FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

All sections must be addressed, or the application will be considered invalid

I. APPLICANT INFORMATION

A. Applicant Name: Clark Fork Coalition

Mailing Address: 140 South 4th Street West, Suite 1

City: Missoula State: MT Zip: 59801

Telephone: 406-550-5503 E-mail: brian@clarkfork.org

B. Contact Person (if different than applicant): Gretchen Watkins – Restoration Project Manager

Address: 140 South 4th Street West, Suite 1

City: Missoula State: MT Zip: 59801

Telephone: 406-550-5514 E-mail: Gretchen@clarkfork.org

C. Landowner and/or Lessee Name (if different than applicant): Allan D. Frey and A'Lisa M. Scott

Mailing Address: 1655 Frey Lane

City: Missoula State: MT Zip: 59808

Telephone: E-mail: alyssa@blackfood.net

II. PROJECT INFORMATION

A. Project Name: Lower Grant Creek Restoration

River, stream, or lake: Grant Creek, 12-digit Hydrologic Unit Codes 170102040103

Location: Township: 13N Range: 20W Section: 14

Latitude: 46.879677 Longitude: -114.095970 *Within project (decimal degrees)*

County: Missoula

B. Purpose of Project: *(high level, focus on why the project is important)*

The purpose of this project is to restore native and wild fish habitat and improve natural recruitment at the confluence of Grant Creek and the Clark Fork River, adjacent to the Kelly Island Fishing Access Site. This project targets one of the most ecologically degraded reaches of Grant Creek—a groundwater-dominated segment—where floodplain disconnection, simplified channel structure, and diminished riparian vegetation have reduced thermal refuge and spawning potential for cold-water fish species.

Grant Creek is one of the most important tributaries in the Middle Clark Fork (MCF) for protecting and restoring native trout populations. The upper reaches support a robust population of bull trout, a federally listed species that relies on cold, connected, and complex habitat for spawning and rearing. Restoration in the lower reaches directly complements upstream conservation efforts by improving migratory pathways and thermal conditions critical to bull trout recovery.

In addition, lower Grant Creek receives seasonal influxes of large rainbow and westslope cutthroat trout from the Clark Fork River in the spring, as well as migrating brown trout in the fall, underscoring its role as a vital spawning and staging corridor for wild fish. Enhancing habitat in this reach will improve recruitment success and bolster wild trout populations throughout the system.

Restoration actions will reestablish floodplain connectivity, enhance instream and riparian habitat using natural channel design principles, and improve stream temperature conditions critical for native trout and other cold-water species. Coarse woody habitat will be strategically placed to increase habitat complexity and sediment transport capacity, while livestock exclusion will protect 15 acres of riparian corridor and allow native vegetation to recover.

These methods reflect proven strategies from similar Montana restoration efforts, such as Kleinschmidt Creek, where increased sinuosity, narrowed channel width, and riparian revegetation led to long-term gains in wild trout abundance and biomass. By applying these evidence-based techniques, the project will directly benefit fish populations and enhance recreational fishing opportunities in the Clark Fork River just downstream of Missoula.

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

Grant Creek is a tributary to the Clark Fork River just downstream from Missoula. It originates in the Rattlesnake wilderness and has an abundant resident bull trout population. Grant Creek then runs through the industrial corridor of Missoula and into legacy ranching lands before the confluence with the Clark Fork River at the protected Kelly Island complex. To address legacy impacts, sedimentation issues, and enhance fish habitat, we will employ various restoration techniques. Treatments will include 2534 feet of bank treatment, the installation of vegetated wood matrices, and 4609 feet of fencing to protect riparian and constructed wetland vegetation, including willow, cottonwood, and other native plantings. There will also be three hardened crossings that will be gated. The grazing management plan will help with vegetation establishment, and natural processes will provide adequate long-term maintenance once established. Additionally, cattle will be excluded from the riparian area to protect the restored vegetation and allow for shading of the creek. Drawing on lessons from similar projects, the CFC will implement effective treatments for each restoration issue on Grant Creek. For example, floodplain treatments will be set lower to activate during high flow, pools will be deepened to ensure longevity, and riparian vegetation will be watered as needed. Noxious weeds will be treated before and after restoration using herbicides and hand-pulling. The project benefits will be protected by a long-term agreement with the landowner. Thus, a long-term landowner agreement will protect riparian areas from grazing.

Project coordination and planning will start as soon as the notification of award. We will finalize the landowner agreement in 2025. Permits will be secured in the winter 2025-2026. Bids will be solicited in spring 2026. In stream construction will proceed after July 15th, 2026, and will be completed by winter 2026. Fencing and weed control and plant maintenance will be the conclusion of the 2-year project and managed by the landowner agreement into the future. Education and outreach activities will happen throughout the project duration.

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

The degradation of habitat in Grant Creek stems from a combination of grazing, land use practices, and hydrologic alterations. Channel straightening during agricultural development disrupted the creek's natural meandering pattern, reducing habitat complexity and increasing erosion. The removal of riparian vegetation further exacerbated bank instability, leading to increased sedimentation and loss of shade, which has negatively impacted water temperature regulation. Additionally, the decline in beaver activity, once a natural force for creating diverse aquatic habitat, has contributed to the creek’s entrenched condition.

To correct these issues, the proposed restoration project will reintroduce native vegetation along the creek and wetlands, providing shade to moderate water temperatures and improve overall habitat conditions. Bank stabilization efforts will reduce sedimentation, helping to maintain cleaner water and healthier spawning grounds for fish. These measures will collectively improve habitat complexity, supporting a more resilient and thriving aquatic ecosystem.

E. Length of stream or size of lake that will be treated (project extent): 2534 ft of stream treatment

Length/size of impact, if larger than project extent (e.g., stream miles opened): 3800 ft stream vegetation & fence

F. Project Budget Summary:

Grant Request (Dollars):	**$**	**50,000**
Matching Dollars:	**$**	**340,000** MCD, DNRC, DEQ, and CFC secured
Matching In-Kind Services:*	**$**	

**salaries of government employees <u>are not</u> considered matching contributions*

Other Contributions (not used as match) **$**

Total Project Cost: $ 390,000

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

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

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

I. Attach project plans:

- [x] Detailed sketches or plan views with the location and proposed restoration
- [x] 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 support letters or statements of (e.g., landowner consent, community or public support). For FWP statement, attach provided template. List any other project partners:

Missoula Conservation District
Montana Department of Environmental Quality – Nonpoint Source Program
Montana Department of Natural Resources and Conservation
FWP and Landowner letter of support attached

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
x	

**If it is a water leasing project, describe the length of the agreement.*

We will establish a landowner agreement that covers fencing to protect the 15 acres of the restored riparian area.

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.*

Yes, grazing will be adjacent to the restored area. Part of the grazing management plan and landowner agreement will be to fence out livestock. Originally when the landowner approached the Conservation District it was for a grant to help with the fencing. Landowners have agreed to keep grazing out of the 15 restored acres.

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?

Yes, the project will be monitored to assess whether its goals are met, with both short-term and long-term plans in place to evaluate effectiveness and guide future restoration strategies. Monitoring will focus on fish habitat improvements and stream temperature conditions critical to native and wild fish populations.

Clark Fork Coalition (CFC) has been collecting summer stream temperature and flow data since 2023 and will continue monitoring these metrics through 2027 to evaluate changes in thermal refuge and hydrologic conditions. Monitoring results will be shared with FWP to support broader fisheries conservation efforts and align with state management goals. These evaluations will help ensure that habitat connectivity, temperature conditions, and ecological function contribute to the long-term health of fish populations and riparian ecosystems.

CFC has also coordinated citizen science monitoring since 2023. Volunteers have collected data on invasive plant presence, fish habitat metrics (pool, riffle, run substrate, extra), and greenline riparian vegetation condition, providing valuable insight into existing ecological conditions and helping prioritize restoration actions.

If the new biologist agrees the Montana Fish, Wildlife & Parks (FWP) will conduct fish assessments before construction begins and again following restoration to evaluate changes in fish use, recruitment, and habitat quality at the confluence of Grant Creek and the Clark Fork River. These assessments will help determine whether restored habitat supports improved thermal refuge, spawning potential, and migratory connectivity.

To complement fish monitoring, photo point documentation will be conducted before construction in fall 2025 and again two years later, following methodologies outlined in the Oregon Watershed Enhancement Board Guide to Photo Monitoring. Using the Solocator app, 10–12 photo points will be established with precise coordinates and bearings to document key restoration features, including riparian shading, channel complexity, and floodplain reconnection.
CFC will also monitor plant survival by conducting counts of installed woody riparian container stock in late summer 2026. Two seasons of site maintenance will ensure proper vegetation establishment, and if survival rates fall below 75%, at least 50% of the dead plants will be replaced after the 2027 mortality count to maintain restoration success.

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

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

The restoration of Grant Creek will provide significant benefits to several key fish species that rely on healthy tributary systems for spawning, rearing, and migration. Native bull trout and native westslope cutthroat trout, both designated for conservation management, will see improvements in habitat quality and connectivity, which are designed to enhance migratory populations. Additionally, rainbow trout and brown trout, classified under quality management, will benefit from improved habitat conditions that enhance spawning habitat, rearing conditions, and natural recruitment. By protecting adult spawners and maintaining connectivity between the Clark Fork River and upper Grant Creek, this project will support the long-term health of both native and wild trout populations.

Grant Creek's lower reach is spring-fed and has maintained summer stream temperatures in the 60s, never exceeding 70°F during monitoring years of 2023 - 2025. Restoration efforts—including riparian revegetation, channel reconstruction, and habitat enhancement—will further improve thermal conditions by increasing shade, groundwater exchange, and instream complexity. These changes will strengthen thermal refuge for coldwater fish species and support long-term ecological resilience. The enhanced stability provided by restoration will ultimately create a more sustainable river fishery and reinforce Montana Fish, Wildlife & Parks' broader conservation goals.

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

The restoration of Grant Creek near its confluence with the Clark Fork River aligns with key priorities outlined in the Statewide Fisheries Management Plan (2023-2026), particularly in improving habitat quality and connectivity for tributaries in a recruitment-limited middle Clark Fork River system. The restoration project will protect and enhance wild fish habitat by improving habitat quality and connectivity, which are essential for sustaining healthy fish populations. By stabilizing streambanks, reducing sedimentation, and restoring riparian vegetation, the project will create better spawning and rearing conditions and lower temperature from shading and spring connection benefiting native and wild fish species including bull trout, westslope cutthroat trout, rainbow trout, and brown trout. Grant Creek serves as an important tributary to the Clark Fork River, and restoration efforts will ensure that fish can migrate freely between Grant Creek cold-water refuges during drought periods and productive mainstem river environments. Additionally, enhanced water quality and temperature regulation will support juvenile fish survival, while improved stream flow conditions will maintain critical lower tributary reaches used for rainbow trout and brown trout spawning.

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

The expected improvements to fish populations from restoring ranch land near Grant Creek could be quite promising. In the short term, habitat restoration—such as stabilizing streambanks, reintroducing native vegetation, and improving water flow—would enhance spawning habitat and reduce sedimentation and temperature, benefiting species like cutthroat and rainbow trout. Improved water quality and temperature regulation would also increase juvenile fish survival rates, leading to healthier populations.

In the long term, these efforts could create a more resilient aquatic ecosystem, boosting biodiversity and supporting larger, more robust fish stocks. Over time, better habitat conditions may lead to more consistent recruitment, ensuring sustainable fish populations in the region. As for angler success, restoration benefits could translate downstream to the interconnected river system that is recruitment-limited and heavily used by anglers. With a healthier upstream ecosystem, more fish will migrate between the Clark Fork and Grant Creek, potentially increasing catch rates and possibly even the average size of fish available to anglers.

D. Will the project increase public fishing opportunity for wild fish and, if so, how? Is public fishing allowed onsite? Is it allowed by permission? If not, describe how the public would benefit.

Yes, the project will increase public fishing opportunities for wild fish by improving aquatic habitat and thermal conditions in Grant Creek and its connection to the Clark Fork River. Restoration efforts will enhance riparian shading, channel structure, and groundwater interaction—key factors in maintaining cool summer stream temperatures critical for coldwater fish species. Grant Creek's lower reach is spring-fed and has consistently remained in the 60s during summer monitoring, never exceeding 70°F. These favorable thermal conditions will be further protected and improved through vegetation planting and channel reconstruction, creating better spawning and rearing habitat for native and non-native trout.

Over time, these improvements will support healthier fish populations that migrate between Grant Creek and the Clark Fork River, benefiting anglers. Anglers can expect increased catch rates, and more consistent seasonal fishing as a result of the ecological benefits stemming from the upstream restoration projects like the one proposed near Kelly Island Fishing Access Site.

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

Beyond angling, the restoration of Grant Creek near the Clark Fork River will bring several ecological and recreational benefits to the local community. Improved riparian habitat and enhanced water quality will attract a greater diversity of birds, making the area more appealing for birdwatchers and nature enthusiasts. The reduction of excess nutrients in the water will lead to less algae growth, improving overall aquatic health and creating clearer water conditions. This, in turn, will benefit recreational activities such as swimming, making the creek and surrounding waters more enjoyable and safer for visitors. Additionally, the restoration will support a healthier watershed by stabilizing streambanks, reducing erosion, and enhancing flood resilience, contributing to long-term environmental sustainability. As the ecosystem improves, the project will strengthen the connection between people and nature, offering a more vibrant and accessible outdoor experience for the public.

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

The restoration project will not interfere with the water or property rights of adjacent landowners. The downstream property is owned by the State of Montana Fish, Wildlife & Parks (FWP), and it is maintained as a public Fishing Access Site. Since FWP prioritizes conservation and public access, the restoration efforts align with their long-term management goals for the area. Additionally, the project will enhance ecological conditions without altering water allocations or restricting property use, ensuring that adjacent landowners experience only positive long term impacts. By improving habitat quality and stabilizing streambanks, the project will support fish and wildlife populations while maintaining the integrity of public lands for recreation and conservation.

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

No

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: 12 November 2025

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

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Both tables MUST be completed appropriately or the application will be invalid. Please see the example budget sheet for clarification.

