



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): Potter Trust-Attn: Jim Stone

Mailing Address: 8470 Sunset Hill Rd

City: Greenough State: MT Zip: 59823

Telephone: 406-210-3595 E-mail: rsrollin2002@gmail.com

II. PROJECT INFORMATION

A. Project Name: Clearwater River Fish Passage Project

River, stream, or lake: Clearwater River

Location: Township: 14N Range: 14W Section: 04 NW 1/4

Latitude: 47.235065 Longitude: -113.533282 *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 fish passage for native populations of native trout throughout the Clearwater River drainage to enhance populations throughout the middle Blackfoot River watershed by upgrading an existing irrigation diversion.

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

The project is located on the Clearwater River at a Montana Fish, Wildlife & Parks fishing access site west of Clearwater Junction, just north of HWY 200 near river-mile 3.0. The Clearwater River is a 4th order tributary to the middle Blackfoot River and supports westslope cutthroat trout and bull trout populations, along with a multi-species assembly of other non-natives. The river segment that is a focus for this project is tied to an irrigation diversion consisting of a rock dam that has been identified as a partial fish passage barrier. Importantly, recent studies have documented the importance of this reach for bull trout passage and the existing infrastructure impedes migration corridors at certain flows along with creating a hazard for recreationists.

Several fish passage issues have been removed throughout the Clearwater River and this structure is one of the last remaining barriers. The existing diversion check structure is a 4-6 ft high permanent, channel-spanning dam built to send water down the adjacent irrigation ditch. Upstream movement of migratory cutthroat trout, rainbow trout x cutthroat trout hybrids, brown trout, and mountain whitefish from the Blackfoot River has been documented in the reach as Blanchard Creek (spawning tributary) lies just upstream. In addition, genetic assignment has documented use by migratory bull trout moving upstream from the Blackfoot River to lakes in the Clearwater Chain.

This project will rebuild the existing diversion structure with a boulder cascade. In addition, a stretch of streambank will be restored with vegetated wood matrix structures to address bank erosion as well as relocating an existing riparian road.

Project objectives include:

1. Restore fish passage for all salmonids and aquatic species accessing this reach of the Clearwater River and beyond
2. Design/build in channel structures that do not pose a hazard to boaters and recreationists utilizing this reach of the Clearwater River
3. Address chronic bank erosion and sediment inputs by relocating an adjacent road and building vegetated wood matrix bank treatments similar to other projects in the Blackfoot River watershed
4. Ensure project will accommodate future irrigation needs

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

As previously described, the existing irrigation diversion is a partial fish passage barrier.

- E. Length of stream or size of lake that will be treated (project extent): 700 feet
 Length/size of impact, if larger than project extent (e.g., stream miles opened): At least 10 miles

- F. Project Budget Summary:

Grant Request (Dollars):	\$ 48,000
Matching Dollars:	\$ 209,437.75
Matching In-Kind Services*:	\$ 75,025

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

Other Contributions (not used as match) \$ _____

Total Project Cost: \$ 326,962.75

- G. Attach itemized (line item) budget – see *budget template*
- H. Attach project location map(s) that include:
- Extent of the project, including context (relation to major landmark or town)
 - Indication of public and private property
 - Riparian buffer locations and widths (if applicable) and grazing locations
- I. Attach project plans:
- Detailed sketches or plan views with the location and proposed restoration
 - Pre-project photographs (GPS location strongly recommended)
 - If water leasing or water salvage is involved, attach a supplemental questionnaire (<https://myfwp.mt.gov/getRepositoryFile?objectID=36110>)
- J. Attach 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 & 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
**If it is a water leasing project, describe the length of the agreement.*

The Potter Trust has committed to signing a 20-year landowner agreement.

- 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.*

Grazing is not a part of nor adjacent to the project.

- 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?

As-built surveys will be completed on the project when the project is complete including revegetation survival. Long term fisheries monitoring data will be collected by FWP on both the Blackfoot and Clearwater River.

