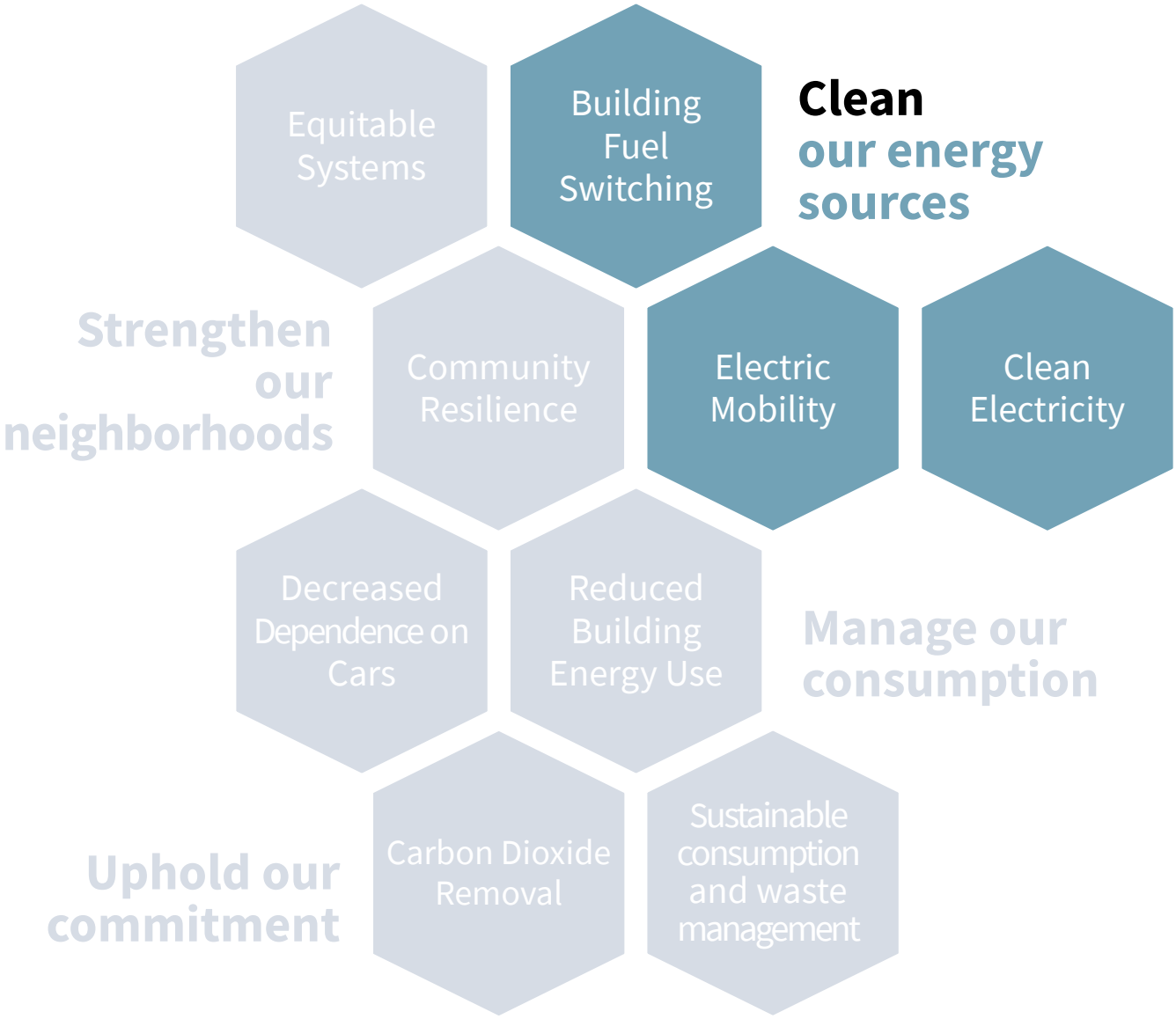
Improvements in transit infrastructure, operations, and encouragement

Mountain Line provides transit service to the City of Flagstaff. Mountain Line and the City must partner to adequately fund improved transit infrastructure and operations in order to move more trips onto transit.

High-priority transit improvements include:

- Identify funding to double service on Mountain Line routes to create high-frequency bus lines that are more usable and attractive for riders. This would require $5 million in additional funding annually.
- Partner with Coconino County to increase transit service coverage and frequency in the greater Flagstaff area. Consider enhancing buses, vanpooling, and shuttle services for outlying communities such as Kachina Village and Bellemont.
- Develop transit services for visitors to Flagstaff, including to popular destinations such as Snowbowl, Twin Arrows, the Grand Canyon, and between Phoenix and Flagstaff.
- Focus on improving access to transit stations by helping riders to complete their 'first mile' and 'last mile' trips to get to stations.
- Consider eliminating bus ridership fees, encouraging organizations and businesses to purchase transit passes for their employees or provide in-house incentives for employees who switch from driving to public transit.

FOCUS TWO: OUR ENERGY SOURCES



We will clean our energy sources through:

- Electric mobility
- Clean electricity
- Building fuel switching

Electric Mobility

Flagstaff will embrace the electrification of mobility options, shifting to vehicle-replacing e-bikes and bike share, electrifying our buses and taking advantage of the rapidly evolving electric vehicle market.

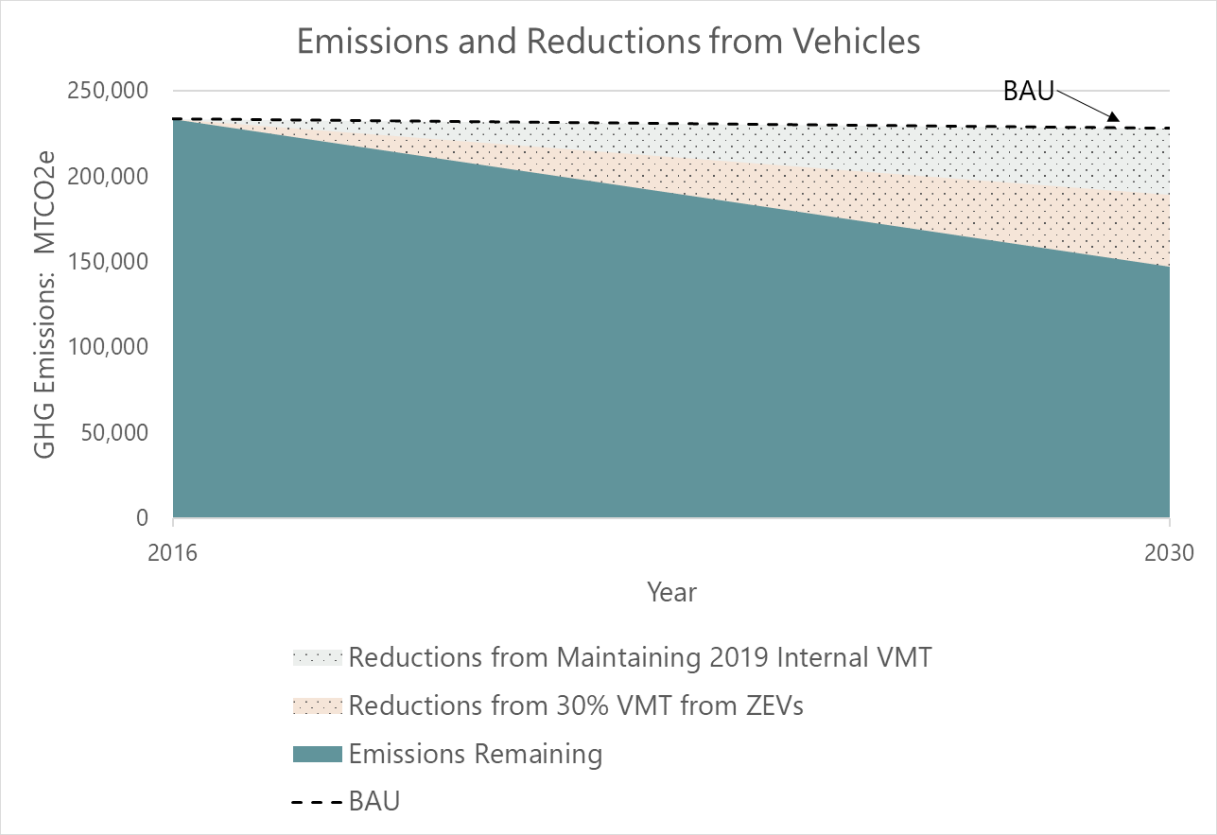


Figure 8: Projected emissions reductions from electric mobility and decreasing dependence on cars, compared to the emissions in the business as usual scenario.

WHAT IT MEANS

Reductions in GHG emissions from the transportation sector will require a transition to clean, low-/zero-emission vehicles while simultaneously enhancing community mobility through increased access to bicycle, pedestrian and public transit modes of transportation to decrease community-wide vehicle miles traveled (VMT). Transportation related emissions account for approximately 30% of Flagstaff's community-wide GHG emissions. In addition to reducing VMT, making progress toward more efficient and lower-carbon vehicles is critical.

HOW WE'LL GET THERE

The future of mobility is electric, mainly due to advances in technology and momentum from the market. Flagstaff can welcome this future by helping increase the speed of the electric mobility transition in Flagstaff. As Flagstaff works to reduce vehicle miles traveled and help folks take non-car modes of travel, electric mobility can play a part in making transit and active transportation more affordability, easier to use, and cleaner.

Electric buses: As we work to increase transit use across Flagstaff, we want to transition our bus fleets from gas or diesel fuels to electric power. Electrification of the bus fleet will require a significant investment from bus fleet operators, including but not limited to Mountain Line, Northern Arizona University and Flagstaff Unified School District. Electrification involves planning for electric charging locations and capacity, operational changes, and coordinating charging schedules, in addition to the acquisition of an entirely new and operationally appropriate bus fleet. The City will work to assist these organizations in their planning for the transition to electric buses, from grant-writing support to charging infrastructure planning.

Mountain Line, Flagstaff's transit provider, has begun planning for a transition to zero emissions vehicles – they recently published a Zero Emissions Bus Transition Plan, and determined to move forward with a battery electric bus transition.[16] Implementation will occur "project by project, bus by bus as funding and interest allows."

Electric micro-mobility: Adding electric power to simple, small transportation devices – such as bikes – is a relatively simple change that transforms the device into a much more accessible and practical transportation option. Electric bike use is rapidly accelerating across the globe, as batteries become smaller and less expensive, and as more people realize the incredible benefits of electrification.

What is electric micro-mobility?

Micro-mobility technology is a rapidly-evolving category of light-weight individual transportation devices. Examples include electric bikes (e-bikes), electric scooters, Segways, electric skateboards, and hoverboards.

While these devices represent very new ways of travel, they are already present in our community, obtainable at local and national retailers, and are already providing accessible, affordable, low-carbon transportation options.

See page 60 for a discussion of how micro-mobility can reduce vehicle miles traveled.

Electric micro-mobility devices are popular for a multitude of reasons: they move people around more quickly than a traditional bicycle or scooter and with significantly less effort – now a five mile commute with hills can be done with far less effort and sweat, making e-bike commutes much more attractive. These devices use very little fuel, or electricity, especially when compared to the gas used to move around a one-

[16] https://mountainline.az.gov/about-us/reports-plans/zero-emissions-bus-zeb-transition-plan/

ton vehicle. This saves money on gas, as well as vehicle wear and tear and maintenance. These devices remove traffic from the road and have a very small footprint, reducing congestion and parking demand – after all, a small scooter is a much more appropriate, efficient and proportional tool to move one person than a car or an SUV. And finally, these devices are popular because they are fun to ride.

The City of Flagstaff can work to welcome these devices in our community and to encourage their use. While these devices represent change in the way we travel, they have numerous personal and community benefits, including that they are a very low-emissions transportation option. Many of these devices can already be found on our neighborhood streets today, whether a senior is taking an e-bike to see their grandchildren, a 10-year-old is using a hoverboard to go to a neighbor's house, or a student is taking an electric scooter to get to class. The City will need to work to incorporate these devices into our transportation planning efforts, so that people using micro-mobility devices have safe options for traveling both within neighborhoods and across town.

Electric vehicles: The widespread transition to zero-emission vehicles is a long-term strategy. The City of Flagstaff can support this transition by investing in and encouraging the necessary supporting infrastructure. Investment and encouragement can occur through codes, partnerships, incentives and other methods that improve the ability of residents to purchase and operate electric vehicles compared to conventional gas-fueled vehicles. For example, charging stations help EV owners fuel their vehicles – the City will encourage businesses and public buildings to install charging stations. In 2020, the City installed four charging stations in City Hall for use by City fleet vehicles as well as the general public. The City can also work through codes: the current Flagstaff building code, adopted in 2019, requires a 240 volt outlet to be installed in new garages – a small, inexpensive and simple modification that ensures the home, which will be around for at least 80 years, is ready for the rapidly approaching future of electric vehicles. This upgrade means a homeowner will not need to perform a costly retrofit to charge their vehicle, saving hundreds of dollars or more.

In addition, the City of Flagstaff will look to transition our own fleet while educating, encouraging and helping facilitate partnerships so that other local fleets might also make the electrification transition over time. We know that it matters which vehicles are electrified – by prioritizing the transition of fleet vehicles and other high usage vehicles that drive a disproportionate number of miles, we can expect to see an outsized impact. For example, if the top 20% of vehicles by mile are electric by 2030, the reduction in fuel use will be considerably larger than 20%.

While the City of Flagstaff can support the transition to EVs by taking early action to establish infrastructure, a considerable amount of the momentum for EV adoption will come from the private sector. Many of these factors are currently unknown or exist only as projections at this time. Some of these factors may include Federal incentives both for infrastructure development and for vehicle purchase. Some of these factors will be market driven – Tesla for example has installed 12 SuperChargers in Flagstaff, and according to ChargeHub there are an additional 50 level 2 and level 3 charging stations in the City that have been installed by businesses and organizations on their own accord.

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: New EVs and electric micro-mobility options can be cost-prohibitive for many. This threatens to leave some populations out of the electric mobility transition, and will likely mean that low-income communities must cope with the higher operating costs and unhealthier air associated with internal combustion engines for a longer period of time. To ensure widespread adoption and affordability for low- and middle-income households, the City will need to establish robust incentive programs.

Adaptation: As Flagstaff experiences the impacts of climate change, having diverse, clean, reliable mobility options will be vital. By creating more good transportation options, Flagstaff can ensure that if one mode of transportation becomes difficult, residents have other choices. Electric bikes are a great way to travel around Flagstaff, even on hot or windy days. Market trends show that electric mobility is the way of the future; by investing in infrastructure and incentives for these options, Flagstaff will be better prepared for these transportation changes.

GOALS

Goal	YEAR
The City will provide 50 publicly available Level 2 electric vehicle charging stations	2025

STRATEGIES TO ACHIEVE ELECTRIC MOBILITY

EM-1: Advance the electrification of buses across Flagstaff.

Opportunities for action:

1. Mountain Line will electrify its bus fleet according to its Zero Emissions Bus (ZEB) Transition Plan.
2. NAU will begin electrifying its bus fleet, to comply with its under-development carbon neutrality plan.
3. Partner with the Flagstaff Unified School District to explore funding options for fleet electrification.

EM-2: Welcome electric micro-mobility devices as legitimate, healthy, affordable and low-carbon modes of transportation.

Opportunities for action:

1. Establish an electric micro-mobility device share service.
2. Distribute electric micro-mobility rebates to community members through local businesses to reduce barriers to residents acquiring these affordable transportation devices.
3. Launch a micro-mobility collective purchasing cooperative to increase access to efficient and affordable modes of transportation.

EM-3: Support residents, businesses and institutions in the transition to electric vehicles.

Opportunities for action:

1. Focus electrification engagement efforts on the vehicles that drive the most miles – for instance heavily used fleet vehicles.
2. Install electric vehicle charging stations at City facilities to serve the City fleet, City staff vehicles, and the public where appropriate.
3. Develop public and private partnerships for the installation of Level II and Level III DC fast-charging electric vehicle charging stations in publicly accessible parking areas along tourism corridors, at workplaces, and in multi-family housing developments.
4. Adopt a policy requiring 100% of new City fleet sedans and SUVs to be electric vehicles starting in 2022, complemented by aggressive goals to test, evaluate, and, where feasible, acquire electric vehicles for other light-duty, medium-duty and heavy-duty fleet vehicles and equipment categories.
5. Encourage and incentivize existing multi-family housing to offer electric vehicle charging stations.

Zero Emission Vehicles beyond Electric Vehicles

While electric vehicles appear to have the inside track for capturing the market on passenger and light-duty vehicles that produce zero tailpipe emissions, vehicles fueled with hydrogen represent another emerging technology that may also play a role. The City will actively monitor advances in technology, infrastructure and partnership opportunities to support wider-spread adoption of hydrogen vehicles.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Transportation and Land Use Strategy 3: Support the use of clean, energy -efficient vehicles

Clean Electricity

Flagstaff will obtain as much of its electricity as possible from sources that do not produce greenhouse gas emissions.

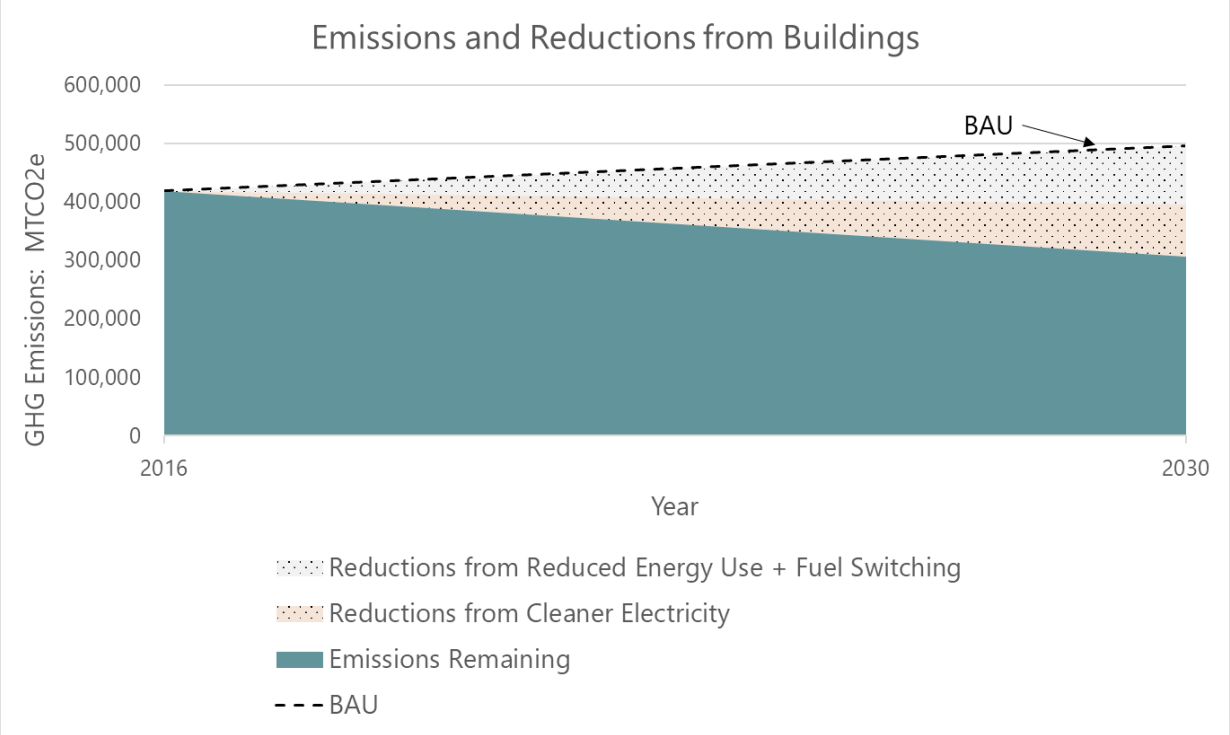


Figure 9: Projected emissions reductions from clean electricity and reducing building energy use, compared to the emissions in the business as usual scenario.

WHAT IT MEANS

Significant reductions in GHG emissions from both the built environment and transportation sectors can be unlocked with a rapid transition to clean, renewable electricity. With clean, renewable electricity available as a resource, appliances, vehicles, and other tools that directly utilize fossil fuels can switch onto this resource. (See Building Fuel Switching on page 77 and Electric Mobility on page 66).

Emissions from electricity currently constitute approximately 25% of all community emissions. This means that even without making any other changes (see the Electric Mobility, Building Fuel Switching, and Reduced Building Energy Use Target Areas, starting on pages 66, 77, and 85 respectively), a 100% clean electricity grid could eliminate one quarter of Flagstaff's emissions. In combination with the various fuel switching strategies, the impact of clean electricity could be even greater.

Are there negative impacts of renewable energy?

When new technologies emerge, there are often legitimate concerns that one bad thing (i.e., air pollution from coal) is just being replaced with another (i.e., waste from used solar panels).There are negative externalities associated with all forms of energy production. While we cannot avoid all negative impacts, we can choose the energy production methods that do the least harm to our environment and our community. The negative impacts of wind and solar are relatively modest, and are far outweighed by the positive impacts on air quality and reduced greenhouse gas emissions.

Large renewable energy projects sometimes face concerns about where turbines go after their useful life, or the amount of water used for large solar arrays. In fact, solar energy uses just 1% or 2% of the water used to create an equal amount of energy from coal or natural gas.[17] The City will continue to consider short- and long-term impacts to the environment and our community when developing renewable energy projects.

HOW WE'LL GET THERE

APS is the investor-owned utility that provides grid electricity to the community of Flagstaff. As of January 2020, APS has made a 'carbon free' commitment by 2050, with an expectation of 65% carbon free grid electricity by 2030. (See the APS Integrated Resource Plan.[18]) This is a 30% improvement compared to the local grid in 2020.

While APS makes the transition to renewable electricity, Flagstaff can increase the prevalence of local renewable energy projects such as rooftop or utility-sponsored community solar to achieve even greater near-term emissions reductions (third-party-sponsored community solar, where solar power projects generate electricity and benefits for multiple users, would require a change in State laws). The municipality can work with the utilities to develop large-scale renewable installations to power *municipal operations* with clean electricity. However, unless there are policy changes at the Arizona Corporation Commission (ACC) and/or APS, it is uncertain whether any additional electricity generated by these municipally-supported installations may be able to be directly acquired by, or attributed to, local residents or businesses. Flagstaff will continue to monitor the evolving electricity policy landscape and consider supporting actions that would unlock strategies for large scale renewable development for the community.

Clean electricity is just one of the many areas where we need to be open to innovation. While solar and wind are specifically called out in this Plan, there are other renewable energy options to explore. Additional technologies, like micro-hydroelectric power, may be incorporated during Plan implementation.

[17] https://nicholas.duke.edu/news/replacing-coal-gas-or-renewables-saves-billions-gallons-water
[18] https://www.aps.com/en/About/Our-Company/Doing-Business-with-Us/Resource-Planning

Until then, this Plan has been developed with only projected on-site residential and commercial installations being able to improve upon the APS grid forecast.

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: Fossil fuels have historically inflicted severe harm to Black, Indigenous, and Hispanic communities through the extraction and combustion of these fuels. By shifting to clean electricity, the current impact these fossil fuels have on historically marginalized neighborhoods and communities can be decreased. To avoid future harm to these communities, they must be consulted prior to and during the development of solar arrays, wind farms, and other new, clean electricity infrastructure.

Adaptation: When developing the infrastructure for new electricity generation, both the City and APS will need to consider how the new developments will respond to shocks and stressors from climate change. A robust, interconnected electric grid with a multitude of battery backup options will be vital to building resilience in the energy sector.

GOALS

Goals	YEAR
100% of municipal electricity use will be from renewables (%)	2025
68% of community electricity use from zero carbon energy (%)	2030

The Flagstaff City Council established a goal of 100% renewable electricity by 2050 through the 2018 Climate Action and Adaptation Plan. Our carbon neutrality models suggest that Flagstaff can achieve 68% clean electricity for the community by 2030. While we will endeavor to reach 100% renewable electricity prior to 2050, the current policy landscape suggests that 68% clean electricity is feasible for 2030.

STRATEGIES TO ACHIEVE CLEAN ELECTRICITY

CE-1: Produce 100% renewable electricity to cover all City of Flagstaff municipal electricity needs.

Opportunities for action:

1. Expand capacity of municipally owned property for on-site solar electric and solar thermal generation.
2. Replace or repair the co-digestion system at Wildcat Hill Water Reclamation Plant and increase clean energy production.
3. When landfill sections are completed and capped, install solar to support City energy usage and eventually connect to the electric grid.
4. Update the City of Flagstaff Sustainable Building Resolution, requiring that newly constructed municipal buildings be built to net zero energy standards.