PROJECT COSTS					GRANT REQUEST AND FUNDING			
Work Items (Itemize by Category)	**Number of Units**	**Unit Description***	**Cost/Unit**	**Total Cost**	**FUTURE FISHERIES REQUEST**	**Matching Contributions (Cash or In-Kind)*** **	**Other Contributions (Funds not used as match)**	**Total Funding**
**Units = feet, hours, cubic yards, etc. Do not use lump sum unless necessary.*								
Personnel								
Survey	1	LS	$12,228.00	$ 12,228.00		12,228.00		$ 12,228.00
Design	150	HR	$200.00	$ 30,000.00		30,000.00		$ 30,000.00
Engineering	1	LS	$16,230.25	$ 16,230.25		16,230.25		$ 16,230.25
Permitting	300	HR	$50.00	$ 15,000.00		15,000.00		$ 15,000.00
Oversight	200	HR	$50.00	$ 10,000.00		10,000.00		$ 10,000.00
Maintenance**	180	HR	$50.00	$ 9,000.00		9,000.00		$ 9,000.00
			Sub-Total	$ 92,458.25	$ -	$ 92,458.25		$ 92,458.25
Travel								
Mileage				$ -				$ -
Per diem				$ -				$ -
			Sub-Total	$ -		$ -	$ -	$ -
Construction Materials								
Wood	2000	EA	$2.00	$ 4,000.00		4,000.00		$ 4,000.00
Alluvium	558	CY	$6.00	$ 3,348.00		3,348.00		$ 3,348.00
Vegetation	4	AC	$2,500.00	$ 10,000.00		10,000.00		$ 10,000.00
Rock Cat. 1	60	CY	$10.00	$ 600.00		600.00		$ 600.00
				$ -				$ -
				$ -				$ -
				$ -				$ -
				$ -				$ -
			Sub-Total	$ 17,948.00	$ -	$ 17,948.00	$ -	$ 17,948.00
Equipment, Labor, and Mobilization								
Mobilization	1	LS	$10,000.00	$ 10,000.00		10,000.00		$ 10,000.00
Diversions	5000	LF	$1.00	$ 5,000.00		5,000.00		$ 5,000.00
Staging	1	LS	$1,500.00	$ 1,500.00		1,500.00		$ 1,500.00
Earthwork	3658	CY	$5.50	$ 20,119.00		20,119.00		$ 20,119.00
Fence	4609	LF	$10.00	$ 46,090.00		46,090.00		$ 46,090.00
Channel work	2534	LF	$25.00	$ 63,350.00	20,000.00	43,350.00		$ 63,350.00
Matrix type 1	2421	LF	$16.25	$ 39,341.25	10,000.00	29,341.25		$ 39,341.25
Matrix type 2	2989	LF	$25.00	$ 74,725.00	20,000.00	54,725.00		$ 74,725.00
Wetland	3267	CY	$5.50	$ 17,968.50		17,968.50		$ 17,968.50
Floodplain	1	Ac	$1,500.00	$ 1,500.00		1,500.00		$ 1,500.00
			Sub-Total	$ 269,593.75	$ 50,000.00	$ 229,593.75	$ -	$ 279,593.75
			OVERALL TOTALS	$ 380,000.00	$ 50,000.00	$ 340,000.00	$ -	$ 390,000.00

OTHER REQUIREMENTS:

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

**For projects that include a maintenance request, it cannot exceed 10% of the total project cost.

***Match can include in-kind materials or labor. Justification for in-kind labor (e.g. hourly rates used) can be noted below. Do not use government salaries as match.

Additional budget detail:

APPLICATION MATCHING CONTRIBUTIONS

Total should equal match listed above; do not include requested funds

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
Montana Department of Environmental Quality Nonpoint	$ -	$ 130,000.00	$ 130,000.00	y
Montana Department of Natural Resources and	$ -	$ 50,000.00	$ 50,000.00	y
Clark Fork Coalition	$ -	$ 80,000.00	$ 80,000.00	y
Missoula Conservation District - Design	$ -	$ 20,000.00	$ 20,000.00	y
Missoula Conservation District - Plants	$ -	$ 10,000.00	$ 10,000.00	n
Montana Association of Conservation Districts	$ -	$ 50,000.00	$ 50,000.00	n
	$ -	$ -	$ -	
	$ -	$ -	$ -	
TOTALS	$ -	$ 340,000.00	$ 340,000.00	

OTHER CONTRIBUTIONS

Total should equal other contributions listed above; these are funds not specically matched to the Future Fisheries application

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
TOTALS	$ -	$ -	$ -	

LOWER GRANT CREEK RESTORATION PROJECT
CONCEPTUAL DESIGN

PROJECT PARTNERS

CLARK FORK COALITION
P.O. BOX 7593
MISSOULA, MONTANA 59807

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
1520 E 6TH AVE
HELENA, MONTANA 59601

MISSOULA CONSERVATION DISTRICT
1075 SOUTH AVENUE W, SUITE 3
MISSOULA, MONTANA 59801

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

MONTANA DEPARTMENT OF NATURAL RESOUCES & CONSERVATION
CONSERVATION DISTRICT BUREAU
1539 ELEVENTH AVE.
HELENA, MONTANA 59601

DRAWING INDEX

LOWER GRANT CREEK VICINITY MAP

PROJECT DESCRIPTION

RIVER DESIGN GROUP, INC. (RDG) WAS RETAINED BY CLARK FORK COALITION (CFC) IN COOPERATION WITH MISSOULA CONSERVATION DISTRICT, MONTANA FISH, WILDLIFE & PARKS, AND MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY TO PREPARE A CONCEPTUAL RESTORATION PLAN (CRP) FOR LOWER GRANT CREEK FROM MISSOULA MONTANA AIRPORT DOWNSTREAM TO THE CONFLUENCE WITH THE CLARK FORK RIVER. FROM THE RATTLESNAKE WILDERNESS BOUNDARY TO THE CLARK FORK RIVER (14.5 MILES), GRANT CREEK IS CLASSIFIED AS A B-1 WATERBODY AND LISTED AS WATER-QUALITY IMPAIRED FOR ALGAE, FLOW REGIME MODIFICATION AND ALTERATION IN STREAMSIDE COVER, NITRATE / NITRITE, TOTAL NITROGEN, SEDIMENT AND TEMPERATURE. PROBABLE SOURCES OF IMPAIRMENT INCLUDE IRRIGATED CROP PRODUCTION, LOSS OF RIPARIAN HABITAT, LAND DEVELOPMENT, STREAMBANK MODIFICATIONS, AND WATER DIVERSIONS. CFC, PROJECT PARTNERS, AND PRIVATE LANDOWNERS ARE INTERESTED IN ADDRESSING WATER QUALITY IMPAIRMENTS THROUGH IMPROVED LAND USE MANAGEMENT AND BOTH PASSIVE AND ACTIVE RESTORATION STRATEGIES TO ADDRESS GEOMORPHIC, AQUATIC, AND FLOODPLAIN LIMITING FACTORS IN THE LOWER WATERSHED. THIS CRP IS ACCOMPANIED BY A BASIS OF CONCEPTUAL DESIGN REPORT THAT PROVIDES MORE DETAILED INFORMATION ON THE INVESTIGATIONS THAT WERE CONDUCTED TO SUPPORT THE CONCEPTS AND RESTORATION STRATEGIES ILLUSTRATED IN THESE DRAWINGS.

THE CRP AIMS TO RESTORE, TO THE GREATEST EXTENT PRACTICAL GIVEN EXISTING SITE CONSTRAINTS, CHANNEL AND FLOODPLAIN AND VEGETATION CONDITIONS THAT WILL SUPPORT HIGH QUALITY WATER AND IMPROVED AQUATIC HABITAT FOR FOCAL FISH SPECIES INCLUDING THREATENED BULL TROUT (SALVELINUS CONFLUENTUS) USING LOWER GRANT CREEK AS A MIGRATORY CORRIDOR TO ACCESS HIGH QUALITY SPAWNING HABITAT IN THE UPPER WATERSHED. FURTHER, THE CRP PRESENTS CONCEPTS AND STRATEGIES TO REDUCE LAND LOSS ASSOCIATED WITH HIGH RATES OF BANK EROSION DUE TO LAND CLEARING AND CONVERSION OF SCRUB-SHRUB AND FORESTED RIPARIAN COMMUNITIES TO POST-AGRICULTURAL ASSEMBLAGES. RESTORATION STRATEGIES ARE EXPECTED TO INCREASE THE OVERALL VALUES AND FUNCTION OF THE AQUATIC ENVIRONMENT BY REDUCING NON-POINT SOURCE POLLUTANTS IDENTIFIED ON THE MONTANA 303(D) LIST OF IMPAIRED WATERBODIES (MDEQ 2014).

GENERAL NOTES

1. SLOPES DESIGNATED AS 2:1, 1.5:1 ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
2. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
3. ALL EXISTING CONDITIONS ARE TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION AND ANY ADJUSTMENTS TO THE DRAWINGS SHALL BE COORDINATED BY RDG.
4. PROTECT ALL VEGETATION 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.
5. THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
6. 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.
7. 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.
8. ALL EXCAVATORS SHALL BE EQUIPPED WITH MACHINE GRADE GPS. CONSTRUCTION AREAS WILL BE STAKED OUT BY RDG PRIOR TO CONSTRUCTION.
9. RDG WILL PROVIDE SURVEY CONTROL FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. RDG SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION, INCLUDING HORIZONTAL CONSTRUCTION EXTENTS, SUBGRADE EXCAVATION EXTENTS, AND FINISHED GRADE ELEVATIONS.
10. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
11. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

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 DUPLICATIONS IS ALLOWED IF THE ORIGINAL CONTENT IS NOT MODIFIED.

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 AVERAGE ANNUAL PEAK FLOW DISCHARGE (90 CFS).

RDG RIVER DESIGN GROUP
NOW PART OF SWCA
311 SW Jefferson Avenue
Corvallis, OR 97333
tel: 541.758.8724
fx: 541.758.8504
236 Wisconsin Avenue
Whitefish, MT 59937
tel: 406.862.4949
fx: 406.862.4949

COVER PAGE AND NOTES
LOWER GRANT CREEK RESTORATION PROJECT

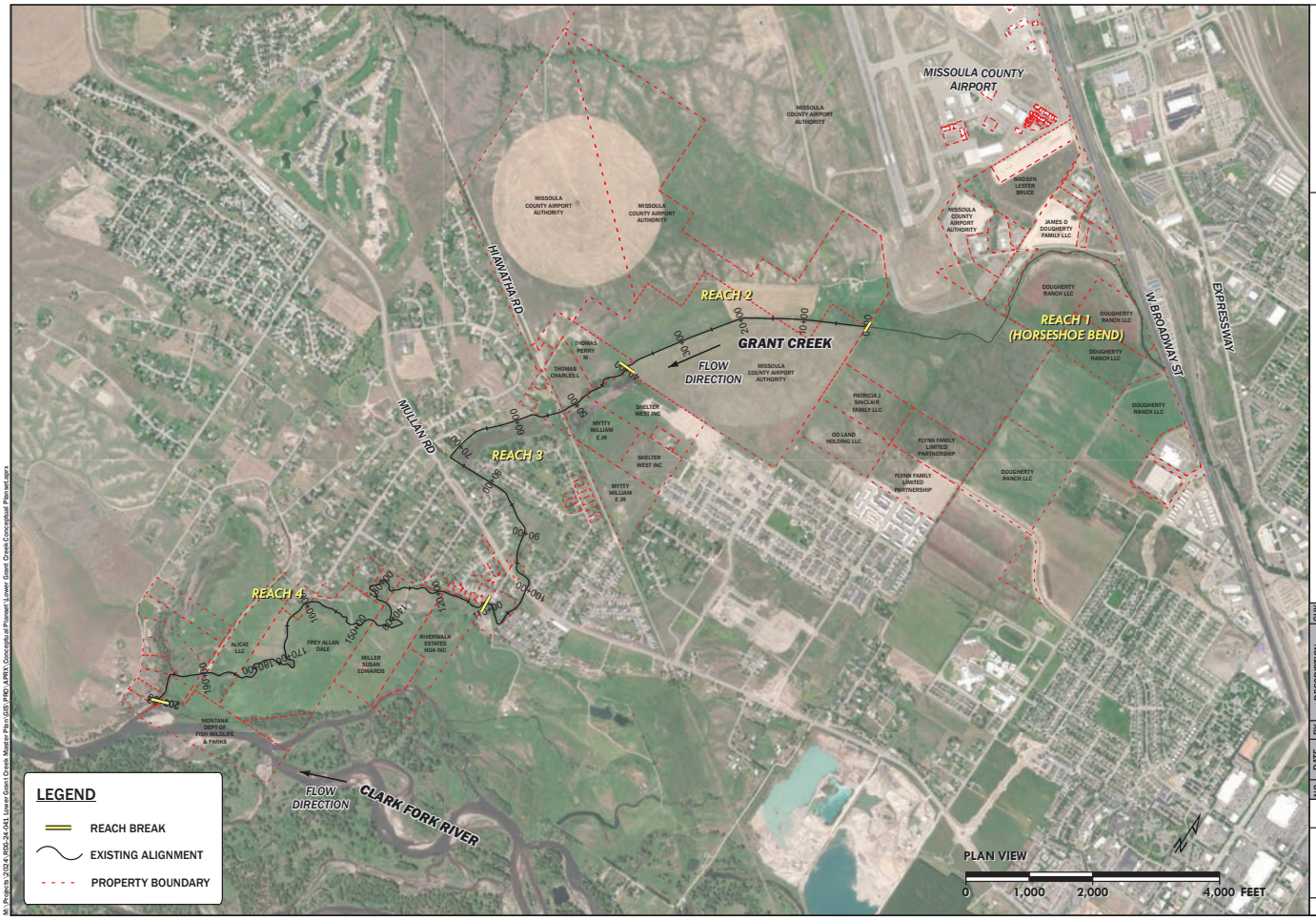
NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
1.0

SHEET 1 OF 25

M:\Projects\2024\RDG-24-041 Lower Grant Creek Master Plan\GIS\MXD_APRX Conceptual Phase\Lower Grant Creek Conceptual Phase.aprx



EXISTING CONDITIONS
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
2.0

SHEET 2 OF 25

M:\Projects\2024\RDG-24-041 Lower Grant Creek Master Plan\GIS\MXD_APRX Conceptual Phase\Lower Grant Creek Conceptual Phase.aprx

TYPICAL CHANNEL CONDITIONS IN REACH 2, SHOWING STRAIGHTENED, SIMPLIFIED CHANNEL LACKING COMPLEXITY.

TYPICAL CHANNEL CONDITIONS IN UPPER REACH 4, SHOWING ENTRENCHED CHANNEL WITH STEEP ERODING BANKS.

OVER-WIDENED RIFFLE HABITAT UNIT WITH COBBLE-GRAVEL SUBSTRATE IN UPPER REACH 4.

EXAMPLE HIGH BANK EROSION HAZARD INDEX, REACH 4.

BANK REVETMENT ON OUTSIDE OF MEANDER BEND, REACH 4.

INSET FLOODPLAIN DEVELOPMENT ON INSIDE OF MEANDER BEND, REACH 4. EXAMPLE LOW/VERY LOW BANK EROSION HAZARD INDEX.

SHALLOW, OVER-WIDENED CHANNEL AS A RESULT OF GRAZING IMPACTS, REACH 4.

SPRING-FED BACKWATER ALCOVE, REACH 4.

VIEW DOWNSTREAM OF BEAVER DAM AND ASSOCIATED BACKWATER IN LOWER REACH 4.

