

**FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION***All sections must be addressed, or the application will be considered invalid***I. APPLICANT INFORMATION**A. Applicant Name: Madison Conservation District-Kate Roberts, ChairMailing Address: PO Box 606City: Ennis State: MT Zip: 59729Telephone: 406-682-3181 E-mail: info@madisoncd.orgB. Contact Person (if different than applicant): Colin ThrelkeldAddress: PO Box 606City: Ennis State: MT Zip: 59729Telephone: 406-682-3181 E-mail: colin@madisoncd.orgC. Landowner and/or Lessee Name (if different than applicant): Pat GogginsMailing Address: 22 Goggins DriveCity: Ennis State: MT Zip: 59729Telephone: 406-581-2999 E-mail: thefeedman@yahoo.com**II. PROJECT INFORMATION**A. Project Name: MCD Moore Creek Restoration Project Implementation – Phase 1River, stream, or lake: Moore CreekLocation: Township: 05S Range: 01W Section: 28Latitude: 45.36708 Longitude: -111.72300 *Within project (decimal degrees)*County: Madison County

B. Purpose of Project: _____

Moore Creek is a tributary to Ennis Lake and is an important ecological resource to the greater Madison River Valley. The project will restore a 0.6 mile straightened and incised reach of Moore Creek to 1 mile of sinuous stream channel with diverse habitat features and a connected floodplain. This project is a “turn key” thanks to design funding provided by NorthWestern Energy, and is considered a demonstration project that will help jump-start future restoration actions on Moore Creek and other tributaries to the Madison River. The project was designed from geomorphic, aquatic habitat, and vegetation “reference reaches” investigated in lower Moore Creek on the Valley Garden Ranch. The design is based in natural channel design philosophy and integrates strategies and techniques that emulate desired conditions, relying entirely on native-based materials. Vegetated wood matrix structures consisting of native alluvium, small diameter woody material, and dense willow cuttings will provide bank stability, complex pool habitat, and increase shade to the channel. Approximately 12 acres of previously drained emergent and scrub-shrub wetland habitats will be restored by reconnecting Moore Creek to its historic floodplain surface. The plan will reduce sediment loading to Moore Creek by 137 tons per year through mitigation of chronic bank and terrace erosion. A floodplain seedling plan and grazing management plan will encourage growth of native riparian vegetation and ensure long term restoration success.

- C. Brief Project Description (attach additional information to end of application). Please include the anticipated construction schedule:

Project Description:

The project reach comprises of a 0.6 mile section of Moore Creek that is straightened, incised, and devoid of woody riparian vegetation. The restoration plan involves the construction of 1 mile of stream and floodplain features with a focus on restoring eroding streambanks, re-establishing channel cross-sections dimensions, plan form and longitudinal profile dimensions, and increasing floodplain connectivity. The following restoration treatments will be implemented:

1. Shape the constructed channel to the appropriate dimensions of a sinuous E4 stream type incorporating riffle, run, pool, and glide habitat features, based on reference reach data collected on streams of similar valley and channel morphology.
2. Convert existing upland plant communities to wetlands in the upstream subreach (Reach 1) by constructing an inset floodplain and restoring floodplain connectivity. Establish a minimum meander belt width of 100-ft.
3. Raise the channel profile in the downstream subreach (Reach 2) to maximize floodplain connection
4. Fill the existing channel in Reach 1 to floodplain elevation to restore wetland hydrology.
5. Increase aquatic habitat complexity by increasing the quality and frequency of pools.
6. Incorporate vegetated wood matrix and brush structures for bank stabilization and pool habitat development.
7. Incorporate 14,550 willow cuttings into bank structures to provide bank stabilization and stream vegetation cover and shade.
8. Incorporate 13,125 willow cuttings into floodplain willow trenches to diversify the floodplain and encourage growth of native riparian vegetation.
9. Implement a grazing management plan including fencing exclosures, water gaps, and stream crossings to protect sensitive riparian areas and vegetation.
10. Install 1 mile of riparian fencing along restoration corridor.

Project Schedule:

January, 2024-September 2024: Permitting, Planning, Landowner Agreements, and Procurement

October, 2024-January 2025: Active Restoration Implementation

January 2025-December 2031: Project Effectiveness Monitoring

D. What was the cause of habitat degradation and how will the project correct the cause?

Approximately 3,200 feet of Moore Creek was ditched and channelized to drain the vast wetland complex that historically characterized the current upland environment. Channelization resulted in severe channel incision, compromising streambank stability and impairing aquatic habitat and water quality. Intensive livestock grazing in streamside riparian zones has also compromised bank stability by converting previous emergent and scrub-shrub wetland vegetation to upland grass species. The existing conditions Bank Erosion Index (BEHI) assessment documented 137 tons per year of sediment being generated from bank erosion (see Drawing 2.1 in Final Design Plan Set). This project will raise the channel profile to match the historical floodplain elevation and restore drained emergent and scrub-shrub wetland habitats, and re-establish a low width-to-depth ratio, meandering E4 stream type, increasing channel length by over 61% relative to existing conditions. Specific root causes of pollution and habitat degradation include:

1. Loss of riparian vegetation and natural vegetation recruitment caused by riparian vegetation removal, cattle grazing, and stream channelization for purposes of agriculture and grazing.
2. *E. coli*, Total Nitrogen, and Total Phosphorus caused by agriculture and cattle grazing in riparian areas.
3. Sedimentation from excessive streambank erosion caused by stream channelization and removal of riparian vegetation for agriculture and cattle grazing.
4. Temperature caused by the loss of stream vegetation cover and hyporheic flow exchange due to stream channelization and removal of riparian vegetation for agriculture and cattle grazing.
5. Loss of aquatic, riparian, and terrestrial habitat diversity and complexity due to stream channelization and removal of riparian vegetation for agriculture and cattle grazing.

E. Length of stream or size of lake that will be treated (project extent): 0.6 miles

Length/size of impact, if larger than project extent (e.g., stream miles opened): Approximately 1 mile

F. Project Budget Summary:

Grant Request (Dollars): \$ 93,296

Matching Dollars: \$ 131,174

Matching In-Kind Services:* \$ _____

**salaries of government employees are not considered matching contributions*

Other Contributions (not part of this app) \$ \$168,500

Total Project Cost: \$ 223,943

G. Attach itemized (line item) budget – see *budget template*

H. Attach project location map(s) that include:

- ☒ Extent of the project, including context (relation to major landmark or town)
- ☒ Indication of public and private property
- ☒ Riparian buffer locations and widths (if applicable) and grazing locations

I. Attach project plans:

- ☒ Detailed sketches or plan views with the location and proposed restoration
- ☒ Pre-project photographs (GPS location strongly recommended)
- ☐ If water leasing or water salvage is involved, attach a supplemental questionnaire (<https://myfwp.mt.gov/getRepositoryFile?objectID=36110>)

J. Attach letters or statements of support (e.g., landowner consent, community or public support, and FWP fisheries support). List any other project partners:

Madison Conservation District, NorthWestern Energy, Pat Goggins/Goggins Ranch, Eric Sheckleton/Starry Night Lodging, Natural Resource Conservation Service, Madison River Foundation, Montana Department of Environmental Quality and Montana Fish, Wildlife, and Parks

III. MAINTENANCE AND MONITORING (attach additional information to end of application):

- A. A 20-year maintenance commitment is required*. Please confirm that you will ensure this protection and describe your approach. Attach any relevant maintenance plans. Yes ☒ No ☐
**If it is a water leasing project, describe the length of the agreement.*

MCD will ensure any necessary maintenance on the project will be completed.

- B. Will grazing be part of or adjacent to the project? If so, describe or attach land management plans, including short term and long term grazing regimes. If the landowner is not the applicant, please describe their involvement in the project. *If you want assistance with grazing plan development, note your need.*

Riparian pastures will be created on the Goggins property by the installation of riparian fencing along the restoration corridor through a cost share agreement between the landowner and the NRCS. The NRCS has planned riparian fencing enclosures for the property that include a 50-ft. buffer from Moore Creek on both sides of the channel corridor (NRCS MC Goggins Fencing Plan Map Draft). This riparian fencing will be constructed post-restoration implementation by the landowner. After installation of the riparian fencing, livestock grazing of the riparian area will be limited to one grazing event per year in the fall. Water Gaps have been designed and are integrated in the final design plan set (Drawing 4.3 in Final Design Plan Set).

- C. Will the project be monitored to determine if goals were met? If so, what are the short-term and long-term plans to assess benefits and lessons learned? Were pre-project data collected? Will monitoring information be shared with FWP?

The project will be monitored 5 years following construction to ensure fulfillment of restoration objectives. The following metrics will be collected and/or modified based on input from MFWP and project partners:

1) Bank Erodibility Hazard Index Assessment

The existing conditions Bank Erosion Index (BEHI) Assessment documented 137 tons per year of sediment being generated from bank erosion (see Drawing 2.1 in Final Design Plan Set). A repeat BEHI assessment will be completed. Depending on guidance from MDEQ and MFWP, the assessment will consist of either measurements of representative BEHI conditions extrapolated to the reach level through visual estimation, or visually estimated based on the following metrics: 1) Bank height ratio; 2) Rooting depth ratio; 3) Percent vegetative cover or bank surface protection; 4) Bank angle; and 5) Near-bank stress rating. A pre-restoration BEHI Assessment was completed for the project and is included as Drawing 2.1 in the attached Moore Creek Restoration Project Final Design Plan Set.

2) Fixed Photo Points or UAS Orthomosaic

MCD and NorthWestern Energy established 20 fixed baseline photo monitoring points in 2022. The photo points will be replicated immediately post-construction and in year 5 post-construction. New photo points will be established post-construction to document the as-built conditions. MCD recommends acquiring a high-resolution UAS orthomosaic to document post-project conditions. The orthophoto can be replicated at year 5 to evaluate project performance remotely, including: 1) lateral channel or bank migration analysis to determine if stability and sediment reduction objectives are being met; 2) percent cover of woody vegetation on streambanks; 3) recovery of emergent wetland vegetation within the 100-ft. meander belt width and floodplain; and 4) pool frequency and percent riffle and pool aquatic habitat features.

3) Rare Plant Monitoring

NorthWestern Energy will contract with Rocky Mountain Botany to conduct rare plant monitoring. This will assess the presence, abundance, and increase of any rare plant species populations within the restoration corridor.

4) Migratory Bird Monitoring

The University of Montana Bird Ecology Lab will conduct biannual migratory bird monitoring. This will assess the presence, abundance, and increase or migratory bird species populations within the restoration corridor.

5) Fisheries Monitoring

MCD is working with MFWP to assess spawning and rearing habitat prior to project implementation and post construction. We do not have any pre-project data at this time, but hope to collect spawning and rearing habitat data prior to construction in 2024.

6) Water Quantity Monitoring

NorthWestern Energy has agreed to supply a water flow meter for the Moore Creek Project and monitor the water quantity data for MCD.

MCD is willing to supply monitoring data with MFWP as requested.

IV. PROJECT BENEFITS (attach additional information to end of application):

- A. What species of fish will benefit from this project?

The project will benefit Brown and Rainbow Trout.

- B. How will the project protect or enhance wild fish habitat?

The project will enhance available spawning and rearing habitat for Ennis Reservoir Brown and Rainbow Trout.

- C. What is the expected improvement to fish populations, both short term and long term? How might the project translate to angler success?

In the short term, we hope to see an increase in the number of fish utilizing improved spawning habitats. In the long term, we would anticipate improved survival of juvenile fish, which over time would translate into increased Brown and Rainbow Trout contributions to the Ennis Reservoir trout population. This would provide greater opportunity for anglers in the Ennis Reservoir.

- D. Will the project increase public fishing opportunity for wild fish and, if so, how? Is public fishing allowed onsite? If not, describe how the public would access the project benefits.

The intended project, if successful, would increase public fishing opportunity in the form of wild fish abundance in Ennis Reservoir. Public fishing is not allowed onsite, except for in the case of an angler accessing Moore Creek channel from a public access point and abided by the provisions stated in the Montana Stream Access Law (MCD Title 23: Part 3). Aside from instream access and benefits, the public will benefit from improved water quality and wild fish populations in Ennis Reservoir. There is also a walking trail system through the emergent and scrub-shrub wetland that is open to the public. This trail system will be expanded upon completion of the project and include the addition of interpretive signage about the project and its partners. This trail system is accessible to the public via the Starry Night Lodging and RV Park.

E. Aside from angling, what local or large-scale public benefits will be realized from this project?

- 1) The Moore Creek Restoration project has brought together a diverse group of partners who are all in on restoring this important community resource, including landowners, the Madison Conservation District, Montana Department of Environmental Quality, Montana Fish, Wildlife, and Parks, Madison River Foundation, US Fish and Wildlife Service, Natural Resources Conservation Service, and NorthWestern Energy.
- 2) Moore Creek and its vast wetland and riparian environments are important ecological resources to the greater Madison River valley. Agricultural land use practices and ditching and incisement of the lower 5 miles of Moore Creek have converted riparian wetland environments to uplands. A primary goal of this project is to reconnect Moore Creek to former floodplain sources which will increase water storage, provide a filter for nutrients and sediments, and improve aquatic and terrestrial environments by diversifying vegetation community types and reducing current rates of bank erosion and migration.
- 3) This project will help reduce sediment, temperature, and nutrient loading to the Ennis Reservoir and the lower Madison River.
- 4) This project is the initial phase of a comprehensive, 5-mile restoration project for lower Moore Creek. Collectively, this phase and all future phases of work are estimated to restore several hundred acres of drained emergent, scrub-shrub, and shallow open water wetlands. Restoring this vast wetland complex and stream corridor will increase water storage in the alluvial aquifer. In the wake of a changing climate, the Moore Creek ecosystem will provide an important coldwater refugia for aquatic species.
- 5) The Montana Constitution ensures the citizens of Montana access to a clean and healthy environment. Ennis Reservoir and the greater Madison River ecosystem are important to the overall economic health of Ennis and surrounding communities.

F. Will the project interfere with water or property rights of adjacent landowners? (explain):

Appropriate analysis will be performed to demonstrate that the project complies with the intent of Montana DNRC's "Guidance for Landowners and Practitioners Engaged in Stream and Wetland Restoration Activities", issued by the Water Resources Division on March 9, 2016. DNRC guidelines state that "any wetland project (restoration) whose final design approximates the natural characteristics of adjacent natural wetlands or approximates something smaller in magnitude does not require a water right". The guidelines also state that restored wetlands should have characteristics similar to other natural wetlands in the area and should function entirely in the absence of artificial controls and diversions of water that intentionally appropriate water for wetland use.

This Phase 1 project intends to restore wetland habitat by enhancing existing wetlands through grading and revegetation. The restored wetlands will have identical hydrologic and vegetative characteristics to existing wetlands in the immediate area. Riverine wetland habitat will be converted to shallow open water and emergent wetlands by restoring sinuosity of the 0.6 mile reach of straightened and incised stream channel through a newly established channel through the approximate 12 acre emergent and scrub-shrub wetland. Wetlands will be located within the floodplain and will be very similar in size and habitat characteristics to pre-settlement open water wetlands in the area. The small open water wetlands will not involve the construction of any berms, dams, or dikes; will not involve any diversion of water; will partially offset the loss of riverine wetland habitat; and will not increase water consumption.

- G. Will the project result in the development of commercial recreational use on the site (including paid access)? Explain:

The Moore Creek Project will result in the development of additional commercial recreational access. The owner and managers of Starry Night Lodging and RV Park have committed to expanding their existing trail system for visitors that navigates the existing emergent and scrub-shrub wetland south of the RV park to include paths and interpretational signage along the stream post-restoration. The newly installed signage will include educational information about the project, its ecological benefits, and highlight project partners.

- H. Is this project associated with the reclamation of past mining activity?

No.

Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.

V. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature: _____ Date: _____

Submittal: **Applications must be signed and received on or before November 15 and May 15 to be considered for the subsequent funding period.** Late or incomplete applications will be rejected.

Mail to: FWP Future Fisheries Fish Habitat Bureau PO Box 200701 Helena, MT 59620-0701	Email: Future Fisheries Coordinator FWPFFIP@mt.gov (electronic submissions must be signed) For files over 10MB, use https://transfer.mt.gov and send to mmcgree@mt.gov
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Applicant Signature:  Date: 11/14/23

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	Fish Habitat Bureau		FWPFFIP@mt.gov
	PO Box 200701		(electronic submissions must be signed)
	Helena, MT 59620-0701		For files over 10MB, use https://transfer.mt.gov and send to mmcgree@mt.gov

Moore Creek restoration project phase 1
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

015-2024

Both tables must be completed or the application will be returned

PROJECT COSTS					CONTRIBUTIONS			
WORK ITEMS (Itemize by Category)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	FUTURE FISHERIES REQUEST	MATCH (Cash or Services)**	OTHER (Not part of this application)	TOTAL
Personnel***								
Survey				\$ -				\$ -
Design				\$ -				\$ -
Engineering				\$ -				\$ -
Permitting	1	Joint Application	\$7,000.00	\$ 7,000.00	2,000.00	5,000.00		\$ 7,000.00
Oversight				\$ -				\$ -
Landowner Agreements	2	Contract	\$500.00	\$ 1,000.00	500.00	500.00		\$ 1,000.00
Maintenance				\$ -				\$ -
			Sub-Total	\$ 8,000.00	\$ 2,500.00	\$ 5,500.00	\$ -	\$ 8,000.00
Travel								
Mileage				\$ -				\$ -
Per diem				\$ -				\$ -
			Sub-Total	\$ -	\$ -	\$ -	\$ -	\$ -
Construction Materials****								
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
				\$ -				\$ -
			Sub-Total	\$ -	\$ -	\$ -	\$ -	\$ -
Equipment, Labor, and Mobilization								
Equipment Mobilization, Clearing and Grubbing, Construct and Decommission Clearwater Diversion, Access and Staging				\$ 17,000.00	6,800.00	10,200.00		\$ 17,000.00

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

015-2024

Salvage, Preserve and Transplant Existing Vegetation				\$ 500.00	200.00	300.00	\$ 500.00
Excavate, Haul and Place Channel and Floodplain Subgrade Excavation in Repository (Reach 1 and Reach 2)				\$ 28,098.00	11,239.00	16,859.00	\$ 28,098.00
Furnish Streambed and Streambank Alluvium, Wood, and Streamband and Floodplain Willow Cuttings				\$ 20,873.00	8,349.00	12,524.00	\$ 20,873.00
Install Sod Bank Structures - Type 1 Riffles	7581 feet		\$6.00	\$ 45,486.00	18,194.00	27,292.00	\$ 45,486.00
Install Sod Bank Structures - Type 2 Runs, Pools, Glides	2910 feet		\$10.00	\$ 29,100.00	11,640.00	17,460.00	\$ 29,100.00
Install Floodplain Willow Trenches	2625 feet		\$1.50	\$ 3,938.00	1,575.00	2,362.00	\$ 3,937.00
Provide and Broadcast Seed Floodplain and Upland Seed	26.04 LBS		\$43.78	\$ 1,140.00	456.00	684.00	\$ 1,140.00
Construction Staking and Management				\$ 17,500.00	7,000.00	10,500.00	\$ 17,500.00

Moore Creek restoration project phase 1
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

015-2024

As-Built and 5 Year Monitoring Reports				\$ 5,000.00	2,000.00	3,000.00		\$ 5,000.00
Restoration Riparian Fencing	19870 feet		\$1.50	\$ 29,805.00	15,840.00	14,493.00		\$ 30,333.00
Unanticipated Expenses				\$ 17,503.00	7,503.00	10,000.00		\$ 17,503.00
			Sub-Total	\$ 215,943.00	\$ 90,796.00	\$ 125,674.00	\$ -	\$ 70,336.00
TOTALS				\$ 223,943.00	\$ 93,296.00	\$ 131,174.00	\$ -	\$ 78,336.00

OTHER REQUIREMENTS:

All of the columns in the budget table and the matching contribution table MUST be completed appropriately or the application will be invalid. Please see the example budget sheet for additional clarification.

*Units = feet, hours, inches, etc. Do not use lump sum unless there is no other way to describe the costs.

**Can include in-kind materials. Justification for in-kind labor (e.g. hourly rates used). Do not use government salaries as match. Describe here or in text.

***The Review Panel suggests that design and oversight costs associated with a proposed project not exceed 15% of the total project budget. If design and oversight costs are in excess of 15%, applications may require a justification or minimum of two competitive bids for the cost of undertaking the project. For projects that include a maintenance request, it must not exceed 10% of the total project cost.

****The Review Panel recommends a maximum fencing cost of \$1.50 per foot. Additional costs may be the responsibility of the applicant and/or partners.

