Drainage Report

Centerpoint Energy Minnesota Gas

PREPARED FOR
Centerpoint Energy Minnesota Gas

DATE
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Acronyms and abbreviations

BMP	Best Management Practice
CAD	Computer-aided design
CF	Cubic feet
CFS	Cubic feet per second
CN	Curve number
DA	Drainage Area
EGLE	Michigan Department of Environment, Great Lakes, and Energy
FEMA	Federal Emergency Management Agency
HSG	Hydrologic soil group
LOI	Line of interest
min	minutes
MPCA	Minnesota Pollution Control Agency
MW	megawatt
NRCS	Natural Resources Conservation Service
PCSM	Post Construction Stormwater Management
SCS	Soil Conservation Service (NRCS)
TR-20	Technical Release 20
TR-55	Technical Release 55
USDA	United States Department of Agriculture
USGS	United States Geological Survey

1. INTRODUCTION

CenterPoint Energy Minnesota Gas (CenterPoint)(Applicant) is proposing to construct Mankato Hydrogen Energy Plant Project (Project), a 1-megawatt (MW) hydrogen plant and a 1 MW on-site solar panel array in the City of Mankato, Blue Earth County, Minnesota. The Project area is owned by CenterPoint and is situated on an approximately 14.83-acre parcel (Project Area) also owned by CenterPoint. Once developed, the property will be used for hydrogen energy production and storage. The disturbed acreage is approximately 4.04 acres and includes the development of a solar array farm, solar equipment areas, hydrogen plant equipment, hydrogen plant buildings, access roads, stormwater management facilities, utilities, and other site amenities.

The majority of the existing site is already developed for CenterPoint's existing facilities. The solar panel array will be installed within the restored prairie located west of the current facility, and the hydrogen production and storage facility will be installed within an existing developed gravel area located east of the existing on-site propane tanks. Access to the site is off of State Highway 14.

2. EXISTING CONDITIONS

The property is located north off of State Highway 14 approximately 0.35 miles north of the intersection with State Highway 14 and Good Counsel Drive and 0.10 miles south of the intersection with State Highway 14 and Augusta Drive. The property is located within city limits of the City of Mankato. All existing topographic information for the project area and immediate surrounding areas has been provided in the Plans Issued for Conditional Use Permitting. The existing site consists of developed area for CenterPoint's existing facilities and restored prairie area located west of the current facility. The proposed construction of the solar arrays is located on the restored prairie area and consists of one drainage area that drains to a line of interest (LOI) offsite (LOI 1), see **Enclosure 1**. The LOI ultimately drains to the Minnesota River. During construction, Erosion and Sediment (E&S) Best Management Practices (BMPs), such as compost filter socks, temporary check dams, and rock construction entrances, shall be installed in order to reduce suspended solids released from the site.

3. DESIGN BASIS AND ASSUMPTIONS

The site's drainage characteristics were modeled for existing and developed conditions in accordance with the Minnesota Stormwater Manual and Mankato Grading Manual that defines Mankato City's standards and specifications for stormwater management practices implemented during land development. The runoff analysis calculations and watershed routing calculations were performed using the SCS TR-20 method in HydroCAD 10.20-7a. This computer program requires the application of several assumptions to some of the input data. These assumptions consist of variables as applied to the pre- and post-development flow paths, soil conditions, above-site drainage areas, and ground cover conditions. This section discusses this input data, and the assumptions utilized.

3.1 ORDINANCE REGULATIONS

This Stormwater Management Plan was designed to be consistent with the Minnesota Stormwater Manual and Mankato City Grading Manual which meet permit obligations with the Minnesota Pollution Control Agency (MPCA). The Mankato City Grading Manual requirements include reducing the peak flow from pre- to post- condition for the 2-, 10-, 100- and back-to-back 10-year 24-hour storm events and treating the volume of runoff for the first 1.1 inches of runoff from all new impervious surfaces. The first 1.1 inches of runoff from impervious surfaces can be treated by routing 100 percent of the runoff volume from new impervious surfaces through a filtration practice where infiltration is not feasible. The Minnesota Stormwater Manual requirements include treating the volume of the first 1.0 inches of runoff from impervious surfaces and allows for the pervious are between solar panels to count towards that treatment. To comply with the Mankato City stormwater requirements and receive credits for the pervious area between the solar panels, a 10% increase in volume is added to the required treatment volume calculated from the solar array area utilizing the Minnesota Stormwater Manual Solar Panel Volume Calculator.

Analysis of the 2-, 10-, 100-, and back-to-back 10-year storm events are included to comply with these requirements. Rate and volume calculations are included in **Appendix B and Appendix C,** respectively.

The rainfall depths for each storm event are shown in **Table 1**. Storms follow the MSE 3 MN NOAA 14 rainfall distribution.

TABLE 1 RAINFALL DATA

Storm	P (in)
2-year	2.92
10-year	4.38
100-year	7.41

Source: MSE 3 MN NOAA Atlas 14

3.2 SITE SOILS

The soils within the project area were listed as hydrologic soil group (HSG) type ‘B’, HSG type ‘C’, and HSG type ‘D’ (see description below).

Group B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of soils moderately deep to deep, well-drained soils. These soils have a moderate rate of water transmission.

Group C soils have a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D soils have a very slow infiltration rate when thoroughly wet. These consist chiefly of soils having high clay content and high runoff potential when wet. These soils have a very slow rate of water transmission.

Site soils information was taken from the United States Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS) website. The soil classification and type located on the property are summarized in **Table 2**.

TABLE 2 SOIL CLASSIFICATION

Symbol	Series Name/Slope	HSG	Hydric?	Prime Farmland
18	Comfrey clay loam	B/D	Yes	Yes, if not flooded
35	Blue Earth mucky silt loam, 0 to 1 percent slopes	B/D	Yes	No
85	Calco silty clay loam, 0 to 2 percent slopes, occasionally flooded	C/D	Yes	Yes, if not flooded
94B	Terril loam, 2 to 6 percent slopes	B	No	Yes
1039	Urban land, 0 to 2 percent slopes	-	No	-

Source: USDA NRCS Custom Soil Resource Report for Blue Earth County, Minnesota

A geotechnical investigation was performed by Braun Interec Corporation dated June 9, 2015. This investigation consisted of three soil boring located on the existing gravel area on site. Existing soils below the gravel were determined to chiefly consist of sandy lean clay which typically corresponds with HSG type 'C' or type 'D' and having slow infiltration rates. Due to the existing soils on site found during the geotechnical investigation, the site has been modeled as HSG type 'D' and infiltration is not proposed.

The approximate soil boundaries are shown on the Soils Map which is provided in **Appendix A**. The contractor should analyze the soils utilized during the construction process. Caution should be exercised in areas of poor soils. A qualified geotechnical engineer should be consulted during construction when unsuitable conditions occur. The recommended foundation design based on the soil findings shall supersede the USDA soil limitations listed above. The contractor should ensure that soils are not cut steeper than the design slopes and that fills are compacted in accordance with the site geotechnical report. Immediate seeding and mulching of disturbed areas will aid in soil stabilization and reduce soil erosion once vegetation is established.

3.3 ASSUMPTIONS

To model the pre-developed and post-developed runoff characteristics, several assumptions were made as follows:

- Acreage measurements (as applied to drainage areas and areas of ground cover) were determined by computer-aided drafting (CAD) and are approximated based on the accuracy of the site mapping and the resulting interpolation of ground slopes, ground cover, and drainage patterns.

- The LOI for the pre- and post-developed drainage areas was assumed to be located at approximately the same study point.
- The varying pre-development ground cover areas for prairie, woods, and gravel land coverage were estimated from survey, aerial imagery, the United States Geological Survey (USGS) National Landcover Database, and from site observation.
- In accordance with TR-55 requirements, pre-development Curve Number (CN) values for Meadow, Woods, and gravel land cover with Type 'D' soils are 78, 77, and 98, respectively. CN values used for post-development Meadow, Woods, gravel land cover, and disconnected impervious with Type 'D' soils are 78, 77, 98, and 98, respectively.

Other assumptions used in the calculations are discussed in the applicable sections of the report.

4. PRE-DEVELOPED HYDROLOGY

The existing site contains one drainage area (DA-1) that drains to a LOI offsite (LOI 1), as shown in **Enclosure 1**. The LOI ultimately drains to the Minnesota River.

Land cover is based on information from survey, aerial imagery, the USGS National Landcover Database, and site observation. Land cover, hydrologic soil group, and curve number information for pre-development conditions within the drainage area are summarized in **Table 3**. The pre-development drainage area curve number was weighted as shown in **Appendix B**.

TABLE 3 DA-1 PRE-DEVELOPMENT CONDITIONS

Land Cover	Area (acres)	HSG	CN
Meadow	14.47	D	78
Woods (Good)	5.43	D	77
Connected Impervious	2.47	D	98
Total/Weighted CN	22.37		80

The pre-development drainage areas and time of concentration paths are shown on the enclosed Pre-Development Drainage Area Map.

5. POST-DEVELOPMENT HYDROLOGY

The proposed site contains one drainage area (DA-1) that drains to a LOI offsite (LOI 1), as shown in **Enclosure 2**. The LOI ultimately drains to the Minnesota River.

The post-development drainage area has been broken down into two sub-drainage areas, DA-1A and DA-1B. DA-1 increases in curve number from pre- to post- condition and includes a vegetated swale and filtration berm. The filtration berm has been designed to filter the volume from all new impervious areas, calculated in accordance with the Mankato Grading Manual and MPCA Solar Site Guidance. DA-1B decreases in curve number from pre- to post- conditions and contains undetained areas. DA-1 drains to a localized low area offsite. The post-development drainage

areas and time of concentration paths are shown on the enclosed Post-Development Drainage Area Map.

Land cover, hydrologic soil group, and curve number information for post-development conditions are summarized in **Tables 4-5**.

TABLE 4 DA-1A POST-DEVELOPMENT CONDITIONS

Land Cover	Area (acres)	HSG	CN
Meadow	2.43	D	78
Connected Impervious	1.60	D	98
Disconnected Impervious	1.30	D	98
Total/Weighted CN	5.33		89

TABLE 5 DA-1B POST-DEVELOPMENT CONDITIONS

Land Cover	Area (acres)	HSG	CN
Meadow	10.71	D	78
Woods (Good)	5.43	D	77
Connected Impervious	0.90	D	98
Total/Weighted CN	17.04		79

5.1 PEAK FLOW SUMMARY

The pre- and post-development runoff at the LOI were determined using the SCS TR-20 method in HydroCAD. The runoff rate for the site was reduced from pre- to post-development conditions for the 2-, 10-, 100-, and back-to-back 10-year 24-hours storm events, in accordance with the City of Mankato Grading Manual, because of the use of peak flow reduction BMPs. Peak flow reduction BMPs include a vegetated swale. A summary of the discharges is as follows and demonstrates the decrease in the overall peak flow from the existing condition to developed condition. Calculations for pre- and post-developed conditions are included in **Appendix B**.

Pre- and post-development runoff rates in cubic feet per second (cfs) for the LOI are summarized in **Table 6.**

TABLE 6 PEAK FLOW RATES PRE- AND POST-DEVELOPMENT

Storm Event	Drainage Area 1		
	Pre-Development (cfs)	Post-Development (cfs)	Net Change (cfs)
2-year, 24-hr	34.28	31.14	-3.14

10-year, 24-hr	68.77	62.20	-6.57
Back-to-back 10-year, 24-hr	97.95	87.42	-10.53
100-year, 24-hr	145.65	132.28	-13.37

5.2 VOLUME SUMMARY

According to the Mankato City Garding Manual, the required treatment volume, which can be infiltrated or filtrated, is the first 1.1-inch of runoff from all new impervious surfaces. Additionally, the MPCA Solar Stormwater Guidance is used to calculate the required treatment volume for the solar array area. The MPCA Solar Stormwater Guidance requires solar arrays to be considered new disconnected impervious and allows for volume reduction to be applied from the previous areas between solar arrays. As such, the treatment volume requirement is a combination of these two calculations. The volume treatment requirement is met through the use of a filtration berm sized to filter the required volume. Calculations for pre- and post-developed conditions are included in **Appendix B**. Treatment volumes in cubic feet (cf) for the LOI are summarized in **Table 7.**

TABLE 7 TREATMENT VOLUME REQUIREMENT

LOI	Treatment Volume Requirement (cf)	Filtration Berm Volume (cf)
LOI-1	5,684	5,684

6. POST CONSTRUCTION STORMWATER MANAGEMENT

The post construction stormwater management design and the overall site development was conceptualized to preserve the integrity of the receiving streams while maintaining and protecting the physical, biological, and chemical qualities of the receiving surface waters.

Physical properties, or rate and volume, will be managed by demonstrating a decrease in peak rate and filtering the required volume.

Biological properties, or thermal impacts are discussed in greater detail in Section 6.2.

6.1 PROPOSED BMP'S

6.1.1 FILTRATION BERM

A filtration berm with conveyance via sheet flow and vegetated swale is proposed in DA-1. The filtration berm is sized to filter the required volume, according to the Mankato City Grading Manual and the MPCA Solar Stormwater Guidance. The site had a geotechnical testing performed by Braun Interec Corporation on May 4, 2015 which showed the site consists of mostly clayey soils, and as such infiltration of the required treatment volume is not feasible. The entire required treatment volume will be filtered through a filtration berm.

Please refer to **Appendix C** for the required filtration berm volume calculations.

6.2 POTENTIAL THERMAL IMPACTS TO SURFACE WATERS

The majority of stormwater flowing across gravel surfaces will enter a vegetated swale prior to discharging to a filtration berm, which will filter the water before discharging downstream and eventually flowing to the Minnesota River.

6.3 CONCLUSION

If the plan is implemented as described, impacts to the biological, chemical, and physical properties of downstream surface waters will be mitigated.

7. REFERENCES

Department, C. o. (n.d.). *Grading Mankato, MN.* Retrieved from https://www.mankatomn.gov/home/showpublisheddocument/2000/637963237930000000

MPCA. (n.d.). *Fact sheet on stormwater guidance for solar farm projects*. Retrieved from Minnesota Sotrmwater Manual: https://stormwater.pca.state.mn.us/fact_sheet_on_stormwater_guidance_for_solar_farm_projects

USDA. (n.d.). *Web Soil Survey*. Retrieved from https://websoilsurvey.nrcs.usda.gov/app/

APPENDIX A – SOILS REPORT

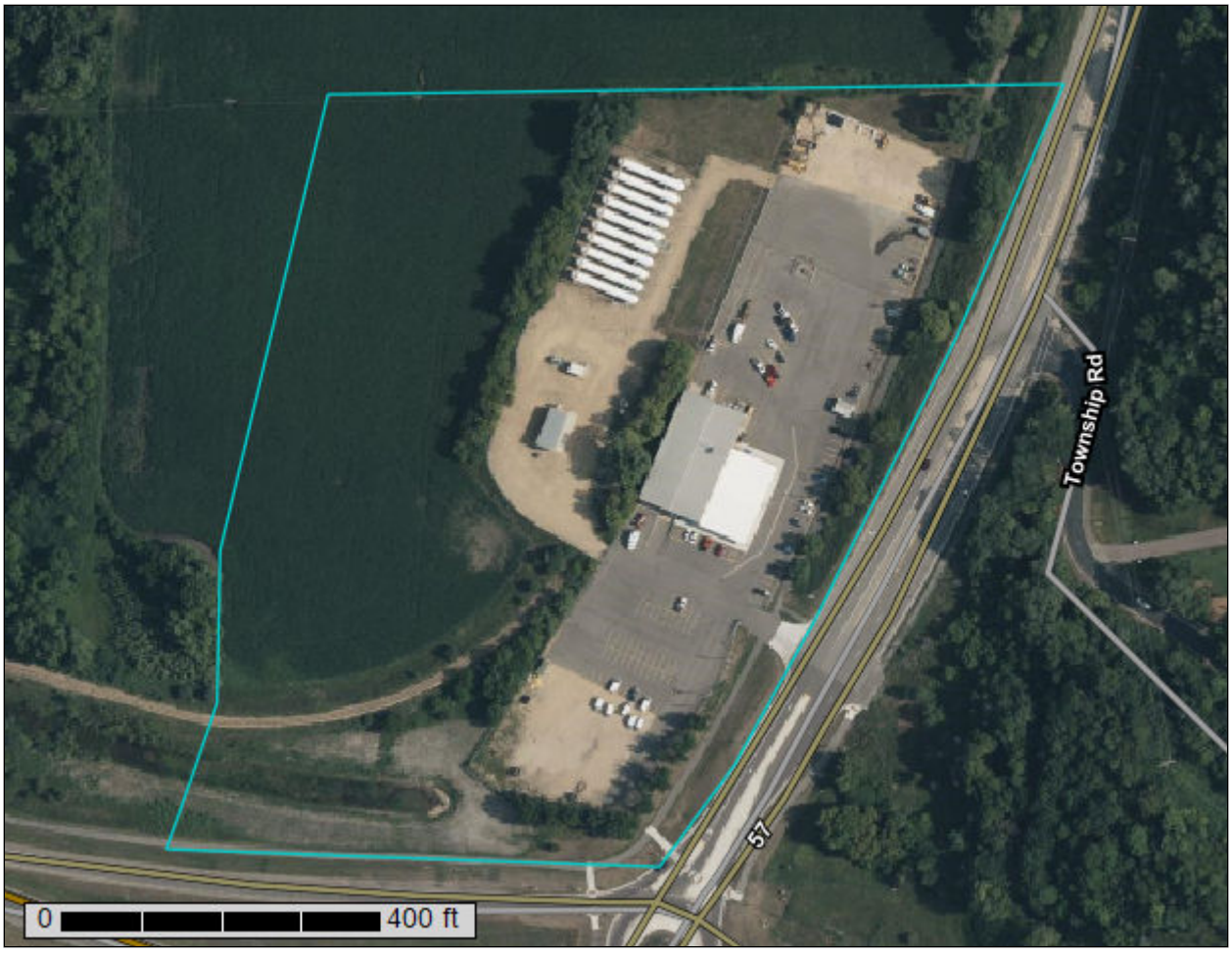
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Blue Earth County, Minnesota