Project in the Pipeline:

Utility-scale Solar Installation at Red Gap Ranch - The primary intention of this project is to first satisfy the 100% renewable electricity for the municipality by 2025 goal.

CE-2: Increase renewable energy installations and usage in new buildings.

Opportunity for action:

1. Implement progressively more aggressive building codes, requiring net zero energy buildings by 2030. Net zero energy buildings often incorporate renewable energy installations – primarily rooftop solar- into the design and construction to offset onsite energy use.

Net zero energy buildings – Net zero energy buildings combine energy efficiency and renewable energy to use net zero energy. They use a low amount of energy due to being air-tight, well-insulated and energy efficient. They typically incorporate renewable energy generation on-site, like solar panels. Due to this low energy use paired with energy production, these buildings produce as much energy as they consume, which means that the occupants enjoy extremely low utility bills and a zero-emissions building.[19]

[19] Learn more: https://zeroenergyproject.org/buy/zero-energy-homes

CE-3: Support solar installations on existing residential and commercial buildings.

Opportunity for action:

1. The Solar United Neighbors program will assist residents in obtaining solar electricity for a lower price.

Solar electricity is now the least expensive source of electricity in history.

As of 2020, the International Energy Agency found that high-quality solar photovoltaic (PV) projects are the least expensive source of electricity in history.[20] Large solar plants with battery storage have decreased in price, making them competitive with natural gas. These developments will accelerate the rapid electrification of the electric grid. Market forces will help to facilitate this transition, but there remains a role for government policy makers to remove barriers to this transition, ensuring equity for communities that have been impacted by resource extraction and those that could be negatively impacted by the transition to renewable electricity.

Due to the low cost of solar, solar photovoltaic panels are a wonderful opportunity for Flagstaff residents and businesses to produce their own energy on-site, with financial and resilience benefits.

Project Highlight: Northern Arizona Solar Co-op with Solar United Neighbors

In partnership with the City, the Northern Arizona Coop was organized through Solar United Neighbors, a non-profit organization that seeks to increase the access and affordability of solar energy.

Rooftop Solar and Prometheus Solar, two local Flagstaff installation companies, were selected by the Northern Arizona Solar Co-op to install solar for more than 80 households across Flagstaff, Sedona, and Coconino County. These installations are projected to result in:

- 647 kW of Solar installed
- 11,608 Metric Tons of CO2 avoided lifetime
- $1,845,219 invested in local businesses, jobs, and clean electricity

[20] https://www.iea.org/reports/world-energy-outlook-2020/outlook-for-electricity

Legislative change

There are policies and strategies being pursued around the country that are not currently available to the City of Flagstaff because of State-level policies. Many of these strategies have the potential to unlock collaborations, financing and other opportunities that could positively contribute to the goal of achieving Carbon Neutrality.

The City will keep an eye on the policy landscape and may choose to lobby or otherwise advocate for some of these strategies including (but not limited to) Community Choice Aggregation, PACE financing (C-PACE and R-PACE), non-utility Community Solar and more. If any of these become available, this living document may be updated to incorporate the newly available mechanism(s).

The City of Flagstaff should also encourage the ACC and DOE to renew and increase renewable energy production incentives for residential and commercial solar and other distributed generation and storage projects, without additional metering fees or other disincentives.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Energy Strategy 2. Expand renewable energy generation and use.

Building Fuel Switching

Flagstaff will shift our building fuel sources from fossil fuels to renewable sources and electricity for applications including space and water heating, cooking, and perhaps even industrial processes, thus taking advantage of the superior efficiency of electric appliances as well as the rapidly decreasing emissions of the electric grid.

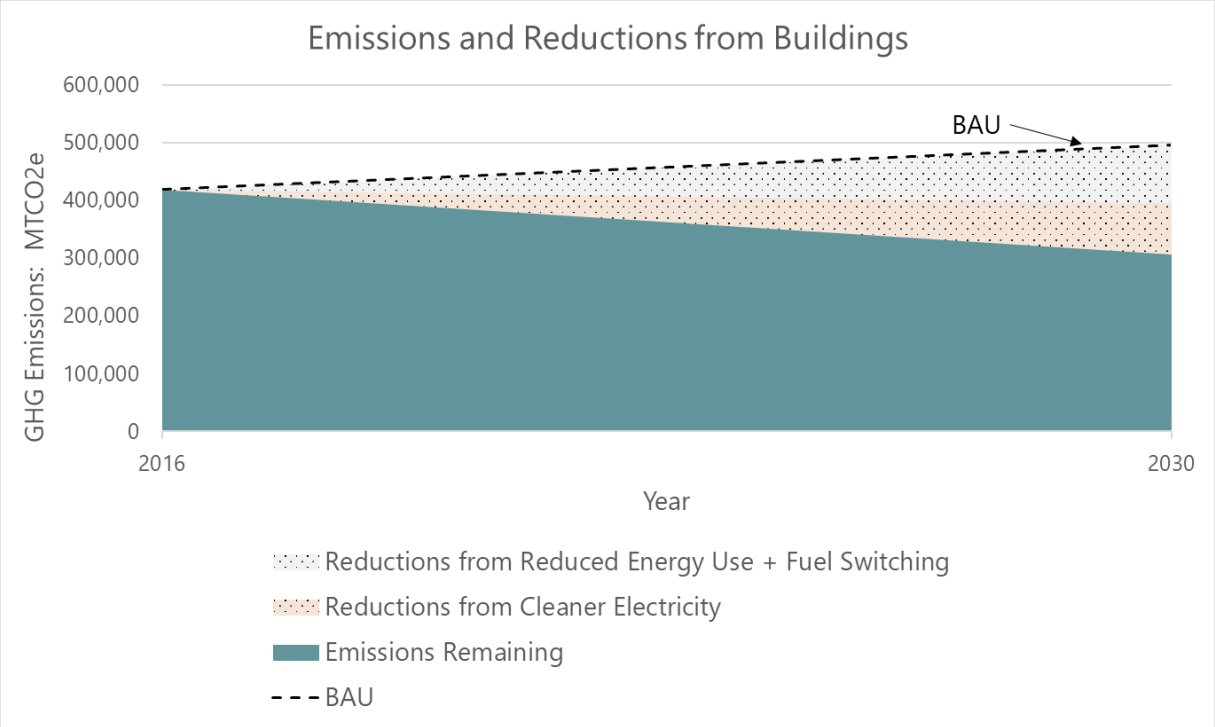


Figure 10: Projected emissions reductions from building fuel switching, compared to the emissions in the business as usual scenario.

WHAT IT MEANS

Fuel switching in buildings involves transitioning buildings from using appliances, processes and generators that directly combust fossil fuels on-site to ones that utilize decarbonized electricity (see the Clean Electricity Target Area on page 71) as well as solar thermal, biomass and other renewable sources of heat and energy. These on-site fossil fuels include natural gas, propane, and diesel. While switching fuel sources, it will also be necessary to ensure that the buildings are well sealed and energy efficient (see Reduced Building Energy Use Target Area on page 85) to manage fuel costs and electrical demand (when applicable).

When building fuel switching is accomplished by transitioning from the combustion of on-site fossil fuels to using electricity, the term “building electrification” is often used to be more specific. Like electric vehicles, building electrification can accomplish significant emissions reductions, but only if the source electricity is sufficiently clean. According to RMI, Arizona has already passed the tipping point in the decarbonization of the electricity grid, so that switching from a natural gas furnace to a grid-based electric heat pump for space and water heating will have an immediate emissions reduction benefit. Additionally, compared to a gas furnace, a heat pump installed in Arizona in 2020 and using grid-based electricity is expected to result in a net reduction in emissions of over 50% for the lifetime of the appliance.

HOW WE'LL GET THERE

> *"In every city we analyzed, a new all-electric, single-family home is less expensive than a new mixed-fuel home that relies on gas for cooking, space heating, and water heating."*
> *– RMI, All Electric New Homes, a Win for the Climate and the Economy* [21]

Approximately 45% of Flagstaff's building emissions, including approximately 56% of residential emissions, come from the on-site combustion of natural gas. Due to the relatively long lifetimes of buildings and appliances, actions now will be crucial for ensuring deep, rapid and long-term emission reductions. These actions include introducing education and incentives to ensure that when existing major appliances require replacement, electric and other renewable alternatives are adopted.

This Plan envisions the electrification of 12,500 major residential appliances as they require replacement as well as significant fuel switching in the commercial sector. Additional efforts can be made to encourage and incentivize electric-only new construction, which has been shown to offer net savings over the lifetime of the building.

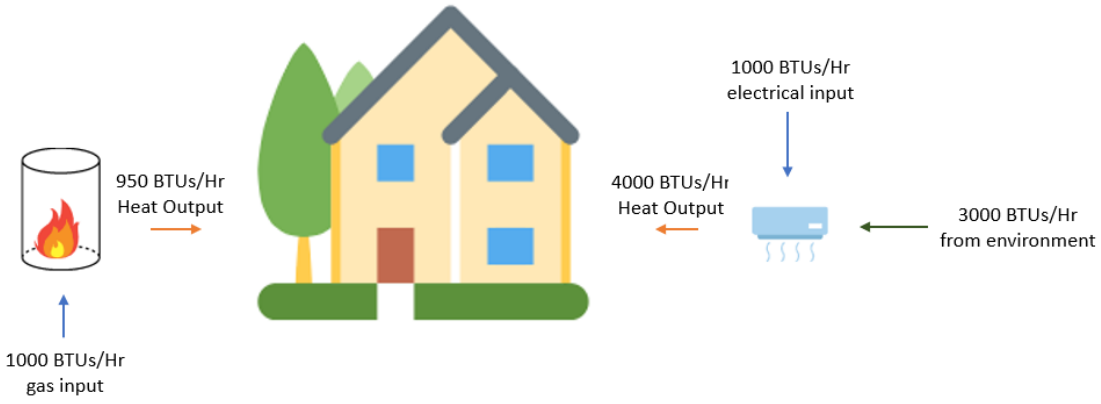
[21] https://rmi.org/all-electric-new-homes-a-win-for-the-climate-and-the-economy/

Fossil fuels for low grade heat – like using a chainsaw to cut through butter

Imagine passing someone a stick of butter and asking them to cut it for you. When they leave the table to "get a tool" for the job, you'd probably expect them to grab a butter knife from the kitchen drawer. But instead they return with a chainsaw. Could the chainsaw accomplish the task of cutting butter? Sure. Is a chainsaw the right tool for the task? Certainly not. For the task of cutting butter, a chainsaw uses far more power than is necessary and is clearly wasteful. Similarly, for the task of low-grade space and water heating, on-site fossil fuel combustion uses far more power than is necessary and is wasteful - like using a chainsaw when a butter knife is available.

Even though gas furnaces have become more efficient in the past decades, they will never be able to compare to the performance of an electric heat-pump. This is because furnaces use energy to *generate* heat – while heat pumps primarily use energy to *transfer* heat from place to place, much like a refrigerator or air-conditioner. Indeed, heat pumps are basically air conditioners that can be reversed, meaning they provide both heating and cooling in a single appliance! Transferring heat requires far less energy than generating it, meaning that heat pumps can deliver the same amount of useable heat while using 2-5x less energy than even the most efficient furnaces. For the task of delivering useable heat, compared to a heat pump, even the most efficient furnace is a chainsaw.

To illustrate, consider that a 95% efficient EnergyStar furnace might be able to generate and deliver 950 BTUs/Hr of useable heat for every 1000 BTUs/Hr of gas energy input. BTUs are a unit of energy, and stand for British Thermal Units. Meanwhile, a heat pump is capable of transferring and delivering as much as 4000 BTUs/Hr or more of useable heat for every 1000 BTUs/Hr of electrical energy input. This is because the majority of the thermal energy delivered by a heat pump comes from the environment, not from the input source.



Based on information and image at: https://www.adams-air.com/houston/what-is-COP.php

In addition to being the right tool for the job of delivering low grade heat for space and water heating due to their superior efficiency, heat pumps and other electric appliances can also be powered by renewable sources. This combination means the lifetime energy use and emissions from the use of electric appliances can be far less than appliances combusting fossil fuels on site.

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: Affordability is a significant concern for Flagstaff community members. When working to promote fuel switching, Flagstaff must carefully weigh the balance between climate action and affordability, with the understanding that both are critical to ensure true sustainability. We do not want a result of climate action to be higher cost of utilities for Flagstaff residents, many of whom already struggle to afford to live in Flagstaff.

When working to electrify homes, the City of Flagstaff will balance affordability and climate priorities. Fortunately, advancements in electric heating technologies, particularly through the use of heat pumps, mean that electrification does not necessarily result in higher costs. The Rocky Mountain Institute has found that electrification of space and water heating can reduce costs over the lifetime of the appliances, for both new buildings and some retrofits.[22]

The City will prioritize incentives in collaboration with local partners to make the cost of fuel switching competitive and even beneficial compared to remaining on fossil fuels. The City will work its partners to help residents utilize the latest technology, analyze policies for their impact of affordability, and ensure that electrification does not have detrimental effects, particularly for Flagstaff's low-income families. See the extended conversation about tensions on page 25 for more on electrification and equity.

Electrified homes and buildings may have more price stability, too. Currently, fossil fuels are subsidized and are associated with large externalities, mainly from the negative effects of their greenhouse gas emissions. Should a carbon price come into effect in the next decade, the artificial affordability of using on-site fossil fuels could be dramatically reduced or eliminated (see the Social Cost of Carbon section on page 41).

Adaptation: Surveys conducted throughout the Plan development process have demonstrated that electric grid reliability is a concern for many community members. This is valid, and electric utilities have much work to do in the next decade to bolster the grid for the renewable energy future. The City can support this transition and support grid reliability by implementing initiatives to reduce and manage energy demand - see the Reduced Building Energy Use Target Area on page 85).

[22] https://rmi.org/insight/the-economics-of-electrifying-buildings/

GOALS

Goal	Year
Reduction in Natural Gas usage by Sector: Industrial: 0% reduction Commercial: 20% reduction Residential: 62% reduction	2030
12,500 residential properties (~50% of residential properties currently connected to natural gas) will have conducted a deep energy efficiency retrofit including the electrification of at least one major appliance.	2030
25% of commercial properties (not including NAU or municipal accounts) will have conducted a deep energy efficiency retrofit including the electrification of at least one major appliance. 15% of commercial properties fully electrify.	2030

Why don't we model natural gas reductions in the industrial sector?

While the low-grade heat used in residential and most commercial applications can be electrified or switched to other renewable sources relatively easily, many industrial processes require high heat or even use natural gas or other fossil fuels as a feedstock. Generally speaking, these are 'harder' problems from a decarbonization standpoint, and as an organization the City is less familiar with how fossil fuels are being used for industrial processes in Flagstaff, and is less well positioned to support Flagstaff industry in making these transitions. The City is prepared to develop education and incentive programs to support residential and commercial entities. While we are optimistic that industrial users will reduce their reliance on fossil fuels, including natural gas, due to our limited information and ability to directly support industrial users, we are not currently modeling any reductions from the industrial sector. Going forward we will look to learn more about the industrial users in our community and their use of fossil fuels, and will look for opportunities to support reductions.

STRATEGIES TO ACHIEVE FUEL SWITCHING

FS-1: Reduce or remove natural gas usage in municipal buildings.

Opportunities for action:

1. Develop and implement a Municipal Building Electrification Plan, to achieve net zero energy in occupied City facilities.
2. Obtain funding to build 100% electric buildings on new City of Flagstaff affordable housing sites, to support affordable living.
3. Electrify appliances during upgrades at existing City of Flagstaff affordable housing sites whenever feasible.

FS-2: Encourage new buildings to rely on the electric grid as their main energy source.

Opportunities for action:

1. Provide monetary incentives to builders that construct or retrofit to achieve net zero energy prior to 2030.
2. Provide incentives to builders to forego natural gas infrastructure in new sub-developments and new buildings.

FS-3: Support fuel switching in existing residential and commercial buildings.

Opportunities for action:

1. Establish a revolving loan fund for major appliance electrification upgrades and solar thermal hot water upgrades for residential and commercial properties.
2. Increase the pace of home and commercial electrification by funding home energy electrification rebates and completing home energy electrification via the Home Energy Retrofit Program.
3. Establish an Electrification Permit Fund to pay for the permits for existing households and businesses to electrify their appliances.
4. Develop incentives to promote the mass installation of solar thermal water heating within the community.

FS-4: Provide training and education on fuel switching.

Opportunities for action:

1. Fund and implement a contractor training program for solar thermal, electric water heaters, electric heat-pump space heaters, and conversions from gas to electric appliances.
2. Develop a program to offer technical assistance, help schedule contractors for fuel switching upgrades, and offer incentives above and beyond what is offered by the utility.
3. Create a Residential Energy Efficiency and Fuel Switching Information Hub for exchanging information about net-zero renovations, electrification, and at-home climate mitigation strategies.

Not Your Grandfather's Heat Pump

According to the Rocky Mountain Institute (RMI) "Heat pump technology has improved significantly in recent years, flipping a commonly accepted narrative that it is not an efficient or dependable heating source. Even accounting for reduced efficiency in extreme cold weather, our analysis finds that modern air source heat pumps are more than twice as efficient as gas furnaces."[23] Modern heat pumps are providing efficient heating in cold weather climates from Denver to Minneapolis to Fargo.

In addition to being able to pair modern heat pumps with smart and programmable thermostats, the main technological updates compared to heat pumps from even a decade ago are the inclusion of:

- Variable speed compressor technology
- Improved expansion valve technology
- Fans with electronically commutated motor (ECM) technology

Each of these technology improvements allow the unit to run at an optimized pressure/openness/speed to best meet the heating (and cooling) needs. Previous heat pumps without these features could typically had to be 'all on or all off,' which reduced performance.

Legislative change

Lobby at the Arizona Corporation Commission for more energy efficiency and electrification programs for all sectors.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Energy Strategy 2. Expand renewable energy generation and use.

[23] https://rmi.org/its-time-to-incentivize-residential-heat-pumps

FOCUS THREE: OUR CONSUMPTION

We will manage our consumption through:

- Reduced building energy use
- Sustainable consumption and waste management

Reduced Building Energy Use

Flagstaff will significantly reduce greenhouse gas emissions from heating, cooling and powering buildings.

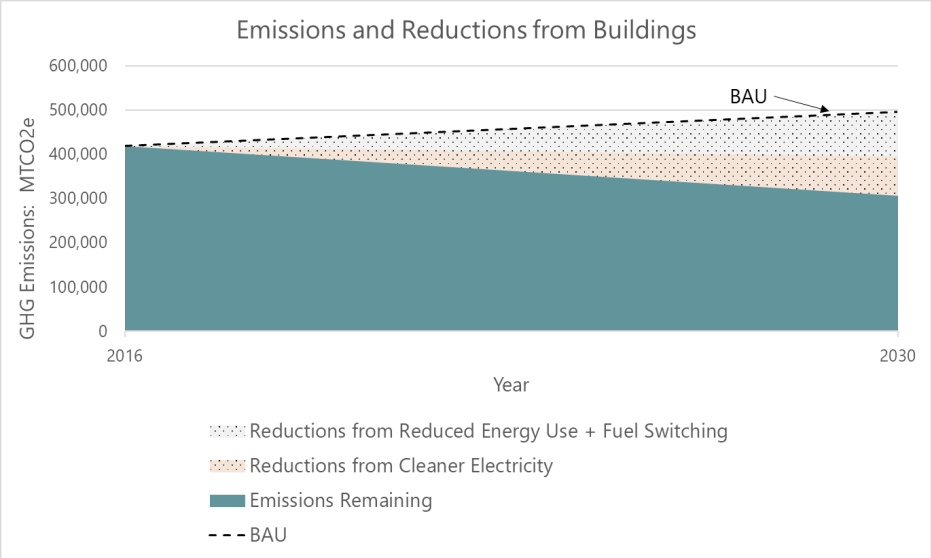


Figure 11: Projected emissions reductions from clean electricity and reducing building energy use, compared to the emissions in the business as usual scenario.

WHAT IT MEANS

Reducing energy demand is one of the quickest and most affordable methods to reduce emissions from buildings.

Whether for new construction or for retrofitting existing buildings, energy efficiency solutions are well understood. Weatherization improves the building envelope and insulation, while other solutions utilize technology (i.e. smart thermostats, energy efficient appliances, distributed energy storage) to optimize energy use. The payback on retrofits, depending on the building, is five to seven years on average.[24]

Reductions in building energy demand will provide immediate emissions reductions from the use of both electricity and natural gas, while also making our homes and businesses more comfortable to live in and more affordable to operate. While APS is making the transition to 100% carbon free electricity (see Clean Electricity Target Area on page 71), reducing building energy demand will also improve the ability of the

[24] https://drawdown.org/solutions/building-retrofitting

Utility to meet demand with cleaner fuel mixes. Reducing building energy demand is especially critical given the various fuel switching strategies in this Plan (see Building Fuel Switching and Electric Mobility Target Areas on page 77 and page 66, respectively). Fuel switching without energy efficiency measures will increase electrical demand significantly. Fuel switching combined with energy efficiency can temper or even reduce electrical demand, thus making it easier and less expensive to bring online the magnitude of clean electricity infrastructure required to meet our future needs.

What about water?

Producing the water that arrives at our taps and then treating it after its use utilizes energy at every stage of our water production and treatment processes. In Flagstaff, water is particularly energy intensive, as many of the wells we use to obtain drinking water are as deep as 1,000 feet or more. Water operations comprise most of the City of Flagstaff's energy use.

Energy use is carefully monitored by the City of Flagstaff's Water Services staff, who work to increase the energy efficiency of Flagstaff's water management processes. Staff also work to manage Flagstaff's water supply, plan for the future, and reduce water use through conservation – more on those efforts can be found at www.Flagstaff.AZ.gov/water.

This Plan, and the City's building energy use reduction efforts, consider water use to fall under the umbrella of building energy use. As water used in a home or a business represents energy use, water efficiency and conservation contribute to reduced community energy use. City staff will work across divisions to coordinate water and energy conservation initiatives.

HOW WE'LL GET THERE

Emissions from buildings currently constitute approximately 44% of all community emissions. To reduce energy demand Flagstaff must set aggressive reduction targets for both new and existing building stock. Due to their long lifetimes and the rate of growth in Flagstaff, it will be important to integrate more energy-efficiency technologies and infrastructure into new construction in the near-term through policies, incentives and economics. The 2018 Climate Action and Adaptation Plan forecast a goal of a net-zero construction code for all new residential and commercial buildings by 2040. This goal will be accelerated to 2030 with an intermediary glidepath to net-zero building code in 2025. While it is important for new buildings to be energy efficient, today's existing building stock is expected to make up over 90% of the community buildings in 2030. Therefore, it will be critical that a significant number of these buildings, especially the older and lower performing ones, undergo building retrofits to both reduce their energy demand and improve their comfort and utility for their occupants. This Plan envisions and supports performing home energy and electrification retrofits on 12,500 homes (~50% of the existing housing stock) in addition to a significant number of building retrofits in the commercial sector. Performing retrofits at this scale will be an enormous opportunity for jobs and partner collaboration.

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: Three in ten households in the US face challenges in meeting their energy needs.[25] Low-income households face disproportionately higher energy burden – or the portion of gross household income spent on energy costs. According to the Department of Energy, low-income households spend 8.6% of their income on energy, compared to 3% for other households.[26] In Flagstaff, low-income households spend 13% of their income on energy each year; higher-income households spend between 1% and 3%.[27] This is a large energy burden that leads to a high cost of living, limited disposable income and financial insecurity for Flagstaff's low-income families.

Purchasing new, energy efficient technology or appliances often requires a significant up-front financial investment. While all households can benefit from the return on investment provided by energy efficiency, high up-front costs meant that not all households can access this investment opportunity that helps save money over the long term. This inequity can persist in incentives, where only those who have access to upfront funds to purchase the appliance are able to access the financial incentive.

Climate action in this target area will work to reduce the energy burden for low-income families, and work to provide emissions and cost-saving benefits equitably throughout the community.

Adaptation: More efficient buildings can help Flagstaff residents be more prepared for more extreme weather, like extreme heat, large winter storms, or extreme cold. By reducing the energy used in homes and other buildings, energy efficiency investments can lead to lower heating and cooling energy use, which leads to lower energy bills and lower reliance on outside fuels, which can be helpful during extreme weather.