M:\Projects\2024\002-24-041 Lower Grant Creek Master Plan\GIS\PRO\APRX\Conceptual Phase\Lower Grant Creek Conceptual Phase1.aprx

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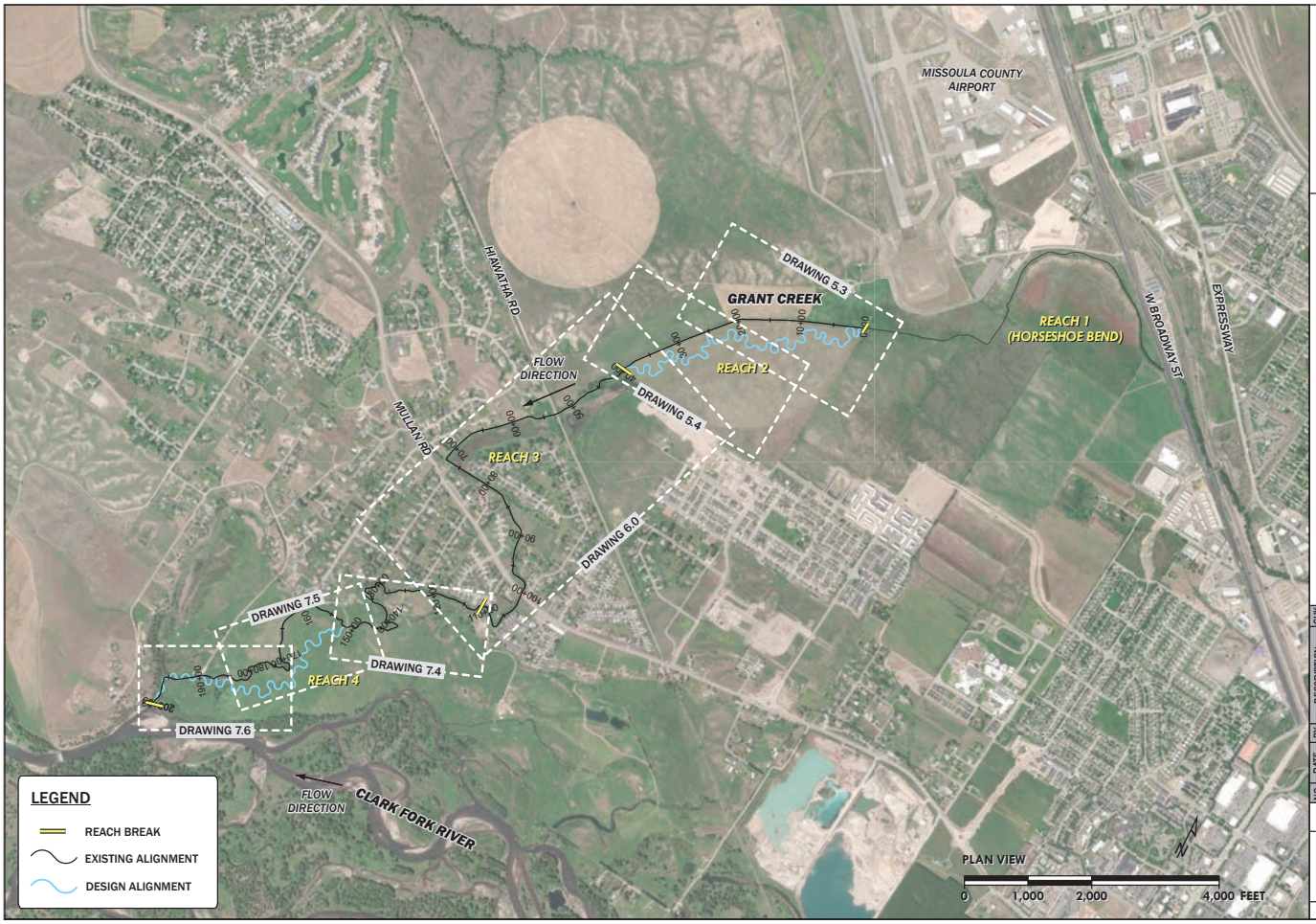
EXISTING CONDITIONS PHOTO POINTS
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 2.1

SHEET 3 of 25



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PLAN VIEW INDEX
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 3.0

SHEET 4 OF 25

TOTAL WOOD QUANTITIES				
ITEM	QUANTITY (EA)	DIAMETER (IN)	LENGTH (FT)	ROOTWAD
CATEGORY 1 WOOD	70	10-12	12-15	YES
CATEGORY 2 WOOD	15886	2-10	10-15	OPTIONAL
CATEGORY 3 WOOD	69920	<3	10-12	OPTIONAL
WILLOW CUTTINGS	247933	0.25-1	8	NO

NOTE:
CONTRACTOR IS REQUIRED TO CUT TO LENGTH CATEGORY 1-3 WOOD TO MEET STRUCTURE DIMENSIONS AS REPORTED ON THE DETAIL DRAWINGS.

TOTAL ROCK QUANTITIES			
ITEM	QUANTITY (EA)	DIAMETER (IN)	
CATEGORY 1 ROCK	1740	6-8	
ITEM	QUANTITY (CY)	GRADATION	
		SIZE (IN)	PERCENT PASSING
STREAMBED/STREAMBANK FILL	8608	4	80-100
		3	30-80
		1	10-30
		0.08	10

TOTAL EARTHWORK QUANTITIES	
ITEM	QUANTITY (CY)
CUT	27982

NOTE:
BACKFILL QUANTITIES TO BE DETERMINED IN SUBSEQUENT DESIGN PHASE.

LARGE WOOD STRUCTURE QUANTITIES		
ITEM	QUANTITY (EA)	
	REACH 2	REACH 4
LARGE WOOD STRUCTURES	0	35
CATEGORY 1 WOOD	0	70
CATEGORY 2 WOOD	0	140
CATEGORY 3 WOOD	0	350

CONSTRUCTED CHANNEL STREAMBED QUANTITIES		
ITEM	QUANTITY	
	REACH 2	REACH 4
CONSTRUCTED RIFFLE	4969 LF	3730 LF
CATEGORY 1 ROCK	994 EA	746 EA
STREAMBED FILL	1739 CY	1306 CY

VEGETATED WOOD MATRIX QUANTITIES		
ITEM	QUANTITY	
	REACH 2	REACH 4
VEGETATED WOOD MATRIX TYPE 1	8245 LF	6271 LF
VEGETATED WOOD MATRIX TYPE 2	5218 LF	7928 LF
CATEGORY 2 WOOD	3365.75 EA	12380 EA
CATEGORY 3 WOOD	26926 EA	42644 EA
WILLOW CUTTINGS	118140 EA	129793 EA
STREAMBANK FILL	2389.9 CY	3173.1 CY

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236 Wisconsin Avenue Whitefish, MT 59937 ph 406.862.4497 fx 406.862.4493

MATERIALS AND QUANTITIES
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
4.0

SHEET 5 OF 25

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EXISTING CHANNEL CHARACTERISTICS	
Length	4380 ft
Valley Slope	0.015 ft/ft
Channel Slope	0.0006 ft/ft
Sinuosity	1.1
Bankfull Discharge	90 cfs
2-Year Flow	170 cfs
10-Year Flow	358 cfs
50-Year Flow	538 cfs
100-Year Flow	629 cfs

EXISTING CONDITIONS, LIMITING FACTORS, & CONSTRAINTS

THE PROJECT REACH OF LOWER GRANT CREEK BEGINS ON THE PROPERTY OF THE MISSOULA COUNTY AIRPORT AUTHORITY (REACH 2). THROUGH REACH 2, GRANT CREEK IS DITCHED AND STRAIGHTENED, PROVIDING NO GEOMORPHIC OR HYDRAULIC COMPLEXITY. THE CHANNEL IS INCISED, LACKS FLOODPLAIN CONNECTIVITY, AND HAS LITTLE POTENTIAL FOR FLOOD ATTENUATION. WOODY RIPARIAN VEGETATION IS SPARSE, PROVIDING LITTLE COVER, SHADE, OR RECRUITABLE WOOD. CONSTRAINTS IN REACH 2 INCLUDE THE EXISTING FLYWAY FOR MISSOULA AIRPORT ABOVE THE PROJECT AREA. THIS RESTRICTS THE USE OF CONSTRUCTED WETLANDS AS A RESTORATION STRATEGY DUE TO THE LIKELY ATTRACTION OF WATERFOWL.

RESTORATION STRATEGIES

RESTORATION STRATEGIES IN REACH 2 INCLUDE:

- CONSTRUCTING AN APPROPRIATELY SIZED BANKFULL CHANNEL THAT INCORPORATES PLANFORM AND LONGITUDINAL PROFILE COMPLEXITY AND PROMOTES HYPORHEIC EXCHANGE THROUGH THE USE OF RIFFLE, RUN, POOL, AND GLIDE HABITAT FEATURES;
- RAISING THE CHANNEL BED PROFILE TO RECONNECT HISTORIC FLOODPLAIN SURFACES, PROMOTE GROUNDWATER RECHARGE, AND PROVIDE FLOOD ATTENUATION;
- INSTALLING STREAMBANK STRUCTURES THAT REDUCE SEDIMENT LOADING AND PROMOTE THE ESTABLISHMENT OF WOODY RIPARIAN VEGETATION, COVER, AND AQUATIC HABITAT COMPLEXITY; AND
- PLACING LARGE WOOD AND INSTALLING WILLOW TRENCHES ON THE FLOODPLAIN TO PROVIDE ROUGHNESS AND PROMOTE THE NATURAL RECRUITMENT OF WOODY RIPARIAN VEGETATION.

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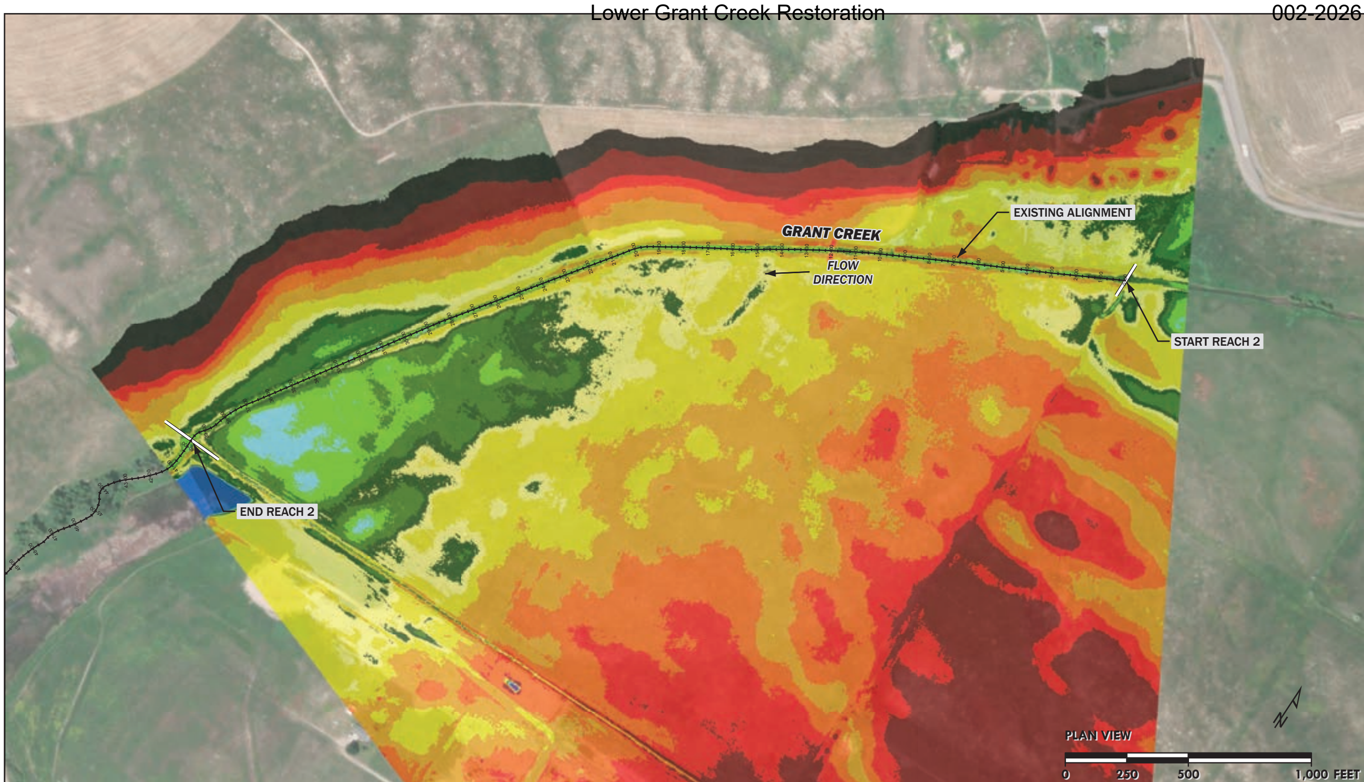
EXISTING CONDITIONS
REACH 2
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
5.0

SHEET 6 OF 25



ELEVATION RELATIVE TO LiDAR WATER SURFACE (FT)

-5.0 - -2.0 | -2.0 - -1.5 | -1.5 - -1.0 | -1.0 - -0.3 | -0.3 - 0.3 | 0.3 - 1.0 | 1.0 - 1.5 | 1.5 - 2.0 | 2.0 - 3.0 | 3.0 - 4.0 | 4.0 - 5.0 | 5.0 - 6.0 | 6.0 - 9.0 | >9.0

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fax.541.758.8524

REACH 2 EXISTING CONDITIONS RELATIVE ELEVATION MODEL

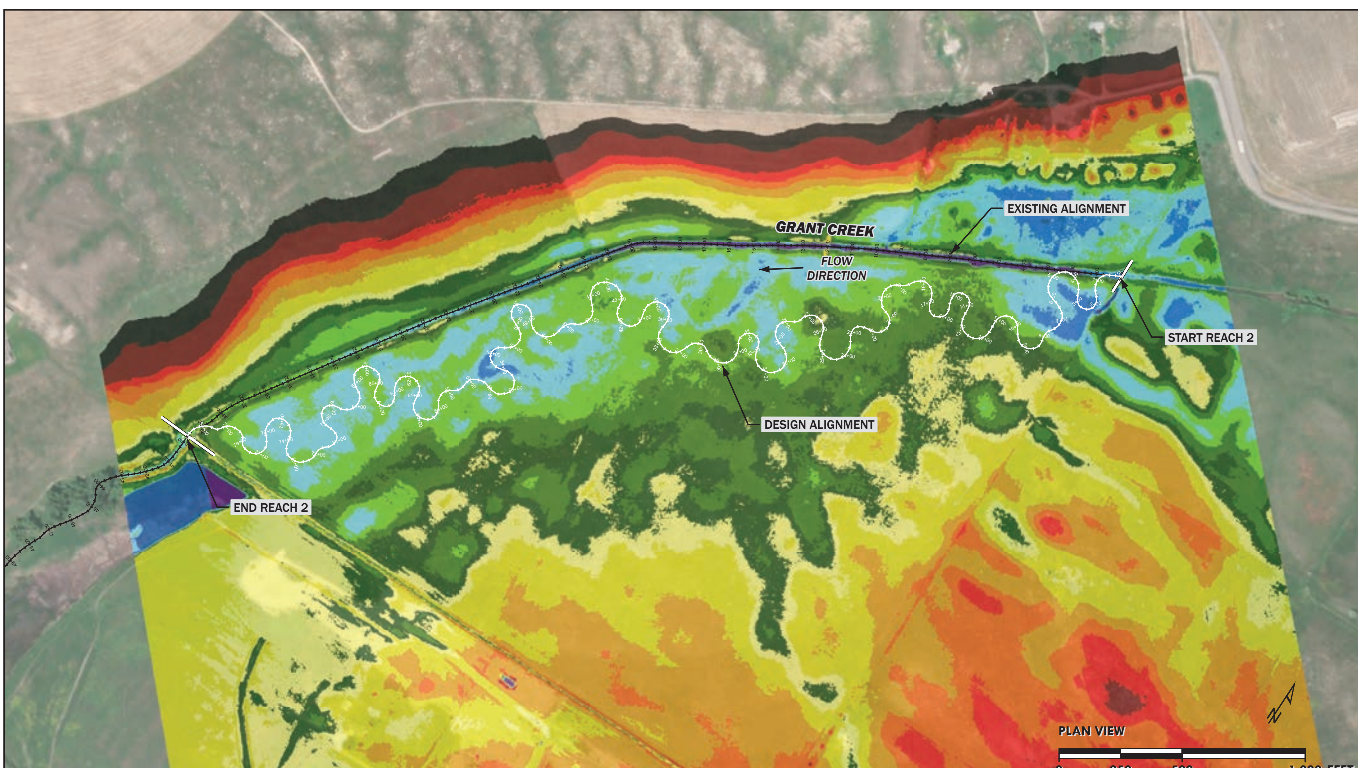
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
5.1