April 1, 2026

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

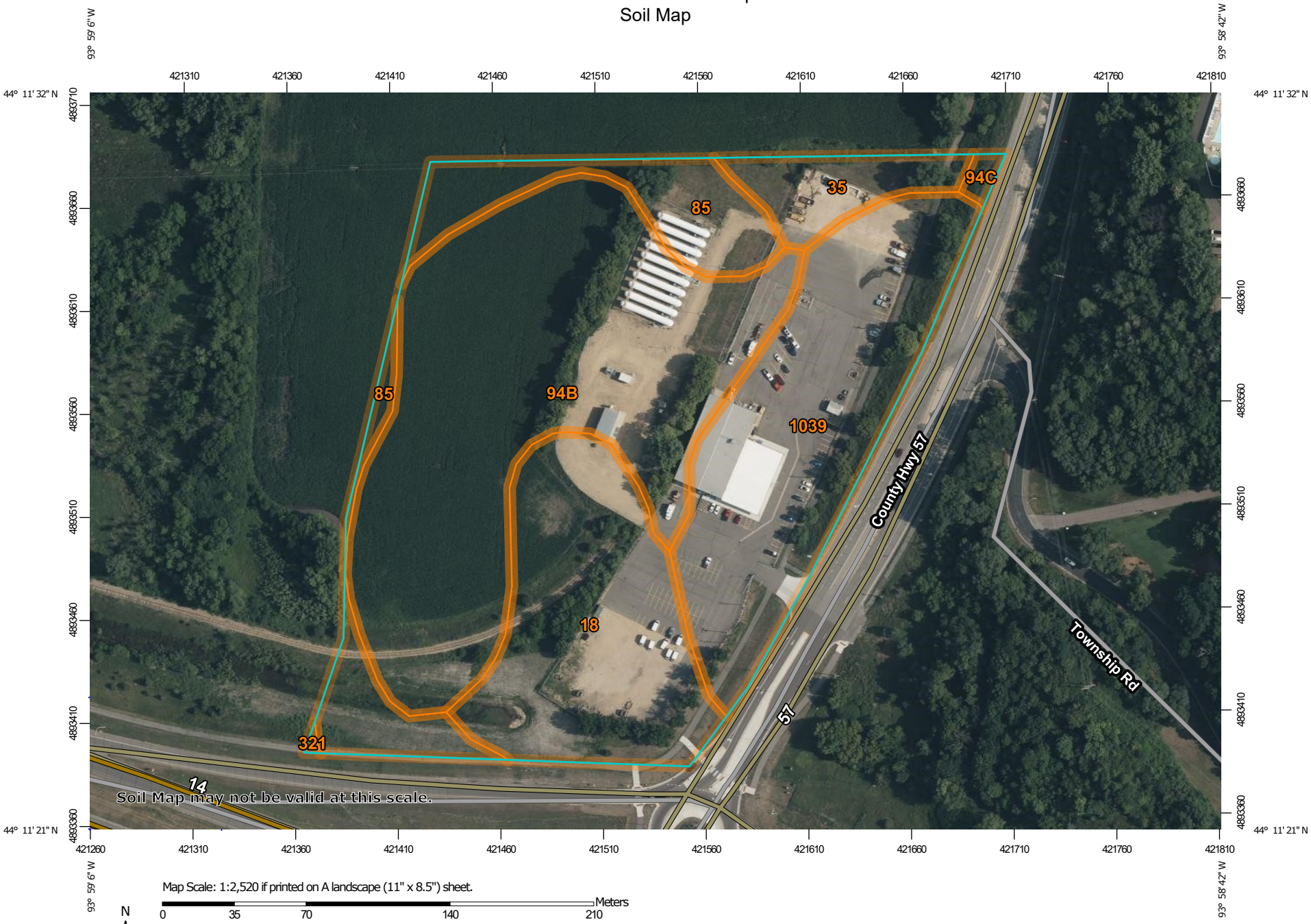
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Blue Earth County, Minnesota
Survey Area Data: Version 23, Sep 9, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 2, 2023—Aug 8, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
18	Comfrey clay loam	3.4	19.2%
35	Blue Earth mucky silt loam, 0 to 1 percent slopes	0.8	4.4%
85	Calco silty clay loam, 0 to 2 percent slopes, occasionaly flooded	2.0	11.4%
94B	Terril loam, 2 to 6 percent slopes	7.2	40.8%
94C	Terril loam, 6 to 15 percent slopes	0.1	0.5%
321	Tilfer silty clay loam	0.0	0.1%
1039	Urban land, 0 to 2 percent slopes	4.1	23.6%
Totals for Area of Interest		**17.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Blue Earth County, Minnesota

18—Comfrey clay loam

Map Unit Setting

National map unit symbol: f96x
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Comfrey, occasionally flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Comfrey, Occasionally Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium

Typical profile

Ap - 0 to 9 inches: clay loam
A - 9 to 34 inches: loam
C - 34 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F103XY033MN - Wet Floodplains
Forage suitability group: Level Swale, Neutral (G103XS001MN)
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Minor Components

Calco

Percent of map unit: 5 percent

Landform: Flood plains
Hydric soil rating: Yes

Chaska

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

35—Blue Earth mucky silt loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2vvf5
Landscape: Till plains
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Blue earth and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blue Earth

Setting

Landscape: Till plains
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coprogenic material over till

Typical profile

Lpco - 0 to 10 inches: mucky silt loam
Lco - 10 to 68 inches: mucky silt loam
2Cg - 68 to 79 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 13.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: R103XY018MN - Shallow Lakes
Forage suitability group: Ponded If Not Drained (G103XS013MN)
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Minor Components

Canisteo

Percent of map unit: 10 percent
Landscape: Till plains
Landform: Ground moraines, Rims on depressions
Landform position (three-dimensional): Talf
Down-slope shape: Linear, concave
Across-slope shape: Linear
Ecological site: R103XY001MN - Loamy Wet Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

Harps

Percent of map unit: 4 percent
Landscape: Till plains
Landform: Rims on depressions
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R103XY009MN - Calcareous Rim Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

Lemond

Percent of map unit: 1 percent
Landscape: Till plains
Landform: Outwash plains, Terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R103XY007MN - Sandy Wet Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

85—Calco silty clay loam, 0 to 2 percent slopes, occasionaly flooded

Map Unit Setting

National map unit symbol: 2wd8d
Landscape: River valleys
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches

Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Calco, occasionally flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calco, Occasionally Flooded

Setting

Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

Ap - 0 to 10 inches: silty clay loam
A - 10 to 45 inches: silty clay loam
Bg - 45 to 55 inches: silty clay loam
Cg - 55 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 0 to 8 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F103XY033MN - Wet Floodplains
Forage suitability group: Level Swale, Calcareous (G103XS009MN)
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

Minor Components

Colo, occasionally flooded

Percent of map unit: 10 percent
Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear

Ecological site: F103XY033MN - Wet Floodplains
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: Yes

Spillville, occasionally flooded
Percent of map unit: 5 percent
Landscape: River valleys
Landform: Flood plains
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F103XY032MN - Loamy Floodplains
Other vegetative classification: Level Swale, Neutral (G103XS001MN)
Hydric soil rating: No

94B—Terril loam, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2tsjq
Landscape: Till plains
Elevation: 690 to 1,840 feet
Mean annual precipitation: 24 to 37 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Terril and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Terril

Setting
Landscape: Till plains
Landform: Ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium

Typical profile
Ap - 0 to 9 inches: loam
A - 9 to 34 inches: loam
Bw - 34 to 52 inches: loam
C - 52 to 79 inches: loam

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 39 to 51 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: R103XY011MN - Footslope/Drainageway Prairies
Forage suitability group: Sloping Upland, Neutral (G103XS002MN)
Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)
Hydric soil rating: No

Minor Components

Delft

Percent of map unit: 8 percent
Landscape: Till plains
Landform: Swales on ground moraines
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R103XY001MN - Loamy Wet Prairies
Other vegetative classification: Level Swale, Calcareous (G103XS009MN)
Hydric soil rating: Yes

Storden, moderately eroded

Percent of map unit: 7 percent
Landscape: Till plains
Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: R103XY002MN - Calcareous Upland Prairies
Other vegetative classification: Sloping Upland, Calcareous (G103XS010MN)
Hydric soil rating: No

Clarion

Percent of map unit: 5 percent
Landscape: Till plains
Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R103XY004MN - Loamy Upland Prairies
Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)
Hydric soil rating: No

94C—Terril loam, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: f99k
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Terril and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Terril

Setting

Landform: Hills on moraines
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Fine-loamy colluvium

Typical profile

Ap,A - 0 to 21 inches: loam
Bw - 21 to 49 inches: loam
C - 49 to 60 inches: loam

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R103XY011MN - Footslope/Drainageway Prairies
Forage suitability group: Sloping Upland, Neutral (G103XS002MN)
Other vegetative classification: Sloping Upland, Neutral (G103XS002MN)
Hydric soil rating: No

Minor Components

Hamel
Percent of map unit: 5 percent
Landform: Drainageways
Hydric soil rating: Yes

Le sueur
Percent of map unit: 2 percent
Landform: Rises
Hydric soil rating: No

Webster
Percent of map unit: 2 percent
Landform: Drainageways
Hydric soil rating: Yes

Nicollet
Percent of map unit: 1 percent
Landform: Rises
Hydric soil rating: No

321—Tilfer silty clay loam

Map Unit Setting
National map unit symbol: f97v
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Tilfer and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tilfer

Setting
Landform: Flats on benches
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty lacustrine deposits over limestone bedrock

Typical profile
Ap,A - 0 to 22 inches: silty clay loam
Bg - 22 to 31 inches: silty clay loam
Cg - 31 to 33 inches: channers
2R - 33 to 35 inches: bedrock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: R103XY010MN - Bedrock Controlled Wet Prairies
Forage suitability group: Ponded If Not Drained (G103XS013MN)
Other vegetative classification: Ponded If Not Drained (G103XS013MN)
Hydric soil rating: Yes

Minor Components

Joliet

Percent of map unit: 10 percent
Landform: Outwash plains
Hydric soil rating: Yes

1039—Urban land, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: f964
Elevation: 700 to 1,570 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Moraines
Down-slope shape: Linear
Across-slope shape: Linear

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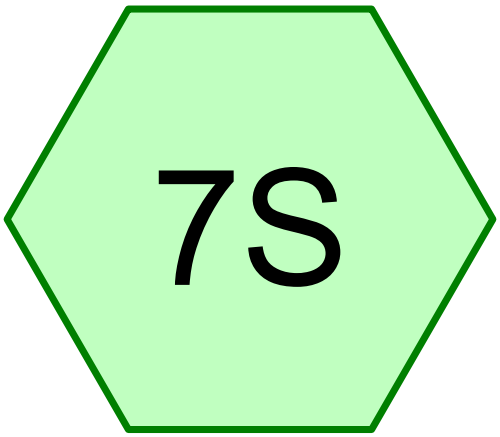
APPENDIX B – RATE REDUCTION CALCULATIONS



DA-1 PRE

Subcat Reach Pond Link

Routing Diagram for Pre Workup_v2
Prepared by ERM, Printed 6/11/2026
HydroCAD® 10.20-8a s/n 02264 © 2025 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 510 MN Blue Earth
Rainfall events imported from "NRCS2-Rain.txt" for 510 MN Blue Earth

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	MSE 24-hr	3	Default	24.00	1	2.92	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.38	2
3	100-Year	MSE 24-hr	3	Default	24.00	1	7.41	2
4	10-Year Back to Back	MSE 24-hr	3	Default	24.00	2	4.38	2

Summary for Subcatchment 7S: DA-1 PRE

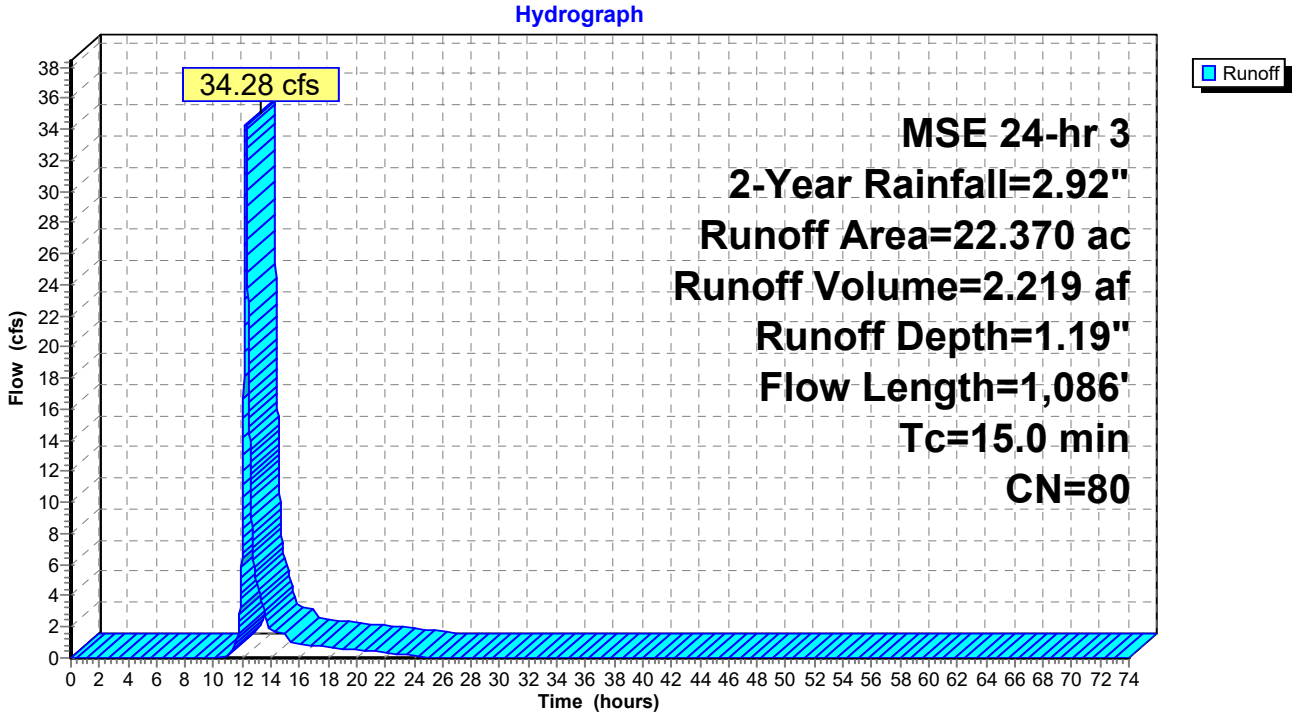
Runoff = 34.28 cfs @ 12.24 hrs, Volume= 2.219 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.92"

	Area (ac)	CN	Description
	14.470	78	Meadow, non-grazed, HSG D
*	2.470	98	Impervious
	5.430	77	Woods, Good, HSG D
	22.370	80	Weighted Average
	19.900		88.96% Pervious Area
	2.470		11.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 7S: DA-1 PRE



Summary for Subcatchment 7S: DA-1 PRE

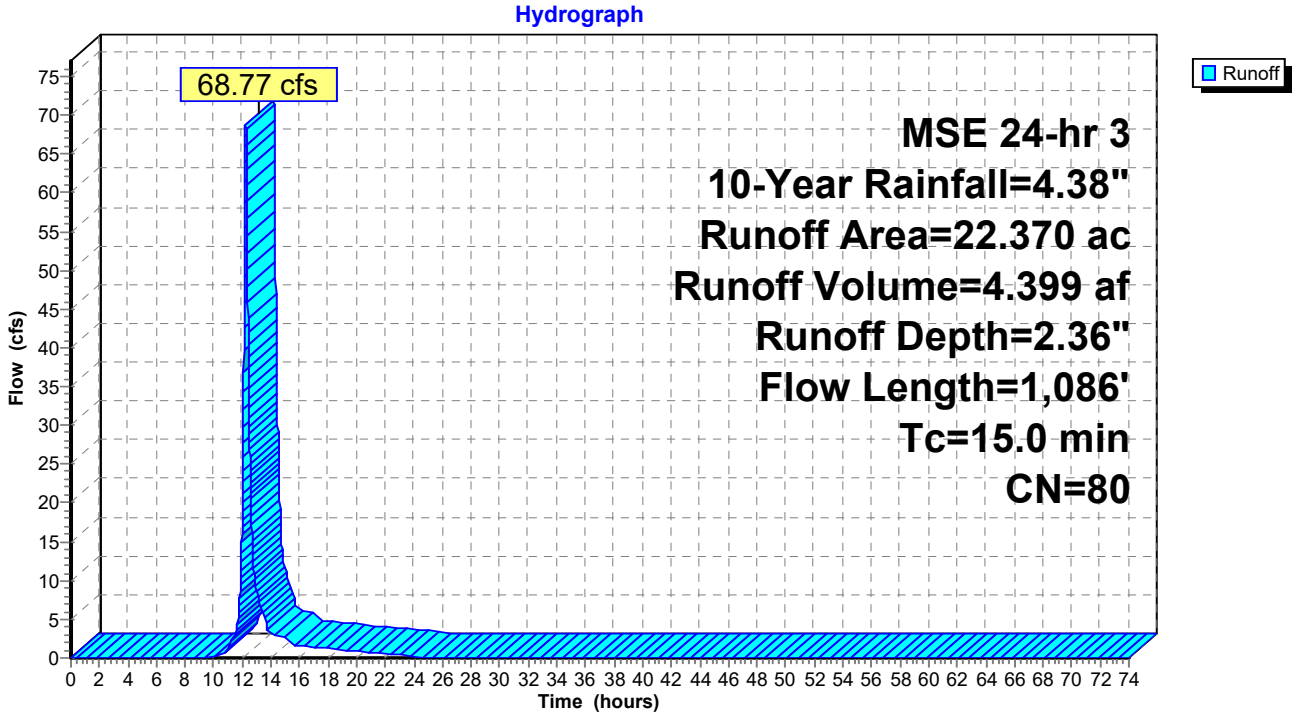
Runoff = 68.77 cfs @ 12.23 hrs, Volume= 4.399 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.38"