Additional details:

APPLICATION MATCHING CONTRIBUTIONS				
(do not include requested funds or contributions not associated with the application)				
CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
Department of Environmental Quality-319 Nonpoint Source	\$ -	\$ 115,568.00	\$ 115,568.00	N
Natural Resource Conservation Service-Fencing Cost Share	\$ -	\$ 14,493.00	\$ 14,493.00	Y
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ -	\$ 130,061.00	\$ 130,061.00	

OTHER CONTRIBUTIONS

(contributions not associated with the application)

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
Madison Conservation District	\$ 3,500.00	\$ 5,000.00	\$ 8,500.00	Y
Madison River Foundation	\$ -	\$ 5,000.00	\$ 5,000.00	Y
NorthWestern Energy	\$ -	\$ 155,000.00	\$ 155,000.00	Y
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ 3,500.00	\$ 165,000.00	\$ 168,500.00	

-111°43'50"

-111°43'40"

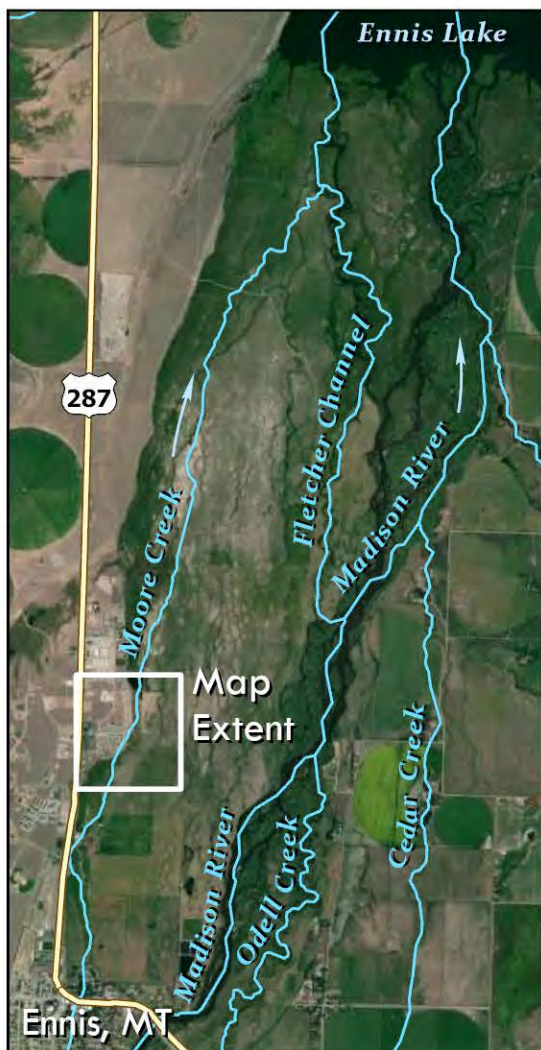
-111°43'30"

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Moore Creek restoration project phase 1

015-2024

Project Vicinity



SJK PROPERTIES LLC

GOGGINS
PATRICK JEROME

MARIC
PROPERTIES
BOZEMAN LLC

STARRY NIGHTS
RV + LODGING

MARIC
PROPERTIES
BOZEMAN LLC

Restoration Project
Design Alignment

GOGGINS
PATRICK JEROME

Moore Creek

Moore Creek Restoration Project

Project Center:

Latitude: 45.36735°N; Longitude: 111.72299°W

Landowners:

Goggins, Patrick Jerome; Maric Properties Bozeman LLC



0 500 1,000 Feet

Scale: 1:4,000

09.28.2023. River Design Group, Inc.

Data: USGS NHD; Madison County Cadastral.; Imagery: Maxar 07.30.2020.

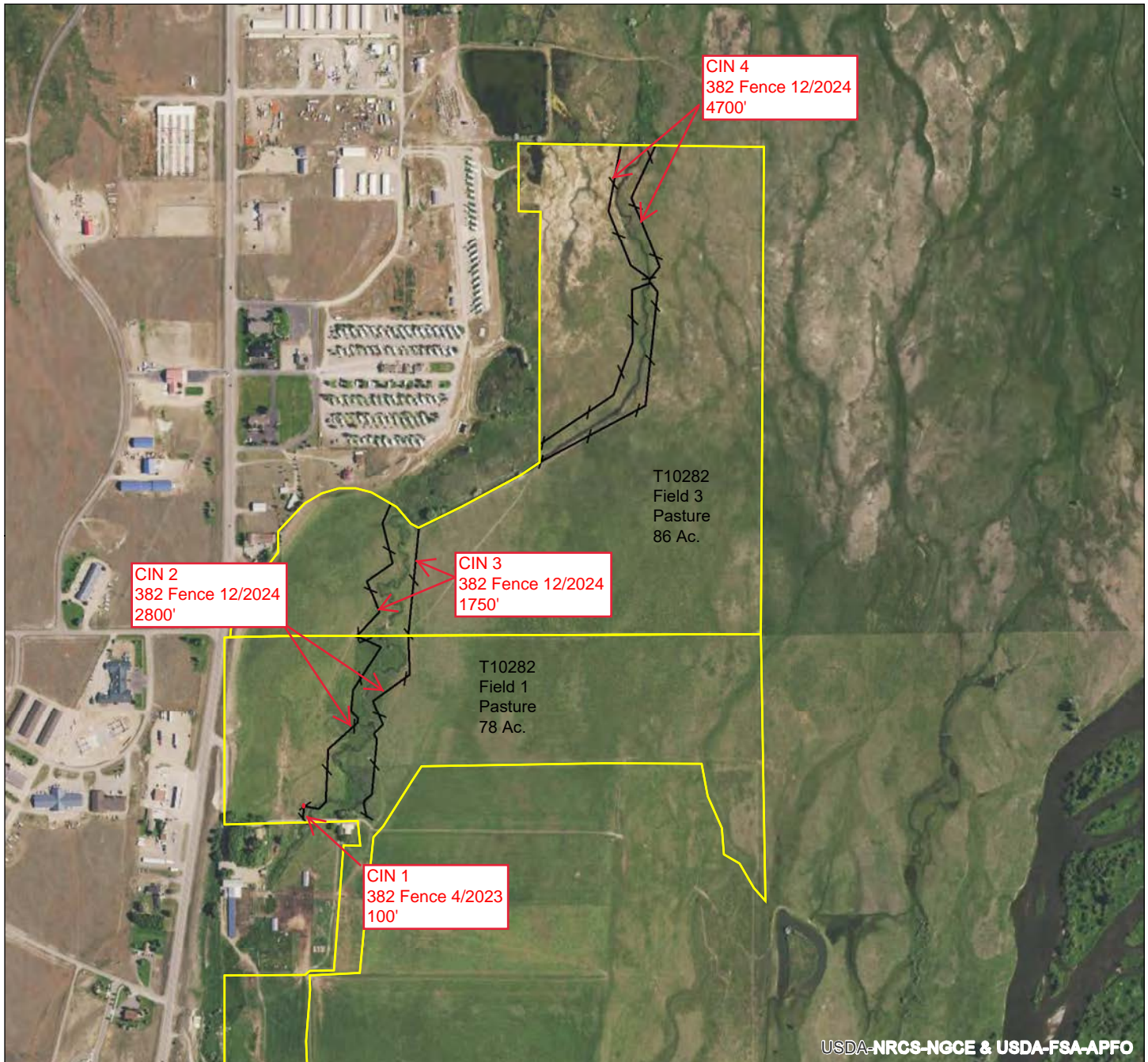
Moore Creek restoration project phase 1
Goggins_ETR_2022_7403252208G

015-2024
Date: 2/10/2022

Client(s): PATRICK J GOGGINS
Location: T5SR1W Sec 33, 28
Madison County, Montana
Approximate Acres: 163.47

Assisted By: JOHN WAGONER
SHERIDAN FIELD OFFICE

Land Units: T10282 field 1, 3



0 752
Feet

Prepared with assistance from USDA-Natural Resources Conservation Service



Practice Schedule
PLUS

Conservation
Practice Lines

— Fence (382)



GOGGINS RANCH

Ennis, Montana

To: Michelle McGree
Future Fisheries Improvement Program
FWP Fisheries Division
P.O. Box 200701
Helena, MT 59620

Date: November 1, 2023

RE: Letter of Landowner Support – Moore's Creek Restoration Project

Dear Michelle,

Please accept this letter of landowner support for the Madison Conservation District's application for funding for the Moore's Creek project.

Since 2010, the ranch has been involved in many passive restoration projects on the streams on ranch property. These include riparian fencing to create riparian pastures so that grazing can be timed appropriately for stream bank protection as well as willow plantings. We've been very active in working with the Madison Conservation District's Stream Team to monitor stream health since the Stream Team's inception. The Ennis High School science class has also monitored Moore's Creek in the past as a class learning experience.

On the section of Moore's Creek in this project, the stream was straightened sometime in the past. This has led to extreme bank erosion which puts immense amounts of sediment into Moore's Creek each year, especially during high water.

This project will address the problem area of erosion and continue improvements downstream on our property. We are working on a cost-share project with NRCS to create a riparian pasture in this section of the stream to protect the area. This will include hardened water gaps for cattle water access and hardened crossings so cattle can utilize pasture on both sides of the stream.

We fully support this project and are excited to see the impacts that the improvements will make on the stream for the fishery, waterfowl, and cattle drinking water quality.

Sincerely,



Pat Goggins
Partner, Goggins Ranch
406-682-4122
thefeedman@yahoo.com

Michelle McGree
Future Fisheries Improvement Program
FWP Fisheries Division
P.O. Box 200701
Helena, MT 59620

October 17, 2023

Dear Ms. McGree,

NorthWestern Energy is providing this letter of support for the Madison Conservation District efforts to pursue a Montana FWP Future Fisheries Grant to address fish and wildlife habitat improvements on Moore Creek in Madison County, Montana.

Over the past two years NorthWestern has funded five projects on Moore Creek totaling \$155,299. The focus of these projects include physical survey, stream restoration planning, stream restoration design and cultural resources inventory of nearly 4 miles of lower Moore Creek between the town of Ennis and the mouth. Our goal is to improve water quality and fish and wildlife habitat at Moore Creek.

NorthWestern believes our investment in planning will be attractive to other funding sources interested in restoration construction projects. I will add that our riparian habitat restoration projects over the past 22 years include monitoring components for birds, native plants and water temperature which clearly measures the effectiveness of habitat restoration. We hope these efforts will be viewed favorably by prospective funding partners at Moore Creek.

Please let me know if you need any additional information.

Sincerely,



Grant Grisak
Fish Biologist - Hydro License Compliance
6700 Rainbow Dam Road
Great Falls, MT 59405
Grant.Grisak@NorthWestern.com
☎ 406-268-2299
📠 406-403-1967

STARRY NIGHT

LODGING + RV

October 24, 2023

Michelle McGree
Future Fisheries Improvement Program
FWP Fisheries Division
P.O. Box 200701
Helena, MT 59620

Dear Ms. McGree,

I am writing this letter in support of the application for the Montana Fish, Wildlife, and Parks Future Fisheries Improvement Program presented by Colin Threlkeld, Conservation Programs Manager of the Madison Conservation District. I represent the ownership of the Starry Night Lodging and RV park located at 15 Geyser Street in Ennis, MT 59729. We own and operate a 112 site RV Park with the stream running through the Eastern edge of our property.

Starry Night Lodging and RV operates 6 RV Parks and two hotels in Montana. Our mission it to provide a more sustainable approach to travel and educate travelers so they become more aware of their impact on the environment and communities they visit. Water awareness is a primary focus for us, as we try to engage with, and inform guests about water protection and conservation. We currently volunteer for river clean-ups at many of our properties, including the Gallatin, Clarks Fork and Flathead. In fact, we serve as Watershed Stewards with the Gallatin Watershed Council, and have raised funds for the organization, volunteered for multiple river clean-up events, and even installed two rain gardens in Bozeman to help reduce pollutants entering the storm drain system. Each of these projects included signage explaining the water cycle and the importance of natural filtration.

In addition to the partnership with Gallatin Watershed Council, we also partner with Project WET, an international nonprofit based in Bozeman. Project WET trains our staff on the importance of water conservation, so we can better educate our guests. We also hand out free activity books to children, which help teach them about water conservation. We hope to perform multiple fun live watershed activities in the coming summer of 2024 as well.

Each of our properties utilizes rain catchment systems to help conserve natural water sources and use them for watering our community gardens. We use signage to educate guests about the role rain

catchment can play in reducing storm water run-off, erosion and water conservation. We also incorporate this into our community garden education when we give away the produce in the fall.

With regards to this project, we have dedicated multiple hours to understanding the need and plan. We are excited to see the stream path restored through our property and hope to turn it into another educational opportunity for the community and our guests. That area of our property already includes a walking trail, but we hope to build on this once the work is done. This would include the installation of a more defined pathway with signage about the project, the watershed and steps guests can take to protect and conserve water. We will work with Project WET and any other partners that are interested in helping to create fun and engaging information, which can include logos or mentions of those organizations that helped to make the project happen.

We look forward to participating in this important project and then inviting our guests and the community to enjoy our trails and educational messages to help raise awareness about the need for healthy watershed to reduce pollutants and erosion, while promoting a natural habitat for wildlife.

Please feel free to contact me with any questions.

Sincerely,



Eric Sheckleton

Owner
Starry Night Lodging and RV
(406)670-6326
eric@starrynightlodging.com





Montana Fish, Wildlife & Parks
Region 3 Headquarters
1400 South 19th Street
Bozeman, MT 59715

November 15th, 2023

Future Fisheries Improvement Program
FWP Fisheries Division
P.O. Box 200701
Helena, MT 59620

Dear Future Fisheries Improvement Program Review Panel,

Montana Fish, Wildlife & Parks (FWP) strongly supports the Madison Conservation District's (MCD) application to address water quality impairments in Moore Creek.

Moore Creek provides important spawning and rearing habitats for rainbow and brown trout that spend much of their adult lives in the Madison River and Ennis Reservoir. However, Moore Creek is listed by the Montana Department of Environmental Quality (DEQ) as impaired for nutrients and *E. coli*. High water temperatures and sediment loads as well as degraded riparian habitats and stream have also compromised water quality and instream fish habitats. The proposed project directly addresses the impairments listed above and will immediately and significantly improve instream habitats in Moore Creek especially in the lower reaches of the stream often used by migrating trout and their offspring. Moreover, Ennis Reservoir chronically suffers from high water temperatures, so FWP is exploring all opportunities to improve water temperatures in nearby tributaries. Albeit relatively minor, the proposed project would help address that issue.

The MCD has been and continues to be an integral partner and facilitator in addressing diverse watershed issues and impairments in the Madison drainage. They have a strong track record of working with Department of Natural Resources, DEQ, FWP, irrigators, the angling community, and other stakeholders to resolve complex issues such as sediment management, water conservation, drought resiliency, and TMDL impairments. MCD's role has included problem identification, project development, fundraising, and implementing on-the-ground solutions, thereby demonstrating a track record of proficiency in solving complex issues.

FWP supports the proposed Moore Creek project grant and is committed as a partner to ensure that its realized benefits are maximized.

For questions or concerns, please reach out to the following FWP personnel:

Mike Duncan, Region 3 Fisheries Manager and acting Madison-Gallatin Program Manager
(406-577-78-71, mike.duncan@mt.gov)

Jen Smitham, Region 3 Public comment coordinator (406-495-3262, jsmitham@mt.gov)

Thank you again for the opportunity to comment.

Sincerely,

A handwritten signature in black ink, appearing to read "Warren Hansen", with a long, sweeping horizontal stroke at the end.

Warren Hansen
Acting Region 3 Supervisor



**Upper Moore Creek Bank Erodibility Hazard Index
Data Summary Report
Goggins Reach**



UPPER MOORE CREEK
Bank Erosion Hazard Index (BEHI) Assessment

BEHI CATEGORIES

- VERY LOW

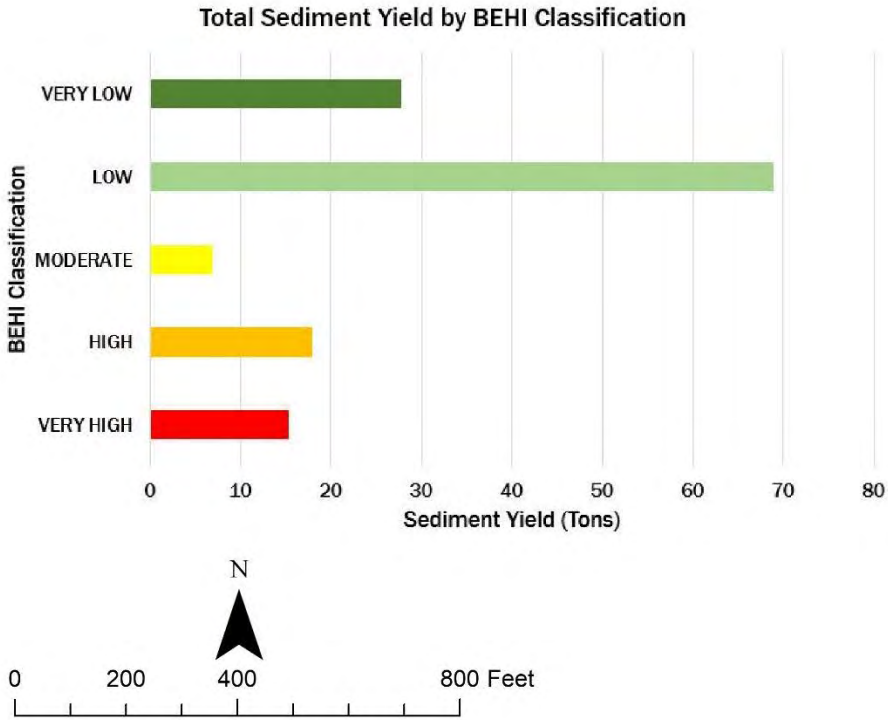
LOW

MODERATE
- HIGH

VERY HIGH

EXTREME

BEHI CATEGORY	LENGTH (FT)	MIGRATION RATE (FT/YR)	HEIGHT (FT)	DENSITY (LBS/FT³)	YIELD (TONS)
VERY HIGH	130	0.39	6	100	15
HIGH	232	0.31	5	100	18
MODERATE	133	0.23	4.5	100	7
LOW	2,701	0.17	3.0	100	69
VERY LOW	4,813	0.1	2.5	100	28
NON-CONTRIBUTING	0	0	0	100	0
RIP-RAP	0	0	5.0	100	0
TOTAL	8,009				137

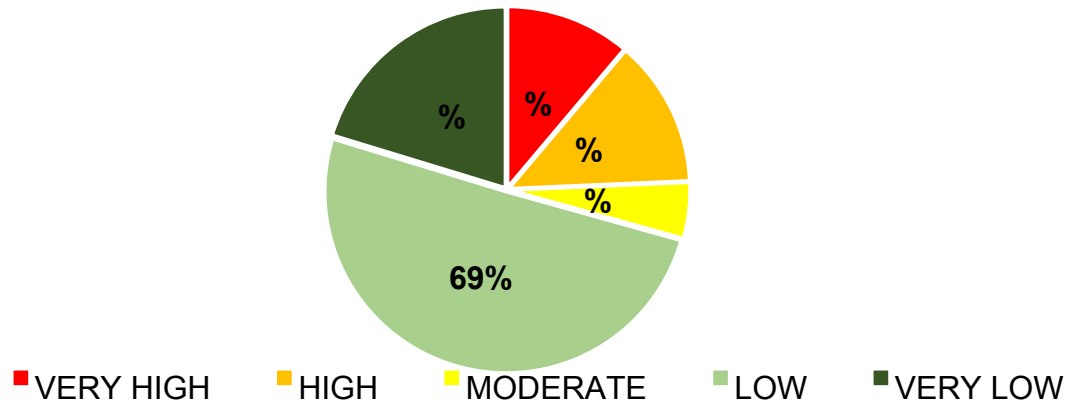


River Design Group, 8/18/2022. NAIP Imagery.



2. Sediment Yield Figures

Sediment Yield Proportion by BEHI Classification



Total Sediment Yield by BEHI Classification

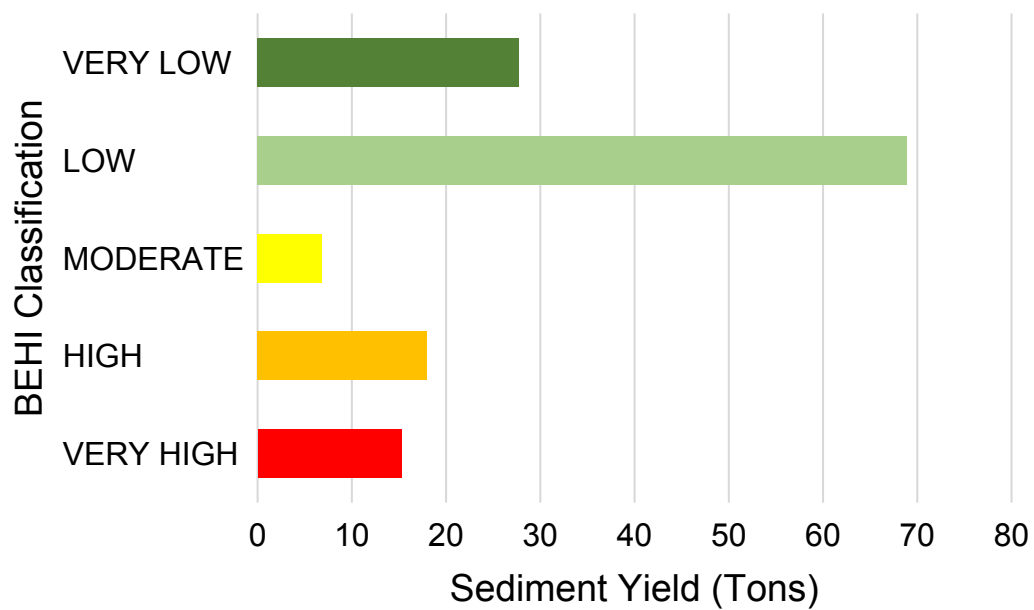


Figure 3: Bar chart of sediment yield by BEHI category for Upper Moore Creek.

3. SITE PHOTOS



Figure 4: Representative in-stream conditions at upper Moore Creek.



Figure 5: Representative straightened section of channel (left) and eroding bank (right).

