FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

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

I. APPLICANT INFORMATION

A. Applicant Name: Big Blackfoot Chapter of Trout Unlimited

Mailing Address: PO Box 1

City: Ovando State: MT Zip: 59854

Telephone: 406-240-4824 E-mail: ryen@montanatu.org

B. Contact Person (if different than applicant): Ryen Neudecker

Address: Same as above

City: State: Zip:

Telephone: E-mail:

C. Landowner and/or Lessee Name (if different than applicant): Mannix Brothers Ranch-Bryan Mannix

Mailing Address: 83 Mannix Ranch Rd

City: Helmville State: MT Zip: 59854

Telephone: 406-793-0812 E-mail: mannixbryan@gmail.com

II. PROJECT INFORMATION

A. Project Name: Nevada Creek Restoration Project Phase 8

River, stream, or lake: Nevada Creek

Location: Township: 13N Range: 10W Section: 31

Latitude: Longitude: *Within project (decimal degrees)*

County: Powell

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

The purpose of this project is to build upon the previous seven phases of Nevada Creek restoration and improve trout habitat by restoring channel stability, aquatic habitat function, fish passage and riparian health while working in collaboration with several project partners and a private landowner who is committed to conservation in the Blackfoot River watershed.

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

The proposed work on Nevada Creek is a continuation of the ongoing efforts in the drainage that have a goal of improving fish passage, instream, riparian, and upland habitat within a working landscape through strong partnerships, following a science-based approach. To date the partnership has restored close to ten-miles of Nevada Creek across seven different phases and Future Fisheries has been involved since the project inception in 2010. With this proposal, we are seeking funding to implement a restoration project across ~8,400 feet of Nevada Creek on the Mannix Brothers Ranch. This project will benefit westslope cutthroat trout (a Montana species of special concern), as well as rainbow trout and brown trout. The project will also improve fish passage and incorporate a grazing management system.

Restoring native westslope cutthroat trout habitat on the largest tributary to the middle Blackfoot River will be accomplished by addressing a range of limiting factors identified in Blackfoot Watershed Restoration Action and Sub Basin Plans, including fish habitat impairments (including degraded spawning and rearing habitat), disconnected floodplains, chronic bank erosion, lack of functional riparian habitat and fish passage restrictions. The proposed project is expected to increase instream habitat capacity and production of trout, similar to the documented benefits of previous restoration projects in Nevada Creek. The project will improve watershed conditions and fisheries resources in Nevada Creek, while also contributing to downstream water quality improvements and increased trout recruitment in the Blackfoot River. The proposed project will increase water storage from floodplain connection and wetland restoration, water temperature decreases, and the rejuvenation of a healthy, self-sustaining, native riparian ecosystem. Restoring proper channel patterns and dimensions will reduce water temperatures during hot and dry periods and facilitate hyporheic flow exchanges. The project will dramatically improve fish passage giving cutthroat access to the upper reaches of Nevada Creek.

Project specifics range from upgrading irrigation diversions, side channel and meander reactivation, bank treatments to address eroding banks, and floodplain grading. An estimated 256 tons of sediment are eroding from stream banks through this project reach annually.

Project objectives include:

- Improve instream aquatic habitat conditions for trout by lowering channel width to depth rations, increasing pool frequency, overhead cover, channel margin complexity and the distribution of riffle, run, pool and glide channel habitat units.
- Decrease surface water temperatures by reducing channel width to depth ratios, increasing cover and share and enhancing hyportheic flow exchange between the floodplain, channel and riverine wetlands.
- Reduce sediment supply by restoring streambanks with coarse wood and vegetation.
- Restore fish passage by upgrading existing irrigation diversions.
- Implement a grazing management plan to protect sensitive floodplain and riparian areas
- Utilize natural channel design techniques and avoid the use of hardened, non-deformable structures.

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

Historic channel manipulations and streamside vegetation removal have contributed to the bank erosion issues. The project design includes both active and passive techniques to rectify the specific issues and their causes. The existing irrigation diversions create partial fish passage barriers.

E. Length of stream or size of lake that will be treated (project extent): 8,400 ft

Length/size of impact, if larger than project extent (e.g., stream miles opened): 10 miles

F. Project Budget Summary:

Grant Request (Dollars):	**$**	**113,700.00**
Matching Dollars:	**$**	**324,034.49**
Matching In-Kind Services:*	**$**	**72,125.00**

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

Other Contributions (not used as match)	**$**	
Total Project Cost:	**$**	**514,859.49**

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
- [ ] 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:

Project partners include: MTFWP, USFWS, USFS & BLM

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.*

The landowner will sign a 20-year maintenance commitment agreement. The entire project is on private land.

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, there will be a grazing plan as part of the project. For now, a riparian exclusion is planned with a grazing management plan under development that incorporates healthy utilization of surrounding upland and riparian habitat.

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 monitoring plan will include pre- and post-project data including: photo points, as-built channel data, revegetation survival surveys, bank erosion hazard index data and FWP surveyed the project reach to assess the fisheries population in 2022. We will assess the project post-project to ensure that our project objectives are being met and if they are not, we will follow up appropriately.

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

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

Westslope cutthroat trout, bull trout, brown trout, rainbow trout.

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

The proposed reach along Nevada Creek lacks high-quality habitat. By addressing bank erosion issues, improper channel dimensions, lack of floodplain connection and riparian function we anticipate a dramatic improvement in instream and riparian habitat conditions. This will increase habitat capacity for trout, which is expected to lead to increased downstream recruitment to sections of lower Nevada Creek and the Blackfoot River. An important piece of this project involves upgrading existing irrigation diversions which is important to restore fish passage.

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

Yes, Nevada Creek is a very productive stream and fisheries monitoring data completed on the reach of Nevada Creek restored in 2010, has shown an increase in trout abundance. Specifically, the average abundance of age-1 and older trout in the Phase 1 section exhibited a two-fold increase following restoration actions. See data chart included within this application. When Nevada Creek was initially surveyed in the early 1990's one brown trout was found in seven miles of stream. Trout populations in the restored reaches are now close to 140 trout per mile.

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: Public access is available. Landowners request permission is asked prior to accessing their property. Due to the monitoring data of the phase 1 project, we have seen a significant increase in the number of trout and thus we anticipate adding close to two miles of fishable habitat on Nevada Creek. The project is also expected to increase trout recruitment to publicly-accessible sections of lower Nevada Creek and the Blackfoot River. A recent radio telemetry study identified trout migration between the upstream project section and the frequently-fished section directly below the reservoir. Increased trout production in this phase will contribute to improved fishing opportunities within adjacent reaches that are more easily accessible by the public.

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

This project involves the continuation of the Blackfoot River Restoration program and the restoration of an important tributary. Public benefits include: 1) expanding suitable habitat conditions for pure westslope cutthroat trout, 2) improved habitat for rainbow and brown trout,3) improved water quality conditions in Nevada Creek and the Blackfoot River, and 4) increased trout recruitment. The project will also support local economies contributing to the cold-water fishery of the Blackfoot River and will involve local contractors and consultants.

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

No.

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: Ryer Nendecker Date: 11/13/2024

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	77	hrs	$155.00	$ 11,935.00		11,935.00		$ 11,935.00
Design	139	hrs	$155.00	$ 21,545.00		21,545.00		$ 21,545.00
Engineering	106	hrs	$155.00	$ 16,430.00		16,430.00		$ 16,430.00
Permitting	58	hrs	$48.00	$ 2,784.00		2,784.00		$ 2,784.00
Oversight	169	hrs	$165.00	$ 27,885.00		27,885.00		$ 27,885.00
Project Mgmt	159	hrs	$48.00	$ 7,632.00		7,632.00		$ 7,632.00
			Sub-Total	$ 88,211.00	$ -	$ 88,211.00	$ -	$ 88,211.00
Travel								
Mileage	2347	miles	$0.67	$ 1,572.49		1,572.49		$ 1,572.49
Per diem				$ -				$ -
			Sub-Total	$ 1,572.49		$ 1,572.49	$ -	$ 1,572.49
Construction Materials								
Pulp Wood	17	loads	$1,200.00	$ 20,400.00		20,400.00		$ 20,400.00
Sods	14,000	sq ft	$0.80	$ 11,200.00		11,200.00		$ 11,200.00
Gravel	2235	CY	$15.00	$ 33,525.00		33,525.00		$ 33,525.00
Fill	1200	CY	$5.00	$ 6,000.00		6,000.00		$ 6,000.00
Transplants	100	Ea	$100.00	$ 10,000.00		10,000.00		$ 10,000.00
Willows	9254	Ea	$1.50	$ 13,881.00	3,000.00	10,881.00		$ 13,881.00
			Sub-Total	$ 95,006.00	$ 3,000.00	$ 92,006.00	$ -	$ 95,006.00
Equipment, Labor, and Mobilization								
Develop access roads/staging areas	1	LS	$6,000.00	$ 6,000.00		6,000.00		$ 6,000.00
Furnish and install sod	14,000	Sq Ft	$0.75	$ 10,500.00	3,000.00	7,500.00		$ 10,500.00
Construct Diversion 1	182	LF	$180.00	$ 32,760.00	12,000.00	20,760.00		$ 32,760.00
Construct Diversion 2 & 3	2	LS	$5,000.00	$ 10,000.00	3,000.00	7,000.00		$ 10,000.00
Process wood onsite	1	EA	$15,000.00	$ 15,000.00	3,500.00	11,500.00		$ 15,000.00
Furnish streambed/streambank fill	2235	CY	$6.00	$ 13,410.00	4,000.00	9,410.00		$ 13,410.00

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Construct VWM Type 2 bank treatments	1730	LF	$40.00	$ 69,200.00	24,000.00	45,200.00		$ 69,200.00
Install large wood structures	6	EA	$1,500.00	$ 9,000.00	4,500.00	4,500.00		$ 9,000.00
Transplant salvaged vegetation	100	Each	$100.00	$ 10,000.00	1,000.00	9,000.00		$ 10,000.00
Construct channel streambed (Reach 1)	1800	LF	$28.00	$ 50,400.00	23,000.00	27,400.00		$ 50,400.00
Shape Channel Reach 2	2700	LF	$27.00	$ 72,900.00	32,000.00	40,900.00		$ 72,900.00
Install willow brush trenches	200	LF	$5.00	$ 1,000.00	200.00	800.00		$ 1,000.00
Livestock crossing/water gap	1	EA	$1,500.00	$ 1,500.00	500.00	1,000.00		$ 1,500.00
Load, haul and place fill in repos and ditches	2100	CY	$4.00	$ 8,400.00		8,400.00		$ 8,400.00
Mobilization & GPS Set Up	1	LS	$20,000.00	$ 20,000.00	5,000.00	15,000.00		$ 20,000.00
			Sub-Total	$ 330,070.00	$ 110,700.00	$ 214,370.00	$ -	$ 330,070.00
			OVERALL TOTALS	$ 514,859.49	$ 113,700.00	$ 396,159.49	$ -	$ 514,859.49

OTHER REQUIREMENTS:

**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)
USFWS Partners Program	$ -	$ 65,000.00	$ 65,000.00	Yes

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

USFS Helena National Forest	$ -	$ 110,000.00	$ 110,000.00	Yes
BLM	$ -	$ 115,000.00	$ 115,000.00	Yes
BBCTU	$ -	$ 34,034.49	$ 34,034.49	Yes
Landowner	$ 72,125.00	$ -	$ 72,125.00	Yes
	$ -	$ -	$ -	
TOTALS	$ 72,125.00	$ 324,034.49	$ 396,159.49	

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	$ -	$ -	$ -	

Photos 1 & 2: Existing Issues on Nevada Creek Phase 8

MONTANA FISH, WILDLIFE & PARKS

Future Fisheries Improvement Program

Appendix: FWP Statement

Project Title: **Nevada Creek Phase 8**

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

Nevada Creek supports a mixed fishery of rainbow trout, westslope cutthroat trout, and brown trout. It also provides foraging and overwintering habitat for bull trout in the lower reaches. Nevada Creek provides ample angling opportunities for the public. This project is expected to complement the success of previous Nevada Creek restoration projects and provide public benefits in the form of increased trout recruitment to publicly accessible stream reaches. Moreover, this project will contribute to FWP's native species conservation goals by expanding the distribution and abundance of westslope cutthroat trout.

Electrofishing surveys in the project vicinity indicated a near-absence of trout, suggesting instream habitat issues such as passage impediments, lack of suitable spawning habitat, and poor water quality are responsible for the lack of trout. Trout are present at high densities upstream of the project section and present at moderate densities downstream of the project section. Two irrigation diversions within the project section limit fish passage and alter stream form and function. Streambank erosion and excessive instream sediment are common issues throughout the project section. The proposed restoration treatments will help address these issues. Phase 8 will commence at the downstream terminus of the recently completed Phase 7 project. The FFIP's continued investment in Nevada Creek will contribute to restoring the quality of aquatic resources in this large tributary while improving conditions in the Blackfoot River. The restoration efforts in Nevada Creek are consistent with FWP's fisheries management objectives for the drainage.

Name of FWP Biologist Patrick Uthe Date: 11/5/24

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

NEVADA CREEK PHASE 8 RESTORATION PROJECT
PRELIMINARY DESIGN

PROJECT PARTNERS

BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED
P.O. BOX 1
OVANDO, MONTANA 59854

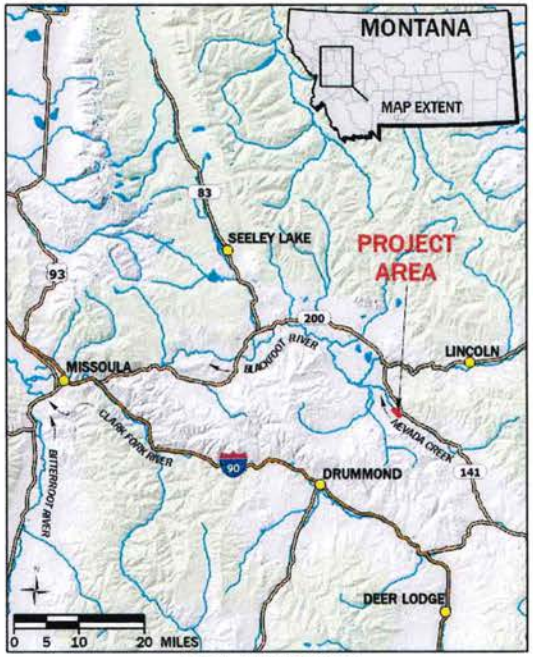
MONTANA FISH, WILDLIFE & PARKS
3201 SPURGIN ROAD
MISSOULA, MONTANA 59804

US FISH AND WILDLIFE SERVICE
P.O. BOX 66
196 LOWER LAKE SIDE LANE
OVANDO, MONTANA 59854

MANNIX FAMILY RANCH

DRAWING INDEX

NEVADA CREEK PHASE 8 VICINITY MAP



LEGAL DESCRIPTION:
SE1/4, S31, T13 N, R10 W
POWELL COUNTY, MONTANA

PROJECT DESCRIPTION

BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED (BBCTU), IN COOPERATION WITH MONTANA FISH, WILDLIFE & PARKS (MFWP) AND THE US FISH AND WILDLIFE SERVICE (USFWS), RETAINED RIVER DESIGN GROUP, INC. TO DEVELOP A RESTORATION PLAN FOR A 8,500-FOOT REACH OF NEVADA CREEK NEAR HELVMILLE, MONTANA, A THIRD ORDER TRIBUTARY TO THE MIDDLE BLACKFOOT RIVER. LOCATED APPROXIMATELY 55 MILES EAST OF MISSOULA, NEVADA CREEK SUPPORTS POPULATIONS OF WESTSLOPE CUTTHROAT TROUT, RAINBOW TROUT, BROWN TROUT AND OTHER FISH SPECIES. NEVADA CREEK HAS BEEN CLASSIFIED AS AN IMPAIRED WATERBODY BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY. THE STREAM IS CONSIDERED NON-SUPPORTING OF AQUATIC LIFE DUE TO FLOW REGIME MODIFICATIONS, TOTAL NITROGEN, TOTAL PHOSPHORUS, PHYSICAL SUBSTRATE HABITAT ALTERATIONS, SEDIMENTATION/SILTATION, TEMPERATURE AND TOTAL KJEHLDAHL NITROGEN (MDEQ 2008). SOURCES OF WATER QUALITY IMPAIRMENT INCLUDE AGRICULTURE, UNKNOWN SOURCES, AND STREAMBANK MODIFICATIONS.

SEVEN PHASES OF RESTORATION HAVE BEEN IMPLEMENTED ON NEVADA CREEK RESULTING IN A NET SEDIMENT REDUCTION OF ~3,600 TONS PER YEAR (2012, 2017, 2019, 2020, 2022, 2023 AND 2024). THESE SEVEN PHASES INVOLVED RECONSTRUCTING THE APPROPRIATE DIMENSION, PATTERN AND PROFILE, ENHANCING AQUATIC HABITAT, RESTORING ERODING STREAMBANKS, AND RECONNECTING FORMER FLOODPLAIN SURFACES. IN THE PHASE 8 PROJECT AREA, NEVADA CREEK EXHIBITS BOTH MULTI-THREAD (ANASTOMOSED) AND SINGLE-THREAD CHANNEL FORMS. AGRICULTURAL PRACTICES AND VEGETATION REMOVAL HAVE COMPROMISED BANK STABILITY RESULTING IN MODERATE SEDIMENT LOADING WITH AN ESTIMATED ANNUAL SEDIMENT YIELD OF 256 TONS. NEVADA CREEK WAS MECHANICALLY STRAIGHTENED RESULTING IN A MAJOR CHANNEL AVULSION THAT RESULTED IN THE ABANDONMENT OF APPROXIMATELY 3,100 FEET OF CHANNEL. RESTORATION STRATEGIES WILL REACTIVATE THE HISTORICAL MEANDER PATTERN BY SLIGHTLY RAISING THE CHANNEL BED PROFILE IN REACH 1 TO RECONNECT FLOODPLAIN SURFACES. STREAMBANK RESTORATION TECHNIQUES WILL INCREASE CHANNEL MARGIN ROUGHNESS AND PROVIDE CONDITIONS SUITABLE FOR ESTABLISHING AND SUSTAINING WOODY RIPARIAN VEGETATION. THESE COMBINED STRATEGIES ARE PROJECTED TO: 1) REDUCE SEDIMENT LOADING TO NEVADA CREEK BY SEVERAL HUNDRED TONS PER YEAR; 2) INCREASE FLOODPLAIN CONNECTION; AND 3) SET THE STAGE FOR RECOVERY OF THE RIPARIAN ZONE AND AQUATIC HABITAT CONDITIONS BY CORRECTING CHANNEL DIMENSIONS IN SELECT LOCATIONS OF THE PROJECT AREA. THESE RESTORATION ACTIONS WILL BE COMPLEMENTED BY A GRAZING MANAGEMENT PLAN THAT WILL INVOLVE FENCING EXCLOSURES, ROTATIONAL GRAZING PRACTICES, AND HARDENED WATER GAPS TO PROTECT SENSITIVE RIPARIAN FLOODPLAIN ENVIRONMENTS.

ADDITIONALLY, THREE IRRIGATION DIVERSION STRUCTURES WILL BE UPGRADED TO MINIMIZE BACKWATER DEPOSITION OF SEDIMENT AND IMPROVE FISH PASSAGE FOR FOCAL FISH SPECIES.

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 NOTED IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED IN 2023 AND 2024 COMBINED WITH LIDAR DATA. LIDAR DATA WAS COLLECTED QUANTUM SPATIAL (QSI) IN 2020. ALL LIDAR DATA WAS COORDINATED 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. ALL EXCAVATORS AND BULLDOZERS SHALL BE EQUIPPED WITH MACHINE GRADE GPS ((L1/L2/GLONASS)). CONSTRUCTION AREAS WILL BE STAKED OUT PRIOR TO CONSTRUCTION USING SURVEY GRADE GPS (L1/L2/GLONASS).
12. ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
13. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
14. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

REUSE OF DRAWINGS

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 10-YEAR RECURRENCE INTERVAL FLOOD. HEC-RAS, A ONE-DIMENSIONAL RIVER ANALYSIS MODEL WAS USED TO COMPLETE HYDRAULIC MODELING AND EVALUATE WATER SURFACE ELEVATIONS, CHANNEL AND OVERBANK SHEAR STRESSES, AND VELOCITIES FOR A RANGE OF FLOWS, INCLUDING BANKFULL DISCHARGE, THE 10-YEAR DESIGN STABILITY FLOW, AND HIGHER RETURN INTERVAL DISCHARGES INCLUDING THE 100-YEAR FLOW.

RDG NOW PART OF SWCA
236 Wisconsin Avenue Wheelish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.753.2503

COVER PAGE AND NOTES

NEVADA CREEK PHASE 8
POWELL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
1.0
Drawing 1 of 15

M:\Projects\2024\RDG-24-003 Nevada Creek Phase 8\Dwg\2024-10-18 Ph1 8 Plan Set.dwg Nov 05,2024

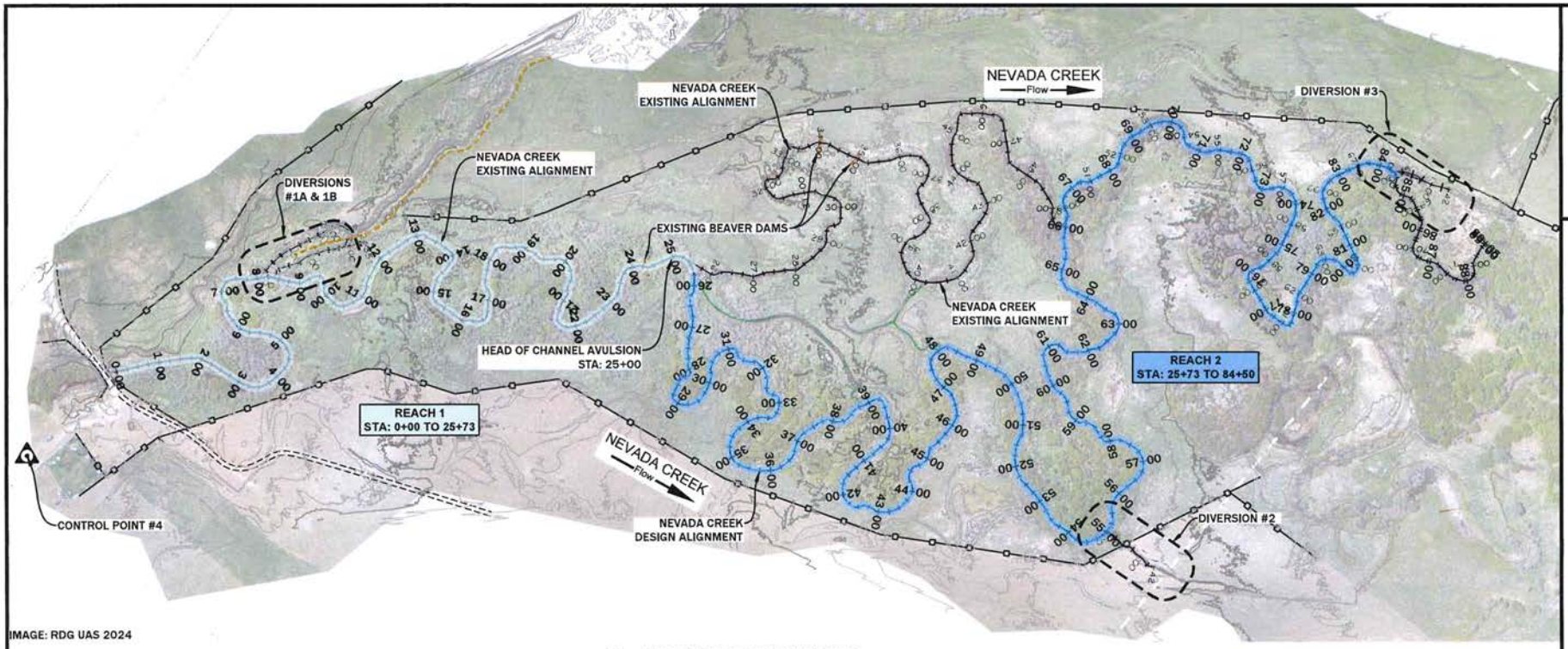


IMAGE: RDG UAS 2024

1 EXISTING CONDITIONS PLAN VIEW 1" = 240'

EXISTING CONDITIONS

THE PHASE 8 RESTORATION PROJECT AREA IS IN THE MIDDLE NEVADA CREEK WATERSHED DOWNSTREAM OF NEVADA CREEK RESERVOIR, IN POWELL COUNTY, MONTANA. THE PROJECT AREA IS WITHIN A REACH OF NEVADA CREEK THAT IS CONSIDERED NON-SUPPORTING OF AQUATIC LIFE DUE TO SEDIMENT AND HABITAT RELATED IMPAIRMENTS. WATER USE CLASS IS B-1, WHICH INCLUDE WATERS CLASSIFIED SUITABLE FOR DRINKING, CULINARY AND FOOD PROCESSING PURPOSES; BATHING, SWIMMING AND RECREATION; GROWTH AND PROPAGATION OF SALMONID FISHES AND ASSOCIATED AQUATIC LIFE; WATERFOWL AND FURBEARERS; AND AGRICULTURAL AND INDUSTRIAL WATER SUPPLY. PROBABLE CAUSES OF IMPAIRMENT INCLUDE STREAMSIDE ALTERATIONS, TOTAL NITROGEN, TOTAL PHOSPHORUS, PHYSICAL SUBSTRATE HABITAT ALTERATIONS, SEDIMENT, AND TEMPERATURE. PROBABLY SOURCES INCLUDE GRAZING IN RIPARIAN AREAS, AGRICULTURE, AND STREAMBANK MODIFICATIONS/DESTABILIZATION. APPROXIMATELY 1,800 OF STREAMBANK IN THE PROJECT AREA ARE CHARACTERIZED BY MODERATE TO HIGH BANK ERODIBILITY HAZARD RATINGS, CONTRIBUTING OVER 76 TONS OF SEDIMENT ANNUALLY TO THE SYSTEM

WITHIN THE PHASE 7 PROJECT AREA, NEVADA CREEK EXHIBITS VARIOUS CHANNEL FORMS. SEGMENTS OF THE REACH ARE CHARACTERIZED BY ANASTOMOSED CHANNEL FORMS (I.E. MULTIPLE THREAD). THESE SEGMENTS ARE CHARACTERIZED BY EXTENSIVE BEAVER DAMS, HIGH FLOODPLAIN CONNECTIVITY, AND A DIVERSE RIPARIAN UNDERSTORY CONSISTING OF RIPARIAN SHRUBS, TREES AND EMERGENT WETLAND VEGETATION. WHERE THE CHANNEL IMPINGES ON EXISTING AGRICULTURAL FIELDS, TERRACE EROSION IS FREQUENT AND CHANNEL ENTRENCHMENT IS PRONOUNCED. RELIC MEANDERS ARE COMMON ON THE LANDSCAPE DUE TO CHANNEL AVULSIONS EXACERBATED BY VEGETATION REMOVAL AND CHUTE CUT-OFF DEVELOPMENT. THE CAUSES OF THE DEGRADED SYSTEM IS ASSOCIATED WITH FLOOD PULSING FROM NEVADA CREEK RESERVOIR COMPOUNDED BY PREVIOUS HEAVY GRAZING PRESSURE THAT CONVERTED A WOODY RIPARIAN VEGETATION COMMUNITY TO A PREDOMINANTLY GRASS/FORB COMMUNITY. STREAMBANKS ARE SUSCEPTIBLE TO EROSION BY MASS FAILURE, FLUVIAL ENTRAINMENT, FREEZE-THAW, DRY RAVEL, AND OTHER EROSIONAL PROCESSES. BED MATERIALS ARE PREDOMINANTLY GRAVEL AND SAND WITH A HIGH PERCENTAGE OF SILTS.

THE CONSTRAINTS AND LIMITING FACTORS IDENTIFIED DURING THE GEOMORPHIC INVESTIGATION INCLUDE:

- HIGH CHANNEL ENTRENCHMENT AND DISCONNECTED (FORMER) FLOODPLAIN SURFACES.
- MODERATE TO VERY HIGH BANK ERODIBILITY CONDITIONS RESULTING IN SEDIMENT LOADING TO THE SYSTEM.
- LACK OF WOODY RIPARIAN SHRUBS, STREAM COVER AND SHADE IN AREAS WHERE THE CHANNEL INTERACTS WITH ADJACENT AGRICULTURAL PASTURES.
- SIMPLIFIED AQUATIC HABITAT CONDITIONS IN AREAS WHERE THE CHANNEL INTERACTS WITH ADJACENT AGRICULTURAL PASTURES.

PROJECT DATUM	
THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:	
HORIZONTAL PROJECTION:	MONTANA STATE PLANE FIPS 2500
UNITS:	US SURVEY FEET
HORIZONTAL DATUM:	NAD83 2011
VERTICAL DATUM:	NAVD88 (GEOID 12B)
TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED BY RDG IN AUGUST AND SEPTEMBER 2023 AND APRIL 2024 COMBINED WITH LIDAR DATA. LIDAR DATA WAS CREATED IN 2020 AND COMBINED BY RDG.	

DRAWING LEGEND	
SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING DITCH
	EXISTING BEAVER DAM
	SURVEY CONTROL POINT

CONTROL POINTS					
	POINT NUMBER	NORTHING	EASTING	POINT ELEVATION	RAW DESCRIPTION
	4	968369.6470'	1110471.6770'	4330.863'	5/8" REBAR WITH A 2" ALUMINUM CAP MARKED "RDG"

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236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
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EXISTING CONDITIONS AND SURVEY CONTROL

NEVADA CREEK PHASE 8
POWELL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
*	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER RDG-24-003

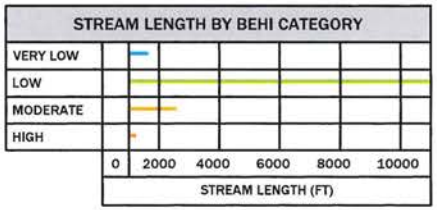
DRAWING NUMBER 2.0

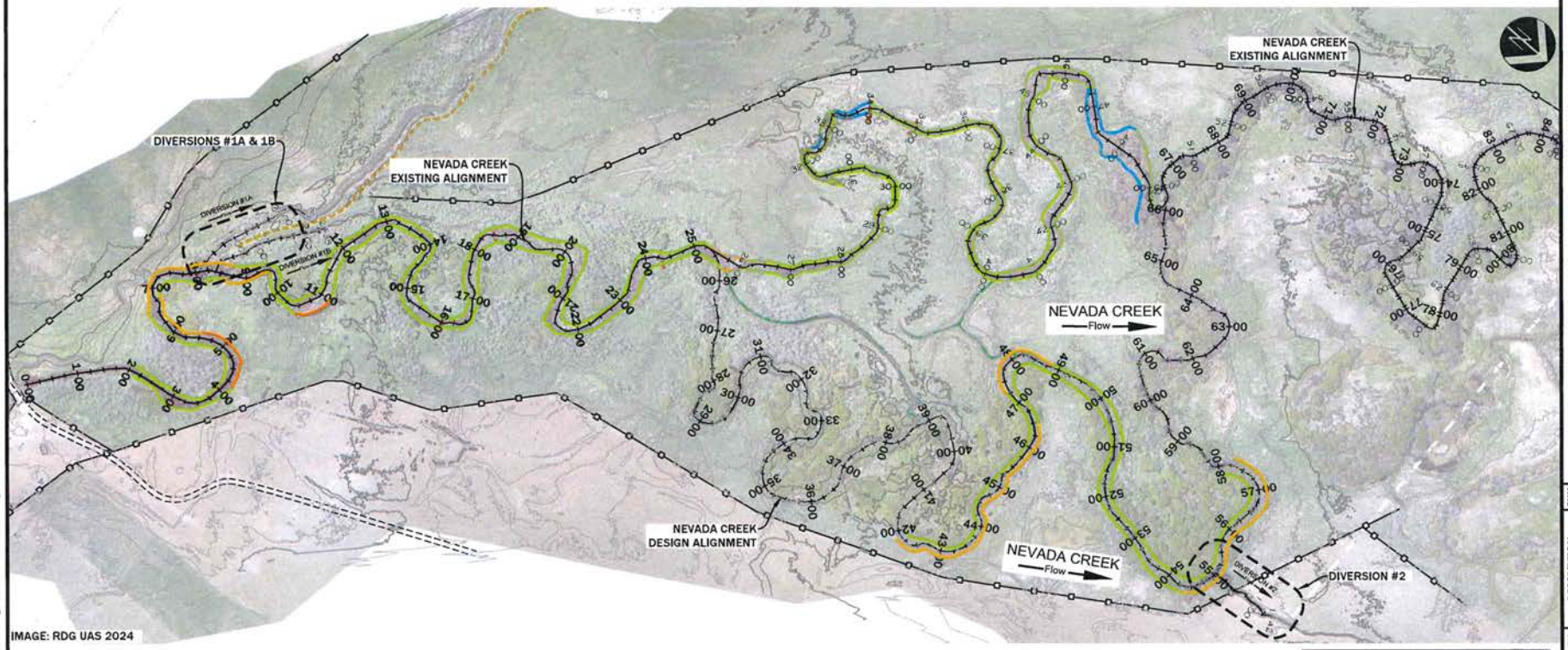
Drawing 2 of 15

M:\Projects 2024\RDG-24-003 Nevada Creek Phase 8\Dwg\2024-10-18 PH 8 Plan Set.dwg Nov 05,2024

NEVADA CREEK BEHI ASSESSMENT PHASE 8 PRE-RESTORATION (2024)

SYMBOL	BEHI RATING	LENGTH (FT)	MIGRATION RATE (FT/YR)	BANK HEIGHT (FT)	DENSITY (LBS/FT^3)	SEDIMENT YIELD (TONS/YR)
	HIGH	231	0.31	5.5	100	20
	MODERATE	1568	0.23	3.1	100	56
	LOW	10,328	0.17	2.2	100	193
	VERY LOW	656	0.10	2.0	100	7
TOTAL		12,552				256





1 **BANK EROSION HAZARD INDEX**
PLAN VIEW
1" = 200'

DRAWING LEGEND	
SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING DITCH
	EXISTING BEAVER DAM

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BANK EROSION HAZARD INDEX ASSESSMENT

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
2.1

Drawing 3 of 15

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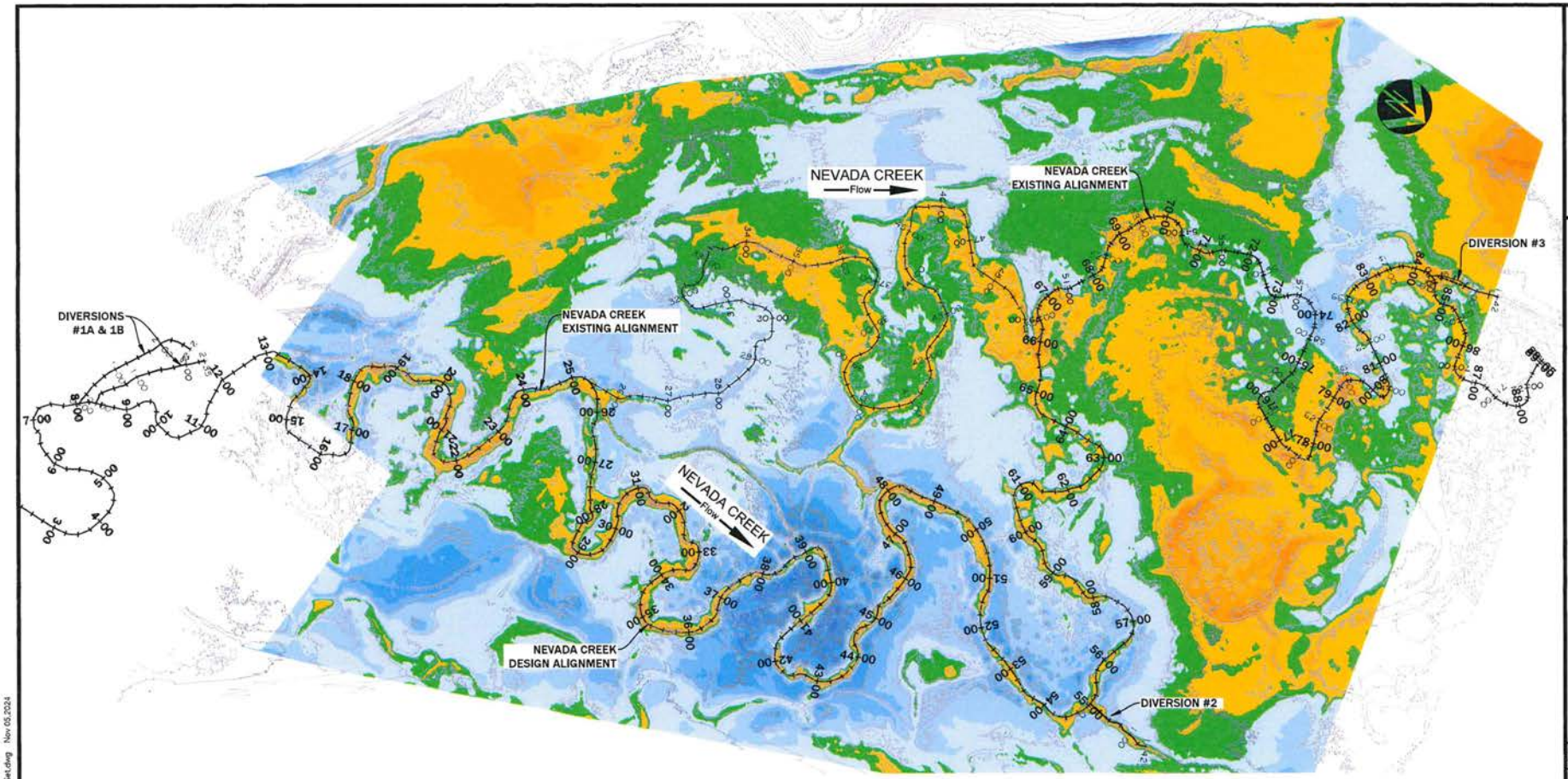

1 **BANKFULL RELATIVE ELEVATION MAP**
PLAN VIEW
1" = 200'

< -9.0' -8.0' -7.0' -6.0' -5.0' -4.0' -3.0' -2.5' -2.0' -1.5' -1.0' -0.3' 0.3' 1.0' 1.5' 2.0' 2.5 3.0' 4.0' 5.0' 6.0' 7.0' 8.0' 9.0' >
CUT FILL
EXISTING GROUND COMPARED TO BANKFULL SURFACE

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BANKFULL RELATIVE ELEVATION MAP
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
3.0
Drawing 4 of 15

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TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	30	10-12 IN	25 FT	YES
CATEGORY 2 WOOD	3,590	3-6 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	7,030	< 3 IN	10-12 FT	OPTIONAL
WILLOW CUTTINGS	9,254	0.25-1.0 IN	8 FT	NO

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

TOTAL ROCK QUANTITIES

ITEM	QUANTITY (EA)	DIAMETER (IN)
CATEGORY 1 ROCK	1375	6 - 8

ITEM	QUANTITY (CY)	GRADATION		
		SIZE (IN)	PERCENT PASSING	REPRESENTANTIVE CLASS
STREAMBED/STREAMBANK FILL	860	6	95	D100
		4	90-95	D84
		2	85-90	D50
		1	65-85	D35
		0.6	50-65	D16
		0.08	30-50	

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
EXISTING CHANNEL FILL	540
DITCH FILLS	275
DIVERSION FILLS	80
RIFFLE FILL	305
TOTAL FILL	1,200
TOTAL CUT	70
NET FILL	1,130

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

LARGE WOOD STRUCTURE QUANTITIES

ITEM	QUANTITY (EA)
LARGE WOOD STRUCTURES	6 (120 LF)
CATEGORY 1 WOOD	30
CATEGORY 2 WOOD	150
CATEGORY 3 WOOD	150
WILLOW CUTTINGS	24

VEGETATED WOOD MATRIX QUANTITIES

ITEM	QUANTITY
VEGETATED WOOD MATRIX TYPE 2	1,730 LF
CATEGORY 2 WOOD	3,440 EA
CATEGORY 3 WOOD	6,880 EA
WILLOW CUTTINGS	8,600 EA
STREAMBANK FILL	345 CY

CONSTRUCTED STREAMBED

ITEM	QUANTITY
CONSTRUCTED CHANNEL	1,720 LF
CATEGORY 1 ROCK	1,375 EA
STREAMBED FILL	516 CY

FLOODPLAIN ROUGHNESS

ITEM	QUANTITY
ACRES OF FLOODPLAIN ROUGHNESS	1.26
CATEGORY 2 WOOD	44
CATEGORY 3 WOOD	315
WILLOW CUTTINGS	630

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PROJECT MATERIALS AND QUANTITIES

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
*	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
3.1

Drawing 5 of 15

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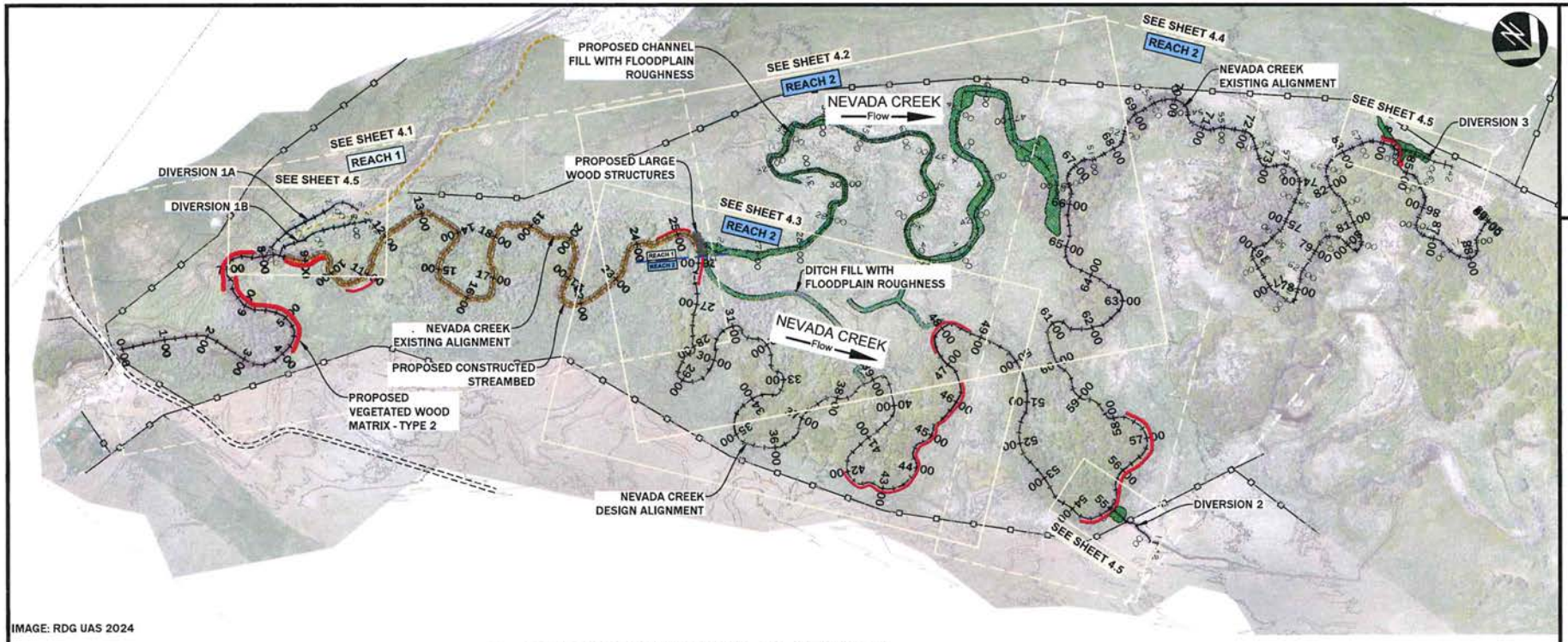

IMAGE: RDG UAS 2024

1 DESIGN OVERVIEW AND SHEET INDEX
PLAN VIEW

1" = 240'

RESTORATION TREATMENTS

THE RESTORATION FOCUSES ON RESTORING ERODING HIGH TERRACES AND STREAMBANKS, RE-ESTABLISHING APPROPRIATE CHANNEL CROSS-SECTION, PLAN FORM AND LONGITUDINAL PROFILE DIMENSIONS IN REACH 1, AND REACTIVATING APPROXIMATELY 3,100 OF RELIC CHANNELS IN REACH 2. THE FOLLOWING GUIDELINES WERE APPLIED TO DEVELOP THE DESIGN:

- TREAT MODERATELY TO HIGHLY ERODIBLE STREAMBANKS AND TERRACES IN REACH 1 WITH VEGETATION WOOD MATRIX STRUCTURES. INCORPORATE LARGE WOOD STRUCTURES TO ENCOURAGE POOL HABITAT DEVELOPMENT. LARGE WOOD STRUCTURES WILL BE SUBMERGED BELOW THE BASE FLOW WATER SURFACE ELEVATION.
- RAISE THE CHANNEL BED PROFILE IN REACH TO DAYLIGHT THE BED PROFILE TO ABANDONED MEANDERS IN REACH 2 OF THE PROJECT AREA. SHAPE THE CHANNEL WITH RIFFLE, RUN, POOL AND GLIDE HABITAT FEATURES TO PROVIDE ENERGY DISSIPATION AND INCREASE AQUATIC HABITAT COMPLEXITY FOR FOCAL FISH SPECIES AND AQUATIC BIOTA.
- FILL THE EXISTING AVULSION CHANNEL TO FLOODPLAIN ELEVATION IN REACH 2.
- DEVELOP HARDENED LIVESTOCK AND VEHICLE/EQUIPMENT CROSSINGS TO CONCENTRATE USE AND MINIMIZE IMPACTS TO NEVADA CREEK AND FLOODPLAIN ENVIRONMENT.
- IMPLEMENT ROTATIONAL GRAZING MANAGEMENT STRATEGIES IN CONCERT WITH LANDOWNER AND PROJECT STAKEHOLDERS.

RESTORATION OBJECTIVES

THE FOLLOWING OBJECTIVES WERE DEVELOPED BY PROJECT PARTNERS:

- 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 CHANNEL HABITAT UNITS.
- DECREASE SURFACE WATER TEMPERATURE BY REDUCING CHANNEL WIDTH-TO-DEPTH RATIOS, WHERE FEASIBLE, INCREASING VEGETATION COVER AND SHADE, AND ENHANCING HYPORHEIC FLOW EXCHANGE BETWEEN THE FLOODPLAIN, CHANNEL AND RIVERINE WETLANDS.
- REDUCE SEDIMENT SUPPLY BY RESTORING STREAMBANKS WITH COARSE WOOD AND VEGETATION.
- 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 AND AVOID THE USE OF HARDENED, NON-DEFORMABLE STRUCTURES.

DRAWING LEGEND

SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	CONSTRUCTED STREAMBED
	VEGETATED WOOD MATRIX - TYPE 2
	LARGE WOOD STRUCTURE

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DESIGN OVERVIEW AND SHEET INDEX

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
4.0

Drawing 6 of 15

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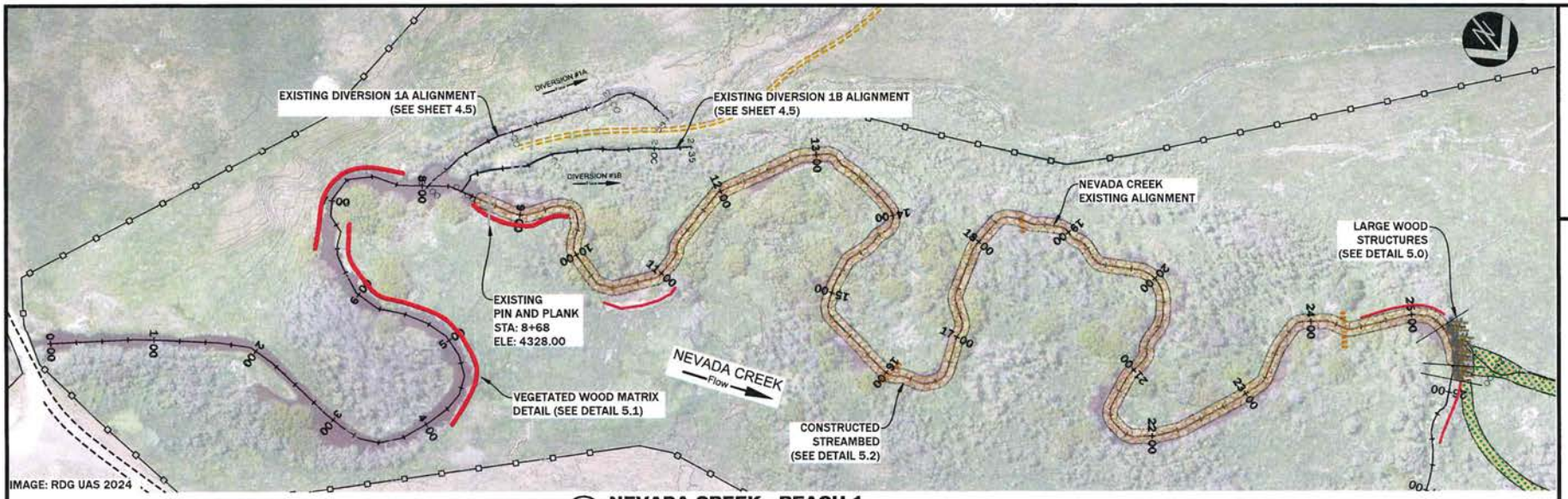
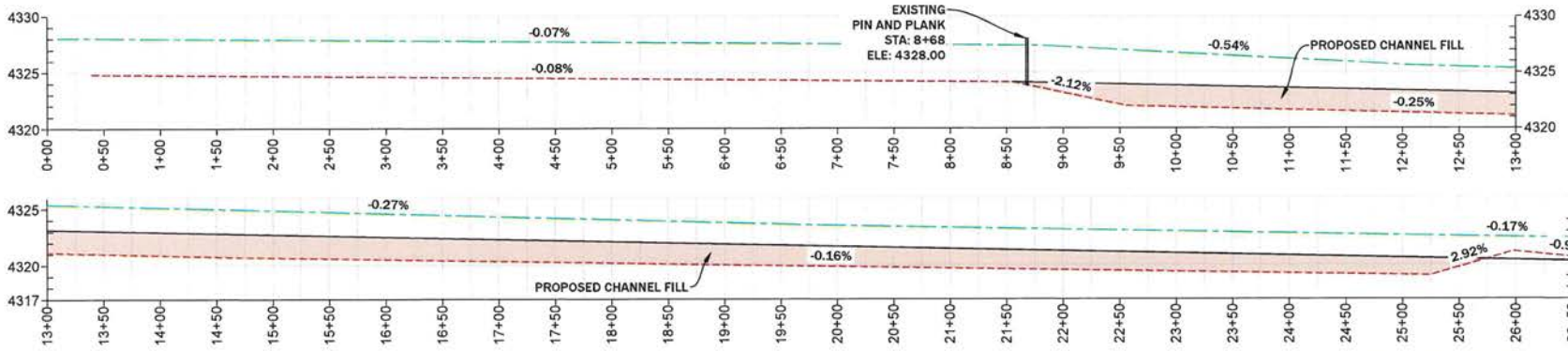


1 NEVADA CREEK - REACH 1
PLAN VIEW STA: 0+00 TO 25+73 1" = 100'



2 NEVADA CREEK - REACH 1
PROFILE VIEWS STA: 0+00 TO 25+73 H: 1" = 100' V: 1" =10'

PROFILE LEGEND
- BANKFULL
- THALWEG (EG)
- THALWEG (FG)

DRAWING LEGEND

SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	CONSTRUCTED STREAMBED
	VEGETATED WOOD MATRIX - TYPE 2
	LARGE WOOD STRUCTURE

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DESIGN PLAN AND PROFILE - REACH 1
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
4.1
Drawing 7 of 15

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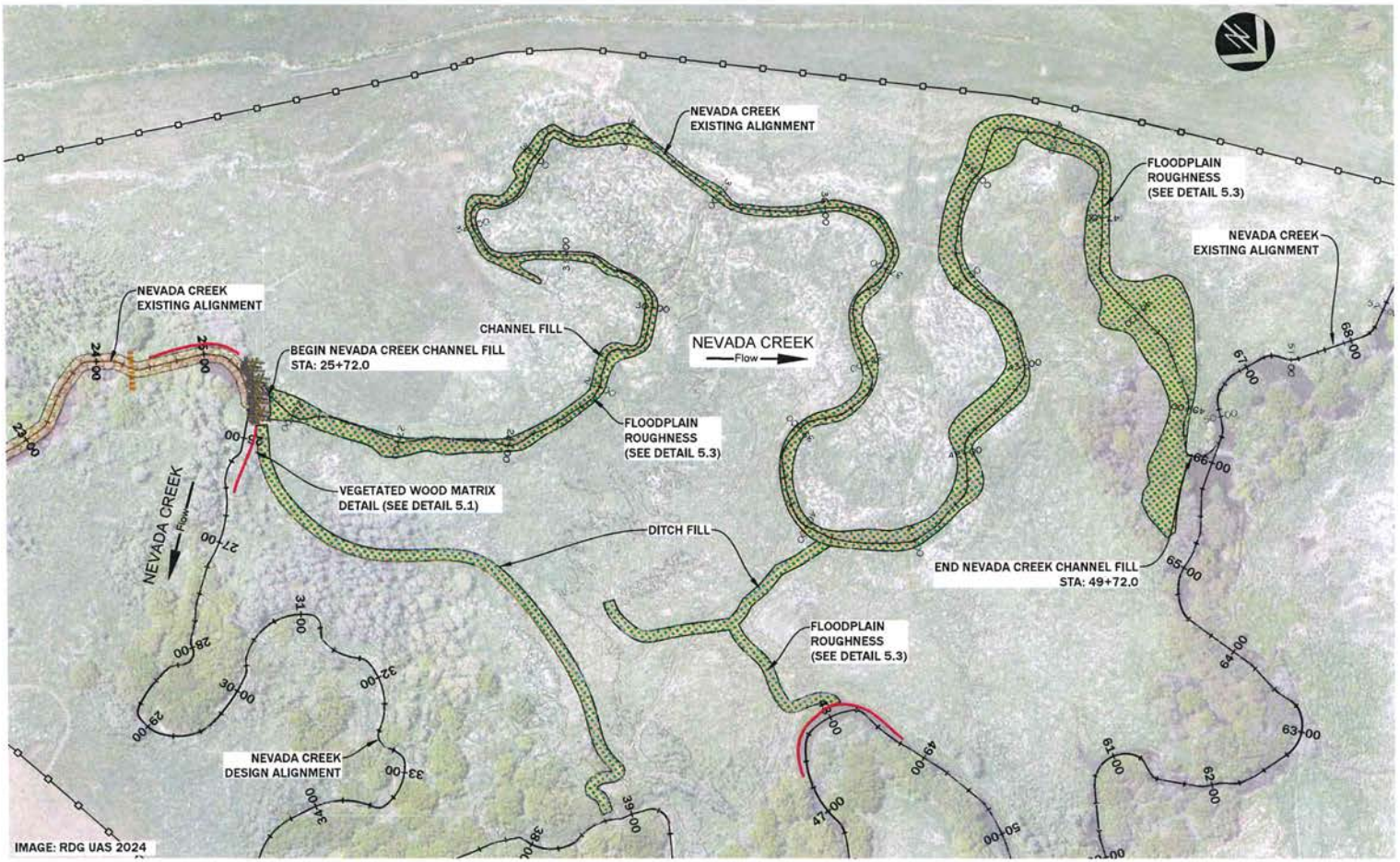

1 NEVADA CREEK PLAN VIEW

1" = 100'

DRAWING LEGEND	
SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	FLODDPLAIN ROUGHNESS
	DITCH/CHANNEL FILL
	VEGETATED WOOD MATRIX - TYPE 2
	LARGE WOOD STRUCTURE

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EXISTING CHANNEL AND FLOODPLAIN IMPROVEMENTS - REACH 2

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER RDG-24-003

DRAWING NUMBER 4.2

Drawing 8 of 15

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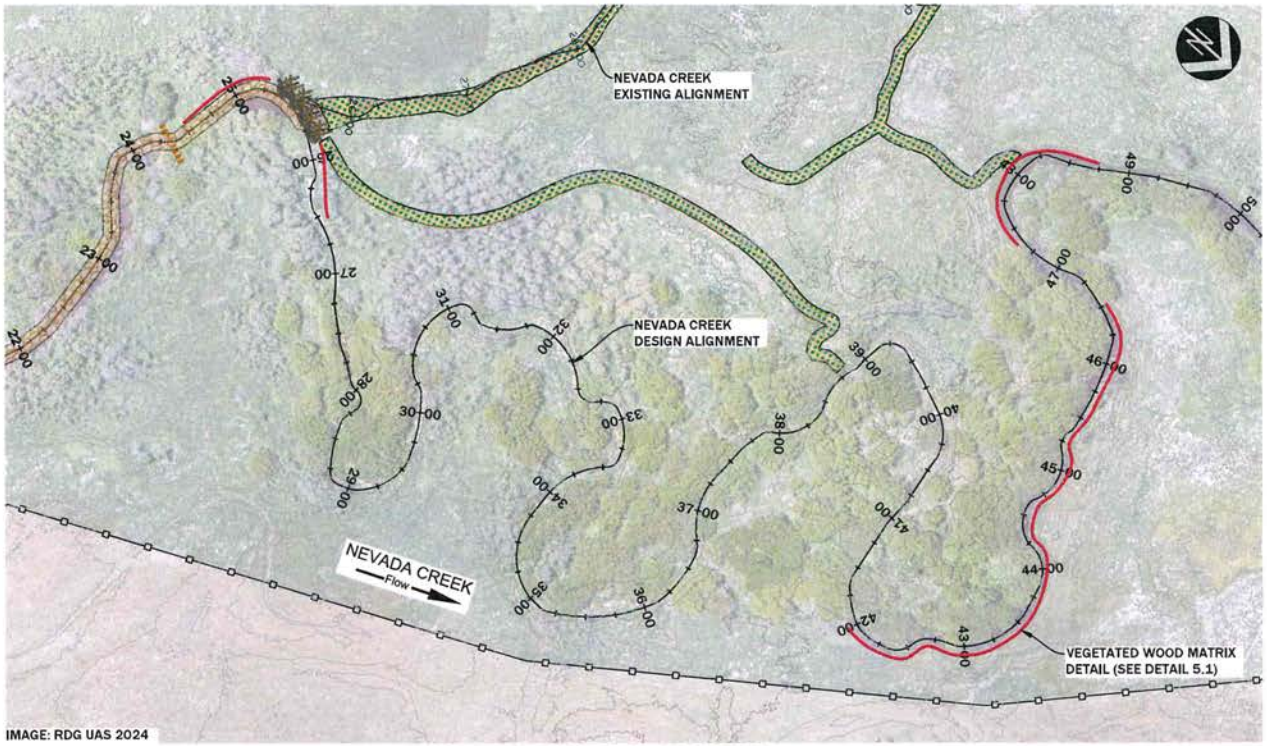

1 NEVADA CREEK - REACH 2
PLAN VIEW STA: 25+73 TO 49+00 1" = 100'

DRAWING LEGEND	
SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	FLOODPLAIN ROUGHNESS
	DITCH/CHANNEL FILL
	VEGETATED WOOD MATRIX - TYPE 2
	LARGE WOOD STRUCTURE

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DESIGN PLAN - REACH 2

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
4.3

Drawing 9 of 15

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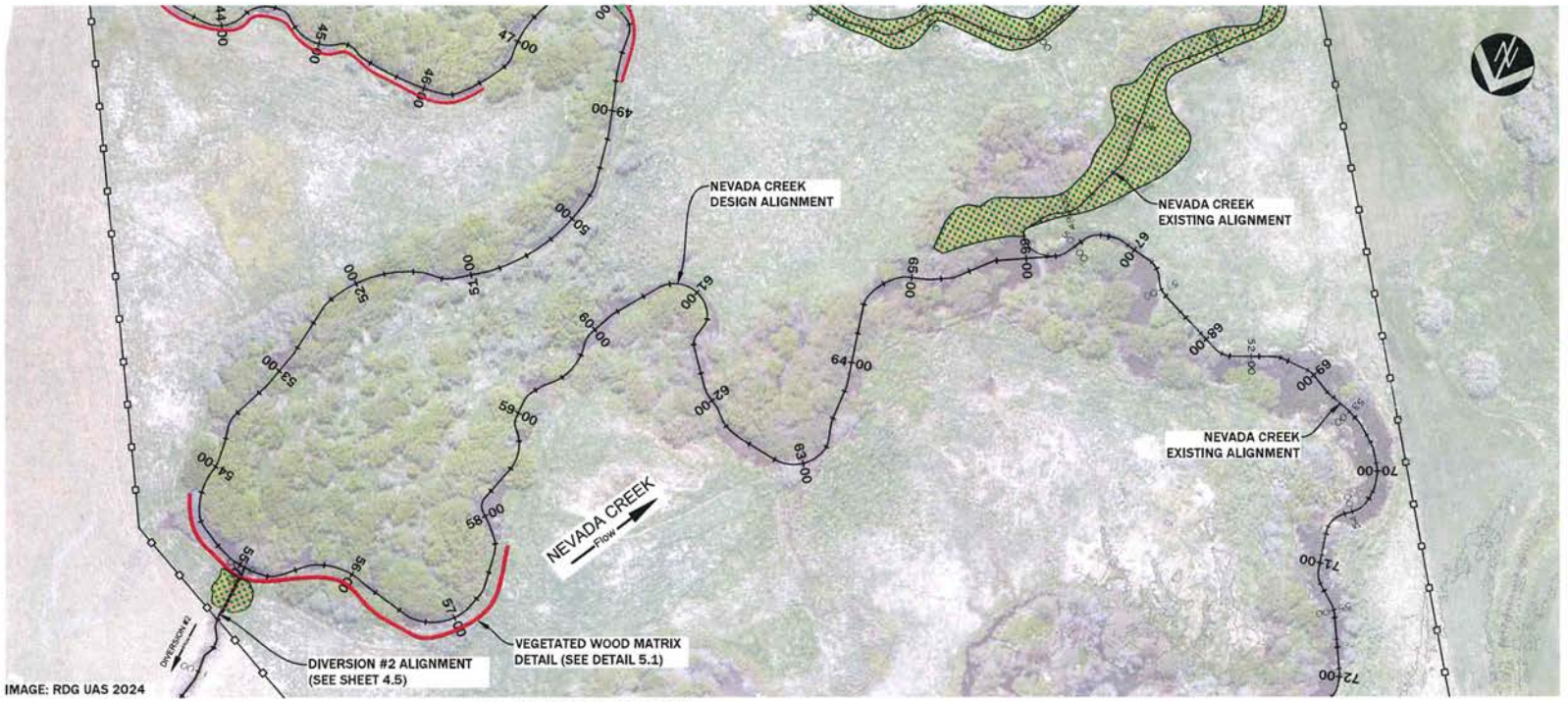

1 NEVADA CREEK
PLAN VIEW STA: 49+00 TO 66+00 1" = 100'

DRAWING LEGEND	
SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	VEGETATED WOOD MATRIX - TYPE 2
	CHANNEL/DITCH FILL
	FLOODPLAIN ROUGHNESS

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DESIGN PLAN - REACH 2
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
*	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
4.4
Drawing 10 of 15

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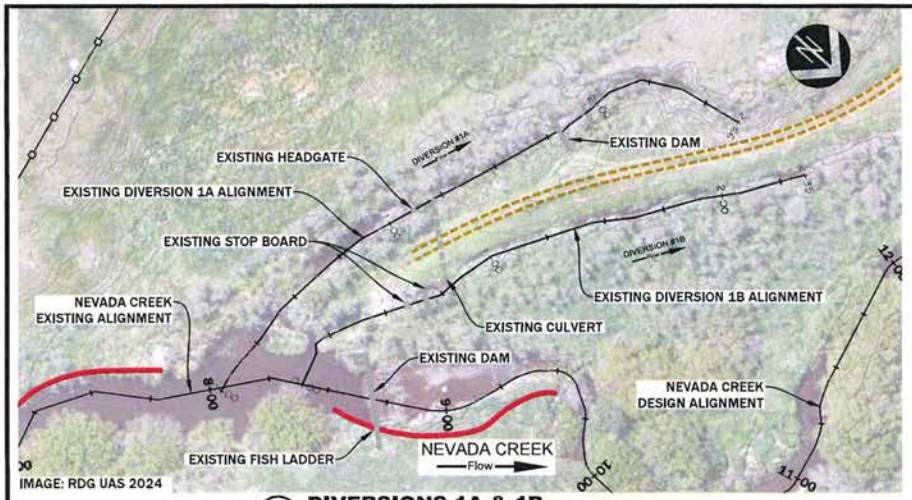
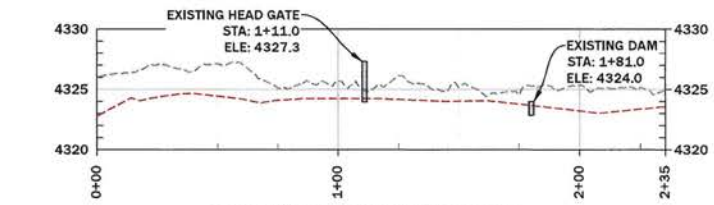
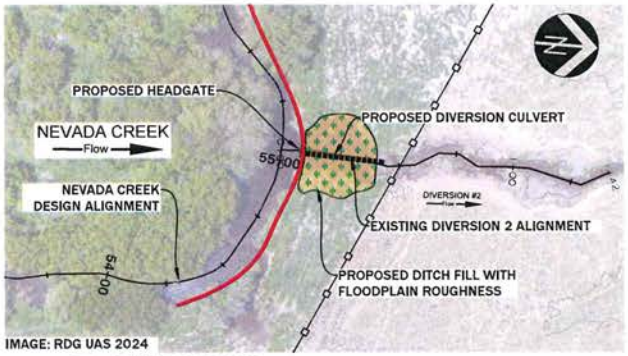


1 **DIVERSIONS 1A & 1B**
PLAN VIEW
1" = 50'

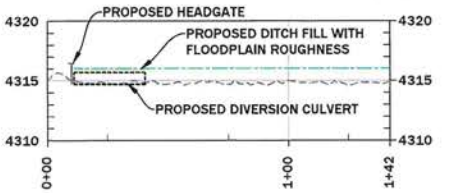


2 **DIVERSION 1A PROFILE**
PROFILE VIEW
H: 1" = 100'
V: 1" =20'

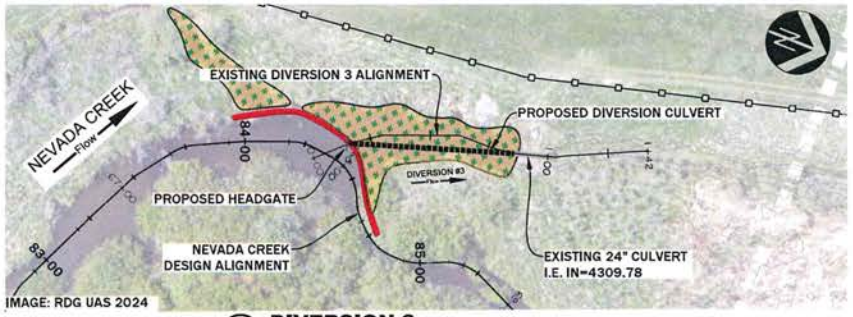
3 **DIVERSION 1B PROFILE**
PROFILE VIEW
H: 1" = 100'
V: 1" =20'



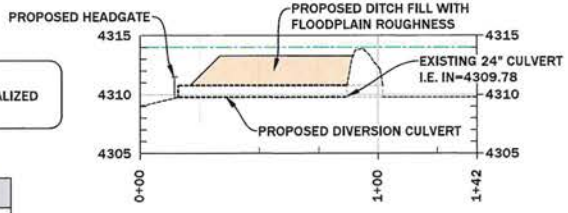
4 **DIVERSION 2**
PLAN VIEW
1" = 50'



5 **DIVERSION 2**
PROFILE VIEW
H: 1" = 100'
V: 1" =20'



6 **DIVERSION 3**
PLAN VIEW
1" = 50'



7 **DIVERSION 3**
PROFILE VIEW
H: 1" = 100'
V: 1" =20'

NOTE:
DIVERSION DESIGNS TO BE FINALIZED WITH SUPLEMENTAL DATA

PROFILE LEGEND

	BANKFULL
	THALWEG (EG)

DRAWING LEGEND

SYMBOL	FEATURE
	PROPERTY LINE
	EXISTING ACCESS ROAD
	EXISTING FENCELINE
	EXISTING BEAVER DAM
	CONSTRUCTED STREAMBED
	VEGETATED WOOD MATRIX - TYPE 2
	CHANNEL/DITCH FILL
	FLOODPLAIN ROUGHNESS

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DIVERSIONS PLAN AND PROFILE
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
*	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
4.5

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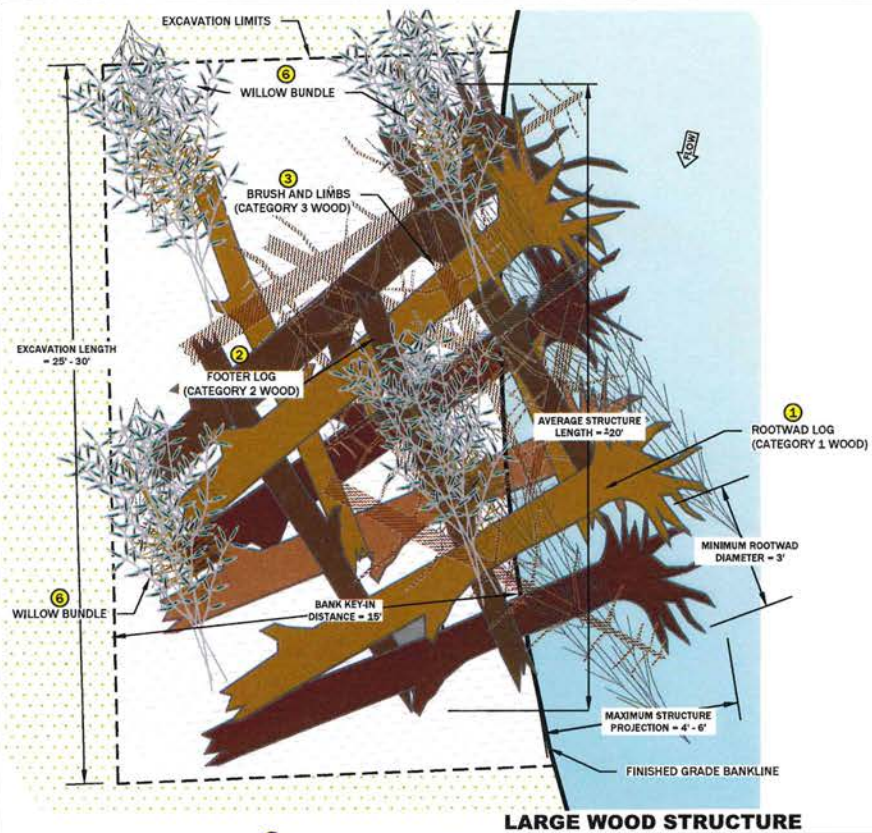
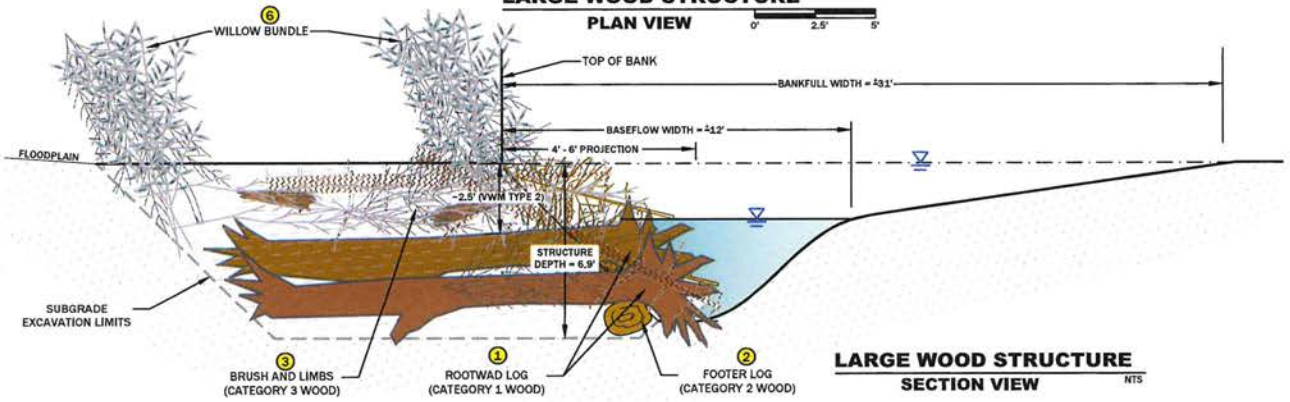


LARGE WOOD STRUCTURE
PLAN VIEW 0' 2.5' 5'



LARGE WOOD STRUCTURE
SECTION VIEW NTS

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 BY THE CONSTRUCTION MANAGER.
3. CONSTRUCTION MANAGER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON LARGE WOOD STRUCTURE INSTALLATION

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 INTO THE DESIGN CHANNEL NO GREATER THEN 3 FEET OR AT DISTANCE DIRECTED BY THE CONSTRUCTION MANAGER. 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 FOUR TO FIVE 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 4 - 6 FT. BEYOND THE FINISHED BANK LINE.
4. THE FINAL TIER OF MATERIAL SHALL BE CONSTRUCTED AS VEGETATED WOOD MATRIX TYPE 2. INSTALL CATEGORY 2 WOOD, BRUSH AND LIMBS (CATEGORY 3 WOOD) UP TO TOP OF BANK AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 2 - 4 FT. BEYOND THE FINISHED BANK LINE.
5. PLACE FOUR WILLOW BUNDLES INTERWOVEN INTO WOOD MATRIX AS SHOWN IN THE PLAN VIEW. WILLOW BUNDLES SHALL BE SET AS TO BE IN CONTACT WITH LOW FLOW WATER SURFACE ELEVATION.
6. BACKFILL STRUCTURE WITH STOCKPILED MATERIAL UP TO THE TOP OF BANK LINE ELEVATION. BACKFILL SHALL BE BUCKET COMPACTED.

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	DIA.	QUANTITY
1	CATEGORY 1 WOOD	10" - 12"	5
2	CATEGORY 2 WOOD	3" - 6"	25
3	CATEGORY 3 WOOD	< 3"	25
6	WILLOW BUNDLES	0.25" - 1"	4

EXAMPLE OF A LARGE WOOD STRUCTURE

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236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

LARGE WOOD STRUCTURE DETAIL

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER RDG-24-003

DRAWING NUMBER 5.0

Drawing 12 of 15

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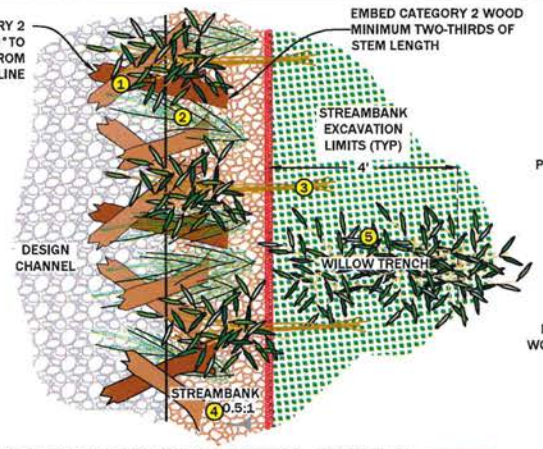
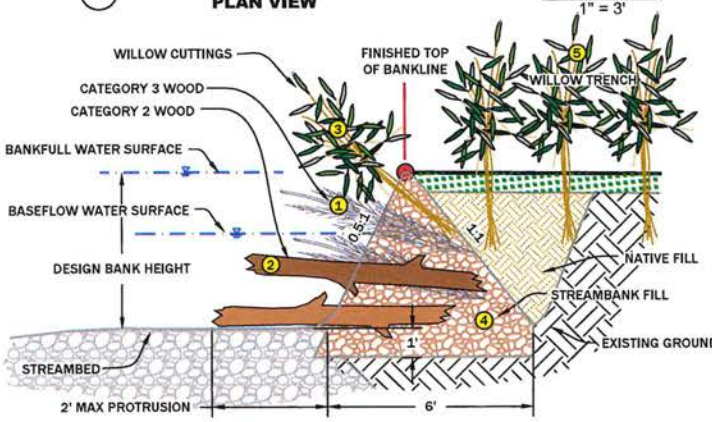
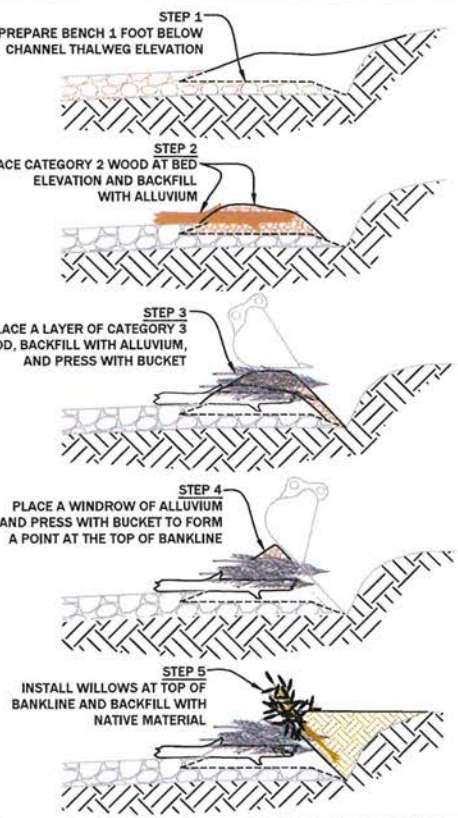


1 VEGETATED WOOD MATRIX - TYPE 2
PLAN VIEW 1" = 3'



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



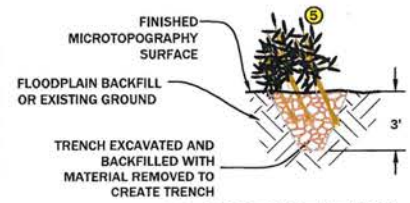
3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE
SECTION VIEW 1" = 5'

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.

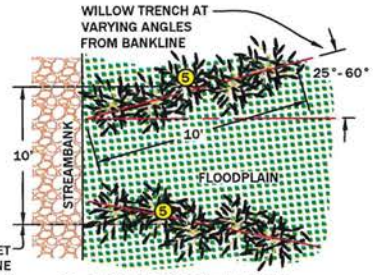
INSTALLATION NOTES

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.



4 WILLOW TRENCH
SECTION VIEW NTS

EVERY 10 LINEAL FEET OF BANKLINE INSTALL A 10 FOOT LONG WILLOW TRENCH



5 WILLOW TRENCH
PLAN VIEW NTS

TYPE 2 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)			
	ITEM	DIA. (IN)	QTY.
1	CATEGORY 2 WOOD	2"-4"	5
2	CATEGORY 3 WOOD	< 2"	2
3	BANK WILLOW CUTTINGS	0.25"-1.0"	5
4	STREAMBANK ALLUVIUM	6" MINUS	.03 CY

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

STREAMBANK FILL GRADATION	
SIZE (IN)	PERCENT PASSING
6	100
4	90-100
3	50-80
1	30-50
0.05	10-30
FINES	10

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

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236 Wisconsin Avenue
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311 SW Jefferson Avenue
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541.738.2920

VEGETATED WOOD MATRIX DETAIL - TYPE 2
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER RDG-24-003

DRAWING NUMBER 5.1

Drawing 13 of 15

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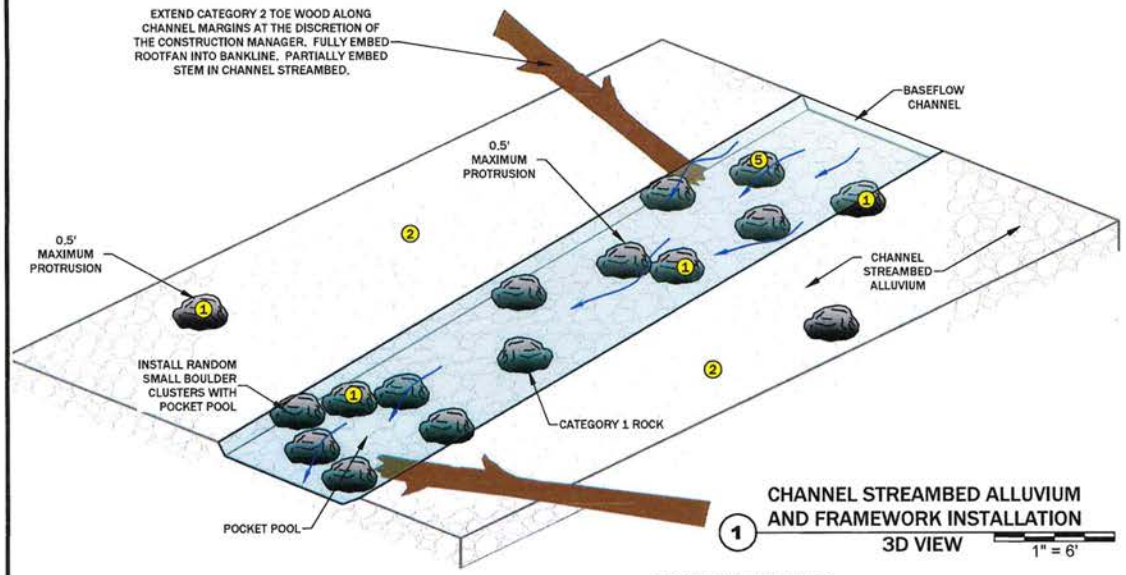
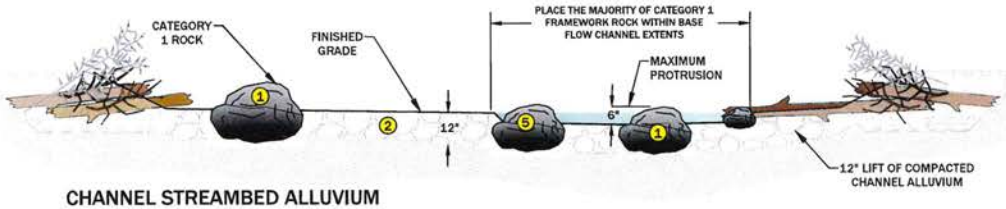


1 CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION 3D VIEW 1" = 6'



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

TYPICAL CONSTRUCTED STREAMBED THROUGH A RIFFLE FEATURE

TYPICAL CONSTRUCTED STREAMBED THROUGH A RUN FEATURE

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 6-INCH TO 8-INCH BOULDERS (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. CONTRACTOR MAY INSTALL 6-INCH TO 8-INCH BOULDERS (CATEGORY 1 ROCK) IN CLUSTERS, AS DIRECTED BY THE CONSTRUCTION MANAGER, TO CREATE A COMPLEX SERIES OF POCKET POOLS THAT EFFECTIVELY DISSIPATE ENERGY AND PROVIDE PATHWAYS FOR FISH MOVEMENT. BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.5-FT.
5. CONTRACTOR MAY INSTALL CHANNEL SPANNING WOOD (CATEGORY 2 WOOD) AND CHANNEL MARGIN WOOD (CATEGORY 2 WOOD) TO PROVIDE AQUATIC HABITAT COMPLEXITY AND ROUGHNESS AT THE DISCRETION OF THE CONSTRUCTION MANAGER. CHANNEL SPANNING WOOD SHALL BE INSTALLED INTO THE BED PERPENDICULAR TO FLOW WITH A MAXIMUM PROJECTION OF 0.3'. CHANNEL MARGIN WOOD SHALL PROJECT NO GREATER THAN 8 FEET INTO THE CONSTRUCTED STREAMBED IN VARIOUS ORIENTATIONS TO FLOW, AS DIRECTED BY CONSTRUCTION MANAGER. CHANNEL MARGIN WOOD SHALL BE EMBEDDED INTO THE CHANNEL STREAMBED A MINIMUM OF ONE-HALF THE LOG DIAMETER, AS SHOWN ON THE DRAWINGS.
6. PREPARE THE MATRIX. AFTER THE FRAMEWORK, WOOD, BOULDER CLUSTERS, AND SMALL 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.

STREAMBED ALLUVIUM GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
4	80 - 90	D84
2	45 - 55	D50
1	30 - 40	D35
0.6	20 - 30	D16
0.08	20	

PROVIDE MINIMUM 20% RETAINED IN 0.08" SIZE CLASS

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA.	QUANTITY
1	CATEGORY 1 ROCK	6" - 8"	0.8 EA
2	CHANNEL STREAMBED ALLUVIUM	6" MINUS	0.3 CY

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CONSTRUCTED STREAMBED DETAIL

NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
*	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER RDG-24-003

DRAWING NUMBER 5.2

Drawing 14 of 15

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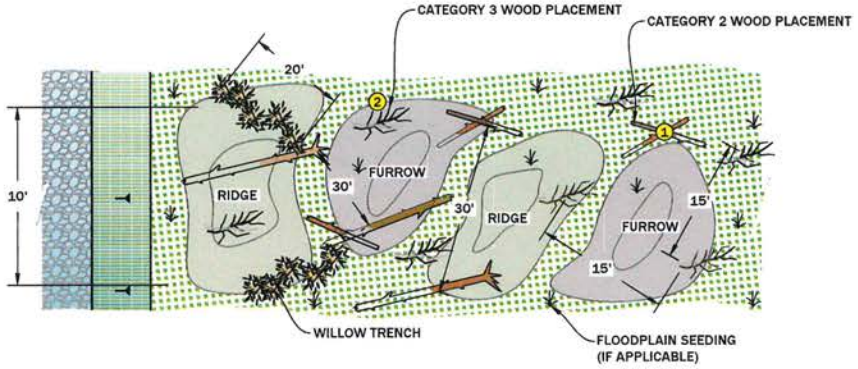
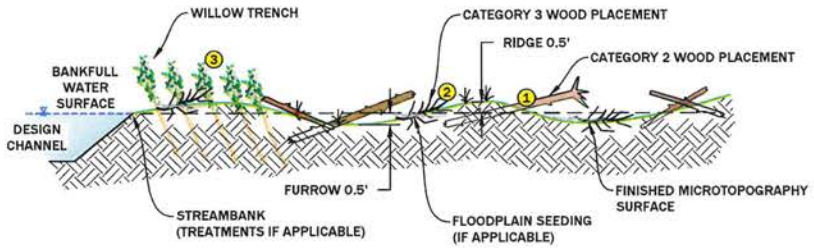
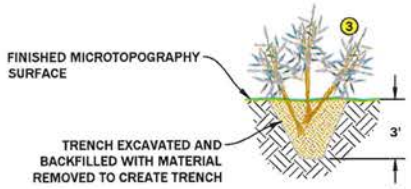


1 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
PLAN VIEW NTS



2 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
SECTION VIEW NTS



3 WILLOW TRENCH
SECTION VIEW NTS

WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)		
ITEM	DIA.	QUANTITY (EA)
③ WILLOW CUTTINGS	0.25" - 1"	5

FLOODPLAIN TREATMENT MATERIAL SCHEDULE (PER ACRE)				
ITEM	DIA.	LENGTH	QUANTITY (EA)	UNIT
① CATEGORY 2 WOOD	3" - 6"	10'-12'	35	EA
② CATEGORY 3 WOOD	1"-3"	10'-12'	25	% COVER*
*APPROXIMATELY 250 PIECES/ACRE				


EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS


EXAMPLE OF WILLOW TRENCH

DESIGN INTENT

PURPOSE: THE PURPOSE OF THIS TREATMENT IS TO CREATE CHARACTERISTICS ON NEWLY CONSTRUCTED FLOODPLAIN SURFACES THAT ARE SIMILAR TO THE CONDITIONS ON NATURAL, VEGETATED FLOODPLAIN SURFACES.

PLACEMENT CRITERIA: TREATMENTS ARE APPLIED TO FLOODPLAIN SURFACES THAT LACK ROUGHNESS ELEMENTS AND VEGETATION.

SUPPLEMENTAL INFORMATION: FLOODPLAIN ROUGHNESS TREATMENTS REDUCE THE RISK OF SURFACE EROSION AND INCREASE THE RETENTION OF SEDIMENT AND NUTRIENTS FOR THE DEVELOPMENT OF RIPARIAN VEGETATION. FLOODPLAIN ROUGHNESS IS APPLIED USING TWO METHODS: (1) MICROTOPOGRAPHY GRADING AND (2) WOODY DEBRIS PLACEMENT. MICROTOPOGRAPHY GRADING WILL CREATE AN UNEVEN SURFACE OF FURROWS AND RIDGES ON THE FLOODPLAIN. WOODY DEBRIS WILL PROVIDE STABILITY AND CONTRIBUTE ORGANIC MATTER TO FLOODPLAIN SOILS. PROPER ANCHORING OF WOODY DEBRIS IS REQUIRED TO PREVENT MOVEMENT DURING OVERBANK FLOWS.

CONSTRUCTION NOTES

1. CONSTRUCTION OF FLOODPLAIN TREATMENT WILL OCCUR AFTER CONSTRUCTION OF THE CHANNEL STREAMBED, INSTALLATION OF LARGE WOOD STRUCTURE BANK TREATMENT, INSTALLATION OF VEGETATED WOOD MATRIX BANK TREATMENT.
2. FLOODPLAIN ROUGHNESS CONSTRUCTION AFTER FINISHED FLOODPLAIN GRADING AND PRIOR TO SEEDING, PLANTING AND FENCING.
3. GRADE FURROWS AND RIDGES INTO THE FINISHED FLOODPLAIN GROUND SURFACE.
4. PARTIALLY BURY CATEGORY 2 WOOD INTO FURROWS AND RIDGES AT SPACING OF 30 FEET WITH ONE HALF THE WOOD LENGTH BELOW THE SURFACE.
5. PARTIALLY BURY CATEGORY 3 WOOD INTO FURROWS AND RIDGES AT SPACING OF 15 FEET AND A DEPTH OF TWO FEET BELOW THE SURFACE.
6. INSTALL WILLOW TRENCHES THROUGHOUT THE FLOODPLAIN AS SHOWN ON THE PLAN SHEETS OR AT THE DIRECTION OF THE CONSTRUCTION MANAGER.

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FLOODPLAIN ROUGHNESS DETAIL
NEVADA CREEK PHASE 8
POWEL COUNTY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
-	10/28/24	LS	PRELIMINARY DESIGN	JM

PROJECT NUMBER
RDG-24-003

DRAWING NUMBER
5.3
Drawing 15 of 15

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