	Area (ac)	CN	Description
	14.470	78	Meadow, non-grazed, HSG D
*	2.470	98	Impervious
	5.430	77	Woods, Good, HSG D
	22.370	80	Weighted Average
	19.900		88.96% Pervious Area
	2.470		11.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 7S: DA-1 PRE



Summary for Subcatchment 7S: DA-1 PRE

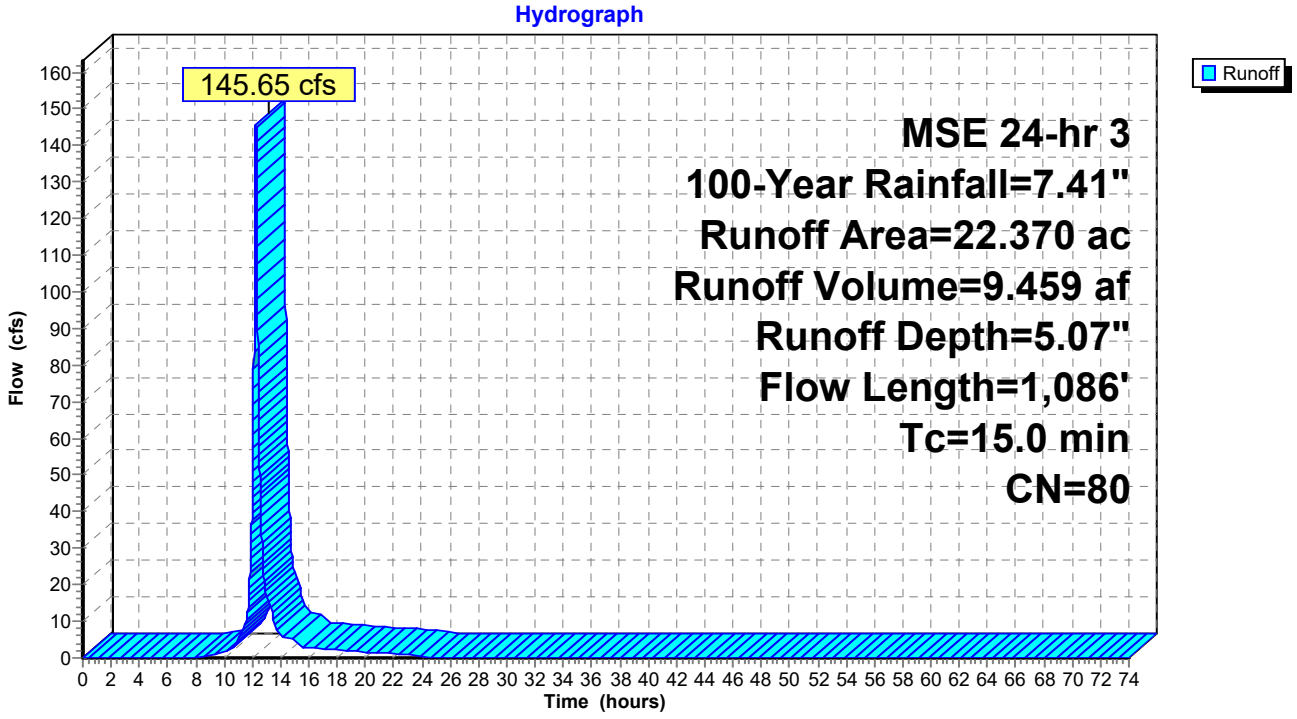
Runoff = 145.65 cfs @ 12.23 hrs, Volume= 9.459 af, Depth= 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (ac)	CN	Description
	14.470	78	Meadow, non-grazed, HSG D
*	2.470	98	Impervious
	5.430	77	Woods, Good, HSG D
	22.370	80	Weighted Average
	19.900		88.96% Pervious Area
	2.470		11.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 7S: DA-1 PRE



Summary for Subcatchment 7S: DA-1 PRE

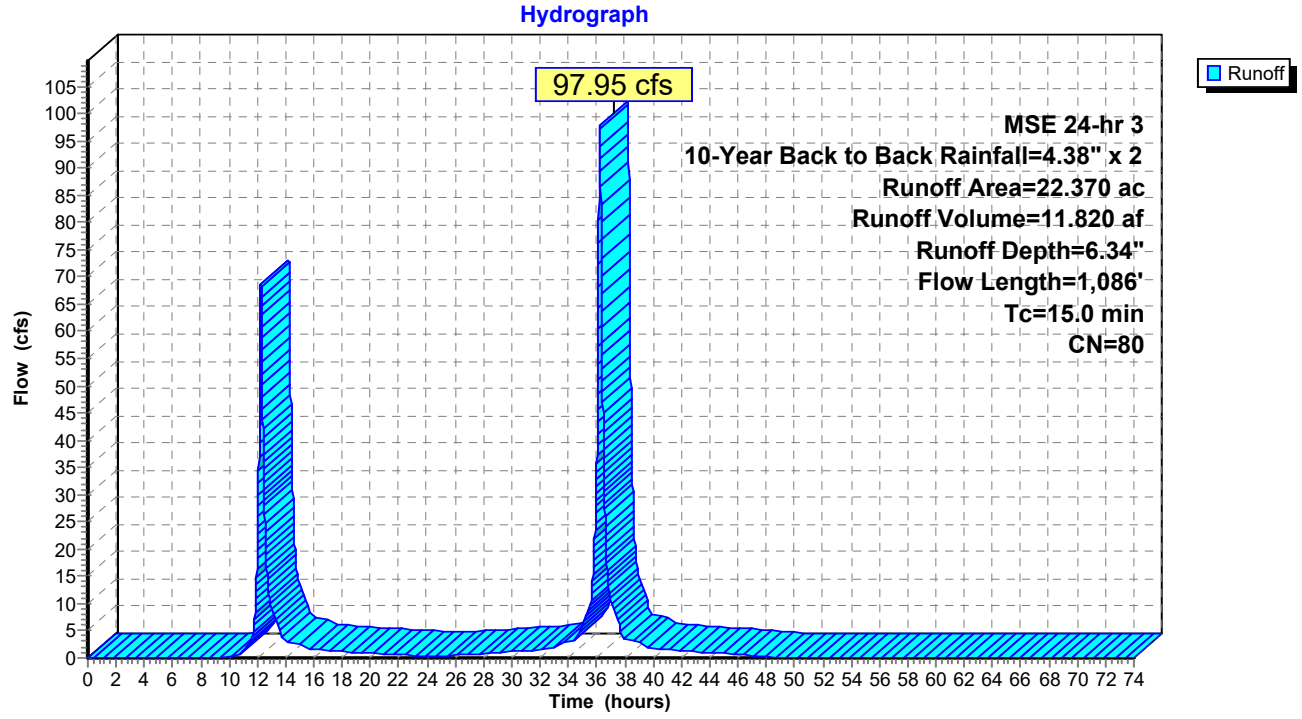
Runoff = 97.95 cfs @ 36.22 hrs, Volume= 11.820 af, Depth= 6.34"

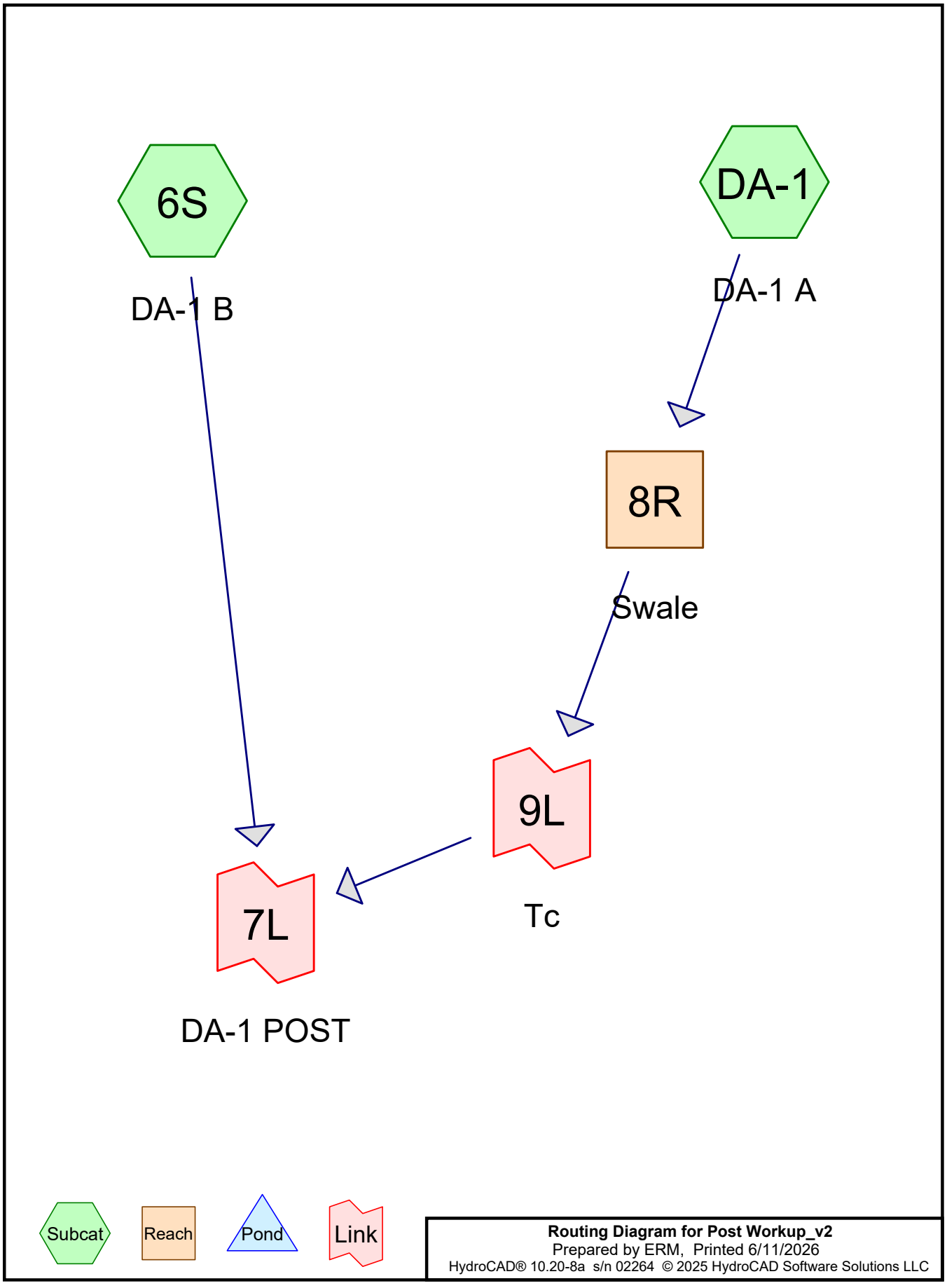
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Back to Back Rainfall=4.38" x 2

	Area (ac)	CN	Description
	14.470	78	Meadow, non-grazed, HSG D
*	2.470	98	Impervious
	5.430	77	Woods, Good, HSG D
	22.370	80	Weighted Average
	19.900		88.96% Pervious Area
	2.470		11.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 7S: DA-1 PRE





Routing Diagram for Post Workup_v2
Prepared by ERM, Printed 6/11/2026
HydroCAD® 10.20-8a s/n 02264 © 2025 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS2-Rain.txt" for 510 MN Blue Earth
Rainfall events imported from "NRCS2-Rain.txt" for 510 MN Blue Earth

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	MSE 24-hr	3	Default	24.00	1	2.92	2
2	10-Year	MSE 24-hr	3	Default	24.00	1	4.38	2
3	100-Year	MSE 24-hr	3	Default	24.00	1	7.41	2
4	10-Year Back to Back	MSE 24-hr	3	Default	24.00	2	4.38	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.300	98	Disconnected Impervious, HSG D (DA-1)
2.500	98	Impervious (6S, DA-1)
13.140	78	Meadow, non-grazed, HSG D (6S, DA-1)
5.430	77	Woods, Good, HSG D (6S)
22.370	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
19.870	HSG D	6S, DA-1
2.500	Other	6S, DA-1
22.370		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	1.300	0.000	1.300	Disconnected Impervious	DA-1
0.000	0.000	0.000	0.000	2.500	2.500	Impervious	6S, DA-1
0.000	0.000	0.000	13.140	0.000	13.140	Meadow, non-grazed	6S, DA-1
0.000	0.000	0.000	5.430	0.000	5.430	Woods, Good	6S
0.000	**0.000**	**0.000**	**19.870**	**2.500**	**22.370**	**TOTAL AREA**	

Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment6S: DA-1 B Runoff Area=17.040 ac 5.28% Impervious Runoff Depth=1.13"
Flow Length=1,086' Tc=15.0 min CN=79 Runoff=24.68 cfs 1.605 af

SubcatchmentDA-1: DA-1 A Runoff Area=5.330 ac 54.41% Impervious Runoff Depth=1.83"
Flow Length=433' Tc=9.1 min CN=89 Runoff=15.56 cfs 0.812 af

Reach 8R: Swale Avg. Flow Depth=0.51' Max Vel=2.97 fps Inflow=15.56 cfs 0.812 af
n=0.020 L=520.0' S=0.0048 '/' Capacity=47.71 cfs Outflow=14.59 cfs 0.812 af

Link 7L: DA-1 POST Inflow=31.14 cfs 2.417 af
Primary=31.14 cfs 2.417 af

Link 9L: Tc delayed by 9.5 min Inflow=14.59 cfs 0.812 af
Primary=14.58 cfs 0.812 af

Total Runoff Area = 22.370 ac Runoff Volume = 2.417 af Average Runoff Depth = 1.30"
83.01% Pervious = 18.570 ac 16.99% Impervious = 3.800 ac

Summary for Subcatchment 6S: DA-1 B

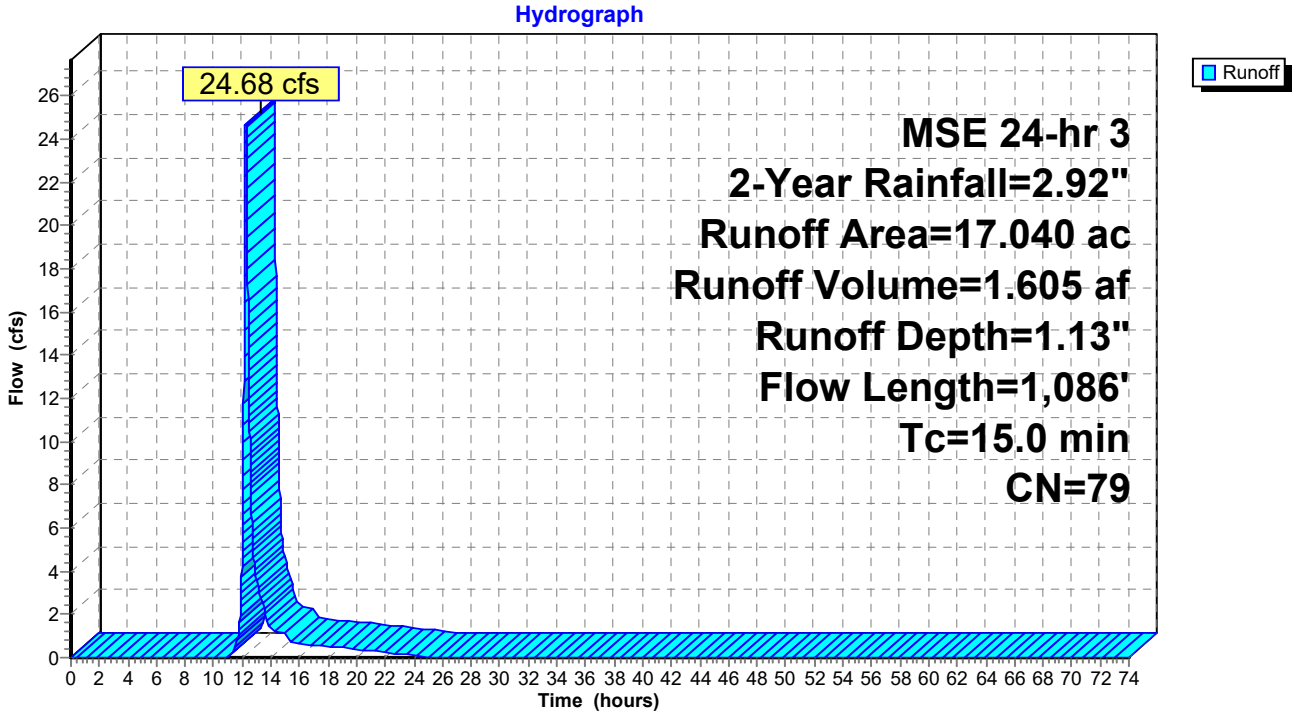
Runoff = 24.68 cfs @ 12.24 hrs, Volume= 1.605 af, Depth= 1.13"
Routed to Link 7L : DA-1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.92"