4. BEHI DATA FORMS

Reach 1: Level III		Bank Erosion Hazard Index (BEHI)																																														
		Stream: Moore Creek					Location: Upper Moore Creek																																									
Station: Sheet 1					Observers: DW																																											
Date: 6/21/2022					Stream Type:			Valley Type:																																								
<div style="display: flex; justify-content: space-between;"> <div> <p>Study Bank Height to Bankfull Height (C)</p> <table border="1"> <tr> <td>Study Bank Height (ft) =</td> <td>1.5 (A)</td> <td>Bankfull Height (ft) =</td> <td>1.25 (B)</td> <td>(A) / (B) =</td> <td>1.2 (C)</td> <td>2</td> </tr> </table> </div> <div> <p>Root Depth to Study Bank Height (E)</p> <table border="1"> <tr> <td>Root Depth (ft) =</td> <td>1.5 (D)</td> <td>Study Bank Height (ft) =</td> <td>1.5 (A)</td> <td>(D) / (A) =</td> <td>1 (E)</td> <td>0</td> </tr> </table> </div> </div> <div style="display: flex; justify-content: space-between;"> <div> <p>Weighted Root Density (G)</p> <table border="1"> <tr> <td>Root Density as % =</td> <td>80% (F)</td> <td>(F) × (E) =</td> <td>80 (G)</td> <td>2</td> </tr> </table> </div> <div> <p>Bank Angle (H)</p> <table border="1"> <tr> <td>Bank Angle as Degrees =</td> <td>15 (H)</td> <td>1</td> </tr> </table> </div> </div> <div style="display: flex; justify-content: space-between;"> <div> <p>Surface Protection (I)</p> <table border="1"> <tr> <td>Surface Protection as % =</td> <td>75% (I)</td> <td>2</td> </tr> </table> </div> <div> <p>Bank Material Adjustment:</p> <p>Bedrock (Overall Very Low BEHI)</p> <p>Boulders (Overall Low BEHI)</p> <p>Cobble (Subtract 10 points if uniform med. to large cobble)</p> <p>Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand)</p> <p>Sand (Add 10 points)</p> <p>Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)</p> </div> </div> <div style="display: flex; justify-content: space-between;"> <div> <p>Bank Material Adjustment</p> <p>0</p> </div> <div> <p>Stratification Adjustment</p> <p>Add 5-10 points, depending on position of unstable layers in relation to bankfull stage</p> <p>0</p> </div> </div> <div style="display: flex; justify-content: space-between;"> <div> <table border="1"> <tr> <td>Very Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Very High</td> <td>Extreme</td> </tr> <tr> <td>5 - 9.5</td> <td>10 - 19.5</td> <td>20 - 29.5</td> <td>30 - 39.5</td> <td>40 - 45</td> <td>46 - 50</td> </tr> </table> </div> <div> <p>Adjective Rating and Total Score</p> <p>V. LOW</p> <p>7</p> </div> </div>												Study Bank Height (ft) =	1.5 (A)	Bankfull Height (ft) =	1.25 (B)	(A) / (B) =	1.2 (C)	2	Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	1.5 (A)	(D) / (A) =	1 (E)	0	Root Density as % =	80% (F)	(F) × (E) =	80 (G)	2	Bank Angle as Degrees =	15 (H)	1	Surface Protection as % =	75% (I)	2	Very Low	Low	Moderate	High	Very High	Extreme	5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50
Study Bank Height (ft) =	1.5 (A)	Bankfull Height (ft) =	1.25 (B)	(A) / (B) =	1.2 (C)	2																																										
Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	1.5 (A)	(D) / (A) =	1 (E)	0																																										
Root Density as % =	80% (F)	(F) × (E) =	80 (G)	2																																												
Bank Angle as Degrees =	15 (H)	1																																														
Surface Protection as % =	75% (I)	2																																														
Very Low	Low	Moderate	High	Very High	Extreme																																											
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50																																											



Figure 6: BEHI data form and representative bank.

Reach 1: Level III		Bank Erosion Hazard Index (BEHI)																					
		Stream: Moore Creek					Location: Upper Moore Creek																
		Station: Sheet 2					Observers: DW																
		Date: 6/21/2022					Valley Type:																
		Stream Type:																					
		Study Bank Height to Bankfull Height (C) (Fig. 3-7) <table border="1"> <tr> <td>Study Bank Height (ft) =</td> <td>2.5 (A)</td> <td>Bankfull Height (ft) =</td> <td>1.5 (B)</td> <td>(A) / (B) =</td> <td>1.6 (C)</td> <td>6</td> </tr> </table>								Study Bank Height (ft) =	2.5 (A)	Bankfull Height (ft) =	1.5 (B)	(A) / (B) =	1.6 (C)	6	BEHI Score						
Study Bank Height (ft) =	2.5 (A)	Bankfull Height (ft) =	1.5 (B)	(A) / (B) =	1.6 (C)	6																	
		Root Depth to Study Bank Height (E) <table border="1"> <tr> <td>Root Depth (ft) =</td> <td>1.5 (D)</td> <td>Study Bank Height (ft) =</td> <td>2.5 (A)</td> <td>(D) / (A) =</td> <td>0.6 (E)</td> <td>3</td> </tr> </table>								Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	2.5 (A)	(D) / (A) =	0.6 (E)	3							
Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	2.5 (A)	(D) / (A) =	0.6 (E)	3																	
		Weighted Root Density (G) <table border="1"> <tr> <td>Root Density as % =</td> <td>70% (F)</td> <td>(F) x (E) =</td> <td>42 (G)</td> <td>5</td> </tr> </table>								Root Density as % =	70% (F)	(F) x (E) =	42 (G)	5									
Root Density as % =	70% (F)	(F) x (E) =	42 (G)	5																			
		Bank Angle (H) <table border="1"> <tr> <td>Bank Angle as Degrees =</td> <td>30 (H)</td> <td>2</td> </tr> </table>								Bank Angle as Degrees =	30 (H)	2											
Bank Angle as Degrees =	30 (H)	2																					
		Surface Protection (I) <table border="1"> <tr> <td>Surface Protection as % =</td> <td>70% (I)</td> <td>3</td> </tr> </table>								Surface Protection as % =	70% (I)	3											
Surface Protection as % =	70% (I)	3																					
		Bank Material Adjustment: Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)																					
		Bank Material Adjustment 0 Stratification Adjustment 0 Add 5-10 points, depending on position of unstable layers in relation to bankfull stage																					
		<table border="1"> <tr> <td>Very Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Very High</td> <td>Extreme</td> <td rowspan="2">Adjective Rating and Total Score</td> </tr> <tr> <td>5 - 9.5</td> <td>10 - 19.5</td> <td>20 - 29.5</td> <td>30 - 39.5</td> <td>40 - 45</td> <td>46 - 50</td> </tr> </table>								Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score																	
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50																		
		LOW 19																					



Figure 7: BEHI data form and representative bank.

Reach 1: Level III		Bank Erosion Hazard Index (BEHI)									
		Stream: Moore Creek					Location: Upper Moore Creek				
		Station: Sheet 3					Observers: DW				
		Date: 6/21/2022					Valley Type:				
		Stream Type:									
		Study Bank Height to Bankfull Height (C) (Fig. 3-7)								BEHI Score	
		Study Bank Height (ft) = 5 (A)	Bankfull Height (ft) = 2.5 (B)	(A) / (B) = 2 (C)					8		
		Root Depth to Study Bank Height (E)									
		Root Depth (ft) = 2 (D)	Study Bank Height (ft) = 5 (A)	(D) / (A) = 0.4 (E)					5		
		Weighted Root Density (G)									
		Root Density as % = 50% (F)	(F) x (E) = 20 (G)					7			
		Bank Angle (H)									
		Bank Angle as Degrees = 90 (H)							8		
		Surface Protection (I)									
		Surface Protection as % = 95% (I)							1		
		Bank Material Adjustment:									
		Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)									
		Bank Material Adjustment								0	
		Stratification Adjustment								0	
		Add 5-10 points, depending on position of unstable layers in relation to bankfull stage									
		Adjective Rating and Total Score									
		Very Low	Low	Moderate	High	Very High	Extreme			MODERATE	
		5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50			29	



Figure 8: BEHI data and representative bank.

Bank Erosion Hazard Index (BEHI)																									
Reach 1: Level III	Stream: Moore Creek				Location: Upper Moore Creek																				
	Station: Sheet 4				Observers: DW																				
	Date: 6/21/2022				Stream Type:		Valley Type:																		
	<div style="text-align: right;">BEHI Score (Fig. 3-7)</div>																								
Study Bank Height to Bankfull Height (C) <table border="1"> <tr> <td>Study Bank Height (ft) =</td> <td>5.5 (A)</td> <td>Bankfull Height (ft) =</td> <td>2.5 (B)</td> <td>(A) / (B) =</td> <td>2.2 (C)</td> <td>8</td> </tr> </table>										Study Bank Height (ft) =	5.5 (A)	Bankfull Height (ft) =	2.5 (B)	(A) / (B) =	2.2 (C)	8									
Study Bank Height (ft) =	5.5 (A)	Bankfull Height (ft) =	2.5 (B)	(A) / (B) =	2.2 (C)	8																			
Root Depth to Study Bank Height (E) <table border="1"> <tr> <td>Root Depth (ft) =</td> <td>1 (D)</td> <td>Study Bank Height (ft) =</td> <td>5.5 (A)</td> <td>(D) / (A) =</td> <td>0.18 (E)</td> <td>8</td> </tr> </table>										Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	5.5 (A)	(D) / (A) =	0.18 (E)	8									
Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	5.5 (A)	(D) / (A) =	0.18 (E)	8																			
Weighted Root Density (G) <table border="1"> <tr> <td>Root Density as % =</td> <td>25% (F)</td> <td>(F) × (E) =</td> <td>4.5 (G)</td> <td>9.5</td> </tr> </table>										Root Density as % =	25% (F)	(F) × (E) =	4.5 (G)	9.5											
Root Density as % =	25% (F)	(F) × (E) =	4.5 (G)	9.5																					
Bank Angle (H) <table border="1"> <tr> <td>Bank Angle as Degrees =</td> <td>90 (H)</td> <td>8</td> </tr> </table>										Bank Angle as Degrees =	90 (H)	8													
Bank Angle as Degrees =	90 (H)	8																							
Surface Protection (I) <table border="1"> <tr> <td>Surface Protection as % =</td> <td>10% (I)</td> <td>9</td> </tr> </table>										Surface Protection as % =	10% (I)	9													
Surface Protection as % =	10% (I)	9																							
Bank Material Adjustment: <table border="1"> <tr> <td> Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points) </td> <td> Bank Material Adjustment 0 </td> </tr> </table>										Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)	Bank Material Adjustment 0														
Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)	Bank Material Adjustment 0																								
Stratification Adjustment Add 5-10 points, depending on position of unstable layers in relation to bankfull stage 0																									
<table border="1"> <tr> <td>Very Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Very High</td> <td>Extreme</td> <td>Adjective Rating and Total Score</td> <td>V.HIGH</td> </tr> <tr> <td>5 - 9.5</td> <td>10 - 19.5</td> <td>20 - 29.5</td> <td>30 - 39.5</td> <td>40 - 45</td> <td>46 - 50</td> <td>42.5</td> <td></td> </tr> </table>										Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	V.HIGH	5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	42.5	
Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score	V.HIGH																		
5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50	42.5																			



Figure 9: BEHI data form and representative bank.

Reach 1: Level III		Bank Erosion Hazard Index (BEHI)									
		Stream: Moore Creek					Location: Upper Moore Creek				
		Station: Sheet 5					Observers: DW				
		Date: 6/21/2022					Valley Type:				
		Stream Type:									
		Study Bank Height to Bankfull Height (C) (Fig. 3-7)								BEHI Score	
		Study Bank Height (ft) = 5.5 (A)	Bankfull Height (ft) = 1.5 (B)	(A) / (B) = 3.6 (C)				10			
		Root Depth to Study Bank Height (E)									
		Root Depth (ft) = 4 (D)	Study Bank Height (ft) = 5.5 (A)	(D) / (A) = 0.72 (E)				3			
		Weighted Root Density (G)									
		Root Density as % = 10% (F)	(F) x (E) = 7.2 (G)				10				
		Bank Angle (H)									
		Bank Angle as Degrees = 80 (H)					6				
		Surface Protection (I)									
		Surface Protection as % = 10% (I)					9				
		Bank Material Adjustment:									
		Bedrock (Overall Very Low BEHI) Boulders (Overall Low BEHI) Cobble (Subtract 10 points if uniform med. to large cobble) Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand) Sand (Add 10 points) Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)									
		Bank Material Adjustment								0	
		Stratification Adjustment								0	
		Add 5-10 points, depending on position of unstable layers in relation to bankfull stage									
		Adjective Rating and Total Score									
		Very Low	Low	Moderate	High	Very High	Extreme			HIGH	
		5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50			35	



Figure 10: BEHI data form and representative bank.

Reach 1: Level III		Bank Erosion Hazard Index (BEHI)																																											
Stream: Moore Creek		Location: Upper Moore Creek																																											
Station: Sheet 6		Observers: DW																																											
Date: 6/21/2022		Stream Type:		Valley Type:																																									
<p align="center">Study Bank Height to Bankfull Height (C) BEHI Score (Fig. 3-7)</p> <table border="1"> <tr> <td>Study Bank Height (ft) =</td> <td>6 (A)</td> <td>Bankfull Height (ft) =</td> <td>3 (B)</td> <td>(A) / (B) =</td> <td>2 (C)</td> <td>8</td> </tr> </table> <p align="center">Root Depth to Study Bank Height (E)</p> <table border="1"> <tr> <td>Root Depth (ft) =</td> <td>1 (D)</td> <td>Study Bank Height (ft) =</td> <td>6 (A)</td> <td>(D) / (A) =</td> <td>0.16 (E)</td> <td>8</td> </tr> </table> <p align="center">Weighted Root Density (G)</p> <table border="1"> <tr> <td>Root Density as % =</td> <td>15% (F)</td> <td>(F) x (E) =</td> <td>2.4 (G)</td> <td>10</td> </tr> </table> <p align="center">Bank Angle (H)</p> <table border="1"> <tr> <td>Bank Angle as Degrees =</td> <td>90 (H)</td> <td>8</td> </tr> </table> <p align="center">Surface Protection (I)</p> <table border="1"> <tr> <td>Surface Protection as % =</td> <td>10% (I)</td> <td>9</td> </tr> </table> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p align="center">Bank Material Adjustment:</p> <p>Bedrock (Overall Very Low BEHI)</p> <p>Boulders (Overall Low BEHI)</p> <p>Cobble (Subtract 10 points if uniform med. to large cobble)</p> <p>Gravel or Composite Matrix (Add 5-10 points depending on percentage of bank material that is composed of sand)</p> <p>Sand (Add 10 points)</p> <p>Silt/Clay (No adjustment unless primarily clay, then subtract 20 points)</p> </div> <div style="width: 45%;"> <p align="center">Bank Material Adjustment</p> <p>Stratification Adjustment</p> <p>Add 5-10 points, depending on position of unstable layers in relation to bankfull stage</p> </div> </div> <table border="1"> <tr> <td>Very Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Very High</td> <td>Extreme</td> <td rowspan="2"> Adjective Rating and Total Score V. HIGH 43 </td> </tr> <tr> <td>5 - 9.5</td> <td>10 - 19.5</td> <td>20 - 29.5</td> <td>30 - 39.5</td> <td>40 - 45</td> <td>46 - 50</td> </tr> </table>								Study Bank Height (ft) =	6 (A)	Bankfull Height (ft) =	3 (B)	(A) / (B) =	2 (C)	8	Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	6 (A)	(D) / (A) =	0.16 (E)	8	Root Density as % =	15% (F)	(F) x (E) =	2.4 (G)	10	Bank Angle as Degrees =	90 (H)	8	Surface Protection as % =	10% (I)	9	Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score V. HIGH 43	5 - 9.5	10 - 19.5	20 - 29.5	30 - 39.5	40 - 45	46 - 50
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Figure 11: BEHI data form and representative bank.

MOORE CREEK RESTORATION PROJECT

100% DESIGN PLAN SET

MOORE CREEK VICINITY MAP



LEGAL DESCRIPTION:
S28, R01 W, ACRES 45, TR IN SE4 & SW4.P.M., M
S28, T05 S, R01 W, C.O.S. 7/922, PARCEL 6.P.M., M
MADISON COUNTY, MONTANA

DRAWING INDEX

1.0	COVER SHEET AND NOTES	4.5	GRADING PLAN AND PROFILE - REACH 2
2.0	EXISTING CONDITIONS AND SURVEY CONTROL	5.0	CROSS SECTIONS - REACH 1
2.1	EXISTING BANK EROSION CONDITIONS	5.1	CROSS SECTIONS - REACH 1
3.0	SITE PLAN AND INDEX	5.2	CROSS SECTIONS - REACH 2
3.1	SITE ACCESS, STAGING AND DEWATERING PLAN	5.3	CROSS SECTION DIMENSIONS
3.2	NOTES AND SPECIFICATIONS	6.0	SOD BANK STRUCTURE DETAILS
3.3	MATERIALS AND QUANTITIES	6.1	CONSTRUCTED CHANNEL STREAMBED DETAIL
4.0	PLAN VIEW AND STRUCTURE LAYOUT - REACH 1	6.2	WILLOW TRENCH DETAIL
4.1	PLAN VIEW AND STRUCTURE LAYOUT - REACH 1	7.0	REVEGETATION PLAN - REACH 1
4.2	GRADING PLAN AND PROFILE - REACH 1	7.1	REVEGETATION PLAN - REACH 2
4.3	PLAN VIEW AND STRUCTURE LAYOUT - REACH 2	7.2	SEEDING PLAN AND SCHEDULE
4.4	PLAN VIEW AND STRUCTURE LAYOUT - REACH 2	8.0	BMP DETAILS

PROJECT PARTNERS



MADISON CONSERVATION DISTRICT
222 MAIN STREET
ENNIS, MONTANA 59729



MONTANA FISH, WILDLIFE & PARKS
3201 SPURGIN ROAD
MISSOULA, MONTANA 59804



NORTHWESTERN ENERGY
6700 RAINBOW DAM ROAD
GREAT FALLS, MONTANA 59404

GOGGINS FAMILY
22 GOGGINS DR
ENNIS, MT 59729-9056

PROJECT DESCRIPTION

MOORE CREEK IS AN IMPORTANT ECOLOGICAL RESOURCE TO THE GREATER MADISON RIVER WATERSHED. ORIGINATING IN THE GRAVELLY RANGE NORTH AND WEST OF ENNIS, MONTANA, MOORE CREEK FLOWS APPROXIMATELY 16 MILES TO ITS CONFLUENCE WITH ENNIS LAKE AND THE MADISON RIVER.

DECADES OF HISTORICAL LAND USE PRACTICES INCLUDING GRAZING, AGRICULTURE, CHANNELIZATION, AND REMOVAL OF RIPARIAN VEGETATION HAS SIGNIFICANTLY ALTERED THE ECOLOGY OF MOORE CREEK. MOORE CREEK WAS CHANNELIZED AND STRAIGHTENED IN THE 1900'S WHICH RESULTED IN CHANNEL INCISION, FLOODPLAIN DISCONNECTION, AND WATER QUALITY IMPAIRMENT. THE MONTANA WATER QUALITY ACT PROVIDES FOR THE RESTORATION AND MAINTENANCE OF THE CHEMICAL, PHYSICAL, AND BIOLOGICAL INTEGRITY OF THE STATE'S SURFACE WATERS SO THAT THEY SUPPORT ALL DESIGNATED USES. WATER QUALITY STANDARDS ARE USED TO DETERMINE IMPAIRMENT, ESTABLISH WATER QUALITY TARGETS, AND TO FORMULATE TOTAL MAXIMUM DAILY LOADS (TMDLS) AND LOAD ALLOCATIONS. MOORE CREEK INCLUDING ENNIS LAKE AND THE MADISON RIVER ARE CLASSIFIED AS B-1 WATERBODIES AND ARE TO BE MAINTAINED FOR THE GROWTH AND PROPAGATION OF SALMONID FISHES AND ASSOCIATED AQUATIC LIFE, AND WATERFOWL. MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY HAS IDENTIFIED 15.83 MILES OF MOORE CREEK AS IMPAIRED FOR SEDIMENTATION (I.E. SILTATION), TEMPERATURE, TOTAL PHOSPHORUS, TOTAL NITROGEN, E.COLI, ARSENIC, AND ALTERATION IN STREAMSIDE VEGETATIVE COVER, AND THE STREAM IS CONSIDERED NON-SUPPORTING OF AQUATIC LIFE, DRINKING WATER AND CONTACT RECREATION. PRIMARY SOURCES OF WATER QUALITY IMPAIRMENT INCLUDE ERODING STREAMBANKS, LOSS OF RIPARIAN HABITAT, GRAZING IN RIPARIAN AREAS, AND AGRICULTURE.

IN 2022, NORTHWESTERN ENERGY RETAINED RIVER DESIGN GROUP, INC. TO EVALUATE RESTORATION OPPORTUNITIES AND DEVELOP FINAL DESIGN DRAWINGS. GEOMORPHIC AND VEGETATION ASSESSMENTS WERE CONDUCTED IN 2022. TO HELP GUIDE THE DEVELOPMENT OF RESTORATION STRATEGIES AND TECHNIQUES, THE FOLLOWING GOALS WERE DEVELOPED:

- IMPROVE AQUATIC, RIPARIAN, AND TERRESTRIAL HABITAT DIVERSITY FOR FISH AND WILDLIFE.
- RESTORE A SELF-MAINTAINING STREAM CHANNEL THAT INCLUDES COMPLEX AQUATIC HABITAT FEATURES INCLUDING RIFFLES, RUNS, POOLS, AND GLIDES.
- CONVERT AREAS WITHIN THE EXISTING UPLAND PLANT COMMUNITIES TO EMERGENT AND SCRUB-SHRUB WETLANDS BY CREATING NEW, LOWER FLOODPLAIN SURFACES IN REACH 1 OF THE PROJECT AREA.
- RESTORE WILLOW AND RIPARIAN SHRUB COMMUNITIES IN PATCHES ALONG STREAMBANKS AND WITHIN PORTIONS OF THE FLOODPLAIN.
- RECLAIM THE EXISTING CHANNELIZED SECTION OF MOORE CREEK IN REACH 1 TO RESTORE WETLAND HYDROLOGY.
- ENSURE RESTORATION ACTIONS ARE COMPATIBLE WITH AND SUPPORT EXISTING AND FUTURE LAND USE ACTIVITIES ON THE RANCH INCLUDING AGRICULTURE AND GRAZING.
- INTEGRATE A GRAZING MANAGEMENT PLAN INCLUDING FENCING ENCLOSURES, WATER GAPS, AND STREAM CROSSINGS TO PREVENT DAMAGE TO THE RESTORED STREAM CHANNEL AND FLOODPLAIN VEGETATION.