Heat pumps are a climate mitigation tool that help residents heat their homes using electricity instead of fossil fuels. Heat pumps can also be used as air conditioners, which can help people with health conditions get through Flagstaff's hottest summer days, but also use a lot of energy. Currently, most homes in Flagstaff do not have air conditioning. As more homes in Flagstaff install heat pumps, more residents will have access to air conditioning, creating the possibility for increased energy use in the summer months. Energy-efficient building practices and demand management will be needed to ensure that Flagstaff's buildings are well-insulated and require lower amounts of both heating and cooling.

[25] https://www.eia.gov/todayinenergy/detail.php?id=37072
[26] https://www.energy.gov/eere/slsc/low-income-community-energy-solutions
[27] https://www.energy.gov/eere/slsc/maps/lead-tool

GOALS

Goal	YEAR
Reduce greenhouse gas emissions from heating, cooling and powering buildings by 34% from BAU.	2030
Reduce electricity usage by building sector: Industrial: 0% reduction Commercial: 0% reduction Residential: 4% reduction	2030
Reduce natural gas usage by building sector: Industrial: 0% reduction Commercial: 20% reduction Residential: 62% reduction	2030

STRATEGIES TO ACHIEVE REDUCED BUILDING ENERGY USE

BE-1: Achieve net zero energy City of Flagstaff facilities.

Opportunities for action:

1. Perform a full-scale energy audit and implement recommended energy retrofits for all City of Flagstaff facilities from this audit.
2. Design and obtain funding for new City of Flagstaff Affordable housing sites to be net zero energy.
3. When retrofits at existing City of Flagstaff Affordable housing sites are made, implement efficiency upgrades to move the sites towards net zero energy.

BE-2: By 2030, require new homes in Flagstaff to be net zero energy homes.

Opportunities for action:

1. Implement progressively more aggressive building codes, requiring net zero energy buildings.
2. City staff should ensure the City's building code is reflective of rapidly changing technology related to energy efficiency, renewable energy, energy or battery storage, and electrification.
3. Provide incentives to builders to construct net zero energy buildings, prior to a net zero energy code requirement. Use these buildings to showcase the feasibility, benefits and innovation.
4. Require large new buildings and new neighborhood developments to submit c**arbon neutrality alignment statements**, to increase collaboration between developers and the City and to communicate how developments contribute to the City's carbon neutrality goals.

BE-3: Reduce energy use in existing buildings.

Opportunities for action:

1. Incentivize and subsidize home energy efficiency retrofits on a sliding scale based on income.
2. Establish a revolving loan fund for energy efficiency upgrades to make affordable financing available to both commercial and residential properties.
3. Work with real estate energy partners to obtain energy efficiency information during real estate transactions, such as requiring home energy efficiency scores when homes are sold or ownership is transferred.
4. Catalyze energy efficiency and more affordable living in rental housing, increasing energy efficiency in rental homes through incentives and potential minimum standards.
5. Expand energy efficiency outreach, including energy efficiency workshops, education on energy price signals, and how to navigate time-of-use pricing.

Why net zero energy homes?

Net zero energy homes are tied to the electric grid, and use a low amount of energy due to being air-tight, well-insulated and energy efficient. They typically incorporate some sort of renewable energy generation on-site, like solar panels. Due to this low energy use paired with energy production, these homes produce as much renewable energy as they consume over the course of a year, leaving the occupants with a net zero energy bill, and a carbon-free home.[28] Homes can be built as **net zero ready**, meaning they can become net zero with the installation of solar panels.

Net zero energy *ready* homes are already being built in Flagstaff – the Crestview neighborhood, by the developer Capstone, is comprised of all net zero energy ready homes – including the homes participating in the City of Flagstaff Community Land Trust Program.

The Department of Energy (DOE) has a Zero Energy Ready Home Program, to recognize ZERH homes and ensure "**outstanding levels of energy savings, comfort, health, and durability.**"[29] The DOE promotes the following benefits from zero energy ready homes:

- Improved home experience and lower ownership costs,
- Benefits to home builders, including customer satisfaction and lower liability,
- Support of a more resilient electric grid with lower peak demand, and
- Approximately $150 billion of utility savings and signification jobs benefits.[30]

Legislative change

This strategy would benefit from enabling legislation to allow:

1). Energy use disclosure and benchmarking for all buildings, and

2). An Arizona PACE program to encourage property owners to make energy-related investments and upgrades to buildings using a special property assessment, for both residential and commercial properties.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Energy Focus Area Strategy 1. Improve energy efficiency in all sectors.

[28] Learn more: https://zeroenergyproject.org/buy/zero-energy-homes
[29] https://www.energy.gov/eere/buildings/zero-energy-ready-homes
[30] https://www.energy.gov/sites/prod/files/2020/08/f77/Zero%20Energy%20Ready%20Homes-%20Why%2C%20What%2C%20and%20How.pdf

Sustainable Consumption and Waste Management

Flagstaff will move towards sustainable consumption, divert more materials from the landfill through reuse and recycling, and then reduce emissions from the landfill.

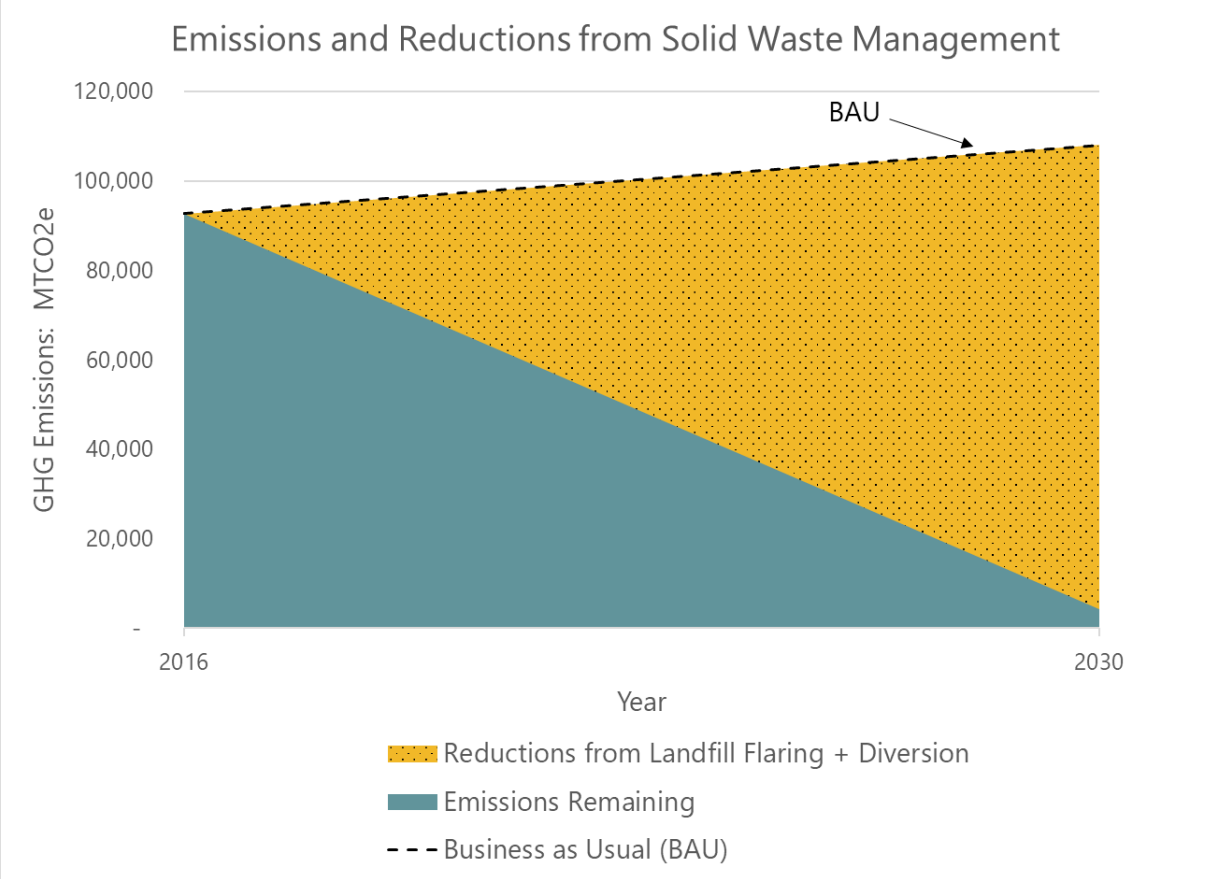


Figure 12: Projected emissions reductions from solid waste management, compared to the emissions in the business as usual scenario.

WHAT IT MEANS

Given our current sector-based inventory methods (see page 106), community emissions related to solid waste come almost entirely from landfill gas, a natural byproduct of the decomposition of organic material. Landfill gas tends to be 40-60% methane, with the rest being carbon dioxide and other non-

methane organic compounds. Methane is a potent greenhouse gas that is 28-36 times more effective than carbon dioxide at trapping heat in the atmosphere over a 100-year period.[31]

HOW WE'LL GET THERE

While reported emissions related to solid waste account for approximately 16% of Flagstaff's current emissions profile, the impact of waste and consumption is likely to be significantly underestimated due to the fact that Flagstaff currently conducts a sector-based rather than a consumption-based inventory (see the Sector-Based Greenhouse Gas Inventory section on page 107). Therefore, many of the prevention actions in this Target Area are expected to have unmeasured beneficial impacts beyond even what can be captured using our current methods of measurement. Additionally, many of the actions in this Target Area offer environmental, economic, and social co-benefits. For example, actions such as rescuing edible food from the landfill and redistributing to food donation programs not only reduces methane emissions, it also helps to address hunger in local communities.

The main strategy in this Plan for managing landfill emissions calls for installing gas collection systems at the Cinder Lake Landfill. This should include pre-installation of a horizontal gas collection system during the construction of the next landfill cell, which is expected to get underway in the next 5-7 years. This next landfill cell will also be lined, which will help maximize the efficacy of the pre-installed gas collection system. Retroactive installation of a gas collection system within the currently open and unlined cells, which are expected to be closed and capped between 2026-2029, may not achieve optimal collection efficiency, but this voluntary action would be supported by the Arizona Department of Environmental Quality. Analysis will need to be conducted to determine the gas collection efficiencies that can be achieved for these unlined cells, and the emissions and reductions projected can be updated as more data becomes available. Flaring was chosen over other potential options (i.e. gas to energy) for the currently open cells after assessing the expected returns and determining that they did not justify the increased price. Flaring has been shown to have a 98% methane destruction efficiency, meaning that it destroys 98% of the gas collected.

The City of Flagstaff ReThink Waste Challenge is a program that joins innovation, equity, and waste minimization. By providing funding to innovative projects focused on decreasing waste, entrepreneurs are better able to implement strategies to decrease waste in the Flagstaff community.

Finally, it should be noted that the ReThink Waste Plan was adopted by resolution in 2018, the same year as the Climate Action and Adaptation Plan (CAAP). These two plans were largely aligned in terms of goals and timelines. Given that the Climate Emergency Declaration has advanced the goals and timelines of the CAAP, the ReThink Waste Plan should also be updated. Indeed, the actions in this target area should be considered a starting point and sneak peek for some of the updates to come in the ReThink Waste Plan.

[31] https://www.epa.gov/lmop/basic-information-about-landfill-gas

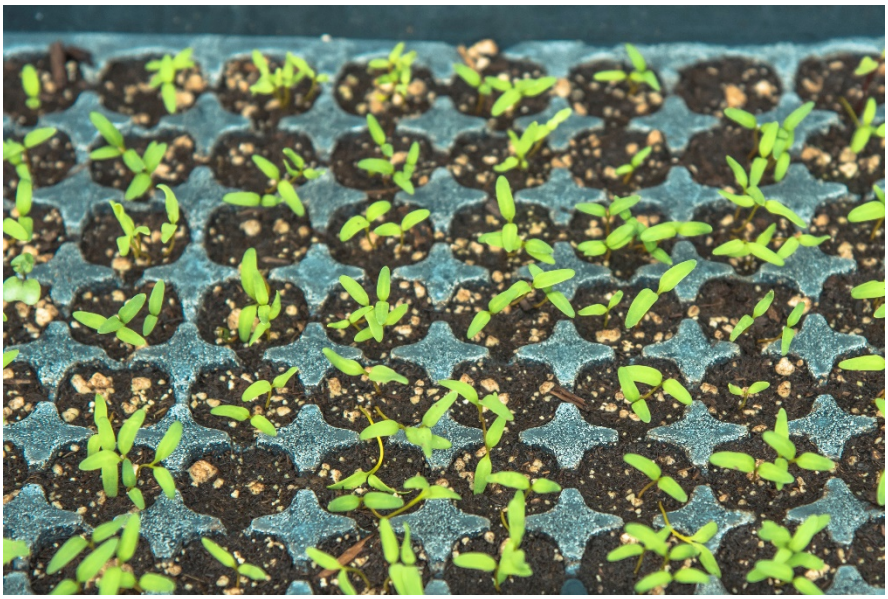
EQUITY AND ADAPTATION CONSIDERATIONS

Equity: Programs to incentivize decreasing waste and overall consumption can be financially beneficial to low and middle income households that produce little waste. The Pay as You Throw pilot program is an example of this, where those who produce little waste will pay less than those who create more. However, some low- and middle-income households inherently produce more waste due to factors such as family size, age, or disability. These factors must therefore be considered when creating and implementing waste reduction programs in order to create effective policies that decrease waste in an equitable manner.

Adaptation: Ideas behind decreasing waste and consumption sometimes rely on purchasing reusable items, under the assumption that all people can afford to buy these items. However, we can learn from the most sustainable among us - those who have decreased waste out of necessity; reusing jars and containers instead of purchasing a new Hydro Flask bottle or package of Tupperware actually does more to decrease consumption. Flagstaff can learn from the ingrained resilience and wisdom of our elders that exists within our community.

GOALS

Goal	YEAR
Reduce methane emissions from the landfill by up to 98%	2030
Ensure equal access to recycling services across Flagstaff.	2030
80% community waste prevented and diverted from landfill	2030



STRATEGIES TO ACHIEVE SUSTAINABLE CONSUMPTION AND WASTE MANAGEMENT

MM-1: Manage emissions from the Cinder Lake Landfill.

Opportunities for action:

1. Establish gas capture and flare systems at the Cinder Lake Landfill.
2. Explore the feasibility of a large-scale digestion or other composting mechanisms.

MM-2: Encourage sustainable consumption.

Opportunities for action:

1. Expand educational programming to encourage sustainable consumption by residents and businesses.
2. Collaborate with local and regional partners to reduce construction and demolition waste.
3. Encourage low-carbon food consumption.

MM-3: Divert more waste from the landfill.

Opportunities for action:

1. Convert the materials recovery facility (MRF) to a transfer station to expand allowable recyclable materials and increase diversion from landfill.
2. Utilize MRF space for a Center for Hard to Recycle Materials (CHARM). Host regular community events and drop off days at this facility and partner with businesses to divert the material.
3. Incorporate residential "Pay as you Throw" volumetric pricing to divert more waste from the landfill.
4. Complete waste characterization study to identify recoverable materials that create economic development opportunities.

MM-4: Reduce organic waste going to the landfill and feed hungry people.

Opportunities for action:

1. Expand composting services to reduce food waste and yard waste going to the landfill, starting with a drop off composting service for residential customers and eventually offering curbside collection service.
2. Offer a composting service to commercial customers.
3. Expand educational programming to prevent wasted food in households and businesses.
4. Work with local partners and provide municipal support and resources to maximize food rescue and redirect that food to help address food insecurity in our community
5. Incentivize or mandate the use of locally produced compost to increase demand.

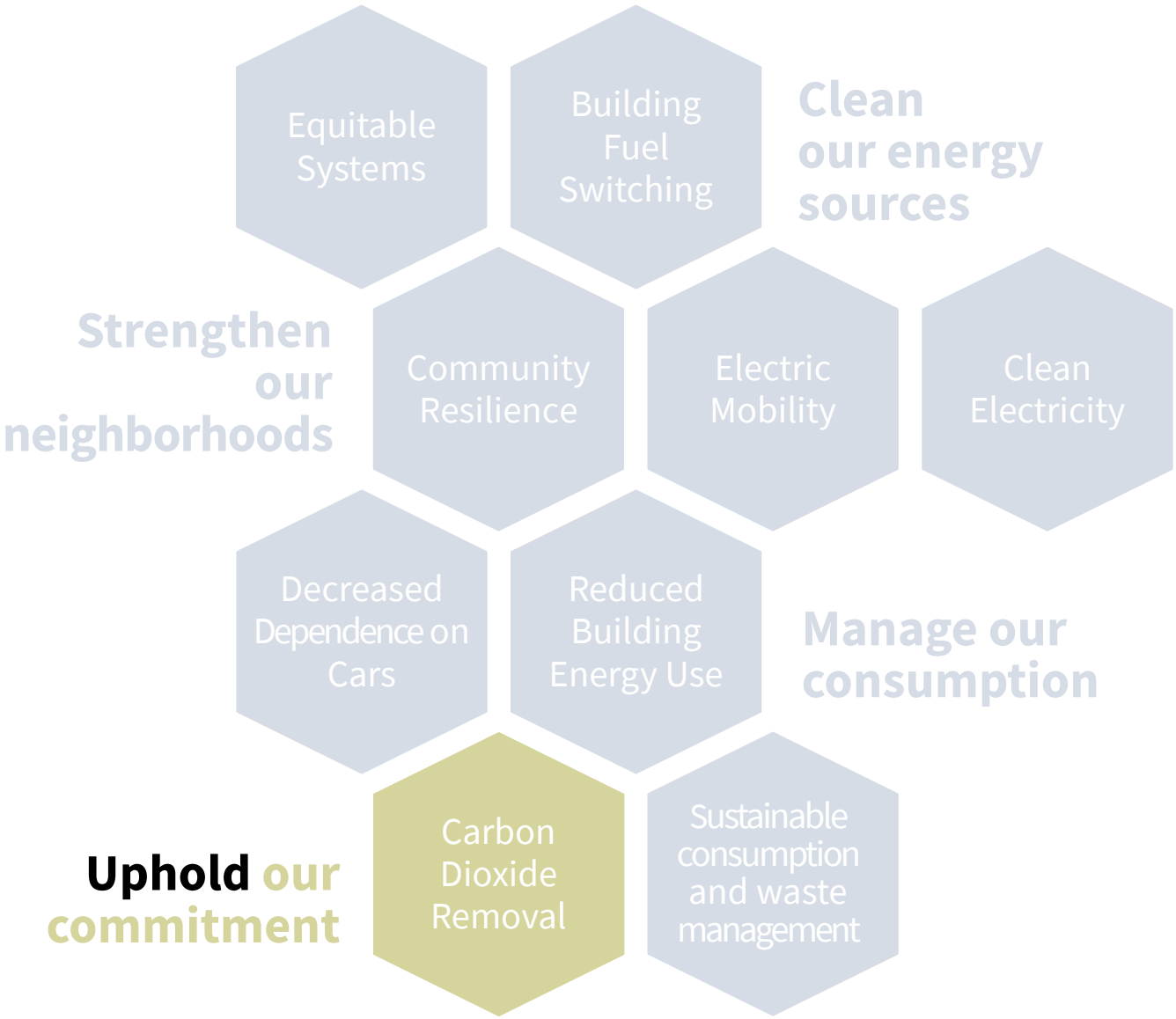
The importance of developing a market for compost material

A composting operation large enough to accept Flagstaff's organic waste will be a major financial investment. In order for the operation to be successful, there needs to be a robust market to sell finished compost and drive greater organic waste diversion. If there is too little demand for compost material, the price of the material will be too low to justify the investment. Thankfully, there are great examples of jurisdictions across the county that we can look to for examples of how to boost demand for compost material. States such as Washington, Oregon, and others require its use in highway development and stormwater infrastructure, while other communities encourage the use of compost as part of new housing developing. Not only does this help sustain composting programs but it also improves soil quality and sequesters carbon.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Waste and Consumption Strategies:
- Strategy 1. Increase waste diversion
- Strategy 2. Support sustainable and accessible production and consumption.
- Strategy 3. Optimize collection and disposal systems to minimize greenhouse gas emissions.
- Strategy 4. Improve data collection on consumption, waste, and diversion.

FOCUS FOUR: OUR COMMITMENT



We will uphold our commitment through:

- Carbon dioxide removal

Carbon Dioxide Removal

Flagstaff will achieve carbon neutrality by first measuring the remaining emissions produced by our community each year, and then balancing with an equivalent amount of carbon dioxide removal (CDR) through local and regional initiatives. If local and regional initiatives are unable to fully satisfy the community's CDR obligation, Flagstaff will explore options for obtaining carbon dioxide removal certificates (CORCs) or other high-quality offsets.

WHAT IT MEANS

Carbon dioxide removal (CDR) refers to the process of removing carbon dioxide from the atmosphere. Removed carbon dioxide can be stored in terrestrial, geological, and oceanic reservoirs and can be stored in products. Removed carbon dioxide may also be utilized, but if this utilization returns the carbon dioxide to the atmosphere, the removal would no longer qualify as a negative emissions initiative – though the net impact may well contribute to reducing community emissions, which is also a productive outcome when striving toward carbon neutrality. There are numerous established and emerging approaches for accomplishing CDR, each associated with a different deployment maturity, permanence of storage, and drawdown potential, as well as considerations of costs, location, co-benefits, risks, and uncertainties.

HOW WE'LL GET THERE

Since emissions will still be produced in Flagstaff by the year 2030, carbon dioxide removal (CDR) will be necessary to achieve carbon neutrality. The magnitude of CDR required will ultimately depend on, and be equivalent to, the amount of emissions still produced each year. If all other local reduction strategies outlined in this Plan meet projections, then it is expected that there will be over 471,000 MTCO2e still produced locally in 2030.

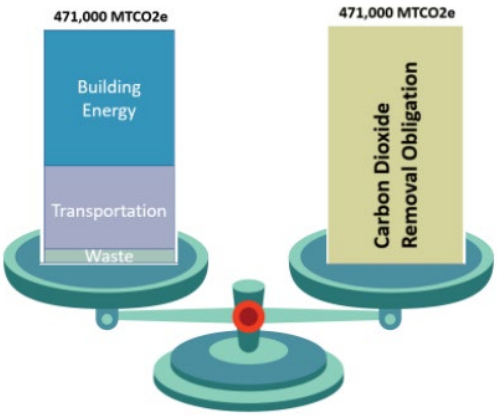


Figure 13: The two sides of the carbon neutrality scale: On the left side are the remaining emissions still produced (after reductions). On the right side is carbon dioxide removal. The two sides of the scale must balance out to achieve carbon neutrality.

Assuming that local reductions continue each year beyond 2030, then the annual CDR obligation required to achieve carbon neutrality will likewise decrease over time. It should always be kept in mind, reductions need to be prioritized and that (using the framework of the graphic above) the smaller that we can make the left side of the scale in 2030, or any other year, the smaller our CDR obligation.

As a City and community, we will first investigate the feasibilities of standing up and supporting local carbon dioxide removal (CDR) initiatives. Potential CDR projects may include nature-based initiatives on City lands and Open Spaces that remove carbon dioxide from the atmosphere and store it in biomass and soils. These could include urban forestry projects in areas of town that lack canopy and are vulnerable to the impacts of heat, or regenerative practices on riparian or degraded lands. We may also explore CDR initiatives that support the removal of waste and liability biomass from our surrounding forests – such as bioenergy or biochar. In addition to performing CDR, many of these initiatives would also reduce the risk of catastrophic forest fire as well as protecting, restoring, or otherwise supporting numerous ecosystems, allowing them to better provide all their many ecosystem services more effectively. We may even consider being an early adopter and making investments in the deployment of technology supported CDR initiatives including projects that provide long-term storage in materials or geologic formations. In developing the portfolio of initiatives that will be needed, the City may look to take the lead on some CDR projects, while other efforts may result from collaborations and perhaps even requests for proposals (RFPs). We also expect that the market will play a role and that some businesses will find opportunity in the CDR space.

If we are unable to meet our full CDR obligation with the portfolio of local initiatives that we develop, we will also have to consider obtaining carbon dioxide removal certificates (CORCs) or other high-quality offsets from third party vendors to satisfy the remaining obligation. The markets for CORCs are in early development and the price forecast is highly uncertain. Offsets have had a checkered history in terms of verification, additionality and permanence and are generally regarded as being insufficient to the problem. In order to address these limitations, Flagstaff will evaluate potential offsets using the Oxford Offsetting Principles[32] in order to ensure that they are high quality.

THE OXFORD OFFSETTING PRINCIPLES

- Cut emissions, use high quality offsets, and regularly revise offsetting strategy as bast practice evolves.
- Shirt to carbon removal offsetting.
- Shift to long-lived storage.
- Support the development of net zero aligned offsetting.