	Area (ac)	CN	Description
	10.710	78	Meadow, non-grazed, HSG D
*	0.900	98	Impervious
	5.430	77	Woods, Good, HSG D
	17.040	79	Weighted Average
	16.140		94.72% Pervious Area
	0.900		5.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 6S: DA-1 B



Summary for Subcatchment DA-1: DA-1 A

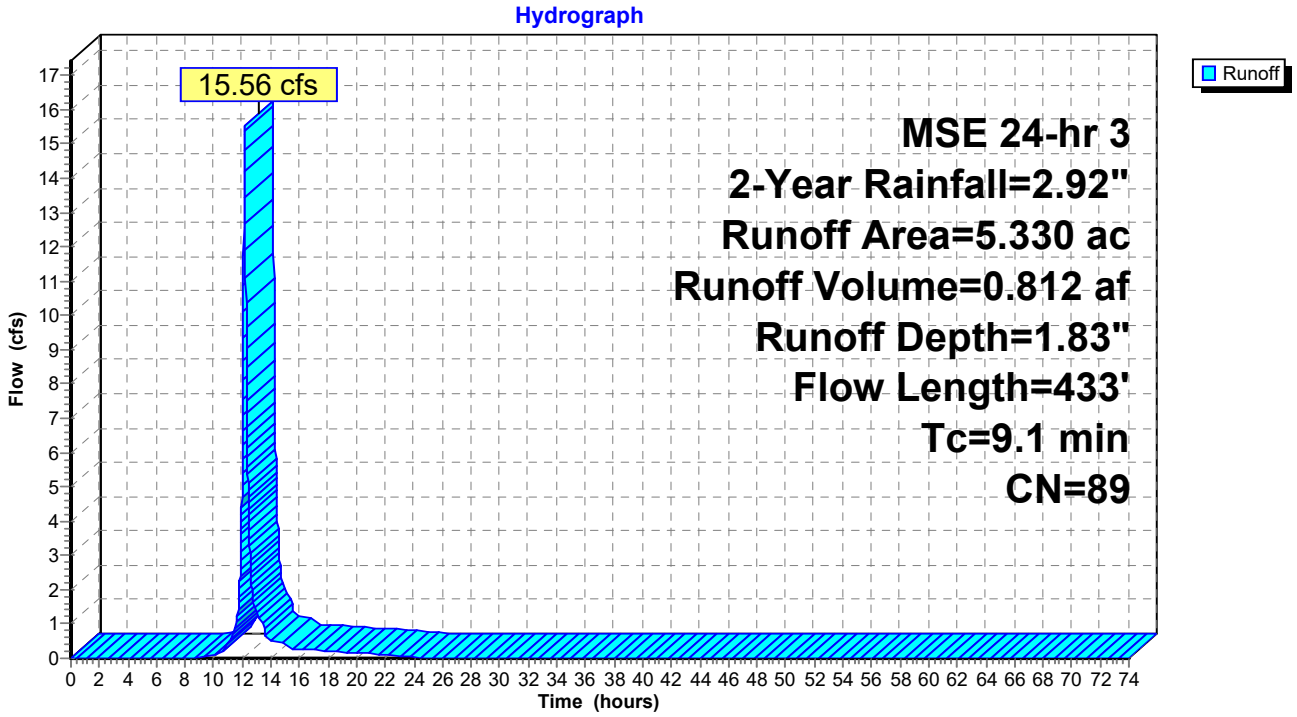
Runoff = 15.56 cfs @ 12.16 hrs, Volume= 0.812 af, Depth= 1.83"
Routed to Reach 8R : Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.92"

	Area (ac)	CN	Description
	2.430	78	Meadow, non-grazed, HSG D
*	1.600	98	Impervious
*	1.300	98	Disconnected Impervious, HSG D
	5.330	89	Weighted Average
	2.430		45.59% Pervious Area
	2.900		54.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	59	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.37"
0.7	41	0.0200	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
0.7	102	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	231	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	433	Total			

Subcatchment DA-1: DA-1 A



Summary for Reach 8R: Swale

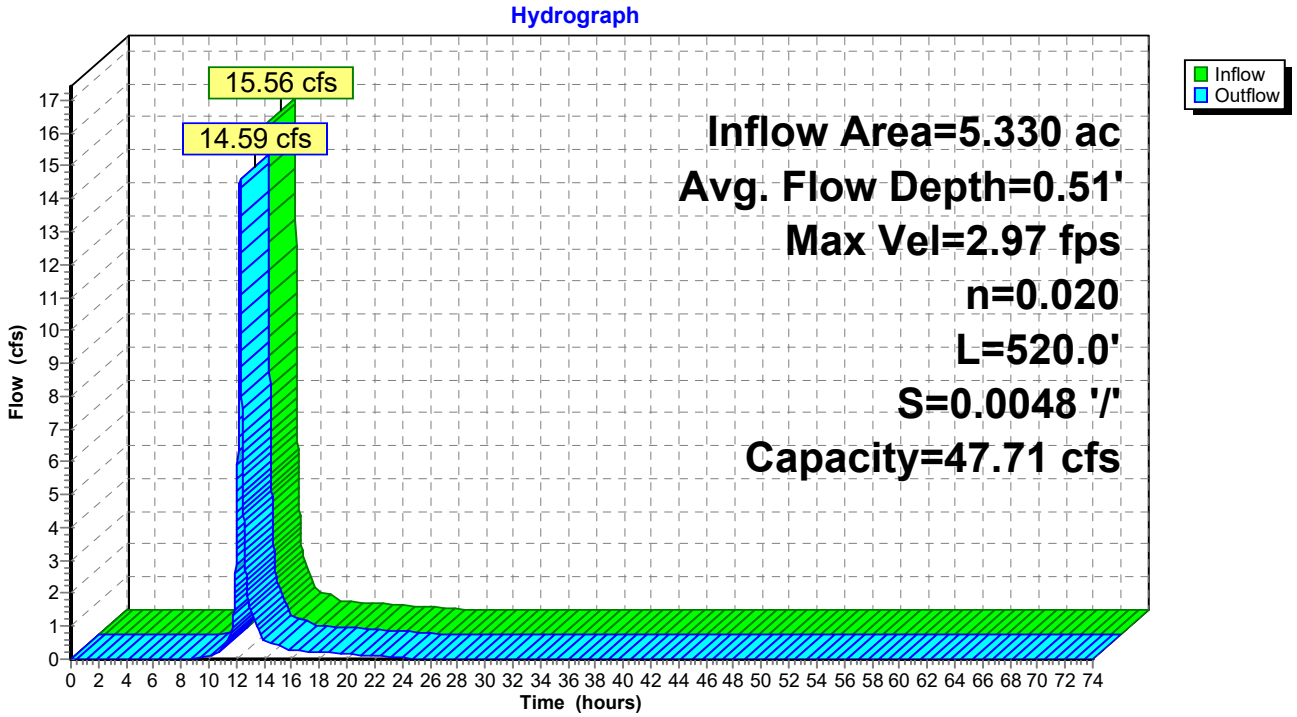
Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 1.83" for 2-Year event
Inflow = 15.56 cfs @ 12.16 hrs, Volume= 0.812 af
Outflow = 14.59 cfs @ 12.24 hrs, Volume= 0.812 af, Atten= 6%, Lag= 4.7 min
Routed to Link 9L : Tc

Routing by Stor-Ind+Trans method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.97 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 14.3 min

Peak Storage= 2,552 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 11.09'
Bank-Full Depth= 1.00' Flow Area= 11.0 sf, Capacity= 47.71 cfs

8.00' x 1.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 520.0' Slope= 0.0048 '/'
Inlet Invert= 835.52', Outlet Invert= 833.00'

‡

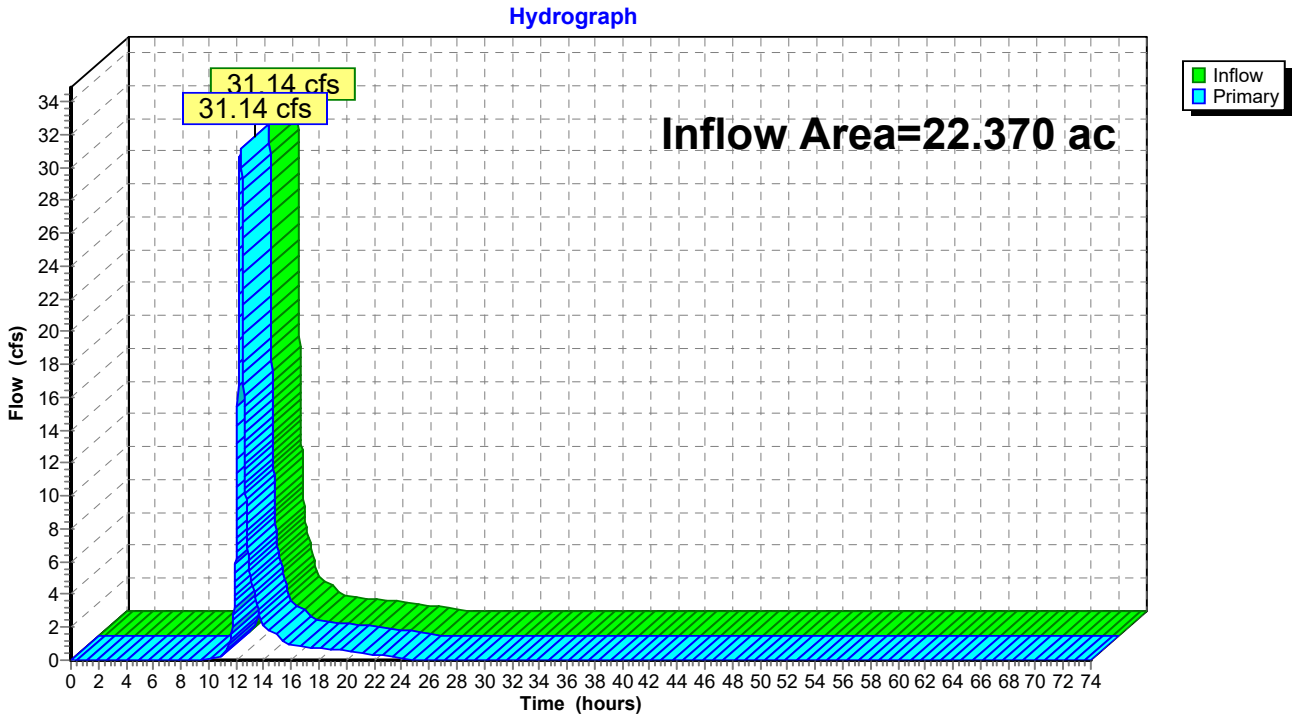


Summary for Link 7L: DA-1 POST

Inflow Area = 22.370 ac, 16.99% Impervious, Inflow Depth = 1.30" for 2-Year event
Inflow = 31.14 cfs @ 12.35 hrs, Volume= 2.417 af
Primary = 31.14 cfs @ 12.35 hrs, Volume= 2.417 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 7L: DA-1 POST

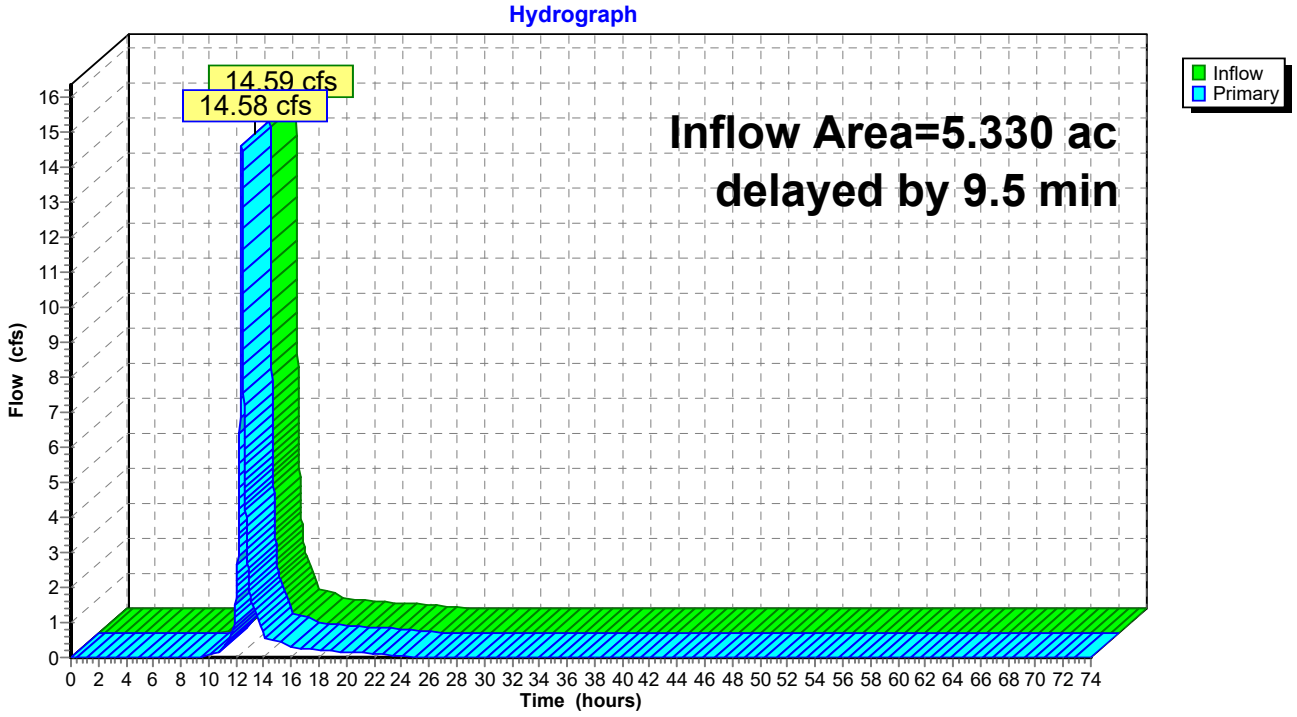


Summary for Link 9L: Tc

Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 1.83" for 2-Year event
Inflow = 14.59 cfs @ 12.24 hrs, Volume= 0.812 af
Primary = 14.58 cfs @ 12.40 hrs, Volume= 0.812 af, Atten= 0%, Lag= 9.5 min
Routed to Link 7L : DA-1 POST

Primary outflow = Inflow delayed by 9.5 min, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 9L: Tc



Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment6S: DA-1 B Runoff Area=17.040 ac 5.28% Impervious Runoff Depth=2.28"
Flow Length=1,086' Tc=15.0 min CN=79 Runoff=50.53 cfs 3.232 af

SubcatchmentDA-1: DA-1 A Runoff Area=5.330 ac 54.41% Impervious Runoff Depth=3.18"
Flow Length=433' Tc=9.1 min CN=89 Runoff=26.42 cfs 1.413 af

Reach 8R: Swale Avg. Flow Depth=0.70' Max Vel=3.55 fps Inflow=26.42 cfs 1.413 af
n=0.020 L=520.0' S=0.0048 '/' Capacity=47.71 cfs Outflow=25.19 cfs 1.413 af

Link 7L: DA-1 POST Inflow=62.20 cfs 4.645 af
Primary=62.20 cfs 4.645 af

Link 9L: Tc delayed by 9.5 min Inflow=25.19 cfs 1.413 af
Primary=25.16 cfs 1.413 af

Total Runoff Area = 22.370 ac Runoff Volume = 4.645 af Average Runoff Depth = 2.49"
83.01% Pervious = 18.570 ac 16.99% Impervious = 3.800 ac