SHEET 7 OF 25



ELEVATION RELATIVE TO DESIGN BANKFULL (FT)

-5.9 - -2.0 | -2.0 - -1.5 | -1.5 - -1.0 | -1.0 - -0.3 | -0.3 - 0.3 | 0.3 - 1.0 | 1.0 - 1.5 | 1.5 - 2.0 | 2.0 - 3.0 | 3.0 - 4.0 | 4.0 - 5.0 | 5.0 - 6.0 | 6.0 - 9.0 | >9.0

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REACH 2 DESIGN CONDITIONS RELATIVE ELEVATION MODEL

LOWER GRANT CREEK RESTORATION PROJECT

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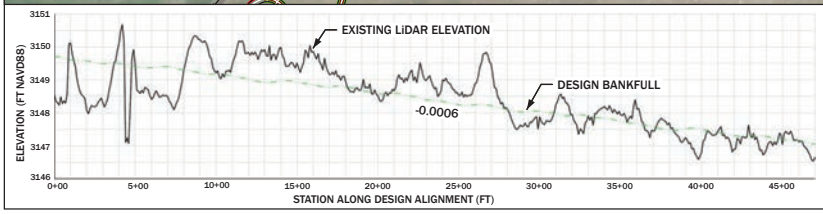
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
5.2

SHEET 8 OF 25



LEGEND

- VEGETATED WOOD MATRIX - TYPE 1
- VEGETATED WOOD MATRIX - TYPE 2
- CONSTRUCTED CHANNEL STREAMBED

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PLAN AND PROFILE REACH 2

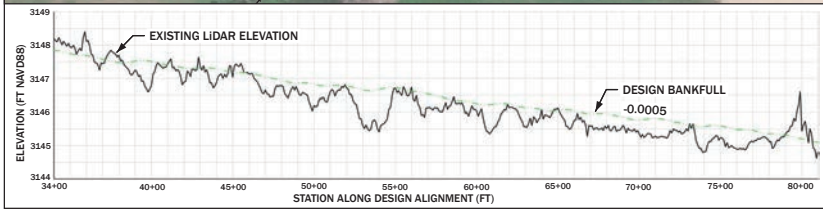
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER **5.3**

SHEET 9 OF 25



LEGEND

- VEGETATED WOOD MATRIX - TYPE 1
- VEGETATED WOOD MATRIX - TYPE 2
- CONSTRUCTED CHANNEL STREAMBED

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PLAN AND PROFILE REACH 2

LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER **5.4**

SHEET 10 OF 25

BANKFULL CROSS SECTION DESIGN CRITERIA						
	Riffle		Run		Pool	
Variable	Value (ft)	Dimensionless Coefficient	Value (ft)	Dimensionless Coefficient	Value (ft)	Dimensionless Coefficient
Area	29		30.5	1.05	33.4	1.15
Width/Depth	5					
Range (Low)	4					
Range (High)	6					
Width						
Average	12		10.5		14.4	1.20
Range (Low)	11		9.7		13.2	1.10
Range (High)	13		11.5		15.7	1.30
Avg. Depth						
Average	2.4		2.9	1.20	2.0	
Range (Low)	2.2	0.91	2.6	1.10	1.9	
Range (High)	2.7	1.12	3.1	1.30	2.2	
Max. Depth						
Average	3.1	1.30	3.6	1.50	6.6	2.75
Range (Low)	2.6	1.20	3.9	1.60	4.2	1.75
Range (High)	3.8	1.40	4.1	1.70	7.2	3.00
Max. Scour	3.6	1.50	3.6	1.50	4.8	2.00

PLANFORM GEOMETRY DESIGN CRITERIA		
Variable	Value (ft)	Dimensionless Ratio
Bankfull Width	12	
Radius of Curvature		
Average	36	3.0
Range (Low)	24	2.0
Range (High)	48	4.0
Meander Length		
Average	144	12.0
Range (Low)	96	8.0
Range (High)	192	16.0
Belt Width		
Average	360	
Range (Low)	240	20.0
Range (High)	480	40.0
Sinuosity	2.1	

CHANNEL DESIGN CRITERIA
REACH 2
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 5.5

SHEET 11 OF 25

EXISTING CONDITIONS
REACH 3
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 6.0

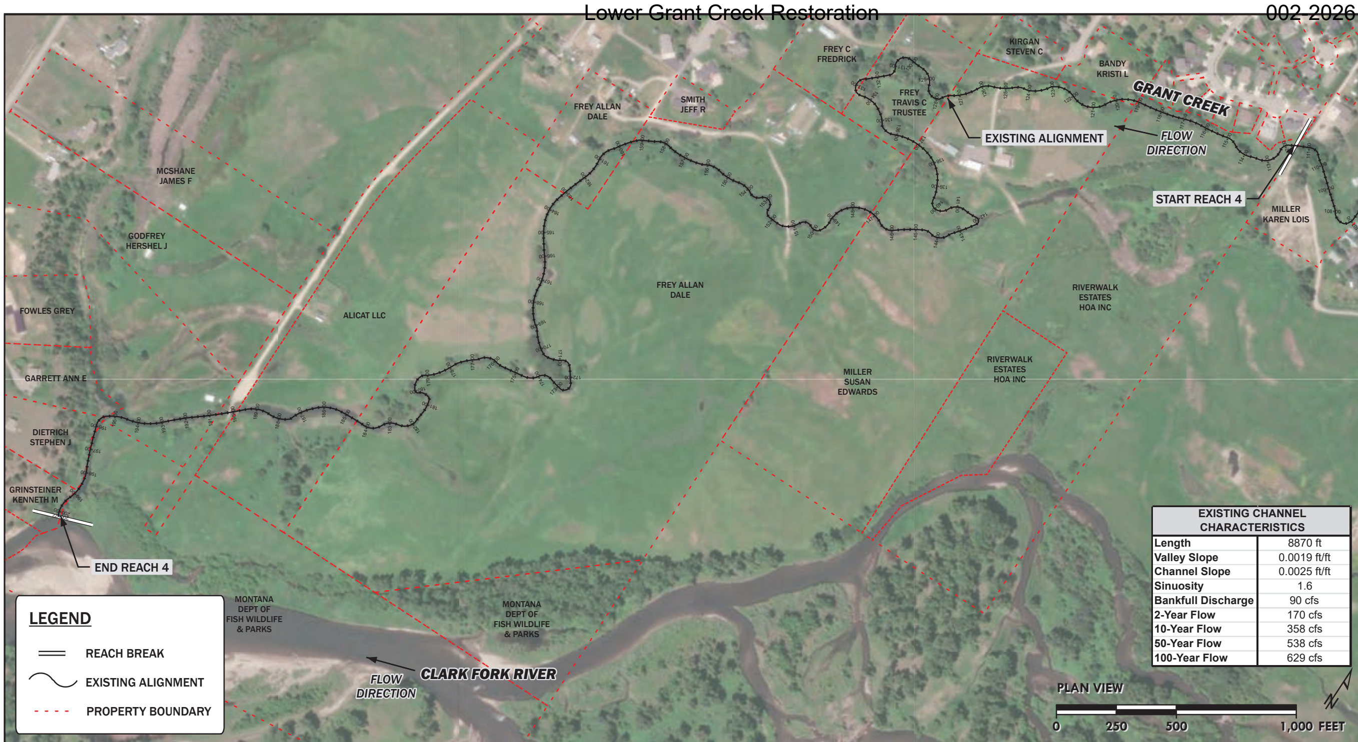
SHEET 12 OF 25

EXISTING CONDITIONS, LIMITING FACTORS, & CONSTRAINTS

REACH 3 EXTENDS 1.36 MILES FROM THE SOUTHERN BOUNDARY OF THE MISSOULA COUNTY AIRPORT AUTHORITY PROPERTY DOWNSTREAM TO THE START OF REACH 3 (RIVERWALK ESTATES HOA, INC.). REACH 2 WAS STRAIGHTENED AND CHANNELIZED TO ACCOMMODATE RESIDENTIAL DEVELOPMENTS IN THE HISTORICAL GRANT CREEK FLOODPLAIN. IN 2008, MISSOULA COUNTY RETAINED HDR ENGINEERING, INC. TO ENGINEER AND CONSTRUCT THE GRANT CREEK RESTORATION AND FLOOD CONTROL PROJECT. THE PROJECT CONSISTED OF CONSTRUCTING TWO FLOOD ATTENUATION / DETENTION BASINS UPSTREAM AND DOWNSTREAM OF HIAWATHA ROAD TO REDUCE FLOOD HAZARD RISK TO ADJACENT RESIDENTIAL DEVELOPMENTS. A SECOND COMPONENT OF THE PROJECT WAS THE CONSTRUCTION OF A CONCRETE INLET PEAK FLOW BYPASS STRUCTURE AND PIPELINE UPSTREAM OF MULLAN ROAD. THE EFFECTIVENESS OF THESE PROJECTS IN AMELIORATING FLOOD RISK IS UNCERTAIN AND WAS BEYOND THE SCOPE OF THIS CONCEPTUAL RESTORATION PLAN FOR LOWER GRANT CREEK.

THE FOLLOWING RESTORATION CONSTRAINTS PRECLUDE ACTIVE RESTORATION STRATEGIES IN REACH 3:

- EXISTING FLOOD ATTENUATION BASINS LIMIT OPPORTUNITIES TO RESTORE APPROPRIATE CHANNEL PLANFORM DIMENSIONS IN UPPER REACH 3.
- RESIDENTIAL DEVELOPMENTS IN THE MIDDLE AND LOWER PORTION OF REACH 3 ENCROACH ON THE HISTORICAL GRANT CREEK FLOODPLAIN AND LIMIT OPPORTUNITIES TO CORRECT THE DIMENSIONS, PATTERN, AND PROFILE OF GRANT CREEK.
- HIAWATHA ROAD, MULLAN ROAD, AND THE PEAK FLOW BYPASS STRUCTURE ARE FIXED INFRASTRUCTURE CONSTRAINTS.



EXISTING CHANNEL CHARACTERISTICS	
Length	8870 ft
Valley Slope	0.0019 ft/ft
Channel Slope	0.0025 ft/ft
Sinuosity	1.6
Bankfull Discharge	90 cfs
2-Year Flow	170 cfs
10-Year Flow	358 cfs
50-Year Flow	538 cfs
100-Year Flow	629 cfs

EXISTING CONDITIONS, LIMITING FACTORS, & CONSTRAINTS

REACH 4 BEGINS WHERE THE CHANNEL EXITS THE RESIDENTAL DEVELOPMENT AND EXTENDS DOWNSTREAM TO THE CONFLUENCE WITH THE CLARK FORK RIVER. UPPER REACH 4 IS FORESTED AND SEVERELY ENTRENCHED WITH STEEP AND ERODING BANKS. RESTORATION IN UPPER REACH 4 IS CONSTRAINED BY THE PROXIMITY TO HOMES IN THE HISTORIC FLOODPLAIN. DOWNSTREAM OF THE FORESTED AREA WOODY RIPARIAN VEGETATION IS LIMITED AND THE REACH IS CHARACTERIZED AS INCISED AND OVER-WIDENED WITH LIMITED FLOODPLAIN CONNECTIVITY. EXCESS BANK EROSION AND SILTATION ARE PERVASIVE IN REACH 4. AS A WHOLE, THE REACH LACKS HYDRAULIC AND GEOMORPHIC COMPLEXITY AND HIGH QUALITY AQUATIC HABITAT.

RESTORATION STRATEGIES

RESTORATION STRATEGIES IN REACH 4 INCLUDE:

- CONSTRUCTING AN APPROPRIATELY SIZED BANKFULL CHANNEL THAT INCORPORATES PLANFORM AND LONGITUDINAL PROFILE COMPLEXITY AND PROMOTES HYPORHEIC EXCHANGE THROUGH THE USE OF RIFFLE, RUN, POOL, AND GLIDE HABITAT FEATURES;
- RAISING THE CHANNEL BED PROFILE TO RECONNECT HISTORIC FLOODPLAIN SURFACES, PROMOTE GROUNDWATER RECHARGE, AND PROVIDE FLOOD ATTENUATION;
- INSTALLING STREAMBANK STRUCTURES THAT REDUCE SEDIMENT LOADING AND PROMOTE THE ESTABLISHMENT OF WOODY RIPARIAN VEGETATION, COVER, AND AQUATIC HABITAT COMPLEXITY;
- PLACING LARGE WOOD AND INSTALLING WILLOW TRENCHES ON THE FLOODPLAIN TO PROVIDE ROUGHNESS AND PROMOTE THE NATURAL RECRUITMENT OF WOODY RIPARIAN VEGETATION;
- CONSTRUCTING OFF-CHANNEL WETLANDS TO PROVIDE HIGH QUALITY WILDLIFE HABITAT, FLOOD ATTENUATION, AND WATER QUALITY BENEFITS; AND
- IMPLEMENTING A GRAZING MANAGEMENT PLAN TO PROTECT SENSITIVE FLOODPLAIN AND RIPARIAN AREAS.