[32] https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf

EQUITY AND ADAPTATION CONSIDERATIONS

Equity: According to the EPA, "A growing body of research points to "intra-urban" heat islands, or areas within a city that are hotter than others due to the uneven distribution of heat-absorbing buildings and pavements, and cooler spaces with trees and greenery. These differences can result from disparities in the way communities are planned, developed, and maintained. There are often correlations between hotter neighborhoods and demographic characteristics of residents, with factors such as race and income often playing a role in who bears the brunt of extreme heat."

Initiatives that increase urban and residential canopy cover and decrease the "heat island effect" are just one example of projects that can have both equity and carbon dioxide removal benefits. Biochar and compost initiatives could also be designed to improve food security for vulnerable residents while also capturing carbon in soils.

Adaptation: There are numerous nature-based CDR approaches that can contribute to improved forest and soil health. Healthy forests provide numerous ecosystem services that will help our community be more prepared and resilient to a changing climate, including protecting water resources. Contributing to local forest health also decreases the risk of catastrophic wildfire, which presents risks to both property and human health.

What about our trees?

The City of Flagstaff has numerous natural landscapes that act as carbon sinks, removing and storing carbon dioxide from the atmosphere. In addition to the ponderosa pine forests within City limits, Flagstaff has 3,300 acres of legally designated open spaces, as well as the Rio de Flag corridor and associated wetlands. At this time, we don't *yet* measure any CDR taking place within these natural landscapes. Over the next two years we will collaborate with partners and organizations (including NAU, the Forest Service, ICLEI) that are working on protocols for determining what (and how much) existing nature-based CDR is appropriate for inclusion in our inventory. It will probably be appropriate to consider and quantify CDR taking place on City owned Open Space, since we manage those areas and their continued protection will allow the CDR these spaces perform to be preserved - in addition to allowing them to perform their many other ecosystem services. It will not likely be appropriate to simply claim 'dibs' on the CDR happening in nearby forests that we aren't involved in managing or protecting. Once we have protocols in place, we expect to find that *some* of the projected 471,000 MTCO2e CDR obligation may already "be on the scale." However even if the entire area of Flagstaff were covered in forest, this would not satisfy our expected CDR obligation – our carbon footprint is greater than our geographical footprint.

GOALS

Goal	YEAR
Remove an equivalent amount of carbon dioxide from the atmosphere as is produced by the community. If all reduction goals are met, this obligation projects to be approximately 471,000 MTCO2e in 2030. This number can be reduced annually as greater local reductions continue to be achieved.	2030

STRATEGY

CD-1: Develop a portfolio of local and regional carbon dioxide removal initiatives to meet Flagstaff's commitment to carbon neutrality.

Opportunities for action:

1. The City's 8000 acre Red Gap Ranch property east of Flagstaff on the I-40 corridor is a possible site for an innovative high desert carbon dioxide removal and sequestration project.
2. Explore the feasibility of smaller-scale regenerative agriculture, meadows, and forests as sequestration sinks in Flagstaff's high desert environment.
3. Collaborate with Northern Arizona University and other governmental organizations and non-profits in Northern Arizona and on the Colorado Plateau to explore opportunities for regional initiatives that achieve carbon dioxide removal and sequestration.

CD-2: If local carbon dioxide removal projects are insufficient, obtain high-quality carbon offsets and CO2 Removal Certificates (CORCs).

Opportunities for action:

1. Evaluate potential certificates and offsets using the Oxford Offsetting Principles.
2. Purchase certificates and offsets that align with Flagstaff's priorities and the Oxford Offsetting Principles.

Connections to the Flagstaff 2018 Climate Action and Adaptation Plan:

Natural Environment Strategy 1. Protect existing forests, resources, and meaningful open spaces.

CDR First Steps

At this time, this Plan does not offer a prescriptive vision for the exact carbon dioxide removal portfolio that Flagstaff will develop and support over the next nine years. That work will require developing regional partnerships, identifying opportunities for collaboration as well as funding. At this time, we have a sense of how much CDR is likely to be necessary to achieve carbon neutrality, based on the emissions reductions anticipated. And so now we need to start doing the groundwork to stand-up and support local CDR projects to meet this obligation. We expect that part of this development will likely involve conducting feasibility studies on various project proposals. We also know that we will need to start deploying initiatives in the next few years to give them time to develop and scale. One thing we do know – it pays to be proactive. Time and again we see that it is the communities that have done the groundwork that are able to take advantage of opportunities – for funding, collaboration, or otherwise. By adopting the Climate Emergency Declaration and thus kicking off the discussion about carbon dioxide removal in our community, we have made our interests clear to potential collaborators, and we are positioning ourselves to be uniquely prepared to take advantage of opportunities as they arise.

V. BACKGROUND

This background section provides information on climate change impacts in Flagstaff and how Flagstaff contributes to climate change via greenhouse gas emissions. This information provides a foundation for our actions. More details on both topics are available on the City of Flagstaff climate action website, at www.flagstaff.az.gov/climate.

In this chapter:

- The Climate Emergency Declaration
- Climate change in Flagstaff
- Flagstaff's greenhouse gas emissions

THE CLIMATE EMERGENCY DECLARATION

The Flagstaff City Council adopted the Climate Emergency Declaration on June 23, 2020. The declaration establishes eight resolutions:

Section 1. The City of Flagstaff declares that a climate emergency threatens our City, region, state, nation, civilization, humanity and the natural world, and recognizes the need for a dramatic increase in its ambition to combat climate change, so that it meets or exceeds the current recommendations of the foremost climate scientists working around the world.

Section 2. The City of Flagstaff commits to its own City-wide transition and climate emergency mobilization effort, utilizing Flagstaff's Climate Action and Adaptation Plan as the foundational framework in recognition of accelerating climate changes and prioritizing appropriate funding for its implementation.

Section 3. The City of Flagstaff commits to educating residents and especially Flagstaff's youth about the current climate emergency and inspiring action.

Section 4. The City of Flagstaff underscores the need for full community participation, and recognizes that the residents of Flagstaff, and community organizations and other such allies will be integral to and in the leadership of the mobilization effort.

Section 5. The City of Flagstaff commits to keeping the concerns of vulnerable communities, minorities, and those experiencing poverty central to all transition and climate emergency mobilization efforts and to facilitate the active participation of such communities.

Section 6. The City of Flagstaff joins a nationwide call for an emergency mobilization collaborative effort, in full partnership with surrounding Tribal nations and traditional agricultural communities, at all levels of government to prioritize adaptation and mitigation in relation to climate change while making all government decisions.

Section 7. The City of Flagstaff will take steps to revise the goals outlined in the Climate Action and Adaptation Plan to be in alignment with the United Nations' November 2019 Emissions Gap Report, while maintaining equal emphasis on adaptation, mitigation, and equity, by advancing the Climate Action and Adaptation Plan's goals to achieve carbon neutrality by 2030.

Section 8. The City of Flagstaff calls on the State of Arizona, the United States of America, and all governments and peoples worldwide to initiate a transition and climate emergency mobilization effort to mitigate global warming and create high-quality, good-paying jobs with comprehensive benefits for those who will be impacted by this transition.

Climate change in Flagstaff

The climate is changing, due largely to human-caused greenhouse gas emissions worldwide. These emissions come from a variety of sources: the cars we drive, the energy we use, the things we use, and even the food we eat. These emissions, once released, stay in the atmosphere, leading to abnormal weather patterns and severe weather events.

Flagstaff emits greenhouse gas emissions into the atmosphere, therefore contributing to global climate change. Emissions in Flagstaff come from three main sources: our energy and electricity sources, how we get around and build our town, and the things we buy and throw away. The chart below shows the portion of our emissions that come from each of these sources (pie chart below).

We get this information about Flagstaff's greenhouse gas emissions from our yearly greenhouse gas inventory. This is a common practice where municipalities itemize and track their annual greenhouse gas emissions. This information tells us where our mitigation efforts are successful, and which areas need more work.

ENVIRONMENTAL CHANGES

Coconino County is already experiencing increased temperatures, and can expect further increases in the future. Flagstaff can also expect to see:

- Increased wildfire risk
- Increased drought
- More flooding
- More insects in the forest and the city
- Damage to our water supply and quality
- Less snow and more rain

For more information on climate change in Flagstaff, view Flagstaff's Climate Profile available at www.Flagstaff.az.gov/climate.[33]

[33] https://www.flagstaff.az.gov/DocumentCenter/View/57498/Climate-Profile?bidId=#:~:text=Since%201950%2C%20Flagstaff%20has%20experienced,risen%20above%2090%C2%B0%20F.&text=In%201974%20and%201990%20temperatures,the%2090%C2%B0%20F%20threshold.

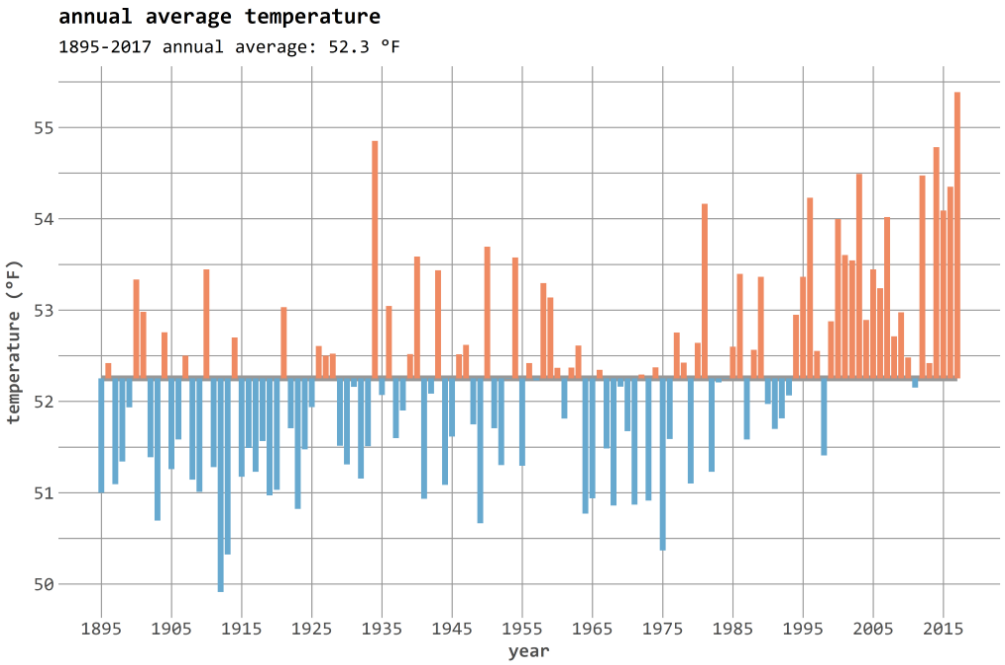


Figure 14. Average annual temperatures for Coconino County from 1895–2017. Orange lines indicate years where the average annual temperature was above average. Blue lines indicate years in which the average annual temperature was below average.

SOCIAL SYSTEMS CHANGES

We can also expect to see a variety of changes to our social systems, including:

- Increased allergens and longer allergy seasons
- Increased susceptibility to insect-borne illness
- Decrease visitation for snowplay
- Heat-related illnesses
- Regional growth that stresses Flagstaff's housing

To learn more about Flagstaff's vulnerabilities, review the Climate Profile at www.Flagstaff.AZ.gov/climate .

Flagstaff's Greenhouse Gas Emissions

HOW WE MEASURE OUR CONTRIBUTION TO CLIMATE CHANGE

To reach carbon neutrality, we must understand how Flagstaff contributes to climate change through greenhouse gas emissions. Each year the Flagstaff Sustainability Office completes a community-scale greenhouse gas emissions inventory. This inventory calculates the emissions produced by the activities taking place in our community. Activities we can measure include the release of greenhouse gas emissions when fossil fuels are burned for transportation and energy, when solid waste breaks down, and when water and wastewater are produced and treated.

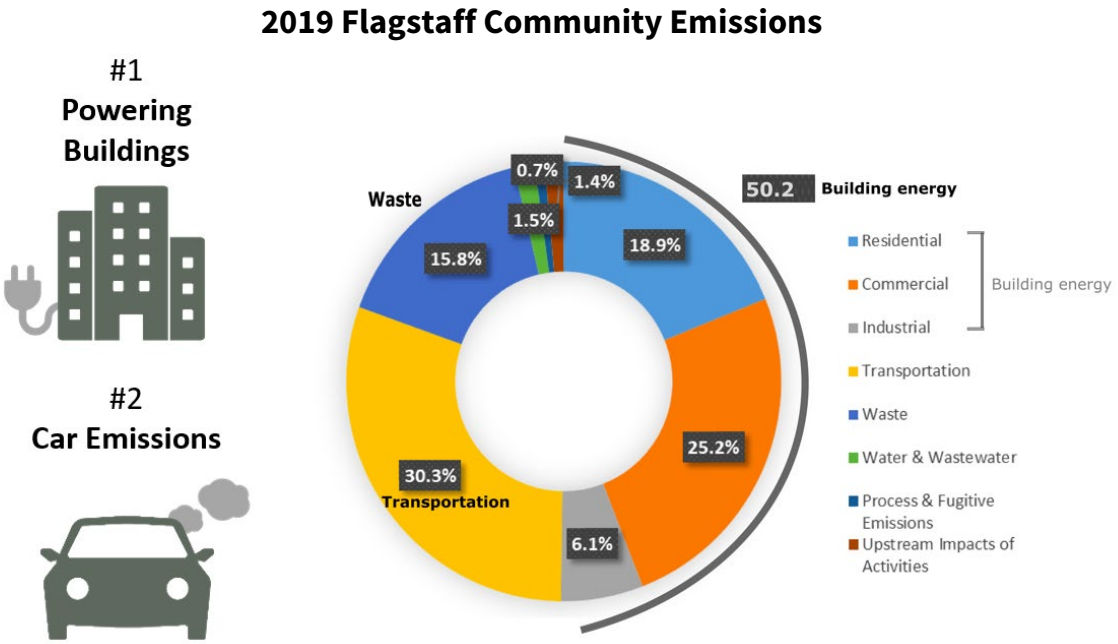


Figure 15. Greenhouse gas emissions from activities across the Flagstaff community in 2019.

Our greenhouse gas emissions fall into four main categories:

1. **Building Energy** contributes to approximately 50% of our emissions. This category represents emissions coming from the use of electricity and natural gas in our homes, and commercial and industrial buildings. Most of these emissions are split between commercial and residential buildings.
2. **Transportation** contributes to approximately 30% of our emissions. This primarily represents emissions from the fuels we use to get around town in vehicles.
3. **Solid waste** contributes to 16%of Flagstaff's emissions, primarily due to emissions from Flagstaff's Cinder Lake Landfill.

4. **Other emissions** are produced from water and wastewater treatment (2%), upstream impacts of activities (1%), and process and fugitive emissions (0.7%). 'Upstream impacts of activities' include emissions that occur prior to the consumption of fossil fuels, from the point of resource extraction, through processing and transportation. 'Process and fugitive emissions' result from the direct release to the atmosphere of GHG compounds from various types of equipment and processes, such as refrigeration and industrial processes. While smaller relative to other sectors, these categories are all important to measure and manage to achieve our emissions reduction goals.

A SECTOR-BASED GREENHOUSE GAS INVENTORY

Currently our inventory methods do not allow us to account for the imported or embedded emissions in the products that we consume. For example, an apple grown in Washington state and consumed in Flagstaff will have embedded emissions associated with the growing, picking, packaging, and transportation to Flagstaff that are not captured using our inventory method. For this reason, it is reasonable to assume that the results of our sector-based inventory represent the minimum emissions attributable to our community activities.

BASELINE: COMMUNITY EMISSIONS BEFORE CLIMATE ACTION

The City of Flagstaff has been tracking community greenhouse gas emissions since 2006. Since then, the way we track emissions has evolved. Today, the City uses the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. This global standard for community-level greenhouse gas inventories creates a reliable methodology that enables Flagstaff to compare its emissions to other communities. Methods and protocols will continue to evolve and improve over time, as will data collection and availability.

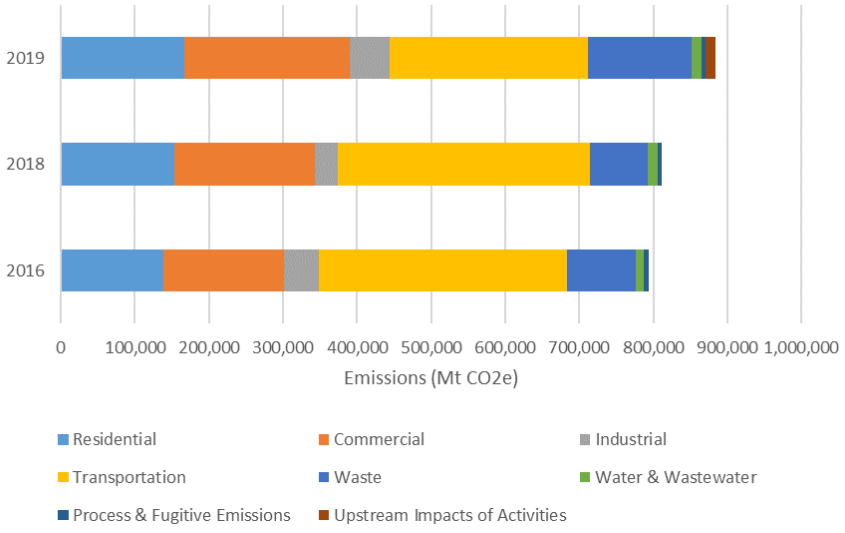


Figure 16. Greenhouse gas emissions by sector for 2016, 2018 and 2019.

The apparent jump observed in 2019 should be considered with the following factors in mind. In 2019:

- Contractual natural gas was accounted for the first time, increasing the emissions of the industrial and commercial sectors.
- The treatment of daily vehicle miles traveled (VMT) was updated, resulting in a net reduction in transportation emissions.
- The protocol for the waste sector was updated from an in-jurisdiction protocol to a methane-commitment protocol, increasing the annual emissions accounted and creating a framework with greater impact potential for waste diversion efforts.
- 2019 was the first year that Upstream Impacts of Activities were included in the Flagstaff inventory.

Each year, the annual greenhouse gas inventory methodology will be updated to utilize the best available practices. When possible and prudent, Flagstaff will also work to retroactively and transparently apply updates and improvements to relevant projections-based models so that their baselines and forecasts might better reflect current methods and data. Indeed, to be more consistent with the 2019 data and methods for buildings and transportation, the 2016 baseline used for the carbon neutrality modeling was amended to 759,000 MTCO2e. This is a lower baseline than was reported in the 2018 Climate Action and Adaptation Plan. (See the conversation about the projected 44% reduction in emissions on page 10.)

For more information on our greenhouse gas inventory and how our methodology and results have changed over time, see: www.flagstaff.az.gov/climate.

The first Flagstaff Climate Action and Adaptation Plan was adopted in November 2018. While the 2019 inventory reflects emissions after adoption of the CAAP, it will take a few years for the impacts on our emissions to be observed. For instance, in 2019, City Council adopted a building code that will ensure new buildings use significantly less energy. However, this code was not mandatory until January 2020, and its emissions reductions will only be truly apparent after buildings built in 2020 and beyond become a greater portion of Flagstaff's building stock.

HOW DO WE MEASURE GREENHOUSE GAS EMISSIONS?

On average, Flagstaff contributes to the production of 759,000 metric tons of carbon dioxide equivalents (MTCO2e).

In order to try to imagine what 759,000 MTCO2e might look like, one might first start by imagining a piece of coal burning, smoking, and releasing CO2 emissions into the atmosphere. Now, if for some reason we wanted to have a single-day bonfire that would emit the entirety of our annual emissions - 759,000 MTCO2e - we would need to gather a lot of coal. Because we are in Flagstaff, we might choose to use our local train tracks to help us bring in all the coal we need for this bonfire.

If we were to fill every railcar with coal, we would require an impossibly long train made up of 4,168 railcars' worth of coal. This would stretch over 41 miles. If you were to get caught behind the gates when this train came by, even if it could travel at the full legal in-town speed limit, you would be waiting at the gates for nearly an hour.[34]

THANK YOU

Climate Emergency Steering Committee

- Rick Barrett, Engineering, City of Flagstaff
- Greg Clifton, City Manager, City of Flagstaff
- Justin Emerick, Water Services, City of Flagstaff
- Dan Folke, Community Development, City of Flagstaff
- Joe Galli, Chamber of Commerce
- Geoffrey Gross, Coconino County
- Todd Hanson, Public Works, City of Flagstaff
- Gail Jackson, Economic Collaborative of Northern Arizona (ECONA)
- Natalie Jacobs, Citizens' Climate Lobby
- Megan Kelly, Grand Canyon Trust
- Dara Marks Marino, Climate Activist
- Dave McCain, City of Flagstaff Sustainability Commission
- Dave McIntire, Economic Vitality, City of Flagstaff
- Kate Morley, Mountain Line
- Matt Muchna, Northern Arizona University
- Amanda Ormond, Ormond Group, LLC
- Judson Tillinghast, APS
- Jed Westover, Loven Contracting

Flagstaff Sustainability Office - Staff and Interns

- Ramón DC Alatorre, Climate & Energy Coordinator
- Nicole Antonopoulos, Sustainability Director
- Jillian Goulet, Climate Engagement Coordinator
- Dylan Lenzen, Sustainability Specialist
- Marissa Molloy, Administrative Assistant
- Jenny Niemann, Climate & Energy Specialist

- Stephanie Arcusa, GHG Emissions Intern
- Lee Bryant, Climate Engagement Coordinator
- Deirdre Conroy, Community Resilience VISTA
- Anona Miller, Transportation & Climate Intern
- Marie Nabors, Carbon Sequestration Intern
- Isabelle Wilhelm, Transportation & Climate Intern

Note: both current and former staff and interns are listed.

Technical emissions consulting provided by the Cascadia Consulting Group

APPENDIX A

The information in this Appendix is intended to give more detailed insights into *some* of the actions and ambition (i.e. number of retrofits) that were used to arrive at our carbon neutrality calculations.

Path to Carbon Neutrality – outcomes modeled	Example City Supporting Actions in the Model
On-road transportation: Vehicle miles traveled (VMT) set to be held at 2019 levels [**1.59M/day (internal)**]	*20% increase in residential density *25% decrease in distance to transit *ATMP fully funded and implemented, including portions that have yet to identify dedicated funding sources; Assumes the Primary Bikeways Network is fully in place
30% Remaining miles electric (or zero tailpipe)	*All new sedans and SUV City of Flagstaff (COF) fleet vehicles till be electric vehicles (EV) or zero emissions vehicles starting in 2022 *50 EV charging stations provided by COF for community. *Additional EV charging stations as needed for fleet operations. **Impact Gap! Some of this will have to happen without COF support. **The 30% goal was modeled**, either the market needs to fill the gap or COF will need to add additional support. OR BOTH.
2000 home solar systems installed (5kW each) for 10MW distributed residential	*Facilitate a twice annual Northern Solar Co-op with SUN *New home building codes
Commercial sector brings on 10MW solar by 2030	
Industrial sector brings on 5MW solar by 2030	
Includes a 50MW solar installation at RGR + 10MW solar at the Cinder Lakes Landfill Assumes 25MW goes to make all COF electricity renewable Assumes COF works with APS to allow half of the remaining solar to be acquired/attributed to the commercial/residential sectors at 7.5MW/10MW split. Note: This does include some policy optimism - that APS and ACC will allow.	*COF works with APS to get utility scale solar at RGR

COF 100% renewable electricity by 2025 (likely to require 25-30MW); + energy efficiency and fuel switching upgrades across the municipality by 2030	*See utility scale solar above *Complete COF municipal energy audit and ESCO
12,500 total residential retrofits ~50% of existing homes. Note: This plan includes actions whereby the City directly supports between 4000 – 5500 of these retrofits.	*Relaunch and retool the ARRA era residential retrofit program: Design program for 4000 retrofits. *Revolving loans funds *Rebate programs **Impact Gap! Some of these have to happen without COF support. **The 12500 goal was modeled.** Either the utilities/State/Fed/market needs to fill the gap or COF will need to add additional support. OR BOTH.
25% of all commercial accounts (NOT COF or NAU) get a deep energy efficiency retrofit	*Revolving loan funds *Rebate programs **Impact Gap! Some of these have to happen without COF support. **The 25% goal was modeled.** Either the utilities/State/Fed/market needs to fill the gap or COF will need to add additional support. OR BOTH.
15% of commercial accounts/establishments fully electrify (not including COF or NAU)	*Revolving loan funds *Rebate programs **Impact Gap! Some of these have to happen without COF support. **The 15% goal was modeled.** Either the utilities/State/Fed/market needs to fill the gap or COF will need to add additional support. OR BOTH.
Landfill gas collection and flaring is operational	*COF installs system when current sequences are capped.