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

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

This project will benefit migratory populations of native bull trout (threatened under ESA) as well as westslope cutthroat trout, a species of special concern in Montana. Other species that will benefit include: rainbow x cutthroat hybrids, brown trout and whitefish.

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

By restoring fish passage to the Clearwater River drainage, native trout will have access to important over wintering habitat found within the Clearwater chain of lakes and other tributaries improving recruitment of populations to the middle Blackfoot River watershed.

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

This project will improve fish passage for native trout species in the short and long term as well as improving recruitment to the larger Blackfoot River watershed.

- 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.

The project site is located on MTFWP property—the Clearwater River Fishing Access site just north of MT HWY 200, approximately 0.2 miles west of Clearwater Junction.

- 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 improvements to a native trout tributary. Public benefits include: 1) expanding suitable habitat conditions for pure westslope cutthroat trout and fluvial bull trout populations, 2) improved water quality on-site and downstream, and 3) contribute to the recovery of westslope cutthroat trout. Additionally, the Bull Trout Conservation Strategy identifies the main factor limiting recovery of bull trout as the lack of high-quality tributaries throughout the watershed. This project, in conjunction with the cumulative effects of other projects in the drainage, will benefit bull trout and work towards stability and recovery of the core population, which is in the public's interest. The recent studies have documented the connection between the Clearwater River and the Blackfoot River for bull trout populations.

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

The existing irrigator is the Potter Trust and this project has been developed in collaboration with them.

- 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: 11/13/2024

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
<i>*Units = feet, hours, cubic yards, etc. Do not use lump sum unless necessary.</i>								
Personnel								
Survey	57	hrs	\$155.00	\$ 8,835.00		8,835.00		\$ 8,835.00
Design	121	hrs	\$155.00	\$ 18,755.00		18,755.00		\$ 18,755.00
Engineering	78	hrs	\$155.00	\$ 12,090.00		12,090.00		\$ 12,090.00
Permitting	38	hrs	\$48.00	\$ 1,824.00		1,824.00		\$ 1,824.00
Oversight	87	hrs	\$165.00	\$ 14,355.00		14,355.00		\$ 14,355.00
Project Mgmt	96	hrs	\$48.00	\$ 4,608.00		4,608.00		\$ 4,608.00
			Sub-Total	\$ 60,467.00	\$ -	\$ 60,467.00	\$ -	\$ 60,467.00
Travel								
Mileage	1125	miles	\$0.67	\$ 753.75		753.75		\$ 753.75
Per diem				\$ -				\$ -
			Sub-Total	\$ 753.75		\$ 753.75	\$ -	\$ 753.75
Construction Materials								
Pulp Wood	7	loads	\$1,100.00	\$ 7,700.00		7,700.00		\$ 7,700.00
Category 1 rock	450	ea	\$75.00	\$ 33,750.00		33,750.00		\$ 33,750.00
6" minus rock	233	CY	\$15.00	\$ 3,495.00		3,495.00		\$ 3,495.00
16" minus rock	1889	CY	\$20.00	\$ 37,780.00		37,780.00		\$ 37,780.00
Willows	9420	Ea	\$1.50	\$ 14,130.00	3,000.00	11,130.00		\$ 14,130.00
			Sub-Total	\$ 96,855.00	\$ 3,000.00	\$ 93,855.00	\$ -	\$ 96,855.00
Equipment, Labor, and Mobilization								
Develop and decommission temporary access roads/staging areas	1	LS	\$5,000.00	\$ 5,000.00		5,000.00		\$ 5,000.00
Salvage Existing Vegetation	1	LS	\$5,500.00	\$ 5,500.00	1,000.00	4,500.00		\$ 5,500.00
Water mgmt-coffer dams, bulk bags	1	LS	\$10,000.00	\$ 10,000.00	1,000.00	9,000.00		\$ 10,000.00
Construct Channel Cascade	182	LF	\$150.00	\$ 27,300.00	10,000.00	17,300.00		\$ 27,300.00

Clearwater River Fish Passage
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