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EXISTING CONDITIONS
REACH 4
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

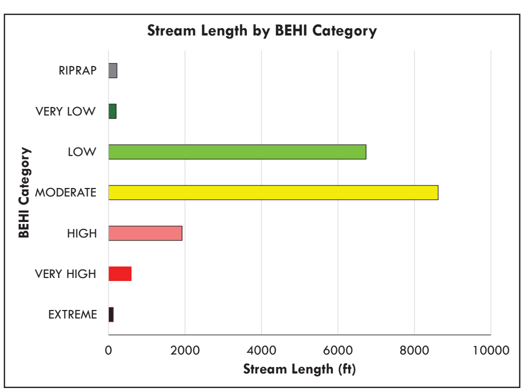
PROJECT NUMBER
RDG-24-041
DRAWING NUMBER
7.0
SHEET 13 OF 25

Lower Grant Creek Phase 4
Bank Erosion Hazard Index (BEHI) Assessment

CATEGORY

- EXTREME
- VERY HIGH
- HIGH
- MODERATE
- LOW
- VERY LOW
- RIPRAP

LOWER GRANT CREEK PHASE 4 BANK EROSION SEDIMENT YIELD.					
BEHI RATING	LENGTH (FT)	MIGRATION RATE (FT/YR)	BANK HEIGHT (FT)	DENSITY (LBS/FT^3)	SEDIMENT YIELD (TONS/YR)
EXTREME	129	0.47	7.0	100	21
VERY HIGH	598	0.39	6.1	100	71
HIGH	1923	0.31	5.0	100	149
MODERATE	8621	0.23	3.6	100	357
LOW	6735	0.17	3.0	100	172
VERY LOW	201	0.1	1.5	100	2
RIPRAP	222	0	3.0	100	0
TOTAL	18,430				772



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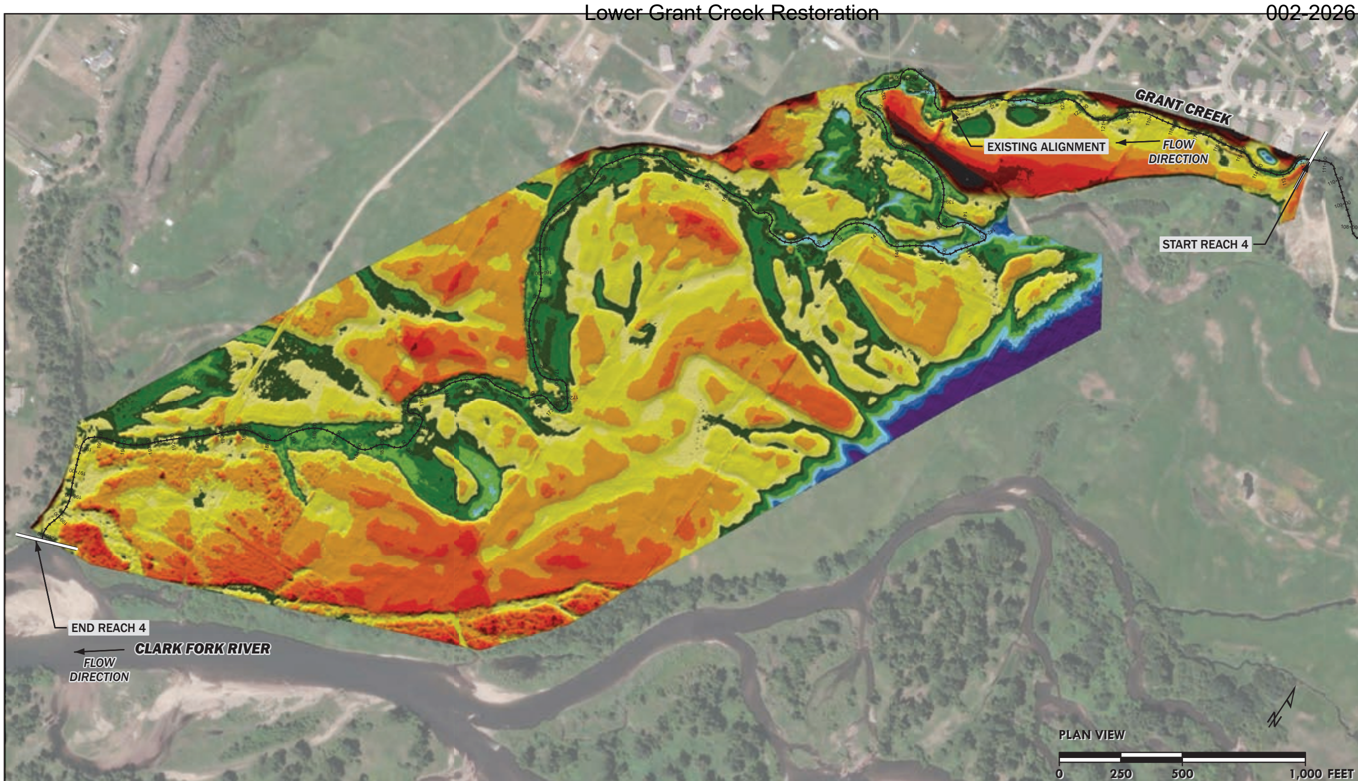
REACH 4 EXISTING CONDITIONS
BEHI ASSESSMENT
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041
DRAWING NUMBER
7.1
SHEET 14 OF 25



ELEVATION RELATIVE TO EXISTING BANKFULL (FT)

<-6.7 - -2.0 | -2.0 - -1.5 | -1.5 - -1.0 | -1.0 - -0.3 | -0.3 - 0.3 | 0.3 - 1.0 | 1.0 - 1.5 | 1.5 - 2.0 | 2.0 - 3.0 | 3.0 - 4.0 | 4.0 - 5.0 | 5.0 - 6.0 | 6.0 - 9.0 | >9.0

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REACH 4 EXISTING CONDITIONS RELATIVE ELEVATION MODEL

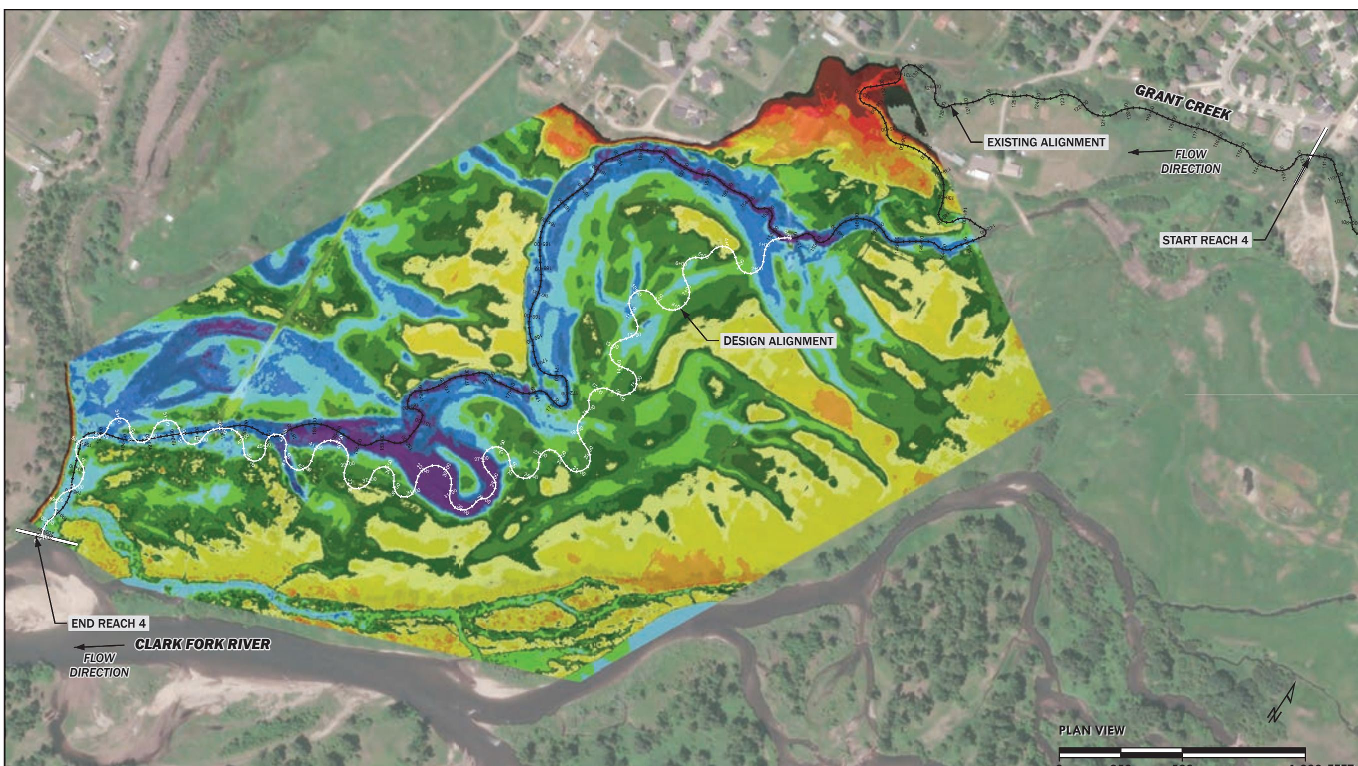
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 7.2

SHEET 15 OF 25



ELEVATION RELATIVE TO DESIGN BANKFULL (FT)

-5.9 - -2.0 | -2.0 - -1.5 | -1.5 - -1.0 | -1.0 - -0.3 | -0.3 - 0.3 | 0.3 - 1.0 | 1.0 - 1.5 | 1.5 - 2.0 | 2.0 - 3.0 | 3.0 - 4.0 | 4.0 - 5.0 | 5.0 - 6.0 | 6.0 - 9.0 | >9.0

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REACH 4 DESIGN CONDITIONS RELATIVE ELEVATION MODEL

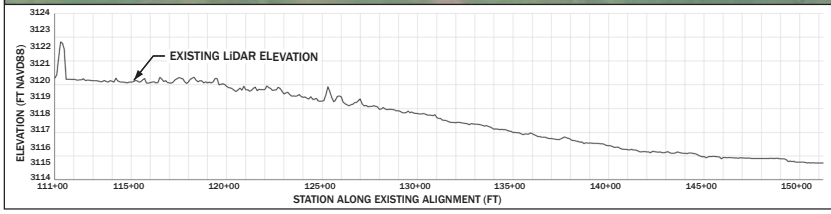
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 7.3

SHEET 16 OF 25



LEGEND

- VEGETATED WOOD MATRIX - TYPE 1
- VEGETATED WOOD MATRIX - TYPE 2
- CONSTRUCTED CHANNEL STREAMBED
- LARGE WOOD STRUCTURE
- CONSTRUCTED WETLAND

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RDG river design group
311 SW Jefferson Avenue Corvallis, OR 97333 ph: 541.758.8504 fx: 541.758.8504
236 Wisconsin Avenue Whitefish, MT 59937 ph: 406.862.4949 fx: 406.862.4949

PLAN AND PROFILE REACH 4

LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
7.4

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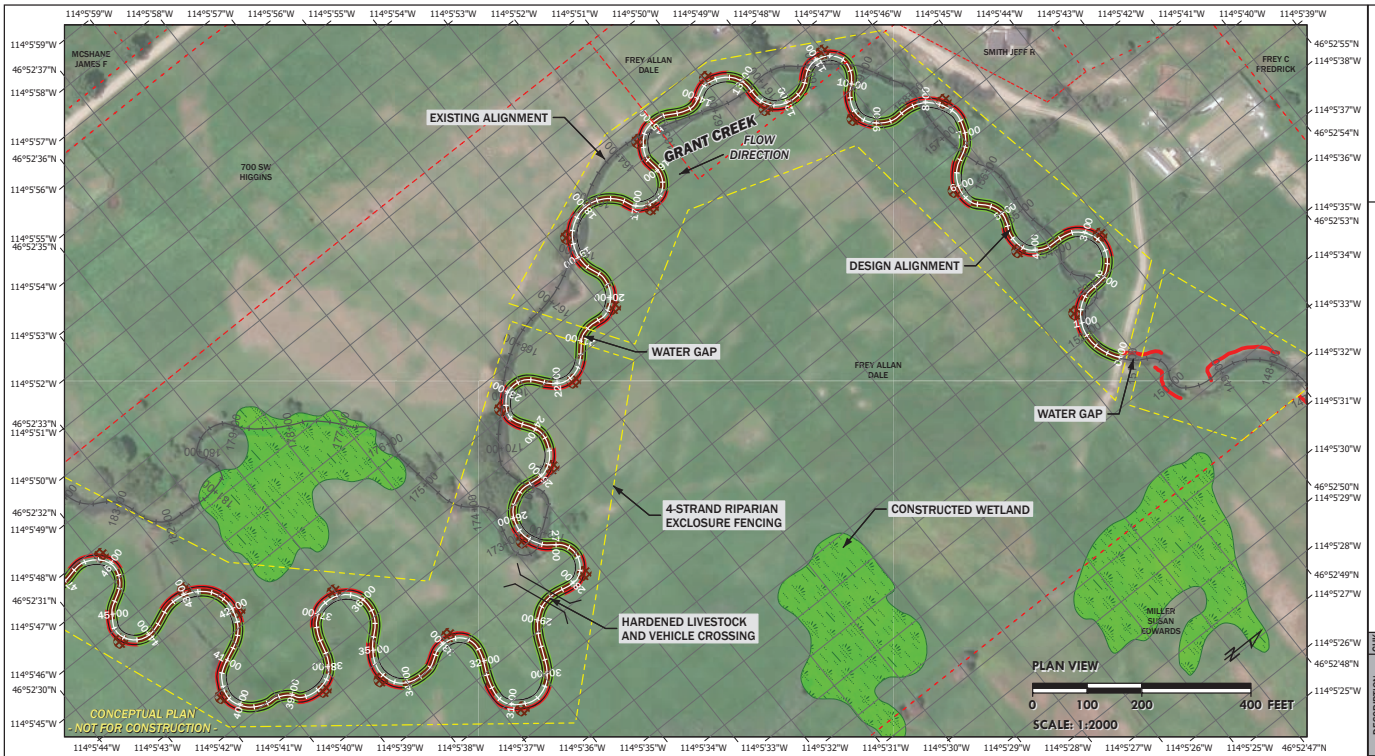

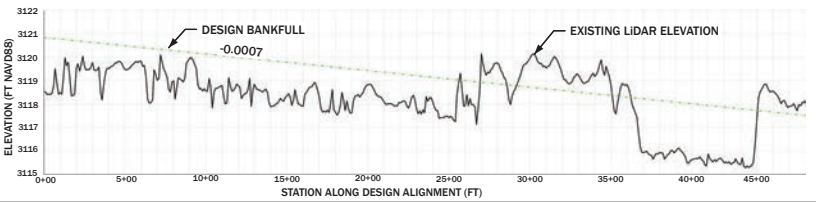

LEGEND

- VEGETATED WOOD MATRIX - TYPE 1
- VEGETATED WOOD MATRIX - TYPE 2
- CONSTRUCTED CHANNEL STREAMBED
- LARGE WOOD STRUCTURE
- CONSTRUCTED WETLAND

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PLAN AND PROFILE REACH 4

LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
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2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
7.5

