



Title: Greenway to Cedar Regional Trail Connection and Streambank Restoration Feasibility Report

Prepared by: Gabriel Sherman
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Purpose:

To provide the Board of Managers an update on the Greenway to Cedar Regional Trail Connection and Streambank Restoration feasibility study and seek Board direction on next steps.

Background:

Since 2009, the Minnehaha Creek Watershed District (MCWD) has worked with municipal and private partners on a series of projects in the highly urbanized corridor between West 34th Street and Meadowbrook Lake (Hopkins and St. Louis Park) to address downstream water quality and quantity issues, lack of recreational access to Minnehaha Creek, and catalyze economic development. A conceptual design for the Minnehaha Creek Greenway encompassing these projects and identifying future projects in the corridor was developed in 2012, and the partnership approach to these projects was distilled into the Balanced Urban Ecology policy adopted by the Board in 2014. With the 325 Blake Road Restoration and Redevelopment underway, the Greenway to Cedar Trail Connection and Streambank Restoration project represents the remaining gap in the network of trails and greenspace.

This project will bring the Greenway trail under the newly constructed SWLRT corridor, creating the final trail connection between the Minnehaha Creek Preserve and the Cedar Lake LRT Regional Trail by 325 Blake Road. With the completion of this project and 325 Blake Road, uninterrupted pedestrian infrastructure along Minnehaha Creek will exist between Methodist Hospital in St. Louis Park and Cottageville Park in Hopkins. This project also provides an opportunity to stabilize the streambanks and enhance the riparian zone of the stretch of Minnehaha Creek between 325 Blake Road and the Minnehaha Creek Preserve.

Initial feasibility work was conducted in 2015/2016 by Wenck (now Stantec) and resulted in two potential trail alignments between Minnehaha Creek Preserve and the Cedar Lake LRT Regional Trail. Since that time, significant construction of the SWLRT has occurred, requiring an updated and more detailed feasibility study to analyze as-built grades and elevations and current stream and riparian conditions. On August 11, 2022, the Board of Managers authorized staff to contract with Stantec and Inter-Fluve to conduct an updated feasibility study, consisting of the following tasks:

- **Task 1: Site Investigation** – Site investigation to collect topographic survey data, tree survey information, and a site walkthrough with MCWD staff.
- **Task 2: Updated Schematic Design** – Update the previously developed schematic trail designs to incorporate data collected in Task 1 and contract with Inter-Fluve to identify pre-concept level channel modifications to the schematic designs.

In addition to these consultant-led tasks, MCWD staff worked closely with St. Louis Park during feasibility to understand the city's trail design requirements, maintenance preferences, and potential funding sources. The city is highly supportive of this trail connection and will remain engaged throughout design and construction. MCWD staff also continued to have conversations with adjacent property owners during feasibility to keep them apprised of the process.

The feasibility study resulted in two modified alignment options, each of which requires some degree of floodplain fill. To ensure the floodplain fill could be mitigated within the project boundaries, staff directed Inter-Fluve to conduct a HEC-RAS modeling exercise to determine the project impacts and identify areas for compensatory storage.

June 22, 2023 MCWD Board Meeting

At the June 22, 2023 MCWD Board Meeting, staff will present the results of the feasibility study and supplemental hydraulic modeling, as well as a status update on partner engagement. Staff will seek Board direction on a preferred alignment to advance to project ordering and move the preferred alignment into final design.

Attachments:

- Attachment 1: Greenway to Cedar Trail Connection Feasibility Memorandum



Memo

To: Gabe Sherman, MCWD
Michael Hayman, MCWD

From: Nick Wyers, PE
Rena Weis, EIT
Chris Meehan, PE

Project/File: 227703704

Date: February 10, 2023
Revised May 19, 2023

Reference: Cedar to Greenway Trail Connection

Introduction

This memo documents the updated feasibility study that was completed to progress design for the proposed trail between the Cedar Lake Trail and Meadowbrook Road in St. Louis Park. This work described within this document builds off the concept design that was completed in 2015/2016 and accounts for construction progress and changes to the original design at the SWLRT site. Two potential trail configurations were evaluated and are further described below. Streambank stabilization practices and habitat improvement opportunities between the 325 Blake Road North site and Meadowbrook Road were also identified by Inter-Fluve and are described in the attached memo.

Data Collection

Topographic and tree survey were completed on site to inform the feasibility study. Land surface, notable features, utilities, rail bridges, and key features of Minnehaha Creek were surveyed along the corridor of interest. A benchmark was established just north of Powell Road, in the boulevard, and permanent benchmarks were surveyed as well (i.e. fire hydrant top nuts, etc.). The tree survey noted tree species, condition, location, and diameter at breast height (DBH) of all trees greater than 6-inches within the proposed trail corridor and construction access routes. All trees with diameters greater than 6-inches were tagged. Survey data is provided as an attachment to this memo (CAD format). A spreadsheet containing tree survey data is also provided.

Alignment Design Considerations

Two trail alignments were evaluated. Key design criteria include maintainability, user experience, user accessibility, and natural resource impacts. Features of the two proposed alignments are relatively interchangeable with each other.

Option 1 accommodates a maximum speed of 16 mph, and Option 2 accommodates a maximum speed of 12 mph. Each option is split into two exhibits on the provided drawings. Maximum speeds are per MnDOT Bicycle Facility Design Manual guidelines and are directly related to minimum allowable turn radii.

The proposed trail would ultimately be maintained by the City of St Louis Park, and as such, it is important to ensure the trail will be maintainable with the City's standard equipment; particularly for snow clearing in the winter months. The City uses standard F150 pickup trucks with 8 ft wide plows for snow clearing, which require 10 ft wide trails and 10 ft vertical clearance. Both trail alignments considered meet these

Reference: Cedar to Greenway Trail Connection

dimensional criteria. The radii associated with the 16 mph trail design will most easily accommodate pickup trucks, while the 12 mph trail design may require use of skid-steers.

The current MnDOT ADA standards are utilized in the preliminary grading layout. Some of these standards include a maximum 2% cross slope, a maximum 5% running slope, and current curb ramp standards for widths and slopes. The maximum running slope shown on the feasibility drawings is 4.30% and 4.89% for Option 1 and Option 2, respectively, which satisfies ADA requirements. The cross slope of the trail in both Option 1 and Option 2 is no greater than 2%, satisfying ADA requirements.

During the site visit, we observed large boulders / riprap beneath the rail bridges, which was placed as part of the SWLRT project. This rock will need to be moved prior to construction of a trail. The rock has little salvage value, since it is limestone based and is not suitable for use on water resources projects due to high erodibility. We estimate the quantity of rock to be 150 cubic yards.

Both trail alignments are expected to result in floodplain impacts, due to the work's proximity to Minnehaha Creek. Estimated floodplain impacts are 700 CY and 220 CY for Option 1 (16 mph) and Option 2 (12 mph), respectively.

As the trail design is further refined, utility conflicts will need to be evaluated. Most notably, there is a City watermain crossing over the creek, which intersects the proposed trail alignment, as well as a 48-inch CMP storm sewer outfall into the creek in the location of the proposed trail. Other smaller storm sewer outfalls are also present into the creek along the trail alignment. The Option 2 (12 mph) alignment cuts into the pipe cover of the watermain alignment. These impacts may require insulation of the watermain if route is selected. The 48-inch CMP outfall could possibly be downsized, as regional diversions in the area have likely reduced the required capacity the pipe, but an assessment of the contributing drainage area would be required to further inform the recommended solution. Smaller existing outfalls to the creek may be able to be consolidated into fewer pipes, reducing the number of instances when pipes cross beneath the trail. Other private utilities may be in the way adjacent to the road or the bike trail, these should be deep enough to avoid impact, but will be coordinated on final design.

Alignment Tradeoff Considerations

Both alignments were reviewed with MCWD staff, and the following tradeoffs were identified.

Option 1 (16 mph)

- Faster speed limit
- Shorter length, fewer curves, nicer overall user experience through trees south of rail bridges (see Exhibit 2)
- More tree removals (see Exhibit 2)
- More floodplain fill & bank stabilization south of rail bridges (see Exhibit 2)
- Larger trail radii north of rail bridges, resulting in easier winter maintenance & snow clearing (see Exhibit 6)

Reference: Cedar to Greenway Trail Connection

- More floodplain fill north of rail bridges (see Exhibit 3)
- Requires encroachment on private property (see Exhibit 3)
- Approximately \$780,000 project cost

Option 2 (12 mph)

- Avoids impacts to trees south of rail bridge, resulting in more winding trail closer to the street, which may not be desirable to users (see Exhibit 4)
- Avoids creek impacts and minimizes floodplain fill south of rail bridges (see Exhibit 4)
- Tight trail radii north of rail bridges will result in reduced navigability during winter snow clearing (see Exhibit 7)
- Minimizes floodplain fill north of rail bridges (see Exhibit 5)
- Contained to public property (see Exhibit 5)
- Approximately \$640,000 project cost

Opinion of Probable Cost

An opinion of probable cost (OPC) was prepared for each alignment option. The OPCs include items required for both civil (Stantec) and ecological / streambank (Inter-Fluve) portions of construction. Costs associated with a base bid of critical work to construct the trail connection and a bid alternate of supplemental streambank stabilization work were estimated for each alignment option. The OPCs assume 30 percent contingency of estimated construction subtotal costs. The OPCs assume legal, engineering, admin, and finance costs as 30 percent of construction cost including contingency.

The base bid for Option 1 is estimated to cost approximately \$780,000, while the base bid for Option 2 is estimated to cost approximately \$640,000. Major differences in cost between the two alignments are primarily driven by tree removals and earthwork. Additional costs could be incurred if retaining walls or other structural measures are deemed necessary as design progresses. Note that if the bid alternate items are completed separately from the trail construction at a later time, the cost of that alternate work will be higher due to reduced efficiencies. See attached Opinion of Probable Costs for further detail.

Permitting Discussion

Both alignment options involve natural resource impacts that will require permits from MCWD and other regulatory agencies. We anticipate that the other regulatory agencies with jurisdiction are the MnDNR; USACE; and City of St Louis Park, serving in the capacity of Local Floodplain Administrator. Key activities triggering regulatory authority are work in public waterbodies associated with floodplain fill and streambank stabilization. We anticipate that a Work in Public Waters Permit and USACE 404 permit will need to be obtained, as well as a no-rise certificate approved by the City. Required MCWD permits will include Floodplain Alteration; Streambank & Shoreline Stabilization; Erosion Control; and possibly Waterbody Crossings & Structures, depending on the scope of work associated with altering outfalls to the creek.