002-2025

Construct inset floodplain surface	2416	CY	\$3.00	\$ 7,248.00	3,000.00	4,248.00	\$ 7,248.00
Construct side channel	195	LF	\$25.00	\$ 4,875.00	1,000.00	3,875.00	\$ 4,875.00
Install VWM Type 1 bank treatments	738	LF	\$35.00	\$ 25,830.00	11,000.00	14,830.00	\$ 25,830.00
Install VWM Type 2 bank treatments	204	LF	\$50.00	\$ 10,200.00	4,500.00	5,700.00	\$ 10,200.00
Transplant salvaged vegetation & install floodplain roughness	0.31	AC	\$1,500.00	\$ 465.00		465.00	\$ 465.00
Furnish wood	7	Loads	\$900.00	\$ 6,300.00		6,300.00	\$ 6,300.00
Furnish Category 1 Rock	350	each	\$35.00	\$ 12,250.00	3,500.00	8,750.00	\$ 12,250.00
Furnish 6" Minus fill	233	CY	\$18.00	\$ 4,194.00	2,000.00	2,194.00	\$ 4,194.00
Furnish 16" Minus Fill	1889	CY	\$25.00	\$ 47,225.00	8,000.00	39,225.00	\$ 47,225.00
Mobilization	1	LS	\$10,000.00	\$ 10,000.00	2,000.00	8,000.00	\$ 10,000.00
			Sub-Total	\$ 176,387.00	\$ 45,000.00	\$ 129,387.00	\$ - \$ 176,387.00
OVERALL TOTALS				\$ 334,462.75	\$ 48,000.00	\$ 284,462.75	\$ - \$ 334,462.75

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	-	\$ 167,252.00	\$ 167,252.00	Yes
USFS Helena National Forest	-	\$ 67,525.00	\$ 67,525.00	Yes

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

BLM	\$ -	\$ 15,000.00	\$ 15,000.00	Yes
BBCTU	\$ -	\$ 7,185.75	\$ 7,185.75	Yes
Potter Trust	\$ 7,500.00	\$ 20,000.00	\$ 27,500.00	Yes
TOTALS	\$ 7,500.00	\$ 276,962.75	\$ 284,462.75	

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 irrigation diversion on the Clearwater River near the Fishing Access Site just north of HWY 200.



Photo 3. Oblique view of Clearwater River diversion dam and project reach.

MONTANA FISH, WILDLIFE & PARKS

Future Fisheries Improvement Program

Appendix: FWP Statement

Project Title: Fish Passage and Structural Improvements at Clearwater Dam / Potter Diversion

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

This project has been a priority in the Blackfoot and Region 2 for nearly 2 decades as the Potter diversion dam acts as a partial barrier to upstream fish passage. The structure lies in the lower portion of the main stem Clearwater River ~ 3 miles upstream of the Blackfoot River confluence. The project high importance for native trout conservation work and recreational fisheries enhancement in the middle Blackfoot watershed.

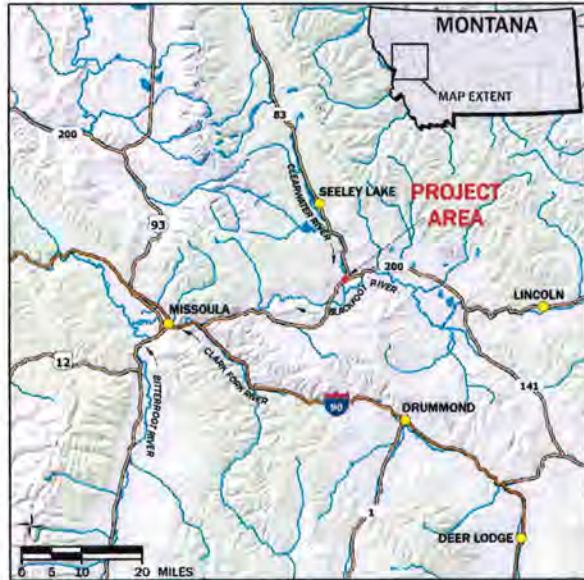
Documented fisheries impacts include obstruction of upstream passage at the diversion check structure, which is a 4-6 ft high permanent, channel-spanning dam built to send water down the adjacent irrigation ditch. Upstream movement of migratory cutthroat trout, rainbow trout x cutthroat trout hybrids, brown trout, and mountain whitefish from the Blackfoot River has been documented in the reach as Blanchard Creek (spawning tributary) lies just upstream. In addition, genetic assignment has documented use by migratory bull trout moving upstream from the Blackfoot River to lakes in the Clearwater Chain.

