



**US Army Corps  
of Engineers®**  
St. Paul District

# **Appendix B: Civil Engineering**

Minnesota River, Redwood County, Minnesota

## **Lower Sioux Indian Community Riverbank Stabilization Project**

Doc Version: Feasibility  
March 2023

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# Appendix B: Civil Engineering

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## Appendix B: Civil Engineering

### B.1 General Project Information

DATUM INFORMATION		
Horizontal:	NAD83	Minnesota State Plane, South Zone, U.S. Survey Feet
Vertical:	NAVD 88	North American Vertical Datum of 1988 (GEOID 18), Feet
Notes:	Survey data collected by USACE Survey team in November 2020.	

### B.2 Software

OpenRoads Designer CONNECT Edition - 2020 Release 3 was used to model the design.

### B.3 Site Access

The site will be access through a field road located 0.7 miles southeast of the intersection of highway 19 and county road 2. The riverbank site is located 1.1 miles from the county road 2 and field road intersection.

The project site can be also accessed by boat through the Minnesota River. The nearest boat ramp is located 2 river miles upstream of the project area. River levels might affect the navigation.

## B.4 Project Features – Alternative 3 – Recommended Plan

### B.4.1 Access Road

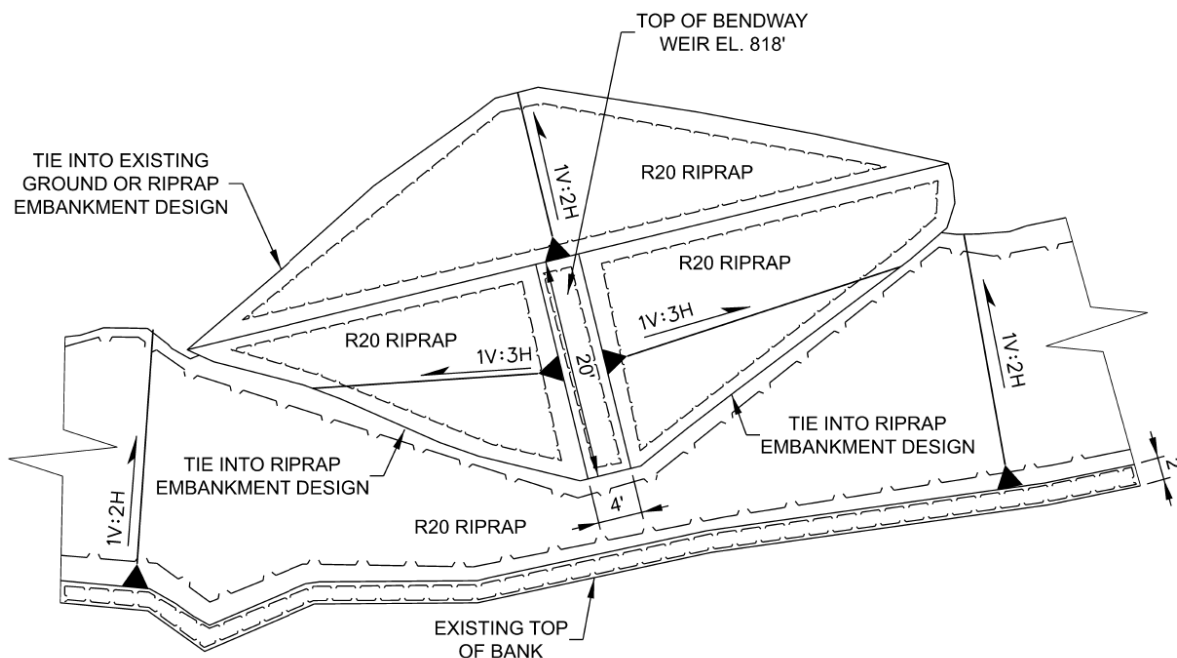
The existing access road will be regraded smooth and a layer of 10 inches of aggregate will be placed on top of a geotextile layer. The width of the access road will be 12 FT for 1.1 mile (5,800 linear feet). A total of 2,150 cubic yards of aggregate will be used. It is assumed the access road will end before reaching the trees on the east side of the site. Access road shall be removed following construction completion.