Reference: Cedar to Greenway Trail Connection

Note that the provided alignments depict the following three different estimated 100-year floodplain extents along the trail corridor:

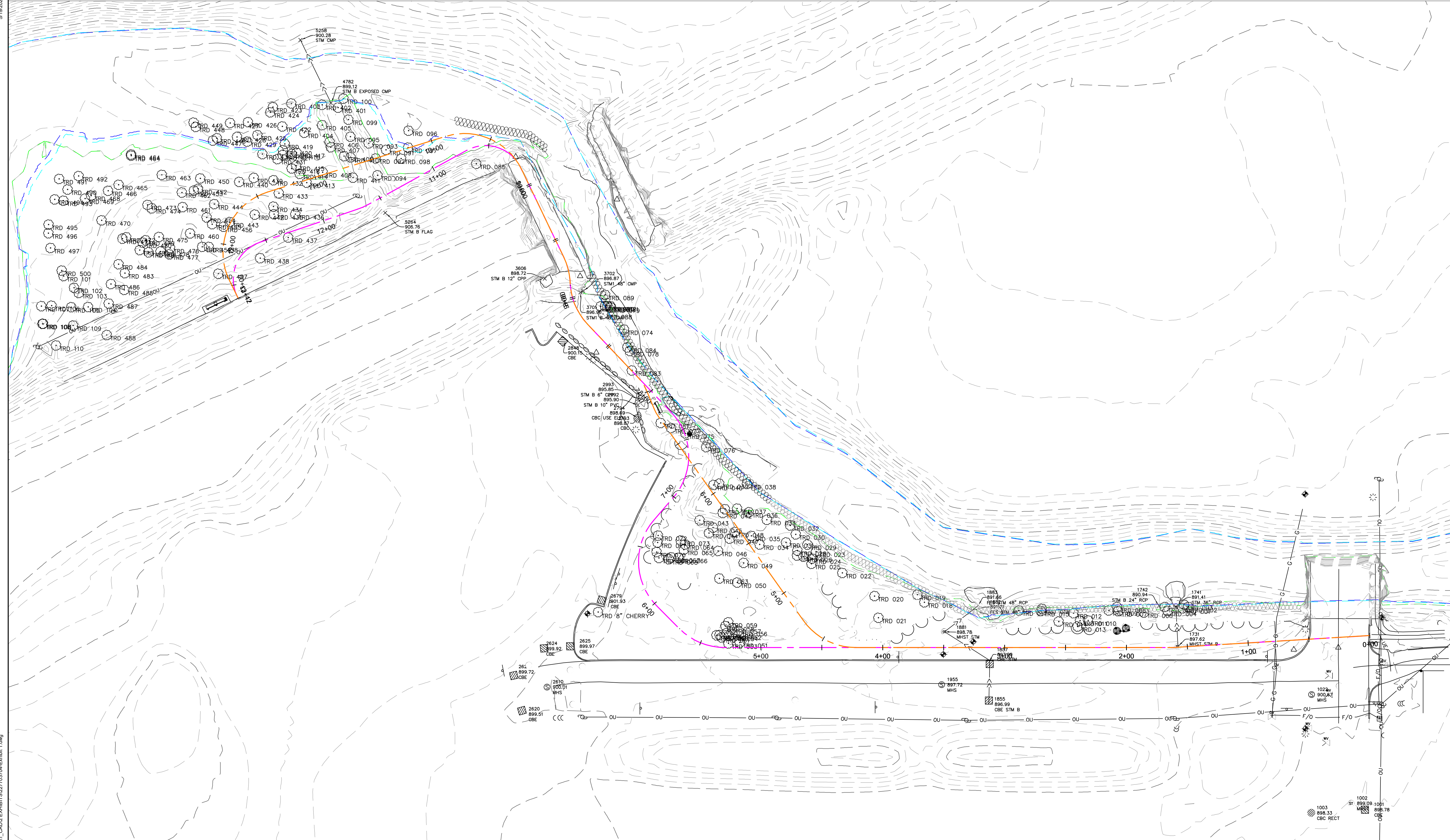
1. XP-SWMM floodplain - taken from MCWD XP-SWMM model, drawn based on LiDAR
2. HEC-RAS floodplain - taken from Inter-Fluve's reach-specific HEC-RAS model, drawn based on LiDAR
3. Interpolated survey floodplain - XP-SWMM floodplain elevation, drawn based on surveyed topography, rather than LiDAR

The interpolated survey floodplain extent is the most conservative, though floodplain modeling can and should be refined as design progresses.

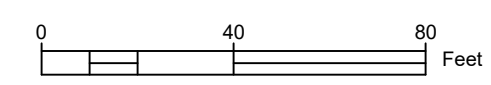
Recommendations & Next Steps

Based on discussions with MCWD staff, it is recommended that the alignment shown by Option 1 be carried forward into design, based on Option 1's higher speed limit, better anticipated user experience, and larger radii to accommodate winter maintenance. However, Option 1 results in more significant natural resource impacts than Option 2, requiring more tree removal and more floodplain fill. Therefore, before design is advanced, it is recommended that floodplain modeling be completed to better evaluate the potential impacts and mitigation options for the anticipated floodplain fill. Furthermore, conversations should be facilitated with impacted property owners, as Option 1 does require the use of private property.

PROPOSED TRAIL ALIGNMENTS



- OPTION 1 (16 MPH)
- OPTION 2 (12 MPH)
- FLOODPLAIN (SWMM)
- FLOODPLAIN (HEC-RAS)
- FLOODPLAIN (INTERPOLATED SURVEY)
- BANK RESTORATION AREA
- BANK RESTORATION AREA (ALTERNATE #1)



PROJECT TITLE	MCWD CEDAR-GREENWAY TRAIL CONNECTION
ISSUE NO.	0
DESCRIPTION	FEASIBILITY STUDY
DATE	11/04/2022

CERTIFICATION:
 I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE: _____

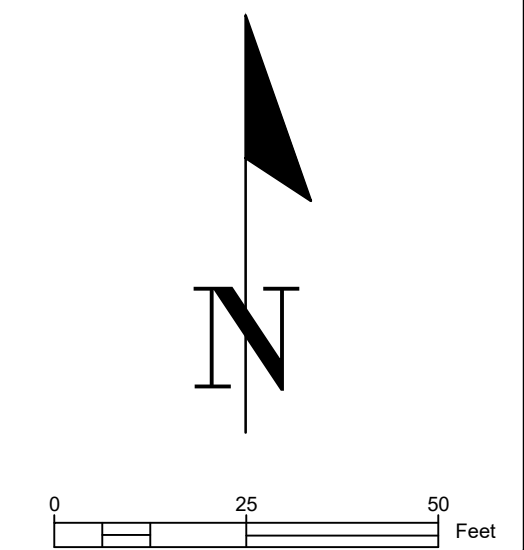
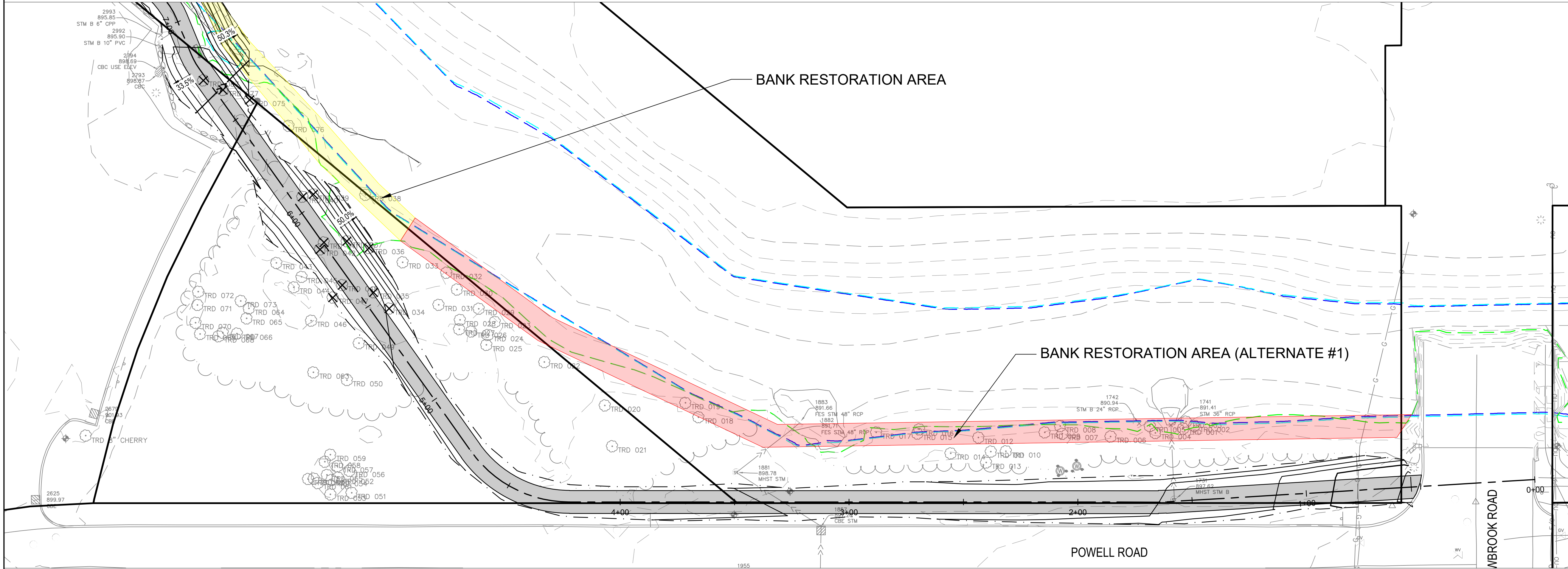
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DWN BY:	JRP
CHKD BY:	RW
APPD BY:	CM
ISSUE DATE:	11/04/2022
ISSUE NO.:	0

SHEET TITLE:
 OVERALL ALIGNMENT PLAN

SHEET NO.:

EXHIBIT 1

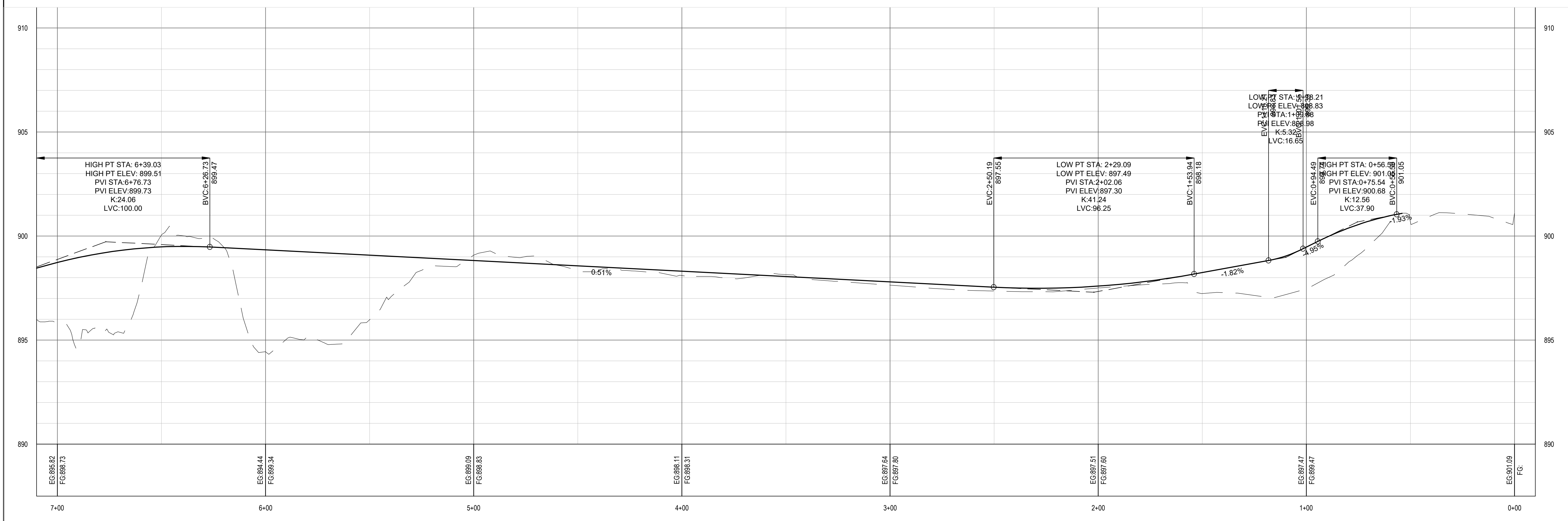
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CLIENT:
 MINNEHAHA CREEK
 WATERSHED DISTRICT

**MCWD CEDAR-GREENWAY
 TRAIL CONNECTION**
 CITY OF HOPKINS
 DAKOTA COUNTY, MINNESOTA



PROJECT TITLE	ISSUE NO.	DESCRIPTION	DATE
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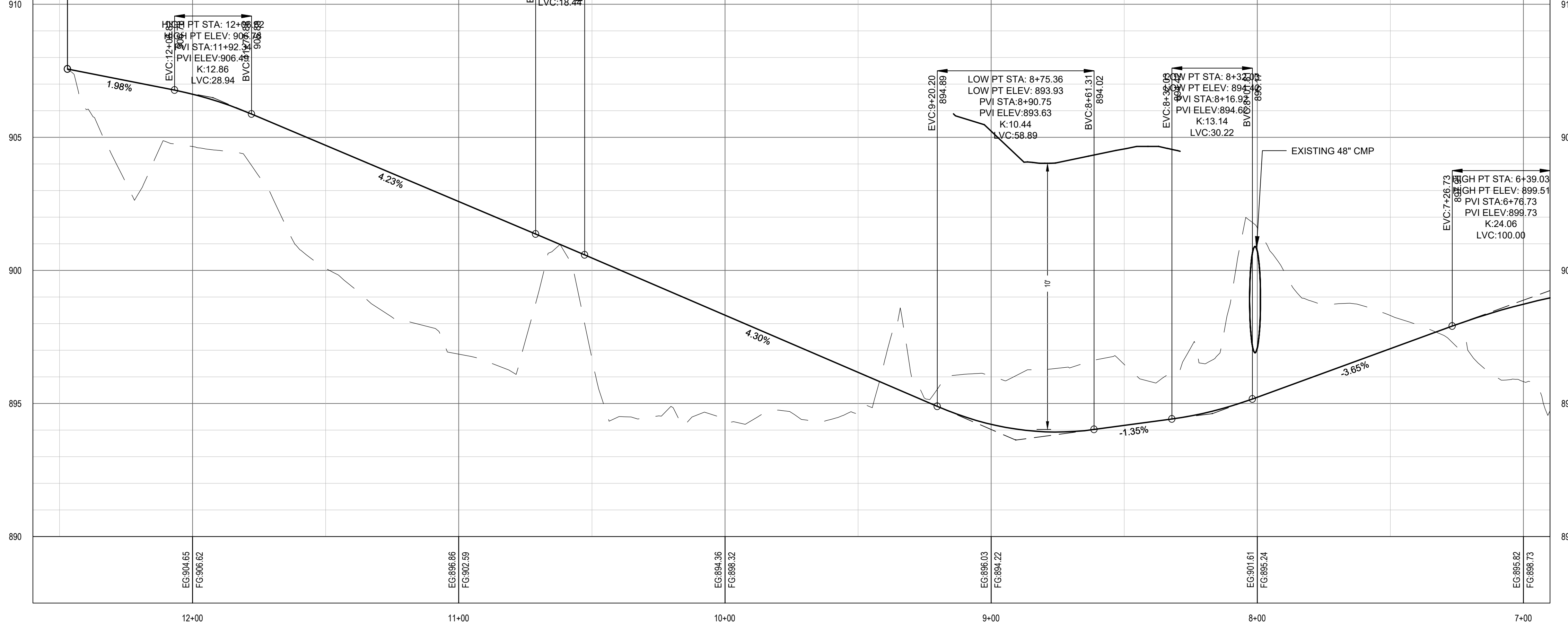
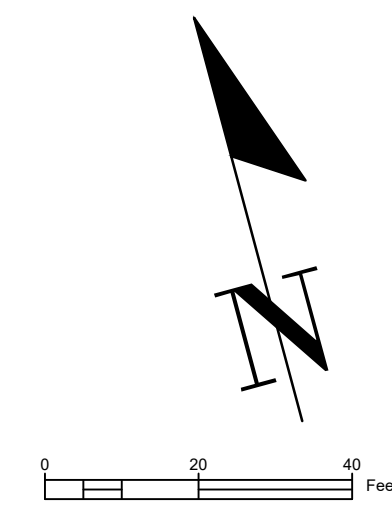
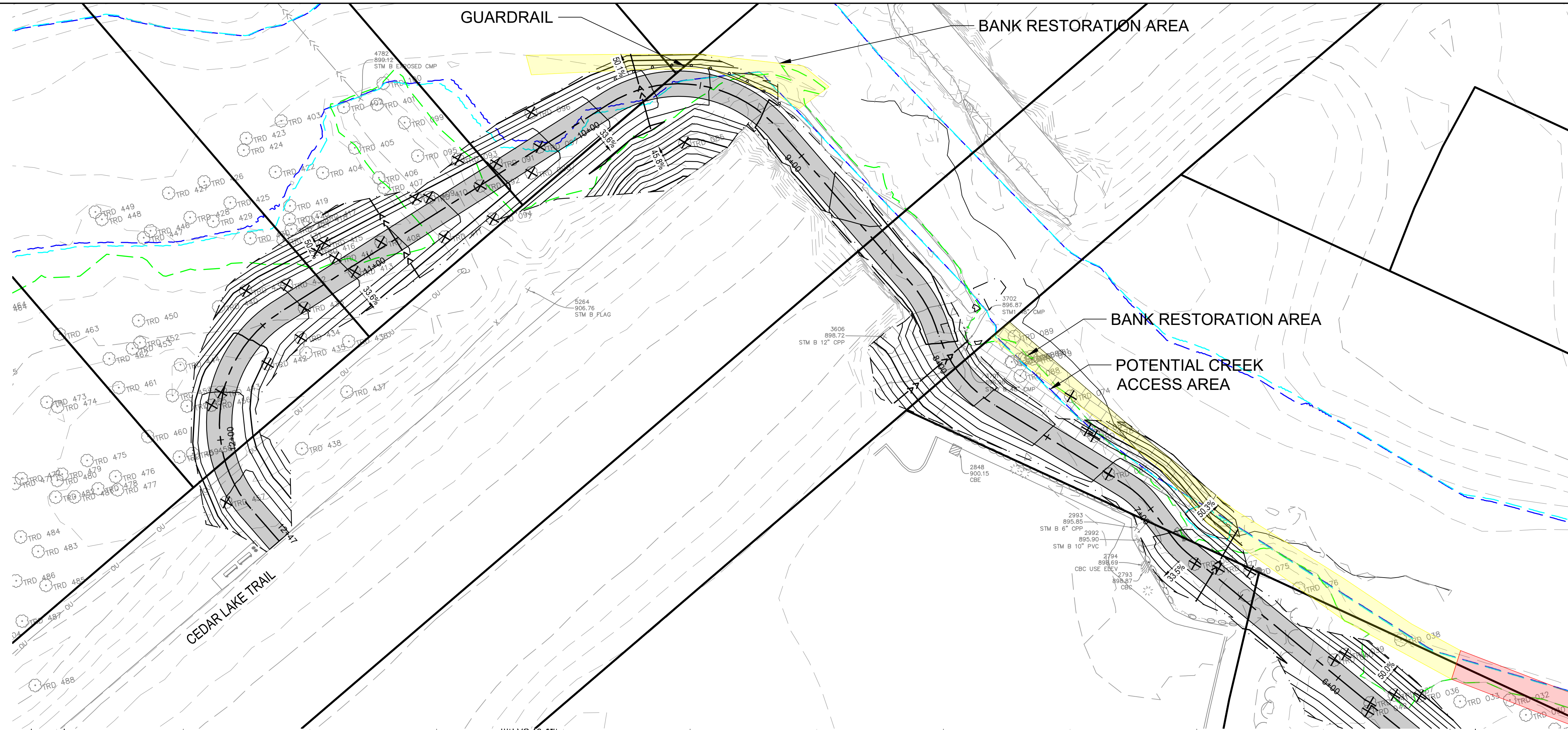
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 OPTION 1 - 16 MPH