STANDARD OF PRACTICE

RIVER DESIGN GROUP, INC. WORKS EXCLUSIVELY IN THE RIVER ENVIRONMENT AND UTILIZES THE MOST CURRENT AND ACCEPTED PRACTICES AVAILABLE FOR PLANNING AND DESIGN OF RIVER, FLOODPLAIN, AND AQUATIC HABITAT RESTORATION PROJECTS. CURRENT STANDARDS FOR THE DESIGN OF RESTORATION PROJECTS VARY DEPENDING ON PROJECT GOALS. STABILITY CRITERIA INCLUDE DESIGNING STREAMBED AND STREAMBANK STRUCTURES FOR THE 25-YR RECURRENCE INTERVAL DISCHARGE FLOOD. REGIONAL CURVES WERE USED TO EVALUATE BANKFULL DISCHARGE, AND HIGHER RETURN INTERVAL DISCHARGES INCLUDING THE 100-YEAR FLOW.

REUSE OF DRAWINGS

THESE DRAWINGS, THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, ARE THE PROPERTY OF RIVER DESIGN GROUP, INC. (RDG) AND ARE NOT TO BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF RDG. LIKEWISE, THESE DRAWINGS MAY NOT BE ALTERED OR MODIFIED WITHOUT AUTHORIZATION OF RDG. DRAWING DUPLICATION IS ALLOWED IF THE ORIGINAL CONTENT IS NOT MODIFIED.



COVER SHEET AND NOTES

MOORE CREEK RESTORATION

MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 1.0				
Drawing 1 of 24				

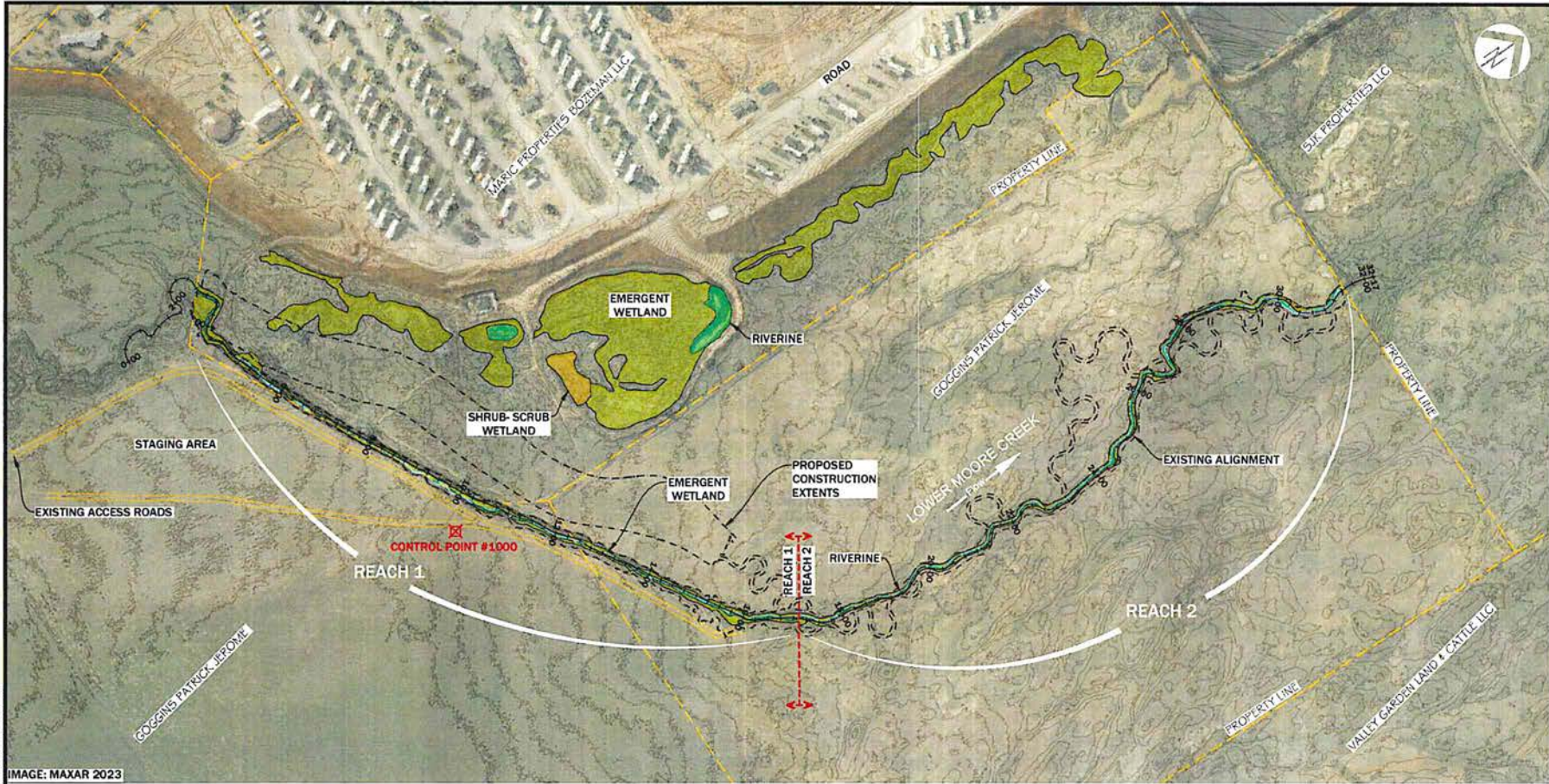


IMAGE: MAXAR 2023

1 EXISTING CONDITIONS
PLAN VIEW

1" = 200'

PROJECT DATUM	
THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:	
HORIZONTAL PROJECTION:	MONTANA STATE PLANE
HORIZONTAL DATUM:	NAD83 (GRS96 2002.00)
UNITS:	US SURVEY FEET
VERTICAL DATUM:	NAVD88 (GEOID 9)
TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED BY RDG SURVEYING IN JANUARY 2023. LIDAR DATA WAS CREATED IN 2023 AND COMBINED BY RDG.	

CONTROL POINTS				
POINT NUMBER	EASTING	NORTHING	POINT ELEVATION	RAW DESCRIPTION
1000	415036.614	139833.307	4904.193'	5/8" REBAR WITH A 2" ALUMINUM CAP MARKED "RDG"

RIVER CHARACTERISTICS	
STREAM TYPE(S)	G5 (REACH 1: F4/C4 (REACH 2)
VALLEY SLOPE	0.03 FT/FT (0.3%)
AVERAGE CHANNEL WIDTH	6 FT.
CONTRIBUTING DRAINAGE AREA	33.7 SQ. MILES
1.5 YEAR FLOW (BANKFULL)	10 CFS
5 YEAR FLOW	179 CFS
50 YEAR FLOW	439 CFS
100 YEAR FLOW	788 CFS



EXISTING CONDITIONS AND SURVEY CONTROL
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 2.0				
Drawing 2 of 24				

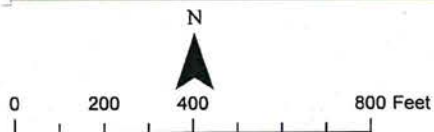
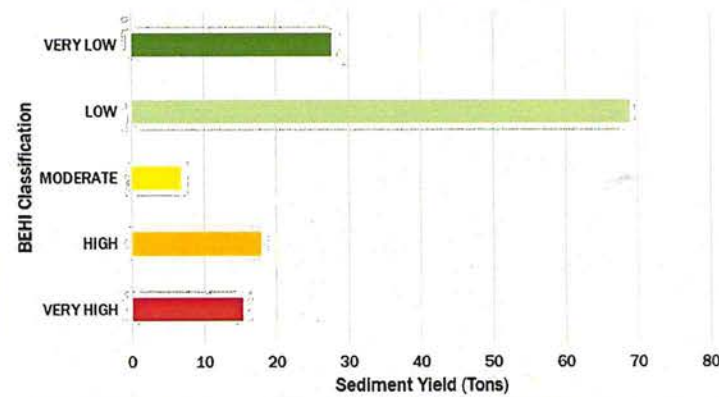
UPPER MOORE CREEK Bank Erosion Hazard Index (BEHI) Assessment

BEHI CATEGORIES



BEHI CATEGORY	LENGTH (FT)	MIGRATION RATE (FT/YR)	HEIGHT (FT)	DENSITY (LBS/FT ³)	YIELD (TONS)
VERY HIGH	130	0.39	6	100	15
HIGH	232	0.31	5	100	18
MODERATE	133	0.23	4.5	100	7
LOW	2,701	0.17	3.0	100	69
VERY LOW	4,813	0.1	2.5	100	28
NON-CONTRIBUTING	0	0	0	100	0
RIP-RAP	0	0	5.0	100	0
TOTAL	8,009				137

Total Sediment Yield by BEHI Classification



River Design Group, 8/18/2022. NAIP Imagery.



EXISTING BANK EROSION CONDITIONS MOORE CREEK RESTORATION MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER
RDG-22-003

DRAWING NUMBER
2.1

Drawing 3 of 24

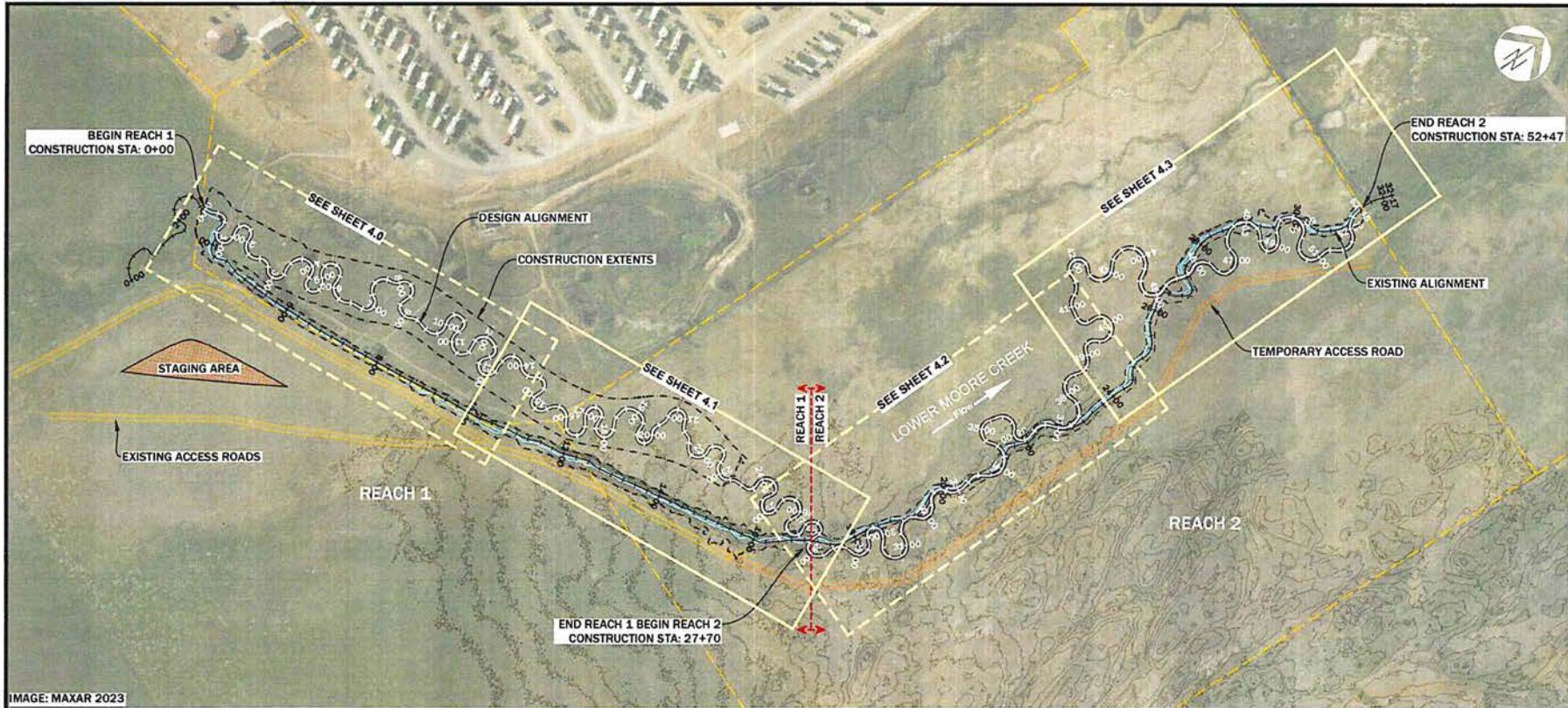


IMAGE: MAXAR 2023

1 SITE PLAN PLAN VIEW

1" = 200'

RESTORATION TREATMENTS

THE RESTORATION PLAN FOCUSES ON RESTORING ERODING STREAMBANKS, RE-ESTABLISHING CHANNEL CROSS-SECTIONS DIMENSIONS, PLAN FORM AND LONGITUDINAL PROFILE DIMENSIONS, AND INCREASING FLOODPLAIN CONNECTIVITY. THE FOLLOWING GUIDELINES WERE USED TO DEVELOP THE DESIGN:

- SHAPE THE CHANNEL TO FORM THE APPROPRIATE DIMENSIONS TYPICAL OF AN E4 STREAM TYPE INCLUDING RIFFLE, RUN, POOL AND GLIDE HABITAT FEATURES.
- RECONNECT THE FLOODPLAIN IN REACH 1 BY CONSTRUCTING AN INSET FLOODPLAIN TO MATCH UPSTREAM AND DOWNSTREAM FLOODPLAIN ELEVATIONS. ESTABLISH A MINIMUM MEANDER BELT WIDTH OF 100-FT.
- SLIGHTLY RAISE THE CHANNEL PROFILE IN REACH 2 TO MAXIMIZE FLOODPLAIN CONNECTION.
- FILL THE EXISTING CHANNEL IN REACH 1 TO FLOODPLAIN ELEVATION TO RESTORE SITE HYDROLOGY.
- INCREASE AQUATIC HABITAT COMPLEXITY BY INCREASING THE QUALITY AND FREQUENCY OF POOLS.
- INCORPORATE VEGETATED WOOD MATRIX AND BRUSH STRUCTURES FOR BANK STABILIZATION AND POOL HABITAT DEVELOPMENT.
- DIVERSIFY THE FLOODPLAIN THROUGH INSTALLATION OF WILLOW TRENCHES.

RESTORATION OBJECTIVES

- IMPROVE INSTREAM AQUATIC HABITAT CONDITIONS FOR SALMONIDS BY LOWERING CHANNEL WIDTH-TO-DEPTH RATIOS, INCREASING POOL FREQUENCY, OVERHEAD COVER, CHANNEL MARGIN COMPLEXITY, AND THE DISTRIBUTION OF RIFFLE, RUN, POOL AND GLIDE HABITAT FEATURES.
- DECREASE SURFACE WATER TEMPERATURE BY INCREASING VEGETATION COVER AND SHADE, AND ENHANCING HYPORHEIC FLOW EXCHANGE BETWEEN THE FLOODPLAIN, CHANNEL, AND EXISTING WETLANDS.
- REDUCE SEDIMENT SUPPLY TO MOORE CREEK BY RESTORING STREAMBANKS WITH DEEP BINDING VEGETATION AND WOOD.
- IMPLEMENT FLOODPLAIN RESTORATION TREATMENTS THAT SET THE STAGE FOR NATURAL RECRUITMENT OF RIPARIAN VEGETATION.
- IMPLEMENT A GRAZING MANAGEMENT PLAN TO PROTECT SENSITIVE FLOODPLAIN AND RIPARIAN AREAS.
- UTILIZE NATURAL CHANNEL DESIGN TECHNIQUES BASED ON REFERENCE REACH DATA COLLECTED ON STREAMS OF SIMILAR VALLEY AND CHANNEL MORPHOLOGY.

DRAWING LEGEND

SYMBOL	
	PROPERTY LINE
	EXISTING ALIGNMENT
	GRADING EXTENTS
	REACH BREAK
	STAGING AREA
	EXISTING ACCESS ROAD
	TEMPORARY ACCESS ROAD



SITE PLAN AND INDEX MOORE CREEK RESTORATION MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 3.0				
Drawing 4 of 24				

GENERAL NOTES

1. CONTOUR INTERVAL IS NOTED ON DRAWINGS.
2. SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
3. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED IN JANUARY, 2023 BY RDG.
5. ALL EXISTING CONDITIONS ARE TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION AND ANY ADJUSTMENTS TO THE DRAWINGS SHALL BE MADE AS DIRECTED BY THE ENGINEER.
6. EXISTING PRIVATE IMPROVEMENTS, WHICH LIE WITHIN THE CONSTRUCTION LIMITS, UNLESS OTHERWISE NOTED WILL BE REMOVED BY THE OWNER PRIOR TO CONSTRUCTION OR ABANDONED IN PLACE.
7. PROTECT ALL TREES AND LAND AREAS NOT LOCATED WITHIN THE PROJECT CONSTRUCTION, STAGING OR EARTHWORK LIMITS. EXERCISE CARE IN AREAS NOT SO MARKED TO AVOID UNNECESSARY DAMAGE TO NATURAL VEGETATION.
8. THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS AND EASEMENTS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
9. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK. THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.
10. EXCAVATION SHALL MEET THE REQUIREMENTS OF OSHA 29 CFR PART 1926, SUBPART P, EXCAVATIONS. ACTUAL SLOPES SHALL NOT EXCEED THE SLOPES AS INDICATED ON DRAWINGS.
11. ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. ENGINEER SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
12. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
13. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

GENERAL SPECIFICATIONS

1. THE PROJECT SHALL BE CONSTRUCTED ACCORDING TO THE PLAN SET. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY CHANGES PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER FOR THIS PROJECT SHALL BE A DESIGNATED RIVER DESIGN GROUP REPRESENTATIVE.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. CALL U-DIG PRIOR TO CONSTRUCTION.
3. COSTS INCURRED DUE TO PROJECT DELAYS RESULTING FROM FAILURE OF THE CONTRACTOR TO MEET THE REQUIREMENTS OF THE GENERAL SPECIFICATIONS, CONTRACTOR QUALIFICATIONS, CONSTRUCTION SPECIFICATIONS, MATERIALS SPECIFICATIONS AND REVEGETATION SPECIFICATIONS SHALL BE THE EXPENSE OF THE CONTRACTOR.

CONTRACTOR QUALIFICATIONS

1. THE CONTRACTOR SHALL HAVE AT LEAST TWO (2) YEARS OF RIVER RESTORATION CONSTRUCTION EXPERIENCE AND SHALL HAVE COMPLETED AT LEAST FIVE (5) RIVER RESTORATION PROJECTS. OR, THE CONTRACTOR SHALL HAVE AT LEAST ONE (1) YEAR OF RIVER RESTORATION EXPERIENCE. SHALL HAVE COMPLETED AT LEAST THREE (3) RIVER RESTORATION PROJECTS, AND SHALL HAVE COMPLETED AN APPROVED RIVER RESTORATION TRAINING CLASS. APPROVED TRAINING CLASSES INCLUDE THOSE SPONSORED BY WILDLAND HYDROLOGY, INC., OR A SIMILARLY QUALIFIED PRACTITIONER OF NATURAL CHANNEL DESIGN STREAM RESTORATION PRINCIPLES.
2. IF THE CONTRACTOR CHOOSES TO DESIGNATE AN EMPLOYEE WITHOUT QUALIFIED STREAM RESTORATION EXPERIENCE, THE CONTRACTOR SHALL BE ON-SITE AT ALL TIMES WHEN THE EMPLOYEE IS PERFORMING RIVER RESTORATION WORK. FAILURE TO ABIDE BY THIS CONDITION WITHOUT PREVIOUS AGREEMENT WITH THE CONSTRUCTION MANAGER WOULD BE GROUNDS FOR TERMINATION.
3. THE CONTRACTOR SHALL MAINTAIN AT LEAST \$2,000,000 IN LIABILITY INSURANCE AND HAVE PROOF OF LIABILITY INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.
4. THE CONTRACTOR SHALL HAVE PROOF OF WORKER'S COMPENSATION INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.
5. COPIES OF ALL PROJECT PERMITS SHALL BE POSTED ON-SITE IN A VISIBLE LOCATION. THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF THE PERMITS. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY KNOWN CHANGES OR ACTIVITIES THAT COULD VIOLATE PERMIT REQUIREMENTS PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER SHALL BE RESPONSIBLE FOR ALL CORRESPONDENCE WITH PERMIT AGENCIES.