Name of FWP Biologist W. Ladd Knotek Date: 10/24/2024

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

CLEARWATER RIVER DIVERSION UPGRADE PROJECT FINAL DESIGN PLAN SET

CLEARWATER RIVER VICINITY MAP



LEGAL DESCRIPTION: NW 1/4, S04, T14 N, R14 W,
MISSOULA COUNTY, MONTANA

PROJECT PARTNERS



MONTANA FISH, WILDLIFE
AND PARKS
3201 Spurgin Road
Missoula, MT 59804



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



U.S. FISH AND WILDLIFE SERVICE
PARTNERS PROGRAM
P.O. BOX 66
196 LOWER LAKE SIDE LANE
OVANDO, MONTANA 59854

POTTER TRUST LANDS

PROJECT DESCRIPTION

RIVER DESIGN GROUP, INC. HAS BEEN RETAINED BY BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED (BBCTU) IN PARTNERSHIP WITH THE U.S. FISH AND WILDLIFE SERVICE PARTNERS PROGRAM (FWS) AND POTTER TRUST LANDS TO DESIGN AND OVERSEE A FISH PASSAGE AND RIVER RESTORATION PROJECT ON THE CLEARWATER RIVER APPROXIMATELY 0.2 MILES WEST OF CLEARWATER JUNCTION AT THE BLACKFOOT-CLEARWATER CROSSING FISHING ACCESS SITE. THE CLEARWATER RIVER IS A FOURTH-ORDER TRIBUTARY TO THE MIDDLE BLACKFOOT RIVER AND SUPPORTS WESTSLOPE CUTTHROAT TROUT (ONCORHYNCHUS CLARKII LEWISII) AND BULL TROUT (SALVELINUS CONFLUENTUS) POPULATIONS, ALONG WITH A MULTI-SPECIES ASSEMBLAGE. THE PROJECT AREA IS CHARACTERIZED BY AN IRRIGATION DIVERSION THAT HAS SERVED POTTER TRUST LANDS AND DELIVERS UP TO 41.2 CUBIC FEET PER SECOND (CFS) OF WATER FROM THE CLEARWATER RIVER UPSTREAM OF HIGHWAY 200 TO 152 ACRES OF IRRIGATED PASTURE ALONG THE EAST SIDE OF THE CLEARWATER RIVER DOWNSTREAM OF HIGHWAY 200.

RECENT STUDIES HAVE DOCUMENTED THE IMPORTANCE OF THIS REACH OF THE CLEARWATER RIVER FOR BULL TROUT PASSAGE AND IT IS PRESUMED THAT THE EXISTING INFRASTRUCTURE MAY IMPEDE FISH PASSAGE DURING CERTAIN FLOW PERIODS, WHILE ALSO CREATING A HAZARD FOR RECREATIONISTS. THE DAM ALSO INDUCES A SIGNIFICANT BACKWATER EFFECT UPSTREAM, CREATING LENTIC HABITAT CONDITIONS THAT FAVOR NORTHERN PIKE, AN INTRODUCED SPECIES WHICH PREYS UPON BULL TROUT AND WESTSLOPE CUTTHROAT TROUT. BBCTU AND FWS DESIRE TO UPGRADE THE DIVERSION STRUCTURE TO RESTORE FISH PASSAGE AND CHANNEL FUNCTION, WHILE ENSURING THE CONTINUED SUPPLY OF IRRIGATION WATER TO POTTER TRUST LANDS. THE FOLLOWING PROJECT GOALS WERE DEVELOPED TO GUIDE THE ASSESSMENT AND RESTORATION DESIGN:

- RESTORE FISH PASSAGE FOR NATIVE WESTSLOPE CUTTHROAT TROUT AND BULL TROUT POPULATIONS.
- ENSURE IRRIGATION NEEDS ARE MET AT A RANGE OF FLOWS THROUGHOUT THE SEASON.
- ENSURE IMPROVEMENTS CAN ACCOMMODATE NEW IRRIGATION INFRASTRUCTURE, EITHER CONCURRENTLY, WITH IMPROVEMENTS TO THE DIVERSION STRUCTURE, OR AT A LATER DATE.
- ADDRESS CHRONIC TERRACE EROSION DOWNSTREAM OF THE DIVERSION STRUCTURE ON RIVER RIGHT.
- DESIGN IN-CHANNEL STRUCTURES THAT DO NOT POSE HAZARDS TO BOATERS AND RECREATIONISTS UTILIZING THIS REACH OF THE CLEARWATER RIVER.

STANDARD OF PRACTICE

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

REUSE OF DRAWINGS

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

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1.1 GENERAL NOTES AND SPECIFICATIONS	6.0 CHANNEL CROSS SECTION DIMENSIONS
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3.1 ACCESS, STAGING AND SURVEY CONTROL	7.1 VEGETATED WOOD MATRIX TYPE 2 DETAIL
3.2 DEWATERING AND CONSTRUCTION SEQUENCING PLAN	7.2 CASCADE CHANNEL DETAIL
3.3 MATERIALS AND QUANTITIES	7.3 FLOODPLAIN ROUGHNESS DETAIL
4.0 STRUCTURE LAYOUT AND DATA SHEET	7.4 COFFER DAM AND BULK BAG DETAILS
4.1 GRADING PLAN AND PROFILE	



RIVER DESIGN GROUP, INC.
311 SW Jefferson Avenue
Vernonia, OR 97150
503.867.4827

COVER PAGE
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	8/8/24	ls	Final Design	JM
PROJECT NUMBER RDG-23-238				
DRAWING NUMBER 1.0				
Drawing 1 of 17				



IMAGE: RDG UAS 2024

**1 EXISTING CONDITIONS
PLAN VIEW**



EXISTING CONDITIONS

CLEARWATER RIVER IS A FOURTH-ORDER TRIBUTARY TO THE MIDDLE BLACKFOOT RIVER. THE WATERSHED HEADWATERS ALONG THE SWAN RANGE DIVIDE NORTH OF SEELEY, MONTANA, WITH A MEAN BASIN ELEVATION OF 5108 FEET AND ANNUAL PRECIPITATION OF 34.1 INCHES, THE WATERSHED DRAINS AN AREA OF 349 MI² AND TRANSITIONS FROM STEEP AND CONFINED FIRST AND SECOND ORDER DRAINAGES TO UNCONFINED FLUVIAL AND LACUSTRINE LANDSCAPES CHARACTERIZED BY MULTIPLE FLOOD-ATTENUATING, GLACIALLY CARVED LAKES INCLUDING RAINY LAKE, LAKE ALVA, LAKE INEZ, SEELEY LAKE, SALMON LAKE, AND ELBOW LAKE.