SHEET NO.:
EXHIBIT 2

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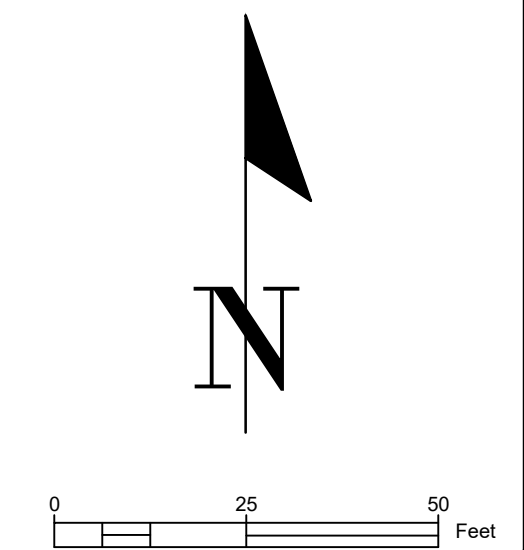
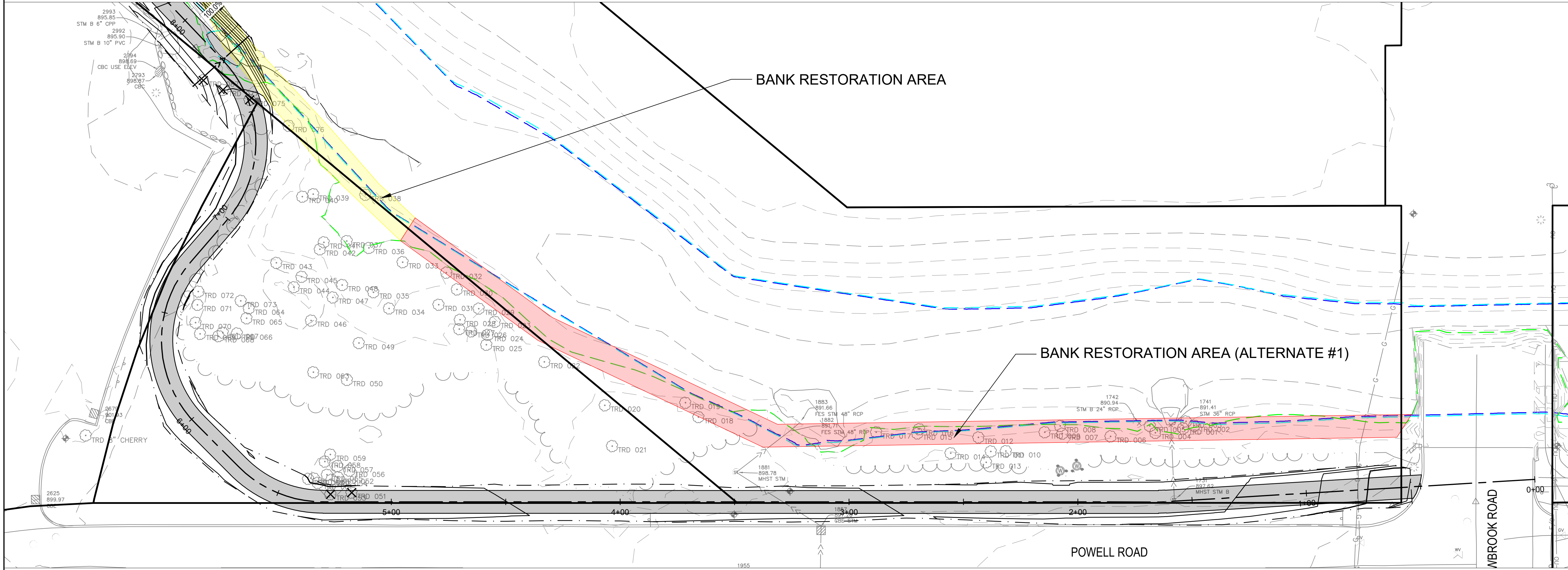
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PROJECT NO.: 227703704
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 ISSUE DATE: 11/04/2022
 ISSUE NO.: 0

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 OPTION 1 - 16 MPH
 SHEET NO.:
EXHIBIT 3

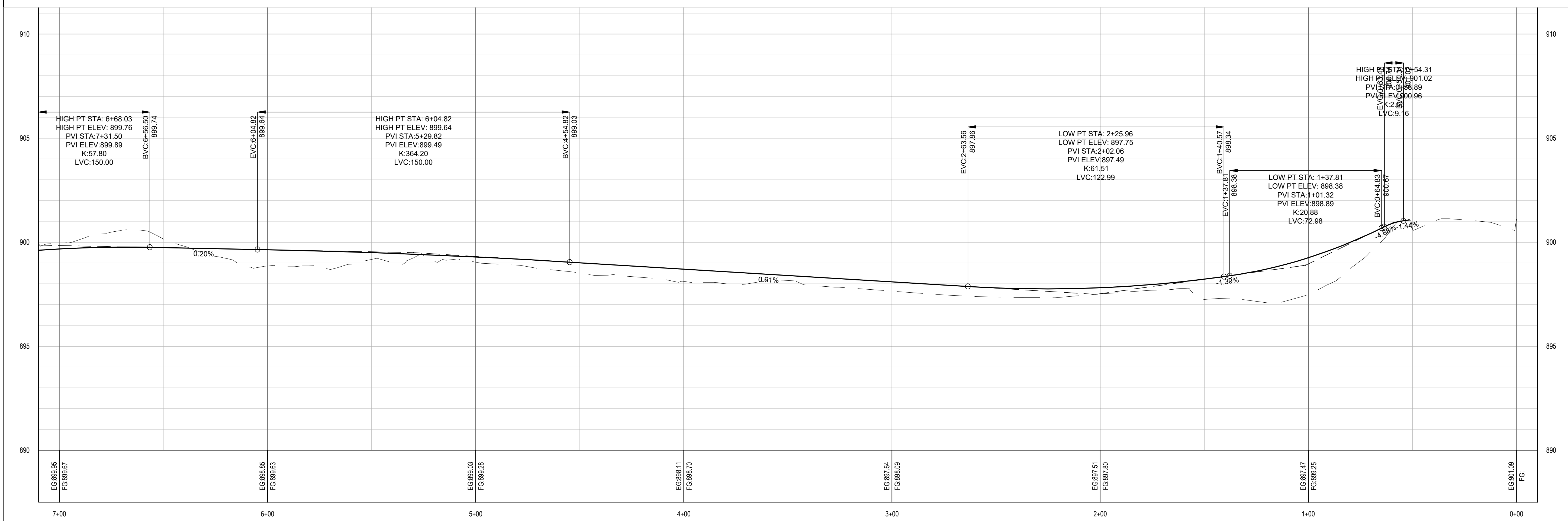
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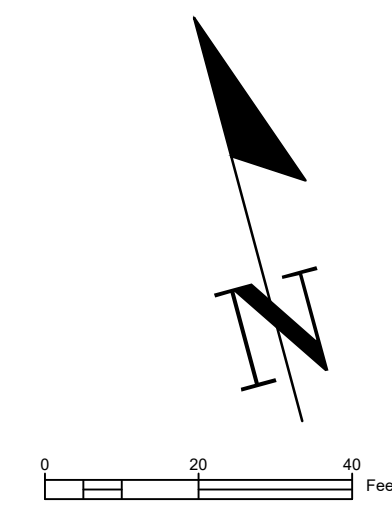
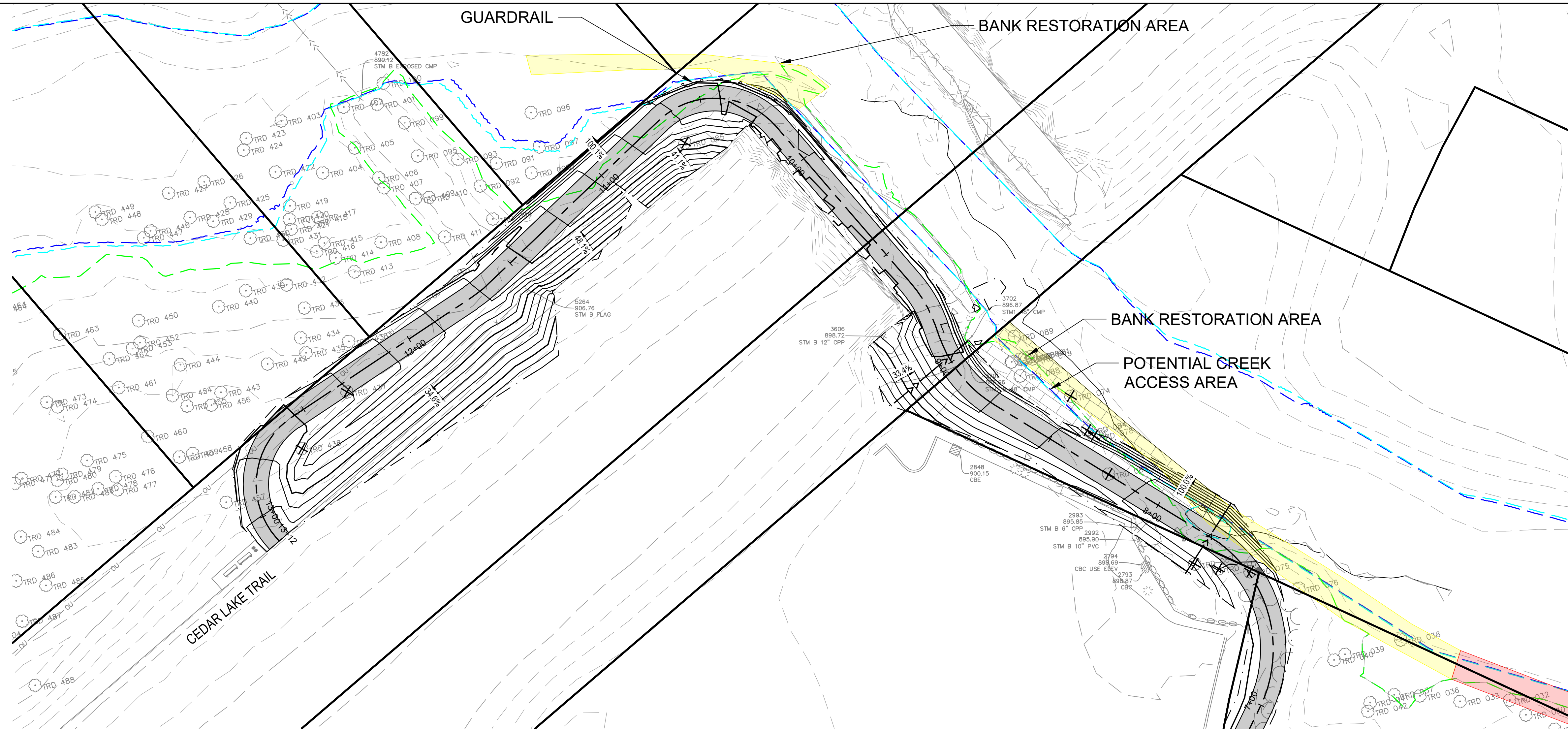
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MCWD CEDAR-GREENWAY TRAIL CONNECTION	0	FEASIBILITY STUDY	11/04/2022