TEMPORARY DIVERSION PROCEDURES

1. TEMPORARY DIVERSIONS SHALL BE ACTIVATED OR DEACTIVATED INCREMENTALLY IN TWO STAGES TO ALLOW RESIDENT AQUATIC LIFE TO EXIT THE DEWATERED AREA.
2. A PERIOD OF APPROXIMATELY ONE HOUR SHALL BE ALLOWED BETWEEN THE TWO STAGES.
3. EFFORTS SHALL BE MADE TO LIMIT TURBIDITY DURING DIVERSION ACTIVATION AND DEACTIVATION. MATERIAL USED TO DIVERT FLOW DURING STAGED DIVERSIONS SHALL BE CLEAN AND DEVOID OF FINES.
4. EFFORTS SHALL BE MADE TO LIMIT DISTURBANCE TO VEGETATION.
5. EFFORTS SHALL BE MADE TO AVOID FATALITIES OF AQUATIC LIFE.

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCTION SHALL OCCUR IN ACCORDANCE WITH THE PLAN SET, CONSTRUCTION SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, MATERIAL SPECIFICATIONS, REVEGETATION SPECIFICATIONS AND GENERAL SPECIFICATIONS.
2. CONSTRUCTION ACCESS SHALL BE DETERMINED BY THE CONSTRUCTION MANAGER. THE CONTRACTOR SHALL LEAVE ALL GATES, WHETHER OPEN OR CLOSED, AS FOUND.
3. STREAM CROSSINGS SHALL BE MINIMIZED DURING CONSTRUCTION. CONTRACTOR SHALL USE CULVERTS AT STREAM CROSSINGS SO THAT EQUIPMENT CAN CROSS THE STREAM WITHOUT GENERATING EXCESS TURBIDITY.
4. STRAW BALES AND SILT FENCING SHALL BE AVAILABLE AND INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER. CONSTRUCTION FENCING (LIMITS OF DISTURBANCE) SHALL BE INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER.
5. INITIALLY, THE CONTRACTOR SHALL EXCAVATE THE CHANNEL TO APPROXIMATE DESIGN DIMENSIONS. EXCAVATION SHALL COMPLY WITH CONSTRUCTION STAKES AND THE PLAN SET. EXCAVATION SHALL ESTABLISH CHANNEL ELEVATIONS WITHIN ONE-HALF FOOT OF FINAL ELEVATIONS. THE CONSTRUCTION MANAGER SHALL INSPECT THE CHANNEL EXCAVATION FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED OFF-SITE OR USED ON-SITE. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED. EXCAVATED SOD AND RIPARIAN SHRUB TRANSPLANTS SHALL BE CAREFULLY STOCKPILED AND REUSED FOR PLANTING FLOODPLAINS OR STREAM BANKS.
6. AFTER EXCAVATING THE CHANNEL, THE CONTRACTOR SHALL INSTALL BANK STABILIZATION AND HABITAT STRUCTURES USING THE EXCAVATOR. EACH STRUCTURE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LOCATIONS AND SPECIFICATIONS PROVIDED IN THE PLAN SET. THE CONSTRUCTION MANAGER SHALL INSPECT AND APPROVE ALL STRUCTURES PRIOR TO BACKFILLING.
7. AFTER ALL STRUCTURES ARE INSTALLED, THE CHANNEL WILL BE SHAPED TO WITHIN 0.3 FEET OF THE FINAL ELEVATIONS SPECIFIED ON THE PLAN SET USING AN EXCAVATOR. THE CONSTRUCTION MANAGER SHALL CHECK THE FINAL ELEVATIONS FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED TO AN ON-SITE REPOSITORY DESIGNATED BY THE CONSTRUCTION MANAGER. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED.
8. THE CONTRACTOR SHALL REMOVE EXCESS MATERIALS, TEMPORARY CULVERTS AND EQUIPMENT FROM THE SITE. THE CONTRACTOR SHALL REGRADE DISTURBED AREAS AND CONSTRUCTION ACCESS ROADS TO THEIR ORIGINAL GRADES. THE CONTRACTOR SHALL TREAT COMPACTED SOIL AREAS INCLUDING ACCESS ROADS AND MATERIAL STOCKPILE AREAS. THE CONTRACTOR SHALL REMOVE SOIL FROM THE PROJECT SITE IF THE SOIL IS TAINTED WITH PETROLEUM-BASED FLUIDS.

EQUIPMENT SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT NECESSARY TO CONSTRUCT THE PROJECT. THE CONTRACTOR SHALL MOBILIZE ALL EQUIPMENT TO THE PROJECT AREA AS DIRECTED BY THE CONSTRUCTION MANAGER.
2. AT A MINIMUM, THE CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT FOR THIS PROJECT:

EXCAVATOR - ONE (1) EXCAVATOR SHALL BE REQUIRED. THE EQUIPMENT SHALL BE MINIMUM 200 CLASS. THE BUCKET VOLUME SHALL BE MINIMUM OF ONE (1) CUBIC YARD. THE BUCKET SHALL BE EQUIPPED WITH A HYDRAULIC THUMB FOR GRASPING LOGS, ROCKS, AND OTHER MATERIALS. THE EQUIPMENT MUST BE CAPABLE OF CROSSING WATER AND WORKING ON OR ADJACENT TO STEEP SLOPES. A CHAIN OR STRAP SHALL BE AVAILABLE FOR ATTACHING CULVERTS, PUMPS AND OTHER EQUIPMENT OR MATERIALS TO THE BUCKET FOR TRANSPORT ON-SITE.

ALL SURFACE VEHICLE - ONE (1) ALL-SURFACE VEHICLE (ASV) SHALL BE REQUIRED. THE EQUIPMENT SHALL BE EQUIPPED WITH SOD TRACKS TO MINIMIZE DISTURBANCE TO FRAGILE AREAS.

CHAINSAW - ONE (1) CHAINSAW SHALL BE REQUIRED. THE CHAINSAW MUST BE CAPABLE OF COMPLETELY SAWING LOGS OF THE DIAMETER SPECIFIED IN THE MATERIAL SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE WASHED PRIOR TO MOBILIZATION TO THE SITE TO MINIMIZE THE INTRODUCTION OF FOREIGN MATERIALS AND FLUIDS TO THE PROJECT SITE. ALL EQUIPMENT SHALL BE FREE OF OIL, HYDRAULIC FLUID, AND DIESEL FUEL LEAKS. TO PREVENT INVASION OF NOXIOUS WEEDS OR THE SPREAD OF WHIRLING DISEASE SPORES, ALL EQUIPMENT SHALL BE POWER WASHED OR CLEANED TO REMOVE MUD AND SOIL PRIOR TO MOBILIZATION INTO THE PROJECT AREA. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ADEQUATE MEASURES HAVE BEEN TAKEN.
4. EQUIPMENT SHALL BE IN A WELL-MAINTAINED CONDITION TO MINIMIZE THE LIKELIHOOD OF A FLUID LEAK. IF A FLUID LEAK DOES OCCUR, THE CONSTRUCTION MANAGER SHALL BE NOTIFIED IMMEDIATELY, AND ALL WORK CEASED UNTIL THE LEAK HAS BEEN RECTIFIED. AT ALL TIMES DURING THE CONSTRUCTION PHASE, FLUID SPILL CONTAINMENT EQUIPMENT SHALL BE PRESENT ON-SITE AND READY FOR DEPLOYMENT SHOULD AN ACCIDENTAL SPILL OCCUR.
5. THE CONTRACTOR SHALL MAINTAIN A COMPLETE TOOL SET WITH COMMONLY REPLACED PARTS (E.G. O-RINGS) TO MINIMIZE DOWNTIME IN THE EVENT OF EQUIPMENT MALFUNCTION. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ON SITE DURING THE PROJECT.

**NOTES AND SPECIFICATIONS**
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
2				
3				
4				
5				
6				
7				
8				
9				
10				
PROJECT NUMBER R00-22-003				
DRAWING NUMBER 3.2				
Drawing 6 of 24				

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 3 WOOD	5,820	2 IN <	8-10 FT	NO
TYPE 2- WILLOW CUTTINGS	14,550	0.25 IN	6-8 FT	-
WILLOW TRENCH - WILLOW CUTTINGS	13,125	0.25 IN	6-8 FT	-
TOTAL WILLOW CUTTINGS	27,625			

NOTE:
WOOD LENGTHS SHOWN WILL PRODUCE THE PROPER AMOUNT OF MATERIAL FOR STRUCTURES WHEN CUT INTO APPROPRIATE SIZES DURING CONSTRUCTION. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.

<u>ITEM</u>	<u>QUANTITY</u>	<u>SIZE (IN)</u>	<u>GRADATION</u>	<u>PERCENT PASSING</u>	<u>REPRESENTATIVE CLASS</u>
CHANNEL ALLUVIUM (*)	1.301 CY				
		4		95	D100
		3		65-95	D65-D94
		2		50-65	D50
		1		30-50	D35
		0.5		20-30	D15
		0.075		20	

NOTE:
(*) CONTRACTOR SHALL STRIP ANY SALVAGE AND COMPETENT EXISTING MOORE CREEK CHANNEL STREAMBED ALLUVIUM.

<u>ITEM</u>	<u>QUANTITY (CY)</u>
CUT	4683
FILL	2999
NET CUT	1683

NOTE:
VOLUMES ARE NEATLINE, CONTRACTOR TO
APPLY EXPANSION FACTORS TO DETERMINE
A MORE ACCURATE BACKFILL VOLUME.

ITEM	QUANTITY (LF)
SOD BANK STRUCTURE - TYPE 1	7,581
SOD BANK STRUCTURE - TYPE 2	2,910

ITEM	QUANTITY (LF)
CONSTRUCTED RIFLE	3 237



ITEM	QUANTITY (L)
SILT FENCE	100
SILT CURTAIN	20

<u>LOCATION</u>	<u>SPECIES</u>	<u>PLS LBS/ACRE</u>	<u>TOTAL PLS LBS</u>
<u>FLOODPLAIN</u> <u>(1.59 ACRES)</u>			
SLENDER WHEATGRASS	ELYMUS TRACHYCAULUS	9.00	14.31
BLUEJOINT REEDGRASS	CALAMAGROSTIS CANADENSIS	4.00	6.36
TUFTED HAIRGRASS	DESCHAMPSIA CAESPITOSA	0.25	0.40
MEADOW BARLEY	HORDEUM BRACHYANTHERUM	6.25	9.94
	TOTAL -		31.04
<u>STAGING, ACCESS ROUTES</u> <u>(1.01 ACRES)</u>	<u>SPECIES</u>	<u>PLS LBS/ACRE</u>	<u>TOTAL PLS LBS</u>
STREAMBANK WHEATGRASS	PHLEUM PRATENSE	8.00	8.08
WESTERN WHEATGRASS	PASCOPYRUM SMITHII	14.22	14.36
IDAHO FESCUE	AGROSTIS STOLONIFERA	3.56	3.59
	TOTAL		26.04

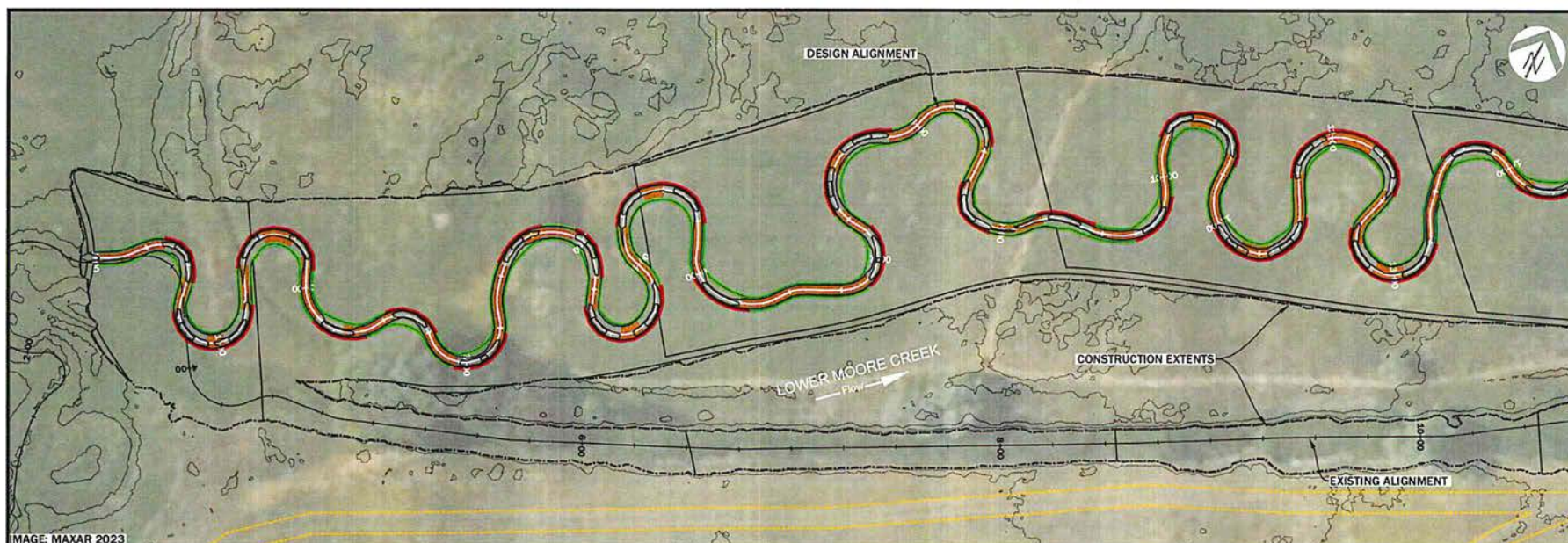
MATERIALS AND SPECIFICATIONS
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
*	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER	RDG-22-003
----------------	------------

DRAFTING NUMBER

3.3



PLAN VIEW AND STRUCTURE LAYOUT-REACH 1

MOORE CREEK RESTORATION


MADISON COUNTY, MT

1 REACH 1 - STA: 0+00 TO 14+00
PLAN VIEW

PLAN VIEW

1" = 50'

STRUCTURE SCHEDULE				STRUCTURE SCHEDULE				STRUCTURE SCHEDULE				STRUCTURE SCHEDULE			
<u>STATION START</u>	<u>STATION END</u>	<u>STRUCTURE</u>	<u>BANK</u>	<u>STATION START</u>	<u>STATION END</u>	<u>STRUCTURE</u>	<u>BANK</u>	<u>STATION START</u>	<u>STATION END</u>	<u>STRUCTURE</u>	<u>BANK</u>	<u>STATION START</u>	<u>STATION END</u>	<u>STRUCTURE</u>	<u>BANK</u>
0+00	0+33	SB 1	L	3+55	3+81	SB 2	L	7+87	8+20	SB 1	L	12+42	12+71	CCS	C
0+00	0+72	SB 1	R	3+77	3+97	CCS	C	8+20	8+48	SB 2	L	12+46	13+65	SB 1	L
0+00	0+35	CCS	C	3+81	3+95	SB 1	L	8+44	8+70	CCS	C	12+68	13+25	SB 2	R
0+33	0+58	SB 2	L	3+95	4+20	SB 2	L	8+48	9+18	SB 1	L	12+90	13+02	CCS	C
0+54	0+74	CCS	C	4+16	4+35	CCS	C	8+67	8+95	SB 2	R	13+21	13+68	CCS	C
0+58	1+41	SB 1	L	4+20	5+20	SB 1	L	8+91	9+21	CCS	C	13+25	14+08	SB 1	R
0+72	1+24	SB 2	R	4+33	4+87	SB 2	R	8+95	9+65	SB 1	R	13+65	13+94	SB 2	L
0+91	1+02	CCS	C	4+52	4+64	CCS	C	9+18	9+46	SB 2	L	13+90	14+11	CCS	C
1+20	1+43	CCS	C	4+83	5+23	CCS	C	9+42	9+68	CCS	C	13+94	14+50	SB 1	L
1+24	2+15	SB 1	R	4+87	6+00	SB 1	R	9+46	10+18	SB 1	L				
1+41	1+92	SB 2	L	5+20	5+77	SB 2	L	9+65	9+91	SB 2	R				
1+60	1+71	CCS	C	5+42	5+53	CCS	C	9+87	10+20	CCS	C				
1+89	2+17	CCS	C	5+73	6+03	CCS	C	9+91	10+98	SB 1	R				
1+92	2+52	SB 1	L	5+77	7+30	SB 1	L	10+18	10+70	SB 2	L				
2+15	2+40	SB 2	R	6+00	6+30	SB 2	R	10+36	10+47	CCS	C				
2+36	2+54	CCS	C	6+26	6+90	CCS	C	10+66	11+01	CCS	C				
2+40	2+94	SB 1	R	6+30	6+87	SB 1	R	10+70	11+72	SB 1	L				
2+52	2+77	SB 2	L	6+87	7+15	SB 2	R	10+98	11+54	SB 2	R				
2+73	2+97	CCS	C	7+11	7+32	CCS	C	11+19	11+30	CCS	C				
2+77	3+55	SB 1	L	7+15	8+67	SB 1	R	11+50	11+75	CCS	C				
2+94	3+23	SB 2	R	7+30	7+87	SB 2	L	11+54	12+68	SB 1	R				
3+19	3+58	CCS	C	7+51	7+62	CCS	C	11+72	12+46	SB 2	L				
3+23	4+33	SB 1	R	7+83	8+22	CCS	C	11+94	12+23	CCS	C				

DETAIL LEGEND		
	<u>SYMBOL</u>	<u>DETAIL SHEET</u>
	SOD BANK STRUCTURE - TYPE 1	6.0
	SOD BANK STRUCTURE - TYPE 2	6.0
	CONSTRUCTED CHANNEL STREAMBED	6.1

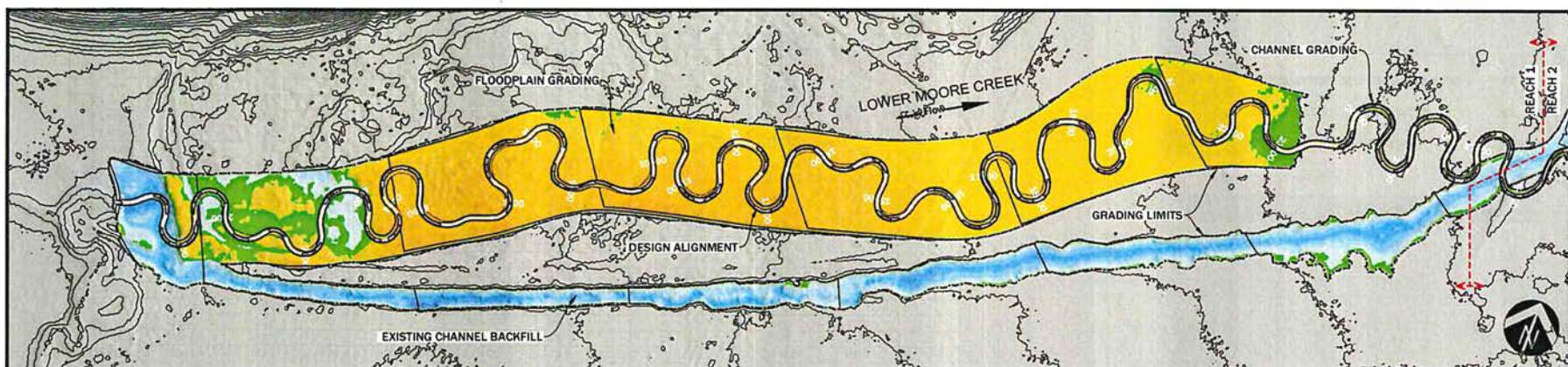
NO.	DATE	BY	DESCRIPTION	CHK
"	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER
RDG-22-003

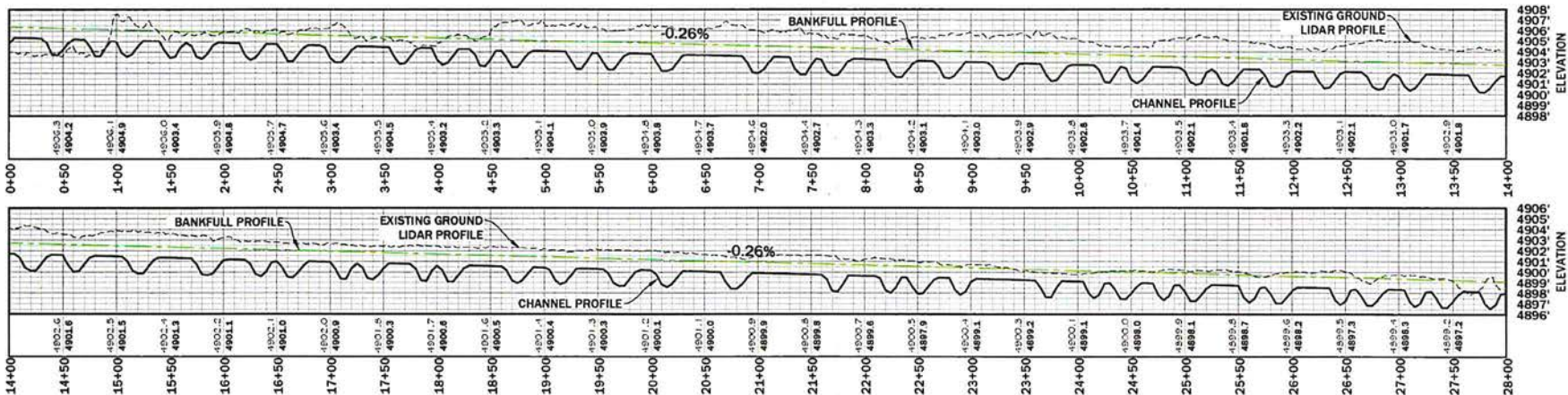
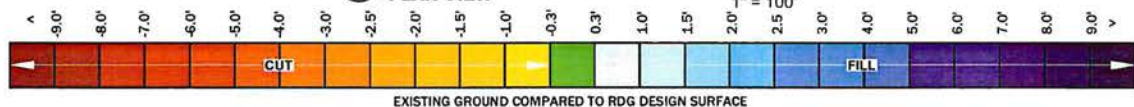
DRAWING NUMBER

4.0

Drawing B of 24



1 REACH 1 - STA: 00+00 TO 27+70
PLAN VIEW



2 REACH 1 - STA: 00+00 TO 27+70
PROFILE VIEWS

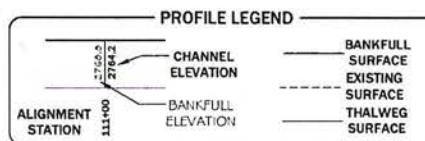
HOR: 1" = 100'
VER: 1" = 10'

EARTHWORK VOLUMES

STATION 0+00 TO 27+70

ITEM	QUANTITY (CY)
CUT	4104
BACKFILL	1911
NET CUT	2193

NOTE:
VOLUMES ARE NEATLINE. CONTRACTOR TO
APPLY EXPANSION FACTORS TO DETERMINE
A MORE ACCURATE BACKFILL VOLUME.