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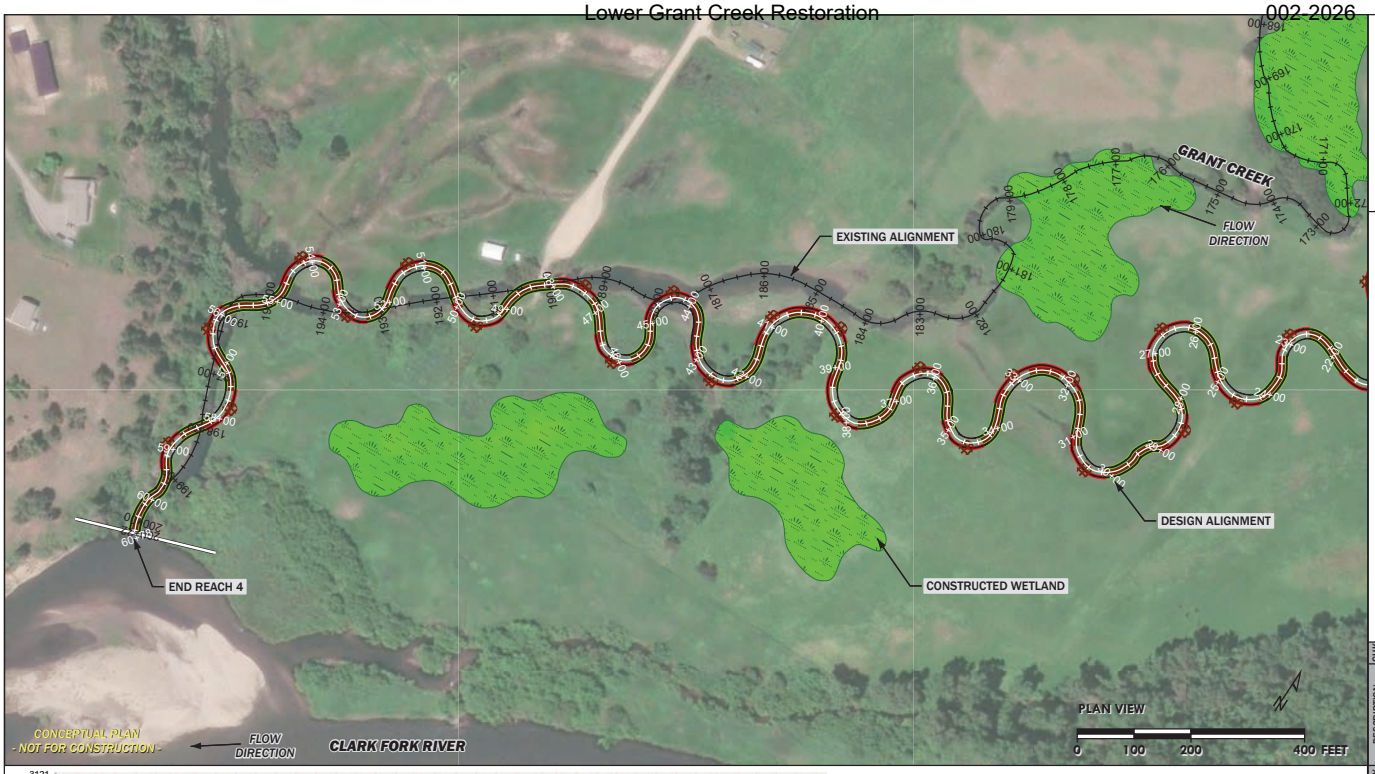

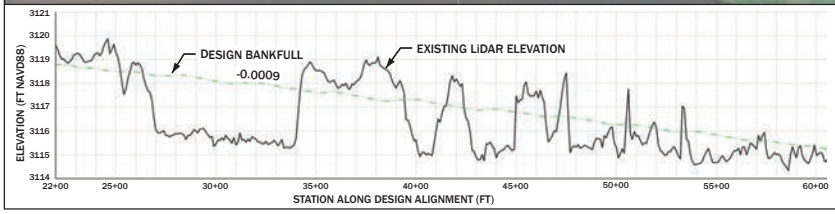

LEGEND

- VEGETATED WOOD MATRIX - TYPE 1
- VEGETATED WOOD MATRIX - TYPE 2
- CONSTRUCTED CHANNEL STREAMBED
- LARGE WOOD STRUCTURE
- CONSTRUCTED WETLAND

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PLAN AND PROFILE REACH 4

LOWER GRANT CREEK RESTORATION PROJECT

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1	08-05-24	DW	CONCEPTUAL DESIGN	JM
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PROJECT NUMBER RDG-24-041

DRAWING NUMBER **7.6**

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BANKFULL CROSS SECTION DESIGN CRITERIA

Variable	Riffle Value (ft)	Riffle Dimensionless Coefficient	Run Value (ft)	Run Dimensionless Coefficient	Pool Value (ft)	Pool Dimensionless Coefficient
Area	29		30.5	1.05	36.3	1.25
Width/Depth	10	1.0	8	1.0	13	1.0
Range (Low)	9	0.9	5	0.6	10	0.8
Range (High)	13	1.3	12	2.5	16	1.6
Width						
Average	17	1.0	18	1.05	21	1.25
Range (Low)	15	0.9	14	0.80	19	1.10
Range (High)	19	1.1	22	1.30	24	1.40
Avg. Depth						
Average	1.7	1.0	2.2	1.30	3.1	1.80
Range (Low)	1.5	0.90	1.8	1.20	2.7	1.60
Range (High)	2.0	1.20	2.9	1.40	3.4	2.00
Max. Depth						
Average	3.0	1.00	3.4	2.00	5.4	
Range (Low)	2.7	0.90	2.7	1.60	4.8	2.80
Range (High)	3.3	1.10	3.9	2.30	6.0	3.50
Max. Scour	3.4	2.00	4.3	2.50	6.8	4.00

PLANFORM GEOMETRY DESIGN CRITERIA

Variable	Value (ft)	Dimensionless Ratio
Bankfull Width	17	
Radius of Curvature		
Average	55	3.3
Range (Low)	43	2.5
Range (High)	68	4.0
Meander Length		
Average	204	12.0
Range (Low)	136	8.0
Range (High)	272	16.0
Belt Width		
Average	136	8.0
Range (Low)	34	2.0
Range (High)	238	14.0
Sinuosity	1.8	

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CHANNEL DESIGN CRITERIA REACH 4

LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER **7.7**

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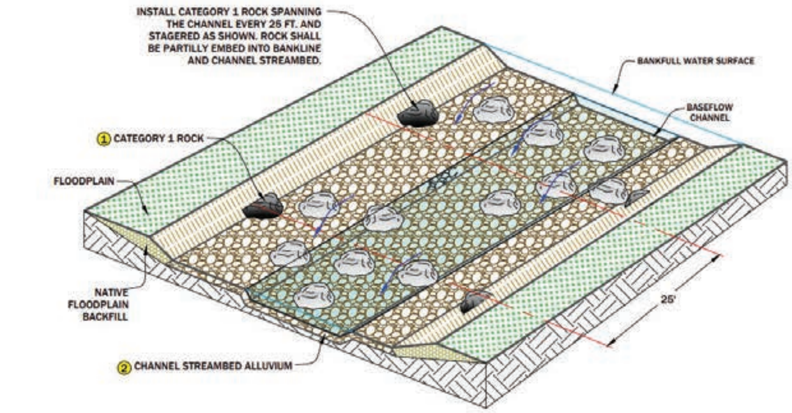
GENERAL NOTES

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. IT IS THE CONTRACTORS RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES.

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

1. 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.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.
3. PREPARE THE FRAMEWORK. CONTRACTOR SHALL PLACE 10-INCH TO 12-INCH BOULDER SILLS (CATEGORY 1 ROCK) ON THE SURFACE OF THE CHANNEL SUBGRADE PRIMARILY WITHIN THE LOW FLOW CHANNEL AS INDICATED ON THE DRAWING. DUE TO THE INHERENT VARIABILITY IN MATERIALS, BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE WILL BE NO GREATER THAN 0.5-FT.
4. PREPARE THE MATRIX. AFTER THE FRAMEWORK BOULDER RIBS ARE INSTALLED AND INSPECTED BY CONSTRUCTION MANAGER, PLACE APPROPRIATE CHANNEL STREAMBED ALLUVIUM GRADATION AND WASH FINES INTO STREAMBED. CHANNEL STREAMED ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS OF 12-INCHES TO FINISHED GRADE.

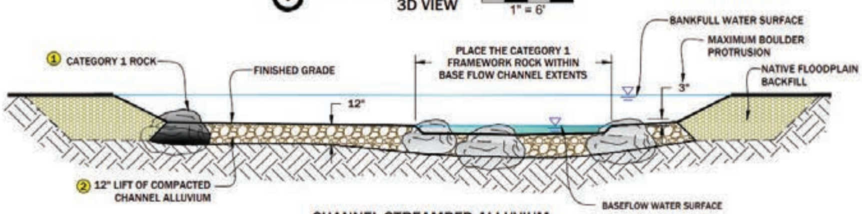


1 CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION 3D VIEW 1" = 6'

STREAMBED FILL GRADATION	
SIZE (IN)	PERCENT PASSING
4	80-100
3	30-80
1	10-30
0.08	10

NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION

	MATERIAL SCHEDULE (PER FOOT)		
	ITEM	DIA. (IN)	QUANTITY (EA)
1	CATEGORY 1 ROCK	6" - 8"	0.2 EA
2	ALLUVIUM	4" MINUS	0.35 CY



2 CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION SECTION VIEW 1" = 5'

TYPICAL CONSTRUCTED STREAMBED THROUGH A RIFFLE FEATURE

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CONSTRUCTED CHANNEL STREAMBED DETAIL

LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

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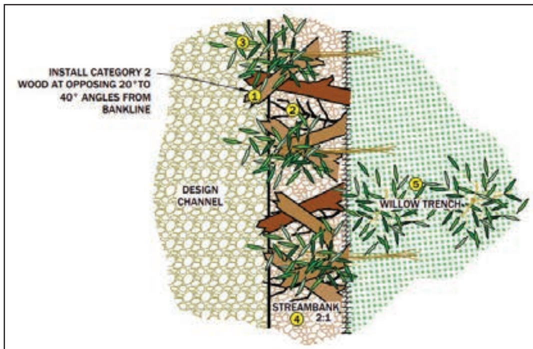
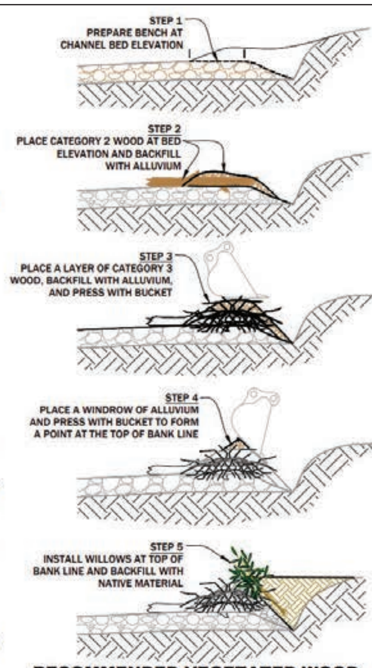


1 VEGETATED WOOD MATRIX - TYPE 1 PLAN VIEW 1" = 3'

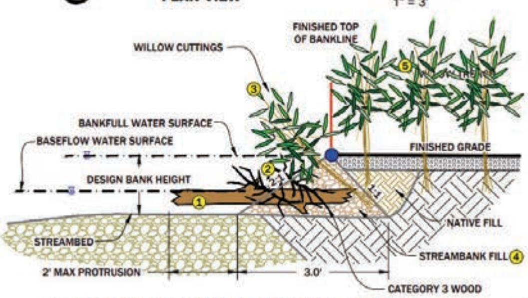


GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER THE CHANNEL AND FLOODPLAIN BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED. INSTALLATION OF FLOODPLAIN TREATMENT SHALL BE COMPLETED AFTER VEGETATED WOOD MATRIXES ARE INSTALLED.
2. IF VEGETATED WOOD MATRIX STRUCTURES ARE INSTALLED PRIOR TO OCTOBER 1, LEAVE BACK TRENCH UNFILLED AND COMPLETE STRUCTURE WHEN DORMANT WILLOWS ARE AVAILABLE.
3. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY CONSTRUCTION MANAGER.
5. CONTRACTOR SHALL MARK AND CONSTRUCTION ENGINEER SHALL APPROVE THE GENERAL LOCATION FOR EACH VEGETATED WOOD MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

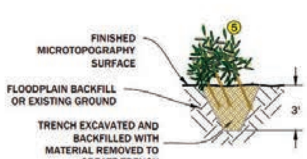
1. EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. PREPARE THE BENCH OF THE STRUCTURE BY PLACING CHANNEL STREAMBED ALLUVIUM FROM THE BASE OF THE EXCAVATION DEPTH/BOTTOM OF EXCAVATION TO WITHIN 1.0-FT. OF FINISHED GRADE.
3. CATEGORY 2 AND CATEGORY 3 WOOD, AND CHANNEL STREAMBED ALLUVIUM SHALL BE PLACED IN ALTERNATING LAYERS AND BUCKET COMPACTED UP TO THE TOP OF BANK ELEVATION AS SHOWN BELOW IN THE INSTALLATION SEQUENCE. PLACE SIX (6) FT TO EIGHT (8) FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER LINEAR FT ALONG THE TOP OF BANK LINE ELEVATION. WILLOW CUTTINGS SHALL SLOPE AT AN APPROXIMATE 1:1 SLOPE AS SHOWN IN SECTION VIEW. STEMS MAY OVERLAP. THE CUT ENDS SHALL BE PLACED AT THE BASE OF THE SLOPES WITH THE UN-CUT ENDS EXTENDING BEYOND THE EDGE OF THE TRENCH SO NO GREATER THAN ONE-THIRD OF THE TOTAL CUTTING LENGTH IS EXPOSED BEYOND THE TOP OF BANK EDGE. WILLOW CUTTINGS SHOULD INTERCEPT THE DESIGN TOP OF BANK LINE AS SHOWN IN STEP 5 OF THE INSTALLATION SEQUENCE.
4. 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.
5. AFTER INSTALLATION OF THE VEGETATED WOOD MATRIX, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE, AND BUCKET COMPACT. INSTALL WILLOW TRENCHES AT A RATE OF 2 PER LINEAR FOOT (OR 20 PER TRENCH) AS SHOWN. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.