Flagstaff Carbon Neutrality Plan

June 15, 2021

Nicole Antonopoulos

MOVING FORWARD

> **CLIMATE CHANGE**, accelerated by human-caused greenhouse gas emissions, is **disrupting global weather patterns and threatening communities across the world.** If the increasing amount of greenhouse gases in the atmosphere is not reduced, life as we understand it will be irreversibly altered.

> **THE CLIMATE EMERGENCY** requires an urgent mobilization effort to restore a safe climate, protect the earth's diversity of culture and life, and prioritize vulnerable communities.

In response to community appeals, the Flagstaff City Council declared a Climate Emergency in June 2020, calling for a dramatic increase in ambition and a city-wide mobilization towards an equitable transition.

The Climate Emergency Declaration is the foundation for this document and Flagstaff's goal to reach carbon neutrality by 2030.

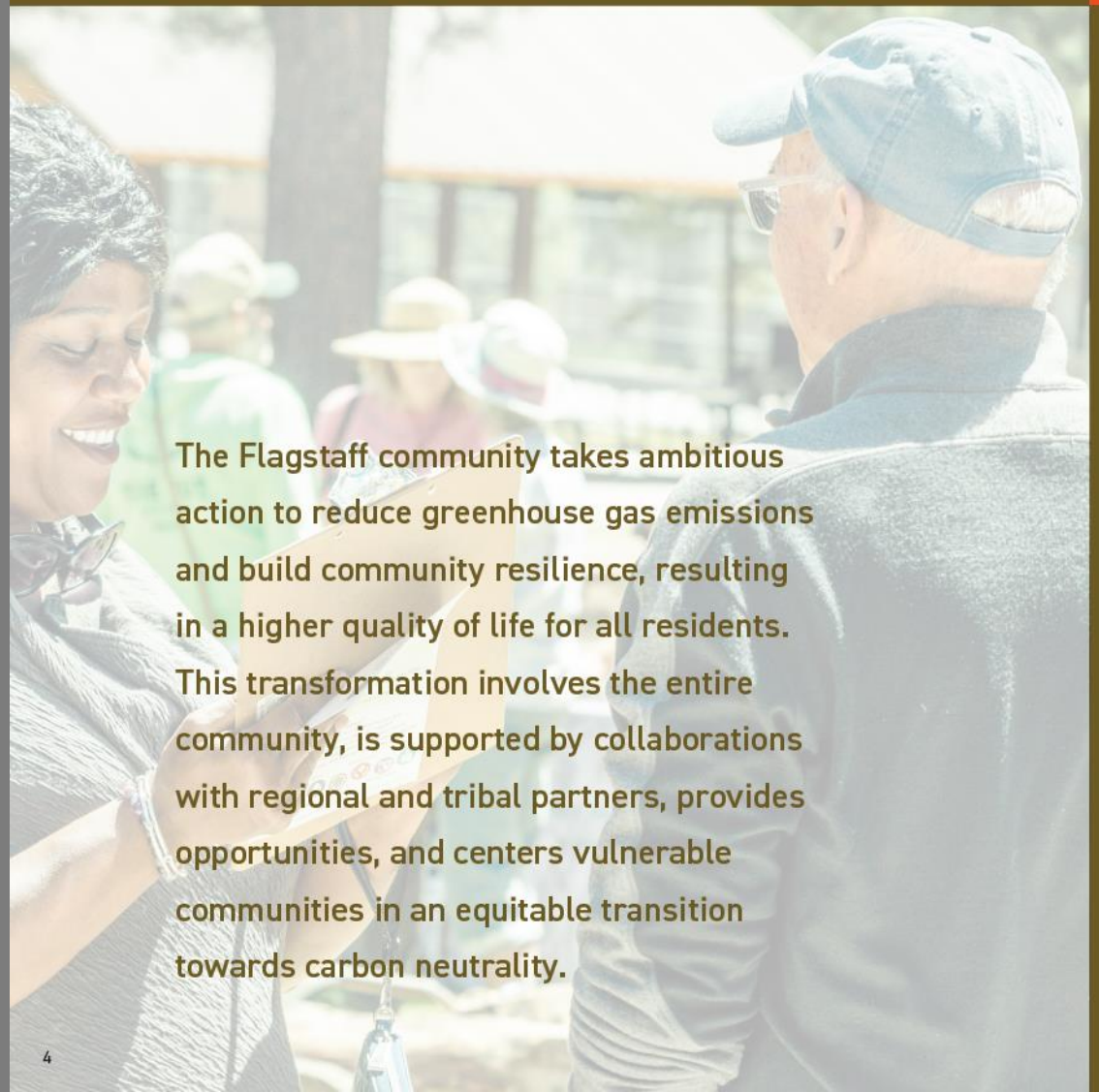
> **FLAGSTAFF COMMUNITY MEMBERS** spurred the creation of the **Climate Emergency Declaration,** starting with a citizen petition. Residents formed coalitions representing groups with unique perspectives on climate change, from business owners to grandparents. Hundreds of community members organized to attend City Council meetings and request the Climate Emergency Declaration.

Community involvement continued throughout the development of this Plan. **Community voices will remain integral as the City moves forward to reach Flagstaff's climate goals.**

> **CLIMATE CHANGE AFFECTS PEOPLE DIFFERENTLY.** Vulnerable communities, including low-income families, communities of color, and the elderly, will face the greatest challenges from climate change. Equity and climate justice will be foundational elements of our work, to avoid harm to underserved groups and to ensure the benefits of climate action are fairly distributed.

The Flagstaff Carbon Neutrality Plan outlines how the Flagstaff community will respond to the climate emergency. The path to carbon neutrality will require leadership, bold action, perseverance and creativity. Each step closer to carbon neutrality offers hope for a healthy, prosperous, and equitable future for the Flagstaff community—and the world.

OUR VISION



The Flagstaff community takes ambitious action to reduce greenhouse gas emissions and build community resilience, resulting in a higher quality of life for all residents. This transformation involves the entire community, is supported by collaborations with regional and tribal partners, provides opportunities, and centers vulnerable communities in an equitable transition towards carbon neutrality.

OUR GOALS

1 Achieve carbon neutrality by 2030.

Flagstaff will arrive at carbon neutrality, also known as net-zero community greenhouse gas emissions, by 2030. Flagstaff will first reduce emissions as much as possible, and then balance the remaining emissions with carbon dioxide removal.

2 Prepare Flagstaff's communities, systems, and resources to be more resilient to climate change impacts.

Climate changes have already taken place in northern Arizona; natural and societal shifts will continue to occur. Flagstaff must respond to climate change through adaptation, or preparing for change and strengthening our social, economic, and infrastructure systems.

3 Address climate change in a manner that prioritizes those most impacted and ensures the costs and benefits of climate adaptation and mitigation are equitably distributed.

Climate change disproportionally impacts communities of color and low-income neighborhoods. These communities contribute the least to greenhouse gas emissions but suffer the greatest effects of climate change and its turbulent impacts.

OUR PATH TO CARBON NEUTRALITY

We will:

> STRENGTHEN OUR NEIGHBORHOODS

- Resilient Community
- Equitable Systems
- Decreased Dependence on Cars

> MANAGE OUR CONSUMPTION

- Reduced Building Energy Demand
- Sustainable Consumption and Waste Management

> CLEAN OUR ENERGY SOURCES

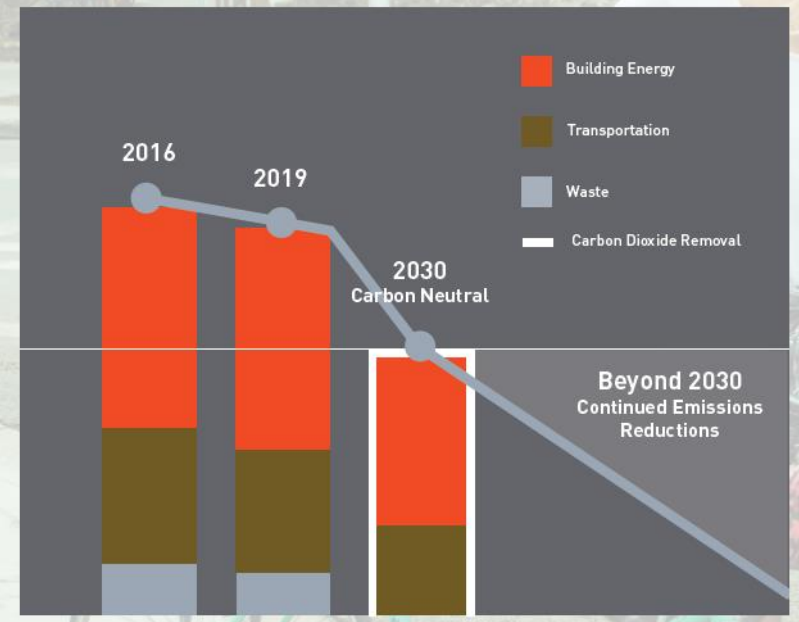
- Clean Electricity
- Building Fuel Switching
- Electric Mobility

> UPHOLD OUR COMMITMENT

- Carbon Dioxide Removal

We will tackle Flagstaff's major sources of greenhouse gas emissions.

FLAGSTAFF'S PATH TO CARBON NEUTRALITY



Carbon neutrality will be achieved through a combination of local emissions reductions and carbon dioxide removal initiatives to offset the remaining community emissions that the City does not eliminate. The City of Flagstaff will work to achieve the greatest reductions in greenhouse gas emissions possible, a projected reduction of 44%. Because our community will still cause emissions in 2030, carbon dioxide removal (CDR) will be necessary. CDR helps to fill the gap between current emissions and zero emissions, counter-balancing remaining emissions with projects that remove emissions from the atmosphere. CDR is a part of all carbon neutrality portfolios, though the proportion of emissions reductions achieved can vary greatly from community to community.

OUR ACTION PLAN

> STRENGTHEN **OUR NEIGHBORHOODS**

> RESILIENT COMMUNITY

- Ensure all mitigation actions improve Flagstaff's ability to adapt to the future.
- Strengthen existing community systems to create resilience to both short-term shocks and long-term change.

> EQUITABLE SYSTEMS

- Incorporate equity as a foundational element of every climate action the City develops and implements.
- Proactively engage community members on an ongoing basis.
- Design targeted policies and programs to serve vulnerable communities first.
- Actively seek to recognize past harms, repair trust, and build deeper relationships with community members.

> DECREASED DEPENDENCE ON CARS

- Encourage vibrancy, appropriate density, and attainability in existing neighborhoods, so that more residents can live within walking distance to their daily needs.
- Create inclusive networks for walking and biking that are continuous, attractive, safe, comprehensive, and convenient for people of all ages.
- Encourage Flagstaff residents and visitors to walk, bike, roll and take the bus.
- Transform transportation policies and planning to incorporate greenhouse gas emissions analysis and reduce dependence on driving.
- Invest in comprehensive and equitable transit.
- Proactively invest to protect Flagstaff's clean air status.

> CLEAN **OUR ENERGY SOURCES**

> ELECTRIC MOBILITY

- Advance the electrification of buses across Flagstaff.
- Welcome electric micro-mobility devices as legitimate, healthy, affordable and low-carbon modes of transportation.
- Support residents, businesses, and institutions in the transition to electric vehicles.

> CLEAN ELECTRICITY

- Produce 100% renewable electricity to cover all City of Flagstaff municipal electricity needs.
- Increase renewable energy installations and usage in new buildings.
- Support solar installations on existing residential and commercial buildings.

> BUILDING FUEL SWITCHING

- Reduce or remove natural gas usage in municipal buildings.
- Encourage new buildings to rely on the electric grid as their main energy source.
- Support fuel switching in existing residential and commercial buildings.
- Provide training and education on fuel switching.

OUR ACTION PLAN

> MANAGE **OUR CONSUMPTION**

> REDUCED BUILDING ENERGY DEMAND

- Achieve net zero energy City of Flagstaff facilities.
- By 2030, require new homes in Flagstaff to be net zero energy homes.
- Reduce energy use in existing buildings.

> SUSTAINABLE CONSUMPTION AND WASTE MANAGEMENT

- Manage emissions from the Cinder Lake Landfill.
- Encourage sustainable consumption.
- Divert more waste from the landfill.
- Reduce organic waste going to the landfill and feed hungry people.

> UPHOLD **OUR COMMITMENT**

> CARBON DIOXIDE REMOVAL

- Develop a portfolio of local and regional carbon dioxide removal initiatives to meet Flagstaff's commitment to carbon neutrality.
- If local carbon dioxide removal projects are insufficient, obtain high-quality carbon offsets and CO2 Removal Certificates (CORCs).

Stay informed. Get involved.

www.flagstaff.az.gov/climate

Take a picture of this QR code
to connect to our climate site.

Learn more about this plan, and the steps we'll take to achieve our goals. The City of Flagstaff is committed to keeping you up to date on our work as it develops, the progress we're making, and how you can contribute to this work.

We want to hear from you.

Use the link above to sign up for our monthly newsletter and follow @flgsustain on social media.

Next steps

- Implementation first steps
- Investment strategy
- Major Amendment to the Regional Plan
- Council update schedule
- Growing confidence in climate action
  - Business outreach survey
  - Advisory committees
  - Relationship building
  - Communicating the Plan
  - Continued community engagement

How to get involved

- One on one conversations about climate action
- Visit our climate actions webpage www.flagstaff.az.gov/climate
- Get involved with climate organizations in town

Coming soon:

- Trainings: Climate Ambassadors, Sustainability Leaders
- Climate and Coffee
- Advisory committees
- Share your story: events and videos

Thank you.

A Bold Vision:
Flagstaff Carbon Neutrality Plan Summary

JUNE 2021

12. F.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Saltzburg, City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE:

Consideration and Approval: Canceling of the August 17, 2021 Regular Meeting and the August 31, 2021 Work Session.

STAFF RECOMMENDED ACTION:

1. Cancel the August 17, 2021 Regular Council Meeting
2. Cancel the August 31, 2021 Work Session

Executive Summary:

The City Charter requires the Council to meet at least one time per month. The City Council Rules of Procedure prescribe that the City Council shall hold a Regular Meeting on the third or fourth Tuesday of August unless a majority of the Council decides to postpone or cancel the meeting.

As it stands currently, the City Council is scheduled to return from summer break on August 17, 2021. Over the past few months and continuing over the summer break, a number of upgrades to the Council Chambers will be done. Staff is recommending that the meeting scheduled on August 17, 2021 be canceled so the Council may hold an Executive Session followed by in-person training of the upgrades and new equipment within Council Chambers. The Regular Meeting, as required by the Charter and Council Rules of Procedure, will occur on the fourth Tuesday, August 24, 2021.

While the Rules of Procedure allow for the first meeting in August to be held on the third or fourth Tuesday, staff felt that a formal cancelation of the August 17, 2021 meeting should occur at a public meeting since the date has been published online as part of the Working Calendar available to the public.

Furthermore, the Work Session of August 31, 2021 coincides with the 2021 Arizona League of Cities and Towns Annual Conference and a majority of the Council is planning to attend. Staff recommends canceling the August 31, 2021 Work Session to accommodate Council's attendance at the conference.

Flagstaff City Charter Article II, Section 12 - COUNCIL MEETINGS

The Council shall meet regularly at such times and at such places as shall be prescribed by its rules, but not less frequently than once each month. All meetings of the Council shall be open to the public. No change shall be made in regular meeting times or place without a published seven day notice.

City Council Rules of Procedure Rule 3.01 - Regular Meetings

The City Council shall hold regular meetings on the first and third Tuesday of January, February, March, April, May, June, September, October, November, and December, and on the first Tuesday of July and third or fourth Tuesday of August unless a majority of the Council decides to postpone or cancel such meeting. No change shall be made in regular meeting times or place without a published seven day notice.

Financial Impact:

None

Policy Impact:

None

Connection to PBB Key Community Priorities/Objectives & Regional Plan:

Priority Based Budget Key Community Priorities and Objectives

High Performing Governance

Previous Council Decision on This:

Council recently updated their Rules of Procedure to allow for the first meeting following Council's summer break to occur on the fourth Tuesday. Council has also canceled meetings in the past to accommodate the League Conference.

Attachments:

14. A.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Saltzburg, City Clerk
Date:	06/10/2021
Meeting Date:	06/15/2021

TITLE

Future Agenda Item Request (F.A.I.R.) A Citizens' Petition regarding lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

STAFF RECOMMENDED ACTION:

Council direction.

EXECUTIVE SUMMARY:

In accordance with Art. II, Sect. 17 of the Flagstaff City Charter, any citizen may present a written petition to the City Manager, signed by a minimum of 25 citizens from the City...who shall present it to the Council at its next regular meeting. The attached petition was filed with the City Clerk's Office on June 9, 2021, requesting "immediate action to improve infrastructure to protect pedestrians and cyclist through the following actions:

1. Reallocate the $157 Million allocated to new streets and street widening in Proposition 419 (which was sold to the community as a bicycling- and pedestrian-focused Proposition but in fact allocated the majority of funds to road expansion) to fund safe bicycle and pedestrian infrastructure as identified in the draft Active Transportation Management Plan.
2. Install protected bike lanes on Beaver St., San Francisco St, Butler Ave, and 4th St by December 2022 and Milton Ave and West Route 66 by December 2023.
3. Reduce the speed limit on Butler Ave and Lone Tree to 25 miles per hour by August 2021."

INFORMATION:

Chapter 1-12 of the Flagstaff City Code formalizes the information to be required, and the attached petition conforms to those requirements. As outlined in this chapter, the petition is to be submitted to the Council under Future Agenda Item Request (F.A.I.R.) to determine if there is Council interest in placing the item on a future agenda for consideration.

Attachments: Petition #2021-04

RECEIVED
JUN 09 2021
BY:

PETITION TO FLAGSTAFF CITY COUNCIL

Pursuant to Flagstaff City Charter Article II Section 17 and Flagstaff City Code Title I Chapter 12

Pursuant to the Flagstaff City Charter and the City Code, any citizen (resident) of the City may present a written petition to the City Manager, signed by a minimum of 25 citizens from the City of Flagstaff, which shall be presented to the City Council.

Title of Issue: _____Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff_____

Action Requested: _Take immediate action to improve infrastructure to protect pedestrians and cyclist through the following actions:

1) Reallocate the $157 Million allocated to new streets and street widening in Proposition 419 (which was sold to the community as a bicycling- and pedestrian-focused Proposition but in fact allocated the majority of funds to road expansion) to fund safe bicycle and pedestrian infrastructure as identified in the draft Active Transportation Management Plan.

2) Install protected bike lanes on Beaver St., San Francisco St, Butler Ave, and 4th St by December 2022 and Milton Ave and West Route 66 by December 2023.

3) Reduce the speed limit on Butler Ave and Lone Tree to 25 miles per hour by August 2021.

Printed Name of Submitter: Scott Heinsius

(Submitter must also sign below and complete information)

Contact Information: 928-853-6436 / goatscanciao@gmail.com

(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Scott Heinsius	2365 E Hemberg Dr Flagstaff AZ 86004	
6/6/21	Irene Barrow	101 N. Hilltop Dr Flagstaff, AZ 86001	
6/6/21	Adam Shimoff	113 N. Aztec St Apt 2 Flagstaff AZ 86001	
6/6/21	JASON HASENBANK	812 N. KENDRICK FLAG, AZ 86001	
6/6/21	Stacey Oberhardt	3411 W. Wilson Dr. Flagstaff, AZ 86001	

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	**BY**	**COUNCIL MEETING DATE**
6/9/21	Stacy Saltzburg	June 15, 2021

COMING BACK WEDNESDAY

2664

PETITION TO FLAGSTAFF CITY COUNCIL

Pursuant to Flagstaff City Charter Article II Section 17
and Flagstaff City Code Title I Chapter 12

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Printed Name of Submitter: _____Scott Heinsius_____
(Submitter must also sign below and complete information)

Contact Information: _____
(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-7	Mitch Kramer	19 S San Francisco St. Apt 55 #7	
6-7	Tim Dale	213 N. Kendrick	Tim Dale
6-7	Justin Young	4375 E Wild Elk Trl	
6-8	Joshua Lessell	3460 Lake Mary Rd	
6-8	Samuel Downing	555 W Forest Meadows St	

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	**BY**	**COUNCIL MEETING DATE**

02/2016

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE:____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Carolina Chavez	440 S. San Francisco St. Flagstaff, AZ 86001	
6/6/21	Stuart Howe	516 W Cherry Ave #1 Flagstaff AZ 86001	
6/8/21	Cayley Payne	517 S WC Riles St. #1 Flagstaff, AZ 86001	
6/9/21	Oakley Fite	8 W Benton Ave Flagstaff AZ 86001	
6/9/21	Margarita Cruz	115 E Terrace Ave, Apt 3 Flagstaff, AZ 86001	

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Printed Name of Submitter: _____Scott Heinsius_____
(Submitter must also sign below and complete information)

Contact Information: _____
(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	Johnathan Bliss	520 S Seville Ln	
6/8/21	Emily Segura Maze	920 W Grand Canyon Apt. 10 Flagstaff	
6/8/21	Julia Conn	501 W Santa Fe Ave Apt 4	
6/9/21	Brittany Montagne	3027 W Brenda Loop Flagstaff, AZ 86001	
6/9/2021	Katherine Kulchak	307 S. O'Leary St	

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	**BY**	**COUNCIL MEETING DATE**

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 5 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Avari Copp	3583 Ancient Trail Flagstaff, AZ 86005	
6/9/21	Susan Ordway	1645 E. Appalachian Rd Flagstaff, AZ 86004	Susan Ordway
6/9/21	Renée Gaun	7010 N Bader Rd Flagstaff, AZ 86001	

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Printed Name of Submitter: _____Scott Heinsius_____
(Submitter must also sign below and complete information)

Contact Information: _____
(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
06/09/21	Kerry E Cobb	3125 W Tami Lane	Kerry E Cobb
6/9/21	William Cobb	3125 W Tami Lane	William Cobb

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	**BY**	**COUNCIL MEETING DATE**

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3) Reduce the speed limit on Butler Ave and Lone Tree to 25 miles per hour by August 2021.