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DATE: _____
 PROJECT NO.: 227703704
 DWN BY: JRP CHKD BY: RW APPD BY: CM
 ISSUE DATE: 11/04/2022
 ISSUE NO.: 0
 SHEET TITLE: OPTION 2 - 12 MPH
 SHEET NO.: **EXHIBIT 4**

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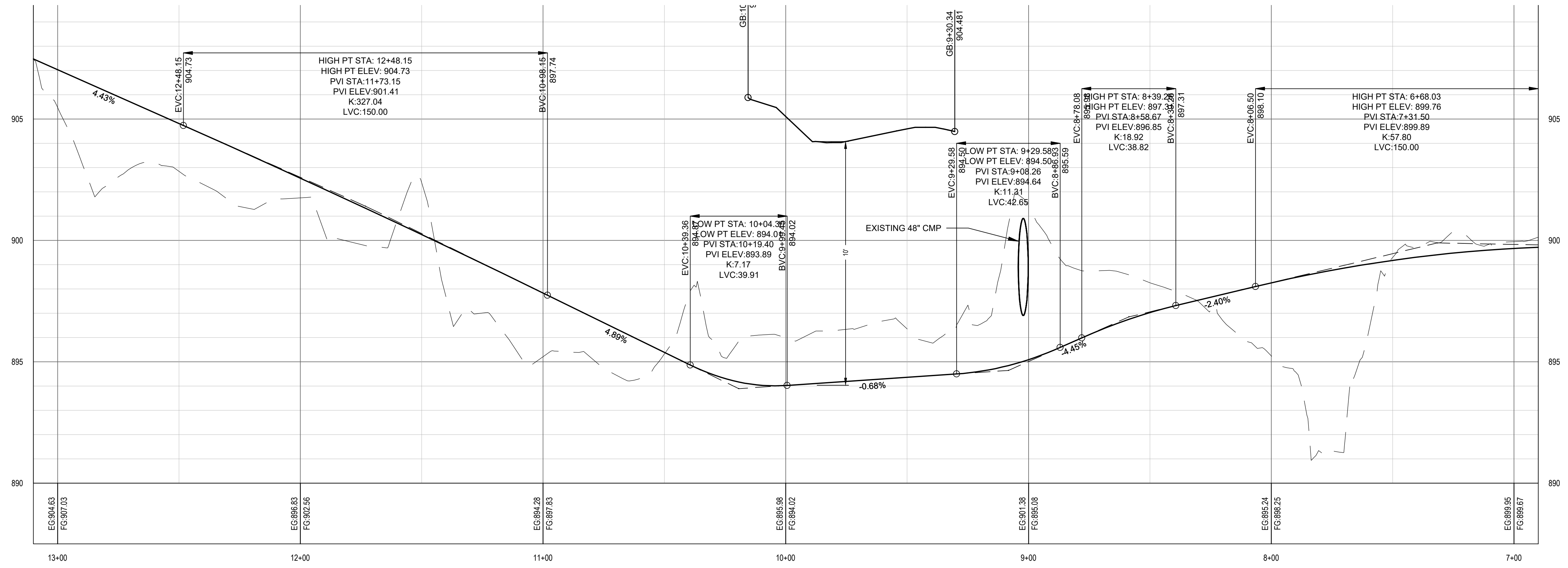
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MINNEHAHA CREEK
WATERSHED DISTRICT

MCWD CEDAR-GREENWAY
TRAIL CONNECTION

CITY OF HOPKINS
DAKOTA COUNTY, MINNESOTA



PROJECT TITLE	ISSUE NO.
MCWD CEDAR-GREENWAY TRAIL CONNECTION	0

DATE: 11/04/2022

DESCRIPTION: FEASIBILITY STUDY

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PROJECT NO.: 227703704

DWN BY: JRP
CHKD BY: RW
APPD BY: CM

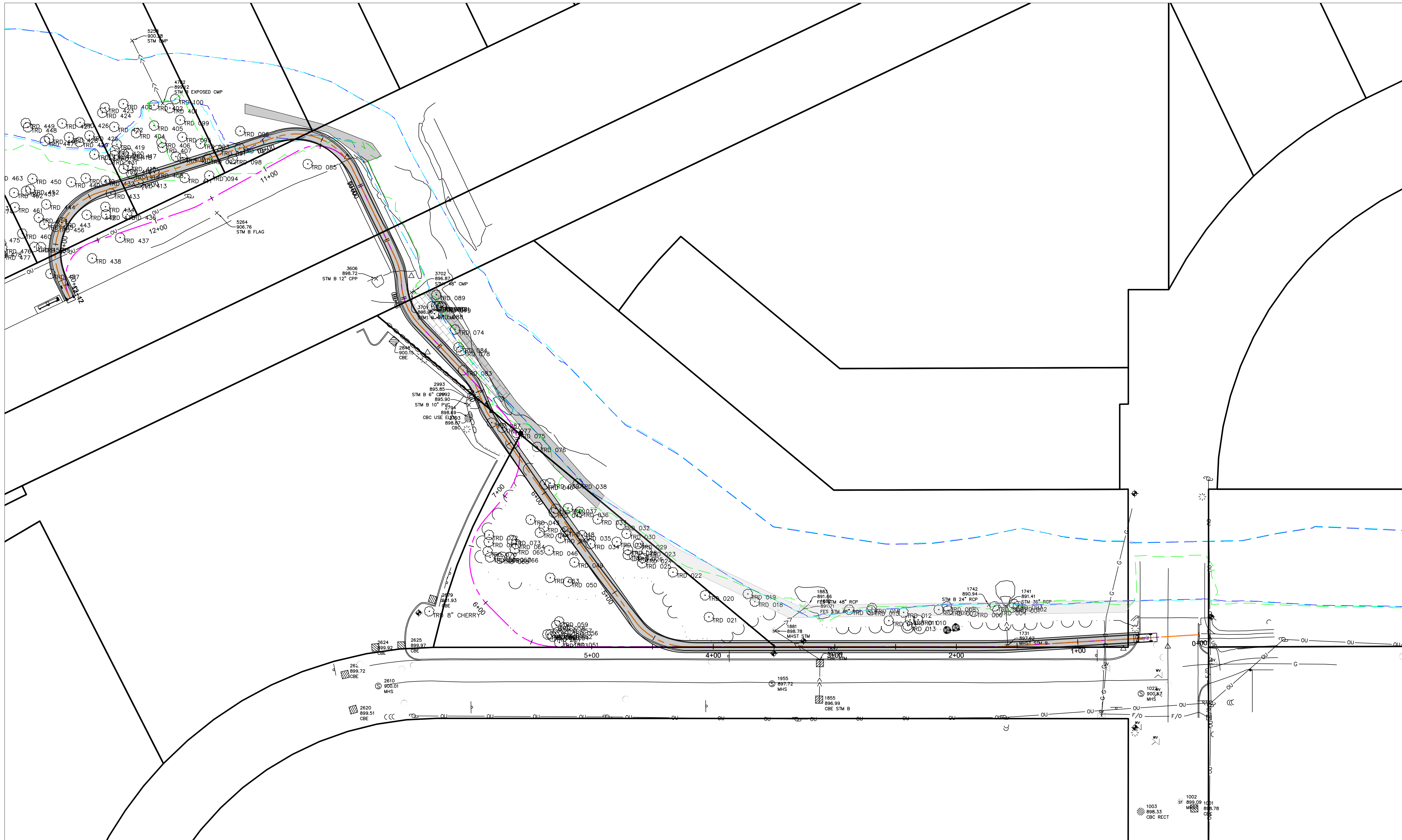
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ISSUE NO.: 0

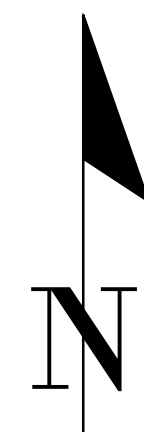
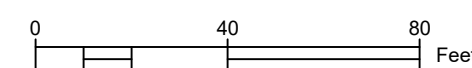
SHEET TITLE: OPTION 2 - 12 MPH

SHEET NO.: EXHIBIT 5

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- — — — — OPTION 1 (16 MPH)
- — — — — OPTION 2 (12 MPH)
- - - - - FLOODPLAIN (SWMM)
- - - - - FLOODPLAIN (HEC-RAS)
- - - - - FLOODPLAIN (INTERPOLATED SURVEY)