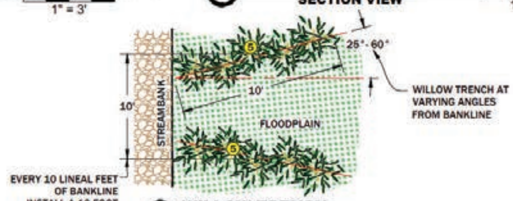
2 VEGETATED WOOD MATRIX - TYPE 1 SECTION VIEW 1" = 3'

3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE SECTION VIEW 1" = 5'

	TYPE 1 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)		
	ITEM	DIA. (IN)	QTY.
1	CATEGORY 2 WOOD	2"-4"	0.2500
2	CATEGORY 3 WOOD	< 2"	2
3	WILLOW CUTTINGS	0.25"-1.0"	3
4	STREAMBANK ALLUVIUM	4" MINUS	0.1 CY



4 WILLOW TRENCH SECTION VIEW NTS



5 WILLOW TRENCH PLAN VIEW NTS

STREAMBED FILL GRADATION	
SIZE (IN)	PERCENT PASSING
4	80-100
3	30-80
1	10-30
0.08	10

NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION

	WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)		
	ITEM	DIA.	QUANTITY (EA)
5	WILLOW CUTTINGS	0.25" - 1"	5

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VEGETATED WOOD MATRIX (TYPE 1)

LOWER GRANT CREEK RESTORATION PROJECT

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PROJECT NUMBER RDG-24-041

DRAWING NUMBER 8.1

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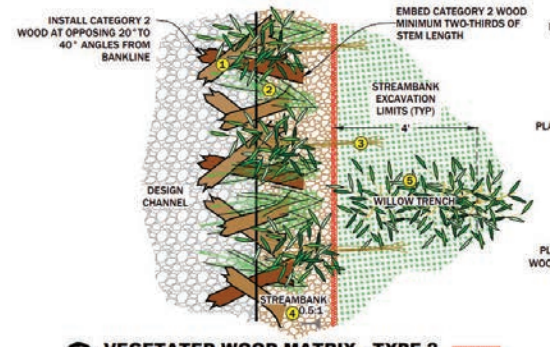
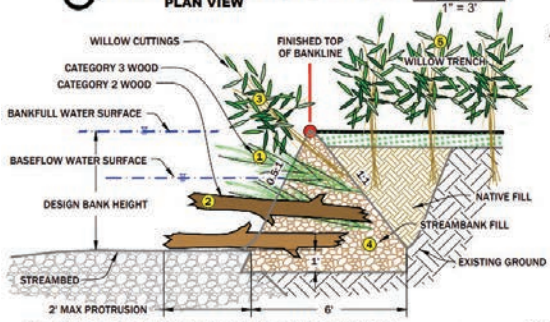
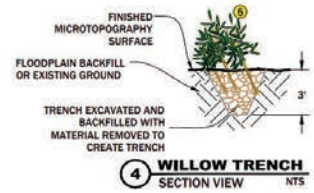


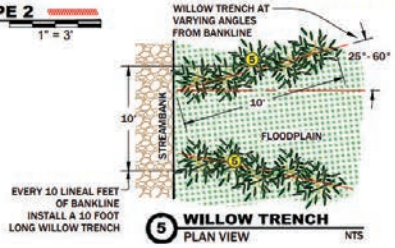
1 VEGETATED WOOD MATRIX - TYPE 2
PLAN VIEW 1" = 3'



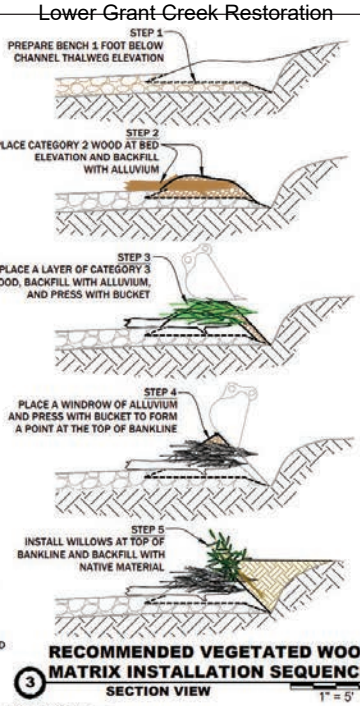
2 VEGETATED WOOD MATRIX - TYPE 2
SECTION VIEW 1" = 3'



4 WILLOW TRENCH
SECTION VIEW NTS



5 WILLOW TRENCH
PLAN VIEW NTS



3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE
SECTION VIEW 1" = 5'

GENERAL NOTES

1. IF VEGETATED WOOD MATRIX STRUCTURES ARE INSTALLED PRIOR TO OCTOBER 1, LEAVE BACK TRENCH UNFILLED AND COMPLETE STRUCTURE WHEN DORMANT WILLOWS ARE AVAILABLE.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
3. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY CONSTRUCTION MANAGER.
4. CONTRACTOR SHALL MARK AND CONSTRUCTION ENGINEER SHALL APPROVE THE GENERAL LOCATION FOR EACH VEGETATED WOOD MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

INSTALLATION NOTES

1. EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. PREPARE THE BENCH OF THE STRUCTURE BY PLACING STREAMBED ALLUVIUM MINIMUM 1 FOOT BELOW CHANNEL THALWEG ELEVATION.
3. CATEGORY 2 AND CATEGORY 3 WOOD, AND STREAMBED ALLUVIUM SHALL BE PLACED IN ALTERNATING LIFTS AND BUCKET COMPACTED UP TO THE TOP OF BANK ELEVATION AS SHOWN IN THE INSTALLATION SEQUENCE. PLACE 6 FT TO 8 FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER LINEAR FT ALONG THE TOP OF BANK LINE ELEVATION. WILLOW CUTTINGS SHALL SLOPE AT AN APPROXIMATE 1:1 SLOPE AS SHOWN IN SECTION VIEW. STEMS MAY OVERLAP. THE CUT ENDS SHALL BE PLACED AT THE BASE OF THE SLOPES WITH THE UN-CUT ENDS EXTENDING BEYOND THE EDGE OF THE TRENCH SO NO GREATER THAN ONE-THIRD OF THE TOTAL CUTTING LENGTH IS EXPOSED BEYOND THE TOP OF BANKLINE. WILLOW CUTTINGS SHOULD INTERCEPT THE DESIGN TOP OF BANKLINE AS SHOWN IN STEP 5 OF THE INSTALLATION SEQUENCE.
4. THE UPSTREAM AND DOWNSTREAM ENDS OF THE STRUCTURE SHALL TRANSITION SMOOTHLY INTO ADJACENT STREAMBANK STRUCTURES TO MINIMIZE EROSION, FLANKING, AND BANK FAILURE.
5. AFTER INSTALLATION OF THE VEGETATED WOOD MATRIX, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE, AND BUCKET COMPACT. INSTALL WILLOW TRENCHES AT A RATE OF 5 PER LINEAR FOOT (OR 50 PER TRENCH) AS SHOWN. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

TYPE 2 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA. (IN)	QTY.
1	CATEGORY 2 WOOD	2"-4"	0.25
2	CATEGORY 3 WOOD	< 2"	2
3	BANK WILLOW CUTTINGS	0.25"-1.0"	5
4	STREAMBANK ALLUVIUM	4" MINUS	0.3 CY

WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)

	ITEM	DIA.	QUANTITY (EA)
5	TRENCH WILLOW CUTTINGS	0.25" - 1"	5

STREAMBED FILL GRADATION

SIZE (IN)	PERCENT PASSING
4	80-100
3	30-80
1	10-30
0.08	10

NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION

NOW PART OF SWCA
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236 Wisconsin Avenue Whitefish, MT 59937 ph 406.862.4949 fx 406.862.4949

VEGETATED WOOD MATRIX (TYPE 2)
LOWER GRANT CREEK RESTORATION PROJECT

NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 8.2

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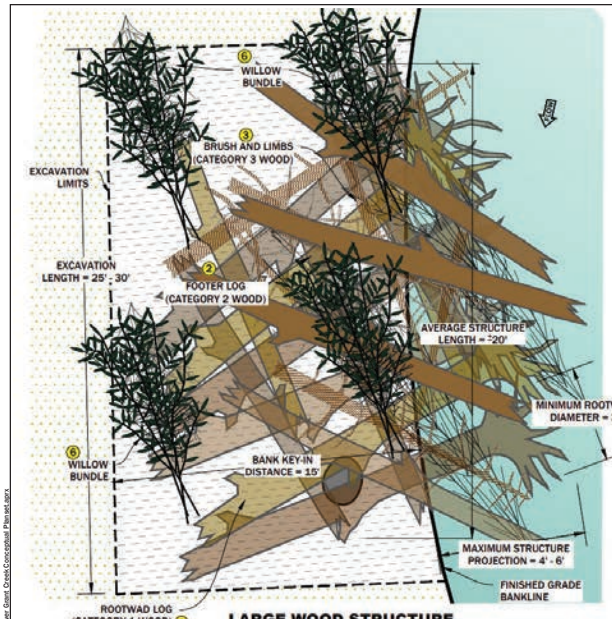


LARGE WOOD STRUCTURE
PLAN VIEW 0' 2.5' 5'

GENERAL NOTES

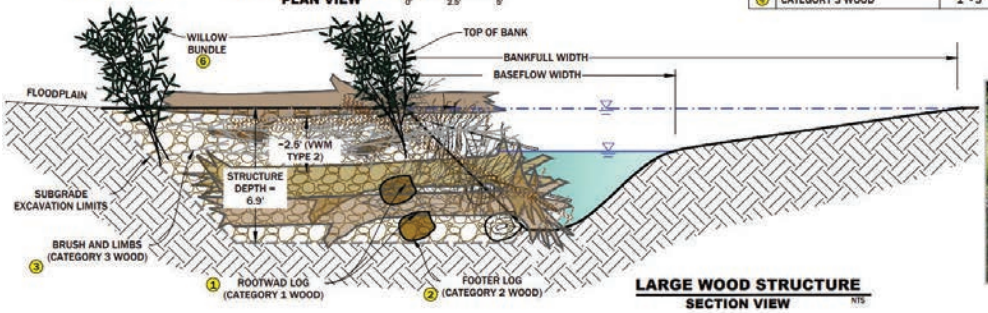
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR BEFORE THE CONSTRUCTED CHANNEL STREAMBED AND VEGETATED WOOD MATRIX BANK TREATMENTS ARE INSTALLED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION.

CONSTRUCTION NOTES

1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
3. INSTALL TWO ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS (CATEGORY 2 WOOD). BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL A SECOND TIER OF TWO FOOTER LOG (CATEGORY 2 WOOD) FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
6. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE.
7. INSTALL ONE TO TWO ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING THE LOWER TIER OF ROOTWADS AT THE ORIENTATION NOTED IN PLAN VIEW. THE ROOTWADS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISHED BANK LINE.
8. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AND WILLOW CUTTINGS INTERWOMEN INTO WOOD MATRIX UP TO FINISHED GRADE. BRUSH, LIMBS, AND WILLOW CUTTINGS SHALL PROJECT NO GREATER THAN 4 FT. BEYOND THE FINISHED BANK LINE.
9. BACKFILL WOOD MATRIX WITH STREAMBED FILL UP TO FINISHED GRADE WITH STOCKPILED NATIVE MATERIAL. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.
10. INSTALL DEFLECTOR LOGS (CATEGORY 2 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL BE HALF EMBEDDED IN THE FLOODPLAIN AND PROJECT NO GREATER THAN 4 FT. BEYOND THE FINISHED BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.

LARGE WOOD STRUCTURE MATERIAL SCHEDULE (PER LINEAR STRUCTURE)

	ITEM	DIA. (IN)	LENGTH (FT)	ROOTWAD (Y/N)	QTY.
1	SUBGRADE EXCAVATION				5 CY
2	CATEGORY 1 WOOD	10"-12"	12-15	YES - 18IN DIA. MIN	2 EA
3	CATEGORY 2 WOOD	3"-10"	10-15	NO	4 EA
4	CATEGORY 3 WOOD	1" - 3"	10-12	OPTIONAL 1-2 FT	10 EA



LARGE WOOD STRUCTURE
SECTION VIEW NTS

EXAMPLE OF A LARGE WOOD STRUCTURE

NOW PART OF SWCA
RDG RIVER DESIGN GROUP
311 SW Jefferson Avenue Corvallis, OR 97333 ph 541.758.8724 fx 541.758.8504
236 Wisconsin Avenue Whitefish, MT 59937 ph 406.862.4949 fx 406.862.4949

LARGE WOOD STRUCTURE DETAIL
LOWER GRANT CREEK RESTORATION PROJECT

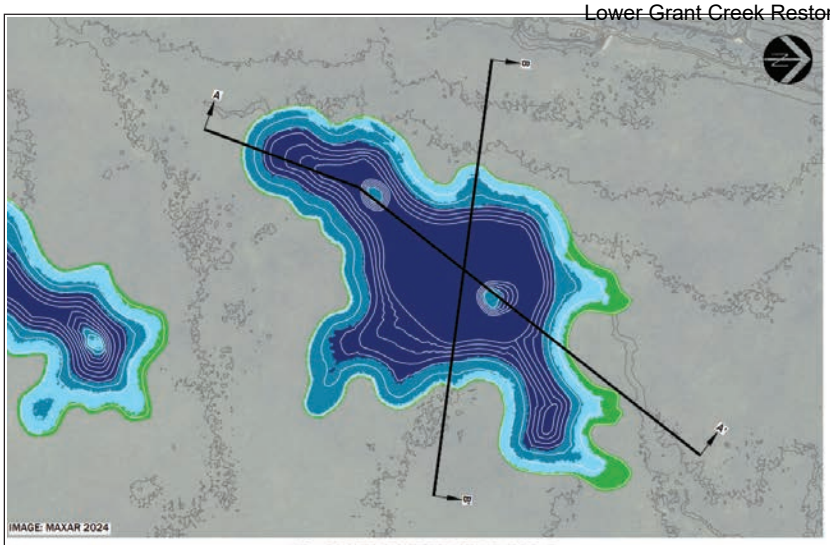
NO.	DATE	BY	DESCRIPTION	CHK
1	08-05-24	DW	CONCEPTUAL DESIGN	JM
2	09-06-24	DB	CONCEPTUAL DESIGN	JM

PROJECT NUMBER RDG-24-041

DRAWING NUMBER 8.3

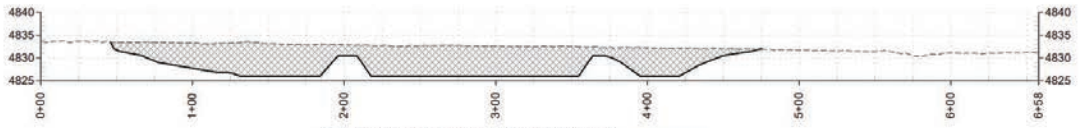
SHEET 24 OF 25

M:\Projects\2024\RDG-24-041 Lower Grant Creek Master Plan\GIS\PRO\APRX\Conceptual Planset\Lower Grant Creek Conceptual Planset.aprx

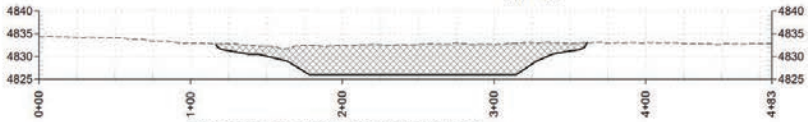


WETLAND HABITAT CLASSIFICATION		
DEPTH	CODE	CLASSIFICATION
0' - 0.5'		SHALLOW WETLAND FRINGE
0.5' - 1.5'		SHALLOW WATER EMERGENT WETLAND
1.5' - 3.0'		DEEP WATER EMERGENT WETLAND
3.0' - 6.0'		OPEN WATER WETLAND

1 CONSTRUCTED WETLAND 2
PLAN VIEW 1' CONTOUR INTERVAL 1" = 100'



2 TYPICAL WETLAND 2 SECTION
SECTION A - A'
H:1" = 60'
V: 1" = 20'



3 TYPICAL WETLAND 2 SECTION
SECTION B - B'
H:1" = 60'
V: 1" = 20'

LEGEND
EXISTING GRADE (EG)
FINISHED GRADE (FG)
CUT

RDG NOW PART OF SWCA
311 SW Jefferson Avenue
Corvallis, OR 97333
541.752.4271
fax 541.753.8924
239 Wisconsin Avenue
Whitefish, MT 59937
406.862.2537
fax 406.862.4943

TYPICAL WETLAND DETAIL

LOWER GRANT CREEK RESTORATION PROJECT

#	DATE	DESCRIPTION		
1	08-05-24	CONCEPTUAL DESIGN	DW	JM
2	09-06-24	CONCEPTUAL DESIGN	DB	JM

PROJECT NUMBER
RDG-24-041

DRAWING NUMBER
8.4

SHEET 25 OF 25

COOPERATIVE AGREEMENT
between
Clark Fork Coalition
And
Allan D. Frey and A'Lisa M. Scott
(Landowners)

This Cooperative AGREEMENT is entered into between the Clark Fork Coalition, a Montana nonprofit corporation, at 140 S. 4th Street West, Unit 1, Missoula, MT 59801 ("CFC"), and Allan D. Frey and A'Lisa M. Scott, at 1655 Frey Lane, Missoula, MT 59808, ("Landowner or Landowners"). CFC and Landowner are sometimes referred to collectively herein as the "PARTIES." In consideration of the mutual covenants and stipulations described below, CFC and the Landowner agree as follows:

1. PURPOSE AND GENERAL PROJECT DESCRIPTION: The purpose of this Agreement is for the Clark Fork Coalition and the Landowner to agree on restoration work to be performed by the Coalition on Grant Creek on Landowner's property (the "Project"). CFC and Landowner have the mutual desire to cooperate in carrying out the activities contemplated herein and this Agreement sets forth the obligations of both CFC and Landowner.