### B.4.2 Clearing and Grubbing

Approximately 959 square yards will have to be cleared and grubbed, near the far east and west side of the bank stabilization. Clearing and grubbing is assumed to be necessary to create access to construct the far east and west ends of the bank stabilization. The water surface elevation at the time of survey was 813.5 FT (NAVD 88).

### B.4.3 Bendway Weirs

After the rock fill is placed along the bank, 7 bendway weirs will be constructed along the bank. Below is a detail showing the dimensions of each bendway weir.



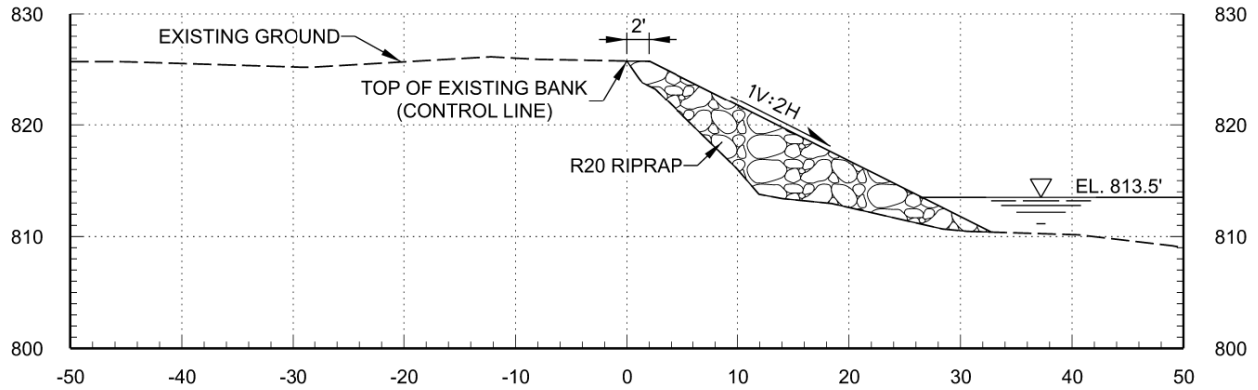
### B.4.4 Rock Fill Bank Stabilization

Rock Fill will be placed starting at the existing top of bank and sloping down to existing ground at a 1v:2h slope to help slow down further erosion and sliding activity. (See

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sheet C-101 for details). A total of 7,214 cubic yards of rock fill is estimated to be placed to protect the riverbank (not including bendway weir rock).

## Typical Section



## B.5 Quantities

Below are the calculated quantities for each alternative. The quantities were separated into reaches. See the main report for the limits of each reach.

### B.5.1 Alternative 1

Alternative 1			
REACH	Protection Features	Quantities	Calculation
1	Longitudinal Stone Toe / 12 Bendway Weirs (CU YD)	6248	Corridor Quantity in LSTPP_ALT1_CORR_C-SP0001.dgn + Bendway weir approximation
1	7 Key-In Excavation (CU YD)	355	Bendway weir approximation (longitudinal toe)
1	7 Key-In Fill (CU YD)	294	Bendway weir approximation (longitudinal toe)
1	Excess Material (CU YD)	61	Key-In fill - Key-In Fill
2	Longitudinal Stone Toe / 4 Bendway Weirs (CU YD)	1128	Corridor Quantity in LSTPP_ALT1_CORR_C-SP0001.dgn + Bendway weir approximation
1,2,3	Clearing and Grubbing (SQ YD)	2011	Surface Area of [CG_1] and Reach 1 Clearing and Grubbing
3 (Cutoff Riprap)	RipRap Slope 1V:3H (CU YD)	628.4	([Existing_merge_Alt1_Reach3_Excavation] - [Alt1_Reach3_Top_Riprap]) - (Bedding)
	Bedding (CU YD)	192.8	[Alt1_Reach3_Excavation] - [Bedding_10in]
	Geotextile (SQ YD)	933.8	Surface Area of [Alt1_Reach3_Excavation]
	Excavation Material (CU YD)	901.9	[Existing_Topo_Nov2020] - [Alt1_Reach3_Excavation] -- CUT
	Fill Material (CU YD)	0	[Existing_Topo_Nov2020] - [Alt1_Reach3_Excavation] -- Fill
	Excess Material (CU YD)	901.9	(Excavation Material) - (Fill Material)