THE PROJECT AREA IS CHARACTERIZED BY AN IRRIGATION DIVERSION THAT HAS SERVED POTTER TRUST LANDS AND DELIVERS UP TO 41.2 CUBIC FEET PER SECOND (CFS) OF WATER FROM THE CLEARWATER RIVER UPSTREAM OF HIGHWAY 200 TO 152 ACRES OR IRRIGATED PASTURE ALONG THE EAST SIDE OF THE CLEARWATER RIVER DOWNSTREAM OF HIGHWAY 200. THE EXISTING DIVERSION STRUCTURE INDUCES A BACKWATER CONDITION EXTENDING APPROXIMATELY 0.5 MILES UPSTREAM. THE BACKWATER CONDITION FORMS A LOWER ENERGY, LENTIC RIVER ENVIRONMENT CHARACTERIZED BY FINE SEDIMENT DEPOSITION, DEGRADED HABITAT, AND SEASONAL ALGAE BLOOMS. THE EXISTING DIVERSION STRUCTURE CONSISTS OF LARGE ANGULAR ROCK, CONCRETE BLOCKS, AND WOODEN TIMBERS. DURING BASE FLOW PERIODS, TOTAL DROP OVER THE DAM CREST AVERAGES FOUR FEET. RECENT STUDIES HAVE DOCUMENTED THE IMPORTANCE OF THIS REACH OF THE CLEARWATER RIVER FOR BULL TROUT PASSAGE AND IT IS PRESUMED THAT THE EXISTING INFRASTRUCTURE MAY IMPEDE FISH PASSAGE DURING CERTAIN FLOW PERIODS, WHILE ALSO CREATING A HAZARD FOR RECREATIONISTS. THE DAM ALSO INDUCES A SIGNIFICANT BACKWATER EFFECT UPSTREAM, CREATING LENTIC HABITAT CONDITIONS THAT FAVOR NORTHERN PIKE, AN INTRODUCED SPECIES WHICH PREYS UPON BULL TROUT AND WESTSLOPE CUTTHROAT TROUT.

STREAM CHARACTERISTICS	
CHARACTERISTICS	VALUE
STREAM TYPE	B3
VALLEY TYPE	SEMI-CONFINED
AVERAGE SLOPE	0.32%
SINUOSITY	1.1
D50	97 MM
D84	136 MM
BANKFULL WIDTH	82 FT
BANKFULL MEAN DEPTH	3.4 FT
BANKFULL MAXIMUM DEPTH	4.2 FT
BANKFULL AREA	190 FT ²
WIDTH/DEPTH RATIO	33.2

PROJECT AREA HYDROLOGY	
CHARACTERISTICS	VALUE
WATERSHED AREA	349 SQ MI
LOG-PEARSON III Q1.5	1,570 CFS
FIELD DETERMINED Q1.5	870 CFS
10 YEAR RI FLOOD	3,120 CFS
25 YEAR RI FLOOD	3,690 CFS
50 YEAR RI FLOOD	4,160 CFS
100 YEAR RI FLOOD	4,640 CFS