Printed Name of Submitter: _____Scott Heinsius_____
(Submitter must also sign below and complete information)

Contact Information: [redacted]
(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	LAURA CHAMBERLIN	7525 OERLY BERRY DR FLAGSTAFF AZ 86004	[signature]
6/8/21	Lexi Striker	1401 N 4th St APT 131 FLAGSTAFF AZ 86004	[signature]
6/8/21	DEANNA + AERO	1728 E. Mt View FLAGSTAFF AZ 86004	[signature]
6/8/21	Raymond Delfino	3745 E. Cedar Hawk Rd. FLAGSTAFF AZ 86004	[signature]
6/8/21			

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	**BY**	**COUNCIL MEETING DATE**

PETITION TO FLAGSTAFF CITY COUNCIL

Pursuant to Flagstaff City Charter Article II Section 17
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PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Tara Callan	207 W. Cherry Ave 86001, Flagstaff	
6/8/21	Taylor Hamilton	831 W. Cherry Ave Flagstaff, AZ	
6/8/21	Todd Schultz	4605 S. Lance FL6, AZ	
6/8/21	Kiya Dandena	2256 N Fremont blvd	
6/8/21	Monica Coplea	2872 N Gregg Dr Flagstaff, AZ 86001	

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PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 9 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-8-21	Corey Coplea	2872 N. Grass Dr. Flagstaff, AZ. 86004	
6-8-21	Evan Strout	2913 W Paz de Avenida Flagstaff, AZ 86001	
6-8-21	Matt Llano	6061 S Amethyst Rd. Flagstaff, AZ 86005	
6-8-21	Brannon Harbur	6061 S. Amethyst Rd Flagstaff	
6-8-21	Marshall Ritter	1550 N Fort Valley R APT #16 Flagstaff, AZ 86001	Marshall Ritter
6-8-21	Ronald Schell	323 N Bonito St. Flag AZ 86001	
6-8-21	Steve Brown	4411 E Mountain View Ln Flagstaff AZ 86004	
6-8-21	Irma Sandercock	1005 E. Sterling AZ	Irma Sandercock
6 8 21	Bill Sandercock	1005 E STERLING	Bill Sandercock

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(Submitter must also sign below and complete information)

Contact Information: [redacted]

(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/2021	ANTHONY PETERSON	23 E. PINE AVE	[signature]
06/09/2021	MIKE KAUCIC	6460 E LEISURE LN.	[signature]
6/9/2021	CONNIE LEE	4746 E TWELVE OAKS DR.	[signature]
6/9/2021	Rob McPherson	3015 N. Alta Vista Dr	[signature]
6/9/21	Logan Noble	6500 Cow Pass Xing	[signature]

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PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE:____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___
PAGE 11 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
06/09/2021	Carson Nabb	6695 N. Bader Rd	Carson Nabb
06/09/2021	Paul Keen	1303 E Dunraven	Paul Keen
6/9/2021	Ronnie George	3551 N. Walker St.	Ronnie George
6/9/2021	Dan Hale	3875 S Jewel Dr	Dan Hale
6/9/2021	Rebecca Zebrauski	1070 Lone Star 86005	Rebecca Zebrauski
6/9/21	David Stephan	1824 N. San Francisco St	David Stephan
6/9/21	Colt Morris	4950 N. Mullein Ln	Colt Morris
6/9/21	Nanda V Martinez	601 E Piccadilly Dr Apt 434	Nanda Martinez
6/9/21	Liz Garcia	3037 N. Fanning Drive, Flag	Liz Garcia
6/9/21	Nicole Karnbach	5400 N. Country Club dr.	Nicole Karnbach
6/9/21	Mitch Wyatt	601 E. Piccadilly Dr #260	Mitch Wyatt
6/9/21	Stephen Sanchez	2409 E Eva loop	Stephen Sanchez
06/09/2021	JAN GIBB	5155 E CRESTVIEW	Jan Gibb
06/09/2021	Logan Faubion	4073 N. Pipit Pl.	Logan Faubion
6/09/2021	Seth Crozier	2710 N. Prescott Rd	Seth Crozier
6/9/21	Jess Matherson	3055 N. Fanning Dr	Jess Matherson
6/9/21	Parker Brown	2707 W Dubleen Dr.	Parker Brown
6/9/21	Bertand Hodges	502 W. Cherry Ave	Bertand Hodges
6/9/21	Susan Huettle	1006 N. Navajo Dr	Susan Huettle
6/9/21	Tristan Hedrick	570 S windsor ln	Tristan Hedrick
6/9/21	Kevin Reynolds	614 W Aspen	Kevin Reynolds
6/9/21	John Petty	2317 N East St	John Petty

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE:___ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___
PAGE _____ **OF**_____

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PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Robin* C. Germansen	205 E. Camille Dr. Flag. Staff	Robin C Germansen
6/8/21	Matthew Germansen	205 E. Camille Dr. Flagstaff AZ	
6/9/21	Sharon A. Osborne	2221 N. East St. Flagstaff AZ	Sharon A. Osborne
6/9/21	DeeAnn M Tracy	1011 W. Elizabeth Flagstaff AZ	DeeAnn M Tracy
6.9.21	ERIC BROWN	1011 W. ELIZABETH FLAGSTAFF AZ 8600	

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PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	John Dailey	1726 N. Navajo Dr. Flagstaff	
6-6-21	Nicholas Nation	1232 E Olive Way Flagstaff, AZ, 86001	
6/6/21	Connor Rosborough	2618 N Main St Flagstaff, AZ, 86004	
6/6/21	Dylan Lang	3029 N Park Dr Flagstaff AZ 86004	
6/6/21	Max Robinson	3508 Blue Canyon Trl Flagstaff AZ 86005	

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6/7/21	DAVID HERBOLD	2520 N. EAST ST. 86004	
6/7/21	Robert Cheesman	10E 24th Ave 86001	
6/7/21	Ellen Joseph	1090 N Reed Rd	
6/7/21	MICHAEL N. DAVIS	509 N. BEAVER ST.	
6/7/21	Rebecca Kempf	1020 W Stevanna Way	

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PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

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6/7/21	Chase Kempf	1020 W Stevanna Way	
06/07/2021	Sean Kempf	1620 W Stevanna Way	
6/June/21	Citlali Cortés	1721 N Sunset Dr.	
06/07/21	STEVE SMITH	7 W COTTAGE AVE	
06/07/21	Kenney Robalos	12 west Aspen Ave	
06/07/21	Britsy Grants	12 west Aspen Ave	
06/07/21	Gavin Wilton	4515 E Bluefield Ave.	
6/7/21	Mary Jo Junger	330 E. Pierce St.	
6-8-21	Emily Bowersox	1450 W Kaibab Ln	
6/8/21	Ben Ritz	1450 W Kaibab Ln	
6/8/21	Samantha Matelski	1701 N Beaver St	
6-8-21	Joseph Korbki	1201 S 4th St	
6-8-21	Lena Lander	3405 N. Grandview Dr	
6/8/21	Tiffany Jackson	17980 S Walapai	
	Travis Jackson	"	
6/8/21	Logan Moore	17980 S Walapai Ln	
6/8/21	Kellye Colyer	17980 S Walapai Ln	
6/8/21	C. Crophe	3630 N. Nelson	
6/8/21	Christopher P. Kuzdas	2336 W. Mission Timber Cir	
6/8/21	Lynn Spangenberg	4011 N. Goodwin Circle Flagstaff AZ 86004	Lynn Spangenberg
6/8/21	Dana Peterson	815 N Pinecliff Dr Flagstaff AZ 86004	
6/8/21	[illegible]	125 N MCMILLAN	

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6/7/21	HEATHER ELLIOTT	1909 N KATCHINA DR.	
6/7/21	JOSHUA LONG	P.O. Box 3415 Flagstaff, AZ 86003	
6/7/21	Athena Akrigis	707 N Birch Ave	
6/7/21	Charles Brister	707 N Birch	
6/8/21	Sean Cadigan	2401 West st., 107	

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6/8/21	KIRA FARMER	333 N PARK ST. APT B	
6/8/21	Ben Mungenast	1111 W. Lower Coconino	
6/8/21	Taylor Johnson	1718 N Fort Valley Rd	
6/8/21	Dennis Givens	211 W. Cottage Ave, #4	
6/9/21	Jacqueline Thompson	PO Box 1192, FLG, AZ	

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6/8/2021	REBEKAH NORDSTROM	801 E. CRESTVIEW AVE FLAGSTAFF, AZ 86001	
6/8/2021	Ryan Geiger	603 W. Whiting Rd Flagstaff AZ 86001	
6/8/2021	christbert	6363 N Snowflake Dr Flagstaff Az, 86004	
6-8-21	Michael Vaughan	4002 S. Josephst	

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6/8/21	Anne Hamlin	1500 Linda Vista	
6/8/21	Heather Overton	1621 E. Arrowhead Ave Flag AZ, 86004	
6/8/21	Arlette Barajas	2052 E ROUTE 66 FLAG AZ 86004	
6/8/21	Sydney Fenn	400 E PINE KNOLL DR APT F12 Flag, AZ	
6/8/21	Lorelei Fernandez	1600 West University Heights Dr N Apt 244	

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PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

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6-6-2021	Amber L. Reimondo	2608 N 1st St. Flagstaff	Amber L. Reimondo
6/6/21	Evan Reimondo	2608 N 1st St. Flagstaff	
6/6/21	Cerissa Hoglander	632 S. Fourtaine St #1A	Cerissa Hoglander
6/8/21	Mason Spruiell	600 West University Heights Dr N Apt 244	
6/8/21	Ryan Drendel	601 E. Piccadilly Dr #459	
6/8/21	William Auberle	606A E Laurel Loop Flagstaff AZ 86004	
6/8/21	Lyric Peate	3311 W Mountain Dr	
6/8/21	Colleen Henderson	607 Marty's Way	Colleen Henderson
6/9/21	Grace McGill	1830 S Milton Rd #137 Flagstaff	Grace McGill

PICKING UP WEDNESDAY!

21 of 64

PETITION TO FLAGSTAFF CITY COUNCIL

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6/7/21	Leah Allee	1385 W University Ave Unit 9-168 Flagstaff, AZ 86001	Leah Allee
6.7.21	Christopher Garza	1 W Runke Dr, Apt 4004 Flagstaff, AZ 86001	Chris Garza
6-7-21	Corinne Custer	2366 N. Izabel St Flagstaff, AZ 86004	
6/7/21	Kaitlyn Ford	2029 N crescent Dr Flagstaff, AZ 86001	
6/7/21	Alex Dangerfield	15 E Columbus Ave Unit #F1 Flagstaff AZ 86001	Alex D.

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PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

6-9-21

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Karen Mattingly	811 W Cherry #7 Flagstaff, AZ 86001	Karen Mattingly
6/9/21	Nicholas Smolinske	2950 S Pedriz Ln Flagstaff, AZ 86001	
6/9/21	MIRIAM LEBARON	1080 W KAIBAB LN APT 49B FLAGSTAFF AZ 86001	
6-9-21	Andrew Armenta	845 Cerillo Flg 86005	
6-9-21	OWEN LUDWIG	2501 NORTH MAIN ST FLAGSTAFF AZ 86004	
6-9-21	Jeremy Hapward	809 W Riordan Rd Flagstaff AZ 86001	
6/9/21	Hannah Capron	6180 E Camden Rd Flg 86004	
6/9/21	MARK Buckholz	2874 W NORIAST 86001	
6/9/21	Ethan Healy	2345 E Hemberg 86004	
6/9/21	BEX HIRSCH	700 S BLACKBIRD ROOST 86001	HIRSCH
6/9/21	Finn Palamaro	323 N Bonito St	
6/9/21	Anna Chilcoun	2029 N. CRESCENT DR	
6/9/21	Tricia Sherrard	602 W Coconino Apts Flagstaff, AZ 86001	
6/9/21	Joe Hazel	2692 N. DovesNest LN 86001	
6/9/21	Michael Caulkins	1101 N. Fifth Rd. Flagstaff AZ 86004	Michael Caulkins
6/9/21	DERIAH DURST	220 S HUMPHREYS ST.	
6/9/21	Matthew Hintzman	1620 N. Sunset Dr.	
6/9/21	Jon Funk	2167 N FREMONT BLVD FLAGSTAFF AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 23 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/4/21	Keegan Evans	3409 N Goodwin Flagstaff AZ 86001	Keegan
6/6/21	Christy Burna	2625 N Josephine St Apt #A Flagstaff AZ 86004	
6/6/2021	Michael Thompson	2510 Mesa Trail, Flagstaff AZ, 86005	
6/6/2021	Kugler, Steve	24 Calle Reposa	
6/6/2021	Deborah Walden	1617 N. San Francisco St. Flagstaff, AZ 86001	Deborah L Walden
6/6/2021	Kaitlin Gould	701 W Tombstone Ave 2 Flagstaff, AZ 86001	
6/6/2021	Karen Wolfson	110 E Camille Dr Flagstaff 86005	
6/6/2021	Avery Thomas	3029 W Foothills	
6/6/2021	Chris Thomas	Way Flagstaff AZ 86001	
6/6/2021	John Crockett	214 N. Main St. Flagstaff, AZ 86004	
6/6/21	Heidi Young-Blackgoat	2483 W Forch Island Arc Flagstaff AZ 86001	
6/6/21	Kelvin Swope	3200 S Lizzie Dr #7-215 Flagstaff AZ 86005	
6/6/21	Veronika Fabra	1604 N. Bonfrant St. Flagstaff AZ 86001	
6/6/21	Niko Mulligan	601 N. Beaver St Flagstaff AZ 86001	Niko Mulligan
6/6/21	Cheyenne Recio	3714 N Beaver Rd Flagst AZ	
6.6.21	JEFF DUNCAN	1202 W. DAVIS WAY FLG AZ 86001	
6.6.21		4015 E. Soliere Ave.	
6/6/21	KATE DICKERSON	Apt. 228 Flagstaff, 86004 → 417 S WC Riles Dr 86001	
6/6/21	Kristin Kauffman	2138 S. Tombaugh Way Flagstaff AZ 86001	
6/6/21	David Bull	2138 S. Tombaugh Way Flagstaff AZ 86001	
6/6/21	Amy Campos	901 S. OLeary St. #41 Flagstaff, AZ 86005	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Brennan Patton	6465 E Settlers Run Rd #18	
6/6/21	PATRICIA WARE	1398 E. Sundrop Ln Flagstaff	Patricia Ware
6/6/21	Jose Rivera	3400 Lake Mary Rd	
6/6/21	Daniel Bowman	PO Box 30944 Flagstaff 86003	
6-6-21	JAMES P. MARZOLF	607 N. LEROUX ST. FLAGSTAFF AZ 86001	
6-6-21	Heidi Huggard	2998 W Wilson Dr 86001	
6-6-21	Morgan Huggard	2998 w Wilson Dr	
6-6-21	Siena Swift	2800 S Highland Mesa 86001	
6/6/21	Tyler Rodriguez	875E Pine knoll dr.	
6/6/21	Jordan Benson	1500 w route 66	
6/6/21	Emily Engan	2809 E Lewis Dr Flg AZ	Emily Engan
6/6/21	Lee Anderson	2627 N Rose ST AZ	
6/6/21	Julia Gaydosh	1 W Runke Dr	
6/6/21	Malia Rodriguez	3019 E. Lockett Flg Rd	
6/6/21	Linda Axtell	1141 N. Worthington Flagstaff Place	Linda Axtell
6/6/21	Daphne Chen	601 E Piccadilly Dr. Apt 554	
6/6/21	Sheri Jordan	8485 Lonesome Tr 86004	
6/6/21	Freinkman, Elena	1520 E. Everest	
6/6/21	BEN ORDAZ	3835 S. YAQUI DR. FLAGSTAFF, AZ 86005	
6/6/21	Sundeep Holland	498 E Twelve Oaks Dr	
6/6/21	Mei. Richardson	2716 Kachina Tr	
6/6/21	Amy Shimoni	2462 Tolani Tr	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 25 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	ROBERT L. SANFORD JR	1002 E. HILLCREST DR.	R. L. Sanford
6/6/21	Nicholas Jones	3042 S. Troxel Cr.	N Jones
6/6/21	Laura Nie	3002 N Tindle Blvd Flagstaff	Laura Nie
6/6/21	thomas Ware	1398 E Sundrop Lane Flagstaff	
6/6/21	Dean Samaha	2012 N Izabel St Flagstaff	
6/6/21	Vanessa Many	2012 N. Izabel St. 86004	
6/6/21	samantha anderson	3400 Lake Mary Rd	
6/6/21	Kimberley Alt	417 w aspen ave	
6/6/21	Katelyn Morris	2800 S Highland Mesa Rd	Katelyn
6/6/21	Fabian Villanueva	2800 S Highland Mesa Rd	
6/6/21	Dede Chapline	700 E Pine Knoll Dr	
6/6/21	Lovelei Haavi	2800 S Highland Mesa Rd	
6/6/21	Emily Smith-Kelley	2500 w route 66	
6/6/21	Jeremy anderson	2624 N rose st	
6/6/21	Jeffrey Axtell	1141 W. Washington PL	
6/6/21	Yaoling	616 Paddington Apt 334	
6/6/21	Malcolm Connor	1500 E. Everest	
6/6/21	Jessica Ordaz	3835 S Yaqui dr. Apt 2C Flagstaff, Az 86005	
6/6/21	Valerie Piet	2164 S. Highland Mesa Rd Flagstaff, AZ 86001	
6/6/21	Rebecca Ness	11755 W Cove Crest Dr Bellemont, AZ 86015	Rebecca Ness
6/6/21	Sarah Dowling	1909 N Katrina Dr. Flagstaff AZ, 86001	
6/6/21	Tom Anderson	" "	

PETITION TO FLAGSTAFF CITY COUNCIL

Pursuant to Flagstaff City Charter Article II Section 17 and Flagstaff City Code Title I Chapter 12

Pursuant to the Flagstaff City Charter and the City Code, any citizen (resident) of the City may present a written petition to the City Manager, signed by a minimum of 25 citizens from the City of Flagstaff, which shall be presented to the City Council.

Title of Issue: _____Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff_____

Action Requested: _Take immediate action to improve infrastructure to protect pedestrians and cyclist through the following actions:

1) Reallocate the $157 Million allocated to new streets and street widening in Proposition 419 (which was sold to the community as a bicycling- and pedestrian-focused Proposition but in fact allocated the majority of funds to road expansion) to fund safe bicycle and pedestrian infrastructure as identified in the draft Active Transportation Management Plan.

2) Install protected bike lanes on Beaver St., San Francisco St, Butler Ave, and 4th St by December 2022 and Milton Ave and West Route 66 by December 2023.

3) Reduce the speed limit on Butler Ave and Lone Tree to 25 miles per hour by August 2021.

Printed Name of Submitter: _____Scott Heinsius_____

(Submitter must also sign below and complete information)

Contact Information: _____

(Phone Number and/or e-mail address)