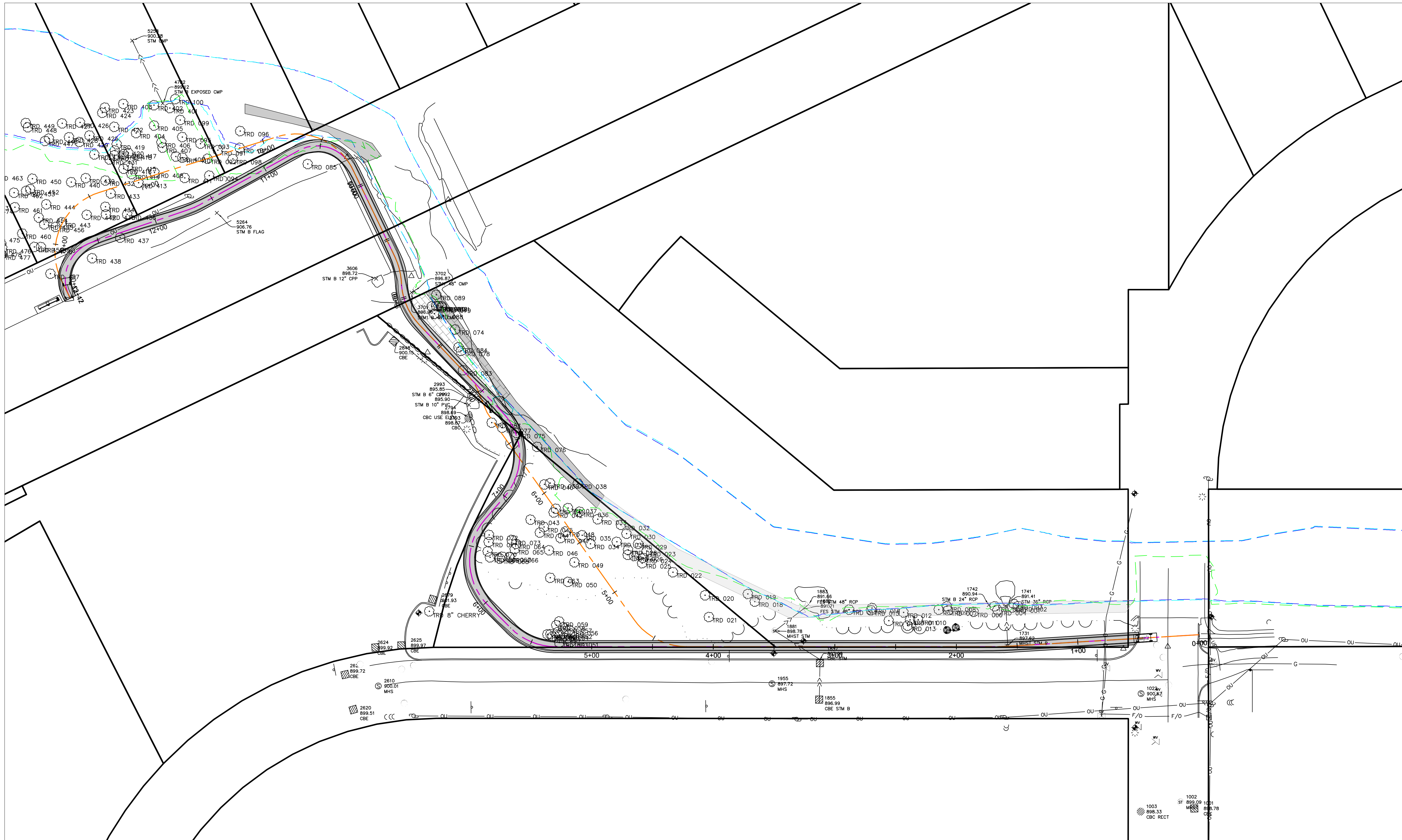


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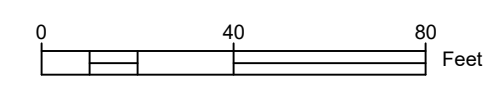
DESCRIPTION	DATE
FEASIBILITY STUDY	11/04/2022

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DATE:		
PROJECT NO.: 227703704		
DWN BY: JRP	CHKD BY: RW	APPD BY: CM
ISSUE DATE:	11/04/2022	
ISSUE NO.:	0	

SHEET TITLE:	16 MPH VEHICLE TRACKING
SHEET NO.:	EXHIBIT 6



- OPTION 1 (16 MPH)
- OPTION 2 (12 MPH)
- FLOODPLAIN (SWMM)
- FLOODPLAIN (HEC-RAS)
- FLOODPLAIN (INTERPOLATED SURVEY)



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CLIENT:
 MINNEHAHA CREEK WATERSHED DISTRICT

MCWD CEDAR-GREENWAY TRAIL CONNECTION
 CITY OF HOPKINS
 DAKOTA COUNTY, MINNESOTA

PROJECT TITLE	ISSUE NO.
MCWD CEDAR-GREENWAY TRAIL CONNECTION	0

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PROJECT NO.: 227703704
 DWN BY: JRP CHKD BY: RW APPD BY: CM
 ISSUE DATE: 11/04/2022
 ISSUE NO.: 0

SHEET TITLE:
 12 MPH VEHICLE TRACKING
 SHEET NO.:
EXHIBIT 7

OPINION OF PROBABLE COST

**OPINION OF PROBABLE COST
MINNEHAHA CREEK WATERSHED DISTRICT
CEDAR TRAIL GREENWAY
227703704
FEASIBILITY STUDY
3/3/2023**



NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
16 MPH DESIGN					
1	MOBILIZATION	LS	1	\$ 56,000.00	\$ 56,000.00
2	DEWATERINGS & EROSION/SEDIMENT CONTROL	LS	1	\$ 37,000.00	\$ 37,000.00
3	CLEAR & GRUB TREE	EA	41	\$ 1,000.00	\$ 41,000.00
4	COMMON EXCAVATION - ONSITE	CU YD	1000	\$ 20.00	\$ 20,000.00
5	COMMON EXCAVATION (FLOODPLAIN) - ONSITE	CU YD	1500	\$ 20.00	\$ 30,000.00
6	COMMON EXCAVATION - OFFSITE	CU YD	500	\$ 25.00	\$ 12,500.00
7	COMMON BORROW	CU YD	820	\$ 30.00	\$ 24,600.00
8	REMOVE RIPRAP	LS	1	\$ 15,000.00	\$ 15,000.00
9	AGGREGATE BASE CLASS 5	TON	800	\$ 22.00	\$ 17,600.00
10	3" BITUMINOUS WALK	SQ FT	12000	\$ 3.50	\$ 42,000.00
11	PEDESTRIAN CURP RAMP	EA	1	\$ 2,000.00	\$ 2,000.00
12	GUARD RAIL	LIN FT	85	\$ 100.00	\$ 8,500.00
13	CM PIPE SEWER	LIN FT	140	\$ 100.00	\$ 14,000.00
14	TRAFFIC CONTROL	LS	1	\$ 2,000.00	\$ 2,000.00
15	STONE TOE	CU YD	308.00	\$ 180.00	\$ 55,440.00
16	FES LIFTS	LIN FT	1050.00	\$ 50.00	\$ 52,500.00
17	IMPORTED FES LIFT BACKFILL (TOPSOIL)	CU YD	147.00	\$ 30.00	\$ 4,410.00
18	SITE ACCESS AND RESTORATION	LS	1	\$ 18,000.00	\$ 18,000.00
19	WETLAND IMPACTS	SQ YD	630	\$ 15.00	\$ 9,450.00
SUBTOTAL					\$ 462,000.00
[30%] CONTINGENCY					\$ 138,600.00
TOTAL CONSTRUCTION COST					\$ 600,600.00
30% LEGAL, ENGINEERING, ADMIN, FINANCE					\$ 180,180.00
TOTAL PROJECT COSTS					\$ 780,780.00

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
ALTERNATE #1: ADDITIONAL BANK RESTORATION					
A.1	MOBILIZATION	LS	1	\$ 8,000.00	\$ 8,000.00
A.2	STONE TOE	CU YD	132.00	\$ 180.00	\$ 23,760.00
A.3	FES LIFTS	LIN FT	450.00	\$ 50.00	\$ 22,500.00
A.4	IMPORTED FES LIFT BACKFILL (TOPSOIL)	CU YD	63.00	\$ 30.00	\$ 1,890.00
A.5	SITE ACCESS AND RESTORATION	LS	1	\$ 5,000.00	\$ 5,000.00
SUBTOTAL					\$ 61,150.00
[30%] CONTINGENCY					\$ 18,345.00
TOTAL CONSTRUCTION COST					\$ 79,495.00
30% LEGAL, ENGINEERING, ADMIN, FINANCE					\$ 23,848.50
TOTAL ALTERNATE COSTS					\$ 103,343.50

TOTAL BASE + ALTERNATE BID					\$ 884,123.50
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**OPINION OF PROBABLE COST
MINNEHAHA CREEK WATERSHED DISTRICT
CEDAR TRAIL GREENWAY
227703704
FEASIBILITY STUDY
3/3/2023**



NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
12 MPH DESIGN					
1	MOBILIZATION	LS	1	\$ 46,000.00	\$ 46,000.00
2	DEWATERINGS & EROSION/SEDIMENT CONTROL	LS	1	\$ 31,000.00	\$ 31,000.00
3	CLEAR & GRUB TREE	EA	10	\$ 1,000.00	\$ 10,000.00
4	COMMON EXCAVATION - ONSITE	CU YD	800	\$ 20.00	\$ 16,000.00
5	COMMON EXCAVATION (FLOODPLAIN) - ONSITE	CU YD	1500	\$ 20.00	\$ 30,000.00
6	COMMON EXCAVATION - OFFSITE	CU YD	500	\$ 25.00	\$ 12,500.00
7	COMMON BORROW	CU YD	50	\$ 30.00	\$ 1,500.00
8	REMOVE RIPRAP	LS	1	\$ 15,000.00	\$ 15,000.00
9	AGGREGATE BASE CLASS 5	TON	850	\$ 22.00	\$ 18,700.00
10	3" BITUMINOUS WALK	SQ FT	12700	\$ 3.50	\$ 44,450.00
11	PEDESTRIAN CURP RAMP	EA	1	\$ 2,000.00	\$ 2,000.00
12	GUARD RAIL	LIN FT	65	\$ 100.00	\$ 6,500.00
13	CM PIPE SEWER	LIN FT	110	\$ 100.00	\$ 11,000.00
14	TRAFFIC CONTROL	LS	1	\$ 2,000.00	\$ 2,000.00
15	STONE TOE	CU YD	308.00	\$ 180.00	\$ 55,440.00
16	FES LIFTS	LIN FT	1050.00	\$ 50.00	\$ 52,500.00
17	IMPORTED FES LIFT BACKFILL (TOPSOIL)	CU YD	147.00	\$ 30.00	\$ 4,410.00
18	SITE ACCESS AND RESTORATION	LS	1	\$ 18,000.00	\$ 18,000.00
19	WETLAND IMPACTS	SQ YD	180	\$ 15.00	\$ 2,700.00
SUBTOTAL					\$ 379,700.00
[30%] CONTINGENCY					\$ 113,910.00
TOTAL CONSTRUCTION COST					\$ 493,610.00
30% LEGAL, ENGINEERING, ADMIN, FINANCE					\$ 148,083.00
TOTAL PROJECT COSTS					\$ 641,693.00

NO.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
ALTERNATE #1: ADDITIONAL BANK RESTORATION					
A.1	MOBILIZATION	LS	1	\$ 8,000.00	\$ 8,000.00
A.2	STONE TOE	CU YD	132.00	\$ 180.00	\$ 23,760.00
A.3	FES LIFTS	LIN FT	450.00	\$ 50.00	\$ 22,500.00
A.4	IMPORTED FES LIFT BACKFILL (TOPSOIL)	CU YD	63.00	\$ 30.00	\$ 1,890.00
A.5	SITE ACCESS AND RESTORATION	LS	1	\$ 5,000.00	\$ 5,000.00
SUBTOTAL					\$ 61,150.00
[30%] CONTINGENCY					\$ 18,345.00
TOTAL CONSTRUCTION COST					\$ 79,495.00
30% LEGAL, ENGINEERING, ADMIN, FINANCE					\$ 23,848.50
TOTAL ALTERNATE COSTS					\$ 103,343.50