Summary for Subcatchment 6S: DA-1 B

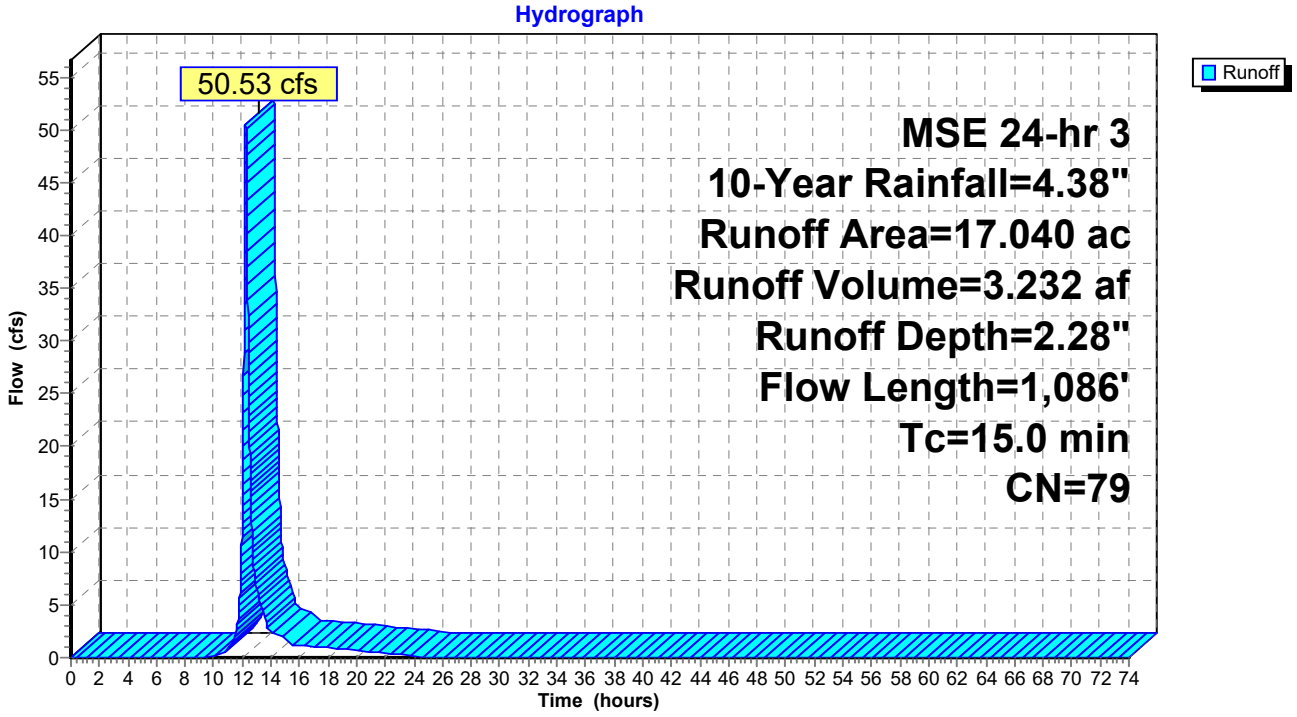
Runoff = 50.53 cfs @ 12.23 hrs, Volume= 3.232 af, Depth= 2.28"
Routed to Link 7L : DA-1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.38"

	Area (ac)	CN	Description
	10.710	78	Meadow, non-grazed, HSG D
*	0.900	98	Impervious
	5.430	77	Woods, Good, HSG D
	17.040	79	Weighted Average
	16.140		94.72% Pervious Area
	0.900		5.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 6S: DA-1 B



Summary for Subcatchment DA-1: DA-1 A

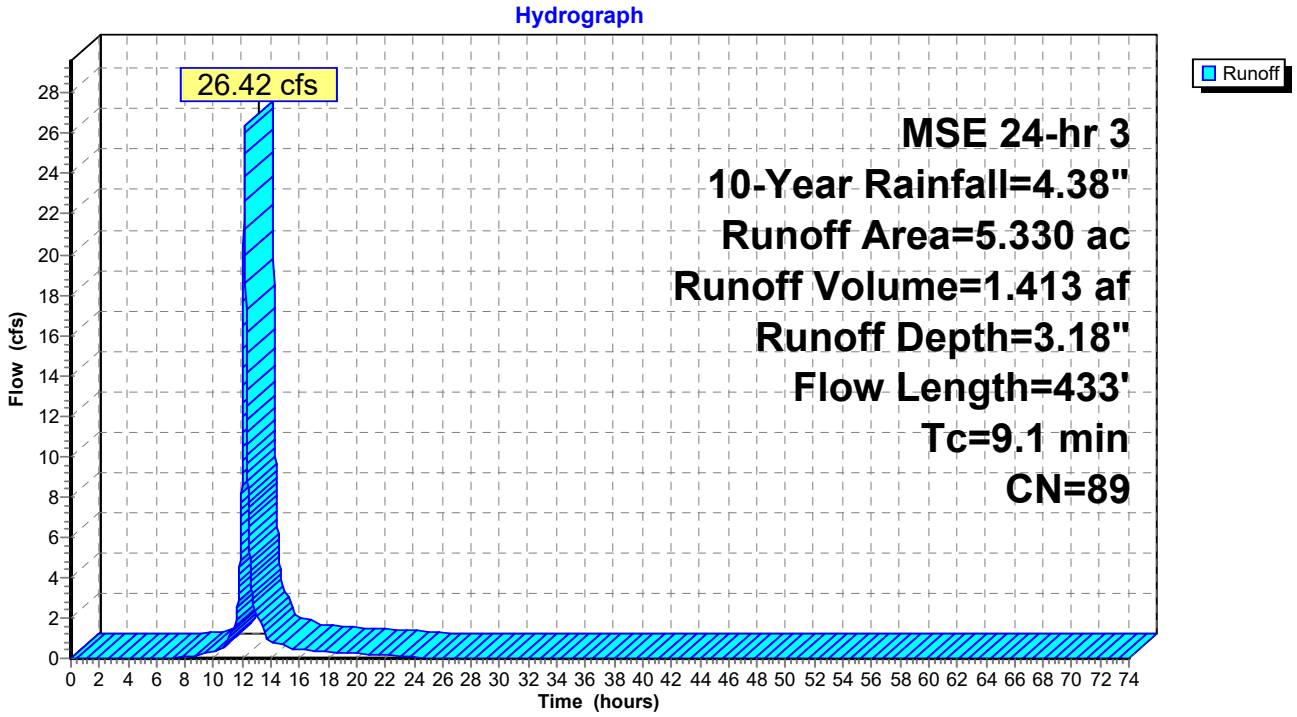
Runoff = 26.42 cfs @ 12.16 hrs, Volume= 1.413 af, Depth= 3.18"
Routed to Reach 8R : Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.38"

	Area (ac)	CN	Description
	2.430	78	Meadow, non-grazed, HSG D
*	1.600	98	Impervious
*	1.300	98	Disconnected Impervious, HSG D
	5.330	89	Weighted Average
	2.430		45.59% Pervious Area
	2.900		54.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	59	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.37"
0.7	41	0.0200	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
0.7	102	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	231	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	433	Total			

Subcatchment DA-1: DA-1 A



Summary for Reach 8R: Swale

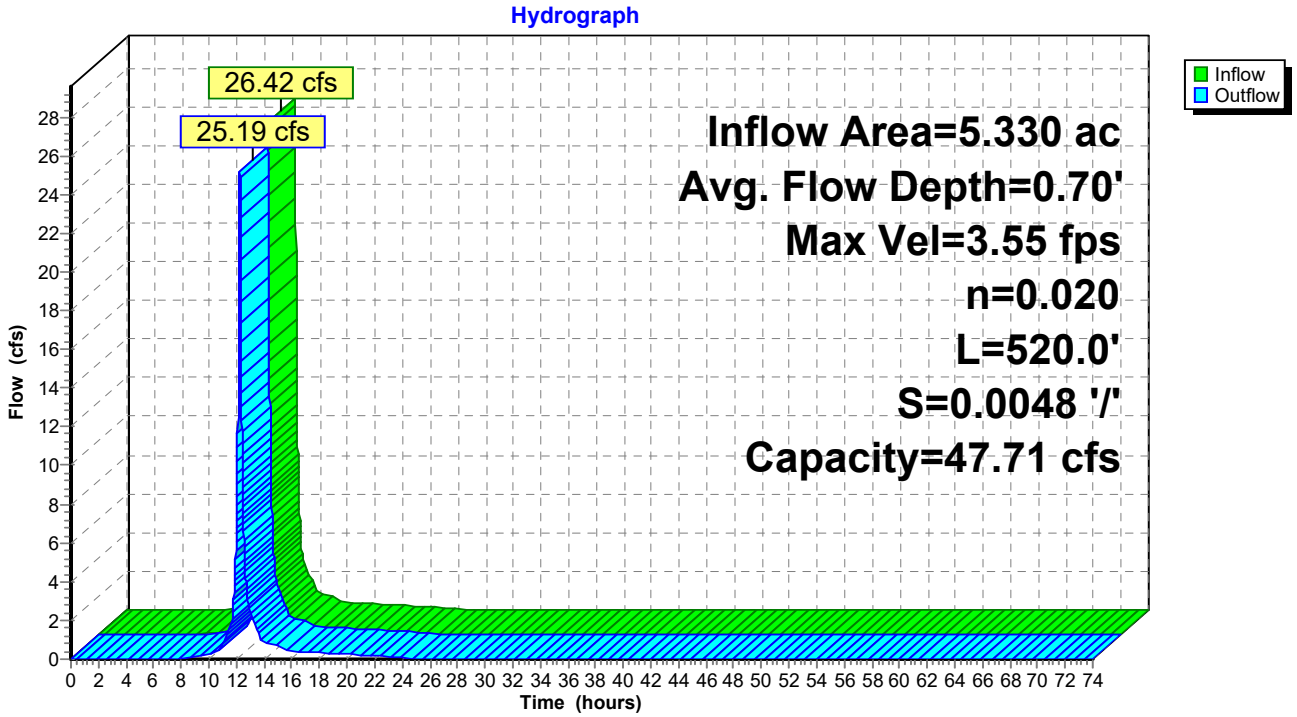
Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 3.18" for 10-Year event
Inflow = 26.42 cfs @ 12.16 hrs, Volume= 1.413 af
Outflow = 25.19 cfs @ 12.23 hrs, Volume= 1.413 af, Atten= 5%, Lag= 3.9 min
Routed to Link 9L : Tc

Routing by Stor-Ind+Trans method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.55 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 12.3 min

Peak Storage= 3,685 cf @ 12.19 hrs
Average Depth at Peak Storage= 0.70' , Surface Width= 12.21'
Bank-Full Depth= 1.00' Flow Area= 11.0 sf, Capacity= 47.71 cfs

8.00' x 1.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 520.0' Slope= 0.0048 '/'
Inlet Invert= 835.52', Outlet Invert= 833.00'

‡

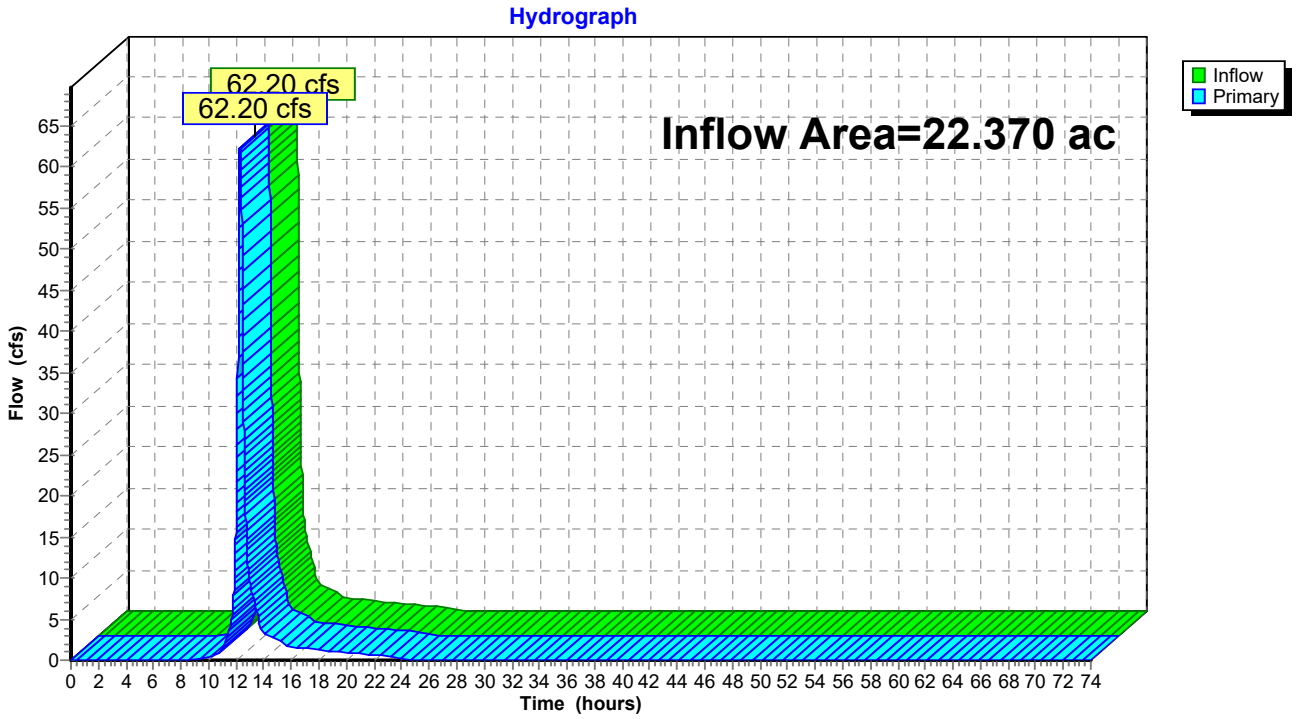


Summary for Link 7L: DA-1 POST

Inflow Area = 22.370 ac, 16.99% Impervious, Inflow Depth = 2.49" for 10-Year event
Inflow = 62.20 cfs @ 12.27 hrs, Volume= 4.645 af
Primary = 62.20 cfs @ 12.27 hrs, Volume= 4.645 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 7L: DA-1 POST

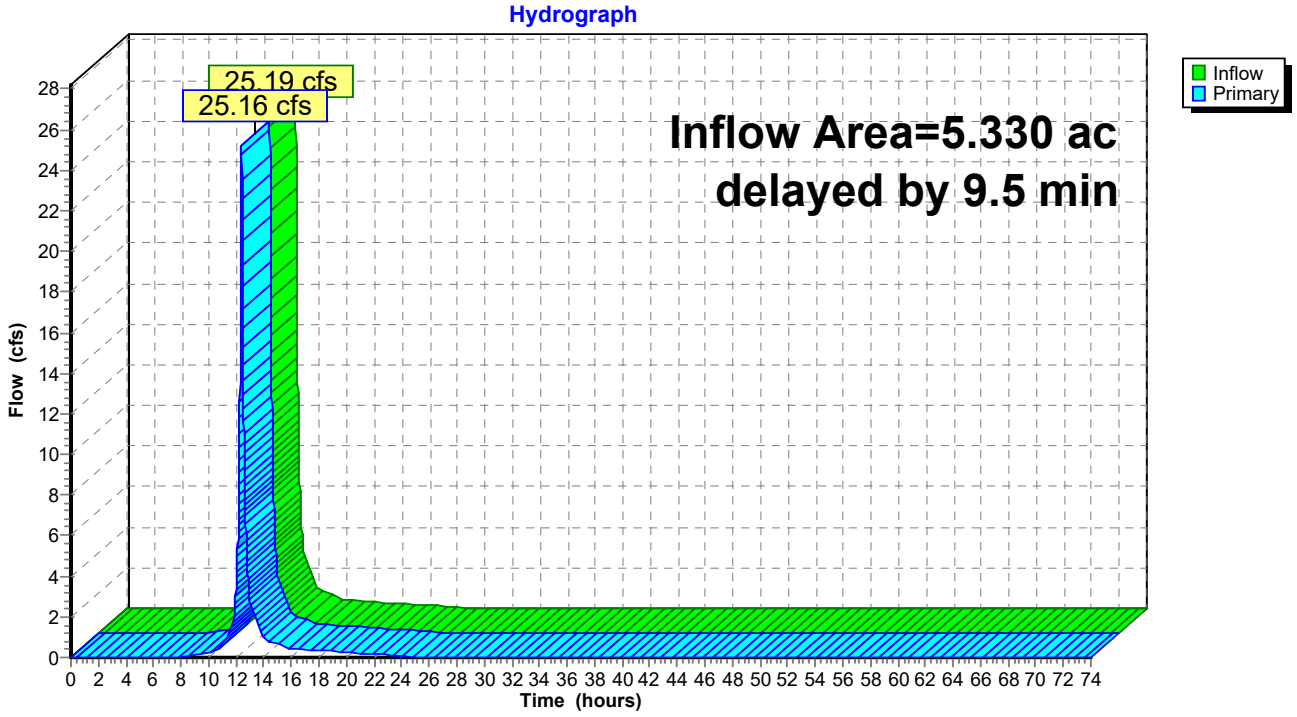


Summary for Link 9L: Tc

Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 3.18" for 10-Year event
Inflow = 25.19 cfs @ 12.23 hrs, Volume= 1.413 af
Primary = 25.16 cfs @ 12.39 hrs, Volume= 1.413 af, Atten= 0%, Lag= 9.5 min
Routed to Link 7L : DA-1 POST

Primary outflow = Inflow delayed by 9.5 min, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 9L: Tc



Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment6S: DA-1 B Runoff Area=17.040 ac 5.28% Impervious Runoff Depth=4.96"
Flow Length=1,086' Tc=15.0 min CN=79 Runoff=108.79 cfs 7.045 af

SubcatchmentDA-1: DA-1 A Runoff Area=5.330 ac 54.41% Impervious Runoff Depth=6.11"
Flow Length=433' Tc=9.1 min CN=89 Runoff=48.82 cfs 2.713 af

Reach 8R: Swale Avg. Flow Depth=0.99' Max Vel=4.32 fps Inflow=48.82 cfs 2.713 af
n=0.020 L=520.0' S=0.0048 '/' Capacity=47.71 cfs Outflow=47.08 cfs 2.713 af