PETITION SIGNATURES

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE

RECEIVED BY CITY OF FLAGSTAFF		
DATE RECEIVED	BY	COUNCIL MEETING DATE

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Marie Dagenais	3465 W. Strawberry Road Flagstaff 86001	
6/6/21	Shane Randell	" " "	
6/6/21	Ann Zielinski	906 Cellilo	
6/6/21	Mario Bifano	7840 Mickelson Dr	
6/6/21	Ta Nee' Townsend	512 W. Santa Fe #14 Flagstaff 86001	
6/6/21	Richelle Spears	315 E. Elden St. Unit #1	
6/6/21	Angelica Vela	1 W Runke Dr	
6/6/21	CYNTHIA MCKINNA	421 N. JAMES FLAGSTAFF	
6/6/21	Chris Stagner	1701 E. Mountain View #2	
6/6/21	Robin Dameron	800 W. Forest Meadows St	
6/6/21	Janet L. McLean	4230 N. Fanning	
6/6/21	Jim Skinner	2450 Chef Trail	
6/6/21	Ali Partridge	1080 W. Kaibab #584	
6/6/21	ELSIE DUNINI	138 W. Juniper	
6/6/21	Amy Nunemaker	1829 N. Calle Lo Way	
6-6-21	Robert Garcia	24 Queenie	ROBERT GARCIA
6-6-21	Kevin Riggle	2625 N west st	
6/6/2021	Jagoda Janiszewska	2510 Mesa Trl	
6/6/21	Katie Hallie	4255 E Soaring Ave Apt 201	
6/6/21	Roger Brown Jr	6005 E Abbey Rd	
6/6/21	Eva Canby	937 E Kensington Dr. Apt 721	Eva Canby
6/6/21	Shannon Gagnon	1101 E Sterling Ln 86004	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-6-21	Robert Stahl	1617 N San Francisco	
6/6/21	Brynn Anderson	1263 E Stone Ridge Dr.	
6-6-21	JAN BLACKMAN	4615 S. LANCE	
6/6/21	Jordyn Upton	1481 E Ivy Lane	
6/6/21	Christine Chitwood	42041 E Spring Meadow Ville	
6/6/2021	Heidi Larson	2614 N East ST	Heidi Larson
6-6-21	Makena Chriss	813 W University Ave	
6-6-21	elizabeth nydick	813 W University Ave	
6/6/21	Luke Mulligan	604 N. Bertrand St	
6/6/21	Dwia mulligan	604 N. Bertrand St.	
6/6/21	Rachael Cogan	1299 E Makavia Way	ACHOG
6/6/21	Rodrigo Recio	3714 N Paradise Rd	
6/6/21	Savanna Smith	2402 S. Hibiscus Ln	
6/6/21	Chris Hill	1786 W. Heavenly Ct.	
6-6-21	Nate Tritle	4995 N. Wildwood Tr.	
6-6-21	Lillian Duncan	1102 W Davis Way	
6-6-21	Katerina Karyala	3301 W Lois Ln	
6-6-21	Anna Coppola	1185 W University	
6-6-21	Chris Lemon	1495 Fawn Dr E	
6-6-21	Lauren Graves	609 W. Dale Ave	
6-6-21	Jessica Hall	417 S. WC. Ritas	
6-6-21	Corey Brooks	505 S Verde St Unit B	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 28 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-6-21	Andrew Bleseneyer	720 W cattle Dr Flagstaff AZ 86005	
6-6-21	Elizabeth Daumbrink	4868 S. Elves Chasm Trail Flagstaff AZ 86001	
6-6-21	Jack Hood	565 W Forest Meadows St	
6/6/21	Elizabeth Aguilar Barrett	969 W. Coy Dr. Flagstaff, AZ 86005	
6/6/21	Ryan Adams	1600 N. Falcon Rd. Flagstaff, AZ 86004	
6/6/21	Stephanie Adams	1600 N. Falcon Rd Flag, AZ 86004	
6-6-21	BYRON SMITH	813 W COCONINO AVE FLAGSTAFF, AZ 86001	
6/6/21	Seth Watkins	313 N. Sitgreaves St Flagstaff, AZ 86001	
6/6/21	Jane Derderian	705 W. Birch Ave	
6/6/21	Chelsea Griffin	703 W. Birch Ave	
6/6/21	Meredith Heller	110 E Dale Ave	
6/6/21	Catherine A. Benavides	3515 N. Tyndall Cir Flagstaff AZ 86004	
6-6-21	Cherie h. Schierl	809 W Grand Canyon	
6-6-21	Tony Schierl	809 W. Grand Canyon	
6/6/21	Claire Van Stelle	766 E Zuni Dr.	
6/6/21	SEAN AUSTIN	1251 N PINE CLIFF DR	
6/6/21	Lindsay Seals	1251 N Pine Cliff Dr	
6/6/21	JOSEPH KOEPKE	1520 N FORDWEEN	
6/6/21	maggie Lembke	1604 W Sunset Dr	
6/6/21	Matt Bowen	1250 Schultz Pass Rd	
6/6/21	J. Leigh Bone	1250 Schultz Pass Rd	
6/6/21	Christine Dart	5371 E Boulder Run Dr.	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6 June 2021	John Bliss	1203 Davis Way	
6 June 2021	Andrea Grabarek	201 Tolani Kachina	
6 July 2021	Jacob Kaserer	3920 E Summerrun Dr	
6 June 21	Laine Buggerly	1611 E Arrowhead Ave	
6 June 21	Filip Bielen	1611 E Arrowhead Ave	
6 June 21	Joseph Taylor	2916 N. Keystone Dr	
6 June 21	Maddie Hahn	911 W. Summit Ave	
6 JUNE 21	DANIEL A. PADUCHOWSKI	2141 E. SKYLINE DR	
6 JUNE 21	JULIE DOSKICZ	3016 W FOOTHILLS WY	
6 June 21	Samantha Meier	2821 N Rose St	
6/6/21	Dillon Joseph	104 E Dale Ave	
6/6/21	Dinah Gillette	3020 N. Scott Way	
6/6/21	Chandler Wiese	209 E Dale Ave	
6/6/21	Sue Pratt	1409 N Beaver	
6/6/21	George Grimes	4343 Sahara #2077	
6-6-21	Jared Taylor	107 W Cedar Ave	
6/6/21	Sarah Reichman	102 W Cedar Ave	
6/6/21	FREDY GONZALEZ	540 S. SEVILLE LN.	
6/6/21	Aeden Kelly	214 W. Sullivan Ave	
6/6/21	AMY BOTHA	210 W. Cedar Ave	
6/6/21	Tyler Botha	11	
6/6/21	Samantha Zuckowski	5303 E Cortland Blvd Apt A7	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 30 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6.6.2021	Raina Olive Boehme	2804 N. Patterson Blvd. Flagstaff AZ	Raing
6.6.21	J.t.t	2727 h.J	
06/6/21	George Sugeliaras	2835 N Prescott Rd Flagstaff AZ 86001	
6.6.21	Matthew	4025 S. Lake Mary Rd Flg AZ 86005	
06/06/21	JEFF PETRENCHIK	404 W SANTA FE AVE 211 86001	
6/6/21	Kimberley Rolfe	2503 W Pikes Peak Dr Flagstaff AZ 86001	
6/6/21	Danielle Rolfe	2503 W Pikes Peak Dr Flag Staff AZ 86001	Danielle
6/6/21	Drone Paul	37 S. Brannen Cir Flagstaff AZ 86001	
6.6.21	Tim Red Deer	2801 N Rose St #1 Flagstaff AZ 86004	
6-6-21	Gwendolyn Abrams	3975 S. Yaqui Dr. Apt. 18 Flagstaff, AZ 86005	
6-6-21	Silas Gidley	200 W. Crescent Dr. Flagstaff, AZ 86001	Silas
6-6-21	LESLIE P. BAKER	5152 E HICKORY DR. FLAGSTAFF, AZ 86004	Leslie P. B
6.6.21	Alison Busche	314 W. CHERRY AVE #4 Flagstaff AZ 86001	
6.6.21	Rose Houk	824 W. Cherry Flagstaff, AZ 86001	Rose Houk
6.6.21	Grace Vonesh	3885 E KOKOPELLI LN Flagstaff, AZ. 86004	
6.6.21	Julie Tietje	2785 N Hemlyeg Dr Flg AZ 86004	
6/6/21	Leah Claus	4880 E Tomahawk Dr. Flagstaff AZ 86004	
6/6/21	Cara Corbin	2318 N. Babel 86004	Cara Corbin
6/6/21	Jamie Perry	3140 s troxler cir 86005	
6/6/21	Max Perry	3140 S TROXLER CIR 86005	
6/6/21	Justin Dubail	901 S. O'Leary St Apt 27	
6/6/21	cassandra Scagliano	901 S OLEARY ST APT 33	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Natalie Pierson	4630 S Milton Rd APT #235 Flagstaff, AZ 86001	
6/6/21	Art Babbott	421 W. Cedar	
6/6/21	Lila Babbott	421 w cedar ave	
6-6-21	ISSAC LARSON	322 S O'LEARY ST	
6/6/21	Sara LaRosa	322 S. O'Leary St. Unit B	
6-6-21	Geoffrey Whittaker	324 N Kendrick St Flagstaff AZ 86001	
6-6-21	Carter Babcock	2619 W Pikes Peak Dr. 86005, Flagstaff, AZ	
6-6-21	MARK STEVENS	2190 E SKYLINE	
6-7-21	Daniel Dunn	311 W Navajo Rd.	
6/7/21	RAYMOND WALKER	616 E. CHERRY AVE.	
6/7/21	Caitlin Malvar	901 S O'Leary St. 86001 Flagstaff, AZ	
6/7/21	Luke Standish	640 N pinecliff Dr	
06/07/21	Svea Conrad	115 E. Terrace Ave. Apt. #3	
06/07/21	Guillermo Cortes	2332 N. Fremont Blvd	
6/7/2021	Michael Ravell	602 W Cocoino Ave #3 Flagstaff AZ, 86001	
6/7/21	Bill Miller	1526 N. NAVAJO 86001	
6/7/21	Jan Boyer	1830 S Highland Mesa Rd. Flagstaff AZ 86001	
6/7/21	JOE ZERMAN	1909 N KATCHINA DR. FLAGSTAFF, AZ 86001	
6/8/21	Jordan Butler	212 S Beaver St Flagstaff AZ 86001	
6.8.21	Alicyn Gitlin	116 S. Spring St. Flagstaff, AZ 86001	
06/08/21	CHRIS OSBORN	3117 W. DANNIELLE DRIVE FLG, AZ. 86001	
06/08/21	AGNES DROGO	3400 N. QUINTANA DR. FLG, AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Ben Crowell	2573 S. Gravel Ln	
6/6/21	Sara Taferre	2573 S. Gravel Ln.	
6.6.21	SASHA HEINEN	3208 N. 4TH ST	
6/6/21	Shani White	3026 N Peak View Pl	
6/6/21	Chantal Piatt	3026 N. Peak View	
6/6/21	Mallory Wilson	3029 N. Joy Ln.	
6/6 21	Brian Beaudry	625 W. Gunnaker Trail	
6/6/21	Kim Shaw	31000 W Rockrock	
6/6/2021	GREGORY A. ZIELINSKI	2405 N. EDGEMERE DR	
6/6/21	Rachel Gildner	7840 Mickelson Rd.	
6/6/21	Shawna Heinsius	2365 E Hembarg Dr Flagstaff 86004	
6-6-21	TOM BURKHART	8600 FLAGSTAFF 812 N. LEROUX	
6/6/21	ANDREA KOLAROVA	2100 N. Valley Rd Flg AZ 86001	
6/6/21	Matt Stagner	1701 E. Mountain View Ave.	
6/6/2021	Lindsay Mullen Newm	40E Camille Dr	
6/6/21	Caitlin Weed	2450 Chief Trail	
6/6/21	Alyssa Lombardi	421 N LEROUX St	
6/6/21	Olivia Both	421 N Leroux St	
6/6/21	Theresa Umbach	1951 N Rain Tree Rd	
6/6/21	Christina Hegood	4005 N. Lugano Way	
6/6/21	Colin Hegood		
6/6/21	MONICA EVANS	3404 N Orchard View Flagstaff AZ 86004	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: ____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6.6.21	J. Bruce Bowditch	2727 N Jamison Blvd Flag 86004	
6/6/21	Evan Dosch	1830 S Milton Road Apt 211 86001	
6.6.21	Taylor Wyum	1830 S Milton Rd Apt 211 Flagstaff, 86001	Taylor Wyum
6.6.21	Jean Johnson	13 N Mogollon St Flag 86001	
6.6.21	Mason Wiggins	323 N. Bonito St Flagstaff 86001	
6-6-21	Heather Quinn	2181 Lohali TR Flagstaff, AZ 86005	
6/6/21	Madeleine Goblet	3200 S. Litzler Dr apt 6-126 86005	Madeleine Goblet
6/6/21	JOAB WADSWORTH	37 S BEAUMEN CIR FLG AZ 86001	
6/6/21	CLAIRE LYONS	505 S. San Francisco St. Apt. 2 FLG AZ 86001	
6/6/21	Amy Ellen	1244 W. Saturn Way 86004	Amy Ellen
6/6/21	Julie Gidley	2009 N Crescent Dr. Flagstaff 86001	
6/6/21	KAREN KOESTNER	324 N. KENDRICK 86001	
6/6/21	Zackary Boft	3613 Tarawood Flagstaff, AZ	
6/6/21	Anne M. Vonesh	3885 Kokopelli Lh Flagstaff 86004	
6/8/21	Erin Brinkman	307 E. Woodland Dr. Flagstaff, AZ 86001	
6/8/21	Alex Dickens	224 W Birch Ave Flagstaff, AZ 86001	
6/8/21	Keaton Williams	3716 N Pine Dr. Flagstaff 86004	
6/8/21	Cat Goldes	3716 N Pine Dr. Flagstaff, AZ 86004	
6/8/21	Cooper Smith	2543 S. eclipse ln Flagstaff AZ, 86001	
6/8/21	Bryce Thayer	2543 S. eclipse ln Flag AZ 86001	
6/8/21	Serge Drogi	3400 N. QUINTANA DR. FLAGSTAFF, AZ 86004	
6/8/21	REMI DROGI	3400 N. QUINTANA DR. FLAGSTAFF AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Samantha Woods	509 E Franklin Ave	
6/6/21	Kailie Klein	824 W. Route 66	
6/6/21	Collin McMillan	51 S Maricopa St #1202B	
6/6/21	Brian van Meerten	687 N Lount St Flag, AZ 86001	
6/6/21	Mindy Fair	612 N Forest View Dr 86001	
6/6/21	Quinn Fair	612 N Forest View Dr. 86001	
6/06/2021	Jennifer Miller	1105 E Ponderosa Pkwy #261	
6/6/2021	Amavi Miller	1526 N. Navajo Dr.	
6/6/21	Stephanie Hanlon	3298 S Hannah Ln	
6/6/21	JUSTIN GILLILAND	N. GRAND CANYON AVE	
6/6/21	Sarah Snelling	3850 N. Fanning Dr Unit B4	
6-6-21	Sherry Poer	2017 N. Creekside Dr	
6-6-21	PAUL POER	2017 N. CREEKSIDE DR	
6-6-21	Christine Newell	713 Grand Canyon	
6-6-21	Ron Hurle	5252 S. Azurite Trail	
6/6/21	Nate Mitton	118 N. Leroux St.	
6/6/21	David Watts	20 E Oak Ave, 86001	
6/6/21	Erik Johnson	502 ½ S Verde ST	
6/6/21	Emily Black	5051 S. Topaz Rd	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 35 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
06/06/21	Lesly Ferrer	2113 N Ellen St. Apt 1	L. Ferrer
6-6-21	Marc Arrugueta	1601 W. Sherrie Dr.	Marc Arrugueta
6-6-21	Elisa Kelley	1401 N. Fourth St. #218	Elisa Kelley
6/6/21	Ting Hsieh	617A N San Fran St.	
6/6/21	Chris Bochert	617A N. San Francisco St.	
6/6/21	Chuck Gillick	829 W. Meade Ln	
6/6/21	Susan Gillick	829 W. Meade Ln	
6/6/21	Ellie Blair	3435W Red Rock	EBK
6/6/21	James Hyde	2370 S Highland Mesa Rd.	
6/6/21	Taylor Collins	535. S. Fountaine St	
6/6/21	Sara Clancey	687 N. Locust St. Flagstaff, AZ 86001	
6/6/21	EMILY POOLE	2912 N. MAIN ST FLAGSTAFF 86004	
6/6/21	ANDIE SZYMAN	1721 N FIRST ST	
6/6/21	SEAN FAIR	612 N Forest View Dr. FLAGSTAFF 86004	
6/6/21	Mackenzie Fair	612 N Forest View Dr. Flagstaff, AZ	Mackenzie F
6/6/21	Shelley Silva	3360 n monte vista Flagstaff AZ 86004	
6/6/21	Tony Silva	3360 N Monte Vista Flagstaff, AZ 86004	
6/6/21	Jessie LeClair	6070 N. Smokerise Dr Flagstaff, AZ 86004	Jessie LeClair
6/6/21	Margaret Poor	4343 E. Soliere #108 FLAG 86004	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Sarah Tabak	605 S O'Leary St. Flag 86001	
6/6/21	Kim Duncan	515 N Leroux	
6/6/21	Elizabeth Hobbs	514 W Navajo Rd	
6/6/21	Nicole Horguindeguy	990 E. Hattie Greene	
6/6/21	margaret Atcley	1926 N. East ST #B	
6/6/21	Ismail OZIS	728 N Locust St.	
6/6/2021	Amanda Gray	18 E Elm Ave Flag 86001	
6/6/21	Shasta Weigut	1909 N. 3rd St Flag 86004	
6/6/21	Estella Hollander	502 1/2 S. Verde St. Flag 86001	
6/6/21	Judy Schopen	820 E. Ponderosa Pkwy	
6/6/21	Jeff Coleman	820 E Ponderosa Pkwy	
6/6/21	Madison Mixon	121 W CHERRY AVE	
6/6/21	Isabella Reeter	121 W CHERRY AVE	
6/6/21	Aimee Lucas	6437 Conrad Ln	
6/6/21	Kyle Rankin	6437 Conrad Ln	
6/8/21	Aaron Teets	516 N James St	
6/6/21	Mia Trent	11510 Homestead Ln	
6/6/21	Aden Trent	11510 Homestead Ln	
6/6/21	Usnaya Honyumptewa	3124 N. Loma Vista Dr.	
6/6/21	Margaret Porter	2915 E Lewis Dr. Flagstaff, AZ	
6/6/21	Allison Huisa	1239 E SEQUOIA DR Flagstaff, AZ	
6/6/21	Harleigh Hyde	2370 S Highland Mesa Rd	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 37 **OF** 84

6 ~~June 21~~

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
~~[illegible]~~	~~Emma Doskocz~~	~~3016 W Foothills Pkwy~~	~~[illegible]~~
6 June 21	Emma Doskocz	3016 W Foothills Pkwy	[illegible]
6 June 21	Kelly Crowley	12 E dupont Ave	[illegible]
6 june 21	Birgitte Briner	4343 E Soliere #2077	B Briner
6 june 21	Morgan Butler	107 W cedar Ave	[illegible]
6 June 21	Sara Johnston	1914 E. Mountain Ave #103	[illegible]
6 June 21	Gisela Kluwin	2333 N Fremont Blv	[illegible]
6 June 21	Alisyn Martinez	3322 W Cooper DR	[illegible]
6 June 21	Samantha Seaman	997 E Pine Knoll Dr Unit 1335	[illegible]
6 June '21	Alexandra Fernandez	1701 N Thistle Rd	[illegible]
6/6/21	Donna Soo	2992 N. Oakmont Dr	[illegible]
6/6/21	Myles Stone	1711 N. Sunset Dr Flagstaff 86001	[illegible]
6/6/21	Aimee Stom	1711 N. Sunset Dr. Flagstaff 86001	[illegible]
6/6/21	Jacob Kaufman	5303 E Cortland Blvd	[illegible]
6/6/21	Rae Hernandez	4011 E Mtn View Ln	[illegible]
6/6/21	Joshua Brown	605 S. Oleck 86001	[illegible]
6/6/2021	David Carrillo	3470 W. Conrad Gate	[illegible]
6/6/2021	STANLEY R. HAGUE JR	1304 N. NAVAJO DR	[illegible]
6.6.21	Michael Olson	604 N. San Francisco	[illegible]
6.6.21	Fethiye Ozis	728 N. Locust	Fethiye Ozis
6.6.21	Kaylee Green	2ND W 1000 N Beaver St Unit 210, Flagstaff, AZ, 86001	[illegible]
6-6-21	David Klassner	18 E Elm Ave Flagstaff AZ 86001	[illegible]

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 38 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Anne Jehle	6646 N Snowflake	
6/6/21	Katherine Evans	2900 S. Pantano Seco Lane Flagstaff AZ 86001	
6/6/21	Jarod Evans	"	
6/6/21	Colin Achey	1103 W Thelma Way	
6/6/21	Megan Kelly	3124 N. Grandview Dr.	
6/6/21	Margy Pracchia-Niblack	3471 S. Carol Dr Flag	
6/6/21	MARK NIBLACK	3471 S. Carol Dr. Flagstaff	
6-6-21	Kathy Fraser	990 Forest Rd #3 Flagstaff, Az 86001	
6-6-21	Steven Barnett	969 W. Coyote 86005	
6-6-21	Karen Dewanshire	4420 N. Mt. Meadows Dr	
6.6.21	KERI STIVERSON	4908 S Bright Angel Trl 86005	
6/6/21	SARAH OMAN	4608 Bright Angel 86005	
6/6/21	Ann-Elise Buntin	8 W Aspen Ave Flagstaff, AZ 86001	
6/6/21	Cassandra Reynolds	3244S Hannah Ln Flg 86005	
6/6/21	Kathleen Starr Bliss	1203 W Davis Way Flag 86001	
6/6/21	Meghan Ozbirn	517 W Cherry Ave	
6/6/21	Matthew Pelan	3200 E Lifeder Dr Unit 14-203	
6/6/21	Lorena Rodriguez	4831 N oakmont dr.	
6/6/21	Keanan Allen	2017 N Center St.	
6/6/21	Riant Northway	2515 W Josselyn Dr	
6/6/21	Ian Tufts	2476 N Crystal Dr	
6/6/21	Caylee Palmisano	700 S Black Bird Roost Flag. AZ	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 39 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	Jessica Maggio	1481 S. Burlington St. Flg 86001	
6/7/21	Scott Perry	105 N. Plaza K St. 86001	
6/7/21	Marquita Morris	510 W Aspen Ave 86001 Flagstaff Az	
6-8-21	Lora Sampson	1263 S Mark Ln Flagstaff AZ 86001	
6-8-21	Faith Blaize	1263 S Mark Ln Flagstaff, AZ 86001	
6/8/21	Cory Island	215 W Phoenix Ave Flagstaff AZ 86001	
6/8/21	Marissa Blanco	215 W Phoenix Ave Flagstaff, AZ 86001	
6-8-21	TONY BAKER	3206 N. King St. FLAGSTAFF AZ 86004	
6-8/21	Jess Montes	1200 W University Drive N Flagstaff, AZ, 86001	
6/8/21	Noa Vallance	4343 Soliere Ave, unit 2050 Flagstaff Az. 86004	
6/8/21	Kelsey Cahill	813 W University Ave, Apt. 1302, Flagstaff, AZ 86001	
6/8/21	Liam Cahill	813 W University Ave, Apt 1302 Flagstaff AZ 86001	
6/8/21	Evan Quinlivan	813 W University Ave APT. 1301 Flagstaff AZ 86001	
6/8/21	Rochelle Werkesman	2361 TOLANI FLAGSTAFF, AZ 86005	
6/8/2021	Gina Robison	2495 Mesa TRL. Flagstaff AZ 86005	
6/8/2021	Carlos Lopez	3840 S Yaqui Dr. IC Flagstaff 86005	
6/8/21	Keum McCain	930 N San Francisco Flagstaff, AZ. 86001	
6/8/21	Hazel Fimbal	924 Crow	
6/8/21	Tonya Joe	418 E. Woodland Dr.	
6/8/21	Elizabeth VanGeem	4711 Alpine Dr Bellemont AZ	
6/8/21	Karinda Klamow	4952 S. Pyrite Rd Flagstaff AZ 86005	
6/8/21	Kaitlin Ellingson	4960 S. Pyrite Rd. Flagstaff, AZ 86005	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-8-21	Pete Morrow	3340 n Harris way	P. MORROW
6/8/21	Barbara Tait	3340 N Harris Way	Barbara Tait
6/8/21	Eric Brunk	5303 E Cortland	Eric Brunk
6/8/21	JERRY L JOHNSON	820 W. ASPEN FLAGSTAFF	Jerry L Johnson
6/8/21	ROABIE Johnsan	820 W. Aspen	Roabie Johnson
6/8/21	JUDITH TINCHER	3165 W BRENDA COO	JTincher
6/8/21	Kelly Poe Wilson	710 W. Grand Canyon	
6/9/21	Kevin Olson	3416 S. Carol Dr	Kevin C. Olson
6/8/21	Taylor Miller	1669 E Jacob Way	
8 JUN 21	CHARLIE SILVER	720 W. ASPEN AVE.	Charlie Silver
8 June 21	Duffie Westheimer	720 W. Aspen Ave -01	Duffie Westheimer
8 June 21	Todd Gonzales	5905 N. Smokerise Dr	
8 June 21	Kathy Flaccus	1021 N Hoja Dr	Kathy K Flaccus
6/8/21	Sage Nelson	13 W. Elm Ave.	
6-8-21	Chris Gunn	303 E. David Dr.	
6-8-21	Marilyn Murov	801 W. Summit Ave	Marilyn Murov
6/8/21	Sarah Vanier	603 W. Whiting Rd.	SLVanier
6/8/21	Sally Evans	1520 N. BEAVER ST	Sally Evans
6/8/21	Joey Bono	501 W. Philomena Dr.	J. Bono
6/8/21	Kelsey Morales	118 E. Benton Ave	Kelsey Morales
6/8/21	Andres Adauto	324 N. Kendrick St.	
6/8/21	Joey Wellman	1430 N Linda Vista	Joey Wellman
6/9/21	Charlotte Hurley	1005 Mike's Pike St	Charlotte Hurley

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 41 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Sarah Andrews	118 E. Benton Ave 86001	
~~6/8/21~~	~~Katie Hawbaker~~	4965 N Primrose Cir 86001	KHawbaker *in solidarity
6/8/21	Nic Hawbaker	4965 N Primrose Cir 86001	*in solidarity
6/8/21	Laura Baggarly	1611 E Arrowhead Ave	
6/8/21	PETER FARNESS	812 W. COCONINO AVE., 86001	
6/8/2021	BRIAN SPENCER	2917 N ELK RUN, FLAGSTAFF AZ. 86004	
6/8/2021	Natalie Zullinger	2888 W. Patio Del Presidio	
6/8/21	Christina Molinaro	2350 W. Mission Cir Timber 86001	Christina Molinaro
6/8/21	Kathryn Lowney	3365 N. Jamison Blvd. 86004	
6/8/21	Linsey Baker	900 W. Weston Rd Flagstaff 86005	
6/8/21	Josefina Acedo	810 S. Paseo Del Flag	
6/8/21	Calvin Fahn	612 N Beaver St.	
6/8/21	Rebecca Platte	2609 N. Eddy Dr.	
6-8-21	Casey Coleman	5205 E. Cortland Blv Apt 142	
6-8-21	Justin Coleman	2924 N. Patterson	
6/8/21	Kristopher Jane	1080 W Kaibab Ln	
6/8/21	Sandy Alexander	1080 W. Kaibab Ln 86001	
6/8/21	KATHRYN SOMOZA	711 W Santa Fe / 86001	Kathryn Somoza
6/8/21	Rej Begay	8610 Arroyo Trail 86004	
6/8/21	Thelma Barlow	997 E Pine Knoll Dr. Flagstaff Az	
6/8/21	Norma Patterson	2734 W. Adirondack Ave.	Norma M. Patterson
6/8/21	David N Patterson	2734 W. Adirondack	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 42 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-8-21	Emily Bechtold	408 W Forest Ave #B Flagstaff AZ 86001	
6/8/21	Caleb Alexander	1731 E Arrowhead Ave #3 Flg, AZ 86004	
6/8/21	Marissa Molloy	1731 E Arrowhead Ave #3 Flagstaff AZ 86004	
6.8.2021	Candace Reagan	1731 E Arrowhead Ave #3 Flagstaff AZ 86004	
6/8/21	Jillian Goulet	828 W Coconino Ave Flagstaff, AZ 86001	
6/8/21	Teo Melis	112 N. Aztec Street Flagstaff, AZ 86001	
6/8/21	Chelsey Hockersmith	6395 E Leisure Ln Flagstaff, AZ 86004	
6/8/21	HARDEN GEBLER	1468 W. UNIVERSITY HEIGHTS DR. NORTH FLAGSTAFF AZ 86005	
6/8/21	Keegan Evans	3409 N Grandview 86004	
6/8/21	Ben Torvik	920 W. Grand Canyon Ave #4 Flagstaff, AZ 86001	
6/8/21	Jordan Dikeman	3212 N. Patterson Blvd. Flagstaff AZ, 86004	
6/8/21	Robert Barcenas	510 Bennett Flagstaff, AZ 86005	
6/8/21	Emily Haworth	823 W. Grand Canyon Ave 86001, Flagstaff AZ	
6/8/21	Chris Scully	823 B W. Grand Canyon Ave Flagstaff AZ 86001	
6/8/21	Denice Arneth	2635 Kachina trl Flagstaff AZ 86005	
6/8/21	EDAN LANOFF	3133 N. Joy Ln Flagstaff AZ, 86001	
6/8/21	Evan Bolyen	813 W. University Ave #502, FLAGSTAFF, AZ	
6/8/21	MATTHEW BARKER	3428 N. PINE DRIVE FLAGSTAFF, AZ 86004	
6/8/21	Andrew Wisniewski	822 W Grand Canyon Ave Flagstaff, AZ 86001	
6/8/21	Ravel Craig	814 W. SUMMIT AVE #2	
6/8/21	Steve Eberly	1680 N. WOOD HOLLOW WAY FLAGSTAFF, AZ 86004	
6/8/21	Megan Coons	5905 N. Smokerise Dr. Flagstaff, AZ 86004	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 43 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Claire Kerata	2820 N Prescott rd 86001	Claire Kerata
6/8/21	Julia Stuart	704½ W Coconino Ave 86001	
6/8/21	Tanner Muscarella	4521 S. Lance Rd.	
6/8/21	Tyler Williams	1075 W. Lava Ln 86001	
6/8/21	Hillary Cooper	1075 W. Lava Ln 86001	
6/8/21	Nora Timmerman	220 W. Juniper Ave Flagstaff, AZ 86001	
6/8/21	Nina Porter	1705 N. San Francisco St. Flagstaff AZ 86001	
6/8/21	Max Hebert	217 W. ELM Ave.	
6/8/21	Summer White	217 W Elm Ave	
6/8/21	Alison Gillam	222 S. Humphreys St. #2	
6/8/21	Michael Tita	222 S. Humphreys St #2	
6/8/21	Chris Keefe	1331 E. Hatcher Dr	
6/8/21	Heidi Rodenhizer	1331 E Hatcher Dr	
6/8/21	Richard Samson	1385 W University Ave	R.A. Samson
6/8/21	Blake Scott	1645 E JACOB WAY Flagstaff AZ 86001	
6/8/21	Zaeh Saunders	617 N. Beaver St	
6/8/21	Matt Ward	617 N. Beaver St.	
6/8/21	Leah Bloom	402 West Apache Rd	
6/8/21	Andrea Hartley	323 N. Kendrick St.	
6/8/21	Ed Hentelt	323 N Kendrick St	
6/8/21	Gwen Beagle	824 W Route 66	
6/8/21	Kyle Grommes	824 W Route 66	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 44 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Katherine Buchanan	5824 Switchback Trl.	Katherine Buchanan
6/8/21	Tiffany Jackman	3217 W. Lois Ln.	Tiffany Jackman
6/8/21	Rayna Bransford	1 W Runke Dr	Rayna Bransford
6/8/21	KEGAN BOYER	1620 N KITTREDGE RD	
6/8/21	Sarah Torosian	1620 N. kittredge Rd	
6/8/21	Elizabeth Brocad	2307 Lantern Lane	
6/8/21	Taylor Joyal	703 W Birch Ave	
6/8/21	Amy Martin	703 W. Birch Ave	
6/9/21	Nicole Perley	555 W Forest Meadows Apt	
6/9/21	Ryan Sander	214 W. Sullivan Ave	
6/9/21	Erin Whalen	19 S San Juan	
6/9/21	Rhyan Peake	1800 N Kittredge Rd	
6/9/21	Katherine Noonan	607 N. Leroux St	
6/9/21	Emilia Anderson	613 W Navajo Rd.	
6/9/21	Brooke Wormsbecker	6905 N Bader Rd	
6/9/21	DAN CHISHOLM	15 W Juniper	
6/9/21	Jan Mark	24 W C Riles	
6/9/21	Renee Jordan	804 N Leroux	
6/9/21	Ryan Ward	" " "	
6/9/21	Holli Phillips	2310 Blackhawk Ln.	
6/9/21	Brooke Phillips	2310 Blackhawk Ln	
6/9/21	Kenny Phillips	2310 Blackhawk Ln	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Nicole Nelson	278 Cherokee	
6/9/21	Renee Henry	2345 E Hemberg Flagstaff, AZ 86004	Renee Henry