TOTAL BASE + ALTERNATE BID					\$ 745,036.50
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TREE REMOVAL TABULATION

Tree Removal Tabulation

tag_id	condition	dbh	comment	common_name	16 MPH Removal	12 MPH Removal
34		22, 24	2 stems	Cottonwood	1	0
35		7		Boxelder	1	0
36		8, 5	two stems	Boxelder	1	0
37	Dead	7			1	0
39	Dying	14 (dead), 14		Boxelder	1	0
40	Dying	18		Boxelder	1	0
41		9		Boxelder	1	0
42		11		Boxelder	1	0
47		9		Boxelder	1	0
48	Dead	6		Boxelder	1	0
51		14		Boxelder	0	1
53		24, 28, 25, 24	quad stem	Cottonwood	0	1
74		6		American Elm	1	1
75		20		Boxelder	1	1
77		10		Boxelder	1	1
78		11, 10, 13		Boxelder	1	1
83		13, 12, 8		White Mulberry	1	1
84		6		White Mulberry	1	1
85		9		Black Cherry	1	1
87		7		White Mulberry	1	1
91		6		Boxelder	1	0
92		9		White Mulberry	1	0
93	Dead	14, 12 (both dead)	very dead		1	0
94		6		White Mulberry	1	0
96		9		Green Ash	1	0
97		7		White Mulberry	1	0
98		7		Boxelder	1	0
408		8		Boxelder	1	0
409		20		Boxelder	1	0
410		7		Boxelder	1	0
411		7, 6		Common Buckthorn	1	0
413		36		Cottonwood	1	0
414		7		Bur Oak	1	0
415		15		Green Ash	1	0
416		8		Green Ash	1	0
432		10		Boxelder	1	0
433		6		Boxelder	1	0
434		27		Bur Oak	1	0
437		12		Bur Oak	0	1
438		11		Bur Oak	0	1
439		20, 11		Green Ash	1	0
442		6		Common Buckthorn	1	0
443		28, 28		Cottonwood	1	0
456		7		Cottonwood	1	0
457		11		Bur Oak	1	0

*In each design alternate column, "1" indicates anticipated tree removal

INTER-FLUVE MEMO: STREAMBANK EVALUATION



MEMORANDUM



To: Rena Weis and Chris Meehan, PE; Stantec
From: Sean Morrison, Maren Hancock, PE, and Jonathon Kusa, PE; Inter-Fluve, Inc.
Date: March 1, 2023 Project: Greenway to Cedar Trail Connection Project
Re: Preliminary Reach Assessment Findings

Inter-Fluve staff completed a preliminary reach assessment of Minnehaha Creek between the downstream reach of the 325 Blake Road site and Meadowbrook Road, adjacent to the location of the planned Cedar Lake Trail connection project. The reach appeared vertically stable with some lateral erosion along the outside of meander bends, and infrastructure induced erosion as a result of hardened streambanks and stream crossings.

Due to the proximity of the proposed alternative trail alignments to the Creek, a structural and hydraulic analysis of bank treatment and stabilization alternatives will be necessary as a next step for the project to limit the risk of future erosion impacts to the proposed trail. Hydraulic modeling of this reach will be needed to identify the appropriate bank treatment type and any additional modifications necessary to avoid impacts to the floodplain and 100-year water surface elevation, if feasible.

Though we understand that due to funding limitations additional habitat and creek improvement projects will likely not be included in this phase, Inter-Fluve identified a “Future Opportunities Area” in which there are a number of projects that could be implemented to improve habitat availability, complexity, and stream function, as funding becomes available.

EXISTING CONDITIONS ASSESSMENT

A preliminary reach assessment was completed of the subject reach of the Minnehaha Creek in order to identify feasibility constraints associated with the proposed Cedar Trail connection and to identify stream restoration opportunities within the project area. The proposed trail project will connect the Cedar Lake Regional Trail from its crossing of the Minnehaha Creek parallel to the Southwest Light Rail Transit (SWLRT) bridge to Meadowbrook Road via a new trail segment on the south side of the creek extending underneath the series of bridges at the SWLRT crossing and along the creek bank and shoulder of Powell Road.

Inter-Fluve staff walked the reach starting from the downstream limit of the Blake Road development project to Meadowbrook Road on September 26, 2022. At the time of the assessment, discharge from the Grey’s Bay Dam was 0 cubic feet per second (cfs.) There was some flow in the assessment reach, which was likely a result of stormwater discharge from recent rains.

Overall, the reach was found to be vertically stable with a pool-riffle morphology. In general, streambank erosion was limited to areas where infrastructure impacts were noted (as shown in Figure 1 below), and floodplain connectivity was minimal. A representative cross-section

measured for this reach had a 51-foot bankfull width, and 1-foot bankfull depth (Figure 1). The cross-section also showed an inset floodplain bench approximately 2 feet below an elevated terrace located between the Cedar Lake Regional Trail and the creek. The terrace was dominated by a buckthorn (*Rhamnus cathartica*) understory. This two-stage cross-section characteristic has previously been noted by Inter-Fluve throughout the Minnehaha Creek corridor and is understood to be a function of the regulated hydraulic regime of the Creek.

Riffle material throughout the reach was dominated by rounded gravels and cobbles. There was a deep pool at Station 20+00, which was un-wadable at the time of the survey. This pool provided a refuge for aquatic species in the otherwise mostly dewatered creek. A canoe/kayak dock in disrepair was located on the river left margin of the pool (Figure 2).

At Station 17+00, a water main pipe extended over the creek. Based on topography, the pipe was buried, but not below the floodplain/floodplain terrace, resulting in a lateral mound bisecting the floodplain (Figure 1). The utility crossing appeared undersized (at approximately 35-feet-wide) and constricts the channel based on bank erosion noted downstream of the crossing. Downstream of the utility crossing, a privately owned cinder block wall replaced the natural bank on river left (Figure 3).

Bank erosion was present on either side of the creek upstream of the Cedar Trail/SWLRT/BNSF crossing, and downstream of the crossing on river right (Figure 4). Downstream of the crossing, several floodplain bars were present and colonized with reed canary grass. Granite slabs and wood piles were located on the right bank and in the channel at the location of an assumed previous crossing. Immediately upstream of the Meadowbrook Road crossing, concrete slabs were found on the right bank

Large and small debris (e.g., bikes, pieces of construction debris, road signs, trash, etc.) was noted throughout the corridor.

IMPROVEMENT OPPORTUNITIES

Inter-Fluve identified several creek improvement opportunities along this reach. These include improvements along the connection corridor that will be required for the Cedar Trail connection project to be implemented, as well as several improvements identified in a Future Opportunities Area that could be implemented to improve habitat availability and complexity, and stream function, if additional funding becomes available.

Creek Improvements Necessary for Cedar Trail Connection Project

Inter-Fluve noted bank erosion in the creek along the proposed trail connection corridor, specifically in the segment where the proposed trail alignments are nearest the creek immediately upstream and downstream of the Cedar Trail/SWLRT/BNSF bridge crossings. Due to the close proximity of the proposed connection-trail to the creek, bank stabilization will be necessary to prevent hydraulically-induced bank erosion impacting the trail. Two trail alignments were provided by Stantec (Figure 6). The bank stabilization treatment type will be a function of the proposed trail design and grades, and results of hydraulic modeling. Due to the close proximity of the trail and creek, there is the potential that the bank stabilization work may encroach on the

creek's channel, potentially necessitating bank shaping work on the opposite side of the creek (if feasible) to match existing regulatory flood elevations. It is anticipated that bank stabilization will be needed to support trail implementation both upstream and downstream of the Cedar Trail/SWLRT/BNSF crossing. Additional areas may be in need of bank stabilization and restoration depending on the proximity of the proposed trail to the creek and the desire to mediate existing stormwater outfalls.

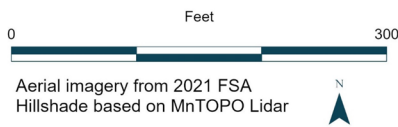
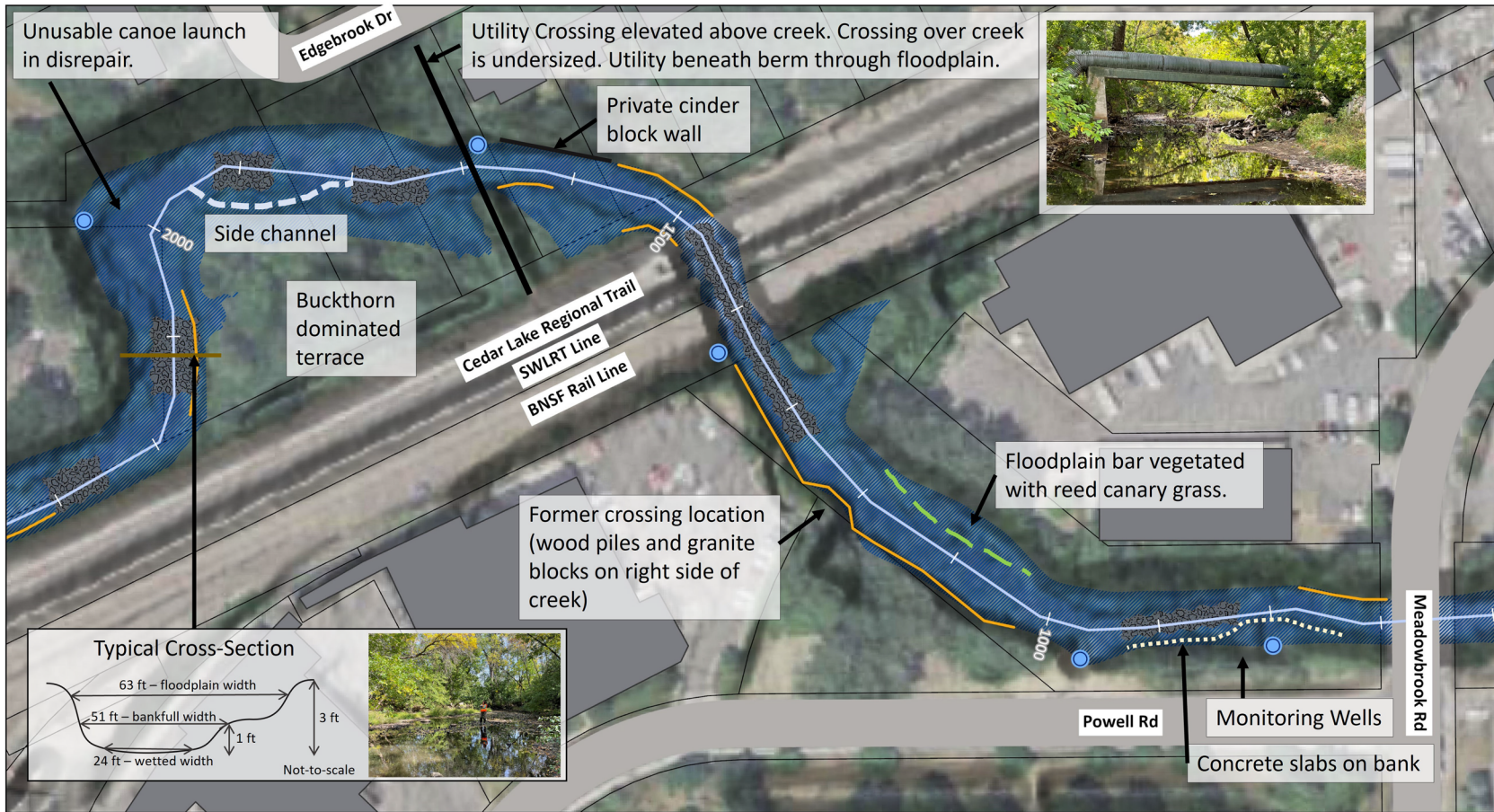
Next steps for the design of this project include hydraulic modeling to assess the impact on the creek, the type of stabilization treatment needed, and potential impacts requiring treatment on adjacent areas.