### B.5.2 Alternative 2

Alternative 2 - Riprap Slope with 1V:2H - no bendway weirs			
REACH	Protection Features	Quantities	Calculation
1	RipRap Slope (CU YD)	5522	Corridor Quantity tool in LSTPP_ALT2_CORR_C-SP0001.dgn
2	RipRap Slope (CU YD)	1197	Corridor Quantity tool in LSTPP_ALT2_CORR_C-SP0001.dgn
3	RipRap Slope (CU YD)	495	Corridor Quantity tool in LSTPP_ALT2_CORR_C-SP0001.dgn
All	Planar Acres of Fill Below OHWM/Top of Bank (Acres)	1.06	Area measured in LSTPP_ALT2_CORR_C-SP0001.dgn

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## B.5.3 Alternative 3

Alternative 3 - Riprap Slope with 1V:2H - with bendway weirs			
REACH	Protection Features	Quantities	Calculation
1	RipRap Slope / 3 Bendway Weirs (CU YD)	6167	Corridor Quantity tool in LSTPP_ALT3_CORR_C-SP0001.dgn + Bendway weir approximation
2	RipRap Slope / 4 Bendway Weirs (CU YD)	2057	Corridor Quantity tool in LSTPP_ALT3_CORR_C-SP0001.dgn + Bendway weir approximation
3	RipRap Slope (CU YD)	465	Corridor Quantity tool in LSTPP_ALT3_CORR_C-SP0001.dgn
1,2,3	Total Clearing and Grubbing (SQ YD)	959	Area measured in LSTPP_ALT3_DESGRD_C-SP0001.dgn
All	Fill Below OHWM/Top of Bank (CU YD)	8690	All rock is below top of bank
All	Planar Acres of Fill Below OHWM/Top of Bank (Acres)	1.22	Area measured in LSTPP_ALT3_CORR_C-SP0001.dgn

## B.5.4 Alternative 4

ALTERNATIVE 4			
REACH	Protection Features	Quantities	Calculation
1, 2 & 3	RipRap Slope 1V:3H (CU YD)	6650	[Riprap 1on3] - [Bedding 10 in]
	Bedding (CU YD)	2150	[Bedding 10 in] - [Existing_Merge 1on3_Cut_Fill]
	Geotextile (SQ YD)	8100	Surface area of [1on3_Cut]
	Clearing & Grubbing (SQ YD)	3970	Area in LSTPP_ALT4_MODEL_C-SP0001.dgn
	Stripping Area (SQ YD)	820	Area in LSTPP_ALT4_MODEL_C-SP0001.dgn
	Excavation Material (CU YD)	5250	CUT of [Existing_Merge 1on3_Cut_Fill] - [Existing TOPO Nov2020_modified]
	Fill Material (CU YD)	2250	FILL of [Existing_Merge 1on3_Cut_Fill] - [Existing TOPO Nov2020_modified]
	Excess Material (CU YD)	3000	(Excavation Material) - (Fill Material)

## B.5.5 Access Road

ROAD	
Length	5915 FT
Width	12 FT
Thickness	10 IN
Area (Geotextile)	1.6 Acres / 7750 SQ YD
CRP Length	3800 FT
CRP Area	1.05 Acres / 5067 SQ YD
Aggregate	58000 CU FT / 2,150 CU YD

Road will need to be removed after construction