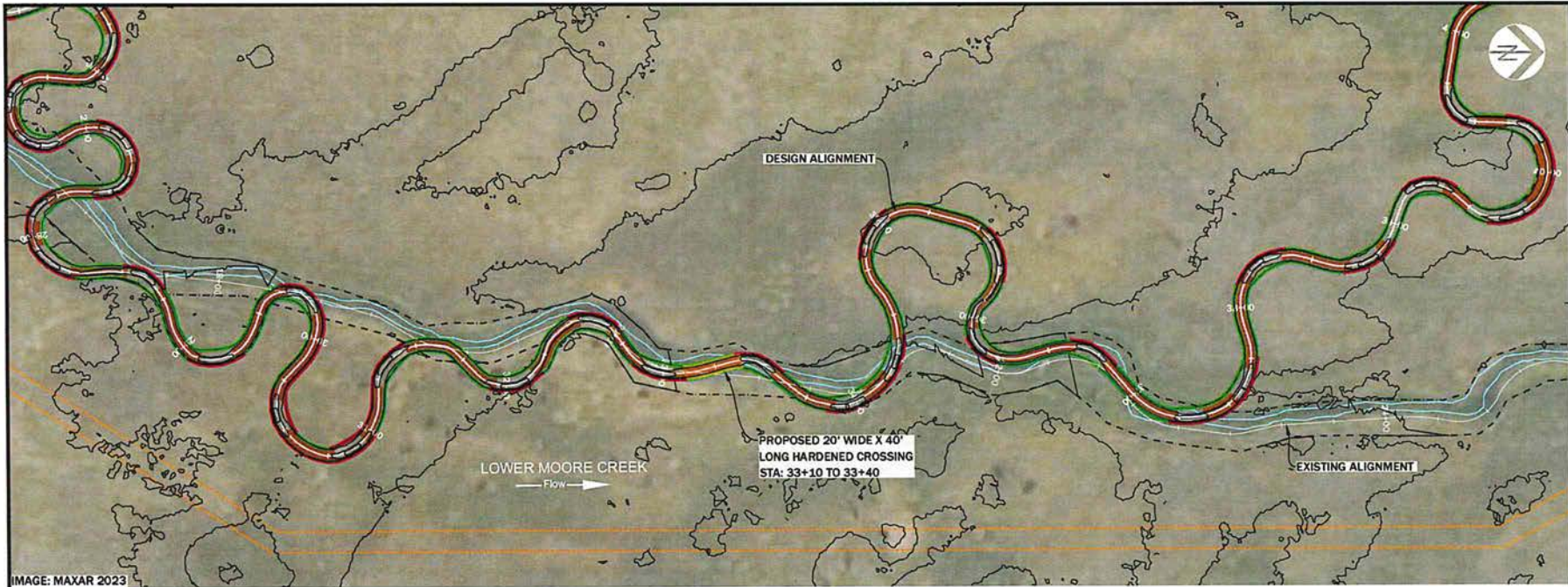


GRADING PLAN AND PROFILE-REACH 1

MOORE CREEK RESTORATION

MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER R00-22-003				
DRAWING NUMBER 4.2				
Drawing 10 of 24				



1 REACH 2 - STA: 27+70 TO 40+00
PLAN VIEW

1" = 50'

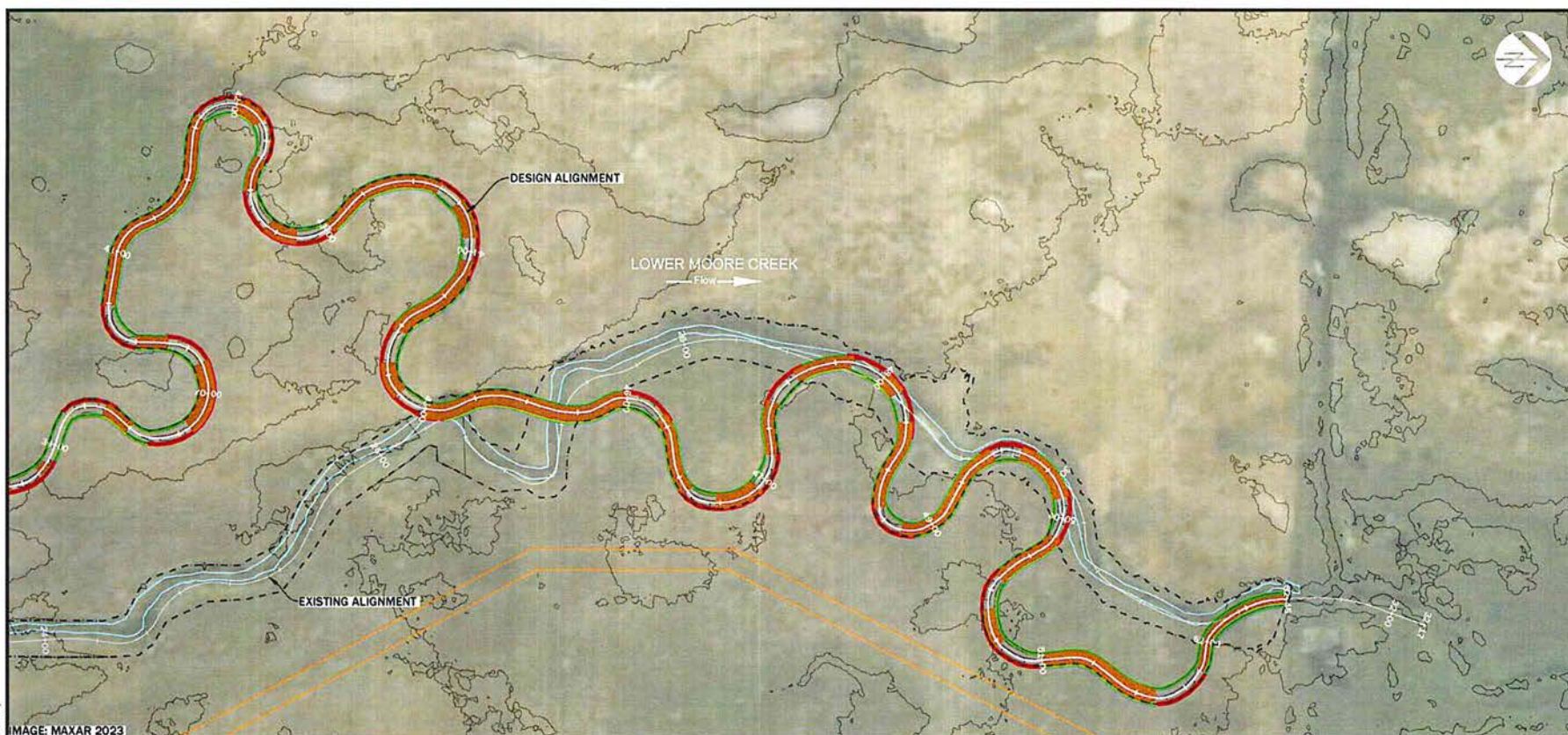
STRUCTURE SCHEDULE				STRUCTURE SCHEDULE				STRUCTURE SCHEDULE			
STATION START	STATION END	STRUCTURE	BANK	STATION START	STATION END	STRUCTURE	BANK	STATION START	STATION END	STRUCTURE	BANK
27+58	28+50	SB 1	L	31+92	32+18	SB 2	R	36+22	36+62	CCS	C
27+75	28+28	SB 2	R	32+14	32+48	CCS	C	36+26	37+20	SB 1	R
27+93	28+04	CCS	C	32+18	32+85	SB 1	R	36+60	36+85	SB 2	L
28+24	28+52	CCS	C	32+45	32+71	SB 2	L	36+81	37+22	CCS	C
28+28	29+05	SB 1	R	32+67	32+88	CCS	C	36+85	38+10	SB 1	L
28+50	28+72	SB 2	L	32+71	33+35	SB 1	L	37+20	37+76	SB 2	R
28+69	29+08	CCS	C	32+85	33+11	SB 2	R	37+39	37+53	CCS	C
28+72	29+65	SB 1	L	33+07	33+37	CCS	C	37+72	38+13	CCS	C
29+05	29+31	SB 2	R	33+11	33+85	SB 1	R	37+76	38+65	SB 1	R
29+27	29+68	CCS	C	33+35	33+60	SB 2	L	38+10	38+38	SB 2	L
29+31	30+30	SB 1	R	33+56	33+87	CCS	C	38+34	38+68	CCS	C
29+65	29+91	SB 2	L	33+60	34+80	SB 1	L	38+38	39+15	SB 1	L
29+87	30+33	CCS	C	33+85	34+41	SB 2	R	38+65	38+93	SB 2	R
29+91	31+20	SB 1	L	34+04	34+18	CCS	C	38+89	39+17	CCS	C
30+30	30+56	SB 2	R	34+37	34+83	CCS	C	38+93	39+60	SB 1	R
30+52	30+78	CCS	C	34+41	36+00	SB 1	R	39+15	39+40	SB 2	L
30+56	30+75	SB 1	R	34+80	35+06	SB 2	L	39+36	39+63	CCS	C
30+75	31+01	SB 2	R	35+02	35+56	CCS	C	39+40	40+50	SB 1	L
30+97	31+23	CCS	C	35+06	35+53	SB 1	L	39+60	40+36	SB 2	R
31+01	31+92	SB 1	R	35+53	35+79	SB 2	L	39+80	40+13	CCS	C
31+20	31+46	SB 2	L	35+75	36+03	CCS	C				
31+42	31+95	CCS	C	35+79	36+60	SB 1	L				
31+46	32+45	SB 1	L	36+00	36+26	SB 2	R				

DETAIL LEGEND		
SYMBOL		DETAIL SHEET #
	SOD BANK STRUCTURE - TYPE 1	6.0
	SOD BANK STRUCTURE - TYPE 2	6.0
	CONSTRUCTED CHANNEL STREAMBED	6.1



PLAN VIEW AND STRUCTURE LAYOUT-REACH 2
MOORE CREEK RESTORATION
MADISON COUNTY, MT

CHK	DESCRIPTION	DATE	BY	NO.	PROJECT NUMBER
	100% DESIGN	05/12/23	LS		RDG-22-003
					DRAWING NUMBER
					4.3
					Drawing 11 of 24






PLAN VIEW AND STRUCTURE LAYOUT-REACH 2
MOORE CREEK RESTORATION
MADISON COUNTY, MT

STRUCTURE SCHEDULE				STRUCTURE SCHEDULE				STRUCTURE SCHEDULE			
STATION START	STATION END	STRUCTURE	BANK	STATION START	STATION END	STRUCTURE	BANK	STATION START	STATION END	STRUCTURE	BANK
40+32	40+52	CCS	C	44+50	45+09	SB 2	R	48+33	49+40	SB 1	L
40+36	42+50	SB 1	R	44+69	44+86	CCS	C	48+65	48+91	SB 2	R
40+50	40+75	SB 2	L	45+05	46+01	CCS	C	48+87	49+43	CCS	C
40+71	41+83	CCS	C	45+09	46+55	SB 1	R	48+91	50+40	SB 1	R
40+75	41+80	SB 1	L	45+98	46+24	SB 2	L	49+40	49+66	SB 2	L
41+80	42+35	SB 2	L	46+20	46+57	CCS	C	49+62	49+90	CCS	C
42+00	42+12	CCS	C	46+24	47+35	SB 1	L	49+66	49+87	SB 1	L
42+31	42+53	CCS	C	46+55	47+14	SB 2	R	49+87	50+13	SB 2	L
42+35	43+60	SB 1	L	46+74	46+91	CCS	C	50+09	50+42	CCS	C
42+50	43+04	SB 2	R	47+10	47+37	CCS	C	50+13	52+45	SB 1	L
42+70	42+81	CCS	C	47+14	48+65	SB 1	R	50+40	51+00	SB 2	R
43+00	43+62	CCS	C	47+35	47+60	SB 2	L	50+59	50+77	CCS	C
43+04	44+50	SB 1	R	47+56	47+82	CCS	C	50+96	51+63	CCS	C
43+60	44+13	SB 2	L	47+60	47+80	SB 1	L	51+00	5160	SB 1	R
43+79	43+90	CCS	C	47+80	48+33	SB 2	L	51+60	51+86	SB 2	R
44+09	44+52	CCS	C	47+99	48+10	CCS	C	51+82	52+45	CCS	C
44+13	45+98	SB 1	L	48+29	48+68	CCS	C	51+86	52+45	SB 1	R

1 REACH 2 - STA: 40+00 TO 53+48
PLAN VIEW

1" = 50'

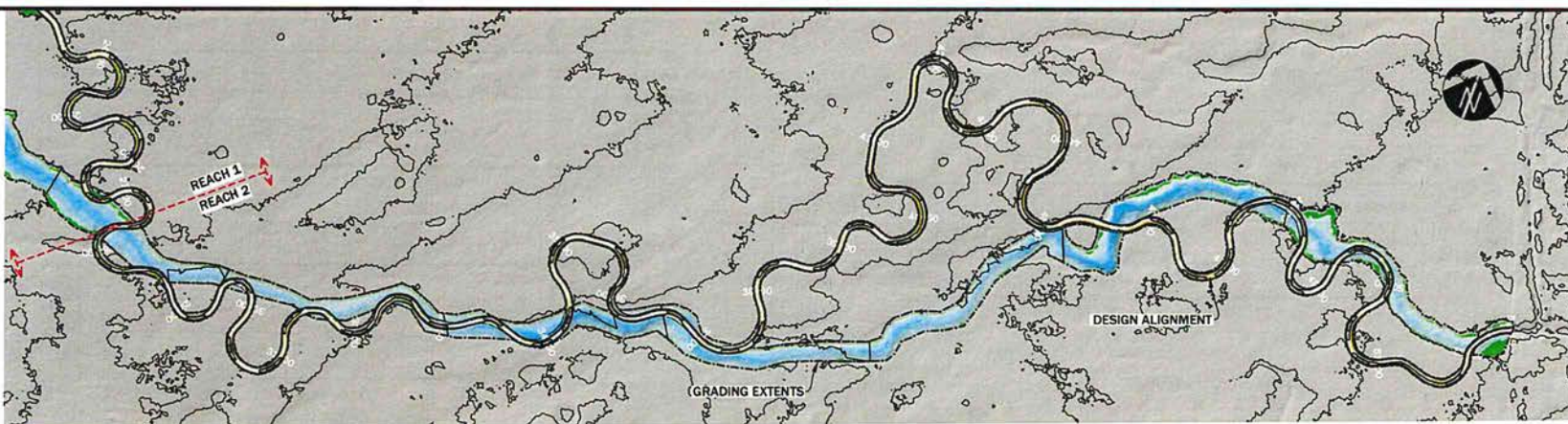
DETAIL LEGEND		
SYMBOL		DETAIL SHEET
	SOD BANK STRUCTURE - TYPE 1	6.0
	SOD BANK STRUCTURE - TYPE 2	6.0
	CONSTRUCTED CHANNEL STREAMBED	6.1

NO.	DATE	BY	DESCRIPTION	CHK
*	05/12/23	LS	100% DESIGN	JM

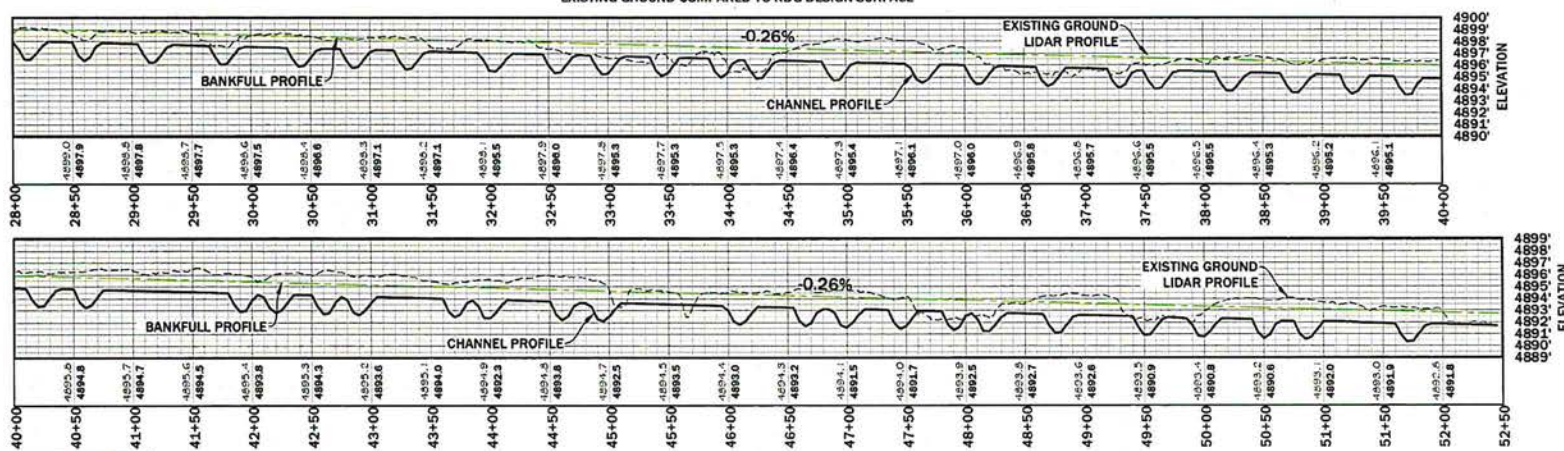
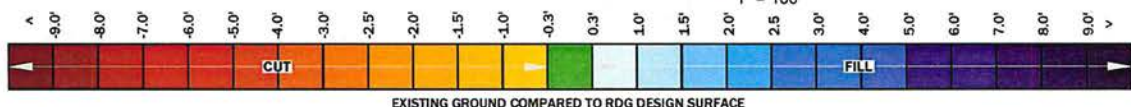
PROJECT NUMBER
RG-22-003

DRAWING NUMBER
4.4

Drawing 12 of 2



1 REACH 2- STA: 27+70 TO 52+47
PLAN VIEW



REACH 2 EARTHWORK VOLUMES

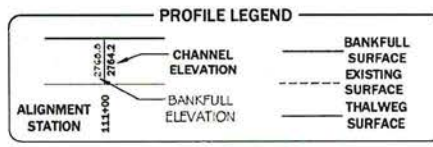
STATION 27+70 TO 52+45

ITEM	QUANTITY (CY)
CUT	578
BACKFILL	1088
NET FILL	509

NOTE:
VOLUMES ARE NEATLINE, CONTRACTOR TO APPLY EXPANSION FACTORS TO DETERMINE A MORE ACCURATE BACKFILL VOLUME.