A budgetary Engineers Opinion of Probable Construction Costs (EOPCC) is included in Table 1. The EOPCC includes an estimate for a bioengineering bank stabilization treatment that is assumed to be sufficient to support the project needs. However, additional design analysis and hydraulic modeling will be needed to determine if the assumed treatment will be appropriate for this creek segment. Additionally, hydraulic modeling will be necessary to review flood flow impacts resulting from the work and assess if any potential impacts can be mitigated through adjustment on the opposite bank. The EOPCC assumes a volume of earthwork needed for this purpose, but that volume is only a high-level estimate at this time. Additional design and modeling for the trail construction may determine that geotechnical or structural solutions are needed for the bank to support the trail which are not included in the EOPCC. Additional potential improvement opportunities including aquatic and riparian habitat improvements, resetting of the stormwater outlet riprap with a focus on the outlet shown in Figure 5, and invasive species removal are not included in the EOPCC. Proposed items mentioned in the Future Opportunities Area section (below) are also not included in the EOPCC.

Future Opportunities Area

Inter-Fluve identified the portion of the reach including the utility crossing and buckthorn dominated terrace as a "Future Opportunities Area" (Figure 6) with a number of projects that could be implemented as funding allows. Potential projects in this area include:

- ▶ Address undersized utility crossing to restore creek function and minimize creek impacts. This could include replacing the crossing with wider crossing (potentially with a bridge and trail connection to Edgebrook Dr.), or burring the utility line below the floodplain and creek. Also address impacts to bisected floodplain.
- ▶ Create backwater wetland in floodplain terrace to improve floodplain connection and backwater habitat availability adjacent to refuge pool. This could include buckthorn removal and revegetation with native species.
- ▶ Remove man-made debris (including canoe/kayak dock)
- ▶ Invasive species removal
- ▶ Meet with the landowner to discuss acceptability/feasibility of coordinating on a project to replace the cinderblock wall and restore creek bank and floodplain connection



- FEMA 100-yr Floodplain
- Parcel Boundary
- Stormwater Outfall
- Riffle
- Streambank Erosion

Field Assessment conducted 9/26/2022 by Maren Hancock and Sean Morrison, Inter-Fluve

Greenway to Cedar Trail Connection Existing Conditions Assessment
 Minnehaha Creek, Minnesota

Figure 1: Existing conditions of the assessed reach.



Figure 2: Pool and unusable canoe/kayak dock.



Figure 3: Cinderblock wall downstream of utility crossing.



Figure 4: Bank erosion downstream of Cedar Lake Trail crossing.



Figure 5: Outfall along connection corridor.

CEDAR LAKE TRAIL TO MINNEHAHA CREEK PRESERVE CONNECTION CREEK IMPROVEMENTS CONCEPTS

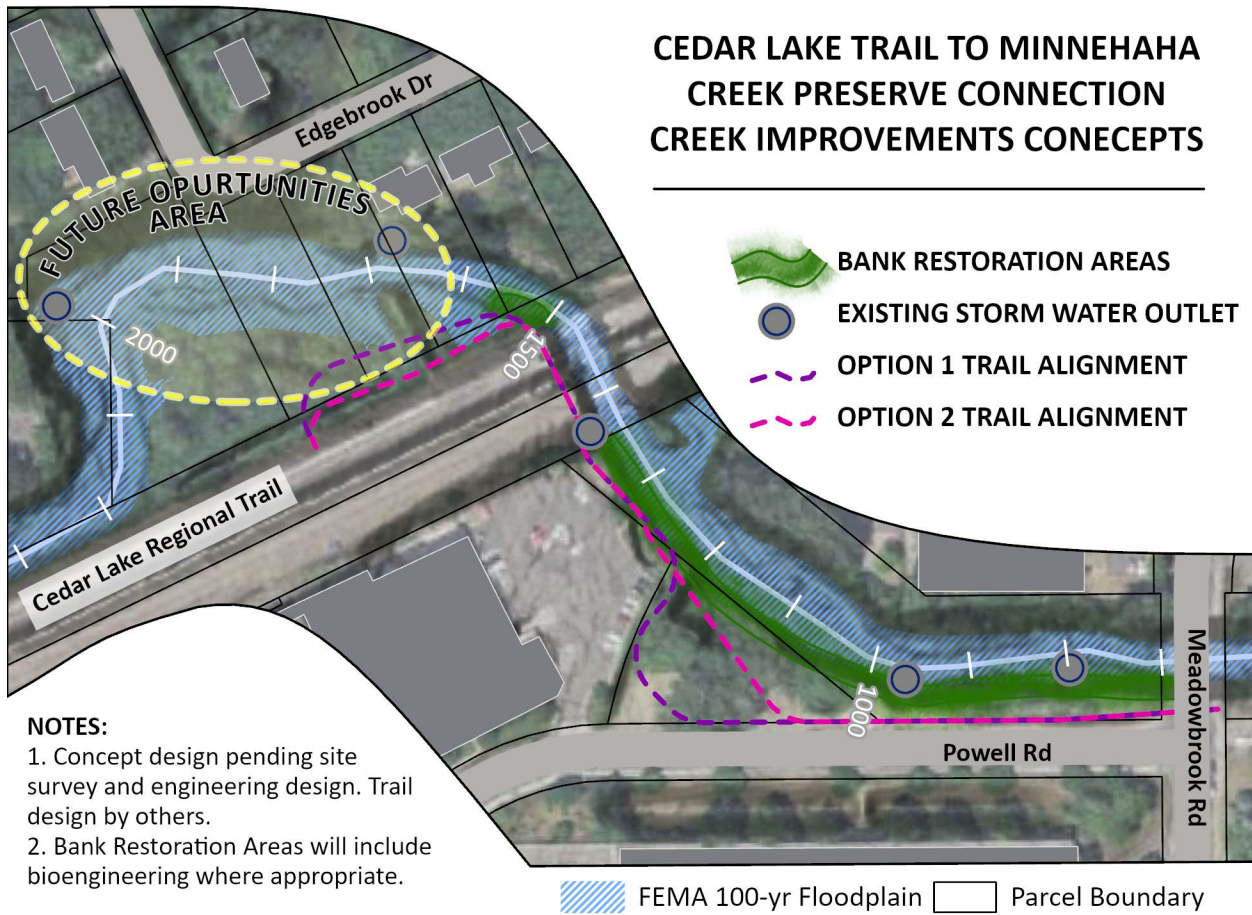


Figure 6: Concept design for bank stabilization along Connection corridor.

Table 1: EOPCC for Cedar Trail to Minnehaha Preserve bank stabilization.

Cedar Trail to Minnehaha Preserve Trail Connection - Bank Toe Stabilization Budgetary Engineer's Opinion of Probable Construction Cost December 2022						
Item #	Item	Unit	Quantity	Unit Cost	Sub Total	Notes
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	1	\$31,000	\$31,000	Assumes 15% of overall cost
2	DEWATERING & EROSION/SEDIMENT CONTROL	LUMP SUM	1	\$21,000	\$21,000	Assumes 10% of overall cost
3	STONE TOE	CY	440	\$180	\$79,200	Assumes subgrade excavation and filter gravel are incidental
4	FES LIFTS	FACE FT	1,500	\$50	\$75,000	Assumes three FES lift layers over stone toe
5	IMPORTED FES LIFT BACKFILL (Topsoil)	CY	210	\$30	\$6,300	
6	FLOODPLAIN BENCH CUT/EARTHWORK	CY	1,500	\$10	\$15,000	Assumes estimated volume for cut on opposite bank; 67% cut material reused onsite for fill
7	EXPORT CLEAN FILL	CY	500	\$20	\$10,000	Assumes 33% cut material exported, assumes clean fill
8	REVEGETATION AND RESTORATION	LUMP SUM	1	\$20,000	\$20,000	Assumes seeding and shrub planting in restored areas.
Rounded Subtotal					\$258,000	
				Contingency	40%	\$103,000
ESTIMATED TOTAL					\$361,000	
AACE Class 4 Low Range (-30%)					\$253,000	
AACE Class 4 High Range (+50%)					\$542,000	
Engineering, Design, and Permitting					\$110,000	
<p>Additional Assumptions - (1) Stone toe and FES lift bank design will be used (no structural bank solutions, walls, reinforcement, etc.) (2) A permittable design is achievable through floodplain bench cutting on opposite bank to achieve no-rise conditions. (3) No resetting of stormwater outlet riprap is included. (4) Structural and civil work for bank stabilization and trail are separate items not included in this EOPCC.</p>						