2. SCOPE OF WORK: The Parties wish to make improvements to Lower Grant Creek and its riparian area, which are enduring in nature. The Project will include work on or near Landowner's property, Lower Grant Creek Exhibit A. CFC shall ensure that the Project is completed in compliance with the Scope of Work.

3. PERIOD OF PERFORMANCE: This Agreement shall begin on the Signing Date of this Agreement and terminate on December 31, 2045. All work described in the Scope of Work except for post-project monitoring will take place between July 1, 2026 and December 31, 2027.

4. COST OF THE PROJECT: As consideration for Landowner's consent under this Agreement and protecting 15 acres of riparian habitat, the CFC will pay for all costs for the Project.

5. CFC'S RESPONSIBILITIES: CFC, its employees, agents, and agency partners shall:

a. Provide technical support, all monetary funding and in-kind support for the Project (as described in Scope of Work and Cost of Project);

b. Provide oversight of the Project, including but not limited to grant writing, acquisition of necessary permits, Project coordination, management and oversight of construction activities and all other activities related to the Project;

c. Perform monitoring of the Project for the life of the agreement;

d. Provide prompt notice to Landowner of any specific areas of concern related to the Project, and repair or replace Project improvements should they become endangered, change or destroyed through natural means; and

e. Prepare any and all reports.

6. LANDOWNER'S RESPONSIBILITIES: Landowner, its employees, and agents shall:

f. Guarantee ownership of the above-described lands and warrant that there are no outstanding rights that will interfere with this cooperative Agreement;

g. Allow for and maintain a riparian area protected from grazing following the agreed upon grazing management plan and fence lines (show on Exhibit A) except where impeded by transportation infrastructure or existing, permanent structures;

h. Use reasonable efforts to protect the restoration improvements and, except in cases of emergency or Force Majeure as described in paragraph 10, refrain from removing or impeding the restoration investments for a minimum of 20 years following completion of the Project.

7. AGREEMENT CONDITIONED ON FUNDING: Landowner acknowledges that funding for the Project is dependent upon availability of state, federal, and non-federal funds subject to circumstances beyond the control of CFC. CFC shall not be liable for failure to provide funds committed to the Project if those funds have been withheld for events or circumstances beyond the control of CFC. However, if funding fails, CFC shall release Landowner from its obligations under this Agreement.

8. COOPERATION AND ACCESS: The Parties shall cooperate as needed in the performance of the Scope of Work. Landowner shall give unrestricted access to CFC and its Contractor for the Project site as needed for CFC to perform its obligations under this Agreement, including any required inspections. Landowner shall also allow access to CFC's Contractor and representatives of the Montana Department of Environmental Quality ("DEQ") for the purposes of evaluating Project effectiveness over time. CFC, its Contractor and DEQ will give 24-hour notice to Landowner of any required visits and coordinate with Landowner as needed.

9. FORCES BEYOND THE CONTROL OF THE PARTIES: Neither party shall be liable to the other party, nor deemed to be in breach of this Agreement, for failure or delay in performance arising from a Force Majeure. Force Majeure means an event beyond the reasonable control of the affected party, and which the party is unable to prevent or provide against by exercising reasonable diligence. If Landowner fails to meet terms of the Agreement due to circumstances beyond its control, Landowner shall release CFC from its obligations under this Agreement. If CFC fails to meet terms of the Agreement due to circumstances beyond its control, CFC shall release Landowner from its obligations under this Agreement.

10. INDEMNITY: CFC agrees to indemnify and hold harmless the Landowner for any damages, loss or injuries incurred during the Project, except for damages and injuries caused by willful misconduct or gross negligence of the Landowner. CFC shall maintain its general liability policy for bodily injury, death or loss, or damage to property of third persons or other liability in the minimum amount of $1,000,000 per occurrence and $2,000,000 in the aggregate. In addition, both CFC and Landowner shall be named as additional insured parties on the Project Contractor's general liability

policy bodily injury, death or loss, or damage to property of third persons or other liability in the minimum amount of $1,000,000 per occurrence and $2,000,000 in the aggregate.

11. ASSIGNMENT AND DELEGATION: The provisions of this Agreement shall be binding upon the heirs, personal representatives, administrators, successors and assigns of the parties in like manner as upon the original parties. This Agreement may not be assigned without the express, written consent of the parties.

12. AMENDMENT: This Agreement may be modified at any time by mutual written consent of Landowner and CFC. No other communication between the parties shall modify or be part of this Agreement except by express written consent. This Agreement may be terminated in writing by either party with thirty (30) days notice.

13. TERMINATION: This Agreement may be terminated in writing by either party by providing thirty (30) days advance notice. If Landowner terminates this Agreement, fails to comply with terms and conditions of this Agreement, fails to respond to reasonable requests from CFC to take corrective actions, or the restoration site is degraded due to purposeful or negligent activities of the Landowner, Landowner shall reimburse CFC for the cost of the habitat developments on a pro rata basis.

14. GOVERNING LAW: The law of the State of Montana governs this Agreement.

15. ATTORNEY'S FEES AND COSTS: If a suit, action or arbitration is instituted in connection with any controversy arising out of this Agreement or to enforce any rights hereunder, the prevailing party shall be entitled to recover such amount as the court may adjudge reasonable as attorneys' or paralegals' fees at trial or on any appeal or review, in addition to all other amounts provided by law.

16. PRINCIPAL CONTACTS:

CFC is exclusively responsible for all management aspects of this Project. The principal contacts for this Agreement are:

CFC Project/Contract Officer:
Gretchen Watkins
Clark Fork Coalition
PO Box 7593
Missoula, MT 59807
Tel. 406-550-5514
Email: gretchen@clarkfork.org

LANDOWNERS

Allan D. Frey and A'Lisa M. Scott
Date: 11/13/25

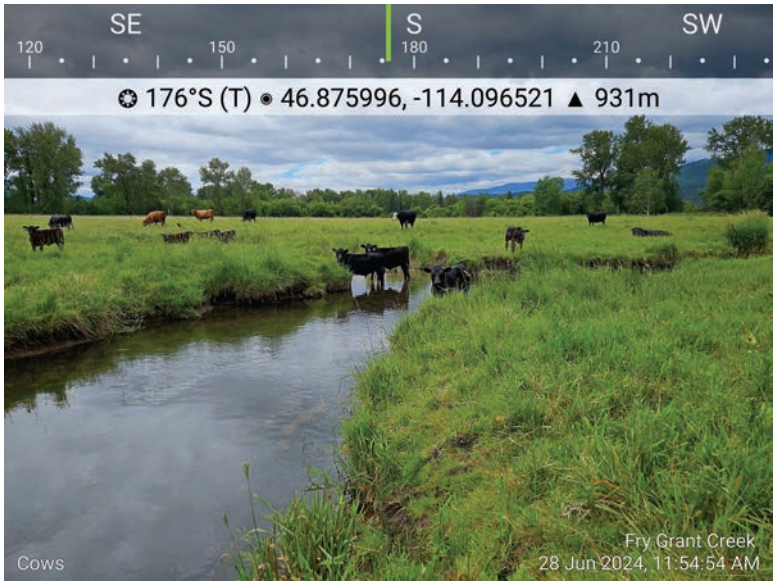
CLARK FORK COALITION

Brian Chaffin, Executive Director
Date: 11/13/2025


S SW W NW
180 210 240 270 300 330
259° W (T) • 46.880216, -114.093454 ±4 m ▲ 944m
Fry Grant Creek
28 Jun 2024, 11:08:14 AM


NE E SE S
30 60 90 120 150 180
106° E (T) • 46.879478, -114.096455 ±4 m ▲ 944m
Fry Grant Creek
28 Jun 2024, 11:27:05 AM


W NW
240 270 300 330
290°W (T) • 46.880581, -114.09252 ▲ 944m
Exposed bank
Fry Grant Creek
28 Jun 2024, 8:27:38 AM


SE S SW
120 150 180 210
176°S (T) • 46.875996, -114.096521 ▲ 931m
Cows
Fry Grant Creek
28 Jun 2024, 11:54:54 AM

MONTANA FISH, WILDLIFE & PARKS

Future Fisheries Improvement Program

Appendix: FWP Statement

Project Title: Lower Grant Creek Restoration – Frey Property

Please describe the potential impact of the project, including the priorities of the Fisheries Division and the importance to Montana's anglers.

Grant Creek is a major tributary to the Clark Fork River located just outside of Missoula. Middle and lower portions of this system have been heavily degraded and heavily modified over the past century. An ongoing large scale restoration effort by a collection of public and private entities aims to mitigate past impacts. The proposed project, planned for the reach immediately upstream of the mouth, is one step in addressing limitations of this watershed for fisheries that will complement past and planned efforts.

Past conservation efforts on lower and middle Grant Creek have focused on providing functional fish passage that connects the more intact upper watershed with the Clark Fork River. The proposed project will complement these efforts and is unique (within middle and lower Grant Creek) in that the reach is perennial - due to active spring activity at the top of the Frey property that provides consistent flow from July-March when upstream reaches are dewatered. Although base instream flows are limited (3-5 cfs), flow is currently adequate to support limited spawning by brown trout and rearing for various other juvenile salmonids.

Implementation of the proposed project is expected to significantly improve channel conditions, cover, complexity, and other physical habitat parameters for salmonids. This will likely enhance spawning activity, trout rearing capacity, and overall production. Most importantly, the reach will undoubtedly be more suitable as a thermal refuge for salmonids in the adjacent Clark Fork River seeking colder water during summer months. In addition, persistent grazing impacts will be alleviated, providing an opportunity for long term riparian recovery and restoration of a functional stream corridor. Immediate benefits for a range of aquatic and terrestrial species are expected.

The proposed project is a refined and scaled-back version of the original proposal. The revised plan more closely aligns with realistic project goals, provides long term protection of restoration investments, and fits within the unique hydrologic context in lower Grant Creek.

Name of FWP Biologist W. Ladd Knotek Date: 11/13/2025

Please attach to the FFIP application and materials and submit according to listed deadlines.

Allan D. Frey and A'Lisa M. Scott

1655 Frey Lane, Missoula, MT 59808

November 13, 2025

Dear Future Fisheries,

We own approximately 70 acres of land that includes a section of lower Grant Creek. The Frey family has been ranching on this land for nearly 90 years. We are writing to share our support for the Clark Fork Coalition's (CFC) funding request for the stream restoration project which includes our property.

For several years we have inquired to many agencies how to restore our section of Grant Creek. This restoration will allow the fish and wildlife to come back stronger and faster than just fencing. We will work with the Clark Fork Coalition to create a grazing management plan that works with the design and landowner agreement. We will keep the cattle off the riparian/restored areas except for areas for them to water.

We look forward to implementing the best restoration and seeing the creek restored.

We feel this would be a lasting positive impact to the future of Grant Creek and the Clark Fork Rivers fisheries.

Thank you for your consideration.

Sincerely,

Allan D. Frey and A'Lisa M. Scott
1655 Frey Ln, Missoula, MT 59808-1262

November 13, 2025

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

Dear Ms. McGree and Future Fisheries Committee:

Please support the funding request submitted by the Clark Fork Coalition (CFC) for stream restoration on Lower Grant Creek on Dale Frye's property. The Missoula Conservation District (MCD) staff responded to Mr. Frye's request for help in 2021. The CD did not have the capacity or funding to help him fully realize his vision, but we did introduce him to many conservation partners, including our local FWP biologist, Ladd Knotek. Ladd facilitated a partner meeting on-site with CD staff and a board member, potential consultants, and CFC. The proposal you see before you is a direct result of that meeting and of CFC's leadership. It is important to note that MCD, CFC, DNRC, and DEQ have all contributed funds to this project. The request for Future Fisheries Improvement Program support represents only a portion of this partner effort, but it is an essential component to enhance this local spawning area.

To provide the citizens of Montana with more fishing opportunities, the Frye family donated a portion of their property to Montana Fish, Wildlife & Parks for the fishing access complex off Council Way, just downstream of this site. Although the Frye Ranch is now utilizing regenerative grazing practices that are in line with what MCD and other conservation districts advocate to build soils and maintain a sustainable, high-quality supply of locally produced beef in Montana, it is important to note that the Fryes are willing to fence off the stream restoration area from their cattle. Given the work that has been done upstream on Grant Creek, and the evidence that this project will reduce sedimentation through these reaches, this restoration will provide better spawning habitat that will benefit anglers downstream at the Council Way Fishing Access and may even provide additional opportunities in Grant Creek through the Montana Stream Access Law.

The fact that the waters of this shallow stream—currently filled with dark sediment—have not been recorded above 70 degrees Fahrenheit is a testament to the cool spring-fed flows on the property. These cool waters are becoming increasingly rare and are essential for fish in the future, provided they flow through good habitat. Please help us restore Grant Creek by joining other partners to bring this project across the finish line with support from Future Fisheries.

Your investment in this project will have a lasting, positive impact on the Grant Creek watershed and the Clark Fork River fishery. Thank you for your consideration.

Sincerely,

Radley Watkins
Executive Director