Link 7L: DA-1 POST Inflow=132.28 cfs 9.758 af
Primary=132.28 cfs 9.758 af

Link 9L: Tc delayed by 9.5 min Inflow=47.08 cfs 2.713 af
Primary=47.04 cfs 2.713 af

Total Runoff Area = 22.370 ac Runoff Volume = 9.758 af Average Runoff Depth = 5.23"
83.01% Pervious = 18.570 ac 16.99% Impervious = 3.800 ac

Summary for Subcatchment 6S: DA-1 B

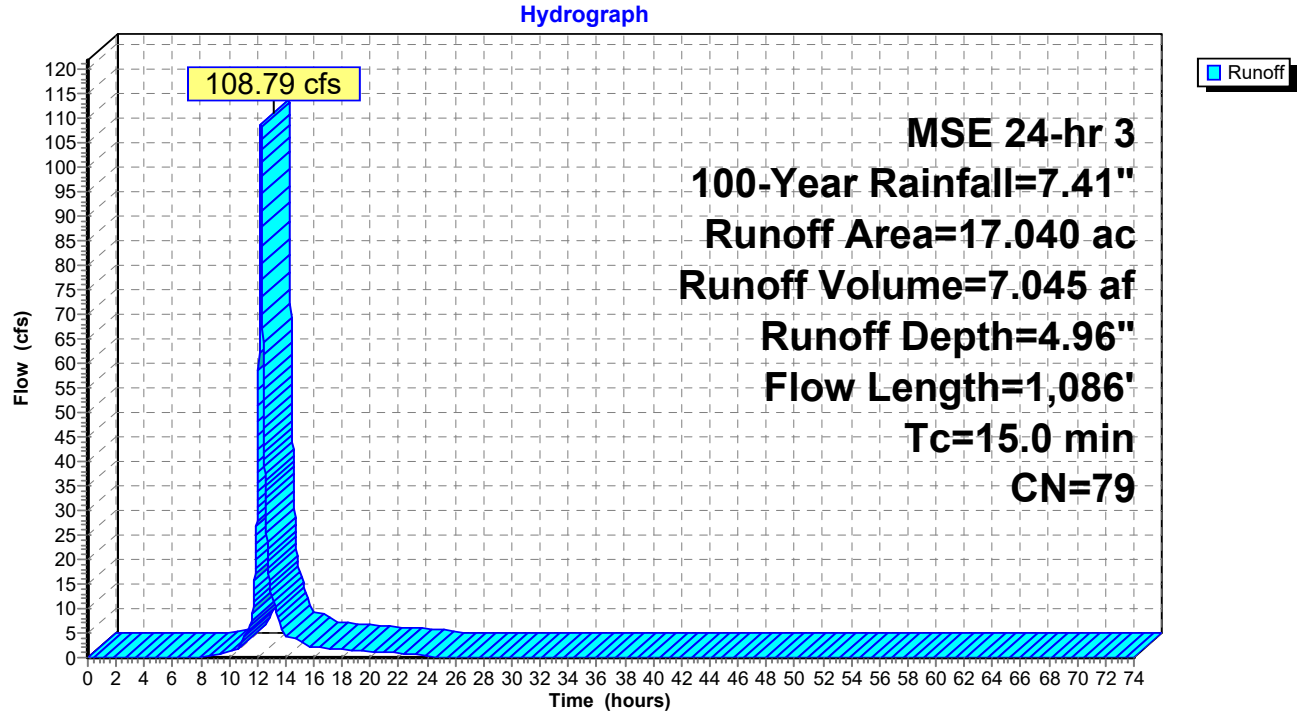
Runoff = 108.79 cfs @ 12.23 hrs, Volume= 7.045 af, Depth= 4.96"
Routed to Link 7L : DA-1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (ac)	CN	Description
	10.710	78	Meadow, non-grazed, HSG D
*	0.900	98	Impervious
	5.430	77	Woods, Good, HSG D
	17.040	79	Weighted Average
	16.140		94.72% Pervious Area
	0.900		5.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 6S: DA-1 B



Summary for Subcatchment DA-1: DA-1 A

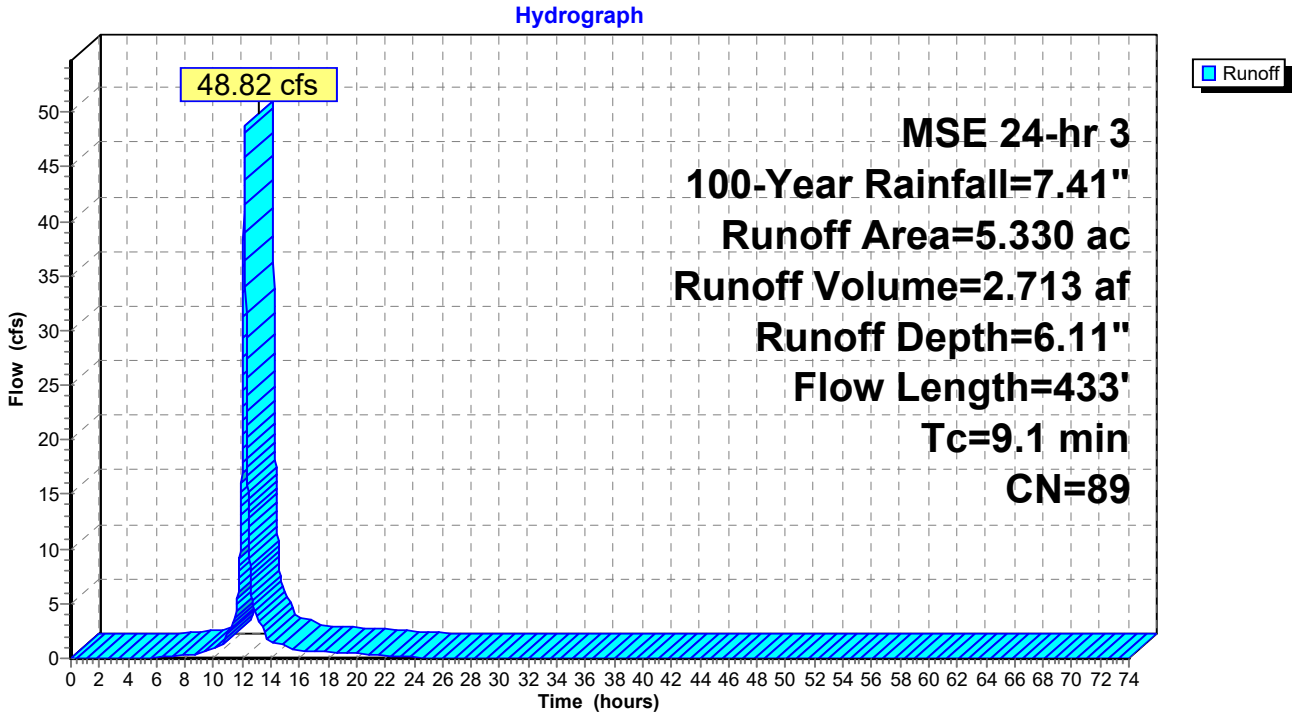
Runoff = 48.82 cfs @ 12.16 hrs, Volume= 2.713 af, Depth= 6.11"
Routed to Reach 8R : Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.41"

	Area (ac)	CN	Description
	2.430	78	Meadow, non-grazed, HSG D
*	1.600	98	Impervious
*	1.300	98	Disconnected Impervious, HSG D
	5.330	89	Weighted Average
	2.430		45.59% Pervious Area
	2.900		54.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	59	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.37"
0.7	41	0.0200	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
0.7	102	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	231	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	433	Total			

Subcatchment DA-1: DA-1 A



Summary for Reach 8R: Swale

[55] Hint: Peak inflow is 102% of Manning's capacity

Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 6.11" for 100-Year event
Inflow = 48.82 cfs @ 12.16 hrs, Volume= 2.713 af
Outflow = 47.08 cfs @ 12.22 hrs, Volume= 2.713 af, Atten= 4%, Lag= 3.3 min
Routed to Link 9L : Tc

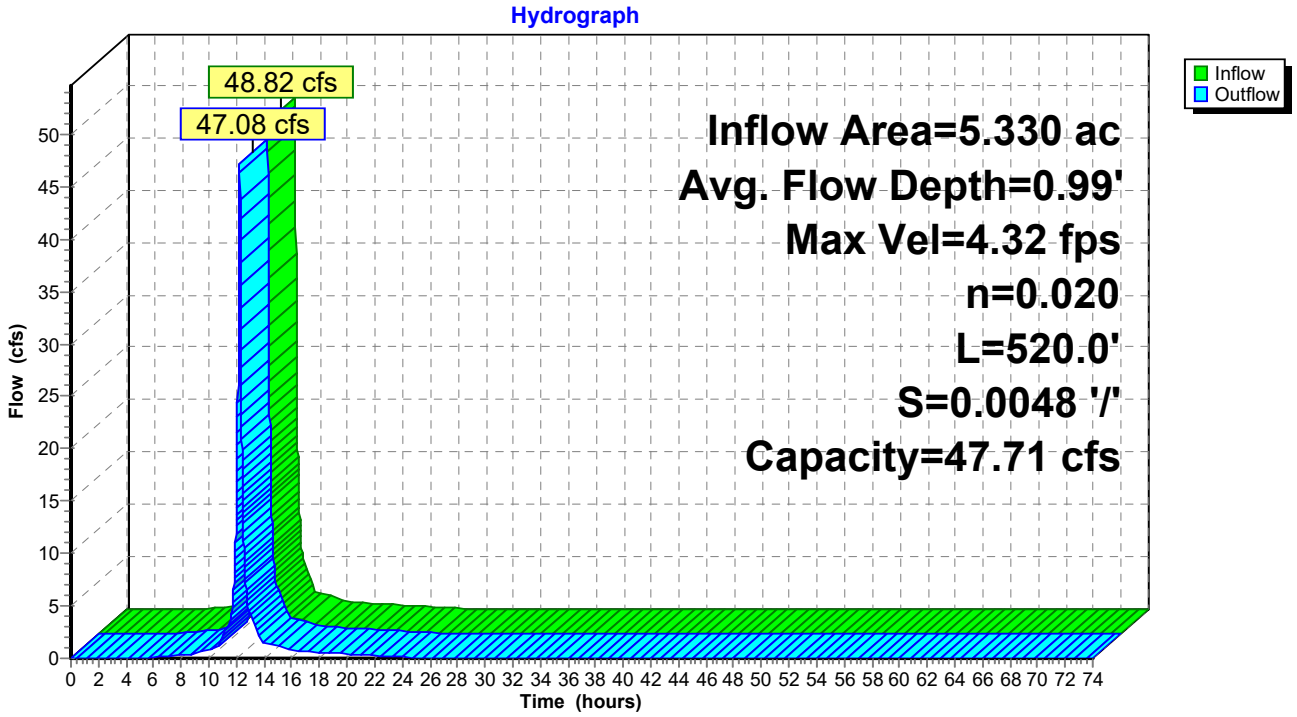
Routing by Stor-Ind+Trans method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.32 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 10.0 min

Peak Storage= 5,674 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.99' , Surface Width= 13.96'
Bank-Full Depth= 1.00' Flow Area= 11.0 sf, Capacity= 47.71 cfs

8.00' x 1.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 520.0' Slope= 0.0048 '/'
Inlet Invert= 835.52', Outlet Invert= 833.00'

‡

Reach 8R: Swale

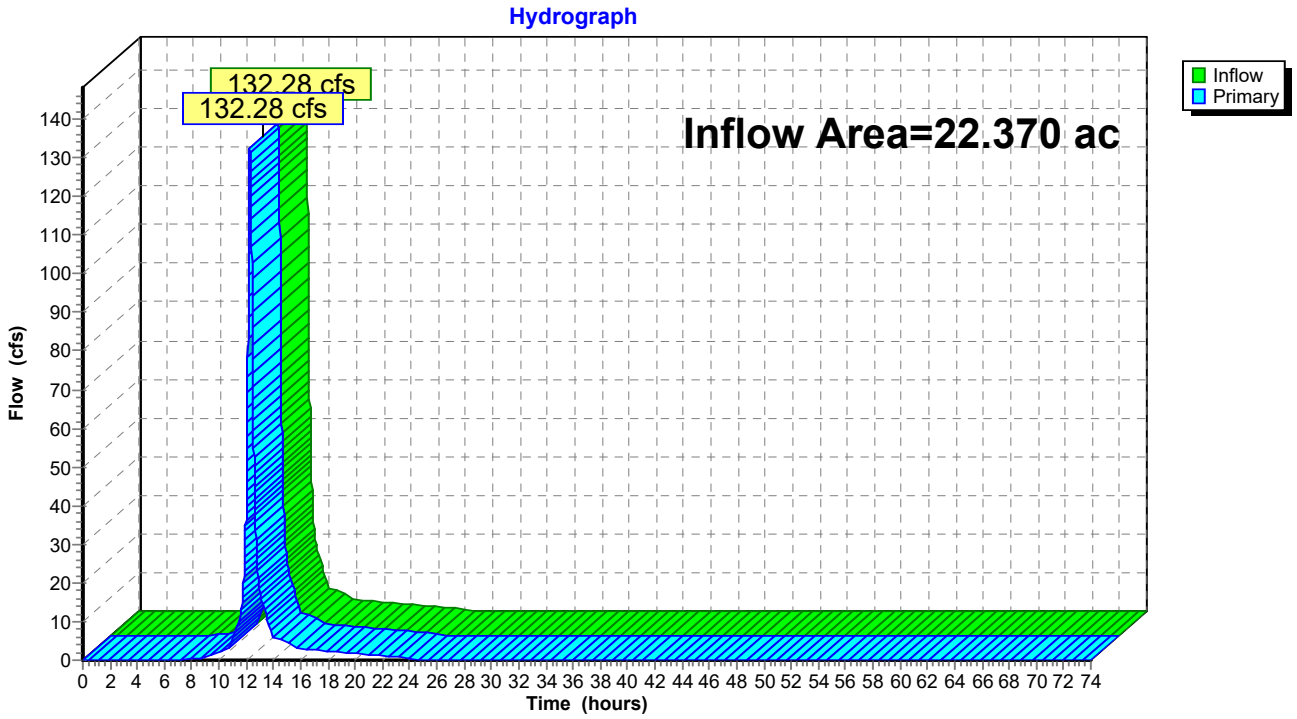


Summary for Link 7L: DA-1 POST

Inflow Area = 22.370 ac, 16.99% Impervious, Inflow Depth = 5.23" for 100-Year event
Inflow = 132.28 cfs @ 12.25 hrs, Volume= 9.758 af
Primary = 132.28 cfs @ 12.25 hrs, Volume= 9.758 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 7L: DA-1 POST

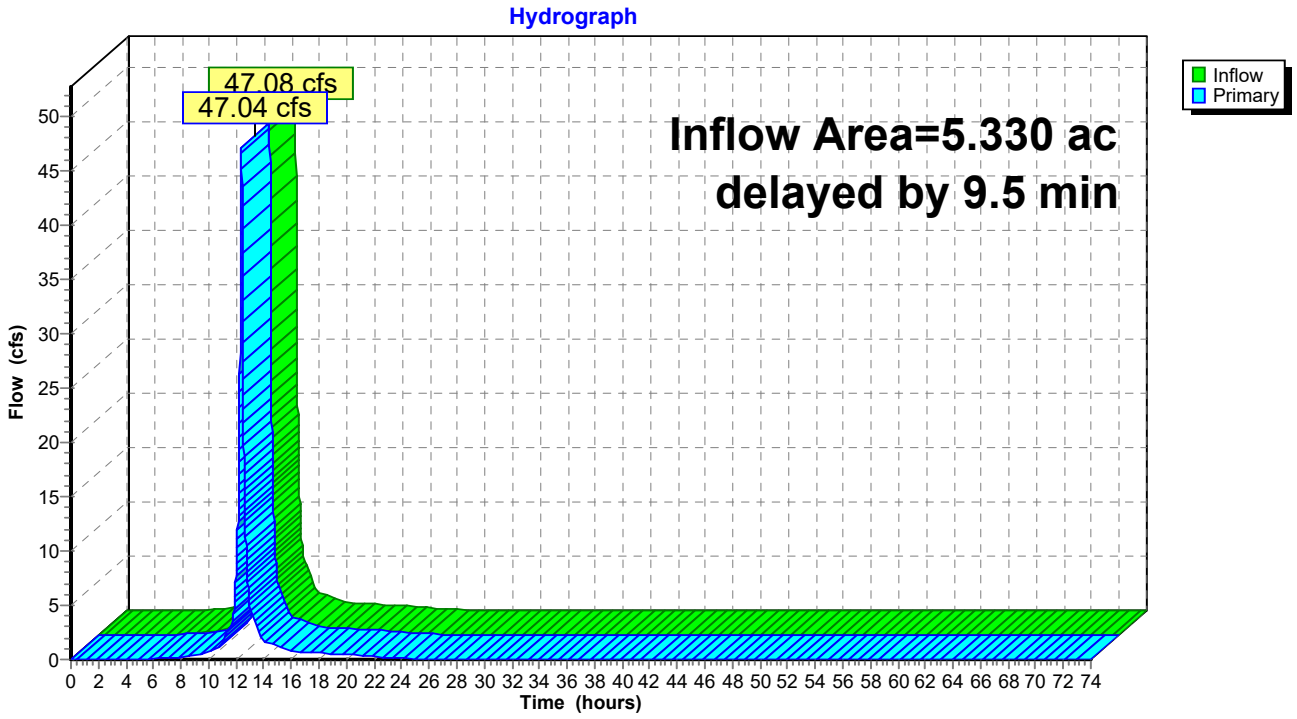


Summary for Link 9L: Tc

Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 6.11" for 100-Year event
Inflow = 47.08 cfs @ 12.22 hrs, Volume= 2.713 af
Primary = 47.04 cfs @ 12.37 hrs, Volume= 2.713 af, Atten= 0%, Lag= 9.5 min
Routed to Link 7L : DA-1 POST

Primary outflow = Inflow delayed by 9.5 min, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 9L: Tc



Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment6S: DA-1 B Runoff Area=17.040 ac 5.28% Impervious Runoff Depth=6.22"
Flow Length=1,086' Tc=15.0 min CN=79 Runoff=73.93 cfs 8.831 af

SubcatchmentDA-1: DA-1 A Runoff Area=5.330 ac 54.41% Impervious Runoff Depth=7.43"
Flow Length=433' Tc=9.1 min CN=89 Runoff=30.19 cfs 3.302 af

Reach 8R: Swale Avg. Flow Depth=0.76' Max Vel=3.71 fps Inflow=30.19 cfs 3.302 af
n=0.020 L=520.0' S=0.0048 '/' Capacity=47.71 cfs Outflow=28.92 cfs 3.302 af

Link 7L: DA-1 POST Inflow=87.42 cfs 12.133 af
Primary=87.42 cfs 12.133 af

Link 9L: Tc delayed by 9.5 min Inflow=28.92 cfs 3.302 af
Primary=28.89 cfs 3.302 af

Total Runoff Area = 22.370 ac Runoff Volume = 12.133 af Average Runoff Depth = 6.51"
83.01% Pervious = 18.570 ac 16.99% Impervious = 3.800 ac

Summary for Subcatchment 6S: DA-1 B

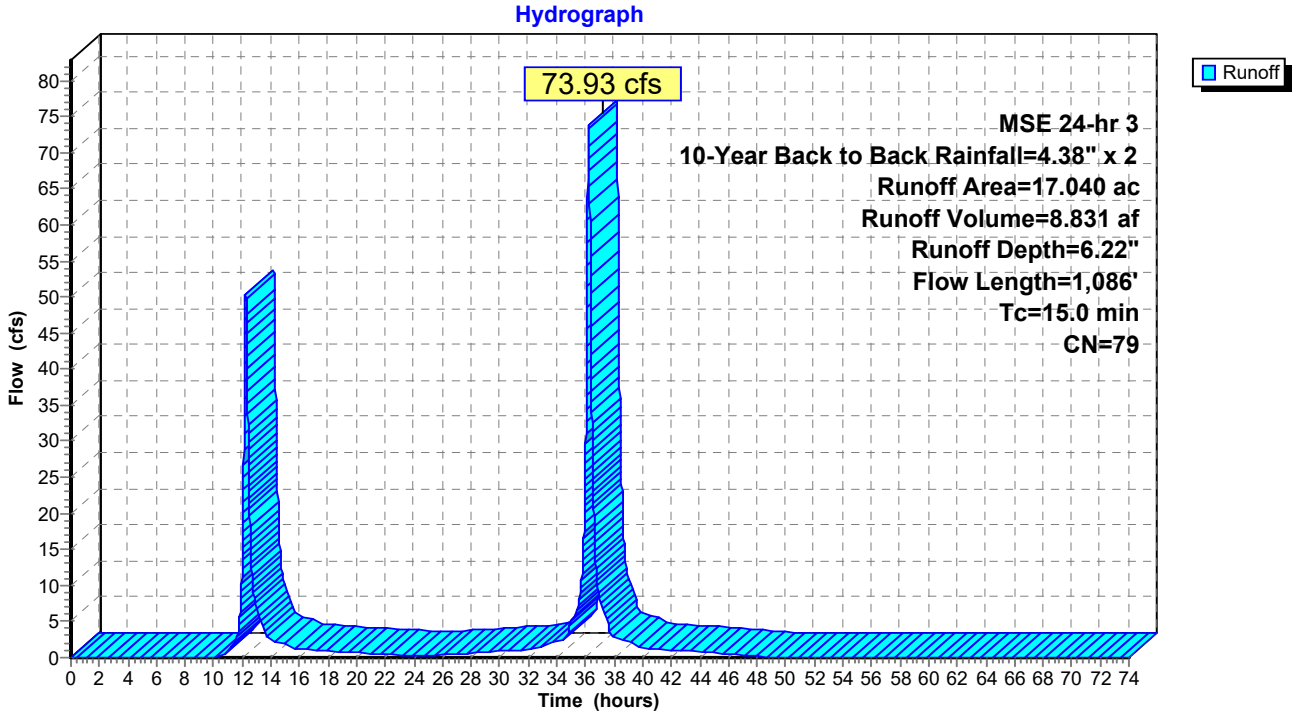
Runoff = 73.93 cfs @ 36.22 hrs, Volume= 8.831 af, Depth= 6.22"
Routed to Link 7L : DA-1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Back to Back Rainfall=4.38" x 2

	Area (ac)	CN	Description
	10.710	78	Meadow, non-grazed, HSG D
*	0.900	98	Impervious
	5.430	77	Woods, Good, HSG D
	17.040	79	Weighted Average
	16.140		94.72% Pervious Area
	0.900		5.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0100	0.90		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
1.1	111	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
12.0	875	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.0	1,086	Total			

Subcatchment 6S: DA-1 B



Summary for Subcatchment DA-1: DA-1 A

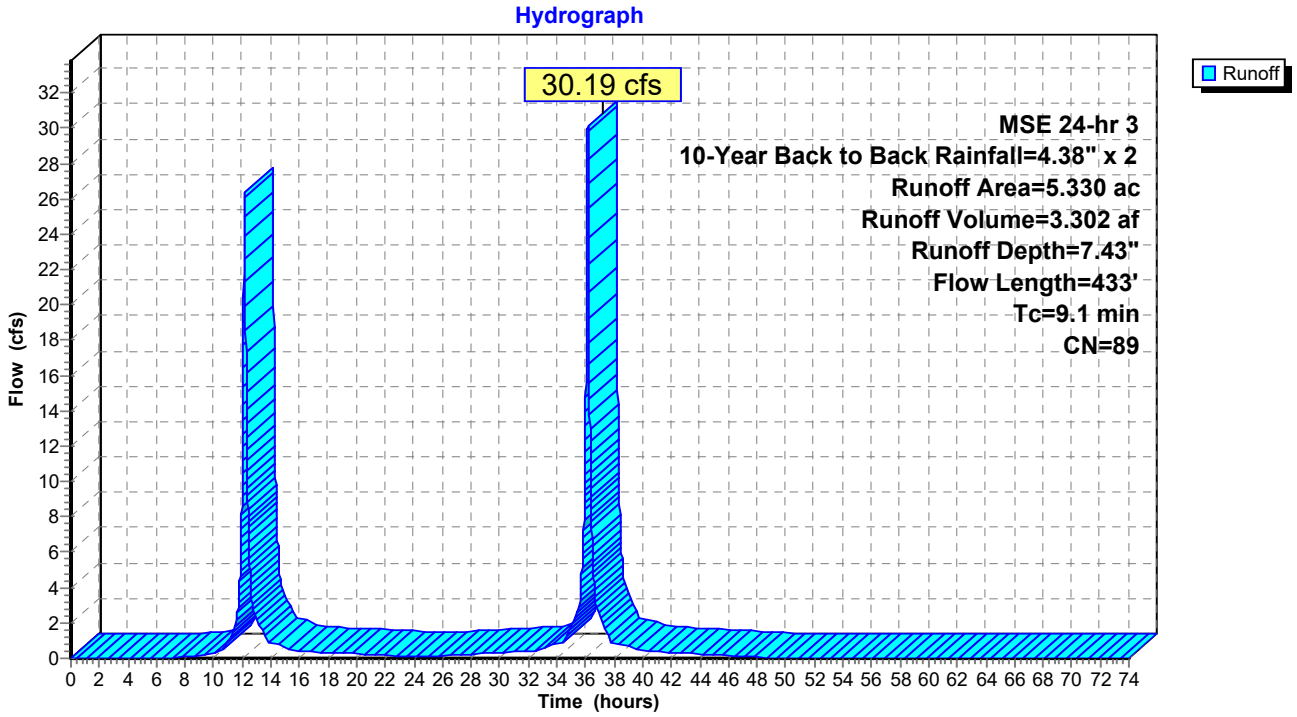
Runoff = 30.19 cfs @ 36.16 hrs, Volume= 3.302 af, Depth= 7.43"
Routed to Reach 8R : Swale

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Back to Back Rainfall=4.38" x 2

	Area (ac)	CN	Description
	2.430	78	Meadow, non-grazed, HSG D
*	1.600	98	Impervious
*	1.300	98	Disconnected Impervious, HSG D
	5.330	89	Weighted Average
	2.430		45.59% Pervious Area
	2.900		54.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	59	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.37"
0.7	41	0.0200	0.99		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.37"
0.7	102	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.5	231	0.0500	1.57		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	433	Total			

Subcatchment DA-1: DA-1 A



Summary for Reach 8R: Swale

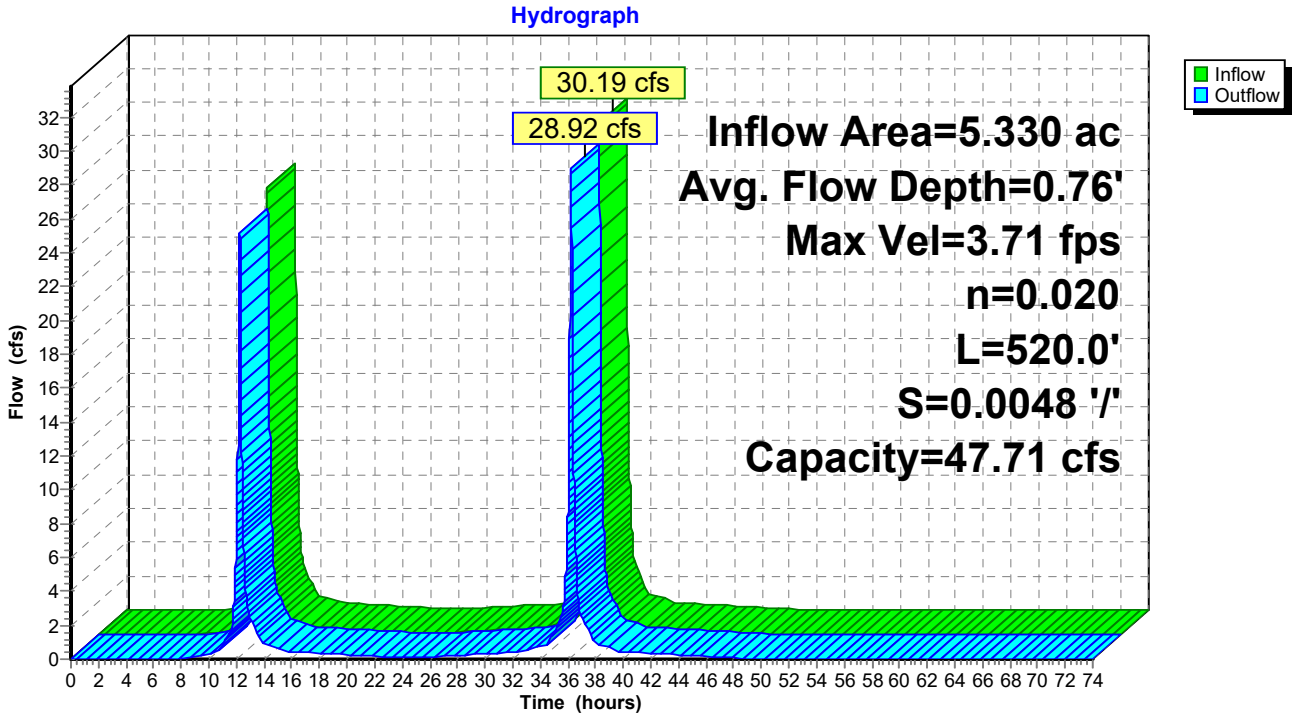
Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 7.43" for 10-Year Back to Back event
Inflow = 30.19 cfs @ 36.16 hrs, Volume= 3.302 af
Outflow = 28.92 cfs @ 36.22 hrs, Volume= 3.302 af, Atten= 4%, Lag= 3.7 min
Routed to Link 9L : Tc

Routing by Stor-Ind+Trans method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.71 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 11.1 min

Peak Storage= 4,050 cf @ 36.18 hrs
Average Depth at Peak Storage= 0.76' , Surface Width= 12.55'
Bank-Full Depth= 1.00' Flow Area= 11.0 sf, Capacity= 47.71 cfs

8.00' x 1.00' deep channel, n= 0.020
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 520.0' Slope= 0.0048 '/'
Inlet Invert= 835.52', Outlet Invert= 833.00'

‡

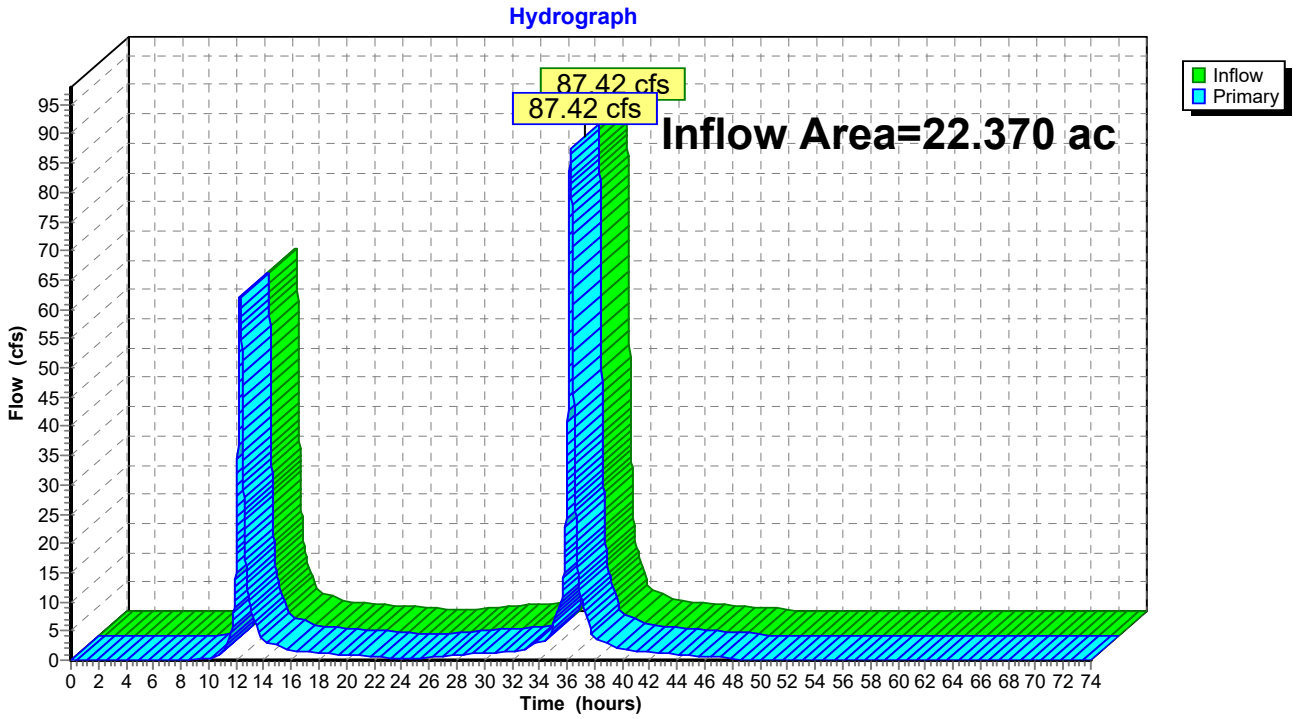


Summary for Link 7L: DA-1 POST

Inflow Area = 22.370 ac, 16.99% Impervious, Inflow Depth = 6.51" for 10-Year Back to Back event
Inflow = 87.42 cfs @ 36.25 hrs, Volume= 12.133 af
Primary = 87.42 cfs @ 36.25 hrs, Volume= 12.133 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 7L: DA-1 POST

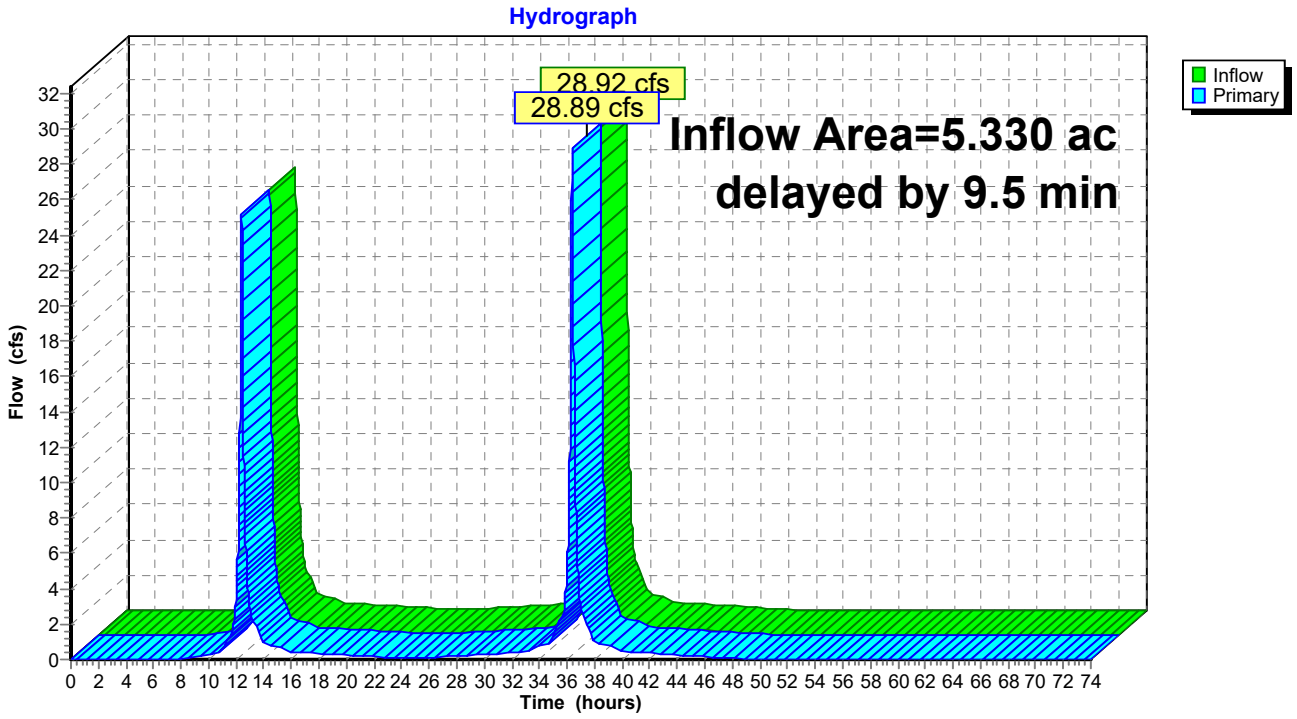


Summary for Link 9L: Tc

Inflow Area = 5.330 ac, 54.41% Impervious, Inflow Depth = 7.43" for 10-Year Back to Back event
Inflow = 28.92 cfs @ 36.22 hrs, Volume= 3.302 af
Primary = 28.89 cfs @ 36.38 hrs, Volume= 3.302 af, Atten= 0%, Lag= 9.5 min
Routed to Link 7L : DA-1 POST

Primary outflow = Inflow delayed by 9.5 min, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Link 9L: Tc



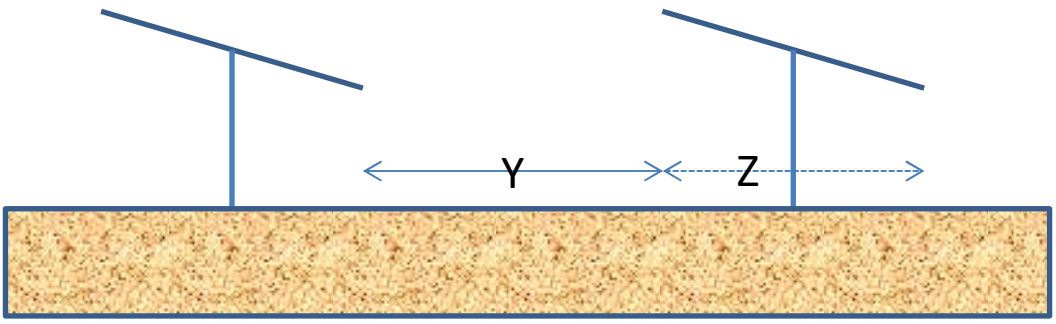
APPENDIX C – VOLUME CALCULATIONS

This spreadsheet makes calculations for an individual solar panel.

Enter values in blue cells		
Soil	D	
I/P ratio	0.570	
Term	**Value**	**Units**
Pervious area	87.56	square feet
Impervious area (area of solar panel)	49.93	square feet
Runoff depth from pervious areas	7.20	inches
Redirected runoff depth from solar panel (called average annual runoff depth)	9.28	inches
Runoff depth from solar panel	22.50	inches
Performance goal	1.00	inches
SUMMARY		
Pre-disconnection		
Runoff from impervious	94	ft3
Runoff from pervious	53	ft3
Total runoff	146	ft3
Post-disconnection		
Total runoff	106	ft3
Total runoff reduced	40	ft3
Runoff from pervious	53	ft3
Runoff from impervious	54	ft3
Adjusted impervious	28.688	square feet
Performance Goal Summary		
Performance goal	**4.16**	ft3
BMP volume credit ($BMP_{volume\ credit}$)	**1.77**	ft3
% of performance goal achieved	**42.5**	%
Remaining water quality volume to be treated (per panel)	**2.39**	ft3

Pervious area = (Y + Z) * W; where W is the width of the solar panel and Z is the average horizontal distance

Impervious area = Z * W; where W is the width of the solar panel and Z is the average horizontal distance of



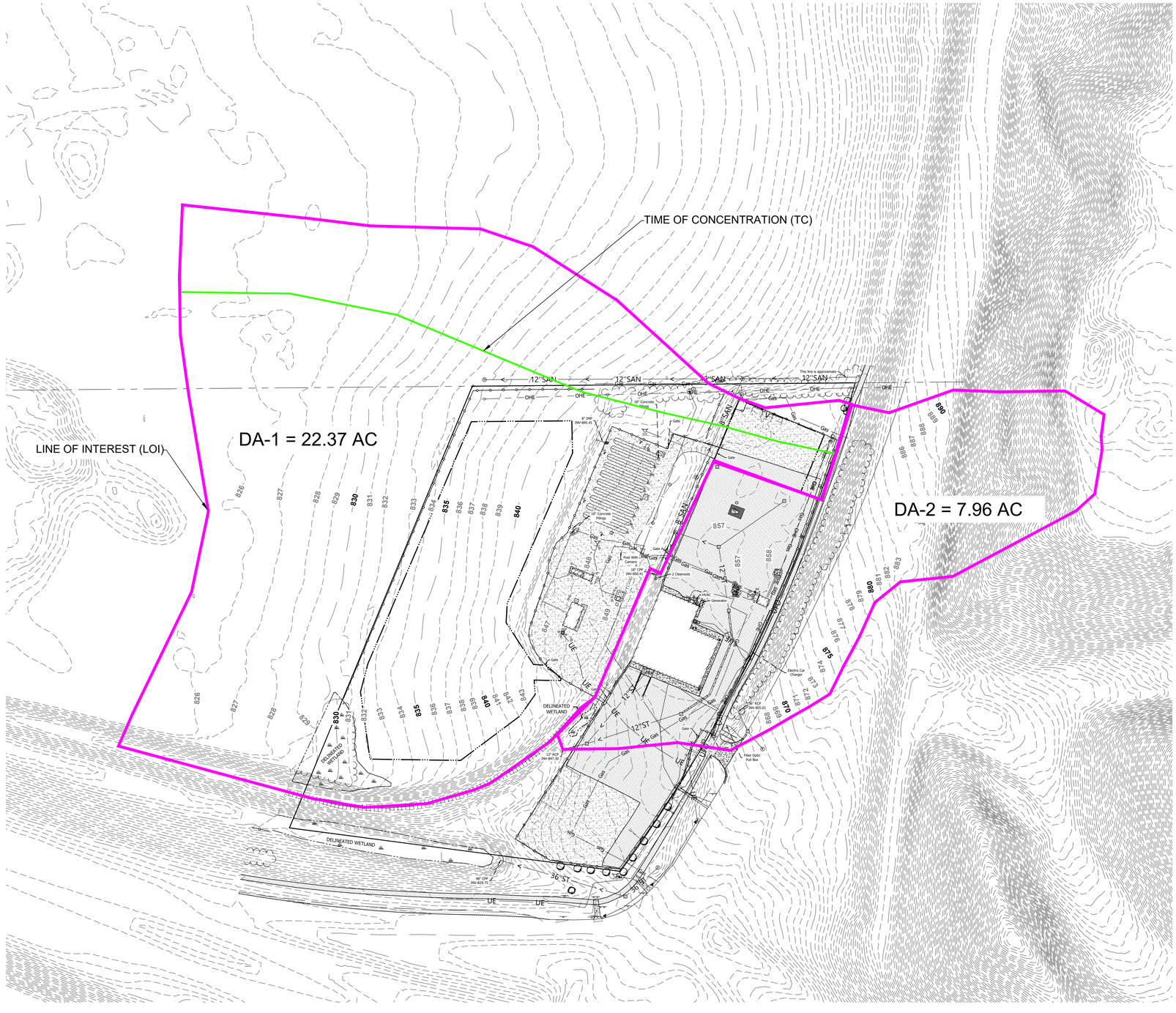
Impervious Area Calculation

Impervious Area	1093	sf
Runnoff Depth	1.1	in
Treatment Volume	100.19	cf

Total Treatment Volume Requirement

Solar Panel Treatment Volume	5066.8	cf
Other Impervious Area Treatment Volume	100.19	cf
Total	5167	cf
110% Total	**5684**	**cf**

ENCLOSURE 1 – EXISTING DRAINAGE AREA MAP



N

SCALE 1" = 100'

0 100 2 300 FEET

DRAINAGE AREA MAP LEGEND

- PROPERTY BOUNDARY LINE
- ZONING SETBACKS
- OHE — EXISTING OVERHEAD ELECTRIC LINE
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREE LINE
- EXISTING TREE
- Gas — EXISTING GAS LINE
- UFO — EXISTING FIBER OPTIC CABLE
- 12"ST — EXISTING SEWER LINE
- EXISTING MANHOLE
- EXISTING CULVERT
- EXISTING CONTOURS
- EXISTING UTILITY POLE
- OHW — EXISTING TRANSMISSION LINE
- UE — EXISTING UNDERGROUND ELECTRIC
- PROPOSED ACCESS ROAD
- PROPOSED FENCE
- PROPOSED SOLAR PANEL ARRAYS
- PROPOSED FILTRATION BERM
- PROPOSED LIMIT OF DISTURBANCE
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION

NOTES:

1. ESTIMATED TOTAL AREA OF DISTURBANCE: 4.17 ACRES
2. DA-2 DOES NOT PROPOSE A CHANGE IN LAND COVER. AS SUCH, DA-2 IS NOT INCLUDED IN THE STORMWATER CALCULATIONS. DA-2 IS SHOWN ON THE DRAINAGE AREA MAP TO REPRESENT DRAINAGE ON-SITE.

ISSUED FOR PERMITTING
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Rev.	Date	Description	By	Chk

ERM

EXISTING CONDITIONS
DRAINAGE AREA MAP

DISCIPLINE NO.: EX.

MANKATO HYDROGEN ENERGY PLANT PROJECT
CENTERPOINT ENERGY
MANKATO, BLUE EARTH COUNTY, MN

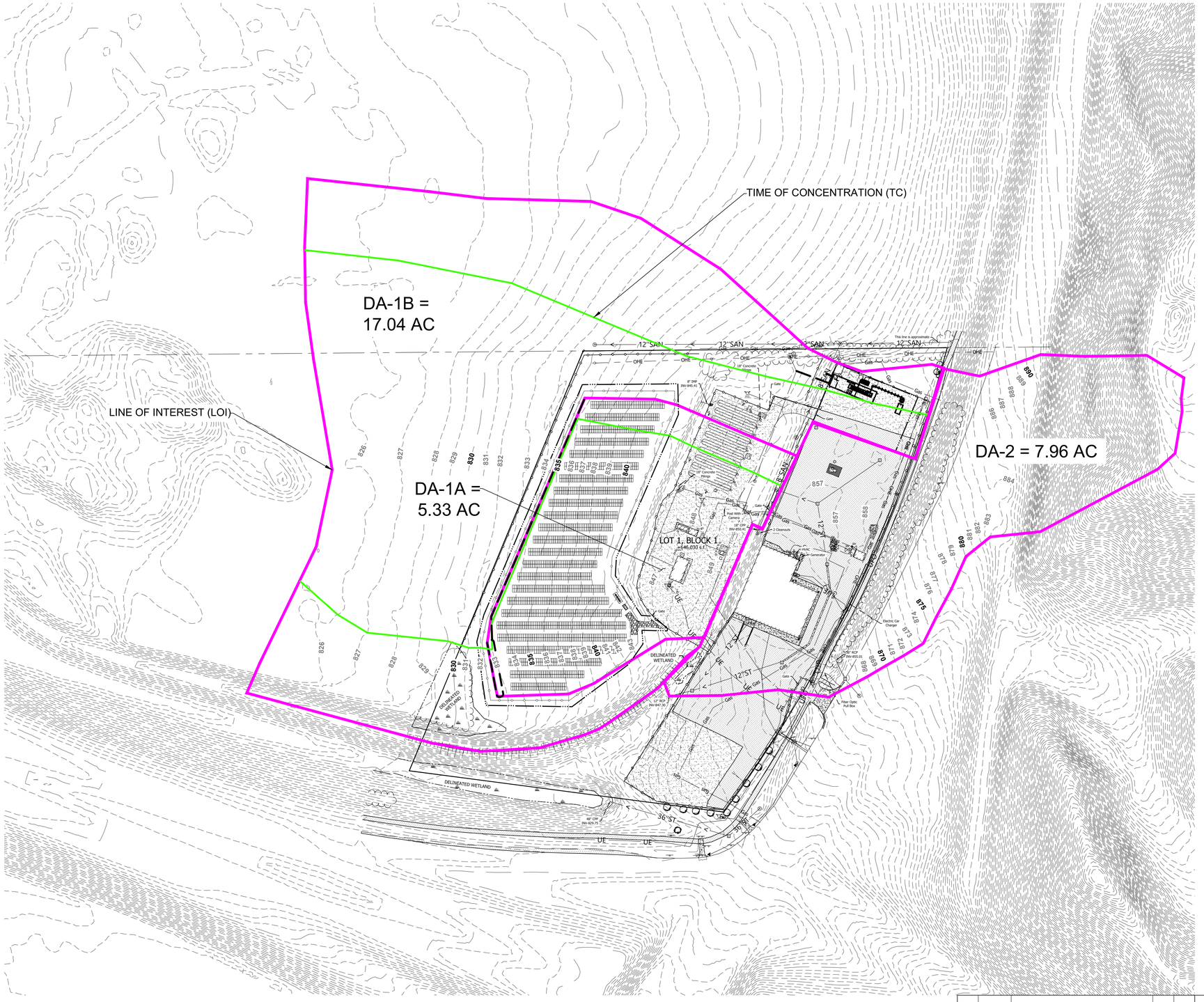
REV.: 0

SCALE	DESIGNED BY	PROJECT NUMBER	SHEET NO.
1"=100'	WS	0764026	A
DATE DRAWN: 05/26/2026	DRAWN BY: JB		

Environmental Resources Management, Inc.

FILE PATH: C:\Users\jessica.blair\OneDrive - ERM\0764159 CenterPoint Energy Environmental Support (Client) - Mankato Hydrogen Plant_CAD\CUP\Exhibits\Drainage Area Maps.dwg EXISTING CONDITIONS DA MAP. PRINTED ON 4/15/2026 BY Jessica Blair

ENCLOSURE 2 – PROPOSED DRAINAGE AREA MAP



SCALE 1" = 100'

0 100 2 300 FEET

DRAINAGE AREA MAP LEGEND

- PROPERTY BOUNDARY LINE
- ZONING SETBACKS
- OHE — EXISTING OVERHEAD ELECTRIC LINE
- EXISTING FENCE
- EXISTING WETLAND
- EXISTING TREE LINE
- EXISTING TREE
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- EXISTING CULVERT
- EXISTING CONTOURS
- EXISTING UTILITY POLE
- OHW — EXISTING TRANSMISSION LINE
- UE — EXISTING UNDERGROUND ELECTRIC
- PROPOSED ACCESS ROAD
- PROPOSED FENCE
- PROPOSED SOLAR PANEL ARRAYS
- PROPOSED FILTRATION BERM
- PROPOSED LIMIT OF DISTURBANCE
- DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION

NOTES:

1. ESTIMATED TOTAL AREA OF DISTURBANCE: 4.17 ACRES
2. DA-2 DOES NOT PROPOSE A CHANGE IN LAND COVER. AS SUCH, DA-2 IS NOT INCLUDED IN THE STORMWATER CALCULATIONS. DA-2 IS SHOWN ON THE DRAINAGE AREA MAP TO REPRESENT DRAINAGE ON-SITE.

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

Rev.	Date	Description	By	Chk

ERM

PROPOSED CONDITIONS
DRAINAGE AREA MAP

DISCIPLINE NO. EX.

MANKATO HYDROGEN ENERGY PLANT PROJECT
CENTERPOINT ENERGY
MANKATO, BLUE EARTH COUNTY, MN

REV. 0

SCALE	DESIGNED BY	PROJECT NUMBER	SHEET NO.
1"=100'	WS	0764026	B
DATE DRAWN 05/26/2026	DRAWN BY JB		

Environmental Resources Management, Inc.

FILE PATH: C:\Users\jessica.bial\OneDrive - ERM\0064199 CenterPoint Energy Environmental Support (Client) - Mankato Hydrogen Plant_CAD\CUP\Exhibits\Drainage Area Maps.dwg PROPOSED CONDITIONS DA MAP PRINTED ON 4/15/2026 BY Jessica Bial

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