2 REACH 2- STA: 27+70 TO 52+47
PROFILE VIEWS

HOR: 1" = 100'
VER: 1" = 10'

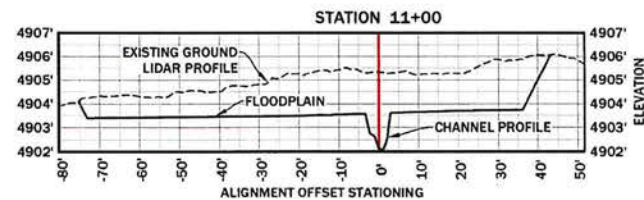
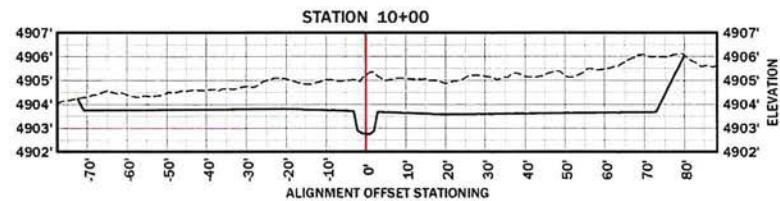
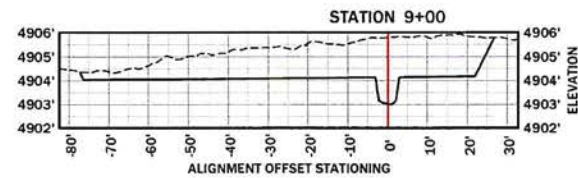
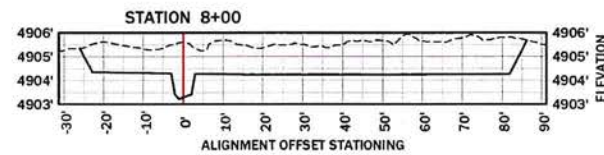
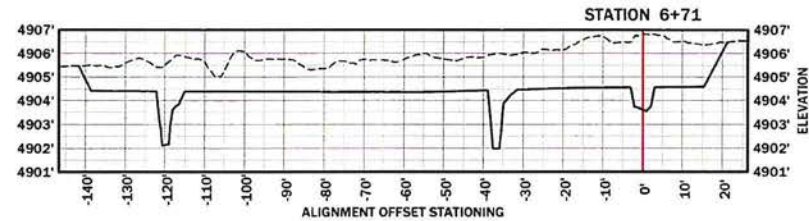
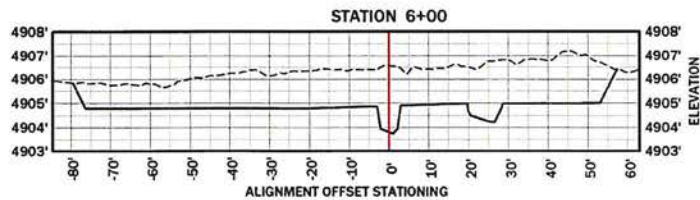
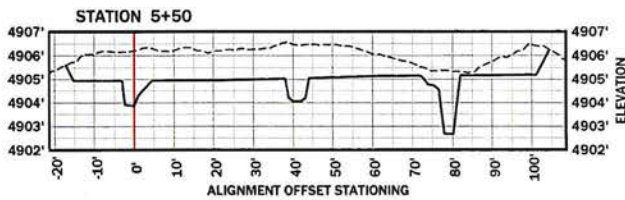
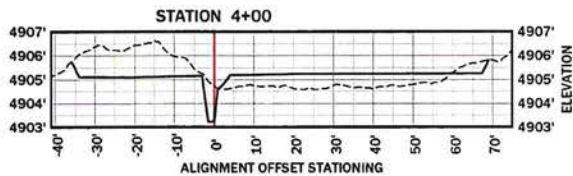
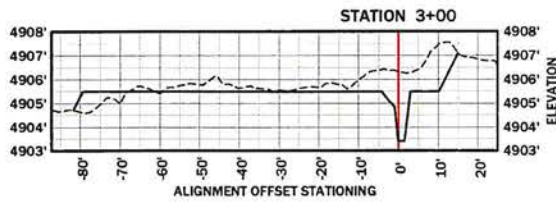
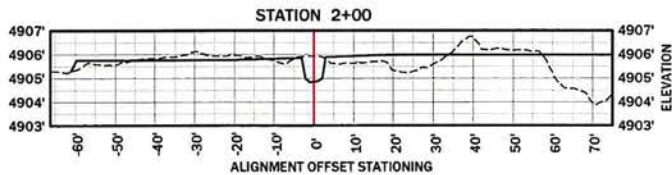
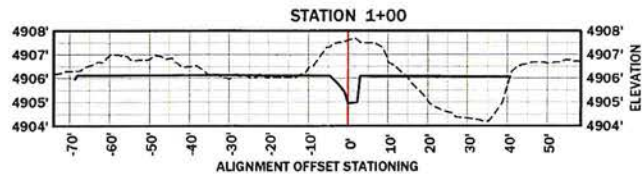


GRADING PLAN AND PROFILE-REACH 2

MOORE CREEK RESTORATION

MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 4.5				
Drawing 13 of 24				



SCALE:
HOR: 1" = 30'
VER: 1" = 6'

LEGEND
--- EXISTING GROUND ELEVATION
--- FINISHED GRADE



CROSS SECTIONS - REACH 1

MOORE CREEK RESTORATION

MADISON COUNTY, MT

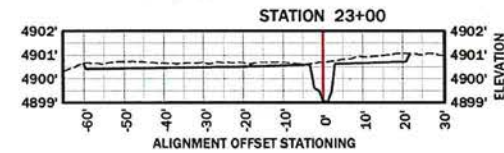
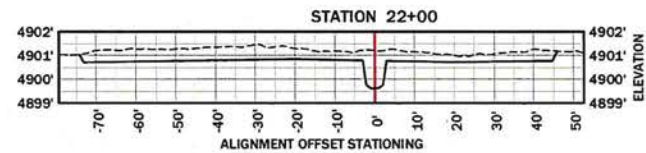
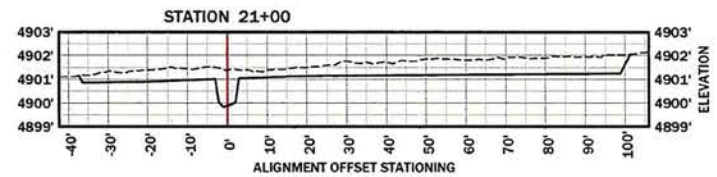
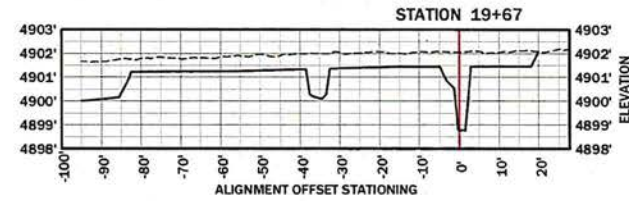
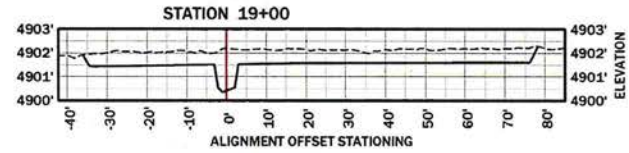
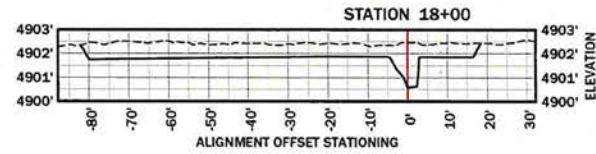
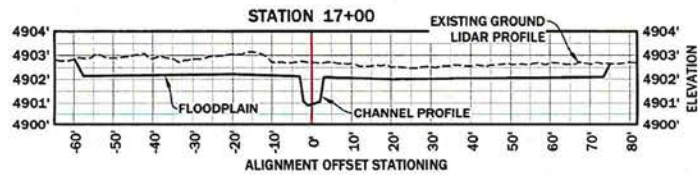
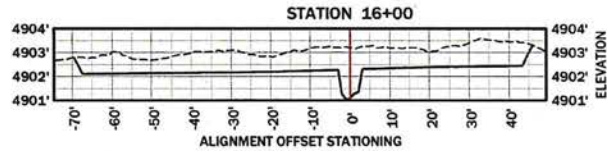
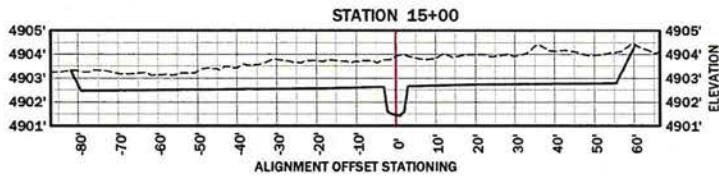
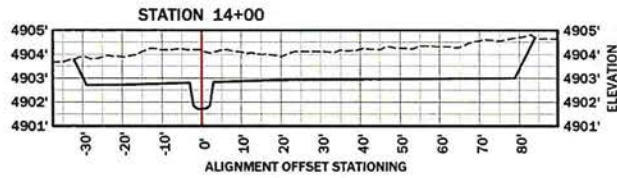
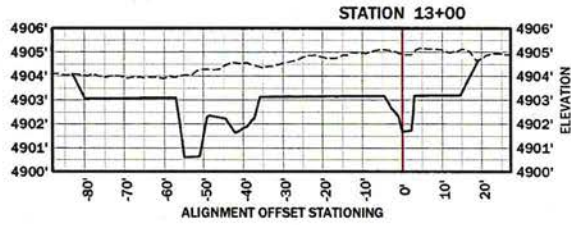
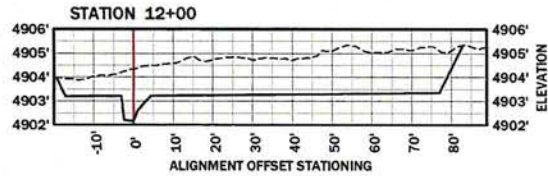
NO.	DATE	BY	CHK	DESCRIPTION
1	05/12/23	LS	JM	100% DESIGN
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PROJECT NUMBER
R00-22-003

DRAWING NUMBER

5.0

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SCALE:
HOR: 1" = 30'
VER: 1" = 6'

LEGEND
--- EXISTING GROUND ELEVATION ---
— FINISHED GRADE —



CROSS SECTIONS - REACH 1

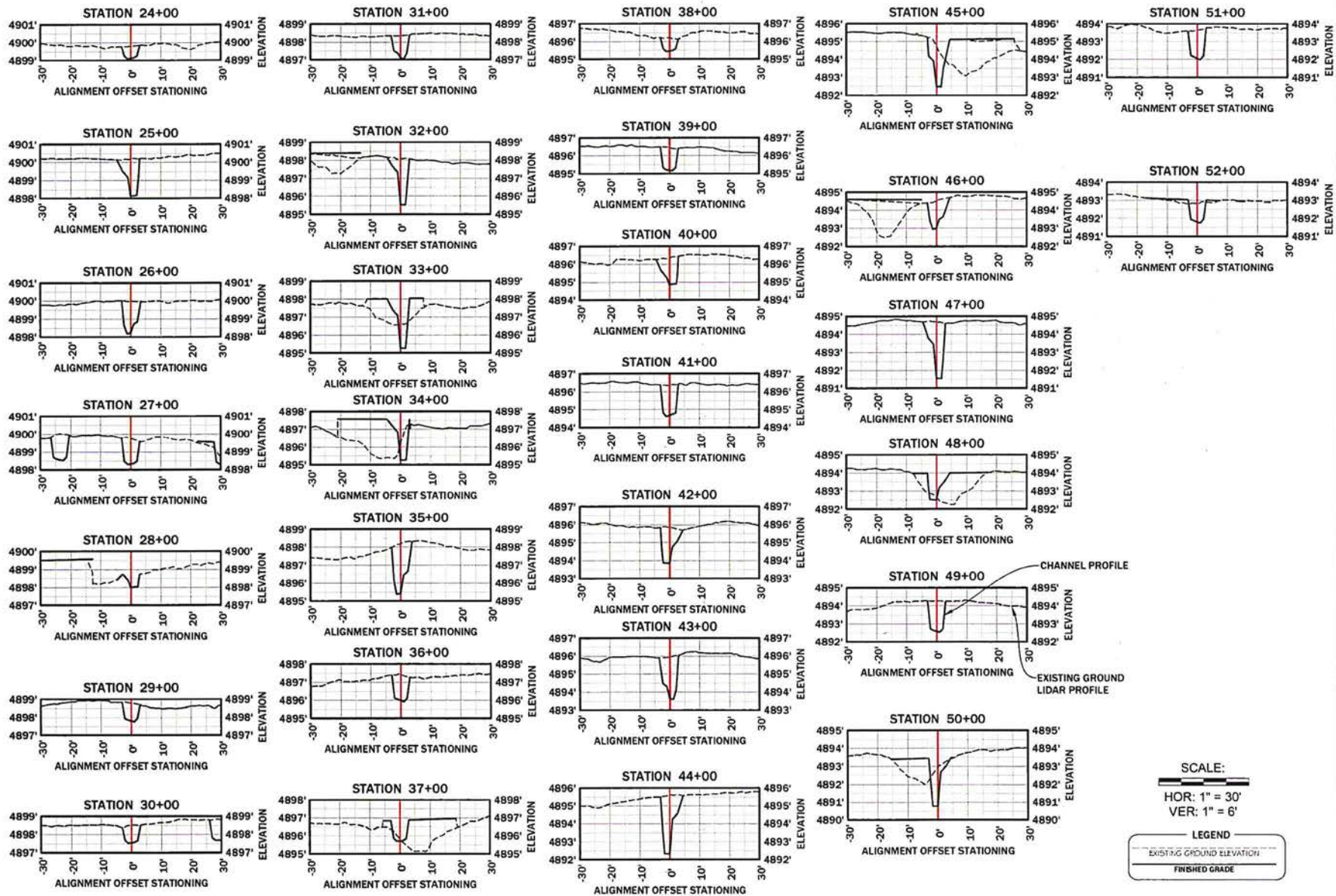
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER
RDG-22-003

DRAWING NUMBER
5.1

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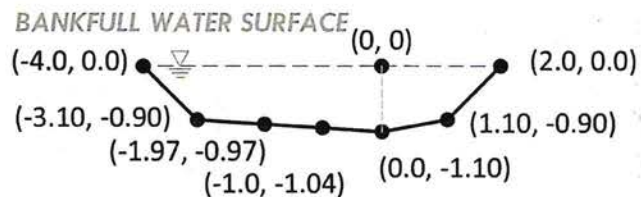


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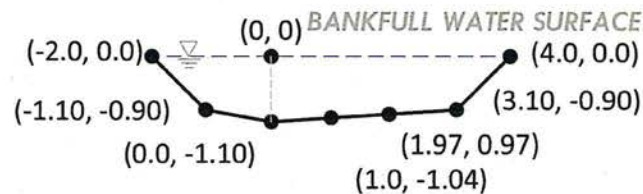
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM

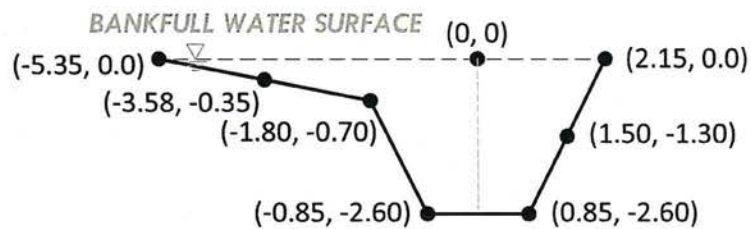
PROJECT NUMBER	RDG-22-003
DRAWING NUMBER	5.2
Drawing	16 of 24



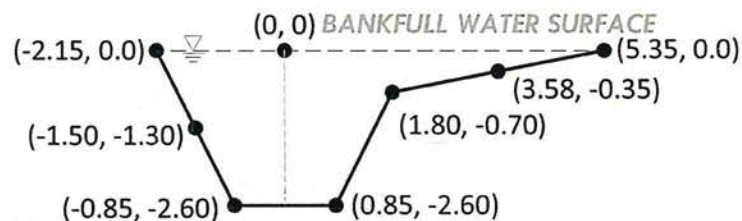
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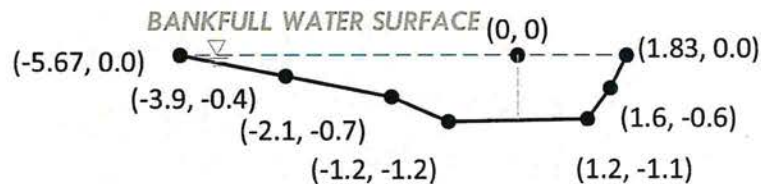
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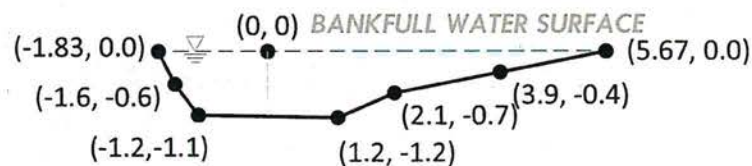
POOL R



POOL L



RUN R



RUN L



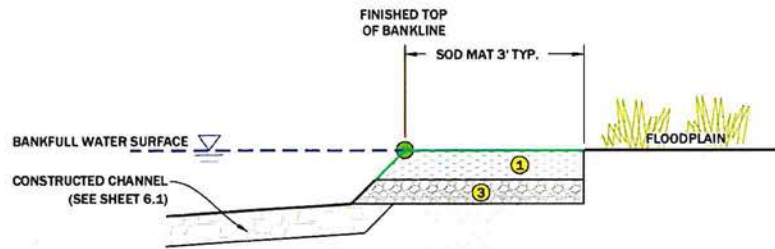
CROSS SECTION DIMENSIONS

MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 5.3				
Drawing 17 of 24				



EXAMPLE OF SOD BANK STRUCTURE STREAMBANK



1 SOD BANK STRUCTURE - TYPE 1
SECTION VIEW
1" = 2'

TYPE 1 SOD BANK STRUCTURE MATERIAL SCHEDULE (PER LINEAR FOOT)		
ITEM	SIZE	QTY.
① SOD MAT		3 SF
② STREAMBANK ALLUVIUM	4" MINUS	0.1 CY

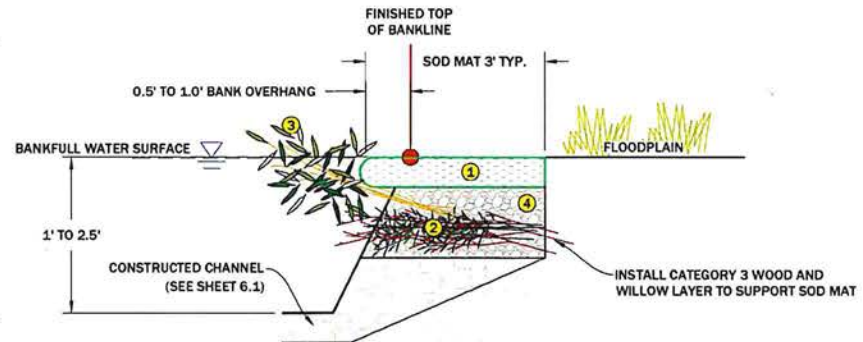
STREAMBED FILL GRADATION	
SIZE (IN)	PERCENT PASSING
4	95
3	65-95
2	50-65
1	30-50
0.5	20-30
0.08	20
NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION	

2 SOD BANK STRUCTURE - TYPE 2
SECTION VIEW
1" = 2'

TYPE 2 SOD BANK STRUCTURE MATERIAL SCHEDULE (PER LINEAR FOOT)		
ITEM	SIZE	QTY.
① SOD MAT		3 SF
② CATEGORY 3 WOOD	< 2"	2
③ WILLOW CUTTINGS	0.25"-1.0"	5
④ STREAMBANK ALLUVIUM	4" MINUS	0.1 CY

NOTES ON SOD BANK STRUCTURE INSTALLATION

- CONSTRUCTION OF THE SOD BANK WILL OCCUR BEFORE THE CHANNEL AND FLOODPLAIN BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED. INSTALLATION OF FLOODPLAIN TREATMENT SHALL BE COMPLETED AFTER SOD BANKS ARE INSTALLED.
- IT IS CONTRACTOR'S RESPONSIBILITY TO CUT BRUSH INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
- ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY CONSTRUCTION MANAGER.
- CONTRACTOR SHALL MARK AND CONSTRUCTION ENGINEER SHALL APPROVE THE GENERAL LOCATION FOR EACH SOD BANK STRUCTURE PRIOR TO CONSTRUCTION.
- EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
- WILLOWS AND CATEGORY 3 WOOD SHALL BE PLACED IN A LAYER AND JUST PRIOR TO THE INSTALLATION OF THE SOD MAT. PLACE 6 - 8 FT DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER LINEAR FT ALONG THE TOP OF BANK LINE ELEVATION. STEMS MAY OVERLAP.
- THE UPSTREAM AND DOWNSTREAM ENDS OF THE STRUCTURE SHALL TRANSITION SMOOTHLY INTO ADJACENT STREAMBANK STRUCTURES TO MINIMIZE EROSION, FLANKING, AND BANK FAILURE. STRUCTURE ENDS MAY BE STABILIZED WITH ADDITIONAL CATEGORY 1 ROCK AS APPROVED BY ENGINEER.



SOD BANK STRUCTURE DETAIL
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER
RDG-22-003

DRAWING NUMBER
6.0

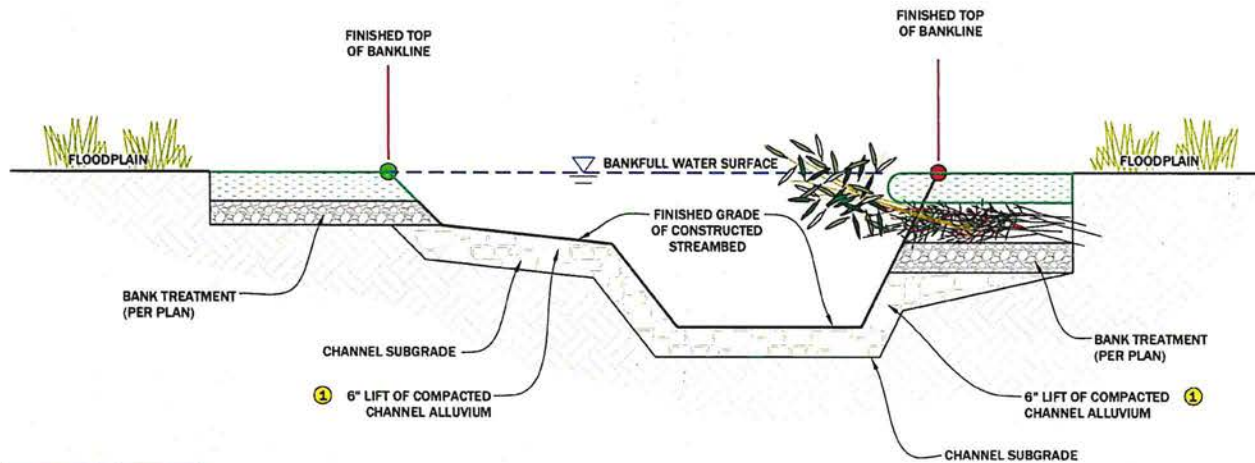
Drawing 18 of 24



EXAMPLE OF CONSTRUCTED STREAM CHANNEL

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

1. CONSTRUCTION OF THE CHANNEL STREAMBED WILL OCCUR AFTER THE CHANNEL SUBGRADE IS PREPARED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE CONSTRUCTION MANAGER.
3. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES.
4. PRIOR TO CONSTRUCTION OF THE CHANNEL STREAMBED, CONSTRUCTION MANAGER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
5. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.



**1 CONSTRUCTED CHANNEL
STREAMBED ALLUVIUM INSTALLATION
SECTION VIEW**

STREAMBED FILL GRADATION	
SIZE (IN)	PERCENT PASSING
4	95
3	65-95
2	50-65
1	30-50
0.5	20-30
0.08	20
NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION	

MATERIAL SCHEDULE (PER FOOT)		
ITEM	DIA. (IN)	QUANTITY (CY)
1 ALLUVIUM	SEE GRADATION TABLE	0.15



CONSTRUCTED CHANNEL STREAMBED DETAIL MOORE CREEK RESTORATION MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM

PROJECT NUMBER
RDG-22-003

DRAWING NUMBER

6.1

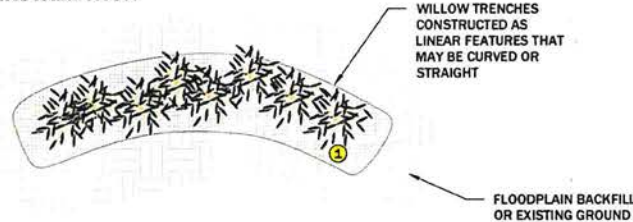
Drawing 19 of 24



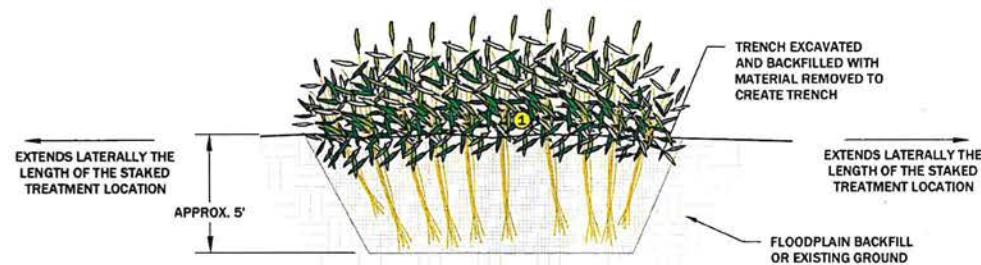
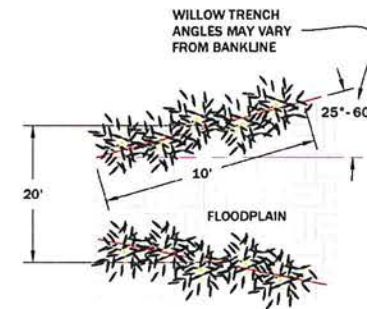
EXAMPLE OF A WILLOW TRENCH INSTALLATION

NOTES ON WILLOW TRENCH INSTALLATION

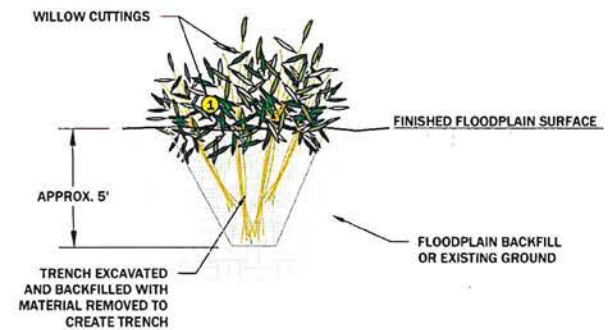
1. WILLOW TRENCHES WILL BE CONSTRUCTED WITHIN THE FLOODPLAIN AT THE DIRECTION OF THE CONSTRUCTION MANAGER.
2. CONSTRUCTION OF WILLOW TRENCHES WILL OCCUR AFTER OCTOBER 1ST AND BEFORE THE END OF THE CONSTRUCTION SEASON.
3. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES.
4. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED BRUSH TRENCH PRIOR TO CONSTRUCTION.
5. A TRENCH WILL BE CONSTRUCTED APPROXIMATELY 5' DEEP AND EXTEND THE LENGTH OF THE STAKED TREATMENT LOCATION. LIVE WILLOW CUTTINGS WILL BE PLACED IN THE TRENCH SUCH THAT THEY ARE INTERMIXED AND ORIENTED AT A NEAR VERTICAL ANGLE.
6. THE TRENCH WILL THEN BE BACKFILLED WITH THE SAME MATERIAL REMOVED TO CREATE THE TRENCH AND SHOULD MATCH THE ELEVATION OF THE SURROUNDING FLOODPLAIN GRADE.



1 WILLOW TRENCH PLAN VIEW



2 WILLOW TRENCH PROFILE VIEW



3 WILLOW TRENCH SECTION VIEW

MATERIAL SCHEDULE (PER LINEAL FOOT)			
	ITEM	DIA.	QUANTITY (EA)
1	WILLOW CUTTINGS	0.25"	3



WILLOW TRENCH DETAIL

MOORE CREEK RESTORATION
MADISON COUNTY, MT

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DRAWING NUMBER 6.2				
Drawing 20 of 24				

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WILLOW TRENCHES
LOCATIONS SHALL BE
DETERMINED BY C.O.
(SEE DETAIL SHEET 6.3)

LOWER MOORE CREEK
Flow →

GRADING LIMITS

DESIGN ALIGNMENT

EXISTING CHANNEL BACKFILL



**1 REACH 1- STA: 0 +00 TO 27+70
PLAN VIEW**

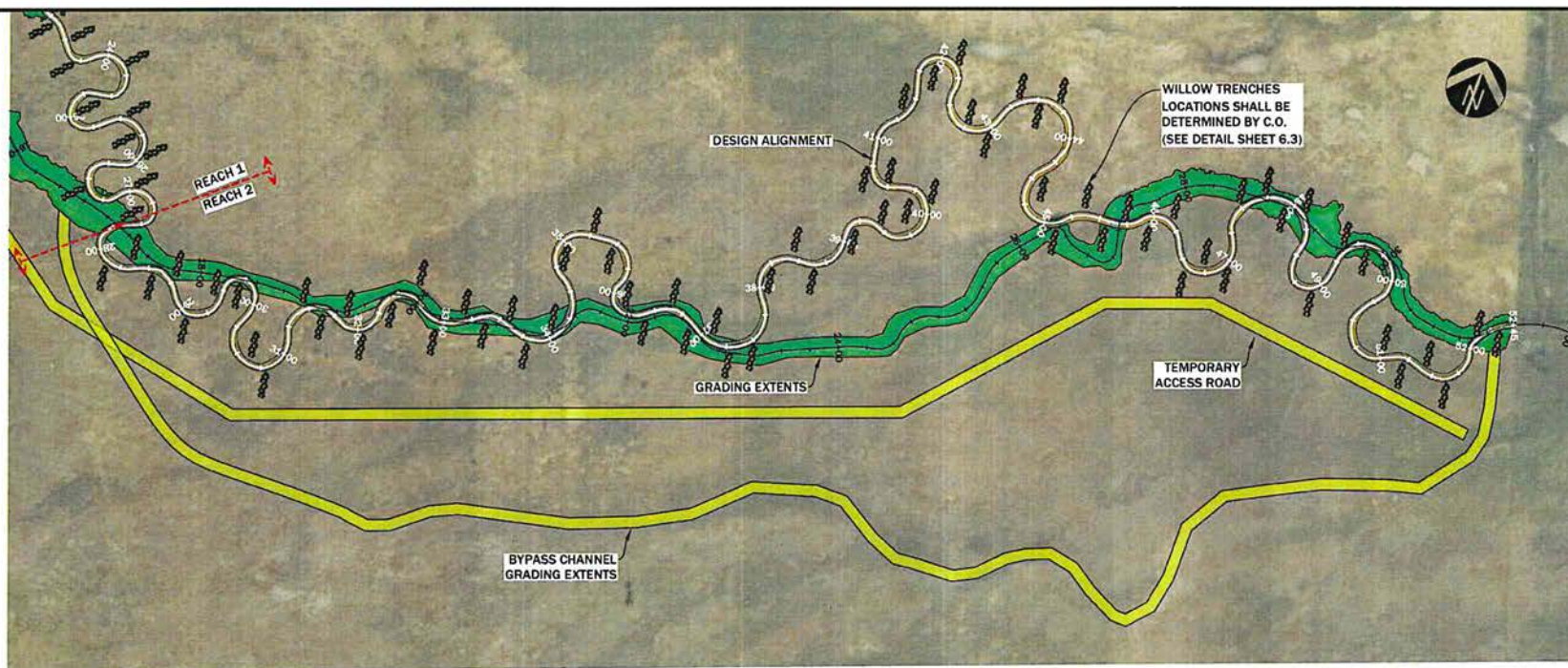
1" = 100'

PLANTING AND SEEDING LEGEND			
	UPLAND SEEDING		
	FLOODPLAIN SEEDING		
	WILLOW TRENCH		

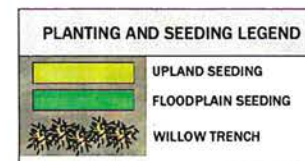


REVEGETATION PLAN - REACH 1
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 7.0				
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1 REACH 2- STA: 27+70 TO 52+47
PLAN VIEW

$$1'' = 100'$$
[illegible]

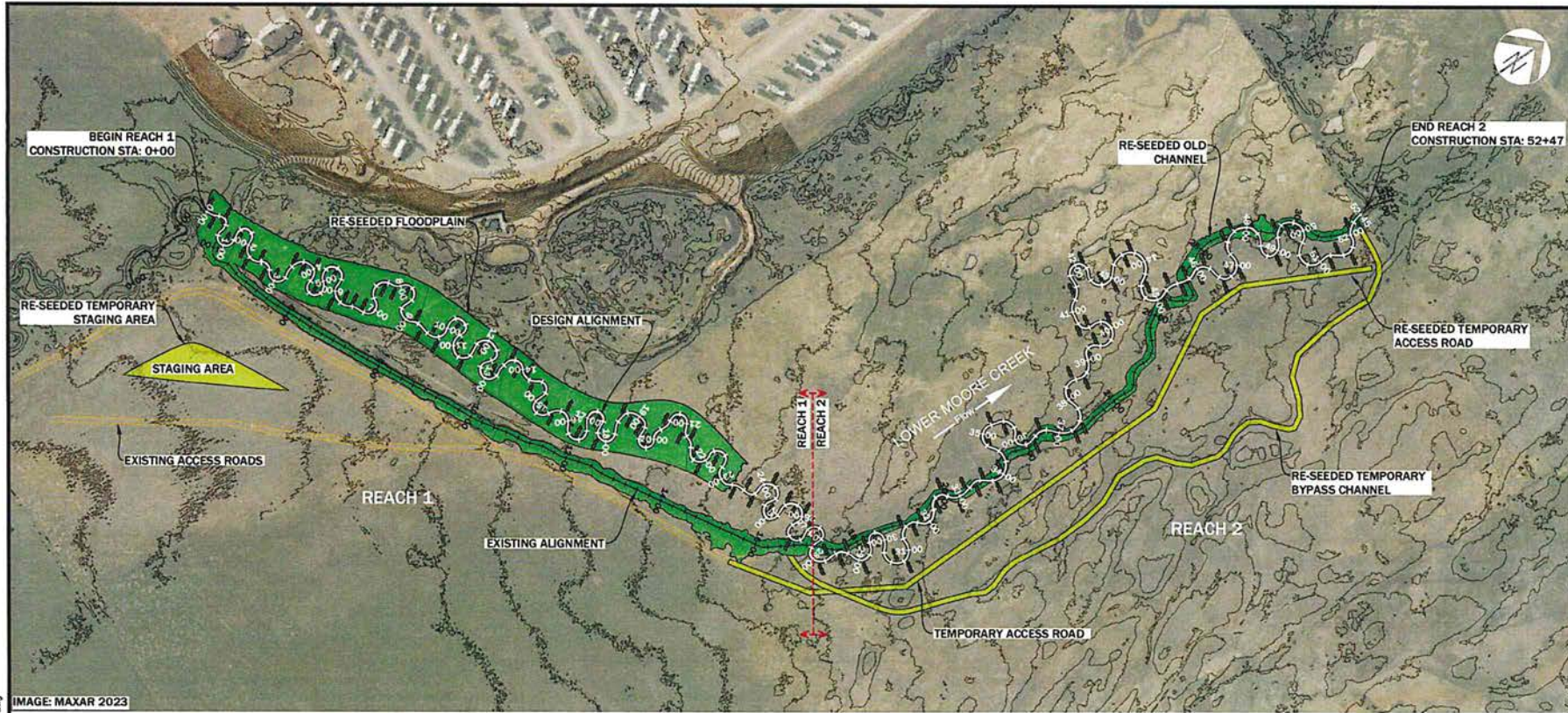


IMAGE: MAXAR 2023

1 SEEDING PLAN
PLAN VIEW
1" = 200'

SEEDING SCHEDULE			
LOCATION	SPECIES	PLS LBS/ACRE	TOTAL PLS LBS
FLOODPLAIN (1.59 ACRES)			
SLENDER WHEATGRASS	ELYMUS TRACHYCAULUS	9.00	14.31
BLUEJOINT REEDGRASS	CALAMAGROSTIS CANADENSIS	4.00	6.36
TUFTED HAIRGRASS	DESCHAMPSIA CAESPITOSA	0.25	0.40
MEADOW BARLEY	HORDEUM BRACHYANTHERUM	6.25	9.94
	TOTAL		31.04
STAGING, ACCESS ROUTES (1.01 ACRES)			
STREAMBANK WHEATGRASS	PHLEUM PRATENSE	8.00	8.08
WESTERN WHEATGRASS	PASCOPYRUM SMITHII	14.22	14.36
IDAHO FESCUE	AGROSTIS STOLONIFERA	3.56	3.59
	TOTAL		26.04

PLANTING AND SEEDING LEGEND			
	UPLAND SEEDING		
	FLOODPLAIN SEEDING		
	WILLOW TRENCH		



SEEDING PLAN AND SCHEDULE
MOORE CREEK RESTORATION
MADISON COUNTY, MT

CHK	NO.	DATE	BY	DESCRIPTION	AM.
		05/12/23	LS	100% DESIGN	
PROJECT NUMBER RDG-22-003					
DRAWING NUMBER 7.2					
Drawing 23 of 24					

GENERAL NOTES:

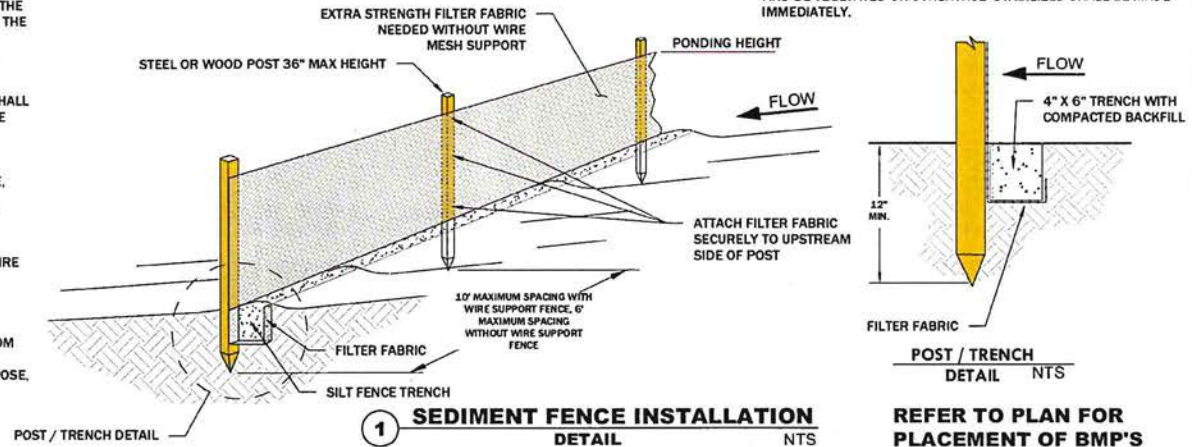
1. THE HEIGHT OF A SEDIMENT FENCE SHALL NOT EXCEED 36 INCHES. STORAGE HEIGHT AND PONDING HEIGHT SHALL NEVER EXCEED 18 INCHES.
2. THE FENCE LINE SHALL FOLLOW THE CONTOUR AS CLOSELY AS POSSIBLE.
3. IF POSSIBLE, THE FILTER FABRIC SHALL BE CUT FROM A CONTINUOUS ROLL TO AVOID THE USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPICED ONLY AT A SUPPORT POST, WITH A MINIMUM 6 INCH OVERLAP AND BOTH ENDS SECURELY FASTENED TO THE POST.
4. POSTS SHALL BE SPACED A MAXIMUM OF 10 FEET APART AND DRIVEN SECURELY INTO THE GROUND (MINIMUM OF 12 INCHES). WHEN EXTRA-STRENGTH FABRIC IS USED WITHOUT THE WIRE SUPPORT FENCE, POST SPACING SHALL NOT EXCEED 6 FEET.
5. TURN THE ENDS OF THE FENCE UPHILL.
6. A TRENCH SHALL BE EXCAVATED APPROXIMATELY 4 INCHES WIDE AND 6 INCHES DEEP ALONG THE LINE OF POSTS AND UPSLOPE FROM THE BARRIER.
7. WHEN STANDARD-STRENGTH FILTER FABRIC IS USED, A WIRE MESH SUPPORT FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH LONG, TIE WIRES OR HOG RINGS.
8. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 2 INCHES AND SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
9. THE STANDARD-STRENGTH FILTER FABRIC SHALL BE STAPLED OR WIRED TO THE FENCE, AND 6 INCHES OF THE FABRIC SHALL EXTEND INTO THE TRENCH.
10. THE FABRIC SHALL NOT EXTEND MORE THAN 36 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
11. FILTER FABRIC SHALL NOT BE STAPLED TO EXISTING TREES.
12. WHEN EXTRA-STRENGTH FILTER FABRIC AND CLOSER POST SPACING ARE USED, THE WIRE MESH SUPPORT FENCE MAY BE ELIMINATED. IN SUCH A CASE, THE FILTER FABRIC IS STAPLED OR WIRED DIRECTLY TO THE POSTS.
13. THE TRENCH SHALL BE BACKFILLED AND THE SOIL COMPACTED OVER THE TOE OF THE FILTER FABRIC.
14. SEDIMENT FENCES PLACED AT THE TOE OF A SLOPE SHALL BE SET AT LEAST 6 FEET FROM THE TOE IN ORDER TO INCREASE PONDING VOLUME.
15. SEDIMENT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY STABILIZED AND ANY SEDIMENT STORED BEHIND THE SEDIMENT FENCE HAS BEEN REMOVED.

GENERAL NOTES - CONT:

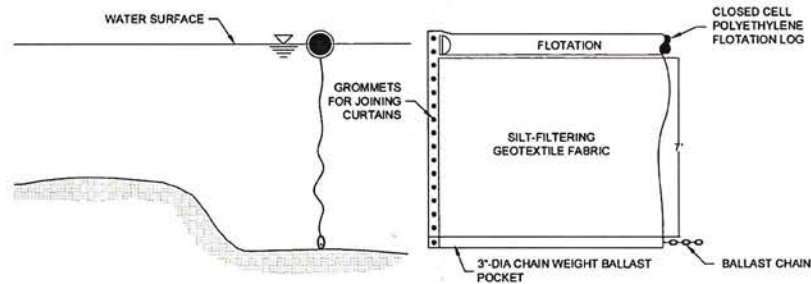
16. SEDIMENT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
17. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY. 9" MAXIMUM RECOMMENDED STORAGE HEIGHT.
18. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.

INSPECTION AND MAINTENANCE:

1. SEDIMENT FENCES AND FILTER BARRIERS SHALL BE INSPECTED WEEKLY AFTER EACH SIGNIFICANT STORM (0.25 INCH IN 24 HOUR).
2. ANY REQUIRED REPAIRS REQUIRED SHALL BE MADE IMMEDIATELY.
3. SEDIMENT SHOULD BE REMOVED WHEN IT REACHES 1/3 HEIGHT OF THE FENCE OR 9 INCHES MAXIMUM.
4. THE REMOVED SEDIMENT SHALL CONFORM WITH THE EXISTING GRADE AND BE VEGETATED OR OTHERWISE STABILIZED SHALL BE MADE IMMEDIATELY.



REFER TO PLAN FOR
PLACEMENT OF BMP'S



FLOATING SILT CURTAIN SHALL BE A "LAYFIELD FSC 13" OR APPROVED EQUAL. THE BODY OF THE FLOATING SILT CURTAIN IS MADE FROM A STRONG, HIGH-FILTRATION FABRIC THAT RETAINS FINE SILTS AND SEDIMENTS ON-SITE. THE FLOAT AND BOTTOM SLEEVE ARE CONSTRUCTED FROM A UV-STABLE, HIGH-STRENGTH POLYETHYLENE (I.E. RIPSTOP-TYPE MATERIAL). THE FLOATING SILT CURTAIN IS INCREASED IN LENGTH BY JOINING ADDITIONAL SECTIONS OF CURTAIN, WHICH TYPICALLY COMES IN 50' LENGTHS.

2 **FLOATING SILT CURTAIN (OPTIONAL)**
DETAIL NTS

REFER TO PLAN FOR
PLACEMENT OF BMP'S



BMP DETAILS
MOORE CREEK RESTORATION
MADISON COUNTY, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	05/12/23	LS	100% DESIGN	JM
PROJECT NUMBER RDG-22-003				
DRAWING NUMBER 8.0				
Drawing 24 of 24				