FEASIBILITY REPORT UPDATE

WEST ARMSTRONG AREA STREET RECONSTRUCTION

CITY IMPROVEMENT PROJECT NO. 18-02

February 2, 2023

Prepared By:

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February 2, 2023

Bruce Westby
City Engineer / Public Works Director
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

Re: Feasibility Report Update- City of Ramsey Improvement Project #18-02
West Armstrong Area Ramsey Street Reconstruction

Dear Mr. Westby,

Transmitted herewith is an Updated Feasibility Report for the proposed West Armstrong Area Reconstruction, previously titled: "HY-10." The project includes 146th Avenue from Ferret Street to its termini cul-de-sac, 147th Avenue from Ferret Street to 380 feet west of Armstrong Boulevard, and Ferret Street from 146th Avenue to Bunker Lake Boulevard. The report examines the feasibility of reconstructing the bituminous street section and completing other appurtenant improvements.

This Feasibility Report examines the scope of the proposed improvements, explores estimated costs and available funding sources, defines a preliminary project schedule, and determines the necessity, feasibility, and general cost-effectiveness of the proposed improvements, including any alternate designs, as well as whether the improvements would best be completed separately or in conjunction with another project.

I would be happy to discuss this report with you at your convenience. Please feel free to contact me at 651-968-7760 or kevin.kielb@bolton-menk.com with any questions.

Sincerely,
Bolton & Menk, Inc.

Kevin P. Kielb, P.E.
Principal Engineer

Enclosure

CERTIFICATION

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Kevin Kielb, PE

Date: February 2, 2022 License No. 23211

`

I hereby certify that this plan, specification or report was reviewed for Quality Control and Quality Assurance purposes and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Bruce Westby, PE

Date: License No. 40116

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1. EXECUTIVE SUMMARY

City Improvement Project No. 18-02 proposes to reconstruct streets within the West Armstrong Area. The West Armstrong Area is bordered on the north by Bunker Lake Boulevard, on the south by TH 10, on the east by Armstrong Boulevard, and on the west by the employment district. Project area includes 146th Avenue, 147th Avenue, and Ferret Street. The streets total approximately 2,025 linear feet (0.39 miles) in length.

The proposed improvements include full reconstruction of roadways, utility extensions, boulevard sidewalk, and stormwater management improvements of public right-of-way runoff only. Additionally, the Anoka Ramsey Athletic Association (ARAA) has been developing plans on their property to construct a sports recreation facility. The resulting larger traffic projections warrant further analyses. Maps showing the location and scope of the proposed improvements are included as ***Figure 1*** in ***Appendix A.***

Initially, On July 11, 2017, the City Council adopted Resolution #17-07-170 authorizing the preparation of a Feasibility Report for the reconstruction of HY-10 Ramsey. These streets were originally included in the City's CIP as proposed 2015 overlay improvements. However, the overlay work was delayed when construction of the Highway 10 & Armstrong Boulevard Interchange was funded. Following completion of the Interchange, the pavement was re-evaluated, and Staff determined it would be best to reconstruct these streets in the future. This project is now listed in the current 10-year CIP as a total reconstruction.

On December 14, 2021, the City Council adopted Resolution #21-349 authorizing the engineering services and preparation of this Feasibility Report Update, retitled "West Armstrong Redevelopment Area." Much of the information contained in this Update has been carried forward from the previously authorized and completed feasibility report.

Upon ordering the Feasibility Report Update, the City Council directed Staff to review the existing street alignments and explore whether the streets should be reconstructed in the same locations, or whether it might make sense to realign or extend one or more of the streets to better serve existing properties and/or to connect to the new Bunker Lake Industrial Park.

The engineer's opinion of probable construction costs including streets, drainage, public sewer and water utilities, and property acquisition is **$1,827,159.66**. A summary of the engineer's opinion of probable costs is included in ***Appendix B.***

The project funding mechanisms are yet to be determined by City Staff. A combination of special assessments to benefitting properties, street reconstruction bond proceeds, and stormwater utility funds are possible. Sewer and Water Utility Funds would be used to pay for any public utility improvements.

Eleven (11) parcels have been identified as receiving special benefit from the improvements. Five of the parcels have permanent structures, and the other five are undeveloped. Additionally, to extend Ferret Street north to Bunker Lake Boulevard, roadway right-of-way and drainage and utility easements would be required. These parcels are identified in the preliminary Assessment Map, Property Acquisition Maps, and Preliminary Assessment Roll, which is attached in ***Appendix C***.

If City Staff concludes special assessments will be utilized for these commercial applications, preliminary assessment roles will be prepared at that time. The Assessment Hearing, if applicable, is proposed for November 14, 2023. If the report verifies the assessment rate as proposed is justified, Staff will propose to adopt the final assessment roll using the rate as preliminarily proposed.

2. INTRODUCTION

2.1 Authorization

The preparation of this report update was authorized by the Ramsey City Council on December 14, 2021. This project has been designated as City Improvement Project No. 18-02

2.2 Pavement Maintenance Program Update

Recent redevelopment discussions with adjacent property owners have resulted in a desire to reconstruct the pavements to account for projected traffic increases. Furthermore, as presented in the original feasibility study, the existing pavements have surpassed its useful life.

The City's pavement evaluation process involves a visual evaluation of each street's pavement surface based on the type, extent and severity of each pavement distress observed. Numerous types of pavement distresses may exist within a pavement section including, but not limited to, alligator cracking, block cracking, longitudinal cracking, transverse cracking, rutting, raveling, shoving, potholes and patches. This field data is then used to rate the pavement condition.

City staff evaluates and rates the condition of pavement sections on all City streets on an annual basis using the Pavement Surface Evaluation and Rating (PASER) system. In the summer of 2017, the pavement section of the above referenced street segments was rated with a PASER rating of 2 which indicates these streets require complete reconstruction. City staff patch the streets at least once per year, particularly before winter so the street can be plowed without further damaging the pavement in the process. Pictures of the street are located in ***Appendix A.***

In the summer of 2017, City staff evaluated and rated the condition of the pavement along the West Armstrong Area Street segments. A PASER rating of 2 was determined for 147th Avenue and Ferret Street. A PASER rating of 7 was determined for 146th Avenue, however, as previously noted a portion of this street segment was reconstructed with a temporary bituminous pavement section as part of the Armstrong Interchange project.

2.3 Scope

City of Ramsey Improvement Project 18-02 proposes to reconstruct the existing bituminous pavements, extend Ferret Street north to Bunker Lake Boulevard, install public utility infrastructure for future development, and complete other appurtenant work on 146th Avenue from Ferret Street to its termini cul-de-sac, 147th Avenue from 380 feet west of Armstrong Boulevard to Ferret Street, and Ferret Street from 146th Avenue to Bunker Lake Boulevard which totals approximately 2,000 feet (0.38 miles) in length. A map showing the location and scope of the proposed improvements options is included as ***Figure 1*** in ***Appendix A.***

3. EXISTING CONDITIONS

3.1 Existing Pavement and Soil Conditions

All streets proposed to be improved were constructed in 1988 with bituminous pavement, class 5 aggregate base, bituminous curb, and bituminous curb cuts for storm runoff. However, during the Highway 10/Armstrong Interchange project the west end of 146th Avenue was reconstructed and a temporary cul-de-sac was constructed. The streets were constructed to a width of 40-feet from face-of-curb to face-of-curb. The streets are generally centered within a 66-foot wide right-of-way.

The only pavement maintenance treatments applied to the street segments included crack sealing and seal coating in 1994 and 2001. Spot patching has been performed on an as-needed basis, and has been a yearly treatment recently. In 2017, Staff observed a PASER rating of 2 on 147th Avenue and Ferret Street, and a PASER rating of 7 on 146th Avenue.

In June 2018 traffic counts were taken on 147th Avenue, a traffic volume of 147 average annual daily traffic (AADT) was recorded. Ferret Street and 146th Avenue would be expected to have similar traffic volumes. The only access to these street segments is Armstrong Boulevard. Five of the parcels have active uses. The speed limit is 30 mph for these street segments.

Standard penetration test borings were performed by American Engineering Testing (AET) in 2022. AET's Report of Geotechnical Exploration is attached in ***Appendix D.*** Standard penetration test borings were performed by American Engineering Testing (AET) in 2021. 2.5 to 2.75 inches of bituminous pavement with 8 inches of apparent gravel base was encountered with silty sand and sand with silt layers encountered to depths of approximately 2 to four feet beneath existing grade. The sands with silt from 2 to 4 feet below grade were classified as "Course Alluvium or Fill." Groundwater was encountered at a depth of 10 feet in one of the borings.

Previously, in 2017, Braun Intertec was employed to complete a ground penetrating radar (GPR) analysis for the project area, which included driving a GPR equipped vehicle throughout all street segments within the project area. A summary table and charts of the GPR Analysis are attached in ***Appendix C***. The GPR data determined an average bituminous pavement thickness of 2.9 inches, and an average aggregate base thickness of 9.7 inches. The average street pavement and base section thickness is therefore 12.6 inches, with a minimum section of 7.5 inches located on 147th Avenue, 160 feet east of Ferret Street.

3.2 Watermain

Watermain was installed along 147th Avenue up to the beginning of the proposed improvements in 2012 as part of the Sunwood Drive re-alignment project. The existing watermain is believed to be in good condition and no repairs are anticipated to be required as part of this project. However, Staff plans to leak test the watermain during development of plans and specifications.

3.3 Sanitary Sewer

Sanitary sewer was installed under Armstrong Boulevard in City-owned right-of-way east of the 146th Avenue temporary cul-de-sac as part of the Armstrong Boulevard Interchange project in

2015. The existing sanitary sewer is believed to be in good condition and no repairs are anticipated to be required as part of this project. However, staff plans to televise the sewer during development of plans and specifications.

3.4 Storm Sewer/Drainage

Storm sewer was installed along 147th Avenue up to the beginning of the proposed improvements in 2012 as part of the Sunwood Drive re-alignment project. Currently storm water runoff drains off the two existing cul-de-sacs to low areas. This storm sewer is believed to be in good condition and no repairs are anticipated to be required as part of this project. However, staff plans to televise the sewer during development of plans and specifications.

3.5 Streets

3.5.1 Existing Typical Sections

The width of 146th Avenue, 147th Avenue, and Ferret Street is 40-feet from face-of-curb to face-of-curb. The cul-de-sac on Ferret Street has a 50-foot radius to the back of curb. The streets are generally centered within a 66-foot wide City-owned right-of-way, with a 130-foot wide diameter right-of-way around the cul-de-sac on Ferret Street.

3.5.2 Maintenance History

The West Armstrong area roadways were originally constructed in 1988. 146th Avenue, 147th Avenue, and Ferret Street received crack seal and seal coat in 1994 and 2001. The street segments have regularly received spot patching on an as-needed basis.

3.6 Land Use

The parcels within the construction area are zoned as COR.

4. PROPOSED IMPROVEMENTS

4.1 Street and Stormwater Improvements

4.1.1 Street Improvements

146th Avenue, 147th Avenue and Ferret Street are proposed to be reconstructed with bituminous pavement and concrete curb and gutter.

The proposed surface improvements are shown on ***Figure 1 in Appendix A.***

<u>*Street Design:*</u>
146th Avenue, 147th Avenue, and Ferret Street are currently urban commercial streets with bituminous curb and pavement, 40 feet wide from face-of-curb to face-of-curb. The proposed cul-de-sac is 100-feet in diameter from back-of-curb to back-of-curb. Existing and proposed traffic counts are low for typical commercial streets.

All street segments are proposed to be reconstructed at their current width. A typical section for the proposed pavement reconstruction improvements is shown in ***Figure 2*** in ***Appendix A.***

This Feasibility Report proposes to reconstruct the existing bituminous pavement section using the Full Depth Reclamation (FDR) process. This process generally involves reclaiming the entire existing bituminous pavement section, along with the underlying aggregate base material. The reclaim material will then be salvaged and stockpiled to install the proposed public utilities. Four and one-half inches of bituminous pavement is proposed to be placed on top of a minimum of 8 inches of aggregate base/reclaim material. This pavement section generally meets the City of Ramsey's standard pavement design for commercial/employment district streets. The proposed improvements should have a service life of at least 30-years, assuming maintenance such as overlays, crack sealing and seal coating is routinely performed.

4.1.2 Storm Sewer Improvements

Storm sewer is proposed to be added for street drainage with catch basins being added to convey water off the road and into a proposed ponding and drainage ditches as shown on ***Figures 1 in Appendix A.***

4.1.3 Other Considerations

Driveways:
Existing driveway aprons may need to be reconstructed to varying degrees. The limits of construction will vary with each driveway apron based on the elevation of the street abutting the driveway and the driveway pavement type. During design, Staff will evaluate the construction limits for each driveway and will incorporate this into the plans, but as with all street reconstruction projects, the exact limits of construction will be determined in the field during construction. None are anticipated, but right-of-entry forms will be obtained from private property owners where work is required outside city rights-of-way and easements.

Irrigation Systems:
Developed properties along the project corridor may have private irrigation systems. Staff will notify property owners of pending construction as far in advance as practical to allow them time to relocate their irrigation systems before construction begins.

Parking Restrictions:
Parking is currently provided along both sides of the streets and is not currently restricted except for overnight parking per City code. During project construction, parking will be restricted during allowable working hours.

Pavement Coring:
Existing pavement thicknesses have been found to be inconsistent throughout the City. It is now standard practice to have City Staff on-site during pavement installation to ensure the proper quantities are being placed. As further conformation, Staff is proposing to collect GPR data or to have pavement cores taken at the conclusion of all reconstruction

projects. This is already a requirement on all State Aid projects and will leave more data on the pavement section for future street maintenance projects.

4.2 Stormwater Treatment

The extension of Ferret Street from the north termini cul-de-sac to Bunker Lake Boulevard results in an impervious area increase of 0.4 acres. Also, the existing storm sewer on 147th Avenue drains to existing ponds east of Armstrong Boulevard and north of Sunwood Drive. They were not designed to receive any runoff west of Armstrong Boulevard. Consequently, stormwater retention and/or treatment improvements will be required with this project to reduce the rate at which runoff leaves the site or infiltrates.

4.3 Water Main Improvements

Watermain is proposed to be extended on Ferret Street from Bunker Lake Boulevard to 146th Street. Watermain is also proposed to be extended from mid-block 147th Avenue to Ferret Street. Adding this segment on 147th Avenue will loop together the watermain in this area and provide service for future development.

4.4 Sanitary Sewer Improvements

Sanitary Sewer is proposed to be extended on Ferret Street from Bunker Lake Boulevard to 146th Avenue NW. Adding this segment on Ferret Street will provide service for future development.

4.6 Private Utilities

Staff has not yet met with the telephone, gas, power and cable utilities regarding this project. During preparation of plans and specifications, Staff will meet with the private utility companies to discuss the proposed improvements as noted in the project schedule within this report. The alignment and footprint of the streets will be considered to minimize impacts to private utilities. Impacts to private utilities area anticipated with this project.

Should any utility company indicate they wish to upgrade, replace and/or otherwise modify their services during this project, any such upgrades, replacements and/or modifications will be at the sole discretion and cost of the utility company.

4.7 Traffic Analysis

Based upon the potential traffic changes associated with the redevelopment of the West Armstrong Area, more comprehensive traffic analyses are recommended to be completed at the following locations:

- Bunker Lake Boulevard/Armstrong Boulevard,
- Bunker Lake Boulevard/Ferret Street, and
- Armstrong Boulevard/147th Street.

Initially, a Bunker Lake Boulevard westbound left turn lane and Ferret Street northbound designated left turn lane and right turn lanes are all warranted. The current land use zoned "COR" allows for flexibility. If the west Armstrong Area evolves to more commercial orientated uses with the addition of the ARAA facility and others, additional analysis is warranted to better understand the impacts. A detailed traffic analysis memorandum is included in ***Appendix D.***

4.8 Permits

Permits that are anticipated to be required as part of the proposed improvements include:

- Minnesota Pollution Control Agency (MPCA): Sanitary Sewer Extension
- Minnesota Department of Health (MDH): Watermain Extension
- MPCA General Stormwater Permit: Grading and Storm Water
- Lower Rum River Watershed Management Organization (LRRWMO) Grading and Storm Water

4.9 Right-of-Ways/Easements

It is anticipated that the City will need to acquire additional permanent right-of-way, easements, and/or entire parcels for this project. Costs for right-of-way or easement acquisitions are included in the probable project costs in Appendix B. Property values are based on conversations with property owners and county-assessed values. Actual appraisals will need to be performed to determine final property values.

City Staff will work with private property owners as needed to obtain any required right of entries.

5. FINANCING

5.1 Opinion of Cost

A detailed opinion of probable costs for the proposed improvements can be found in ***Appendix B*** of this report. The opinion of probable costs incorporates anticipated 2023 construction costs for the proposed improvements with 10-percent contingency costs and projected property acquisition costs.

5.2 Funding

5.2.1 Assessments

If City Staff recommend the use of special assessments, the City's adopted Special Assessments Policy allows special assessments to be levied against all benefitting properties in an amount not to exceed 25% of eligible street reconstruction costs. Eligible costs include costs required to reconstruct the street at its current width, and to reconstruct the pavement without increasing its structural capacity. Benefitting properties are defined as any developable parcel that has, or has the ability to create, one or more direct accesses onto the segment of 146th Avenue, 147th Avenue or Ferret Street being reconstructed.

State Statute and the City Charter do not allow for assessments to exceed benefit to the property. Therefore, Staff would want to ensure all assessments applied with this project would not exceed the benefit to assessed properties. Therefore, if special assessments are utilized, Staff recommends ordering a benefit appraisal consultation report for this project in accordance with the City's Special Assessments Policy at the time a construction contract is awarded.

5.2.2 City Contribution

The City contribution to the project would include all funding in excess of the amount collected through special assessments to benefiting properties. No funds have been budgeted for this project. The City's share of eligible project costs related to surface (street) improvements is proposed to come from the previously encumbered 5-year Street Reconstruction and Overlay Program bonds. Water and Stormwater Utility Funds are proposed to pay for all utility improvements.

6. PROJECT SCHEDULE

The proposed project schedule is as follows:

Council Orders Feasibility Report Update..... December 14, 2021

Council Reviews Feasibility Report/Orders Public Informational Meeting.. February 28, 2023

Staff Conducts Public Information Meeting..... January 26, 2023

Council Accepts Feasibility Report/Orders Public Hearing..... March 14, 2023

Council Conducts Public Hearing..... March 28, 2023

Staff Conducts Private Utility Coordination Meeting ..... March 2023

Staff Finalizes Property Acquisition..... March 2023

Council Approves Plans and Specifications / Authorizes Ad for Bids..... April 25, 2023

Final Plat approved ..... April 2023

Staff Receives Bids..... June 1, 2023

Council Awards Contract..... June 13, 2023

Contractor Begins Construction..... July 2023

Contractor Completes Construction..... September 29, 2023

Council Orders Assessment Hearing (if applicable)..... October 10, 2023

Council Conducts Assessment Hearing (if applicable) ..... November 14, 2023

7. CONCLUSIONS AND RECOMMENDATIONS

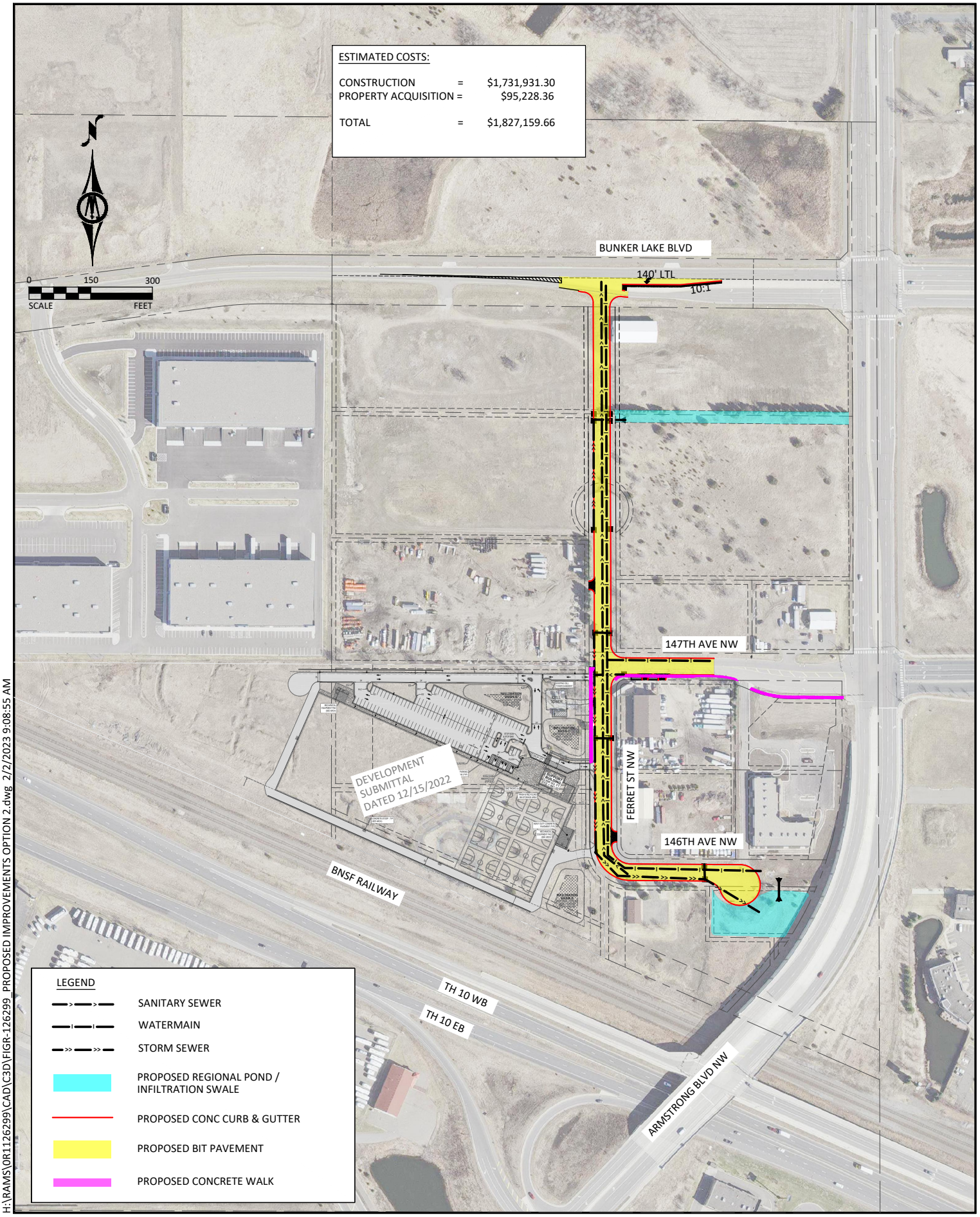
City of Ramsey Improvement Project No. 18-02 proposes to reconstruct the bituminous pavement section, to remove the existing bituminous curb and replace it with a combination of B618 concrete curb and gutter and bituminous curb, and to complete miscellaneous appurtenant work on the following street segments within the West Armstrong Area commercial subdivision:

1. 146th Avenue (approx. 230 linear feet) – Ferret Street to bulb of east cul-de-sac.
2. 147th Avenue (approx. 190 linear feet) – Ferret Street to 180 feet west of Armstrong Boulevard.
3. Ferret Street (approx. 1500 linear feet) – 146th Avenue to Bunker Lake Boulevard

It is the recommendation of City staff that City Project No. 18-02 is feasible, necessary, and cost-effective from an engineering standpoint, and this project would best be constructed as a stand-alone project as proposed herein.

APPENDIX A

Figure 1 – Proposed Improvements
Figure 2 – Typical Section
Project Site Pictures



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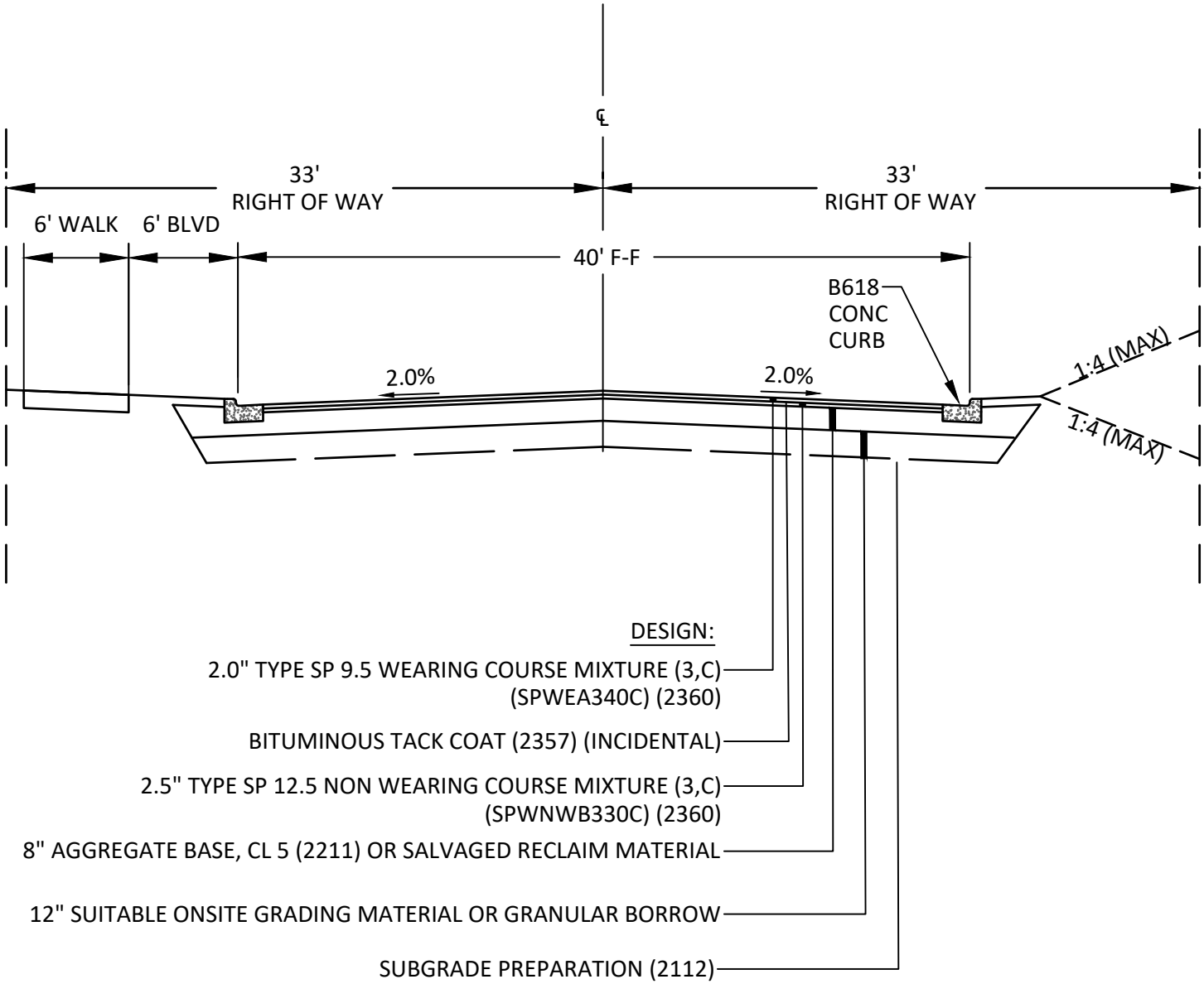

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PROJECT SITE PICTURES

1: 146th Avenue from Ferret Street

2: Ferret Street from 146th Avenue

3: Ferret Street from north cul-de-sac

4: 147th Avenue from Ferret Street

APPENDIX B

Opinion of Probable Costs
Preliminary Assessment Map
Property Acquisition
Preliminary Assessment Roll

PRELIMINARY ENGINEER'S ESTIMATE

WEST ARMSTRONG REDEVELOPMENT
CITY PROJECT NO. 18-02
CITY OF RAMSEY, MN
BMI PROJECT NO. 0R1.126299

BOLTON & MENK
Real People. Real Solutions.

Date: 2/1/2023

ENGINEER'S ESTIMATE								ROADWAY		STORM SEWER		SANITARY SEWER		WATERMAIN	
ITEM NO.	MnDOT SPEC NO.	ITEM	NOTES	TOTAL ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
1	2021.501	MOBILIZATION		1	LUMP SUM	$80,000.00	$80,000.00	0.50	$40,000.00	0.16	$12,800.00	0.09	$7,200.00	0.25	$20,000.00
2	2101.502	CLEARING		13	EACH	$500.00	$6,500.00	13	$6,500.00						
3	2101.502	GRUBBING		13	EACH	$200.00	$2,600.00	13	$2,600.00						
4	2101.505	CLEARING		0.25	ACRE	$8,000.00	$2,000.00	0.25	$2,000.00						
5	2101.505	GRUBBING		0.25	ACRE	$6,000.00	$1,500.00	0.25	$1,500.00						
6	2102.503	PAVEMENT MARKING REMOVAL		1,090	LIN FT	$1.50	$1,635.00	1090	$1,635.00						
7	2104.502	REMOVE MAIL BOX & SUPPORT		1	EACH	$100.00	$100.00	1	$100.00						
8	2104.502	REMOVE CASTING ASSEMBLY		1	EACH	$400.00	$400.00			1	$400.00				
9	2104.502	SALVAGE CATCH BASIN		1	EACH	$1,000.00	$1,000.00			1	$1,000.00				
10	2104.502	SALVAGE SIGN		3	EACH	$50.00	$150.00	3	$150.00						
11	2104.502	REMOVE SIGN		1	EACH	$50.00	$50.00	1	$50.00						
12	2104.502	REMOVE GATE VALVE & BOX		1	EACH	$800.00	$800.00							1	$800.00
13	2104.503	REMOVE PIPE SEWERS		12	LIN FT	$20.00	$240.00			12	$240.00				
14	2104.503	REMOVE FENCE		600	LIN FT	$5.00	$3,000.00	600	$3,000.00						
15	2104.503	SAWING BIT PAVEMENT (FULL DEPTH)		1,100	LIN FT	$2.50	$2,750.00	1100	$2,750.00						
16	2104.503	SAWING CONCRETE PAVEMENT (FULL DEPTH)		390	LIN FT	$5.00	$1,950.00	390	$1,950.00						
17	2104.503	REMOVE CURB AND GUTTER		900	LIN FT	$4.00	$3,600.00	900	$3,600.00						
18	2104.504	REMOVE BITUMINOUS PAVEMENT		830	SQ YD	$4.00	$3,320.00	830	$3,320.00						
19	2104.504	REMOVE CONCRETE PAVEMENT		680	SQ YD	$10.00	$6,800.00	680	$6,800.00						
20	2106.507	EXCAVATION - COMMON (EV)	(P) (1)	4,040	CU YD	$18.00	$72,720.00	4040	$72,720.00						
21	2106.507	EXCAVATION - CHANNEL AND POND	(P) (1)	5,300	CU YD	$14.00	$74,200.00			5300	$74,200.00				
22	2106.507	EXCAVATION - SUBGRADE (EV)		200	CU YD	$15.00	$3,000.00	200	$3,000.00						
23	2106.507	STABILIZING AGGREGATE (CV)		200	CU YD	$20.00	$4,000.00	200	$4,000.00						
24	2106.507	COMMON EMBANKMENT (CV)	(P)	500	CU YD	$5.00	$2,500.00	500	$2,500.00						
25	2106.607	HAUL AND STOCKPILE BITUMINOUS MATERIAL	(P)	2,050	CU YD	$12.00	$24,600.00	2050	$24,600.00						
26	2112.519	SUBGRADE PREPARATION		21	ROAD ST	$500.00	$10,500.00	21.0	$10,500.00						
27	2118.507	AGGREGATE SURFACING (CV) CLASS 2		20	CU YD	$85.00	$1,700.00	20	$1,700.00						
28	2123.610	STREET SWEEPER (WITH PICKUP BROOM)		20	HOUR	$200.00	$4,000.00	20	$4,000.00						
29	2211.507	AGGREGATE BASE (CV) CLASS 5 MODIFIED		700	CU YD	$42.00	$29,400.00	700	$29,400.00						
30	2211.607	AGGREGATE BASE (CV) FROM STOCKPILE		2,050	CU YD	$16.00	$32,800.00	2050	$32,800.00						
31	2215.504	FULL DEPTH RECLAMATION (10")		7,350	SQ YD	$2.50	$18,375.00	7350	$18,375.00						
32	2231.604	BITUMINOUS PATCH SPECIAL (DRIVEWAY)		20	SQ YD	$80.00	$1,600.00	20	$1,600.00						
33	2360.509	TYPE SP 9.5 WEARING COURSE MIX (3,C)		1,220	TON	$100.00	$122,000.00	1220	$122,000.00						
34	2360.509	TYPE SP 12.5 NON WEARING COURSE MIX (3,C)		1,500	TON	$95.00	$142,500.00	1500	$142,500.00						
35	2501.502	18" RC PIPE APRON		2	EACH	$1,500.00	$3,000.00			2	$3,000.00				
36	2501.602	TRASH GUARD FOR 18" PIPE APRON		2	EACH	$700.00	$1,400.00			2	$1,400.00				
37	2503.503	12" RC PIPE SEWER DESIGN 3006 CLASS V		300	EACH	$55.00	$16,500.00			300	$16,500.00				
38	2503.503	15" RC PIPE SEWER DESIGN 3006 CLASS V		380	LIN FT	$62.00	$23,560.00			380	$23,560.00				
39	2503.503	18" RC PIPE SEWER DESIGN 3006 CLASS V		725	LIN FT	$70.00	$50,750.00			725	$50,750.00				
40	2503.503	8" PVC PIPE SEWER		1,798	LIN FT	$55.00	$98,890.00					1798	$98,890.00		

PRELIMINARY ENGINEER'S ESTIMATE

WEST ARMSTRONG REDEVELOPMENT
CITY PROJECT NO. 18-02
CITY OF RAMSEY, MN
BMI PROJECT NO. 0R1.126299

BOLTON & MENK
Real People. Real Solutions.

Date: 2/1/2023

ENGINEER'S ESTIMATE								ROADWAY		STORM SEWER		SANITARY SEWER		WATERMAIN	
ITEM NO.	MnDOT SPEC NO.	ITEM	NOTES	TOTAL ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
41	2503.602	8" PIPE PLUG		10	EACH	$200.00	$2,000.00					10	$2,000.00		
42	2503.602	CONNECT TO EXISTING SANITARY SEWER		2	EACH	$1,000.00	$2,000.00					2	$2,000.00		
43	2504.602	ADJUST GATE VALVE BOX		1	EACH	$500.00	$500.00	1	$500.00						
44	2504.602	CONNECT TO EXISTING WATER MAIN		2	EACH	$2,000.00	$4,000.00							2	$4,000.00
45	2504.602	6" GATE VALVE & BOX		7	EACH	$2,300.00	$16,100.00							7	$16,100.00
46	2504.602	8" GATE VALVE & BOX		10	EACH	$3,000.00	$30,000.00							10	$30,000.00
47	2504.602	12" GATE VALVE & BOX		5	EACH	$5,000.00	$25,000.00							5	$25,000.00
48	2504.602	HYDRANT		7	EACH	$6,000.00	$42,000.00							7	$42,000.00
49	2504.603	6" WATERMAIN DUCTILE IRON CL 53		90	LIN FT	$70.00	$6,300.00							90	$6,300.00
50	2504.603	8" WATERMAIN DUCTILE IRON CL 52		323	LIN FT	$75.00	$24,225.00							323	$24,225.00
51	2504.603	12" WATERMAIN DUCTILE IRON CL 52		2,025	LIN FT	$90.00	$182,250.00							2,025	$182,250.00
52	2504.608	WATERMAIN FITTINGS		2,680	POUND	$12.00	$32,160.00							2,680	$32,160.00
53	2506.502	CASTING ASSEMBLY (MANHOLE)		7	EACH	$750.00	$5,250.00					7	$5,250.00		
54	2506.502	CASTING ASSEMBLY (CATCH BASIN)		14	EACH	$750.00	$10,500.00			14	$10,500.00				
55	2506.602	INSTALL CATCH BASIN (SALVAGED)		1	EACH	$4,000.00	$4,000.00			1	$4,000.00				
56	2506.503	CONSTRUCT SANITARY SEWER MANHOLE		59.42	LIN FT	$450.00	$26,739.00					59.42	$26,739.00		
57	2506.503	CONSTRUCT DRAINAGE STRUCTURE DESIGN SPEC 1 (2'X3')		36.00	LIN FT	$500.00	$18,000.00			36.00	$18,000.00				
58	2506.503	CONSTRUCT DRAINAGE STRUCTURE DES 48-4020		46.00	LIN FT	$600.00	$27,600.00			46.00	$27,600.00				
59	2506.602	ADJUST FRAME & RING CASTING		2	EACH	$800.00	$1,600.00	2	$1,600.00						
60	2506.602	SEAL MANHOLE	(3)	7	EACH	$500.00	$3,500.00					7	$3,500.00		
61	2521.514	4" CONCRETE WALK		4,300	SQ FT	$8.00	$34,400.00	4300	$34,400.00						
62	2531.503	CONCRETE CURB AND GUTTER DESIGN B612		55	LIN FT	$14.00	$770.00	55	$770.00						
63	2531.503	CONCRETE CURB AND GUTTER DESIGN B618		4,350	LIN FT	$16.00	$69,600.00	4350	$69,600.00						
64	2531.504	CONCRETE MEDIAN		150	SQ YD	$70.00	$10,500.00	150	$10,500.00						
65	2531.504	8" CONCRETE DRIVEWAY PAVEMENT		180	SQ YD	$80.00	$14,400.00	180	$14,400.00						
66	2531.602	CONCRETE MEDIAN NOSE-SPECIAL		1	EACH	$800.00	$800.00	1	$800.00						
67	2531.602	CONSTRUCT 6" CONCRETE PEDESTRIAN RAMP		5	EACH	$2,500.00	$12,500.00	5	$12,500.00						
68	2540.602	MAIL BOX & SUPPORT		1	EACH	$500.00	$500.00	1	$500.00						
69	2563.601	TRAFFIC CONTROL		1	LUMP SUM	$20,000.00	$20,000.00	0.50	$10,000.00	0.16	$3,200.00	0.09	$1,800.00	0.25	$5,000.00
70	2573.501	STABILIZED CONSTRUCTION EXIT		1	LUMP SUM	$2,500.00	$2,500.00	1	$2,500.00						
71	2573.502	STORM DRAIN INLET PROTECTION		18	EACH	$200.00	$3,600.00	18	$3,600.00						
72	2573.502	CULVERT END CONTROLS		6	EACH	$300.00	$1,800.00	6	$1,800.00						
73	2573.503	SILT FENCE, TYPE MS		1,300	LIN FT	$2.00	$2,600.00	1300	$2,600.00						
74	2573.503	SEDIMENT CONTROL LOG TYPE WOOD FIBER		1,000	LIN FT	$2.50	$2,500.00	1000	$2,500.00						
75	2574.505	FERTILIZER TYPE 3		730	POUND	$1.50	$1,095.00	730	$1,095.00						
76	2574.507	COMMON TOPSOIL BORROW		1,380	CU YD	$40.00	$55,200.00	1380	$55,200.00						
77	2575.504	ROLLED EROSION PREVENTION CATEGORY 20		2,670	SQ YD	$1.50	$4,005.00	2670	$4,005.00						
78	2575.505	SEEDING		2.0	ACRE	$500.00	$1,000.00	2.0	$1,000.00						
79	2575.508	SEED MIXTURE 25-121		100	POUND	$5.00	$500.00	100	$500.00						
80	2575.508	SEED MIXTURE 25-131		330	POUND	$5.00	$1,650.00	330	$1,650.00						
81	2575.508	SEED MIXTURE 33-261		30	POUND	$10.00	$300.00	30	$300.00						

PRELIMINARY ENGINEER'S ESTIMATE

WEST ARMSTRONG REDEVELOPMENT
CITY PROJECT NO. 18-02
CITY OF RAMSEY, MN
BMI PROJECT NO. 0R1.126299

BOLTON & MENK
Real People. Real Solutions.

Date: 2/1/2023

ENGINEER'S ESTIMATE								ROADWAY		STORM SEWER		SANITARY SEWER		WATERMAIN	
ITEM NO.	MnDOT SPEC NO.	ITEM	NOTES	TOTAL ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT	QUANTITY	AMOUNT
82	2575.508	HYDRAULIC BONDED FIBER MATRIX		7,000	POUND	$1.50	$10,500.00	7000	$10,500.00						
83	2582.503	4" SOLID LINE MULTI COMP		140	LIN FT	$1.00	$140.00	140	$140.00						
84	2582.503	24" SOLID LINE MULTI COMP		90	LIN FT	$17.00	$1,530.00	90	$1,530.00						
85	2582.503	4" DOUBLE SOLID LINE MULTI COMP		835	LIN FT	$2.00	$1,670.00	835	$1,670.00						
86	2582.518	PAVEMENT MESSAGE MULTI COMP		15.45	SQ FT	$20.00	$309.00	15.45	$309.00						
						ESTIMATED CONTRUCTION TOTAL:	**$1,574,483.00**		**$792,119.00**		**$247,150.00**		**$147,379.00**		**$387,835.00**
						10% CONSTRUCTION CONTINGENCY:	**$157,448.30**		**$79,211.90**		**$24,715.00**		**$14,737.90**		**$38,783.50**
						TOTAL ESTIMATED CONSTRUCTION COST:	**$1,731,931.30**		**$871,330.90**		**$271,865.00**		**$162,116.90**		**$426,618.50**

NOTES:

(1) INCLUDES TOPSOIL STRIPPING AND STOCKPILING

(2) STOCKPILE LOCATION: PUBLIC WORKS, 14199 JASPER STREET NW. CONTRACTOR SHALL USE ALL AVAILABLE STOCKPILE MATERIAL BEFORE IMPORTING AGGREGATE

(3) CHIMNEY SEAL

PRELIMINARY PROPERTY ACQUISITION

WEST ARMSTRONG REDEVELOPMENT
CITY PROJECT NO. 18-02
CITY OF RAMSEY, MN

BOLTON & MENK
Real People. Real Solutions.

PARCEL	PARCEL ID	PROPERTY ADDRESS/OWNER	NEW R/W	NEW D&U	CONVERTED FROM D&U TO R/W	R/W VACATED	UNIT	UNIT PRICE	TOTAL AMOUNT
1	29-32-25-11-0010	BLOCK 1, LOT 2 - PSD, LLC		1580.0	5618.8	2758.8	SQ FT	$3.08	$13,675.20
2	29-32-25-11-0011	BLOCK 1, LOT 3 - NATIONAL GROWTH, LLC		1470.9	5604.7	2759.1	SQ FT	$3.08	$13,294.82
3	29-32-25-11-0013	14816 ARMSTRONG BLVD NW - PSD, LLC	16501.4	5000.4	660.0		SQ FT	$3.08	$68,258.34

ESTIMATED PROPERTY ACQUISITION TOTAL: **$95,228.36**

TOTAL ESTIMATE CONSTRUCTION COST: **$1,731,931.30**

TOTAL ESTIMATED PROPERTY & CONSTRUCTION COST: **$1,827,159.66**

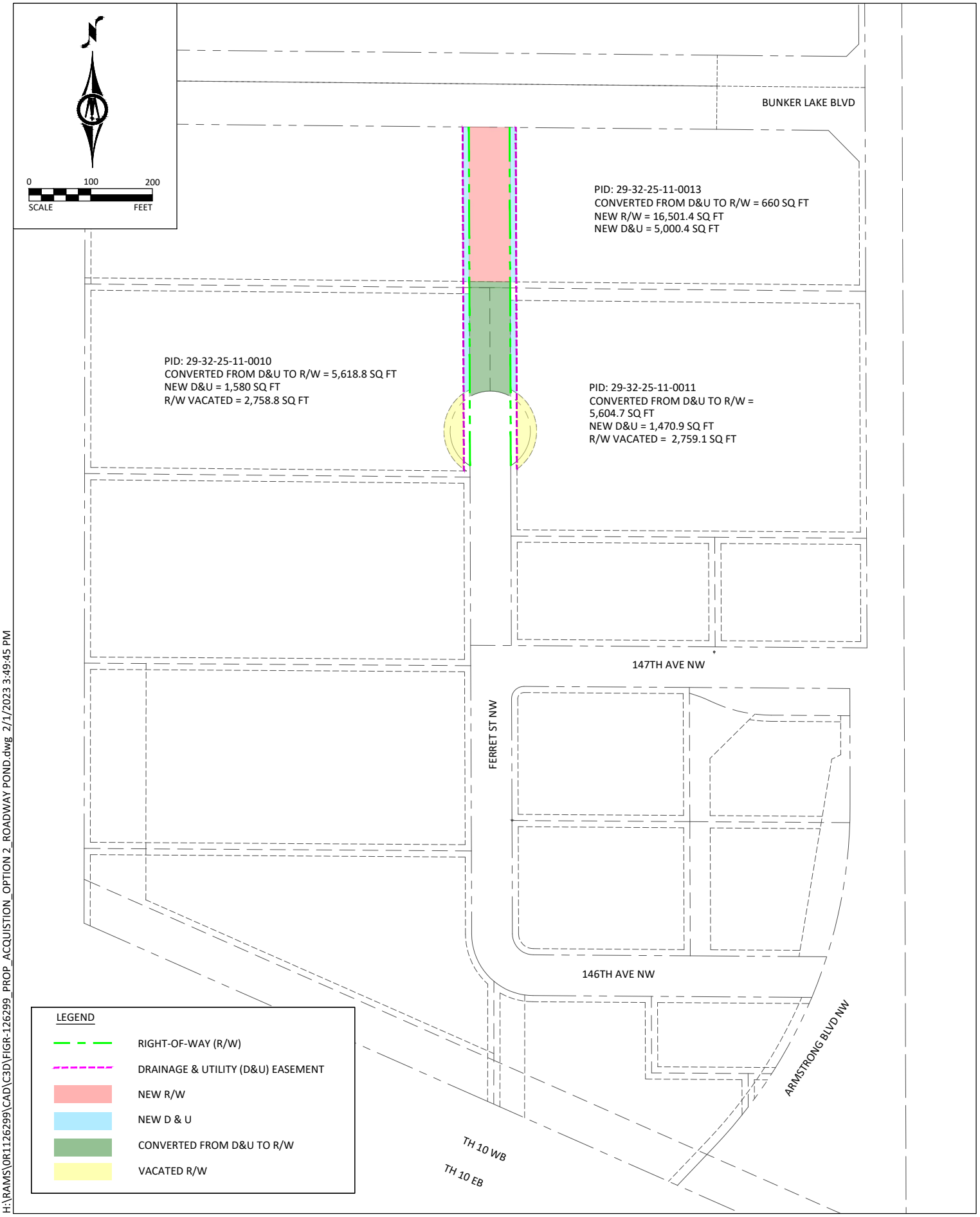
West Armstrong Redevelopment

City of Ramsey

Property Acquisition

February 2023

BOLTON & MENK



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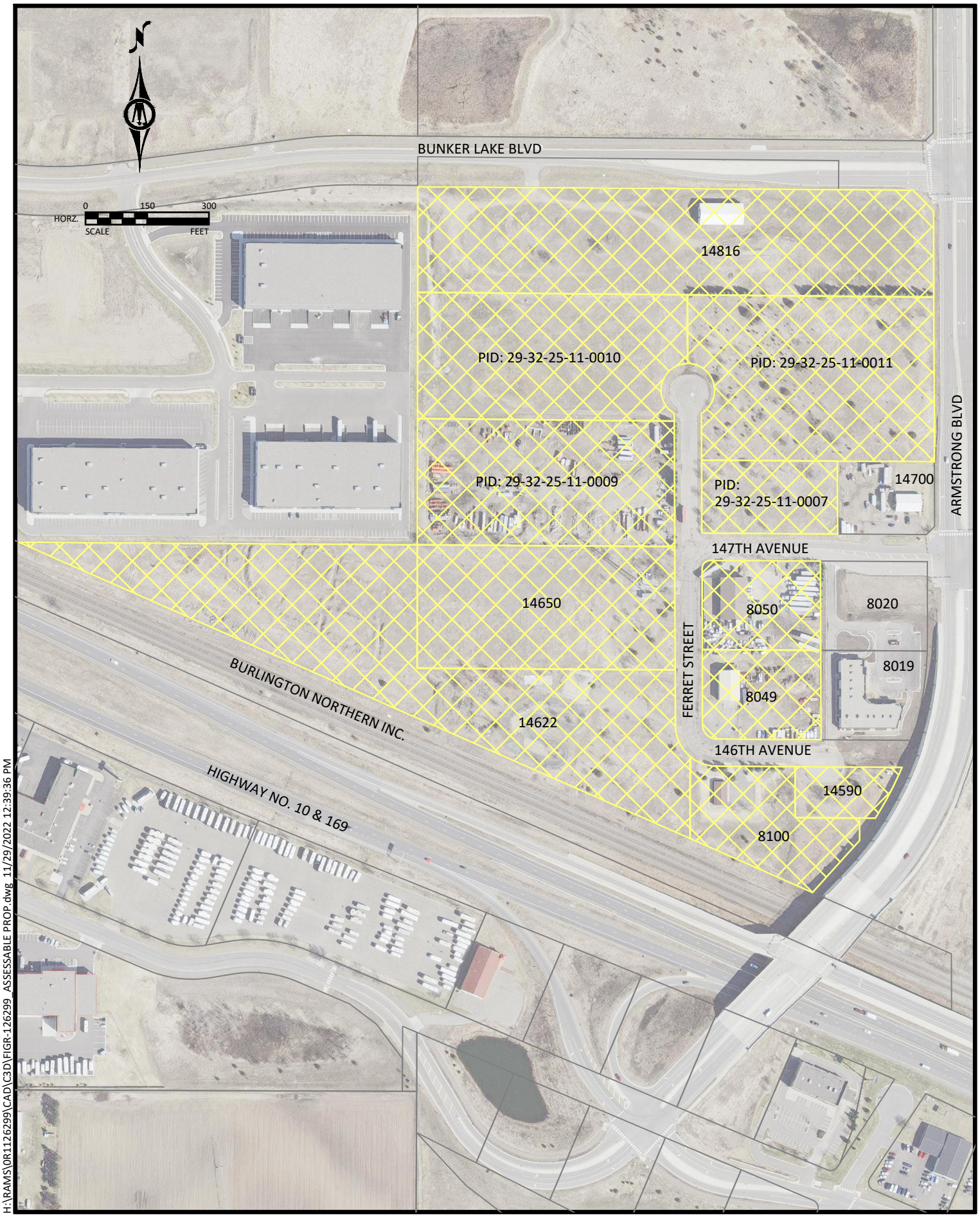
West Armstrong Redevelopment

City of Ramsey

Assessable Properties

November 2022

BOLTON & MENK



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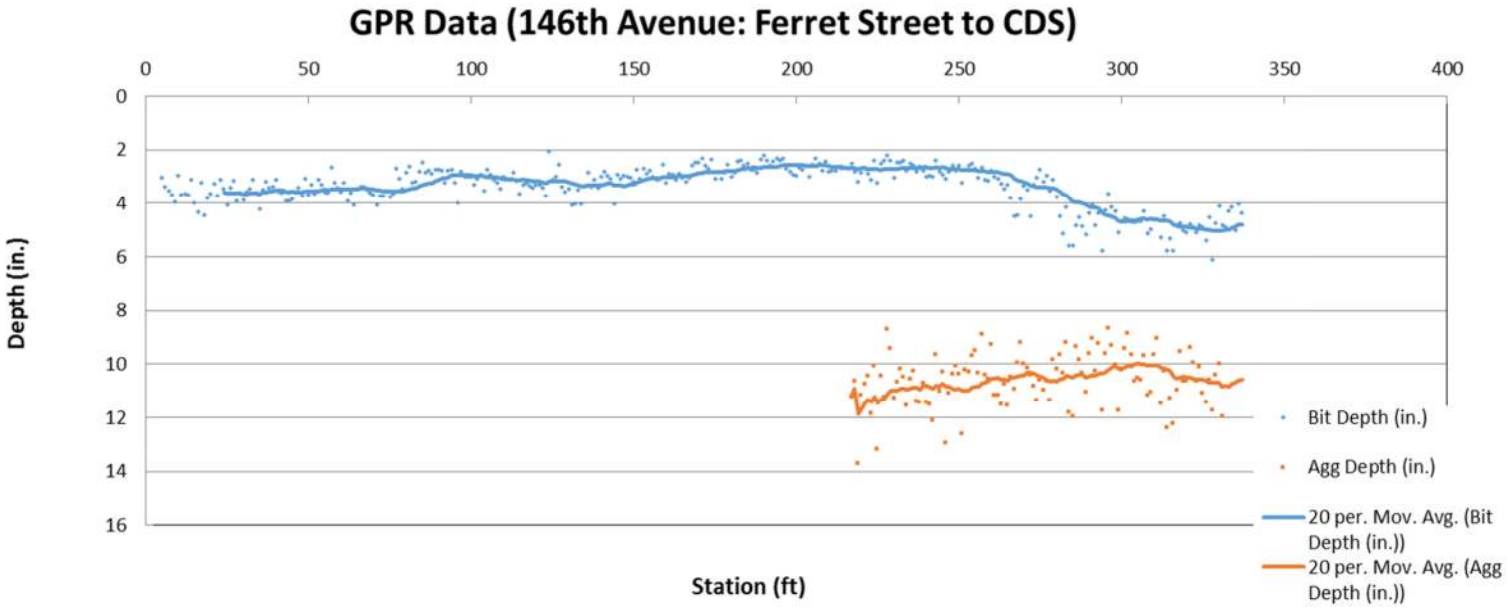
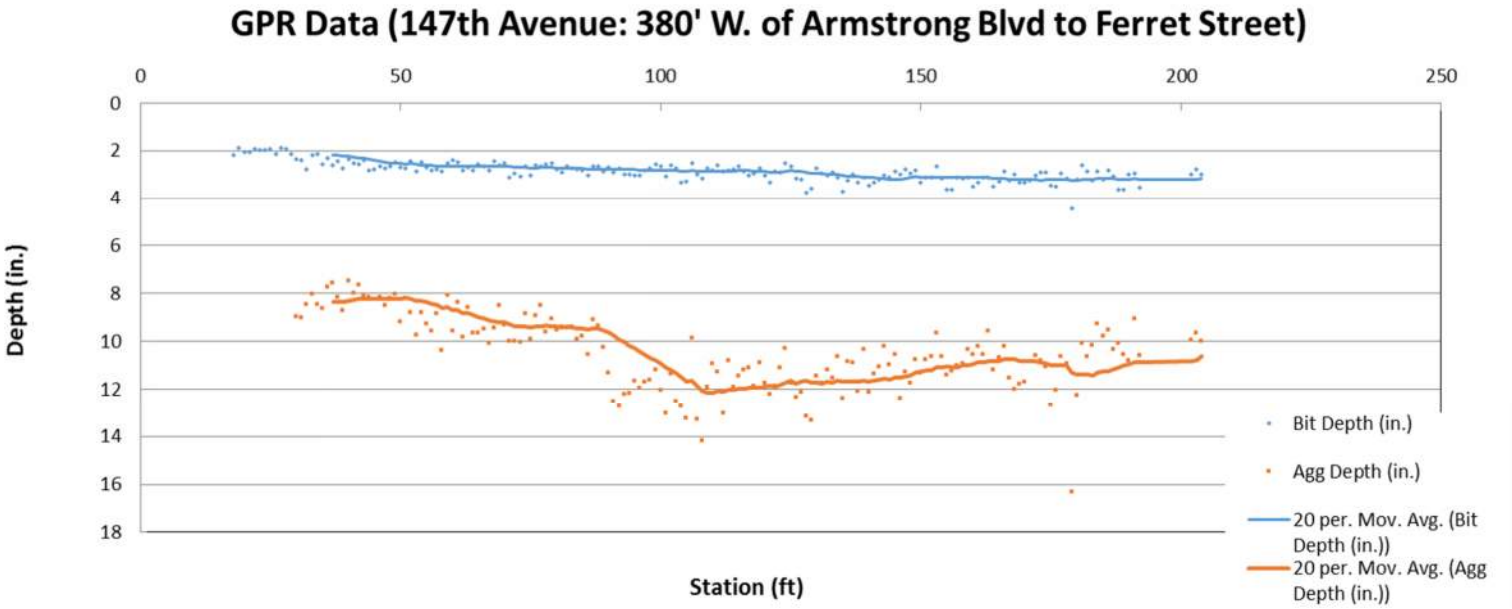
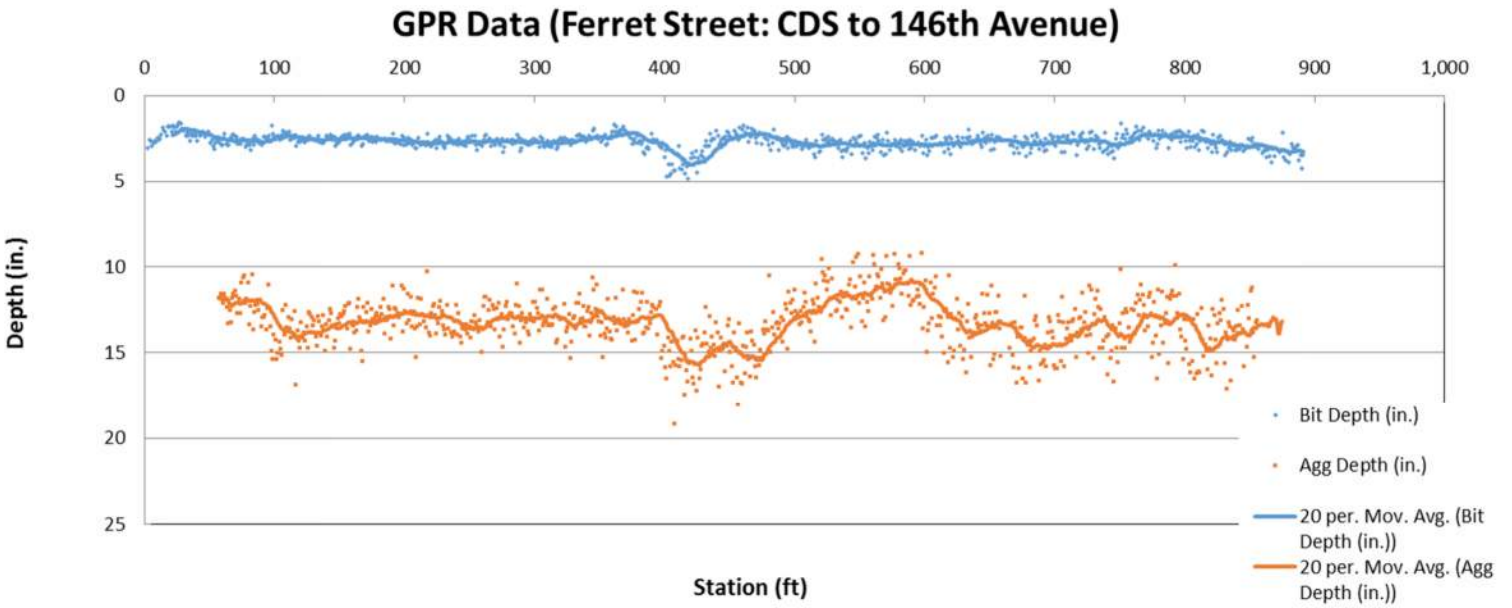
APPENDIX C

Ground Penetrating Radar (GPR) Results

HY-10 Ramsey GPR Summary										
Project Segment		**Pavement**			**Aggregate**			**Section**		
Street	**Segment Description**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Avg**	**Location**
146th Avenue	Ferret Street / CDS	2.0	6.1	3.4	4.3	10.5	6.8	8.6	10.6	296' east of Ferret Street.
147th Avenue	380' west of Armstrong Blvd. / Ferret Street	1.9	4.5	2.9	5.0	11.9	7.6	7.5	10.5	160' east of Ferret Street.
Ferret Street	CDS / 146th Avenue	1.6	4.9	2.7	6.6	15.5	10.6	9.3	13.3	250' north of 146th Avenue
Project Summary		*1.6*	*6.1*	*2.9*	*4.3*	*15.5*	*9.7*	*7.5*	*12.6*	*147th Avenue 160' east of Ferret Street.*




GPR Data (147th Avenue: 380' W. of Armstrong Blvd to Ferret Street)
Depth (in.)
Station (ft)
Bit Depth (in.)
Agg Depth (in.)
20 per. Mov. Avg. (Bit Depth (in.))
20 per. Mov. Avg. (Agg Depth (in.))


GPR Data (Ferret Street: CDS to 146th Avenue)
Depth (in.)
Station (ft)
Bit Depth (in.)
Agg Depth (in.)
20 per. Mov. Avg. (Bit Depth (in.))
20 per. Mov. Avg. (Agg Depth (in.))

APPENDIX D

Revised West Armstrong Area Traffic Analysis Memorandum
Report of Geotechnical Evaluation

BOLTON & MENK
Real People. Real Solutions.

7533 Sunwood Drive NW
Suite 206
Ramsey, MN 55303-5119

Ph: (763) 433-2851
Fax: (763) 427-0833
Bolton-Menk.com

MEMORANDUM

Date: November 17, 2022

To: City of Ramsey

From: Bryan Nemeth, P.E., PTOE

RE: West Armstrong Area Traffic Analysis – Anoka Ramsey Athletic Association (ARAA)
City of Ramsey, MN
City Project No.: 18-02

Development Considerations

The West Armstrong Area reviewed is bordered on the north by Bunker Lake Boulevard, on the south by TH 10, on the east by Armstrong Boulevard, and on the west by the ARAA site. The proposed ARAA recreation facility represents a new type of land use within this area.

A sports recreation facility has traffic peaking characteristics represented by the highest use starting in the PM peak hour and on weekends, with a high inbound and outbound volume (55% in, 45% out). This is a change from the employment district or light industrial land use which generates a higher outbound in the PM (31% in, 69% out).

The proposed ARAA facility has an area of 175,500 square feet with a support building and future expansion of 13,000 square feet. According to the ITE Trip Generation Manual (Multipurpose Recreation Facility) the site would result in approximately 675 trips during the PM peak hour.

Based on the comparison of forecasts between what was previously calculated for the West Armstrong area and the currently proposed land use, there is anticipated to be no difference in trips during the AM peak, but a significant difference in the PM peak.

Bunker Lake Boulevard Improvement Considerations

Roadway Section West of the Existing Median

For Bunker Lake Boulevard, the 3-lane section west of the median (just west of Armstrong Boulevard) is still adequate, as the change in land use affects it minimally in the PM (approx. 25 trips), and even less in the AM.

Right Turn Lanes

Bunker Lake Boulevard eastbound traffic entering any of the sites south of Bunker Lake Boulevard is low; although, with the change in land use, there is a higher potential for use of an eastbound right turn lane at Ferret Street. The need for a right turn lane was reviewed based on 734 through vehicles on eastbound Bunker Lake Boulevard plus 20 vehicles turning right. The right turn lane was determined not to be needed.

For westbound traffic, the amount of traffic coming from the east and entering any of the sites on the north was reviewed:

- For the first access west of Armstrong Boulevard, we estimated 400 employees, or 180 trips entering in the AM. The right turn lane was determined to not be needed as westbound traffic is relatively low (605 vehicles or less in the AM).
- Since the first access did not need a right turn lane, accesses further west wouldn't need right turn lanes either.

Left Turn Lane

For Ferret Street, just west of the existing median, the left turn volumes are estimated to be low in the AM peak but much higher in the PM peak. The industrial traffic will come from both Hwy 10 and from the north and east. Approximately 50% of the traffic entering the area will gain access at 147th Avenue.

The traffic to and from the ARAA recreational facility is projected to come from the residential areas of the City. This indicates that the amount of traffic from Bunker Lake Boulevard is likely to be higher, 55% at the Ferret Street and Bunker Lake Boulevard access:

- 25% from Armstrong Boulevard north of Bunker Lake Boulevard,
- 5% from the west on Bunker Lake Boulevard, and
- 25% from Bunker Lake Boulevard east of Armstrong Boulevard.

The remaining 45% of the traffic is projected to use 147th Avenue:

- 5% from Hwy 10,
- 5% from 147th east of Armstrong Boulevard,
- 20% from Armstrong Boulevard north of Bunker Lake Boulevard, and
- 15% from Bunker Lake Boulevard east of Armstrong Boulevard.

A left turn lane was found to be warranted in the AM based on the following:

- Roadway Speed = 40 mph,
- Advancing Volume = 823,
- Opposing Volume = 493, and
- Left turn volume estimated to be 38.

A left turn lane was found to be warranted in the PM based on the following:

- Roadway Speed = 40 mph,
- Advancing Volume 826,
- Opposing Volume 754, and
- Left turn volume estimated to be 205.

Based on the above information, a westbound left is appropriate for the westbound Bunker Lake Boulevard traffic at Ferret Street. With the low speeds and an urban setting, but significantly higher left turn volume in the PM peak hour due to the recreational facility, a minimum length 210-foot, full-width left turn lane would be appropriate. Tapers can be at either 10:1 or 15:1. There could be need for the left turn lane to be longer based on other development changes that could occur along Ferret Street.

Ferret Street and Bunker Lake Boulevard Intersection

Separate left and right turn lanes along northbound Ferret Street at Bunker Lake Boulevard are recommended.

Recommended Studies

With the change in traffic volumes noted above, we recommend more comprehensive traffic analyses being completed at the following locations:

- Bunker Lake Boulevard /Armstrong Boulevard,
- Bunker Lake Boulevard /Ferret Street, and
- Armstrong Boulevard /147th Street.

The storage length needs at the signalized intersections in the area should be also evaluated as a part of a future traffic analysis.

Other Considerations

The land use in the West Armstrong Area, south of Bunker Lake Boulevard and adjacent to Ferret Street, is zoned “COR” which allows a lot of flexibility. In our previous analysis, this area was considered light industrial, similar land use east of Puma Street and south of Bunker Lake Boulevard. If the West Armstrong Area evolves to more commercial orientated uses with the addition of the ARAA Facility and other facilities such as the Big Adventure Academy/Daycare and Anytime Fitness, additional analysis is warranted to understand the impacts of a more intensive land use.

REPORT OF GEOTECHNICAL EXPLORATION

West Armstrong Redevelopment Area
147th Avenue NW & Ferret Street NW
Ramsey, Minnesota

AET Project No. P-0004952

Date: March 30, 2022

Prepared for:

Bolton & Menk, Inc.

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
5548 Barthel Industrial Drive NE, Suite 550
Albertville, MN 55301
TeamAET.com • 800.792.6364

March 30, 2022

Bolton & Menk, Inc.
7533 Sunwood Drive NW
Ramsey, Minnesota 55303

Attn: Kevin Kielb, PE

RE: Geotechnical Exploration
West Armstrong Redevelopment Area
147th Avenue NW & Ferret Street NW, Ramsey, Minnesota
AET Report No. P-0004952

Dear Mr. Kielb:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for your West Armstrong Redevelopment Area project in Ramsey, Minnesota. These services were performed according to our proposal to you dated July 28, 2021.

We are submitting one electronic (.pdf) copy of the report to you.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services.

Sincerely,
American Engineering Testing, Inc.

Robert J. Olson, PE (MN)
Branch Manager
rolson@teamAET.com
Office: (651) 659-1316
Mobile: (763) 742-8651

SIGNATURE PAGE

Prepared for:

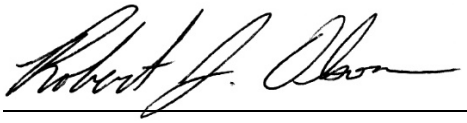
Bolton & Menk, Inc.
7533 Sunwood Drive NW
Ramsey, Minnesota 55303

Attn: Kevin Kielb, PE

Prepared by:

American Engineering Testing, Inc.
5548 Barthel Industrial Drive NE, Suite 500
Albertville, Minnesota 55301
(651) 659-9001/www.TeamAET.com

Authored by:



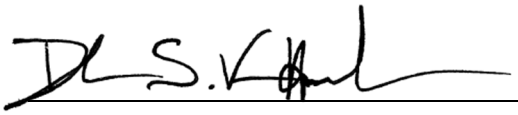
Robert J. Olson, PE (MN)
Branch Manager

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under Minnesota Statute Section 326.02 to 326.15

Name: Robert J. Olson

Date: March 30, 2022 **License #: 45023**

Reviewed by:



Derek S. Van Heuveln, PE (MN)
Senior Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

The city of Ramsey (City) is proposing to perform street and utility improvements in the West Armstrong Redevelopment Area in Ramsey, Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to you dated July 28, 2021, which you authorized on December 20, 2021. The authorized scope consists of the following.

- Drilling 3 standard penetration test borings to a depth of 14½ feet each.
- Performing soil laboratory testing.
- Performing a geotechnical engineering review based on the data and preparing this report.

These services are intended for geotechnical purposes only. The scope is not intended to explore for the presence or extent of environmental contamination in the soil or groundwater.

3.0 PROJECT INFORMATION

We understand the City is planning to reconstruct 147th Avenue NW, 146th Avenue NW, and Farret Street NW and extend Farret Street NW to the north. These improvements are located west of Armstrong Boulevard NW and south of Bunker Lake Boulevard. We understand that the project will involve reconstructing or constructing a bituminous roadway with public utilities (sewer and watermain).

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project consisted of 3 standard penetration test borings. The number of borings, boring locations, and boring depths were determined by Bolton & Menk. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic origins, and moisture condition. A density description or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The boring locations are shown on Figure 1 in Appendix A. The borings were located in the field by AET personnel by taping from nearby site features. Surface elevations were approximated based on the web application MnTOPO.

4.2 Laboratory Testing

The laboratory test program included water content testing and percent passing the #200 sieve tests. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed.

5.0 SITE CONDITIONS

5.1 Surface Observations

The bituminous roadway surface is in poor condition. The roadway has no curb or gravel shoulder; the shoulder area consists of grass with commercial/industrial businesses beyond the shoulder. The elevation of the roadway slopes downward from south to north with elevations from 874.8 to 869.3 feet at the boring locations. Driveways for the businesses connect to the roadway.

5.2 Subsurface Soils/Geology

The site geology consists of fill or topsoil overlying naturally deposited alluvial soils.

5.2.1 Bituminous Pavement/Fill

Bituminous pavement overlying fill or possible fill was encountered at the surface of Borings SB-2 and SB-3. The surface consisted of 2½ to 2¾ inches of bituminous pavement with approximately 8 inches of apparent gravel base. Beneath the aggregate base, silty sand and sand with silt layers encountered to depths of approximately 2 to 4 feet beneath existing grade. The sands with silt from 2 to 4 feet below grade were classified as “Coarse Alluvium or Fill” as

we were unable to determine the geologic origin from the recovered samples. We could not determine the geological origin based on the recovered samples. The fill and possible fill soils were frozen at the time of exploration. The fill is moderately slow draining and is judged to have moderate frost susceptibility.

5.2.2 Topsoil

Topsoil was encountered at the surface of Boring SB-1. The topsoil extended to a depth of about 1 foot beneath existing grade. The topsoil consists primarily of silty sand. These soils were mostly frozen to a depth of 1 foot. These soils are slow draining and highly susceptible to freeze-thaw movements. Due to the presence of vegetation, we judge these soils to be moderately compressible under structural loads.

5.2.3 Coarse Alluvium

Coarse alluvial sands exist beneath the topsoil, fill, or possible fill at all of the soil borings to the termination depths of the borings. The coarse alluvial soils consist of sands with silt and sands containing variable amounts of gravel, and could include cobbles and/or boulders. These alluvial soils range from very loose to medium dense and are judged to have moderate to moderately high strength and moderate to low compressibility under the anticipated structural loads. The sands and sands with silt are fast draining and are judged to have low susceptibility to freeze-thaw movements.

5.3 Groundwater

We encountered groundwater while drilling at Boring SB-1 at a depth of 10 feet which equated to an approximate elevation of 859.3 feet. As the borings terminated in free draining sands, we judge the measured water level to be reflective of the hydrostatic groundwater level conditions at that point in time.

Groundwater was not measured in Borings SB-2 and SB-3. Due to the borings terminating in free draining sands with silt and sands at depths/elevations near where the groundwater level was measured at Boring SB-1, we judge the water level to be below the depth explored at these boreholes at the time of exploration.

Groundwater levels fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors. The Minneapolis metro area has been in a low precipitation pattern for the last 2 years and the presently observed ground water levels may be lower than normal.

6.0 RECOMMENDATIONS

6.1 Definitions

The italicized words used in this section have specific definitions. These definitions are presented on the attached Standard Sheet entitled "Definitions Relating to Pavement Construction" or in ASTM Standards or MnDOT references.

6.2 Approach Discussion

We recommend that at a minimum the upper foot of fill be removed from beneath the proposed roadway extension and removal of the existing bituminous and aggregate base in the reconstruction portion of the project. Additional topsoil or fill may need to be removed based on the organic content of the soils or if soft or loose soils are encountered. We recommend these soils be evaluated by AET geotechnical personnel before new fill is placed. A subgrade R-value of 50 can be assumed for the anticipated subgrade.

6.3 Subgrade Preparation

To prepare the area for new roadway embankment placement, we recommend removing all existing pavement, aggregate base, and topsoil from below the roadway area. The excavation would need to include lateral oversizing to accommodate the lateral loads imposed.

The soils exposed in the subgrade excavations are likely to consist of silty sands, sands with silt, and sands. We recommend these soils be evaluated by AET geotechnical personnel before new fill is placed. If soft or unstable soils are observed, then correction should be performed as needed by subcutting and replacing the inferior soils; or by scarification, drying, and re-compaction.

Following excavation of inferior soils, new engineered fill can be placed as needed to re-attain subgrade elevation. *Suitable Grading Material* can be used as general embankment fill; except that where fill is placed over wet, unstable ground conditions or in standing water, cleaner granular soils should be used.

The fill should be placed per the requirements of MnDOT Specification 2106.3G.1 (Specified Density Method). This specification requires soils placed within the *critical subgrade zone* be compacted to a minimum of 100% of the *standard maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test), at a water content 65% to 102% of the *standard optimum water content*. This water content requirement does not apply to the *sand subbase* zone. A reduced

minimum compaction level of 95% of the *standard maximum dry unit weight* can be used below the *critical subgrade zone*.

6.4 Design R-Value

Based on the subgrade preparation recommendations presented herein, the pavement section (bituminous and aggregate base layers) can be designed based on an R-value of 50.

6.5 Utilities

Based on the conditions encountered at the boring locations, we judge the inorganic soils to be suitable to provide adequate support for utility construction. If silty soils are present at the trench bottom, a 4-inch thick Granular Bedding (MnDOT Specification 3149.F) layer should be placed beneath the pipe to improve support uniformity. We also recommend the removal of any cobbles/boulders in the trench bottoms prior to utility installation. This will reduce the potential for the development of point loads on the pipe that would not be accounted for in the pipe design.

Please refer to the attached standard sheet entitled “Utility Excavation Backfilling” and “Bedding/Foundation Support of Buried Pipe” for additional details regarding utility bedding and utility backfilling.

6.5.1 Trench Backfill

The excavated non-organic soils can be used as backfill for the new utility trenches. Excavated organic soils should not be used as backfill below the roadway. Review of our borings indicates that the trench backfill will primarily consist of sands with silt and sands. These types of soils are generally not considered corrosive. We recommend that bedding be placed uniformly around the pipe to avoid having dissimilar materials touch the pipe that could set up corrosion cells. In our opinion, all metallic utilities should be coated or wrapped.

Utility trench backfill should be placed per the requirements of MnDOT Specification 2106.3G.1 (Specified Density Method). The backfill soils should be placed in a maximum lift thickness of 1 foot or less for the granular soils and 8 inches or less for the cohesive soils. This specification requires all backfill soils placed within an excavation trench be compacted to a minimum of 100% of the *standard maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test). Consideration can be given to modifying the project specifications to allow for a reduced minimum compaction level of 95% of the *standard maximum dry unit weight* to be used below the *critical subgrade zone*. Backfill soils placed in the upper 3 feet of the subgrade should be compacted at a water content between 65% to 102% of the standard optimum water content.

The moisture content below the upper 3-foot zone shall be from 65% to 115% of the standard optimum water content.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Runoff Water in Excavation

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the groundwater can be handled with conventional sump pumping.

7.1.2 Disturbance of Soils

The on-site soils can be disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.1.3 Cobbles and Boulders

The soils at this site can include cobbles and boulders. This may make excavating procedures somewhat more difficult than normal if they are encountered.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or sloughing which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed in order to document that project specifications for compaction have been

satisfied.

8.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

9.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled “Geotechnical Report Limitations and Guidelines for Use.”

DEFINITIONS RELATING TO PAVEMENT CONSTRUCTION

Top of subgrade: Grade which contacts the bottom of the aggregate base layer.

Sand subbase: Uniform thickness sand layer placed as the top of subgrade which is intended to improve the frost and drainage characteristics of the pavement system by increasing drainage of excess water in the aggregate base and subbase, by reducing and "bridging" frost heaving, and by reducing spring thaw weakening effects.

Critical subgrade zone: The subgrade portion beneath and within three vertical feet of the top of subgrade. A sand subbase, if placed, would be considered the upper portion of the critical subgrade zone.

Suitable Grading Material: Mineral soil materials, typically from the project site, excluding the following: 1) soils which have an organic content exceeding 3%, 2) cohesive soils having a Liquid Limit exceeding 50%, 3) soils which include debris, cobbles, and/or boulders, and 4) soils which are considered acceptable from an environmental standpoint. The soil must also be capable of attaining the specified compaction level at its current water content or at a water content that can be reasonably scarified, blended, and moisture conditioned to a uniform water content in order to uniformly meet compaction requirements.

Granular Material: Soils meeting MnDOT Specification 3149.2B.1. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 20% by weight passing the #200 sieve.

Select Granular Material: Soils meeting MnDOT Specification 3149.2B.2. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 12% by weight passing the #200 sieve.

Select Granular Material (Super Sand): Soils meeting MnDOT Specification 3149.2B.3. This material is cleaner and coarser than Select Granular Material (see specification for specific requirements).

Compaction Subcut: Construction of a uniform thickness subcut below a designated grade to provide uniformity and compaction within the subcut zone. Replacement fill can be the materials subcut, although the reused soils should be blended to a uniform soil condition, moisture conditioned as needed to meet MnDOT Specification 2105.F; and re-compacted per the Specified Density Method defined in MnDOT Specification 2105.3F.1.

Test Roll: A means of evaluating the near-surface stability of subgrade soils (usually non-granular). Suitability is determined by the depth of rutting or deflection caused by passage of heavy rubber-tired construction equipment, such as a loaded dump truck, over the test area. Yielding of less than 1" is normally considered acceptable, although engineering judgment may be applied depending on the equipment used, soil conditions present, and/or depth below final grade.

Unstable Soils: Subgrade soils which do not pass a test roll. Unstable soils typically have water content exceeding the *standard optimum water content* defined in ASTM:D698 (Standard Proctor test).

Organic Soils: Soils which have sufficient organic content such that the soils engineering properties are negatively affected (typically more than 3% organic content). These soils are usually black to dark brown in color.

UTILITY EXCAVATION BACKFILLING

GENERAL

Clayey and silty soils are often difficult to compact, as they may be naturally wet or dry, or may become wet due to ground water or runoff water during construction. Soils will need to be placed within a certain range of water (moisture) content to attain desired compaction levels. Moisture conditioning to within this range can be time consuming and labor intensive, and will require favorable weather.

The degree of compaction and the soil type used for backfill within open cut utility excavations depends on the eventual function of the overlying land surface. Details are as follows:

ROADWAYS

Where trenches are located below roadways, we recommend using inorganic fill and compacting these soils per MnDOT Specification 2105.3F1 (Specified Density Method). On MnDOT funded roads, the 2016 Specification requires 100% compaction over the entire trench depth. On non-MnDOT funded roads, we feel the specification can be relaxed to the previous version of achieving 100% of the Standard Proctor density in the upper 3-foot subgrade zone, and 95% below this depth. Note that this specification also includes moisture content range requirements which are important for proper subgrade stability.

Where available soils are wet or of poor quality, it may be possible to use the “Quality Compaction Method” (MnDOT Specification 2105.3F2) for soils below the upper 3-foot subgrade zone if you can tolerate some subsidence. However, a high level of stability is still important within the upper subgrade zone and recommend that the “Specified Density Method" be used in this upper subgrade area. We caution that if backfill soils in the lower trench area are significantly unstable, it may be difficult or even impossible to properly compact soils within the upper 3-foot subgrade zone. In this case, road subgrade stability can be improved by placing a geotextile reinforcement fabric directly over the unstable soils followed by properly drained granular fill placement.

STRUCTURAL AREAS

If fill is placed beneath or within the significant zone of influence of a structure (typically a 1:1 lateral oversize zone), the soil type and minimum compaction level will need to be evaluated on an individual basis. Because trenches result in variable fill depths over a short lateral distance, higher than normal compaction levels and/or more favorable (sandy) soil fill types may be needed. If this situation exists, it is important that special geotechnical engineering review be performed.

NON-STRUCTURAL AREAS

In grass/ditch areas, backfill soils should be placed in reasonable lift thicknesses and compacted to a minimum of 90% of the Standard Proctor density (ASTM: D698) and/or per the MnDOT “Quality Compaction Method.” If lower compaction levels are accepted, more noticeable subsidence at the surface can occur. Steep or high slopes require special consideration, and if this situation exists, it is important that special geotechnical engineering review be performed.

SPECIAL CASES

Structural retention systems are often used to reduce impacts on adjacent streets/improvements. If localized excavations/pits or annular spaces are created which need to be backfilled, it may not be possible to place and compact soils by the conventional means of backfilling. Retraction of structural systems can also leave soils loosened. Significant settlement can occur in areas where backfill cannot be compacted. If these situations are located in non-structural or non-paved areas, it may be reasonable to accept the settlements and associated follow-up maintenance in order avoid the high cost of trying to compact the soil or placing flowable lean concrete fill. However, there may be areas where fill settlement needs to be avoided, especially as the settlement will be differential from the surrounding surface, or differential from a buried structure in the case of higher piping entering the structure. Where settlement needs to be avoided, the specification should require that the contractor submit a backfill compaction plan along with the retention plan. Improper sequencing of retention system removal and backfilling of the pits could result in excessive settlement and/or lateral movement of nearby improvements.

BEDDING/FOUNDATION SUPPORT OF BURIED PIPE

GENERAL

This page addresses soil bedding and foundation support of rigid pipe, such as reinforced concrete, and flexible pipe, such as steel and plastic. This does not address selection of pipe based on loads and allowable deflections, but rather addresses the geotechnical/soil aspects of uniform pipe support. Bedding/foundation support needs relate to local conditions directly beneath and to the sides of the pipe zone, which may be influenced by soft in-situ ground conditions or by soil disturbance due to soil sensitivity or ground water. Bedding relates to granular materials placed directly beneath the bottom of the pipe (usually 4" to 6" thick), which is intended to provide increased support uniformity. We refer to foundation soils as thicker layers of sands and/or gravels (beneath the bedding zone) intended to provide increased foundation strength support, usually needed due to soft, unstable and/or waterbearing conditions.

GRANULAR BEDDING

With circular pipes, high local loads (approaching point loads) develop if pipes are placed on hard surfaces. Load distribution is improved by placing granular bedding materials beneath the pipe, which are either shaped to match the pipe bottom or are placed without compaction to allow "settling in." The bedding should be placed in such a manner that the pipe will be at the proper elevation and slope when the pipe is laid on the bedding. Common bedding material is defined in MnDOT Specification 3149.2F, Granular Bedding. Published documents recommend rigid pipes having a diameter of 12" to 54" be placed on a bedding thickness of 4", which increases to 6" of bedding for pipe diameters ranging from 54" to 72". Beyond a 72" diameter, the bedding thickness can be equal to the pipe outside diameter divided by 12. Typically, the need for bedding under small diameter pipes (less than 12") depends on the pipe designer's specific needs, although in obvious point loads situations (bedrock, cobbles, significant coarse gravel content), bedding is recommended. Note that bedding should also account for larger diameter bells at joints.

FOUNDATION FILL

Positive uniform strength is usually compromised in soft or unstable trench bottom conditions. In this case, deeper subcuts and foundation fill placement is needed beneath the pipe. In moderate instability conditions, improvement can likely be accomplished with a thicker bedding layer. However, in more significant instability situations, particularly where ground water is present, coarser materials may be needed to provide a stronger foundation. Thicker gravel layers can also be a favorable media from which to dewater. The following materials would be appropriate for stability improvement, with the coarser materials being appropriate for higher instability/ground water cases.

- Fine Filter Aggregate – MnDOT Specification 3149.2J
- Coarse Filter Aggregate –MnDOT Specification 3149.2H

When using a coarser material which includes significant void space, we highly recommend enveloping the entire gravel layer within a geotextile separation fabric. The gravel material includes open void space, and the fabric acts as a separator which minimizes the intrusion of fines into the open void space. If additional granular bedding sand is used above foundation gravel, the fabric would also prevent downward infiltration of bedding sand into the rock void space.

Although it is preferred to not highly compact thin granular bedding zones directly beneath the pipe center, it is desirable to compact the foundation materials to prevent more significant pipe settlement. We recommend foundation fill be compacted to a minimum of 95% of the Standard Proctor density (ASTM: D698). It is not possible to test coarse rock fill, although this material should still be well compacted/ tamped.

Often, pipes entering structures such as catch basins, lift stations, etc., enter the structure at a higher elevation than the structure bottom, and are therefore placed on the structure backfill. Fill beneath these pipes should be considered foundation fill. Depending on the flexibility of the connection design, it may be necessary to increase the minimum compaction level to reduce differential settlements, particularly with thicker fills.

SIDE FILL SUPPORT

If the pipe designer requires support from the side fill, granular bedding should also be placed along the sides of the pipe. In poor soil conditions, the sand fill may need to be placed laterally up to two pipe diameters on both sides of the pipe. With rigid pipe, compacted sand placement up to the spring line (within the haunch area) is usually sufficient. With flexible pipe, side fill should be placed and compacted at least to the top of the pipe. For positive support, it is very important to properly compact the sands within the haunch area.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Boring Locations
Subsurface Boring Logs

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0004952

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling three (3) standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Material in Soils Finer than the #200 (75 micron) Sieve

Conducted per AET Procedure 01-LAB-060, which is performed in general conformance with ASTM: D1140.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

SAMPLING METHODS

Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2" O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil. After an initial set of 6", the number of hammer blows to drive the sampler the final 12" is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

Most of today's drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30". The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviations of the N-values using this method are significantly better than the standard ASTM Method.

Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

CLASSIFICATION METHODS

Soil classifications shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

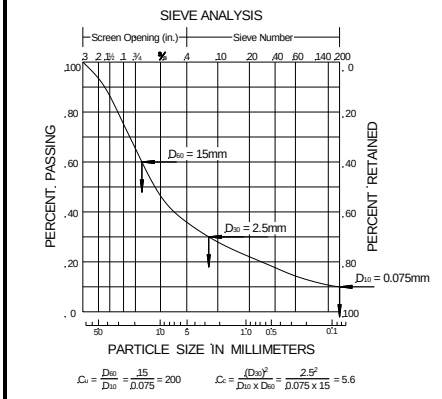
Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu≥4 and 1≤Cc≤3[E]	GW	Well graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu≥6 and 1≤Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 and/or 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]

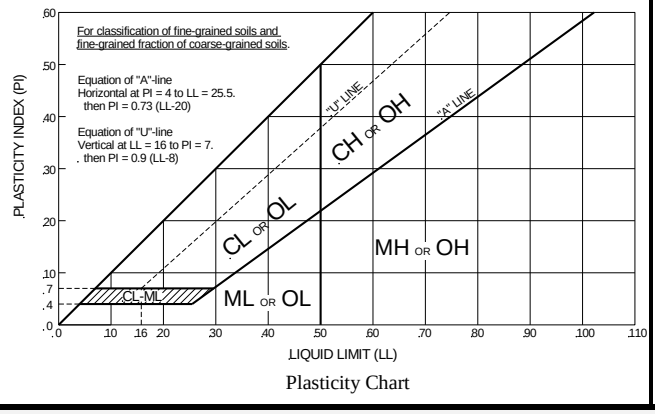
Notes

[A]Based on the material passing the 3-in (75-mm) sieve.
[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.
[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H]If fines are organic, add "with organic fines" to group name.
[I]If soil contains ≥15% gravel, add "with gravel" to group name.
[J]If Atterberg limits plot is hatched area, soil is a CL-ML silty clay.
[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.
[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N]PI≥4 and plots on or above "A" line.
[O]PI<4 or plots below "A" line.
[P]PI plots on or above "A" line.
[Q]PI plots below "A" line.
[R]Fiber Content description shown below.





Plasticity Chart

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition

(MC Column)

D (Dry): Absence of moisture, dusty, dry to touch.
M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing): Free water visible, intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.
Lenses: Pockets or layers greater than ½" thick of differing material or color.

Peat Description

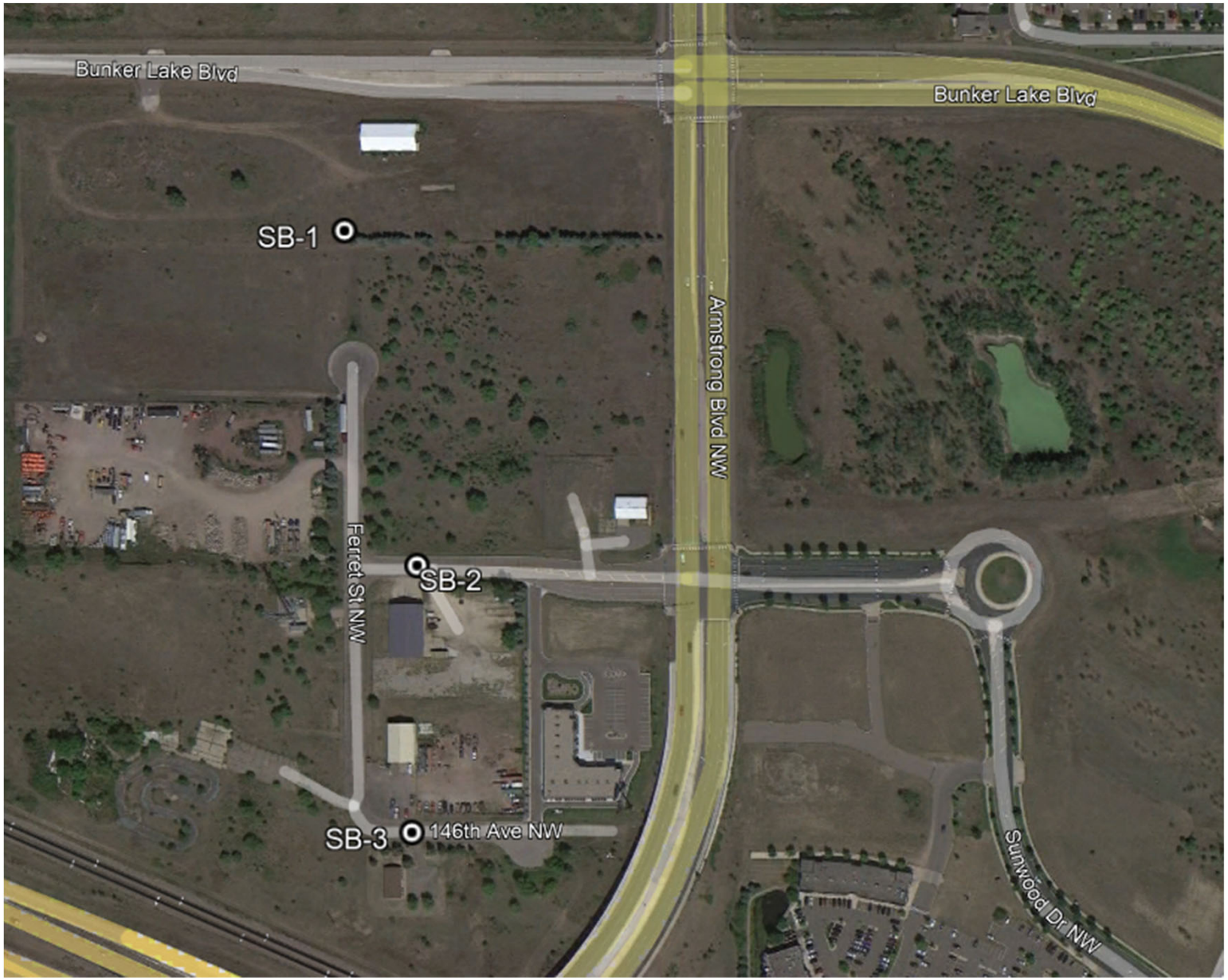
Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots: Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.



AMERICAN ENGINEERING TESTING	**PROJECT** West Armstrong Redevelopment; Ramsey, Minnesota			**AET NO.** P-0004952
	SUBJECT Boring Locations			**DATE** March 2022
	SCALE As Shown	**DRAWN BY** RJO	**CHECKED BY** DSV	**FIGURE 1**

SUBSURFACE BORING LOG

AET No: **P-0004952** Log of Boring No. **SB- 1 (p. 1 of 1)**

Project: **West Armstrong Redevelopment Area Project; Ramsey, MN**

DEPTH IN FEET	Surface Elevation **869.3** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	SILTY SAND, fine to medium grained, dark brown, frozen (SM)	TOPSOIL		F/M	SU						
2	SAND, fine grained, brown, moist, loose (SP)	COARSE ALLUVIUM									
3			6	M	SS	12	4				4
4											
5	SAND WITH SILT, fine to medium grained, brown, moist, very loose, laminations of clayey sand (SP-SM)		4	M	SS	10					
6											
7	SAND, a little gravel, fine to medium grained, grayish brown, moist to about 10' then waterbearing, loose to very loose (SP)										
8			8	M	SS	12					
9											
10			7	M/W	SS	8					
11											
12											
13											
14			3	W	SS	7					
	END OF BORING										

*WD - Water level measured while drilling
*AD - Water level measured at completion of drilling

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-13' 3.25" HSA	**1/12/22**	***WD**					**10.0**	
	1/12/22	***AD**		**13.0**	**7.0**		**10.5**	
BORING COMPLETED: **1/12/22**								
DR: **BR** LG: **DR** Rig: **GRD751**								

AET_CORP P-0004952 WEST ARMSTRONG REDEVELOPMENT.GPJ AET+CPT+WELL.GDT 1/18/22

SUBSURFACE BORING LOG

AET No: **P-0004952** Log of Boring No. **SB- 2 (p. 1 of 1)**

Project: **West Armstrong Redevelopment Area Project; Ramsey, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION (Surface Elevation 872.9)	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	2.75" Bituminous pavement 8" Aggregate base course FILL, mostly silty sand, a little gravel, brown with a little dark brown, frozen	FILL		F	SU						
2–3	SAND WITH SILT, a little gravel, fine grained, brown, frozen (SP-SM) (possible fill)	COARSE ALLUVIUM OR FILL		F	SU	6	3				7
4–6	SAND WITH SILT, fine grained, brown, moist, medium dense (SP-SM)	COARSE ALLUVIUM	14	M	SS	12					
7–11	SAND, a little gravel, fine to medium grained, brown, moist, loose to very loose (SP)		5	M	SS	10					
			3	M	SS	10					
12–14	SAND WITH SILT, a little gravel, fine to medium grained, grayish brown, moist, loose, laminations of clayey sand (SP-SM)		6	M	SS	10					
	END OF BORING										

*WD - Water level measured while drilling
*AD - Water level measured at completion of drilling

DEPTH: DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-13' 3.25" HSA	**1/12/22**	***WD**					**None**
	1/12/22	***AD**					**None**
BORING COMPLETED: **1/12/22**							
DR: **BR** LG: **DR** Rig: **GRD751**							

WATER LEVEL MEASUREMENTS

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0004952 WEST ARMSTRONG REDEVELOPMENT.GPJ AET+CPT+WELL.GDT 1/18/22

SUBSURFACE BORING LOG

AET No: **P-0004952** Log of Boring No. **SB- 3 (p. 1 of 1)**

Project: **West Armstrong Redevelopment Area Project; Ramsey, MN**

DEPTH IN FEET	Surface Elevation **874.8** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	2.5" Bituminous pavement 8" Aggregate base course FILL, mostly silty sand with gravel, dark brown, frozen	FILL		F	SU						
3	SAND WITH SILT, a little gravel, fine to medium grained, brown with a little dark brown, frozen (SP-SM) (possible fill)	COARSE ALLUVIUM OR FILL		F	SU		4				7
5	SAND, a little gravel, fine to medium grained, grayish brown, moist, loose to very loose to loose (SP)	COARSE ALLUVIUM	7	M	SS	12	3				3
8			3	M	SS	12					
10			6	M	SS	12					
13	SAND, a little gravel, fine to medium grained, brown, moist, loose, laminations of silty sand (SP)		8	M	SS	12					
14	**END OF BORING**										

*WD - Water level measured while drilling
*AD - Water level measured at completion of drilling

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-13' 3.25" HSA	**1/12/22**	***WD**					**None**	
	1/12/22	***AD**					**None**	
BORING COMPLETED: **1/12/22**								
DR: **BR** LG: **DR** Rig: **GRD751**								

AET_CORP P-0004952 WEST ARMSTRONG REDEVELOPMENT.GPJ AET+CPT+WELL.GDT 1/18/22

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0004952

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Understand the Geotechnical Engineering Services Provided for this Report

Geotechnical engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical engineering services is typically a geotechnical engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

B.2.2 Geotechnical Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client.

Likewise, geotechnical engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

1 Geoprofessional Business Association, 1300 Piccard Drive, LL14, Rockville, MD 20850
Telephone: 301/565-2733: www.geoprofessional.org, 2019

B.2.3 Read the Full Report
Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. Read and refer to the report in full.

B.2.4 You Need to Inform Your Geotechnical Engineer About Change
Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, always inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

B.2.5 Most of the "Findings" Related in This Report Are Professional Opinions
Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

B.2.6 This Report's Recommendations Are Confirmation-Dependent
The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

B.2.7 This Report Could Be Misinterpreted
Other design professionals' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

B.2.8 Give Constructors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious

problems this practice has caused, include the complete geotechnical engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material for information purposes only. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

B.2.9 Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.10 Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical engineering study. For that reason, a geotechnical engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

B.2.11 Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.