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 46 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6.7.21	Katie Condrey	43 S Paseo Del Flag	
6/7/21	Conner Lowe	991 E Pine Knoll 1625	
6.8.21	Destiny Gourley	43 S Paseo Del Flag	
6/8/2021	John Hartman	1316 McMillan Ave	
6/9/2021	Michael Malcolm	212 W Elm Ave	
6/9/2021	Richelle Speilman	305½ N. Kendrick St	
6.9.2021	Jonathan Whitehorn	305½ N. Kendrick St	
6/9/2021	MIRIAM LEBARON	1080 W KAIBAB LN APT 6B	
6/9/21	Peter Skowron	Arrowhead Rd	
6/9/21	Samuel Bockelman	219 W. Cedar Ave #8 Flagstaff, AZ 86001	
6/9/21	Eli Katz	706 Grand Canyon ave APT-5	
6/9/21	ANGELA GASTON	208 W. PINE AVE	
6/9/21	Abigail Lemus	2789 w Pico del Monte cir	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Celia Frost	7096 W Private Pine Mtn Flagstaff AZ 86001	
6/9/21	Candace Deacon	1270 E. Appalachian, Flagstaff, AZ 86004	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: ____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___
PAGE 48 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	Jenny Blackler	514 W Dale Ave	Jenny Blackler
6/7/21	Nicholas Gleason	2519 N Centaur St	Nicholas Gleason
6/7/21	Chloe Foresta	809 Leroy	
6/7/21	Andrew Ibrado	1185 W University Ave 13-206	
6/7/21	Cole Lupton	823 W. Birch unit D	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	Amanda Sanchez	3740 N Steves Blvd	
6/8/21	Danielle Kaminskas	3601 Lake Mary Rd 311	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/2021	Kimberly Celona	4025 Lake Mary Rd #58 Flagstaff, AZ	Kimberly Celona
6/9/2021	Adam Smith	4025 Lake Mary Rd #58 Flagstaff AZ 86005	Adam Smith
6/9/2021	John Reinartz	220 S Beaver St. Flagstaff 86001	
6/9/2021	Taylor Wisniewski	3112 N. Tinkle Blvd Flagstaff, AZ 86004	
6/9/2021	Violet Eklund	920 W. Grand Canyon Ave. #10	Violet Eklund
6/9/2021	Catrina Morgan	19 S. San Francisco St Apt F	
6/9/21	James Ashley Smith	10 W Phoenix Ave Flag, AZ 86001	
6/9/21	Kirsten Miller	1500 S San Francisco St #909 Flag, AZ 86001	K. Miller
6/9/21	Marlee Morin	1500 S San Francisco St #107 Flag, AZ 86001	Marlee Morin
6/9/21	SARAH BARBA	404 W Santa Fe Avenue #110, Flagstaff, AZ, 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: ____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___
PAGE 51 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/07/2021	Jared Wesley	3092 Mesa Trail, Flagstaff 86005	
6-07-2021	Tessa Bottemiller	15 Asco Dr, Flagstaff, AZ	
6-07-21	Steve Brans	4629 Sandy Loop Pass Parks AZ	
6-7-21	Jamison Douglas	419 W Cedar Ave Apt 2 Flagstaff AZ 86001	
6-7-21	Dennis Grant	3224 N. Pine Dr. Flagstaff AZ 86004	
6-7-21	Ruth Campana	2701 W Adirondack ave. Flagstaff AZ 86001	
6-8-21	Corryn Smith	3601 E mallard Lane Flagstaff, AZ 86004	Corryn Smith
6-8-21	Brian Burke	997 E Pine Knoll Dr apt 335 86001	
6-8-21	Max Knaus	215 W Phoenix Ave	
6-8-21	Jesse Prescott	1691 Gemini Dr.	
6/8/21	Robert Faus	6300 Doubletrack	
6/8/21	Kyle Colarito	2090 S. Tombaugh Way, Flagstaff, AZ 86001	
6/8/21	Chloe Herman	2419 W. Alaska Ave. Flagstaff AZ 86001	Chloe Herman
6/8/21	Andrea Herrin	2419 W. Alaska Ave Flagstaff, AZ, 86001	
6/9/21	Melanie Colarito	2090 S. Tombaugh Way Flagstaff AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 52 OF 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/6/21	Annabelle Nelson	2015 N Navajo FLAGSTAFF AZ 86001	
6/7/21	Erin Osborne	2618 N. Main St. Flagstaff, AZ 86004	Erin Osborne
6/7/21	David Decher	1924 N. San Francisco St.	
6/8/21	Austin Smith	3655 N. Steves Blvd	
6/8/21	Michael Murphy	409 W Havasupai Rd Flagstaff, AZ 86001	
6/8/21	Libby Stortz	3240 W. Shannon Dr Flagstaff AZ 86001	Libby Stortz
6/8/2021	chuck SERPANEN	2283 E CHISHOLM TRL FLAGSTAFF, 86005	
~~6/8/21~~	~~Mark Daniels~~		
6/8/21	ELLEN HOBSON	102 S. WC RILES ST APT. B FLAGSTAFF 86001	Ellen Hobson
6/8/21	Daniel Preis	412 E. Branner ave	
6/8/21	Sara Slosky	1820 W University Heights Dr N Flagstaff AZ. 86005	
6/8/2021	GINA HANSEN	1539 W University Heights Dr N Flagstaff AZ 86005	
6/8/2021	Jose Bejarano	997 E Pine Knoll Dr APT 1322 Flagstaff, AZ 86001	
6/8/21	Michelle Galloway	22 E. Ridgecrest Dr. Flagstaff, AZ 86001	
6/8/21	Ian Galloway	22. E. Ridgecrest Dr. Flagstaff AZ 86001	
6/9/21	Madeline Margevicius	2074 W University Ave Flagstaff, AZ 86001	
6/9/21	Colin Quinn	323 S Elden St, Flagstaff AZ, 86001	
6/9/21	Isabelle Dove Robinson	113 1/2 E. Aspen Flagstaff. AZ 86001	
6/9/21	Chris Latham	113 1/2 E. Aspen Ave. Flagstaff, AZ 86001	
6/9/21	Chase Edwards	436 Comanche Flagstaff, AZ 86005	
6/9/21	Kristina Barnett	2856 N Gregg Dr. FLAGSTAFF AZ 86001	
6-9-21	Kelly McCue	1232 E Olive Way Flagstaff, AZ, 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	Madison Mazon	121 W. CHERRY AVE	Madison Mazon
6/7/21	Isabella Reeter	121 W CHERRY AVE	IReeter
6/7/21	Miguel Sotelo	819 W. Grand Canyon Ave	Miguel Sotelo
6/7/21	Kara Byrne	3360 N STEVES BLVD	
6/7/21	Ben Drozdowicz	555 W Forest Meadows St	
6/7/21	Kyle Gambino	9 East Phoenix Ave Apt 4	Kyle Gambino
6/7/2021	Kelsey Whitaker	9 E. Phoenix Ave #4	
6/8/2021	Stephanie Tanke	875 E. Pine Knoll Dr. Apt. 227	
6/8/2021	Quinn Scully	578 N Pinecliff Dr	
6/8/2021	Graham McGuin	3509 West Mountain Drive	
6/8/2021	MIGUEL GUZMAN	13 SOUTH LEROUX ST.	
6/8/2021	Tesso Corsetti	3210 W Brenda Loop	Tesso Corsetti
6/8/2021	Natalie Haan	997 E. Pine Knoll Drive	Natalie Haan
6/8/2021	Kaitlen Rieber	100 E Paseo del Rio	
6/8/2021	Katie O'Malley	320 W Cherry Ave	KOMalley
6/8/2021	Erin Kaczmarowski	320 W. Cherry Ave	erinkaczmarowski
[redacted]	[redacted]	[redacted]	[redacted]
6/8/21	Michelle Kuzdas	2338 W. Mission Timber Cir	
6/8/21	Jessica Rakestraw	2338 W Mission Timber	Jessica Rakestraw
6/8/21	Sarah Keer	997 E Pine Knoll Dr.	Sarah Keer
6-8-2021	MADISON MCMAHAN	100 E PASEO DEL RIO	
6/8/21	Joshua Beaty	927 W Packer Dr	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/08/21	ALEXANDER L.	823 W. CLAY AVE	
6/8/21	Naomi Lopez	6 N AZTEC ST.	
6/8/21	LESLIE LUNA	6 N AZTEC. ST.	
6/8/21	Amanda Strait	820 N Beaver St.	
6/8/21	Felicia M. [illegible]	3360 N. Steves	
6/8/21	Seth Evans	2532 N 4th St	
6/8/21	Jeremy Brayer	2459 Kearns Canyon	
6/8/21	Katelin Friedericks	2818 S. Fossil Creek Ln	
6/8/21	Sandra Widmer	[redacted] 4748 S. Dory Trl.	
6/8/21	Rob Friedericks	"	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/21	RICK KAZMER	1654 W. MIKE'S DR. FLAGSTAFF, 86001	
6/8/21	SAMANTHA McCulloch	" "	
6/8/21	grace Kelley	701 E. Crestview Apt A, 86001	
6/8/21	Lydia Bailey	" "	
6/8/21	Cierra Montella	875 N Pine Cliff Dr	
6/8/21	Anya Metcalfe	1806 N Cedar St	
6/8/21	Brooke Solarte	1830 S milton rd	
6/8/21	Kristen Wold	620 W Birch Ave	
6/8/21	Stephanie Yost	1250 Schultz Pass Rd	
6/8/21	FRED GREEN	2600 N Country St.	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 56 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	RYAN MCELLIGOTT	9 E. PHOENIX AVE. APT 5.	Ryan McElligott
6/7/21	CHRISTOPHER ALAGNA	9E. PHOENIX AVE APT 5.	Christopher Alagna
6/7/21	Matthew Urban	313 E Brannen Ave Flagstaff AZ	
6/9/21	Daniel Kennedy	1760 W. Windtree Drive	
6/9/21	Scott Sandlo	1105 E Ponderosa Pkwy Unit 124	
6/9/21	Sarah ~~Singley~~ Corkill	1129 W. Shullenbarger Dr. Flagstaff, AZ 86005	
6/9/21	Ceta Singley	1129 W. Shullenbarger Dr. Flagstaff, AZ 86005	
6/9/21	Claire Van Stelle	760 E. Zuni DR. Flagstaff, AZ 86005	Claire Van Stelle
6/9/21	Ryan Wheless	1701 W. Stevanna Way	
6/9/21	Meghan Ozbirn	316 W Cherry Ave	
6/9/21	Wendy Ross	111 E. Oak Ave, Apt 10 Flag, AZ	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 57 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
06/08/2021	Heather Giovale	2224 E. Forest Heights Dr Flagstaff AZ 86004	
06/08/2021	Michael Mongini	302 N. Verde St Flagstaff, AZ 86001	
06/08/2021	Olga Baykova	708 N. Canyon Terrace Dr. Flagstaff, AZ 86001	
6/8/2021	Marc Schlaud	708 N. Canyon Terrace Dr. Flagstaff, AZ 86001	
6/8/2021	Lori Rubino-Hare	426 W. Juniper Ave Flagstaff AZ 86001	
6/8/2021	TRENT HARE	426 W. Juniper Ave Flagstaff AZ 86001	
6/9/2021	KIM MCCASLAND	1215 E KANDAHAR LN FLAGSTAFF, AZ 86004	
6/9/21	Meredith Smith	10 W Pine Ave Flagstaff, AZ 86001	
	Miranda Todd	550 S. windsor lane Flagstaff, AZ	
6/9/2021	Cynthia Perger	3600 W. Mountain Dr. Flagstaff, AZ 86001	
6/9/21	NICOLE CUAZ	2502 N Main St Unit B Flagstaff, AZ 86004	
06/9/2021	MARCUS FORD	1021 N. Navajo 86001	
6/9/21	MARY TOLAN	409 W. Aspen Flagstaff AZ 86001	
6/9/21	Sherri Gallagher	2808 N Gregg Dr Flagstaff, AZ 86001	
6/9/21	Melissa Dunstan	493 W Philomena Flagstaff AZ 86001	
6/9/21	Anna Braun	2016 N. Center St. Flagstaff AZ 86004	
6/9/21	Donna Shillington	1075 W Beal Rd Flagstaff, AZ 86001	
6/9/21	James Gaherty	1075 W. Beal Rd Flagstaff, AZ 86001	
6/9/2021	Christine Graham	523 W. Aspen Ave Flagstaff, AZ 86001	
6/9/2021	Frances & Joseph	4576 S. Lake Mary Rd; Flagstaff, AZ 86005	
6/9/2021	Kevin Oelerich	1924 N. Marion dr Flagstaff, AZ 86001	
6/9/2021	Meredith Brown	118 E Benton Ave Flagstaff, AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 58 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Katie Chapman	4035 Canyon Loop Flagstaff 86005	
6/9/21	Amanda Stan	601 W. Cherry Ave Flagstaff, AZ 86001	
6/9/21	Kalai Kollus	2208 N. West St Flagstaff, AZ 86004	
6/9/21	Scott Krankkala	2929 N PRESCOTT RD FLAGSTAFF, AZ 86001	
6/9/21	Jrie Kenkel	2929 N. Prescott Rd Flagstaff AZ 86001	
6/9/21	Kelly A. Woodruff	111 E. Oak Ave #43 Flagstaff AZ 86001	
6/9/21	Andrew M. Baker	1481 S. Burlington Flagstaff AZ 86001	
6/9/21	Holly Troy	3170 W SHEILA DR FLAGSTAFF AZ 86001	
6-9-21	PAUL PERREAULT	3100 W SHEILA DR FLAGSTAFF AZ 86001	
9 June 21	Clare Schneider	914 N LEROUX ST Flagstaff AZ 86001	
6/9/21	DREW BARRINGER	914 N. LEROUX, FLAG. 86001	
6/9/21	Emmett White	909 W. CLAY AVE. APT. A, FLAG, AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6-8-21	Cameron Clark	11 E Pine Ave FLG 86001	Cameron Clark
6-8-21	Nick McNaughton	4030 N Lorem Circle FLG 86004	
6.8.21	Shawn Skabelund	310 W. Pine Ave Flg	
6/8/21	Alexandra Campino	310 W. Pine Ave Flagstaff 86001	
6/8/21	Vickey Finger	6048 E Mountain Oaks Dr Flag 86004	
6/9/21	Heath Norton	5048 S Topaz Rd Flag 86005	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 60 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/8/2021	Amy Rhodes	1725 N Kutch Dr. Flagstaff, AZ 86001	
6/8/2021	Adam Neisen	1725 N. Kutch Dr. Flagstaff, AZ 86001	
6/8/2021	RuAn Porter Tilman	809 W Murray Rd Flagstaff, AZ 86001	
6/8/2021	Melissa Rhodes	3310 W. Mountain Flagstaff AZ 86001	
6/8/2021	Todd Barnell	601 W. Whipple Rd Flagstaff, AZ 86001	
6/8/2021	John Hurley	615 W Whipple Rd Flagstaff AZ 86001	
6-8-2021	Jillian Worssam	815 Grand Canyon Ave Flagstaff. AZ 86001	
6/8/2021	Mackenzie Chase	907 W. Summit Ave. Flagstaff, AZ 86001	
6/8/2021	Becky Lewis	1061 N Conifer Rd Flagstaff AZ 86001	
6/8/2021	Sandra Lubbersley	1021 N. Navajo Dr. Flagstaff, AZ 86001	
6/8/2021	Martha Johnson	2845 W. Rico del Monte Cir Flagstaff, AZ 86001	
6/8/2021	Kaci Fankhauser	612 W. Whiting Rd Flagstaff, AZ 86001	
6-9-21	K.C. Kinney	710 W Whipple Flagstaff AZ 86001	
6/9/21	McKelvie Kuppinger	710 W. Whipple Rd Flagstaff, AZ 86001	
6/9/21	CAMI SCOTT	1550 N. FORT VALLEY RD. APT #25 Flagstaff AZ, 86001	
6-9-21	Allison Bohn	1550 N Fort Valley Rd Apt 25 Flagstaff AZ 86001	
6-9-21	Ryanne Sebern	801 W Anderson Rd Flagstaff AZ 86001	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE:____ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/21	Cassandra Price	3885 S Yaqui Dr, APT 20 Flagstaff	
6-7-2021	Anna Whitley	1 W Runke Dr APT 1507, Flagstaff	Anna Whitley
6/7/21	Mallory Garcia	305 E McConnell Dr.	Mallory Garcia
6/7/21	April Pitman	5205 E Cortland Blvd APT 1160	
6/8/21	Shilo Bailey	1683 W. Shellie Dr.	
6/8/21	Rebecca Wolfe	5205 E. CORTLAND APT 1170	
6/8/21	Michael Wellsford	2314 N center un. 6	
6/8/21	Charles Truettner	212 S. Leroux St. #3	
6/9/21	Erik Schiefer	601 W Cherry Ave	
6/9/21	Sean Tope	1105 E ponderosa parkway	
6/9/21	Sophie Bowers	1105 E. ponderosa pkwy.	Sophie Bowers
6/9/21	Annalisa Hansen	3415 N Walker	
6/9/12	RHONDA URDANG	5171 E. HAWTHORNE DR, FLAGSTAFF, AZ 86004	Rhonda Urdang @ 11:38 a.m.
6/9/12	Zachary Larger	246 S. Elden Street	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE:___ Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff___
PAGE _____ **OF** _____

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
06/07	Luke Howland	820 W Linger Ln	
6/07	TIM HAMRAH	4635 S. LAKE MARY Rd	
6-7	Jim Novak	1898 N. Mesa Dr.	
6/7	Tyler Howland	820 W Linger Lane	
6/8	Kristen Suverkrup	1200 S Chattanooga St Flagstaff AZ 86001	
6/9	Caleb Howland	820 W Linger lane	
6/9	Ryan S Pinto	702 W. Whipple Rd	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 63 **OF** 64

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/12	Abby Mackie	923 W University Ave. Flagstaff, AZ & APT 217	Abby Mackie.
6/9/21	Dan Gaseau	201 E. Woodland Dr Flagstaff, AZ 86001	
6/9/21	Singer Horse Capture	323 S. Elden St. Flagstaff, AZ 86001	
6/9/21	JEROME McLAUGHLIN	923 W. BEAL RD FLAGSTAFF, AZ 86001	
6/9/21	Jorge Donitz	440 W. Thorpe Rd. Flagstaff, AZ, 86001	
6/9/21	Melinda Bell	3300 N Chickadee Ln Flagstaff AZ 86001	
6/9/21	DAVID KUMASAKA	921 W. GRAND CANYON FLAGSTAFF, AZ 8600	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 64 **OF** _____

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/7/2021	Allison McNelly	837 N. Fox Hill rd. Flagstaff AZ 86004	
6/7/2021	Abby CHAN	522 W. Havasupai Rd. Flagstaff, AZ 86001	
6/7/2021	Jed Hayes	7895 Alma Rd. Flagstaff, AZ 86004	
6/7/2021	Katie Kendall	3200 S. Litzler 17-217 Flagstaff, AZ	Katie Kendall
6/7/2021	Jose Cisterna	415 E. Ashurst Ave. Flagstaff, Az. 86001	
6/7/2021	Sophia Escalante	1410 North Rim Drive Flagstaff, AZ 86001	
6/8/21	Chris Barquin	3125 N Joy Ln Flagstaff, AZ 86001	
6/8/21	Jose Bowers	3561 W. Cooper Dove Flagstaff, AZ, 86001	
6-8-21	Suzanne Nobles	1651 N Gemini Dr #47 Flagstaff, AZ 86001	
6-8-21	Glenn Farley	3751 E. Trading Post Trl Flagstaff, AZ 86005	
6/8/21	Beth Duschatko	1211 W Dale Way Flagstaff AZ 8600	
6/8/21	Emma Bowers	1300 North Aztec Street Flagstaff AZ 86001	
6-8-21	Alexander Conrad	2349 W. Poodel Mountain Flagstaff, AZ 86001	
6-8-21	Eric Rettenbach	2117 E. Arroyo Seco Dr. Flagstaff AZ 86004	
6-8-21	Liz Gehret	1115 N. East St. Flagstaff, AZ 86004	
6-8-21	Brian Kinsler	522 W Havasupai Rd Flagstaff AZ 86001	
6-8-21	VICKY DOULL	1620 N. Kittredge Rd Flagstaff, AZ 86001	
6/9/21	Rebekah Glebe	908 N Humphreys St Flagstaff AZ 86001	
6/9/21	Helsey Epstein	2975 N. Baldt Dr Flagstaff AZ 86001	
6/9/21	Ylandra Wimmer	1603 W. Mikey Drive Flagstaff, Az 86001	
6/9/21	Mason Hults	908 N Humphreys St. Flagstaff, AZ 86001	
6/9/21	Chris Parsze	3329 S. Little Dr. Flagstaff, AZ 86005	

PETITION TO FLAGSTAFF CITY COUNCIL (Continued)

TITLE OF ISSUE: Lack of safe and accessible bicycle and pedestrian infrastructure in Flagstaff
PAGE 65 **OF** _____

DATE SIGNED	PRINTED NAME	RESIDENCE ADDRESS	SIGNATURE
6/9/21	Becky Pomeroy	6576 E Ulli Dr Flagstaff, AZ 86004	

14. B.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Saltzburg, City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE

Future Agenda Item Request (F.A.I.R.): A request by Councilmember Salas to place on a future agenda a discussion about reviewing and possibly amending the 2021 Commemorative Flag schedule to designate flags for July and August.

STAFF RECOMMENDED ACTION:

Council direction.

EXECUTIVE SUMMARY:

Rule 4.01, Procedures for Preparation of Council Agendas, of the City of Flagstaff City Council Rules of Procedure outlines the process for bringing items forward to a future agenda. Councilmember Salas has requested this item be placed on an agenda under Future Agenda Item Requests (F.A.I.R.) to determine if there are two other members of Council interested in placing it on a future agenda.

INFORMATION:

Attachments:

14. C.

CITY OF FLAGSTAFF

STAFF SUMMARY REPORT

To:	The Honorable Mayor and Council
From:	Stacy Saltzburg, City Clerk
Date:	06/09/2021
Meeting Date:	06/15/2021

TITLE

Future Agenda Item Request (F.A.I.R.): A request by Councilmember Aslan to place on a future agenda a discussion about the addition of a "Land Acknowledgement" in the City Council Rules of Procedure, to be read during the agenda's PLEDGE OF ALLEGIANCE AND MISSION STATEMENT section.

STAFF RECOMMENDED ACTION:

Council direction.

EXECUTIVE SUMMARY:

Rule 4.01, Procedures for Preparation of Council Agendas, of the City of Flagstaff City Council Rules of Procedure outlines the process for bringing items forward to a future agenda. Councilmember Aslan has requested this item be placed on an agenda under Future Agenda Item Requests (F.A.I.R.) to determine if there are two other members of Council interested in placing it on a future agenda.

Councilmember Aslan proposed the following language for discussion and consideration:

> The Flagstaff City Council recognizes that this city we consider home sits at the base of the Sacred Peaks, on homelands shepherded by more than 12 Tribal Nations and Indigenous Peoples throughout this region. We honor them, their legacies, their traditions, and their past, current, and future generations who will forever call this place home.

INFORMATION:

Attachments: