MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

Meeting: Board of Managers
Meeting date: 2/27/2025
Agenda Item #: 12.1
Item type: Board Discussion

Title:	60% Design Update: East Auburn Wetland Restoration Project
Prepared by:	Rachel Baker, Planner-Project Manager Phone: 952-641-4522 rbaker@minnehahacreek.org

Purpose:
At the February 27, 2025, Minnehaha Creek Watershed District (MCWD) Board of Managers meeting, staff will provide an update on the progress of the East Auburn Wetland Restoration project, including review of the 60% design plans (attached), and lead a discussion on project design details and forthcoming permitting process.

Background:
The 2017 Watershed Management Plan (WMP) for the Minnehaha Creek Watershed District (MCWD) states that the main cause of impairments in East Auburn Lake is phosphorus being exported from nearby wetlands and entering the lake. The WMP also identifies the wetland systems between Wassermann Lake and East Auburn Lake (East Auburn Wetland or wetland) as a potential restoration opportunity to address nutrient export to East Auburn Lake.

In early 2023, MCWD contracted with Moore Engineering to complete a feasibility study that identified opportunities to address phosphorus export from East Auburn Wetland. The feasibility report identified hydrologic restoration of the wetland through the installation of an outlet control structure (sheet pile weir) as the most cost-effective and feasible opportunity to reduce nutrient export from the wetland system by approximately 50% to East Auburn Lake while restoring the wetland to a more natural hydrologic condition.

At the January 25, 2024 meeting, the Board received an update from staff on the outcomes of the feasibility study and staff's recent coordination to initiate project design with the City of Victoria (City), which owns the land on which the project will occur. The Board was informed that the City supports the District's project goals and wishes to facilitate project development and implementation, and potentially integrate trail improvements (boardwalk) along with the proposed outlet control structure.

On May 9, 2024, following a competitive request for proposal process, MCWD selected Moore Engineering as the consultant for the design of the outlet control structure, and a potential new boardwalk, in consideration of the water quality benefits to downstream East Auburn Lake.

Due to above average precipitation levels throughout the months of June and July 2024, geotechnical work completed during the summer would require expensive mats for the machinery. In consideration of the design engineer and their understanding of the site and its conditions, MCWD agreed with Moore's recommendation to pause the project until water levels in the wetland declined and the geotechnical evaluation could be completed without the use of the mats. At the August 22, 2024 Policy and Planning Committee meeting, staff provided an update on the 30% design milestone of both the weir and the boardwalk, and offered reflections on the decision to pause the project until conditions were more favorable to complete geotechnical evaluation.

Geotechnical evaluation of the project site was completed in early December 2024. Results of the evaluation were generally favorable, with stiff clays identified within seven feet of the wetland surface. The results allowed the design team to progress with additional design elements, including determining the depth needed for the sheet pile weir and boardwalk helical piers.

MCWD received the 60% design memo, engineering plans, and revised opinion of probable cost (OPC) on February 20, 2025. Additional modeling of the system revealed that the 30% design weir elevation of 944.0 was unachievable due to a rise of the 100-year High Water Level (HWL) on Wasserman Lake. The design team altered the weir by removing the notch and lowering the sheet pile elevation to 943.9 to achieve no-rise conditions on all nearby FEMA Zone A waterbodies (Wasserman Lake, Carl Krey, and Auburn Lake). Project staff are in coordination with the permitting team and other agency partners as MCWD works through remaining permitting requirements.

The boardwalk designs have been updated to reflect the City's desire to create a leaner and less costly boardwalk. Project staff also delivered a draft term-sheet to the City of Victoria that covers terms for construction and maintenance access as well as terms for repayment of boardwalk construction costs.

At the February 27, 2025 Board of Managers meeting, staff will give a presentation outlining the 60% design milestone of both the weir and the boardwalk, and provide reflections on the revised OPC as well as the remaining permitting processes required to deliver the project.

Attachments

- East Auburn Wetland Restoration 60% Design package

Two Carlson Parkway, Ste 110, Plymouth, MN 55447
P: 612.355.7726

Memorandum

Date: February 18th, 2025

Prepared By: Dan Elemes, PE
Quentin Scott, PE
Jeff Madejczyk

Project: East Auburn Wetland Restoration
Subject: 60% Design Summary Memo

Narrative:

Minnehaha Creek Watershed District (MCWD) hired Moore Engineering, Inc. (Moore) to design a sheet pile weir in a wetland in Victoria, MN. The wetland is located between Wassermann Lake (upstream) and East Auburn Lake (downstream) as shown in Figure 1. Studies conducted by MCWD and its consultants identified the wetland as a contributor of phosphorus to East Auburn Lake. MCWD funded a feasibility study in 2023 to evaluate potential improvement alternatives to prevent phosphorus from leaching from the wetland into the lake. One of the improvement options, a sheet pile weir, was selected for implementation. This memorandum describes Moore's design of the sheet pile weir and the effects on adjacent water levels.

Figure 1: Project Location

Existing Conditions

The existing East Auburn wetland complex contains four cells as shown in Figure 2. Cell 1 is the upstream most cell and receives water from Wassermann Lake. The wetland, and particularly Cell 1, has been identified as a source of phosphorus loading to East Auburn Lake. This finding was documented in the East Auburn Wetland Phosphorus Analysis (Beck, 2019), which was completed to better understand phosphorus loading to the lake. Cell 1 was identified as the most likely source of phosphorus release. Subsequent studies determined phosphorus leaching from Cell 1 occurs during dry conditions, where phosphorus leaches out of Cell 1's underlying soil and is discharged to the lake.

Six Mile Creek flows through the wetland complex, connecting Wasserman and East Auburn Lake. Within the proposed project area, there is a pedestrian trail on either side of Cell 1 that is connected by a boardwalk that roughly separates Cell 1 and Cell 2.

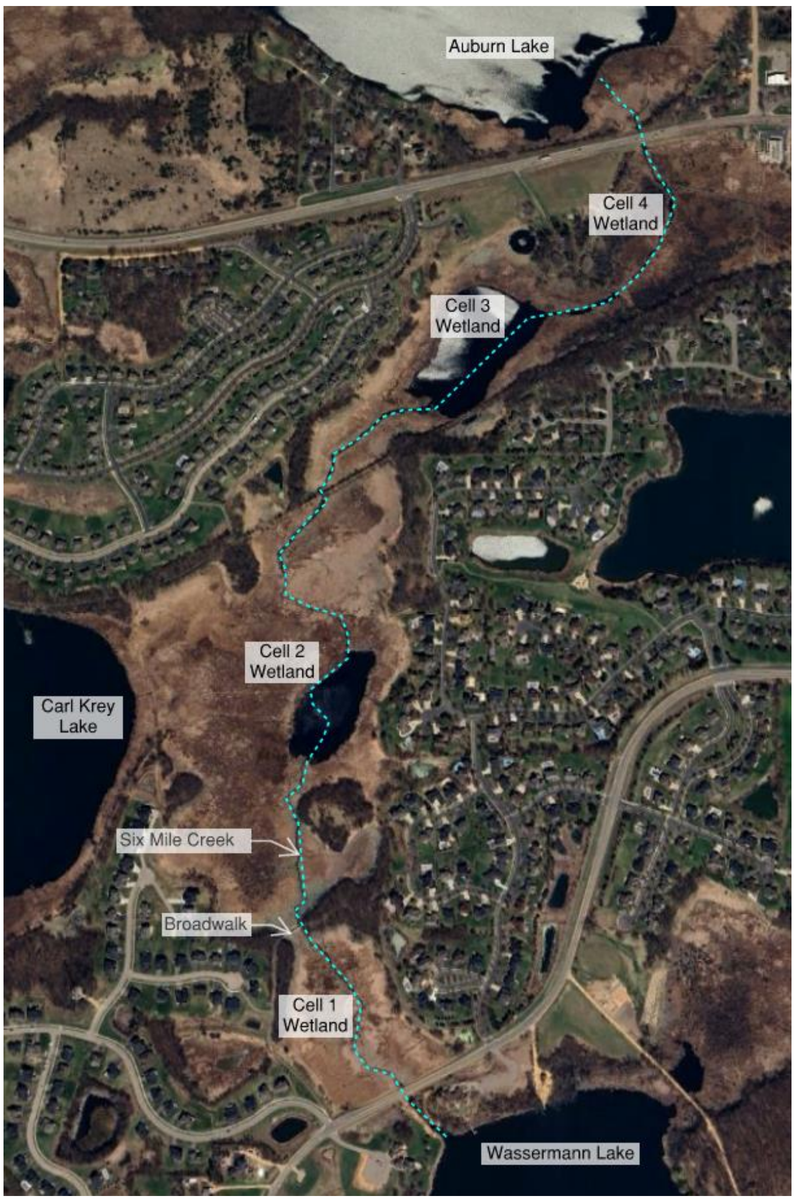

Figure 2: Wetland Complex

Proposed Conditions

A 2023 feasibility study identified installing a sheet pile weir to prevent the underlying soil in Cell 1 from drying out, by raising the wetland's normal water level with the intent of maintaining saturated conditions for the underlying soil and preventing phosphorus-rich groundwater from draining through the channel that cuts through the wetland cells. Under existing conditions, the channel through Cell 1 is at an elevation of 942.21 (unless clearly stated otherwise, all elevations referenced in the body of the text are in reference to the North America Vertical Datum of 1988 (NAVD88). The proposed sheet pile will have a low flow runout elevation set to 943.9. The sheet pile will be installed along the entire length of the wetland offset from the boardwalk. Depending on future discussions between MCWD and the City, the boardwalk may be replaced in conjunction with the sheet pile weir, but as a separate structure.

Methodology and Objectives

Moore received an existing XPSWMM model from MCWD that has the entire watershed modeled and is maintained and updated by MCWD. Moore truncated the model to focus on the Six Mile Creek (SMC) watershed, which includes the wetland complex, Wassermann Lake, and East Auburn Lake. The wetland complex was subdivided into its four cells, as the provided model considered the entire wetland complex as a single cell. Subdividing the single complex into its four cells allows for an understanding of cell-specific high-water levels, discharge rates between the cells, and how constructing the sheet pile weir could affect adjacent properties. This approach is necessary to demonstrate how the project and its impacts meet MCWD regulations regarding floodplain management, discharge rates, high-water levels, and other rules.

Moore updated modeled culverts and natural channels with collected survey data. New, cell-specific storage curves were developed based on LiDAR. It should be noted that modeled elevations in the MCWD XPSWMM model are in the National Geodetic Vertical Datum of 1929 (NGVD29). In the location of the project, NAVD88 is 0.23 feet higher than NGVD29. Moore converted survey data and LiDAR from the NAVD88 datum to the NGVD29 datum for purposes of updating the model.

Hydraulic connections from one cell to another were input based on survey information. Overflows between the cells were supplemented based on LiDAR, where survey information was unavailable. Hydrologic inputs were updated to reflect the smaller, cell-specific drainage area. However, area was the only input parameter that was changed for the hydrologic components; watershed percent impervious, widths, and soils information were not altered. Moore executed the model to evaluate existing conditions. The existing model was updated to include a sheet pile weir to control water levels on Cell 1. Moore designed the sheet pile weir with the target objectives summarized in Table 1 below.

Location	Existing 100-yr HWL	Maximum Elevation	Target Objective
Wasserman Lake	946.27	946.27	No-rise; in Zone A
Carl Krey Lake	945.70	945.70	No-rise; in Zone A
Lake Auburn	942.01	942.01	No-rise; in Zone A
Cell 1	945.49	946.00	Increase permissible as long as increase stays within public property or within wetland boundary, and does not affect Zone A floodplain
Cell 2	945.49	946.00	
Cell 3	944.52	946.00	
Cell 4	943.20	946.00	

Table 1: HWL Constraints

Findings

The sheet pile weir profile, shown in **Error! Reference source not found.** below and in Attachment 1, meets the objectives listed in Table 1 above. The no-rise objective was achieved at Wasserman, Carl Krey, and Auburn Lakes. Cells 1, 2 and 4 do increase, but within permissible limits.

During the initial iterations it was found that the HWLs within Wasserman Lake were the most sensitive to the sheet pile installation. Moore then focused on achieving the no-rise within Wasserman. The original design assumption was that the sheet pile's overflow elevation would be set at 944.00 and the sheet pile would have a narrow notch (20-50 feet) that would allow for the 2-year event to pass through and then a larger section that would accommodate the 10- and 100-year events. However, with the sheet pile overflow being set to 944.00 it became the new controlling elevation for Wasserman Lake. Given that Wasserman must maintain no-rise conditions the only option was to lower the entire sheet pile weir to 943.90. The design still allows for a permanent pool within Cell 1 and doesn't restrict flow or create high head during the larger events.

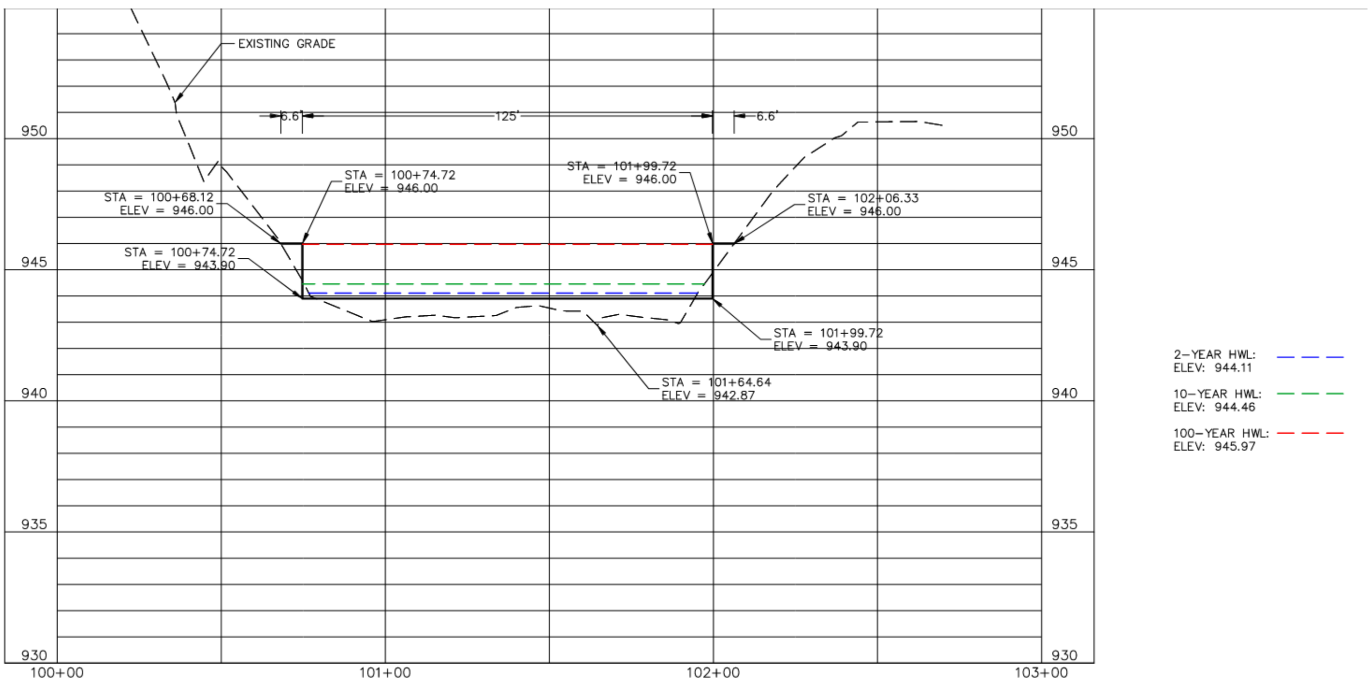

Figure 3: Sheet Pile Profile

Moore reviewed preliminary findings with MCWD to discuss the increase within the wetland cells. A recent wetland delineation on an adjacent property to Cells 3 and 4 from 2023 closely followed the contour of 946.00. Therefore, the elevation of 946.00 was then the assumed edge of wetland for each cell given they are all connected. It was determined that a minor increase in HWL, as long as it stays within wetland boundaries would be acceptable as fill within the wetland, business operations, or residential use of wetland would not be allowed per current wetland regulation. While the current design does increase the HWL within three of the cells, none are above 946.00, as shown Figure 4 below.

Figure 4: Site HWLs

Table 2 through Table 4 summarize modeled HWLs on the lakes and wetlands considered as part of this analysis.

Proposed 100-yr HWL				
Name	Existing	Target Maximum Elevation	Proposed	Change (ft)
Wasserman Lake	946.27	946.27	946.27	±0.00
Carl Krey Lake	945.70	945.70	945.70	±0.00
Lake Auburn	942.01	942.01	942.01	±0.00
Cell 1	945.49	946.00	945.51	+0.02
Cell 2	945.49	946.00	945.50	+0.01
Cell 3	944.52	946.00	944.52	±0.00
Cell 4	943.20	946.00	944.21	+0.01

Table 2: Proposed 100-yr HWLs

Proposed 10-yr HWL			
Name	Existing	Proposed	Change
Wasserman Lake	945.00	945.00	±0.00
Carl Krey Lake	944.96	945.96	±0.00
Lake Auburn	941.30	941.31	+0.01
Cell 1	943.94	944.00	+0.06
Cell 2	943.94	944.96	+0.02
Cell 3	943.59	943.61	+0.02
Cell 4	943.09	943.09	±0.00

Table 3: Proposed 10-yr HWLs

Proposed 2-yr HWL			
Name	Existing	Proposed	Change
Wasserman Lake	944.38	944.38	±0.00
Carl Krey Lake	944.40	944.40	±0.00
Lake Auburn	940.75	940.75	±0.00
Cell 1	943.15	944.65	+0.50
Cell 2	942.64	942.68	+0.04
Cell 3	942.47	942.49	+0.02
Cell 4	941.38	941.38	±0.00

Table 4: Proposed 2-yr HWLs

The velocities overtopping the weir are 2.3, 3.0, and 7.2 fps for the 2, 10, and 100-year events respectively. To protect against erosion riprap is recommended on the downstream side of the sheet pile weir. This will likely be considered wetland "fill" and will need to be permitted through the WCA process.

Boardwalk

Moore and Heyer Engineering designed the boardwalk with the following criteria in mind:

- Replace all the existing boardwalk, including the section that appears to be stable, installed on helical piers.
- Design profile to MnDOT bike design standards, specifically having no gradient change greater than 4.00-percent (which would require adding a vertical curve to the design, which would be challenging to accurately construct with timber framing).
- 8 feet wide, based on City preferences.
- Generally, match aesthetic and structural design of the Wasserman boardwalk.
- Design boardwalk to withstand City's preferred snow removal equipment (3,000 pond, four wheeled ATV).

Conclusion

Moore and Heyer Engineering collaborated to develop a set of 60-percent, preliminary construction for installing a sheet pile weir and replacing the boardwalk on the East Auburn Wetland complex. As currently shown, Cell 1 in the wetland would be inundated with approximately six to 12-inches of standing water on average, depending on the exact location. Inundated depths within the existing channel would be deeper. This would minimize phosphorus leaching by maintaining saturated conditions, and preventing groundwater to flow through and out of the wetland except potentially in extreme drought circumstances.

As part of the design, Moore evaluated the hydraulic and hydrologic impact of the proposed improvements. As summarized above, model output indicates 100-year HWLs will rise in some locations within the wetland, but the surrounding lakes would remain the same. In order to achieve the no-rise the runout elevation of 943.90 was used for the sheet pile structure.

Heyer Engineering provided structural design for the boardwalk and sheet pile improvements. Design was informed based on the completed geotechnical report, included as an attachment to this memorandum.

Finally, Moore and Heyer Engineering developed a cost estimate for the proposed improvements, including both the boardwalk and sheet pile weir. Concept Plans are included as Attachment 1, the Concept Cost Estimate is included as Attachment 2, and the Geotechnical report is included as Attachment 3.

Attachments:

1. 60% Concept Plans
2. 60% Cost Estimate
3. Final Geotechnical Report

Attachment 1

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EAST AUBURN WETLAND RESTORATION

MINNEHAHA CREEK WATERSHED DISTRICT

moore engineering, inc.
Consulting Engineering • Land Surveying
www.mooreengineeringinc.com

VICTORIA, MINNESOTA

VICINITY MAP

PROJECT LOCATION

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
G-001	COVER
C-101	SITE ACCESS AND TRAFFIC CONTROL
C-102	TEMPORARY EROSION CONTROL AND REMOVALS
C-103	BOARDWALK PHOTOS
C-201	DETAILS
C-202	DETAILS
C-401	SHEET PILE WEIR PLAN AND PROFILE
C-402	BOARDWALK PLAN AND PROFILE
C-601	RESTORATION PLAN
S001	GENERAL NOTES
S201	OVERALL BOARDWALK WEIR WALL PLAN
S202	HELICAL PILE LAYOUT PLAN
S203	HELICAL PILE LAYOUT PLAN
S204	BOARDWALK FRAMING PLAN
S205	BOARDWALK FRAMING PLAN
S401	SHEET PILE WEIR WALL ELEVATION
S402	FRAMING DETAILS
S403	FRAMING DETAILS

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PROJECT No. 24026

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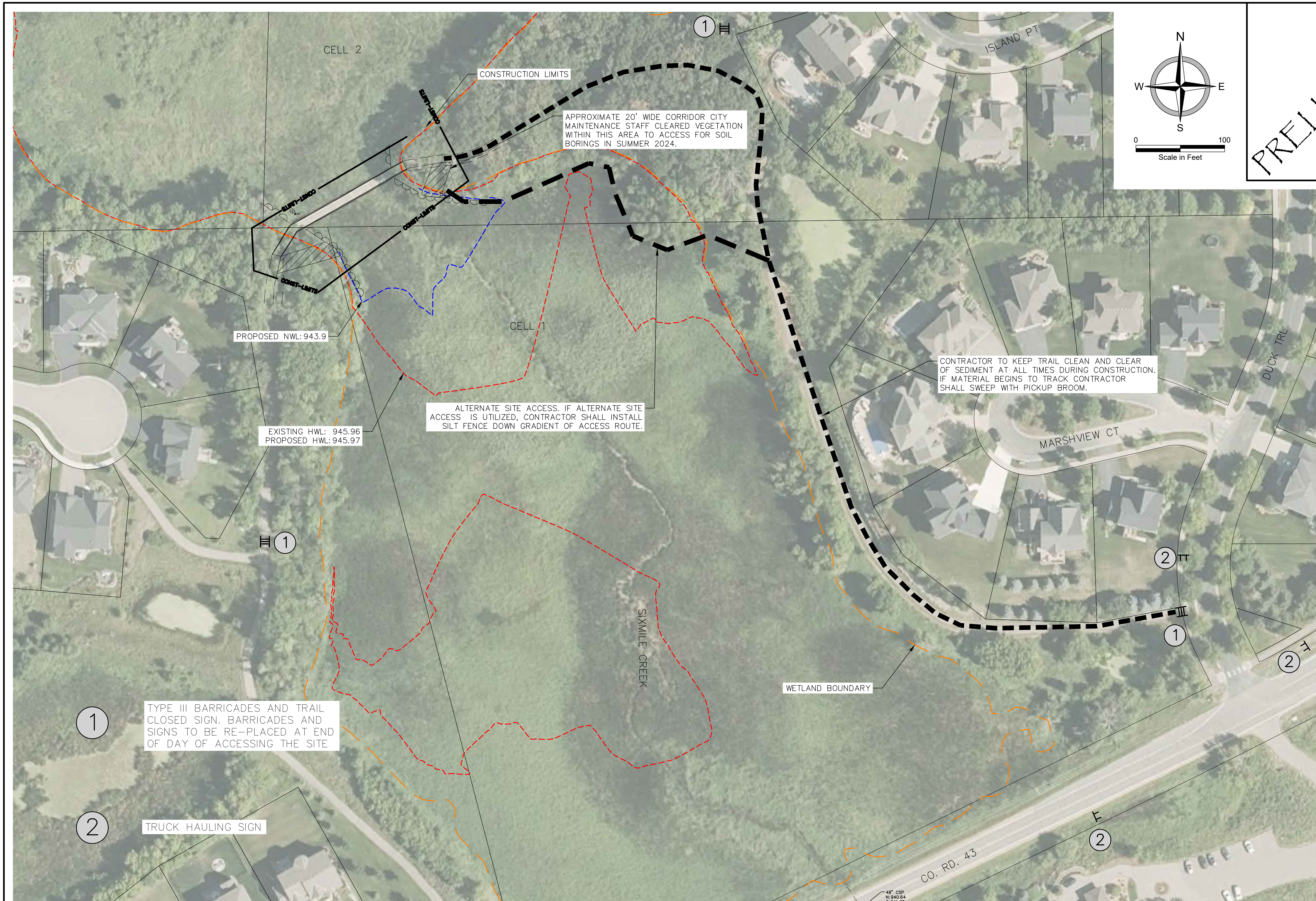

PRELIMINARY

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PROJECT LAYOUTS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
SITE ACCESS AND TRAFFIC CONTROL

DATE:	2-17-2025
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REVIEWER:	DTE

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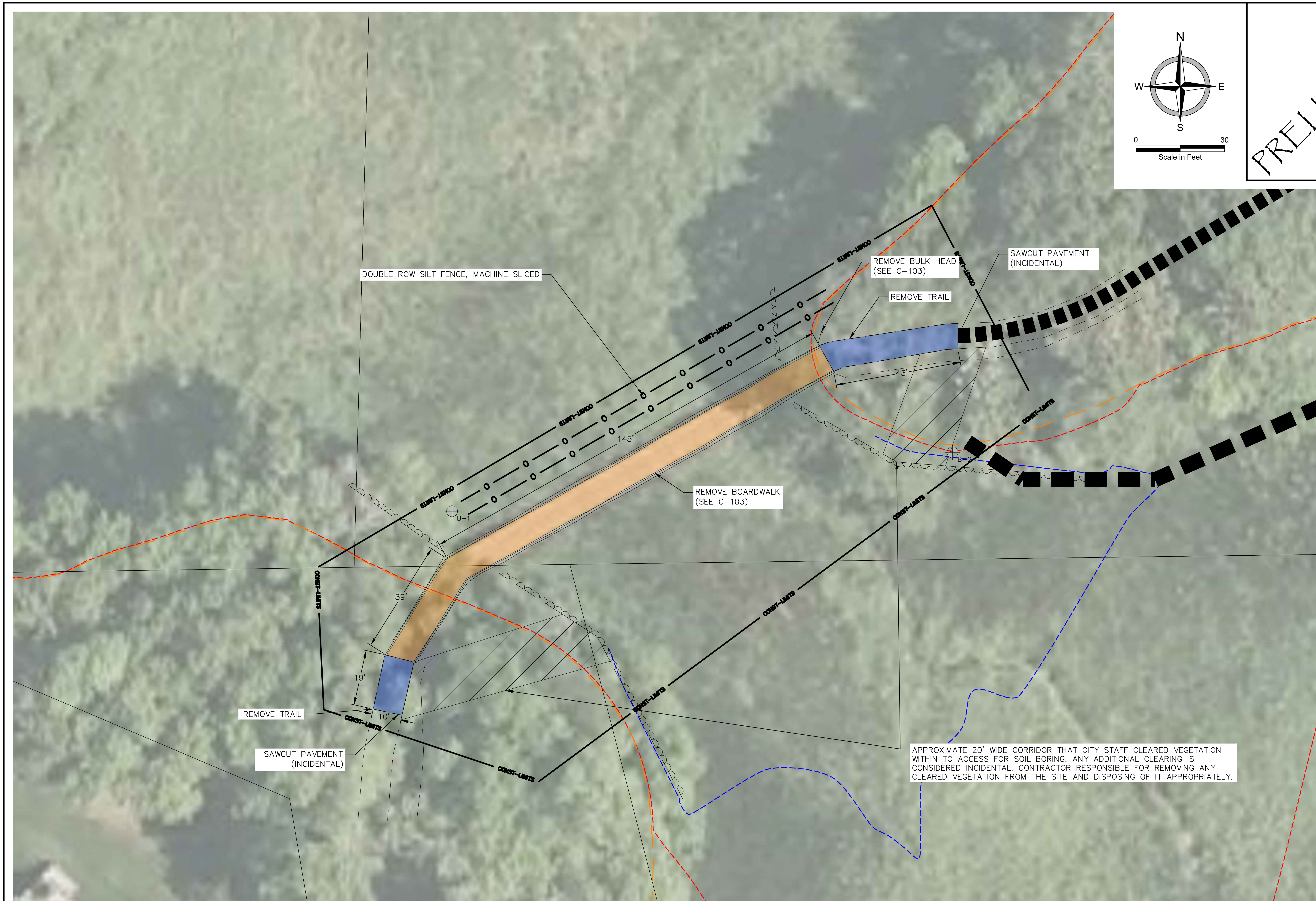

PRELIMINARY

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PROJECT LAYOUTS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
TEMPORARY EROSION CONTROL AND REMOVALS

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PHOTO 1: EXISTING BOARDWALK

PHOTO 2: EXISTING ABUTMENT

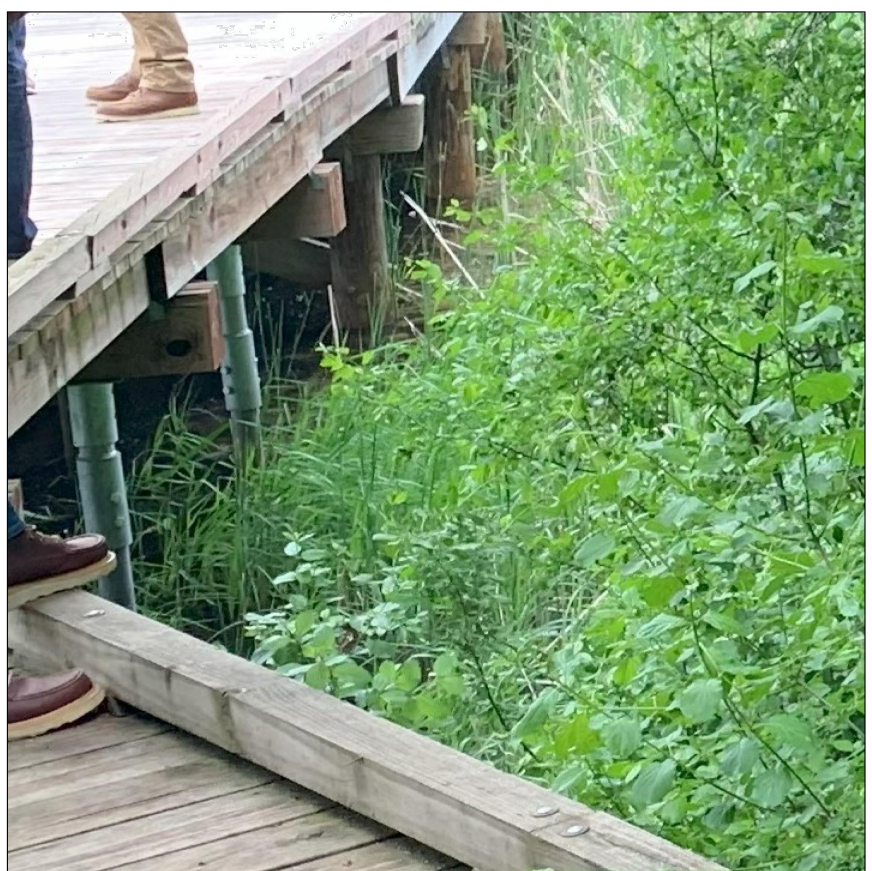

PHOTO 3: TIMBER AND HELICAL PIERS

PHOTO 4: UNDERSIDE OF BOARDWALK

PRELIMINARY

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PROJECT LAYOUTS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
BOARDWALK PHOTOS

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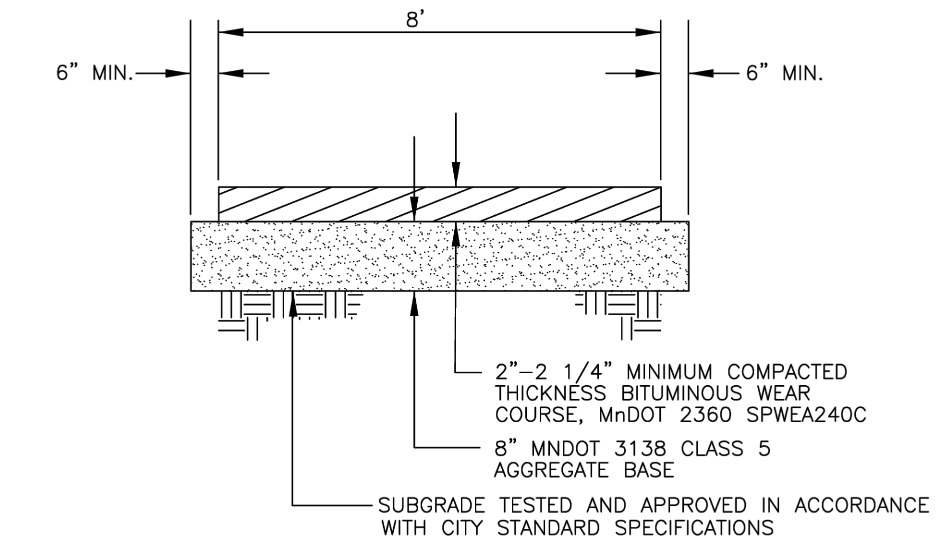
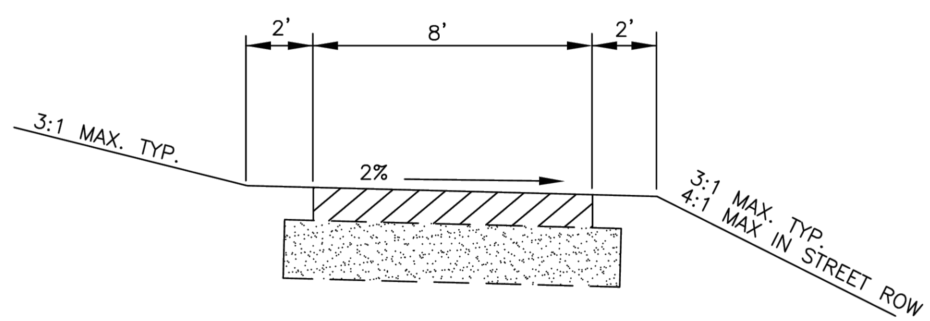




NOTE

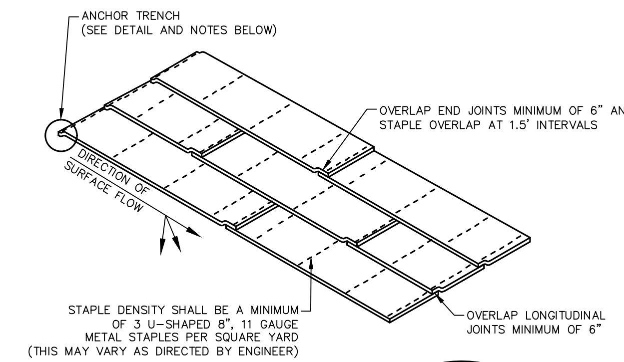
1. BITUMINOUS TRAILS SHALL HAVE CONCRETE PED RAMPS AT ALL STREET INTERSECTIONS.
2. PROVIDE 2% CROSS-SLOPE TO MAINTAIN POSITIVE DRAINAGE AWAY FROM TRAIL SURFACE THROUGHOUT LENGTH OF TRAIL.

BICYCLE-PEDESTRIAN PATH

FEBRUARY 2022

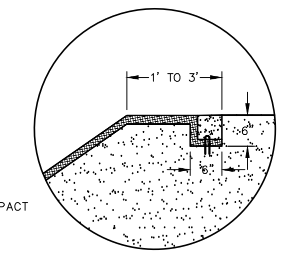
CITY OF VICTORIA

STANDARD DRAWING NO.
509
Victoria



NOTES:

1. DIG 6" X 6" TRENCH
2. LAY MAT IN TRENCH
3. STAPLE AT 1.5' INTERVALS
4. BACKFILL WITH NATURAL SOIL AND COMPACT
5. MAT LENGTH SHALL NOT EXCEED 100' WITHOUT AN ANCHOR TRENCH



ANCHOR TRENCH

EROSION STABILIZATION MAT

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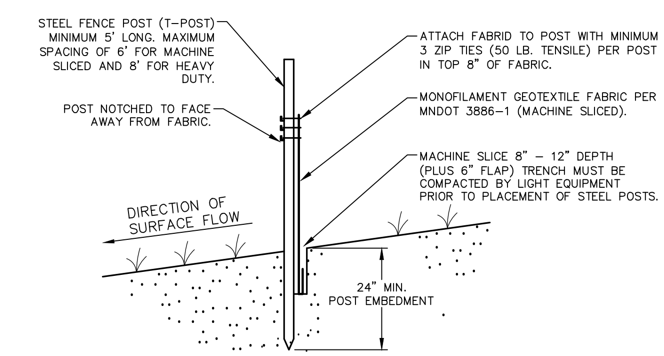

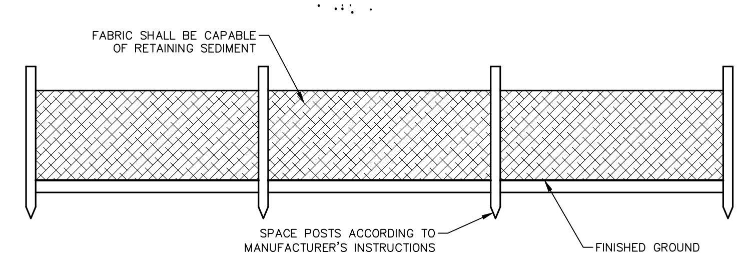

MACHINED SILT FENCE DETAIL

NO SCALE *WRG-312500-02 12.15.17*

NOTES:

1. INSPECT AND REPAIR AFTER EACH STORM EVENT, AND REMOVE SEDIMENT WHEN NECESSARY.
2. REMOVED SEDIMENTS SHALL BE DEPOSITED IN AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

PRELIMINARY

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DETAILS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
DETAILS

DATE:	2-17-2025
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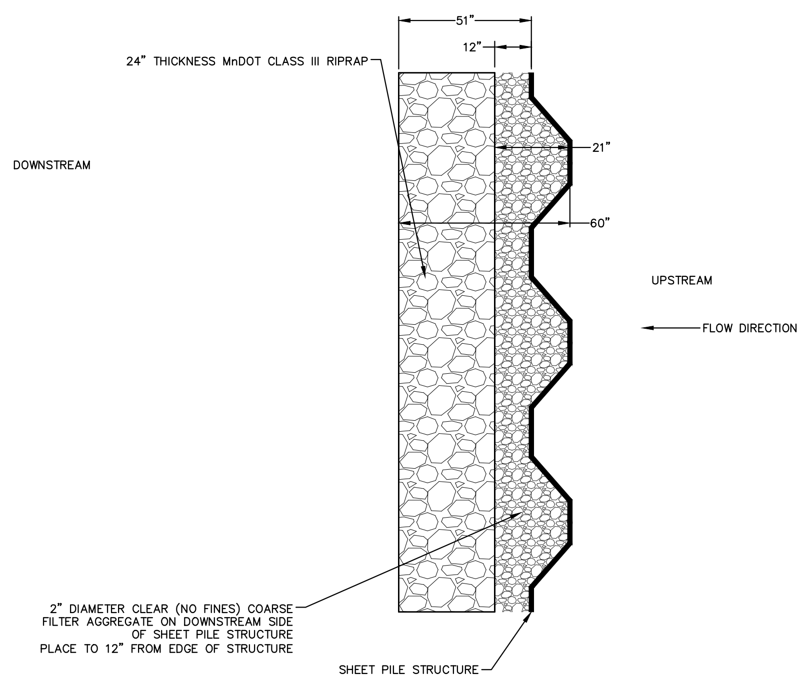

RIPRAP DETAIL - SHEET PILE PLAN VIEW (A-A)

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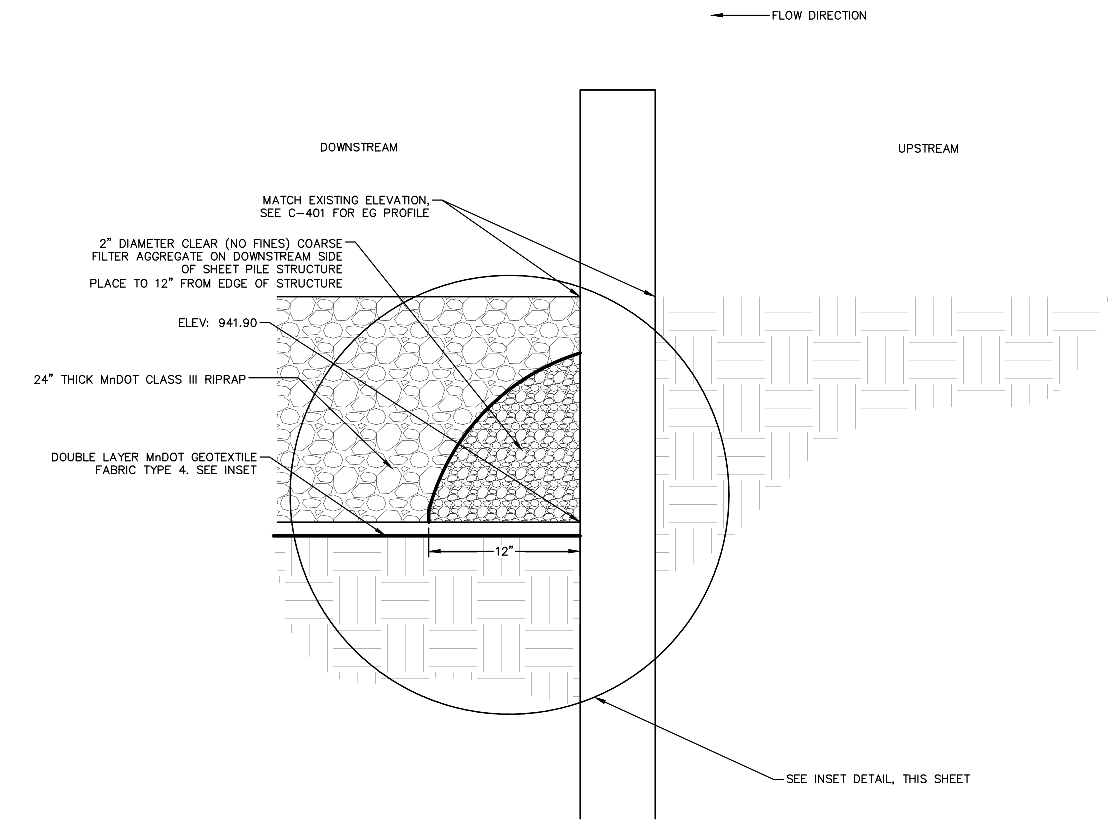

RIPRAP DETAIL - SHEET PILE SECTION VIEW

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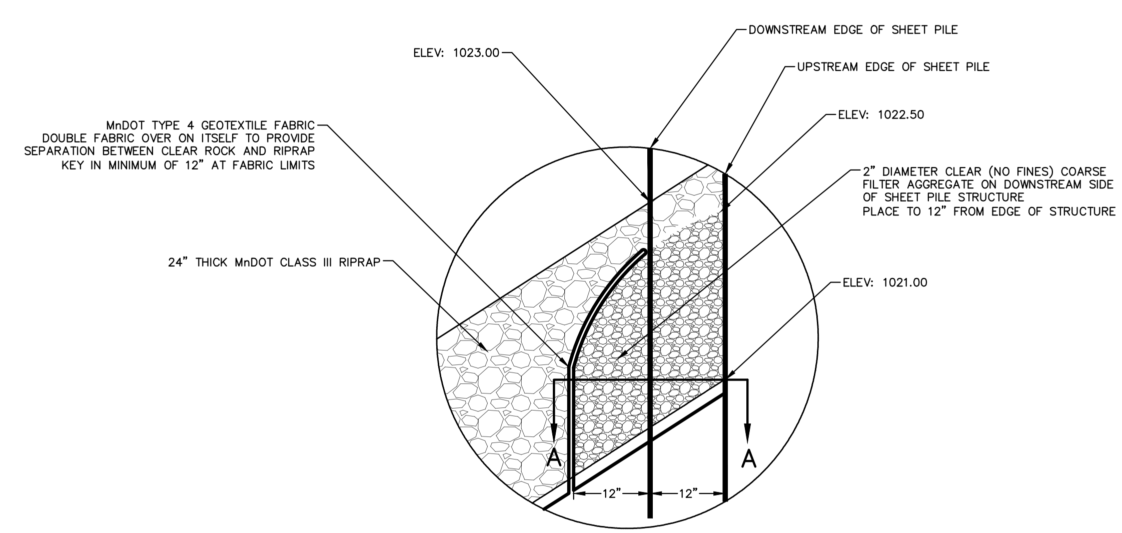

RIPRAP DETAIL - INSET DETAIL

NO SCALE

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DETAILS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA

DETAILS

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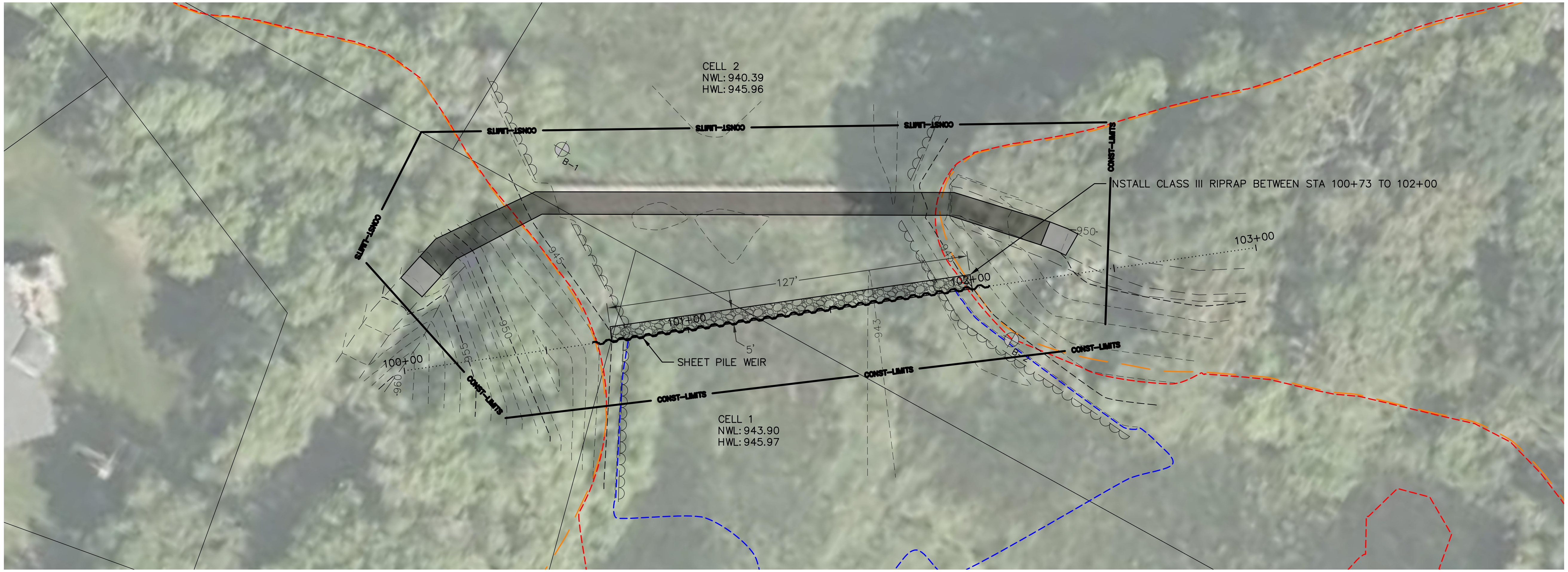

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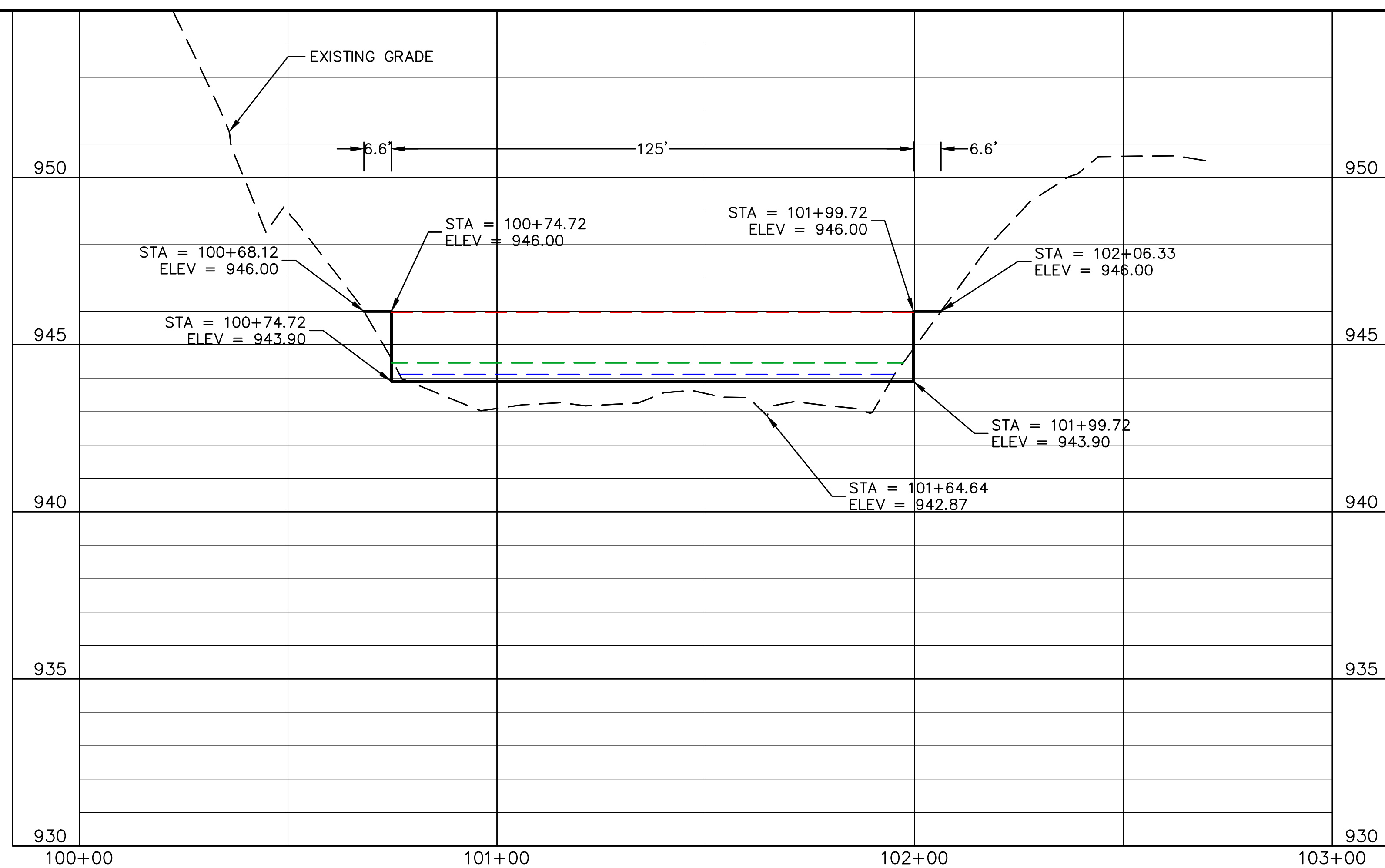
Scale in Feet



2-YEAR HWL:
ELEV: 944.11

10-YEAR HWL:
ELEV: 944.46

100-YEAR HWL:
ELEV: 945.97

moore
engineering, inc.

PLAN & PROFILE
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA

SHEET PILE WEIR PLAN AND PROFILE

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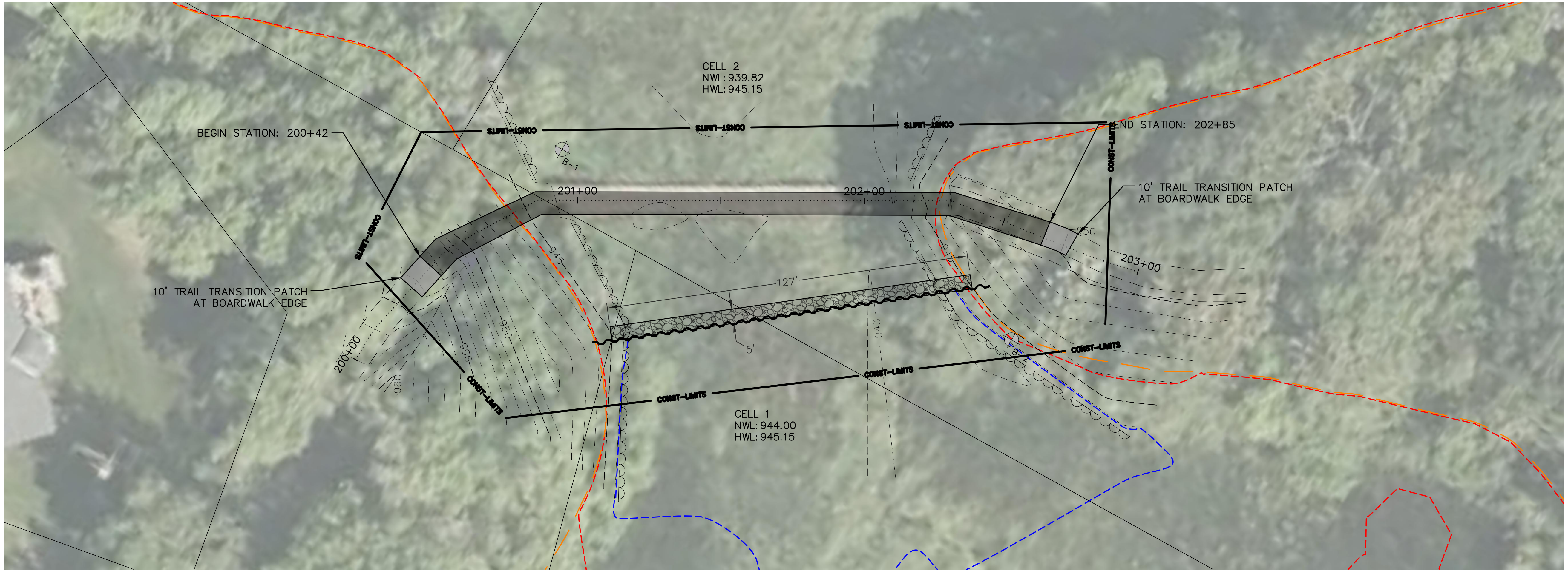

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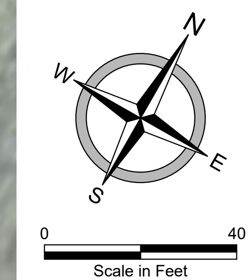

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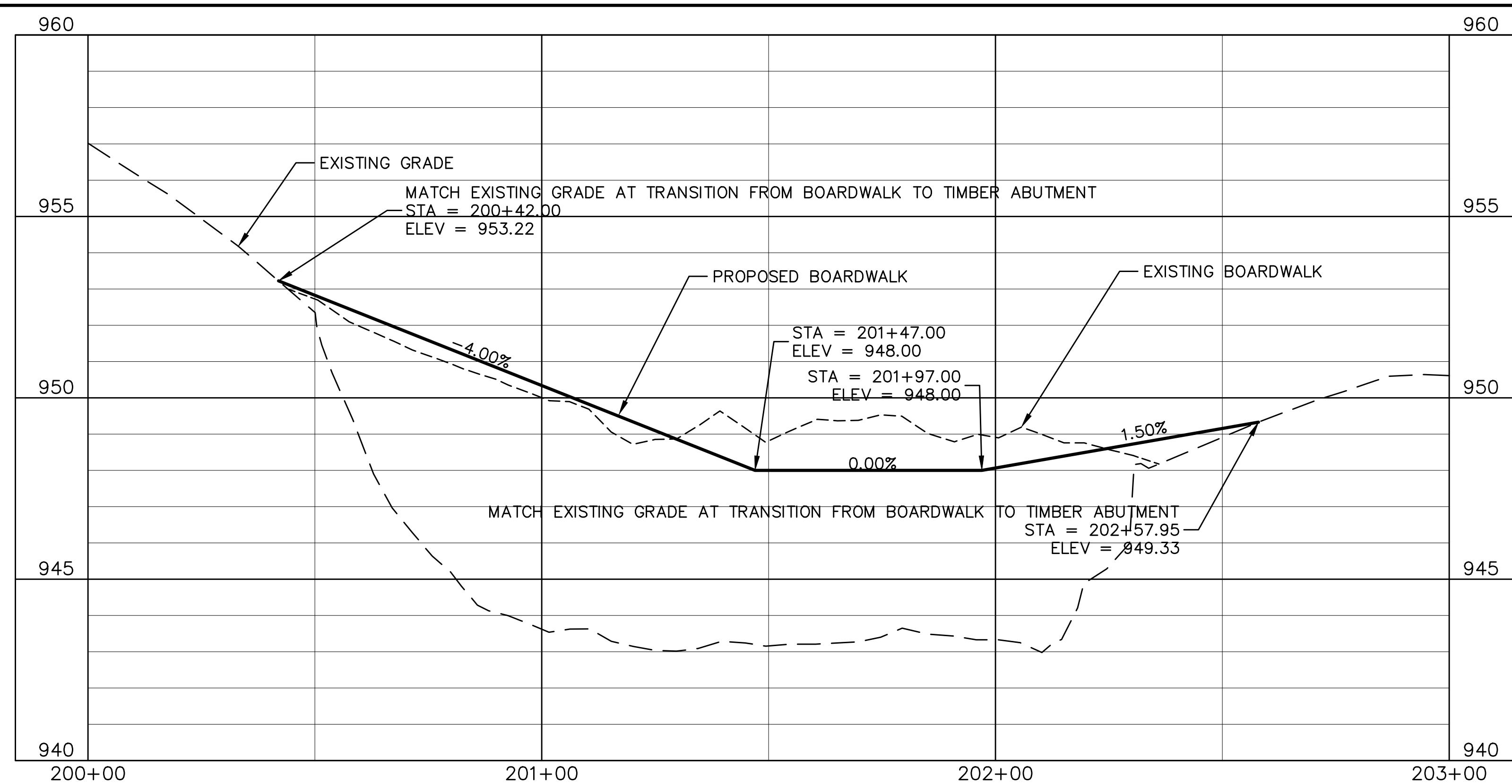

PLAN & PROFILE
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
BOARDWALK PLAN AND PROFILE

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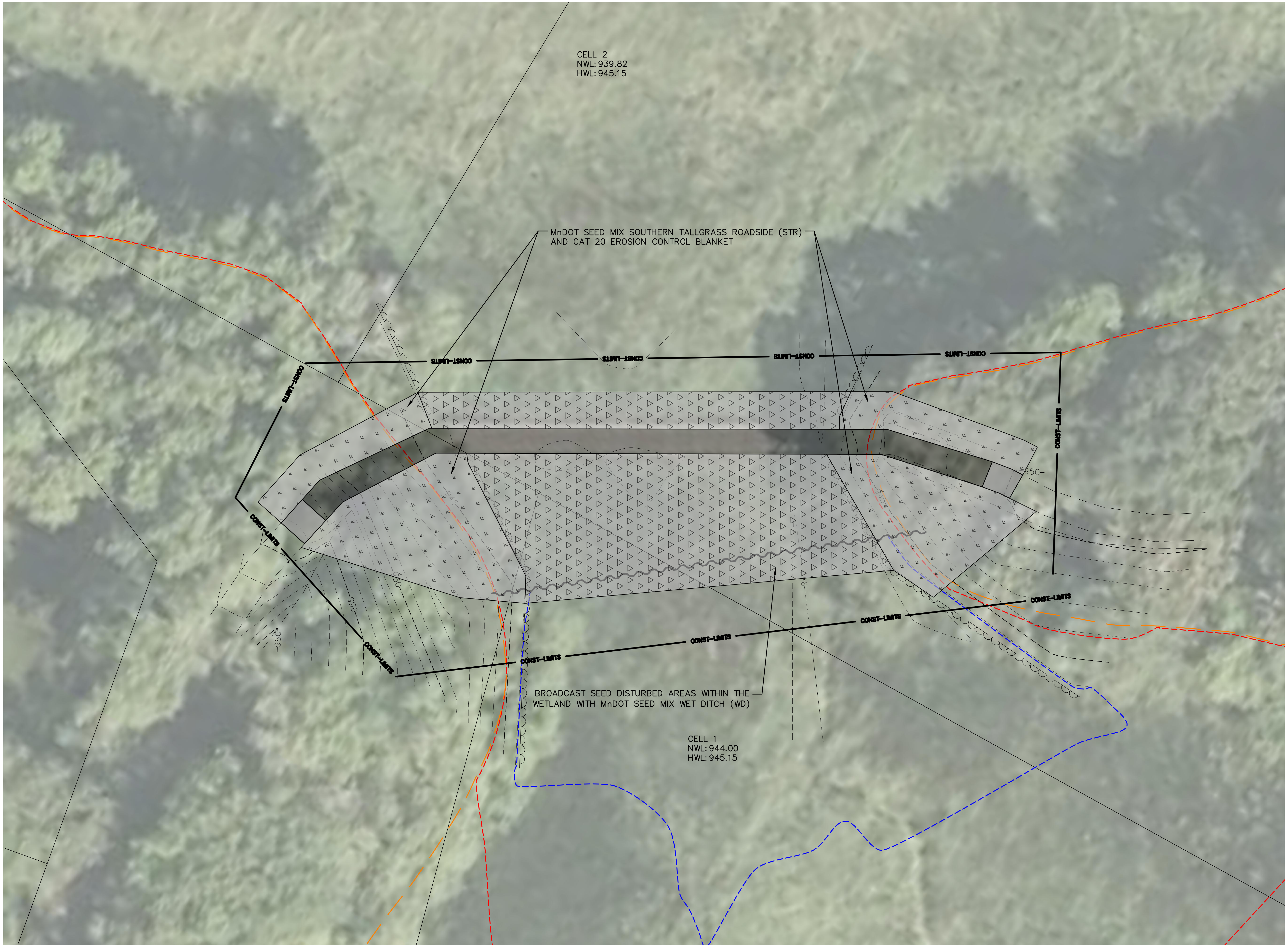
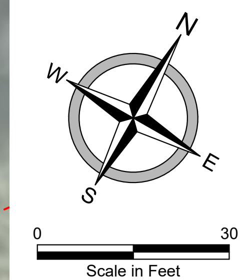


PRELIMINARY



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PLAN & PROFILE
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
RESTORATION PLAN

DATE:	2-17-2025
REV DATE:	----
REV NUM:	----
RECORD:	----
PROJECT No.	24026
MANAGER:	JCM
DESIGNER:	QDS
DRAFTER:	DWA
REVIEWER:	DTE

C-601

GENERAL CONSTRUCTION NOTES:

1. THE INTENT OF THESE PLANS AND NOTES IS TO PRESENT THE PROJECT REQUIREMENTS FOR THE EAST AUBURN WETLAND RESTORATION PROJECT IN VICTORIA, MINNESOTA.

2. THESE STRUCTURAL DRAWINGS ARE INTENDED TO BE USED IN CONJUNCTION WITH THE PROCESS DRAWINGS. SOME DIMENSIONS, SECTIONS, AND FRAMING DETAILS MAY BE SHOWN ON THE PROCESS DRAWINGS.

3. DURING CONSTRUCTION, THE CONTRACTOR MAY ENCOUNTER EXISTING CONDITIONS THAT ARE UNKNOWN OR THAT DIFFER THAN AS DEPICTED IN THESE DRAWINGS. SUCH EXISTING CONDITIONS MAY INTERFERE WITH THE NEW CONSTRUCTION OR REQUIRE PROTECTION DURING CONSTRUCTION.

4. CONTRACTOR SHALL NOTIFY CIVIL/STRUCTURAL ENGINEER OF ALL ENCOUNTERED EXISTING CONDITIONS THAT INTERFERE WITH THE PROPER EXECUTION OF NEW WORK OR COMPROMISE THE STRUCTURAL INTEGRITY OF THE EXISTING STRUCTURE.

5. ALL WORK SHALL COMPLY WITH THE 2018 INTERNATIONAL BUILDING CODE, AS APPROVED BY THE STATE OF MINNESOTA / CITY OF VICTORIA.

6. REFERENCE STANDARDS: UNLESS OTHERWISE NOTED, ALL STANDARDS SHALL BE CURRENT EDITION, WITH LATEST ADDENDA, IF APPLICABLE.

7. THE CONTRACTOR SHALL VERIFY ALL CONTRACT DOCUMENTS, SITE ELEVATIONS, DIMENSIONS AND CONDITIONS PRIOR TO STARTING WORK AND SHALL NOTIFY THE CIVIL/STRUCTURAL ENGINEER OF ANY DISCREPANCIES OR INCONSISTENCIES.

8. SPECIFIC NOTES AND DETAILS SHALL TAKE PRECEDENCE OVER GENERAL NOTES.

9. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. UNLESS OTHERWISE INDICATED, THEY DO NOT INDICATE THE MEANS, METHODS, TIMING, OR PROCEDURES USED TO COMPLETE THE CONSTRUCTION. TEMPORARY BRACING, SHORING, OR PROTECTION OF THE STRUCTURE AGAINST WIND, ERECTION AND OTHER SITE CONDITIONS DURING CONSTRUCTION OF THE BUILDING SHALL BE THE RESPONSIBILITY OF CONTRACTOR. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE PROTECTION OF THE STRUCTURE DURING ALL PHASES OF DEMOLITION, CONSTRUCTION, AND INSTALLATION.

10. NO AREA OF THE STRUCTURE SHALL BE LOADED WITH CONSTRUCTION MATERIALS OR EQUIPMENT THAT EXCEEDS FINAL DESIGN CRITERIA.

11. HOLES, PIPES, SLEEVES, ETC NOT SHOWN ON THE DRAWINGS MUST BE APPROVED BY THE STRUCTURAL ENGINEER BEFORE PLACEMENT THROUGH STRUCTURAL MEMBERS.

12. SHOP DRAWINGS PREPARED BY SUPPLIERS, SUB CONTRACTORS, ETC, SHALL BE DIMENSIONED, REVIEWED, COORDINATED, AND SIGNED/STAMPED BY THE GENERAL CONTRACTOR PRIOR TO SUBMITTING TO THE STRUCTURAL ENGINEER. MANUFACTURED COMPONENTS SUCH AS TRUSSES OR PRECAST CONCRETE SHALL BE ENGINEERED AND STAMPED PRIOR TO SUBMISSION.

13. FABRICATOR SHALL CLEARLY NOTE CHANGES MADE IN THE SHOP DRAWINGS WHICH DO NOT COMPLY WITH THE CONTRACT DOCUMENTS. REVIEWED APPROVAL SHOP DRAWINGS SHOWING ENGINEERS COMMENTS ACCOMPANIED WITH RECORD SET SHOP DRAWINGS, SHALL BE AVAILABLE FOR REFERENCE AT THE CONSTRUCTION SITE.

DESIGN LOADS:

LIVE LOADS:

4x6 TIMBER DECKING		= 40 psf
FLAT ROOF SNOW	P_f	= 40.9 psf
EXPOSURE FACTOR	C_e	= 1.0
IMPORTANCE FACTOR	I_s	= 1.0
THERMAL FACTOR	C_t	= 1.2
GROUND SNOW LOAD	P_g	= 50 psf

DEAD LOADS:

4x6 TIMBER DECKING		= 20 psf

LATERAL LOADS (WIND-MWFRS):

ULTIMATE DESIGN WIND SPEED (3 SEC. GUST)	V_{ult}	= 109 mph
NOMINAL DESIGN WIND SPEED	V_{asd}	= 84.4 mph
WIND EXPOSURE		= "C"
INTERNAL PRESSURE COEFFICIENT		= +/- 0
RISK CATEGORY		= II
COMPONENTS & CLADDING	q_h	= 21.9 psf

EQUIPMENT LOADS:

4-WHEELER ATV (50" AXLE SPACING)	= 3,000 lbs
FRONT/REAR AXLE DISTRIBUTION	= 55:45

EXCAVATION AND BACKFILL NOTES:

1. EXCAVATION AND BACKFILL SHALL BE EXECUTED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

2. BACKFILL AND COMPACTION SHALL BE INSPECTED AND CERTIFIED BY A LICENSED GEOTECHNICAL ENGINEER. REPORTS ARE TO BE SUBMITTED TO THE CIVIL/STRUCTURAL ENGINEER.

4. BACKFILL SHALL BE COMPACTED BY MECHANICAL MEANS. FLOODING OR WATER INUNDATION SHALL NOT BE PERMITTED.

5. BACKFILL SHALL BE PLACED IN 8" (ALTERNATING) LIFTS ON EACH SIDE OF THE RETAINING WALLS TO MAINTAIN STABILITY OF RETAINING WALLS.

6. THE CONTRACT STRUCTURAL DOCUMENTS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. THE MEANS AND METHODS USED TO PERFORM THE EXCAVATION IS AT THE SOLE DISCRETION OF THE CONTRACTOR, INCLUDING THE DESIGN AND INSTALLATION OF TEMPORARY BRACING OR SHORING. CONTRACTOR IS RESPONSIBLE FOR ALL CODE AND REGULATORY SAFETY REQUIREMENTS.

STRUCTURAL STEEL NOTES:

1. STRUCTURAL STEEL WORK SHALL BE PER AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) SPECIFICATION, 14TH EDITION, MATERIAL:

A690	GRADE 50 – SHEET PILES	Fy = 50 ksi
A992	W SHAPES	Fy = 50 ksi
A36	S, AND M SHAPES	Fy = 36 ksi
A53	GRADE C – STANDARD PIPES	Fy = 35 ksi
A500	GRADE C – HSS PIPES	Fy = 46 ksi
A500	GRADE C – HSS TUBES	Fy = 50 ksi
A36	PLATES, BARS, MISC SHAPES (ANGLES), CHANNELS, & RODS	Fy = 36 ksi
A240	GRADE 316 – S.S. PLATE	Fy = 30 ksi
F1554	GRADE 36 - ANCHOR RODS	Fy = 36 ksi
	GRADE 55 - ANCHOR RODS	Fy = 55 ksi
F325	GRADE 105 - ANCHOR RODS	Fy = 105 ksi
	GRADE A325 – CONNECTION BOLTS	
	GRADE A490 – CONNECTION BOLTS	
A563	CONNECTION NUTS	
F436	WASHERS	
A108	HEADED STUD ANCHORS	Fy = 65 ksi
E70XX	ELECTRODES	Fy = 70 ksi
E309LXX	ELECTRODES	Fy = 58 ksi

2. WELDED CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH THE LATEST RECOMMENDATIONS OF:
   AISC – AMERICAN INSTITUTE OF STEEL CONSTRUCTION
   AWS – AMERICAN WELDING SOCIETY

3. COLUMN BASE AND CAP PLATES TO BE WELDED AROUND ALL SIDES.

4. WELDS NOT SPECIFIED SHALL BE A FILLET WELD, CONTINUOUS AND/OR ALL AROUND WITH MINIMUM THROAT DIMENSION AS REQUIRED FOR MATERIAL THICKNESS PER AWS.

5. STRUCTURAL FABRICATORS SHALL SHOW ALL FIELD WELDING REQUIREMENTS ON SHOP DRAWINGS SUBMITTED TO THE ENGINEER.

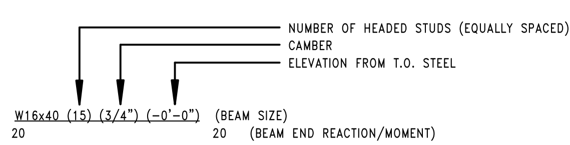
6. BEAMS AND COLUMNS SHALL BE ERECTED TRUE AND PLUMB WITHIN AISC TOLERANCE. PROVIDE TEMPORARY BRACING AS REQUIRED.

7. PROVIDE DOUBLE ANGLE CONNECTIONS AS DESCRIBED IN PART 10 OF THE AISC. MANUAL OF STEEL CONSTRUCTION (14TH ED-ASD)

   - CONNECTIONS SHALL BE SELECTED TO SUPPORT BEAM END REACTIONS INDICATED ON THE CONTRACT DRAWINGS.
   - IF BEAM END REACTIONS ARE NOT INDICATED, CONNECTIONS SHALL BE SELECTED TO SUPPORT 1/2 THE TOTAL UNIFORM LOAD CAPACITY GIVEN IN THE ALLOWABLE UNIFORM LOAD TABLES, PART 3- FORTEENTH EDITION (ASD), FOR THE SPECIFIED BEAM SIZE, SPAN, AND STEEL GRADE UON. OTHER RATIONAL ENGINEERING CONNECTION DESIGN AND STANDARD CONNECTION PRACTICES MAY BE USED WITH APPROVAL OF THE ENGINEER.
   - CONNECTIONS SHALL HAVE MINIMUM ROWS OF BOLTS FOR BEAM DEPTHS AS INDICATED IN PART 10.

8. FRAMED STEEL BEAM CONNECTIONS SHALL BE "BEARING TYPE" UON.

9. STEEL BEAM KEY:



10. BEAMS SHALL BE MARKED AND ERECTED WITH NATURAL CAMBER PLACED UPWARDS.

11. DO NOT PAINT STEEL SURFACES TO BE FIELD WELDED.

12. ALL STRUCTURAL STEEL MEMBERS AND COMOPNENTS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A123 & ASTM A153.

WOOD FRAMING NOTES:

1. WOOD AND TIMBER CONSTRUCTION SHALL CONFORM TO PROJECT SPECIFICATIONS AND AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC) STANDARDS.

2. WOOD CONSTRUCTION SHALL CONFORM TO CHAPTER 23, OF THE INTERNATIONAL BUILDING CODE (UON).

3. ALL NAILING SHALL BE COMMON WIRE NAILS (UON) & SHALL CONFORM TO TABLE 2304.10.1 "FASTENING SCHEDULE" OF THE INTERNATIONAL BUILDING CODE UNLESS OTHER REQUIREMENTS NOTED ON THE PLAN ARE MORE STRICT.

4. FRAMING LUMBER SHALL CONFORM WITH THE PROVISIONS OF THE AMERICAN SOFTWOOD LUMBER STANDARD PS20-10 AND EACH PIECE SHALL BEAR THE GRADE STAMP OF A GRADING AGENCY APPROVED BY THE AMERICAN LUMBER STANDARDS COMMITTEE. ALL FRAMING LUMBER 2" AND LESS IN THICKNESS SHALL BE SEASONED TO A MOISTURE CONTENT OF 19% OR LESS PRIOR TO SURFACING WITH THE INDICATION "S-DRY" ON THE GRADE STAMP.

5. PRESSURE TREATED LUMBER SHALL BE SOUTHERN PINE MEMBERS (MSP), NO. 2 GRADE OR BETTER WITH THE FOLLOWING MINIMUM DESIGN VALUES (UON):

Fb	= 800 psi	– BENDING
Fv	= 175 psi	– SHEAR
Fc	= 1300 psi	– COMPRESSION PARALLEL TO GRAIN
Fc	= 565 psi	– COMPRESSION PERPENDICULAR TO GRAIN
E	= 1400 ksi	– MODULUS OF ELASTICITY
Emin	= 510 ksi	– MINIMUM MODULUS OF ELASTICITY

** SOUTHERN PINE LUMBER MAY BE SUBSTITUTED WITH PRESSURE TREATED LUMBER OF EQUIVALENT SPECIES.

6. LUMBER USED FOR HEADERS, BEAMS, AND JOISTS SHALL BE FREE OF CHECKS AND SPLITS.

7. ALL HEADERS, BEAMS, JOISTS, AND TRUSSES SHALL BEAR FULLY ON STUD WALLS, POSTS, AND JACK STUDS. DO NOT OVERCUT.

8. NO NOTCHING OF STUDS, JOISTS, BEAMS, OR TRUSSES IS PERMITTED WITHOUT THE ENGINEERS APPROVAL. DO NOT OVERCUT NOTCHES. HOLES BORED IN STUDS OR JOISTS SHALL BE IN THE MIDDLE ONE-THIRD OF THE DEPTH AND MIDDLE ONE-THIRD OF THE SPAN. THE DIAMETER OF ANY SUCH HOLE SHALL NOT EXCEED ONE-FOURTH THE DEPTH.

ABBREVIATIONS AND SYMBOLS

AA	ADHESIVE	MFG	MANUFACTURER
AR	ANCHOR ROD	MIN	MINIMUM
APA	AMERICAN PLYWOOD ASSOCIATION	MISC	MISCELLANEOUS
ARCH	ARCHITECT/ARCHITECTURAL	MTL	METAL
BB	BOND BEAM	MO	MASONRY OPENING
BLDG	BUILDING	N	NORTH
BLK	BLOCK	NTS	NOT TO SCALE
BM	BEAM	NS	NON-SHRINK
B.O.	BOTTOM OF	OC	ON CENTER
BOT	BOTTOM	OD	OUTSIDE DIAMETER
BRG	BEARING	OF	OUTSIDE FACE
CL	CENTER LINE	OH	OVERHEAD
CJ	CONTROL JOINT	OPNG	OPENING
CCJ	CONSTRUCTION CONTROL JOINT	ORIG	ORIGINAL
CLR	CLEAR/CLEARANCE	PAF	POWDER ACTUATED FASTENER
CMU	CONCRETE MASONRY UNIT	PART	PARTITION
COL	COLUMN	PC	PRECAST CONCRETE
CONC	CONCRETE	PLF	POUND PER LINEAR FOOT
CONN	CONNECTION	PL	PLATE
CONT	CONTINUOUS	PWD	PLYWOOD
CSA	CONCRETE SCREW ANCHOR	PNL	PANEL
DBL	DOUBLE	PSF	POUNDS PER SQUARE FOOT
DET	DETAIL	PSI	POUNDS PER SQUARE INCH
DEG	DEGREES	RAD	RADIUS
DIA	DIAMETER	RD	ROOF DRAIN
DIM	DIMENSION	REINF	REINFORCING
DL	DEAD LOAD	REM	REMOVE
DT	DRAIN TILE	RQD	REQUIRED
DWL	DOWEL	RFG	ROOFING
EA	EACH	RO	ROOF OPENING
EF	EACH FACE	SA	SCREW ANCHOR
EJ	EXPANSION JOINT	SB	SOIL BORING
EL	ELEVATION	SCHED	SCHEDULE
ELEV	ELEVATOR	SD	SEE DETAIL
EQ	EQUAL	SDL	SUPERIMPOSED DEAD LOAD
EW	EACH WAY	SLL	SUPERIMPOSED LIVE LOAD
(E)	EXISTING	SER	STRUCTURAL ENGINEER OF RECORD
EXC	EXCAVATION	SHT	SHEET
EXP	EXPANSION	SIM	SIMILAR
FD	FLOOR DRAIN	SQ	SQUARE
FDN	FOUNDATION	SJ	STEEL JOIST
FTG	FOOTING	SL	SNOW LOAD
FT	FOOT/FEET	SPA	SPACE/SPACING
GALV	GALVANIZE	SPECS	SPECIFICATIONS
GA	GAUGE	SS	STAINLESS STEEL
GC	GENERAL CONTRACTOR	STD	STANDARD
GT	GIRDER TRUSS	STL	STEEL
HC	HOLLOW CORE	TEMP	TEMPORARY
HORIZ	HORIZONTAL	T & B	TOP & BOTTOM
HSA	HEADED STUD ANCHOR	T & G	TONGUE & GROOVE
HSS	HOLLOW STRUCTURAL SECTION	THK	THICK/THICKENED
IF	INSIDE FACE	T.O.	TOP OF
INT	INTERIOR	TRANS	TRANSVERSE
JST	JOIST	TS	TUBE STEEL
K	KIPS	TYP	TYPICAL
KLF	KIPS PER LINEAR FOOT	UON	UNLESS OTHERWISE NOTED
KSI	KIPS PER SQUARE INCH	VER/(V)	VERIFY
L	ANGLE	VERT	VERTICAL
LL	LIVE LOAD	WF	WIDE FLANGE
LB	LEDGER BEAM	WD	WOOD
LBS	POUNDS	WL	WIND LOAD
LLH	LONG LEG HORIZONTAL	W/	WITH
LLV	LONG LEG VERTICAL	W/O	WITH OUT
LONG	LONGITUDINAL	WT	WEIGHT
MAS	MASONRY	WWF	WELDED WIRE FABRIC
MAX	MAXIMUM	@	AT
MECH	MECHANICAL	+/-	PLUS OR MINUS

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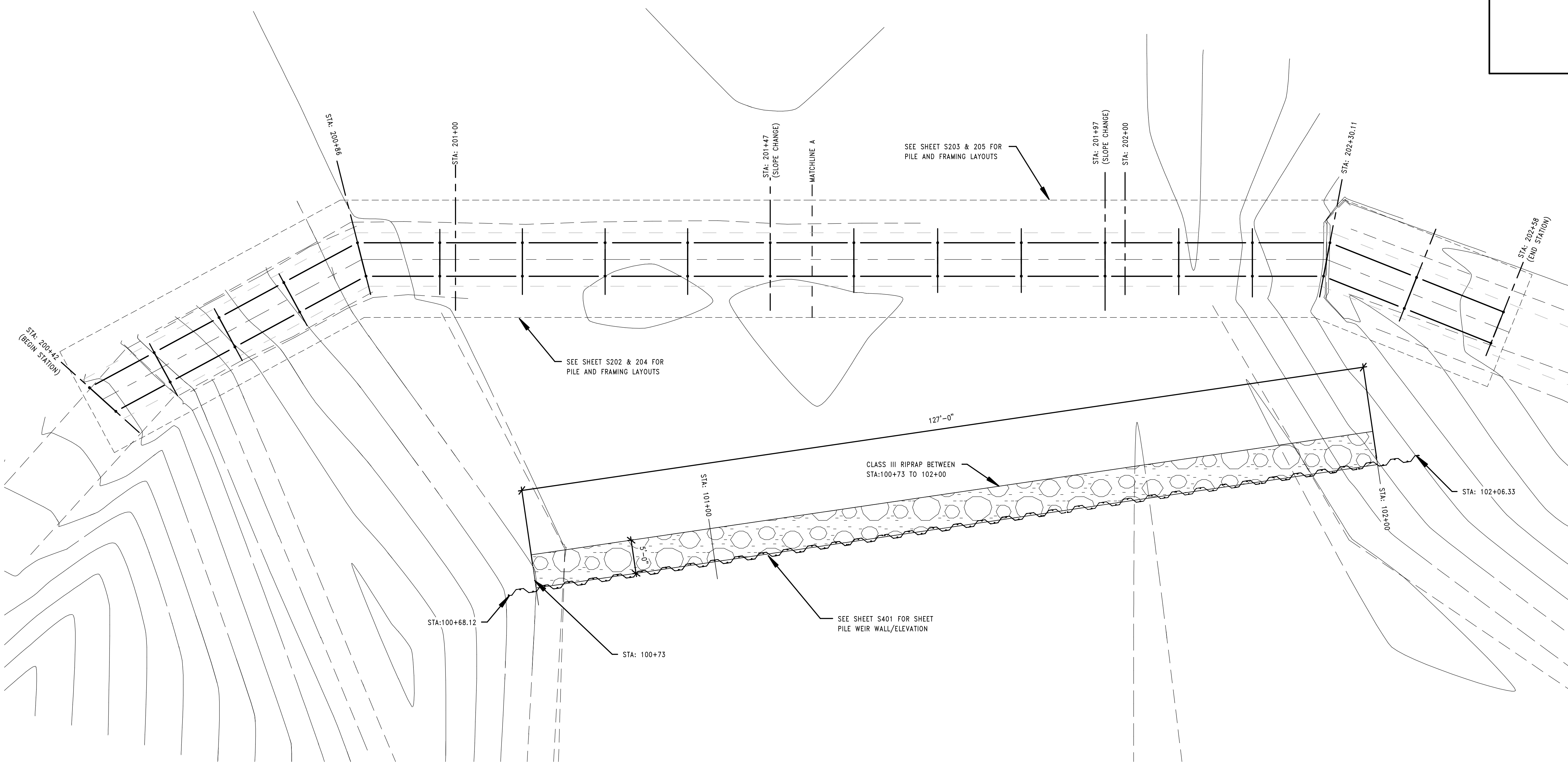
www.heyerengineering.com

HE 057.0143.2024 KF/JG

STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
GENERAL NOTES

DATE:	2/18/25-IFR
REVISED:	
REVISED:	
REVISED:	
REVISED:	
REVISED:	
REVISED:	
PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

S001



OVERALL BOARDWALK/WEIR WALL PLAN

1/16" = 1'-0"

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
OVERALL BOARDWALK/WEIR WALL PLAN

DATE:	2/18/25-IFR
REVISED:	
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REVISED:	

PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

S201

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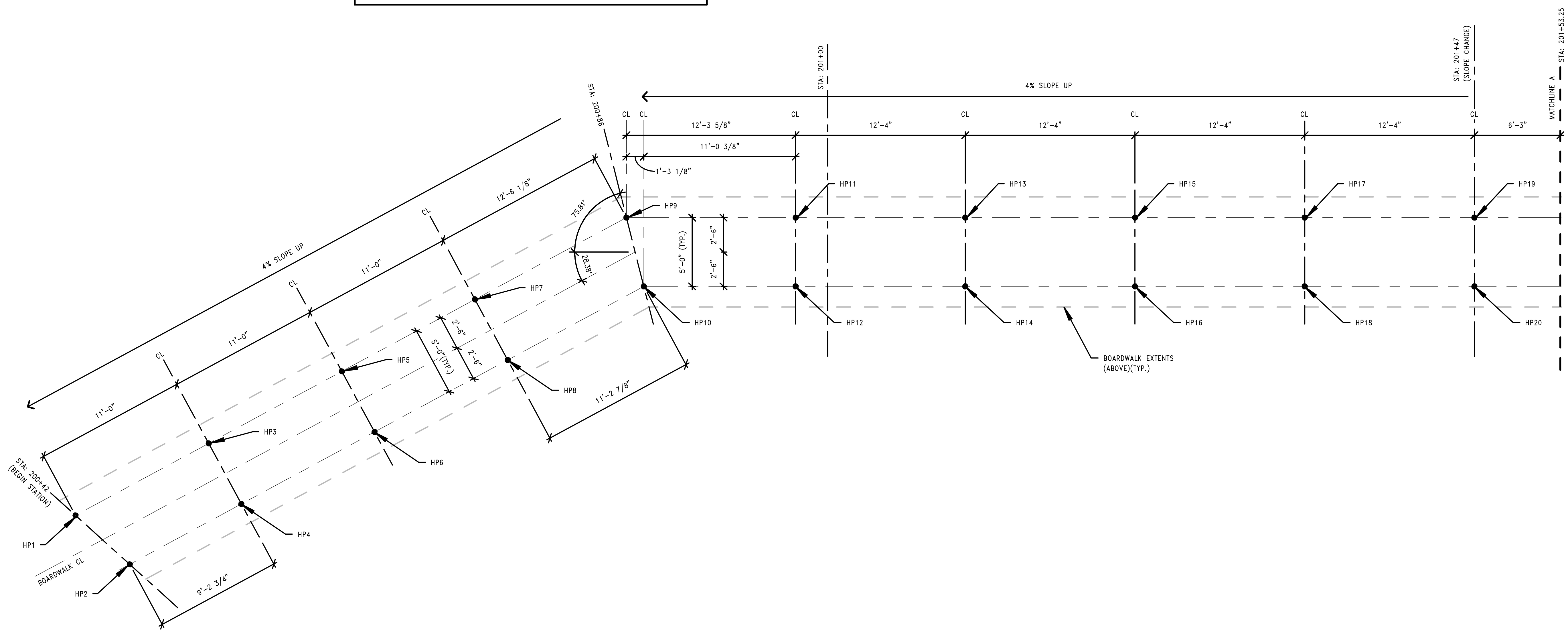
HELICAL PILE PLACEMENT TABLE				
HELICAL #	MIN. HELICAL SIZE	HELICAL DESIGNED WORKING CAPACITY REQUIRED (COMP./TENS.)	ULTIMATE DRIVEN CAPACITY (COMP./TENS.)	NOTES
HP1-HP20	3" DIA.	20 KIPS/4 KIPS	60 KIPS/6 KIPS	1-6

NOTES:
1. ALL HELICAL PIPE PILE & PL'S SHALL BE ASTM A527 (MINIMUM GRADE FOR HELICAL PL).
2. MINIMUM WALL THICKNESS = 0.375"
3. MINIMUM HELIX PL TO BE 3/8". HELICAL ANCHOR SUPPLIER TO DETERMINE FINAL f SIZE.
4. CORRODED PROPERTIES & CAPACITIES INCLUDE A 50 YEAR SCHEDULED SACRIFICIAL LOSS IN THICKNESS PER ICC-ES AC358. ABOVE THIS REQUIREMENT, SOIL TO BE TESTED BY SOIL ENGINEER TO DETERMINE ADDITIONAL REQUIREMENTS.
5. PILE DESIGNER TO DESIGN PILES FOR MAX LATERAL LOAD OF 5 KIPS.
6. PILE DESIGNER TO DESIGN PILE FOR MAX MOMENT OF 10 KIPS/FT.

SHEET NOTES:

1. SEE SHEET S001 FOR GENERAL CONSTRUCTION NOTES.
2. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO NEW ADDITION INSTALL. CONTACT HEYER ENGINEERING IF DIFFERENCES OCCUR.
3. HPXX - HELICAL PILE MARK SEE SCEHDULE ON THIS SHEET.
4. ALL STRUCUTRAL STEEL TO BE HOT DIPPED GALVANIZED, SEE SHEET S001.



HELICAL PILE LAYOUT PLAN STA:200+42 TO STA:201+53.25

1/8" = 1'-0"

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
HELICAL PILE LAYOUT PLAN

DATE:	2/18/25-IFR
REVISED:	
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REVISED:	

PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

S202

HELICAL PILE PLACEMENT TABLE				
HELICAL #	MIN. HELICAL SIZE	HELICAL DESIGNED WORKING CAPACITY REQUIRED (COMP./TENS.)	ULTIMATE DRIVEN CAPACITY (COMP./TENS.)	NOTES
HP21–HP38	3" DIA.	20 KIPS/4 KIPS	60 KIPS/6 KIPS	1–6

NOTES:
1. ALL HELICAL PIPE PILE & PL'S SHALL BE ASTM A527 (MINIMUM GRADE FOR HELICAL PL).
2. MINIMUM WALL THICKNESS = 0.375"
3. MINIMUM HELIX PL TO BE 3/8". HELICAL ANCHOR SUPPLIER TO DETERMINE FINAL f SIZE.
4. CORRODED PROPERTIES & CAPACITIES INCLUDE A 50 YEAR SCHEDULED SACRIFICIAL LOSS IN THICKNESS PER ICC–ES AC358. ABOVE THIS REQUIREMENT, SOIL TO BE TESTED BY SOIL ENGINEER TO DETERMINE ADDITIONAL REQUIREMENTS.
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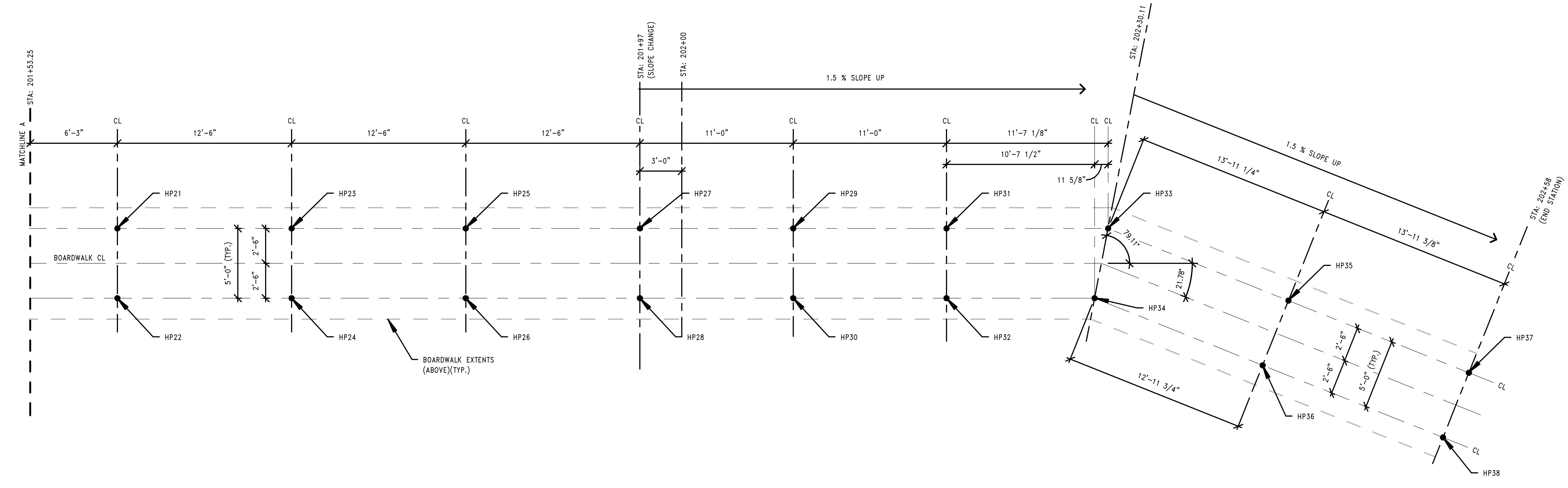
SHEET NOTES:

1. SEE SHEET S001 FOR GENERAL CONSTRUCTION NOTES.
2. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO NEW ADDITION INSTALL. CONTACT HEYER ENGINEERING IF DIFFERENCES OCCUR.
3. HPXX – HELICAL PILE MARK SEE SCHEDULE ON THIS SHEET.
4. ALL STRUCTURAL STEEL TO BE HOT DIPPED GALVANIZED, SEE SHEET S001.



HELICAL PILE LAYOUT PLAN STA:201+53.25 TO STA:202+58

1/8" = 1'-0"

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
HELICAL PILE LAYOUT PLAN

DATE:	2/18/25-IFR
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PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

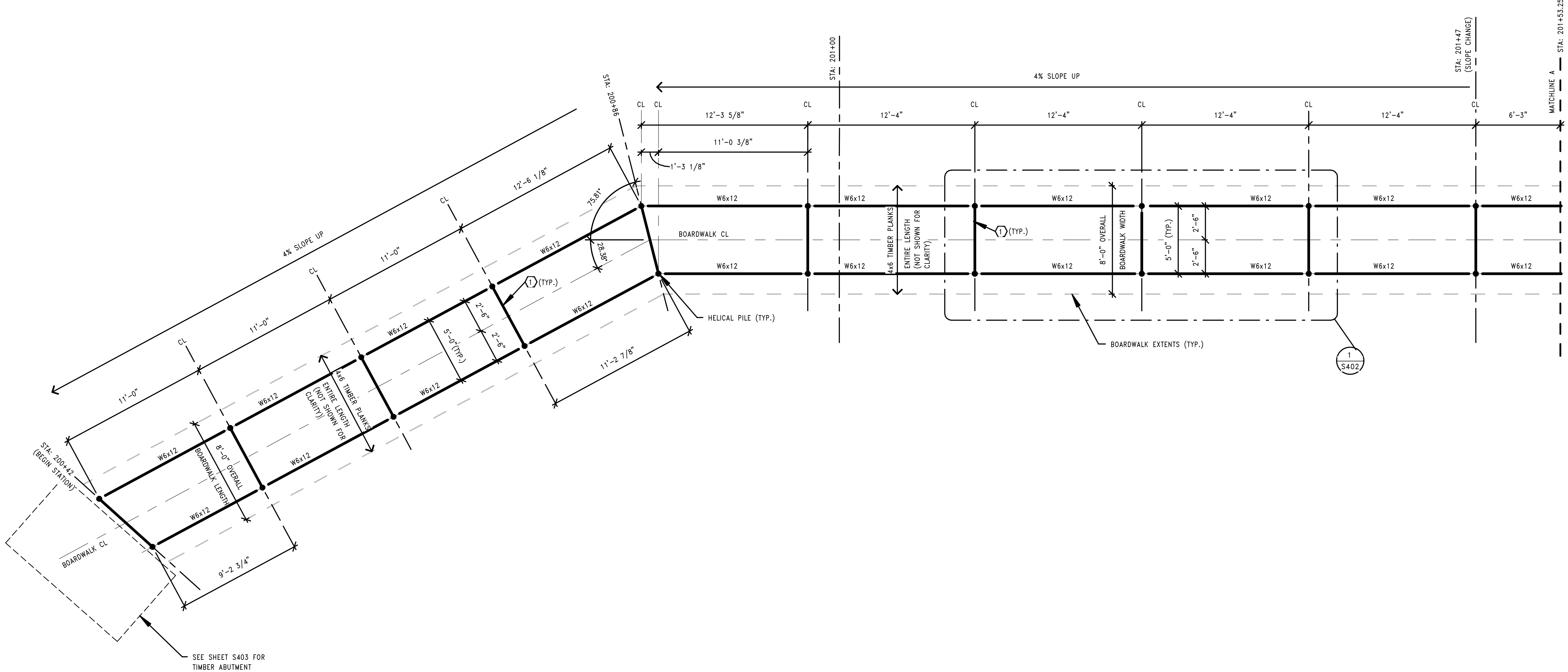
S203

SHEET NOTES:

1. SEE SHEET S001 FOR GENERAL CONSTRUCTION NOTES.
2. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO NEW ADDITION INSTALL. CONTACT HEYER ENGINEERING IF DIFFERENCES OCCUR.
3. LUMBER NOTATED W/ 'TREATED' SHALL BE PRESSURE TREATED SOUTHERN PINE NO. 2 OR BETTER.
4. ALL STRUCTURAL STEEL TO BE HOT DIPPED GALVANIZED, SEE SHEET S001.
5. TOP OF STEEL ELEVATION AT LEVEL/FLAT SECTION OF BOARDWALK IS 948'-5 3/16".

KEY NOTES:

(1) 3" DIA. SCHED 40 PIPE



BOARDWALK FRAMING PLAN STA:200+42 TO STA:201+53.25

1/8" = 1'-0"

T.O. STEEL EL. = VARIES

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
BOARDWALK FRAMING PLAN

DATE:	2/18/25-IFR
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PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

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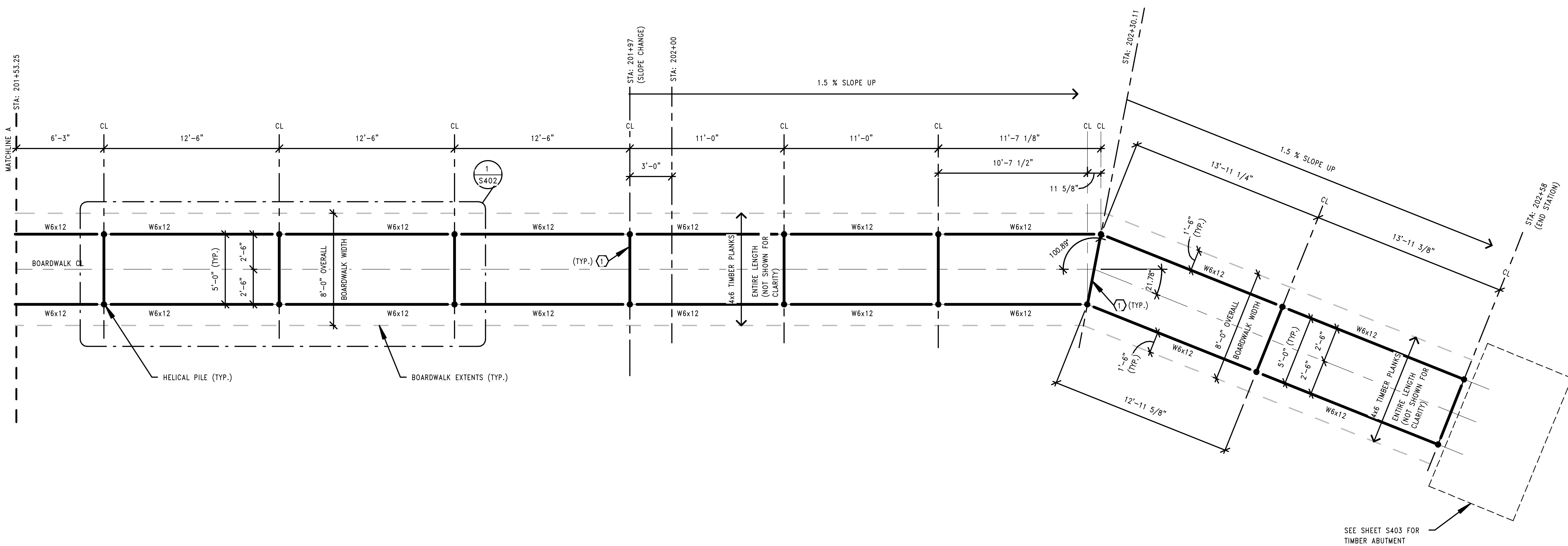
S204

SHEET NOTES:

1. SEE SHEET S001 FOR GENERAL CONSTRUCTION NOTES.
2. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO NEW ADDITION INSTALL. CONTACT HEYER ENGINEERING IF DIFFERENCES OCCUR.
3. LUMBER NOTATED W/ 'TREATED' SHALL BE PRESSURE TREATED SOUTHERN PINE NO. 2 OR BETTER.
4. ALL STRUCTURAL STEEL TO BE HOT DIPPED GALVANIZED, SEE SHEET S001.
5. TOP OF STEEL ELEVATION AT LEVEL/FLAT SECTION OF BOARDWALK IS 948'-5 3/16".

KEY NOTES:

(1) 3" DIA. SCHED 40 PIPE



HELICAL PILE LAYOUT PLAN STA:201+53.25 TO STA:202+58

1/8" = 1'-0"

T.O. STEEL EL. = VARIES

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
BOARDWALK FRAMING PLAN

DATE:	2/18/25-IFR
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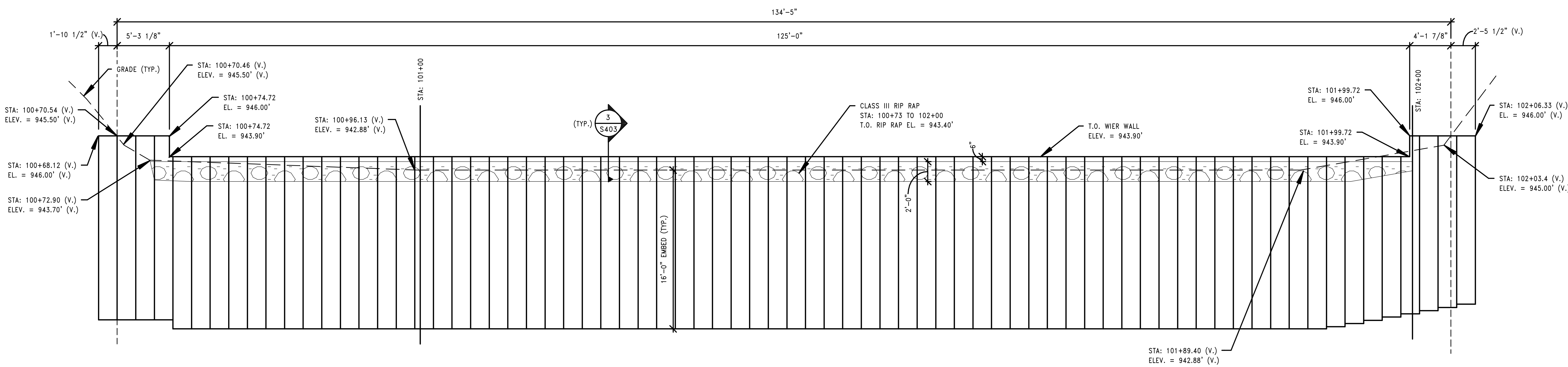
HE 057.0143.2024 KF/JG

SHEET NOTES:

1. SEE SHEET S001 FOR GENERAL CONSTRUCTION NOTES.
2. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO NEW ADDITION INSTALL. CONTACT HEYER ENGINEERING IF DIFFERENCES OCCUR.
3. SHEET PILE TO BE PZ22.
4. ALL STRUCTURAL STEEL TO BE HOT DIPPED GALVANIZED, SEE SHEET S001.
5. CONTRACTOR TO INSTALL ONE FULL PILE WIDTH BEYOND INTERSECTION WITH GRADE.



SHEET PILE/WEIR WALL ELEVATION
3/32" = 1'-0"

moore engineering, inc.

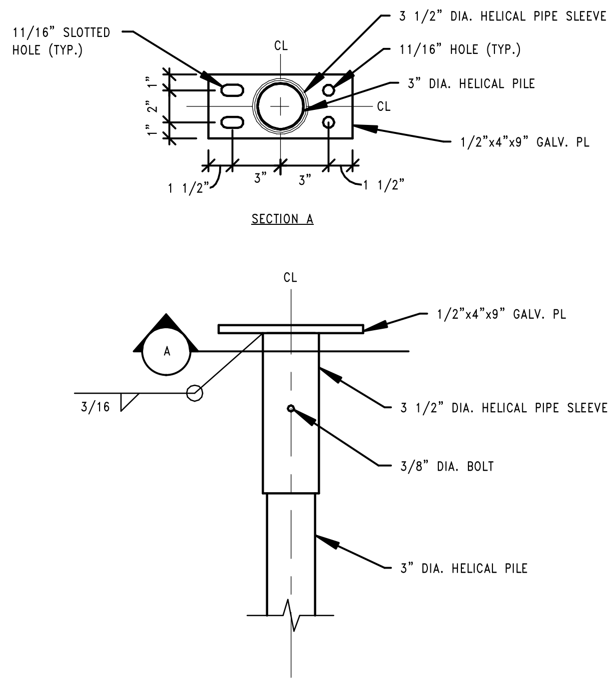
STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
SHEET PILE WEIR WALL ELEVATION

DATE:	2/18/25-IFR
REVISED:	
REVISED:	
REVISED:	
REVISED:	
REVISED:	
REVISED:	
PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

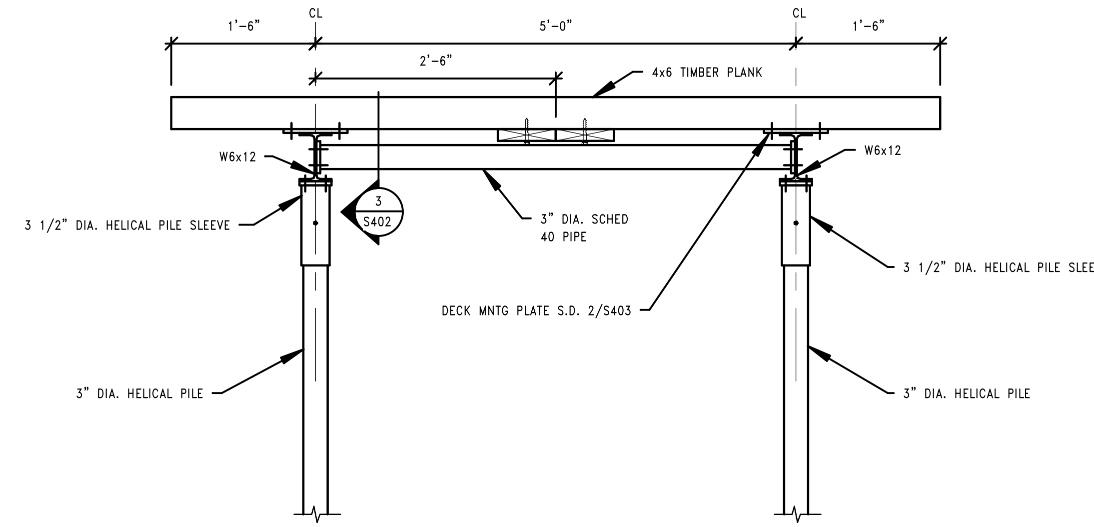
HEYER ENGINEERING
STRUCTURAL CONSULTANT
4180 24th Avenue S | Fargo, ND 58103 | (P)701.280.0949
www.heyerengineering.com

HE 057.0143.2024 KF/JG

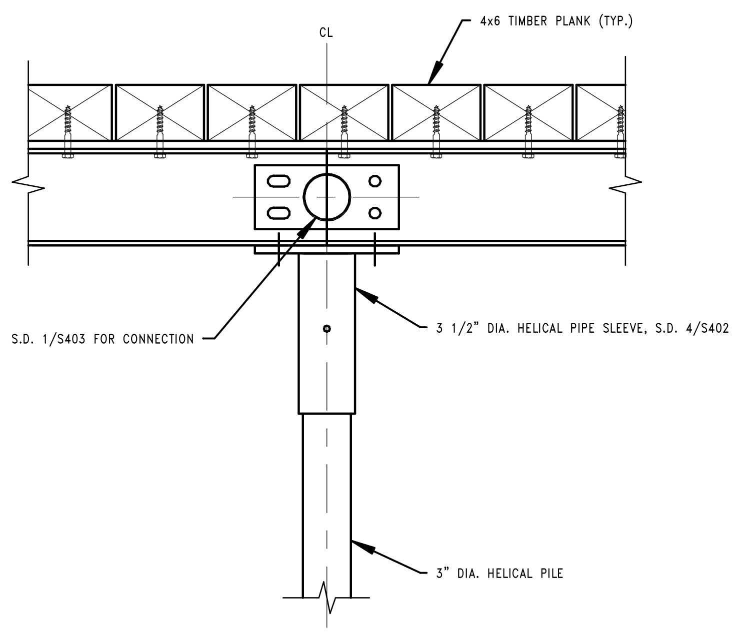
S401



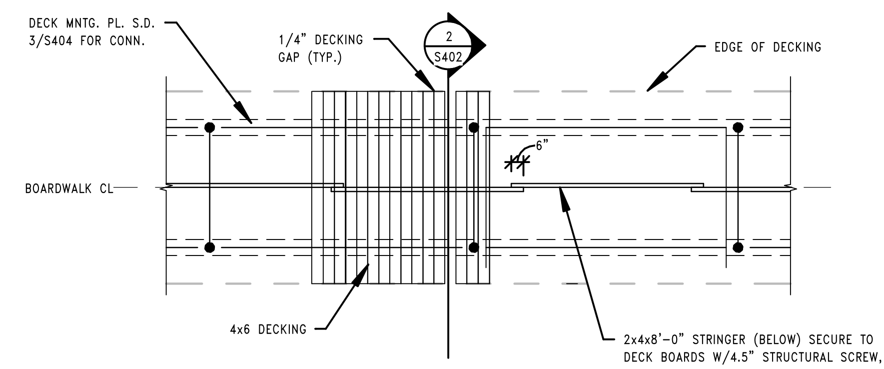
4 / S402 PILE & PILE CAP DETAIL
1" = 1'-0"



2 / S402 BOARDWALK SECTION
1/2" = 1'-0"



3 / S402 BOARDWALK ELEVATION
1" = 1'-0"



1 / S402 BOARDWALK DETAIL PLAN
1/8" = 1'-0"

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
FRAMING DETAILS

DATE:	2/18/25-IFR
REVISED:	
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REVISED:	
PROJECT No.	24026
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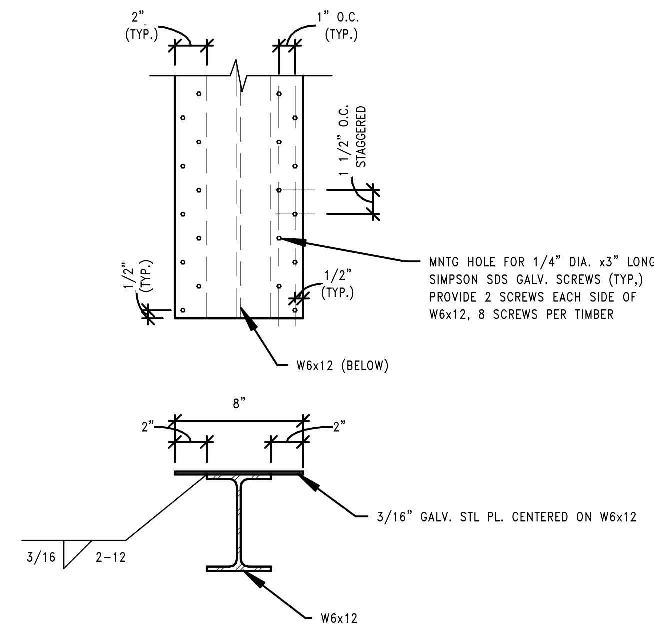
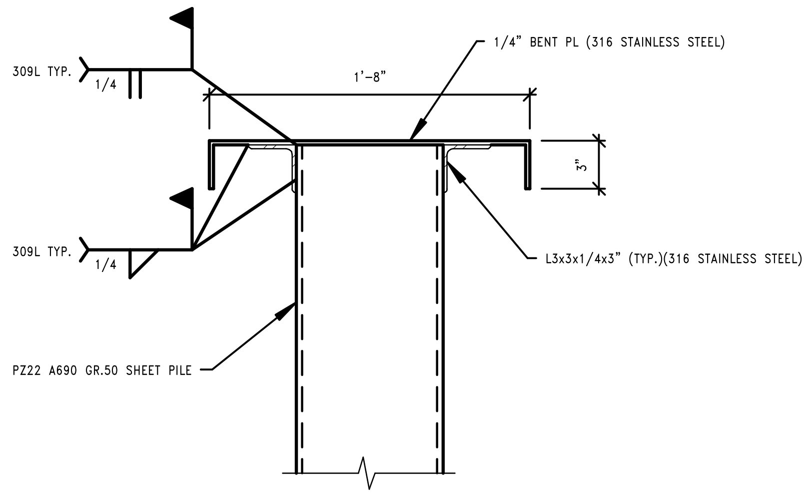
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

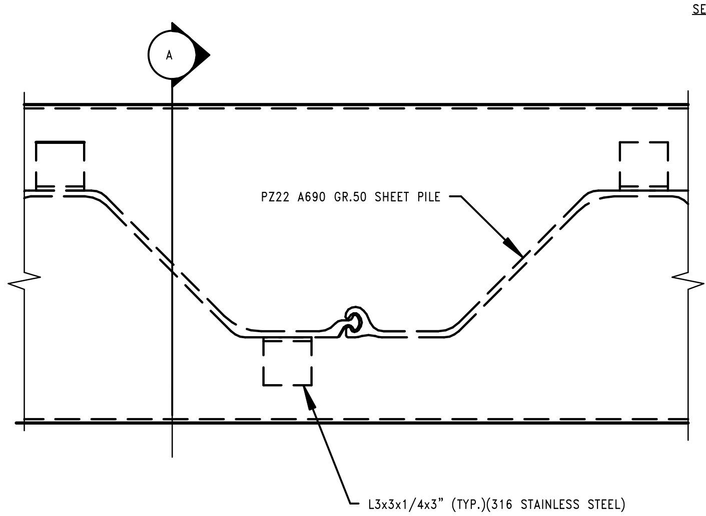
S402

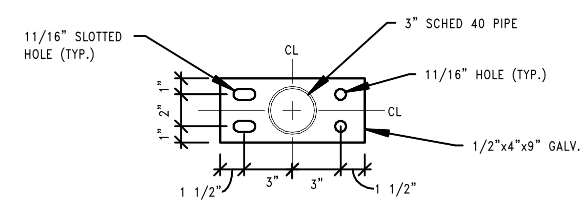


2 S403 DECK MTNG PLATE DETAIL
1" = 1'-0"

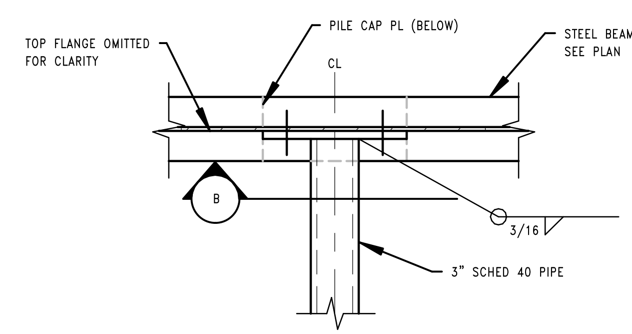


SECTION A





SECTION B



3 S403 PILE CAP DETAIL
1" = 1'-0"

1 S403 CROSS PIPE & PLATE DETAIL
1" = 1'-0"

PRELIMINARY 60% NOT FOR CONSTRUCTION

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STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
FRAMING DETAILS

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REVISED:	

PROJECT No.	24026
DRAWN BY:	KF
CHECKED BY:	JDG
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

S403

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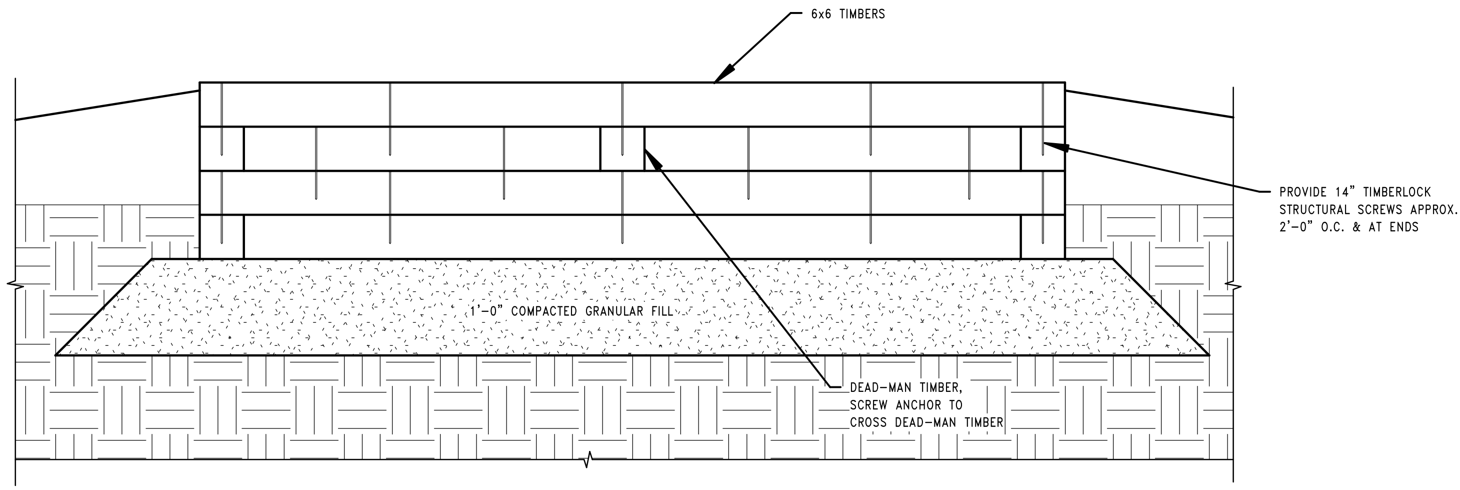
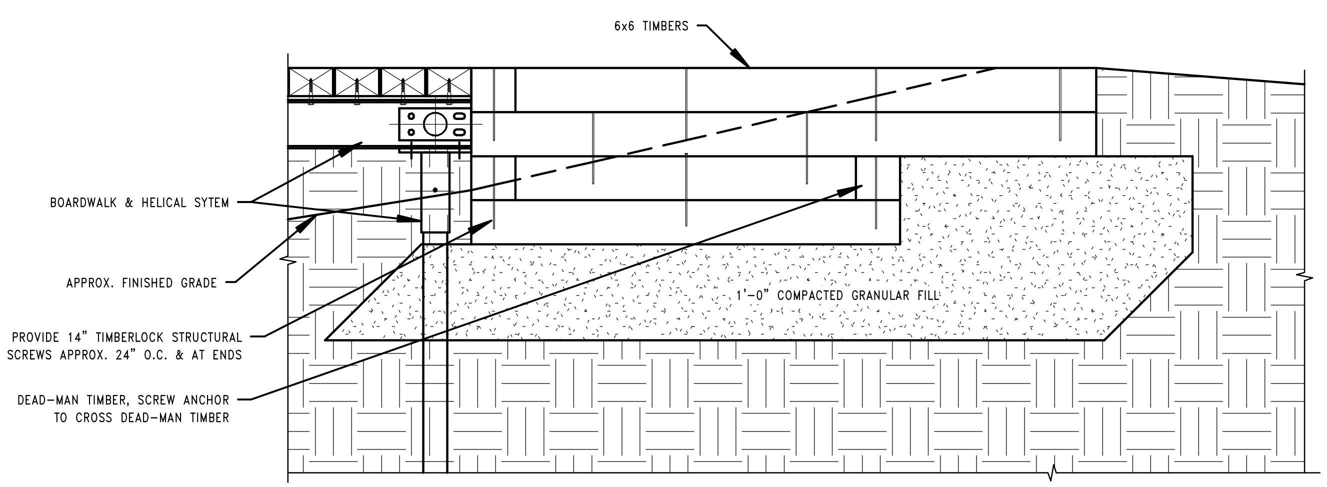
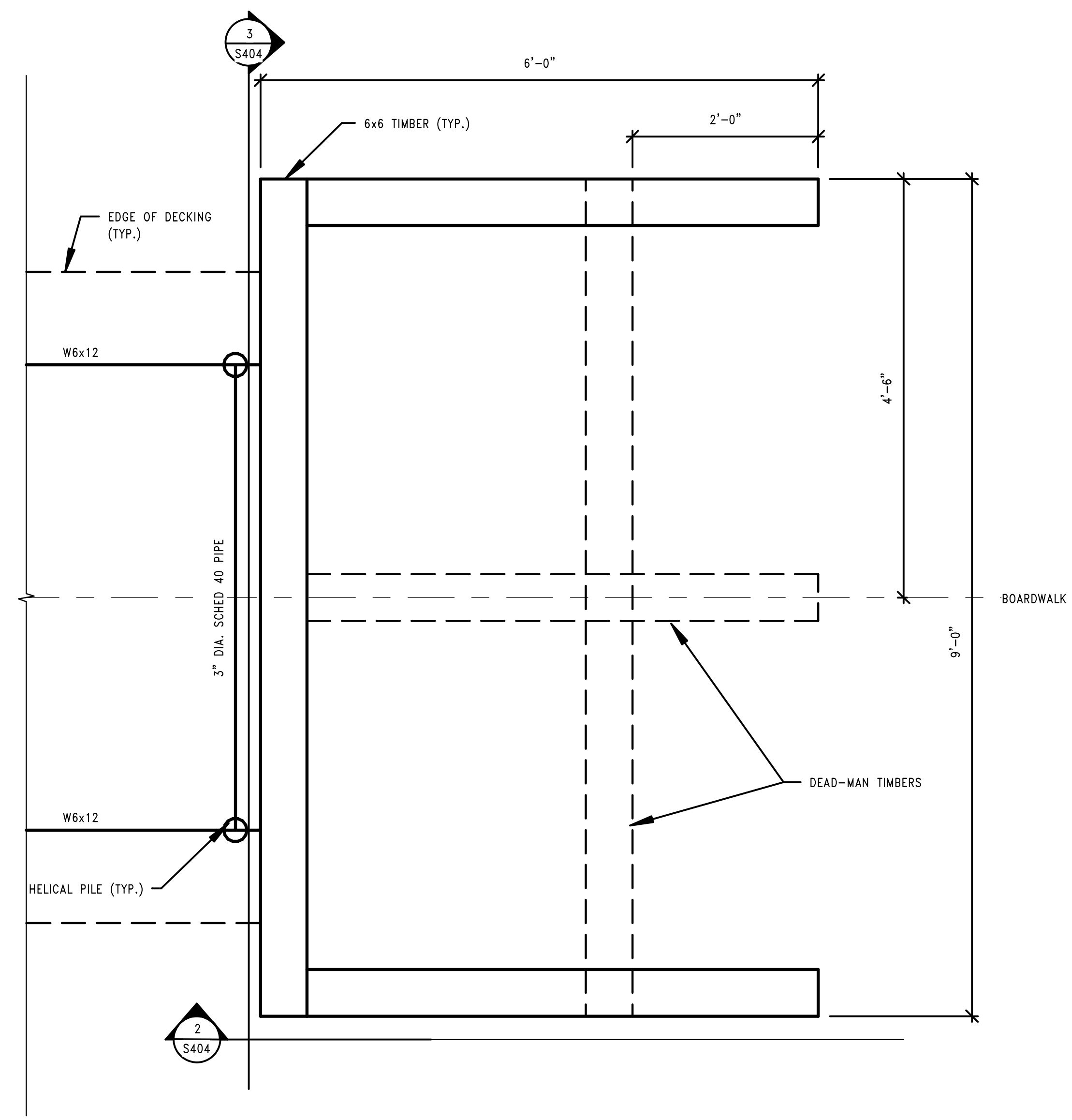


3 S404 TIMBER ABUTMENT ELEVATION
1/2" = 1'-0"



2 S404 TIMBER ABUTMENT SECTION
1/2" = 1'-0"



1 S404 TIMBER ABUTMENT DETAIL
1/2" = 1'-0"

moore engineering, inc.

STRUCTURAL DRAWINGS
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
FRAMING DETAILS

DATE:	2/18/25-IFR
REVISED:	
REVISED:	
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REVISED:	
REVISED:	

PROJECT No.	24026
DRAWN BY:	Author
CHECKED BY:	Designer
PROJ. MANAGER:	JCM
PROJ. ENGINEER:	QDS

S404

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Attachment 2

EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
60% DESIGN OPINION OF PROBABLE COST
FEBRUARY 18, 2024

moore engineering, inc.

ITEM NO.	ITEM DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT COST	TOTAL PROJECT COST
1	MOBILIZATION	LS	1	$ 42,000	$ 42,000
2	CLEAR AND GRUB	LS	1	$ 5,000	$ 5,000
3	REMOVE SIDEWALK/TRAIL (ALL TYPES)	SY	70	$ 20	$ 1,400
4	REMOVE BOARDWALK	SF	2,030	$ 20	$ 40,600
5	STABILIZED CONSTRUCTION ENTRANCE	EA	1	$ 3,000	$ 3,000
6	STORMWATER MANAGEMENT AND DEWATERING	LS	1	$ 30,000	$ 30,000
7	SILT FENCE, MS	LF	300	$ 5	$ 1,500
8	COMMON EXCAVATION (P) (CV)	CY	10	$ 50	$ 500
9	3" BITUMINOUS TRAIL PATCH	SY	25	$ 300	$ 7,500
10	AGGREGATE BASE - CL 5	CY	10	$ 50	$ 500
11	HELICAL PIERS (BOARDWALK)	LF	760	$ 110	$ 83,600
12	STEEL BEAMS (BOARDWALK)	TON	3.0	$ 15,000	$ 45,000
13	MISC. STEEL	TON	1.2	$ 15,000	$ 18,000
14	6x6 TIMBER PLANKS	SF	100	$ 12	$ 1,200
15	4x6 TIMBER PLANKS	SF	1,720	$ 12	$ 20,640
16	2x4 BOARDS	SF	75	$ 4	$ 300
17	SHEET PILE	SF	2,520	$ 85	$ 214,200
18	SHEET PILE CAP	TON	1.6	$ 15,000	$ 24,000
19	RANDOM RIPRAP CLASS III	CY	50	$ 125	$ 6,250
20	SEED MIX - SOUTHERN TALLGRASS ROADSIDE (STR)	LB	3	$ 250	$ 750
21	SEED MIX - WET DITCH (WD)	LB	3	$ 250	$ 750
22	CATEGORY 20	SY	530	$ 3	$ 1,590
23	TRAFFIC CONTROL	LS	1	$ 10,000	$ 10,000
24	STREET SWEEPER (WITH PICKUP BROOM)	HR	20	$ 100	$ 2,000
25	SHRUB PLANTINGS	EA	20	$ 50	$ 1,000
				SUBTOTAL	$ 561,280
				CONSTRUCTION ENGINEERING (8%)	$ 45,000
				CONTINGENCY (10%)	$ 61,000
				CONSTRUCTION TOTAL	$ 667,280

Attachment 3

REPORT OF GEOTECHNICAL EXPLORATION

Proposed Sheet Pile Weir
Victoria, Minnesota

AET Project No. P-0035448

Date: January 29, 2025

Prepared for:
Moore Engineering, Inc.
925 10th Avenue East Suite 1
West Fargo, ND 58078

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com • 800.972.6364

January 29, 2025

Moore Engineering, Inc.
925 10th Avenue East Suite 1
West Fargo, ND 58078

Attn: Daniel Elemes, PE
dan.elemes@mooreengineeringinc.com

RE: Report of Geotechnical Exploration
Proposed Sheet Pile Weir
Between Wassermann Lake and Carl Krey Lake
Victoria, Minnesota
AET Report No. P-0035448

Dear Mr. Elemes:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for Proposed Sheet Pile Weir - Victoria in Victoria, Minnesota. These services were performed according to our executed contract to you dated June 11, 2024.

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

Sincerely,
American Engineering Testing, Inc.

Thomas Evans, PE (MN)
Senior Engineer
tevans@teamAET.com
Mobile: (701) 690-9732

SIGNATURE PAGE

Prepared for:

Moore Engineering, Inc.
925 10th Avenue East Suite 1
West Fargo, ND 58078

Attn: Daniel Elemes, PE
dan.elemes@mooreengineeringinc.com

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
(651) 659-9001/www.teamAET.com

Authored by:

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Engineer I
kdhungana@teamAET.com
(651) 442-1357

Reviewed by:

Thomas Evans, PE (MN)
Senior Engineer
tevans@teamAET.com
(701) 690-9732

I hereby certify that this 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: Thomas Evans

Date: January 29, 2025

License #: 55092

TABLE OF CONTENTS

1.0 INTRODUCTION

Minnehaha Creek Watershed District (MCWD) is proposing the construction of a sheet pile weir in Victoria, Minnesota. Moore Engineering is performing the design services on the project. 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 the obtained data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our executed contract to you dated June 11, 2024. The authorized scope consists of the following:

- Perform 2 standard penetration tests (SPT) borings to a depth of 24.5 feet.
- Soil laboratory testing.
- Geotechnical engineering review based on the data and preparation of this report.

3.0 PROJECT INFORMATION

We understand the MCWD is proposing the construction of a proposed sheet pile weir, between Wassermann Lake and Carl Krey Lake in Victoria, Minnesota. Moore Engineering has provided preliminary plan and profile drawings of the weir dated August 7, 2024, which are attended in the appendix of this report. We understand the weir will be about 150 feet long. The top of weir elevation ranges from 944.0 feet to 945.5 feet while the bottom of weir elevation ranges from about 934 feet to 935½ feet. Therefore, the weir is about 10 feet tall. However, these dimensions are subject to change. We understand a portion of the weir will have several feet of riprap placed behind the weir.

We understand the proposed construction will also consist of replacing a portion of the existing boardwalk. The new boardwalk will be using helical piles for foundation support.

The above stated information represents our understanding of the proposed and previous 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 two standard penetration test borings performed on December 6 and December 9, 2024. Moore Engineering determined the number, location, and depth of the soil borings.

The approximate boring locations are shown on the Boring Location Map in Appendix A. The borings were located in the field by AET personnel. The boring locations and ground surface elevations were collected in the field by AET personnel using GPS equipment with sub-meter accuracy. Please note that the GPS collected elevations were recorded to provide relative consistency for presenting geotechnical data, and they do not represent the precision of a licensed land surveyor.

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).

4.2 Laboratory Testing

Samples collected in the field were reviewed at the AET geotechnical laboratory. The laboratory testing program included moisture content tests on fine-grained soil samples. Additionally, one unconfined compression test was performed on a twin wall sample.

5.0 SITE CONDITIONS

5.1 Surface Observations

The site currently is occupied with a wetland with heavily forested areas on both sides of the wetland. The proposed construction site will be located south of the existing boardwalk. The borings were performed in the wetland area. Elevations at our soil borings ranged from 943.4 feet to 943.6 feet.

5.2 Subsurface Soils/Geology

The soils encountered at the boring locations consist of up to 4.5 feet of swamp deposits underlain by interbedded layers of alluvium and till deposits to the termination depths at each boring location.

The swamp deposit consists of organic clay and sapric peat. The moisture contents of these soils ranged from 89% to 155%.

The coarse alluvial soils consist of loose silty sand. The till soils consist of soft to very stiff clayey sand and sandy lean clay. Additionally, mixed alluvial soils encountered in our borings, consist of soft sandy lean clay. Please refer to the boring logs for additional information.

5.3 Groundwater

The soil borings were observed for the presence of groundwater during drilling and upon reaching the planned termination depths. At the time of drilling, groundwater was observed in both borings at approximate depths ranging from 7.3 feet to 9.3 feet below existing grade. However, groundwater levels can take hours, days, or longer to stabilize within the clayey soils encountered throughout the site. Therefore, the measured groundwater depth and lack of measured groundwater may not be indicative of the hydrostatic groundwater level at the site. The groundwater levels at the boring locations will be heavily dependent on the surface water elevation within the wetlands. Based on the drawings from Moore Engineering, the 2-year, 10-year, and 100-year high water level (HWL) are 944.39 feet, 944.64 feet, and 945.23 feet, respectively.

Groundwater levels at other times and locations may vary from the groundwater levels observed at the time of our exploration. Additionally, groundwater levels will fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors.

6.0 RECOMMENDATIONS

6.1 Boardwalk

We understand the MCWD and Moore Engineering are considering helical piles for the boardwalk foundation support.

Helical piles consist of small diameter, cylindrical steel shafts or square steel bars that have one or more steel helixes spaced along the lead (bottom) section. Helical piles are typically installed by a small skid steer or excavator with a hydraulic torque head. The helical piles are rotated into the ground and sections are added to the length of the pile until competent bearing soil is encountered. The capacity of the piles is determined during installation by monitoring the torque needed to install the piles. Helical pile installation creates less perceivable noise and vibrations compared to driven pile installation methods.

Helical pile design is generally performed by specialty contractors such as Veit and Atlas Foundation Company. We can provide contact information for these firms if you are interested.

A specialty contractor can best determine the appropriate pile type, the required installation depths, and the load carrying capacities for their various pile types, pile lengths, shaft sizes, and/or number and sizes of helices. Actual installed pile depths will be dependent upon the geometry of the installed pile and the resistance of the pile in the soil at the time of construction. Allowable design capacities will be dependent upon the spacing between the elements and pile geometry.

We recommend the contractor determine the ultimate capacity using a static axial compressive load test (in accordance with ASTM D 1143), such that the conventional torque proof test used during installation can be properly confirmed. We recommend a minimum of one load test per 200 piles.

The helical piles should have center-to-center spacing of at least 3 times the largest helix diameter, resulting in an edge-to-edge spacing of 2 or more for the largest helix. If piles are placed closer, a reduction factor for group effects should be applied. Given that the existing boardwalk is supported by direct connection to helical piles that extend up from the ground, we assume a similar configuration will be used for the new boardwalk. Frost uplift forces will tend to act on the helical pile shaft during winter. In our experience, it is typical to use a frost adhesion value of 15-psi acting upward on the surface area of the shaft to the annual maximum frost depth. For this area of Minnesota, we recommend assuming a frost depth of 5 feet unless other specific long-term data on surface frost depth is available. We recommend that the helical pile designer check uplift stability of the helical piles due to frost adhesion by this method. For this type of non-building structure, we recommend using a safety factor of at least 1.25 (i.e. the uplift capacity of the helical pile should be at least 25% higher than the frost uplift force).

The helical pile elements, including the central steel shaft, helix bearing plates, bolts, and couplings should be hot-dipped galvanized in accordance with ASTM: A153, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Hardware* after fabrication. The installer should demonstrate that the corrosion protection provides for a 50-year minimum lifespan using industry evaluation methods. Electrical continuity should be maintained along the entire length of the pile.

6.2 Sheet Pile Weir

We understand the design of the sheet pile weir will be performed by others. AET is only contracted to provide lateral earth pressures based on the soils encountered at the boring locations.

As mentioned previously, the top of weir elevation ranges from 944.0 feet to 945.5 feet while the bottom of weir elevation ranges from about 934 feet to 935.5 feet. We understand a portion of the weir will have several feet of riprap placed behind the weir. However, due to the preliminary nature of the plans, we understand these dimensions may change.

Therefore, Table 6.2 shows our estimated lateral earth pressures (given in equivalent fluid pressure values) for the organic soils, clayey till/alluvial soils, and the riprap. These values assume groundwater is at or above the surface; and therefore, the soils will be saturated. The depths listed in Table 6.2 are based on the soil conditions encountered in boring B-1, as it had a greater thickness of soft, organic soils. However, soil conditions will vary from the boring locations. Additionally, the planned thickness of the riprap was not provided, so the depth is not included in the table.

Table 6.2 - Soil Parameters

Soil Parameter	Organic Soils	Clayey Sand and Sandy Lean Clay	Riprap
Approximate Elevation	0-4½ feet	4½-24½ feet	--
Active Earth Pressure	80	105	75
Passive Earth Pressure	90	145	NA*
At-rest Earth Pressure	85	110	85
Internal Friction Angle	5	10	38
Unit Weight (pcf)	85	120	125

*Passive resistance does not apply for the riprap, which we understand is only planned to be placed behind the weir, not in front.

Because movement is required to develop the full passive pressure, we recommend applying a factor of safety of at least 2 to the above passive value for design. The lateral earth pressures do not include surcharge loading.

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.

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 till and alluvial 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."

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Boring Location Map
Subsurface Boring Logs
Unconfined Compression Test Result
Preliminary Weir Plans

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling two standard penetration test borings. The locations of the borings appear on the Boring Location Map, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586. 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.

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 Unconfined Compressive Strength of Cohesive Soil
Conducted per AET Procedure 01-LAB-080, which is performed in general accordance with ASTM: D2166 and AASHTO: T208.

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.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1-3/8” is inside diameter; 2” outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after “falling” through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
∇:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4” or more in length as a percent of total core run)
SA	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

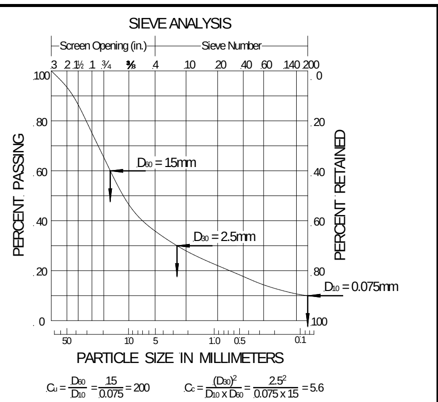
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6” increments of penetration. If the sampler is driven less than 18” (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6” increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

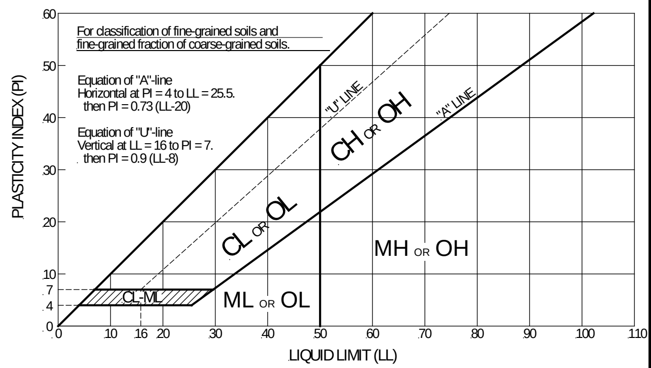
The length of sample recovered, as shown on the “REC” column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6” set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18”).

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]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[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]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[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]





Plasticity Chart

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 $\geq$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 $\geq$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 $\geq$30% plus No. 200, predominantly sand, add "sandy" to group name.
[M]If soil contains $\geq$30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N]$PI \geq 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.

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

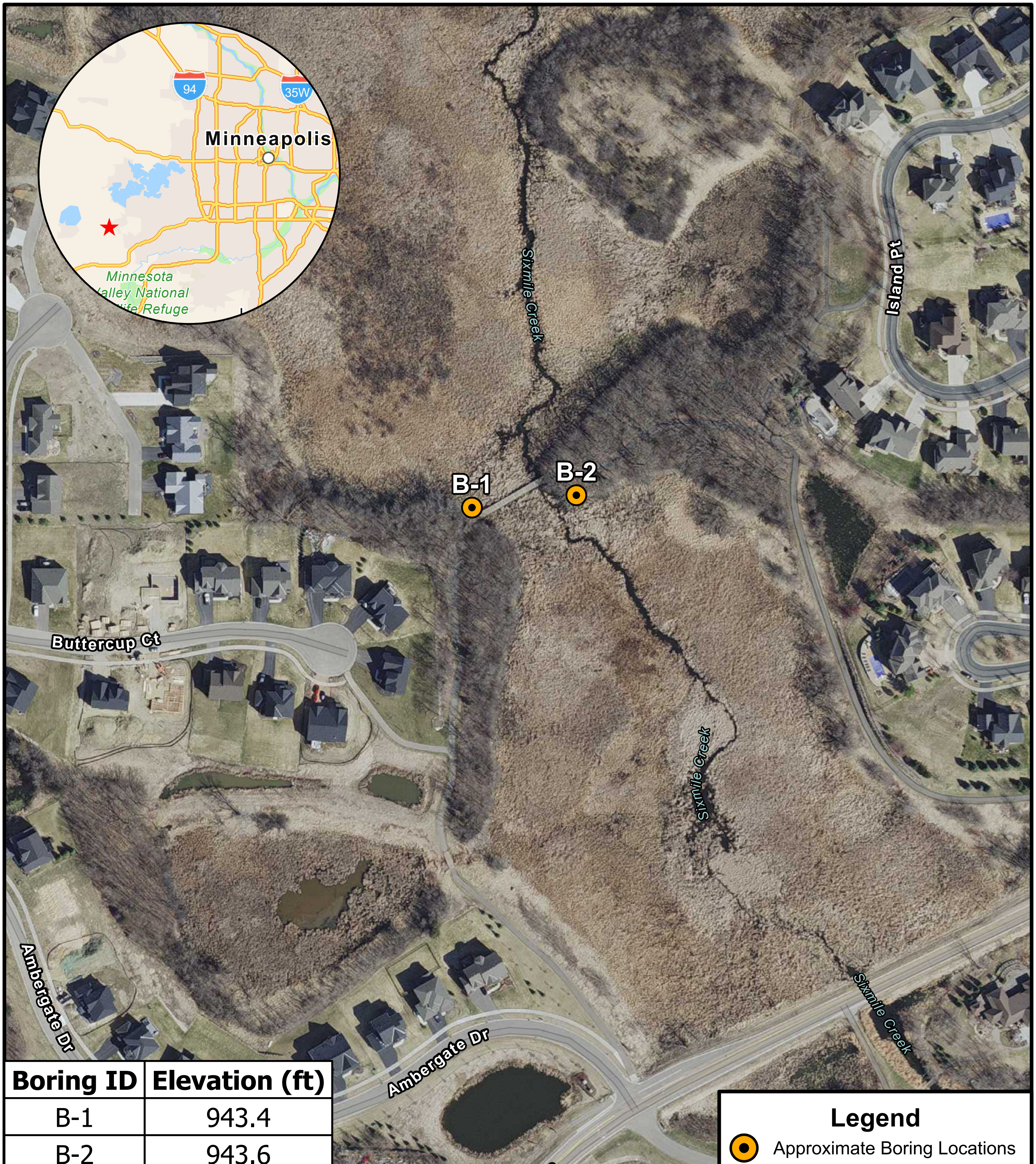
Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

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.



Boring ID	Elevation (ft)
B-1	943.4
B-2	943.6

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Figure 1
Boring Location Map

Proposed Sheet Pile Weir
Victoria, MN

Date: 12/16/2024 AET Project No. P-0035448

SUBSURFACE BORING LOG

AET JOB NO: **P-0035448** LOG OF BORING NO. **B-1 (p. 1 of 1)**

PROJECT: **Proposed Sheet Pile Weir; Victoria, MN**

SURFACE ELEVATION: **943.4** LATITUDE: **44.848626** LONGITUDE: **-93.682295**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	ORGANIC CLAY, trace roots, black, very soft (OL)	SWAMP DEPOSIT									
1			0	M	SS	0	91				
2	SAPRIC PEAT, trace roots, black, very soft (PT)										
3			0	M	SS	4	155				
4											
5	SANDY LEAN CLAY, trace roots, dark gray (CL)	MIXED ALLUVIUM		M	TW	24	36				
6											
7	CLAYEY SAND, a little gravel, gray, firm to very stiff, lens of silty sand around 15' (SC)	TILL									
8			8	M	SS	20	23				
9				▼							
10			9	M	SS	18	20				
11											
12											
13				M	SS	18					
14											
15			16	M	SS	24	17				
16											
17											
18											
19											
20			14	M	SS	14	19				
21											
22											
23			14	M	SS	24	15				
24											
	END OF BORING N-values not collected for 12-14' sample.										

DEPTH:	DRILLING METHOD
0-22½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
12/9/24	11:20	9.0	7.0	9.5		9.3
12/9/24	11:30	9.0	7.0	9.5		9.3
12/9/24	12:00	24.5	22.5	24.5		24.3

BORING COMPLETED: **12/9/24**

DR: **SD** LG: **RG** Rig: **92**

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

AET_CORP W-LAT-LONG P-0035448 VICTORIA - MOORE ENGINEERING.GPJ AET+CPT+WELL.GDT 1/2/25

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET JOB NO: **P-0035448** LOG OF BORING NO. **B-2 (p. 1 of 1)**

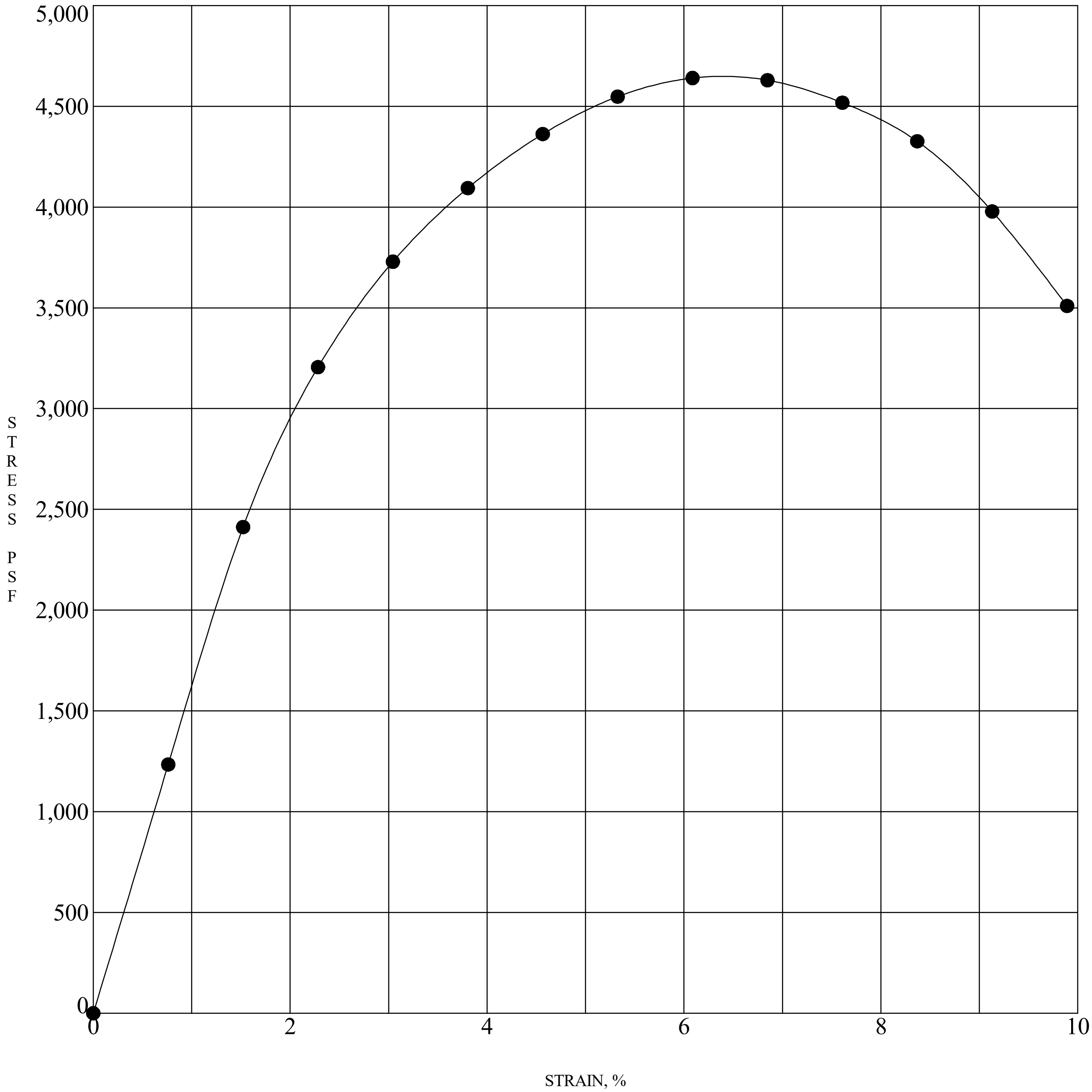
PROJECT: **Proposed Sheet Pile Weir; Victoria, MN**

SURFACE ELEVATION: **943.6** LATITUDE: **44.848680** LONGITUDE: **-93.681643**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–1.5	ORGANIC CLAY, trace roots, black, soft (OL/OH)	SWAMP DEPOSIT	2	M	SS	10	89				
1.5–2.7	SANDY LEAN CLAY, trace roots, gray and brown mottled, soft (CL)	MIXED ALLUVIUM					30				
2.7–4.5	SANDY LEAN CLAY, trace roots, brown, gray and light gray mottled, soft (CL)	TILL	4	M	SS	16	21				
4.5–18	SANDY LEAN CLAY, a little gravel, brown and gray mottled to grayish brown below 12', stiff to very stiff (CL)			M	TW	20	21	106			
7.3	(water level ▼)										
			13	M	SS	24	18				
			14	M	SS	24	17				
			16	M	SS	24	18				
			20	M	SS	18	17				
18–22	SILTY SAND, fine grained, grayish brown, waterbearing, loose (SM)	COARSE ALLUVIUM	10	W	SS	18					
22–24.5	CLAYEY SAND, a little gravel, gray, stiff, lenses of waterbearing sand (SC)	TILL	10	M	SS	16	15				
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-22½'	**3.25" HSA**	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		12/6/24	**1:10**	**24.5**	**22.5**	**22.5**		**7.3**	
BORING COMPLETED:	**12/6/24**								
DR: **GH** LG: **JMM**	Rig: **92**								

AET_CORP W-LAT-LONG P-0035448 VICTORIA - MOORE ENGINEERING.GPJ AET+CPT+WELL.GDT 1/2/25



	Specimen Identification		Classification	DD	MC%
●	#B-2	4.5'	**SANDY LEAN CLAY, a little gravel (CL)**	**106**	**21**

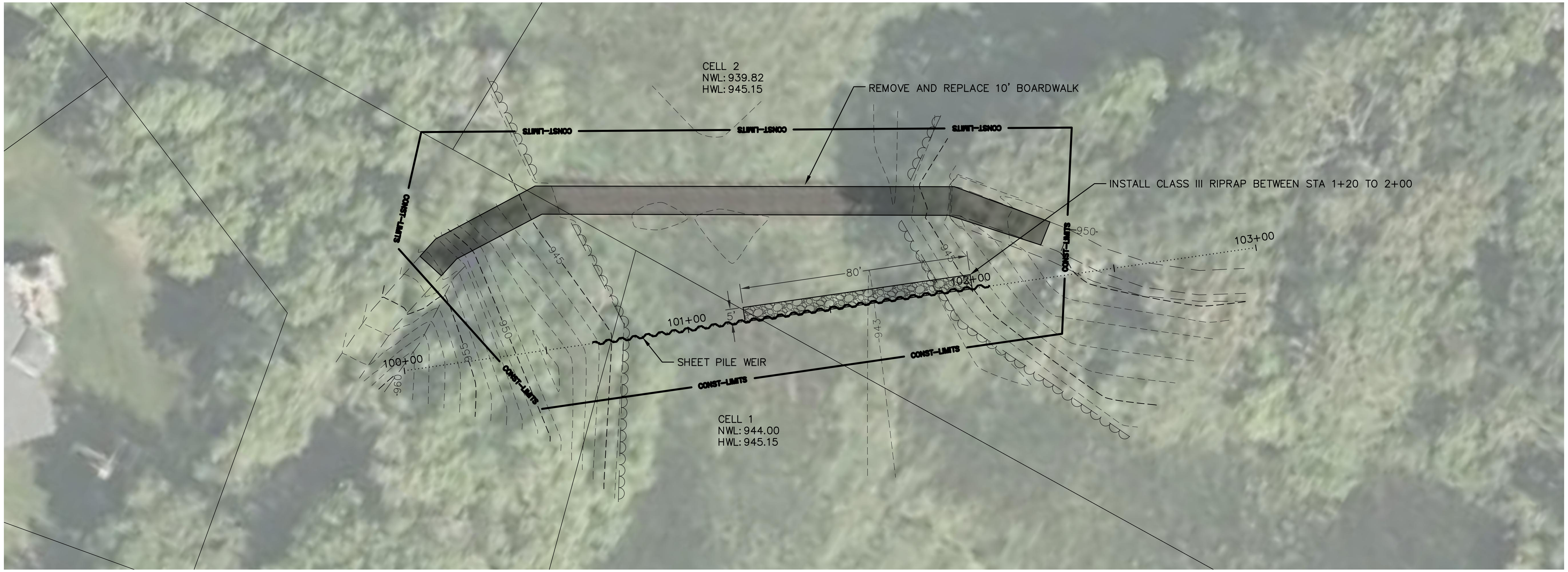
PROJECT **Proposed Sheet Pile Weir; Victoria, MN**

AET JOB NO. **P-0035448**
DATE **12/6/24**

AMERICAN ENGINEERING TESTING
AET
550 Cleveland Avenue North
St. Paul, MN 55114
Telephone: (651) 659-9001
Fax: (651) 659-1347

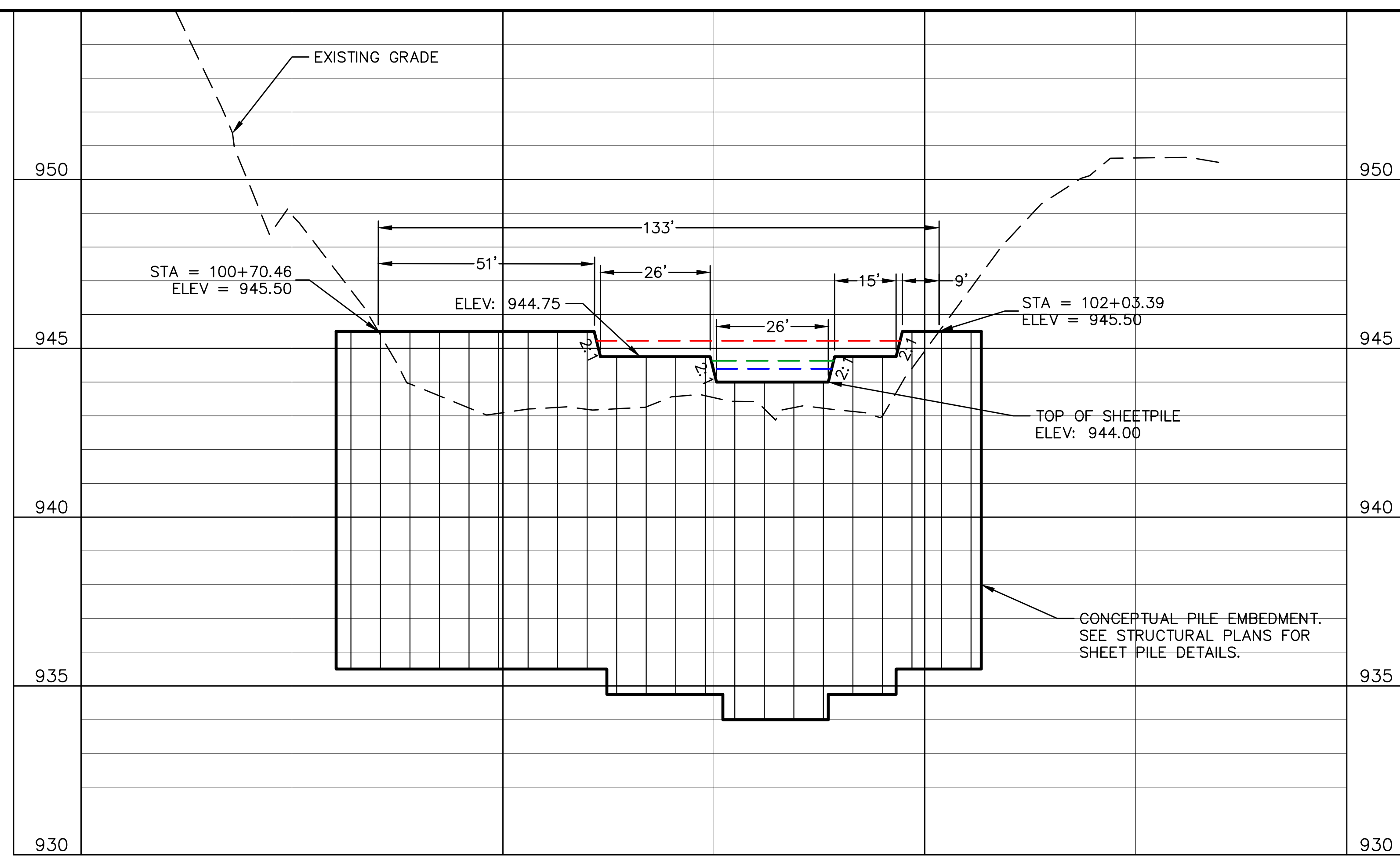
UNCONFINED COMPRESSION TEST

FILE LOCATION: R:\Projects\24000\24026\CIVIL\PRODUCTION\24026_Plan.dwg



PRELIMINARY

0 40
Scale in Feet



2-YEAR HWL:
ELEV: 944.39

10-YEAR HWL:
ELEV: 944.64

100-YEAR HWL:
ELEV: 945.23

moore engineering, inc.

PLAN & PROFILE
EAST AUBURN WETLAND RESTORATION
MINNEHAHA CREEK WATERSHED DISTRICT
VICTORIA, MINNESOTA
SHEET PILE WEIR PLAN AND PROFILE

DATE:	8-7-2024
REV DATE:	----
REV NUM:	----
RECORD:	----
PROJECT No.	24026
MANAGER:	JCM
DESIGNER:	QDS
DRAFTER:	DWA
REVIEWER:	DTE

C-401

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0035448

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.