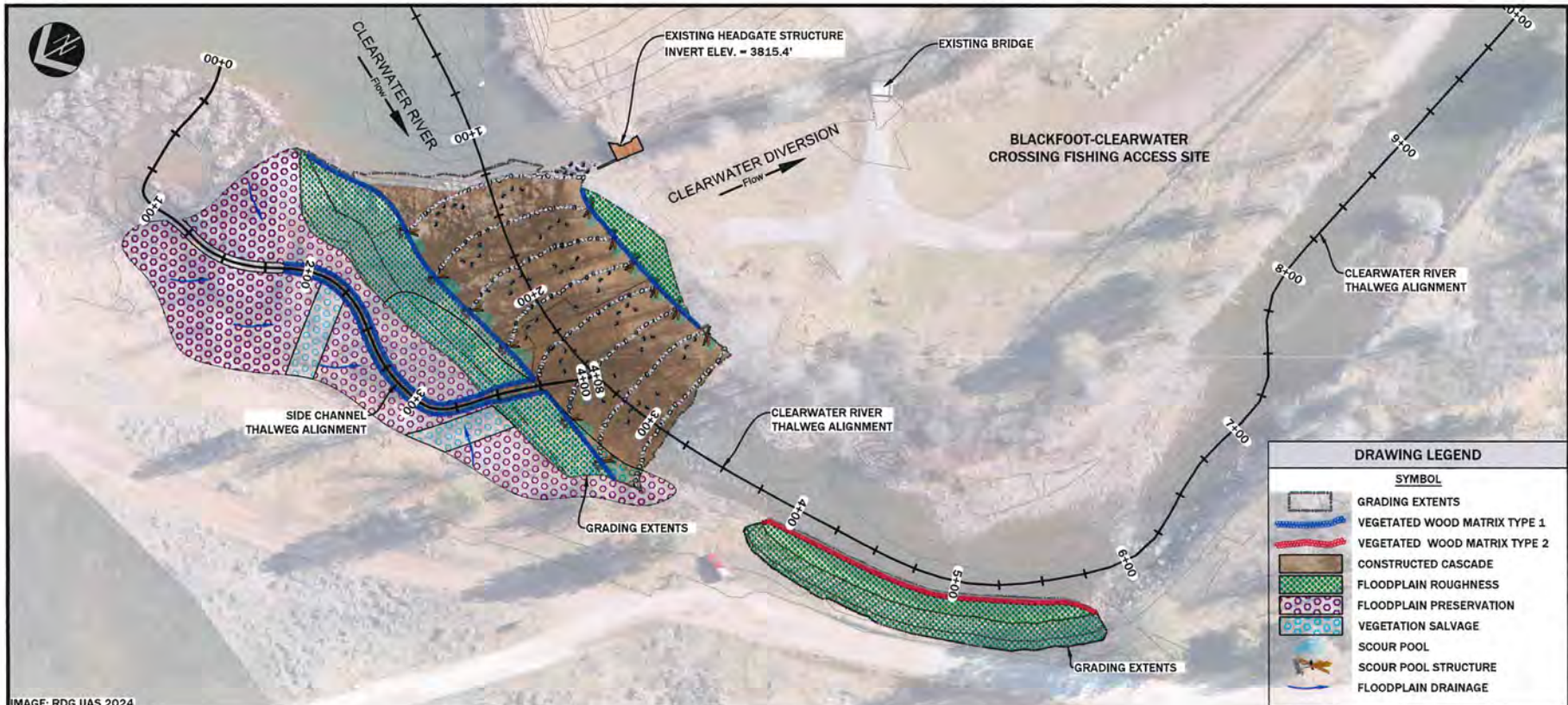
EXISTING CONDITIONS
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	8/6/24	HS	Final Design	JM

PROJECT NUMBER
RDG-23-238

DRAWING NUMBER
2.0

Drawing 3 of 17



RESTORATION PLAN
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

DRAWING LEGEND	
SYMBOL	
[Pattern]	GRADING EXTENTS
[Blue wavy line]	VEGETATED WOOD MATRIX TYPE 1
[Red wavy line]	VEGETATED WOOD MATRIX TYPE 2
[Brown wavy line]	CONSTRUCTED CASCADE
[Green wavy line]	FLOODPLAIN ROUGHNESS
[Purple wavy line]	FLOODPLAIN PRESERVATION
[Blue wavy line]	VEGETATION SALVAGE
[Blue circle]	SCOUR POOL
[Blue circle]	SCOUR POOL STRUCTURE
[Blue line]	FLOODPLAIN DRAINAGE

1 RESTORATION PLAN
PLAN VIEW
1" = 60'

RESTORATION PLAN

PROJECT GOALS

BBCTU, MFWP AND FWS DESIRE TO UPGRADE THE DIVERSION STRUCTURE TO RESTORE FISH PASSAGE AND CHANNEL FUNCTION, WHILE ENSURING THE CONTINUED SUPPLY OF IRRIGATION WATER TO POTTER TRUST LANDS. THE FOLLOWING PROJECT GOALS WERE DEVELOPED TO GUIDE THE ASSESSMENT AND RESTORATION DESIGN:

- RESTORE FISH PASSAGE FOR NATIVE WESTSLOPE CUTTHROAT TROUT AND BULL TROUT POPULATIONS;
- ENSURE IRRIGATION NEEDS ARE MET AT A RANGE OF FLOWS THROUGHOUT THE SEASON;
- ENSURE IMPROVEMENTS CAN ACCOMMODATE NEW IRRIGATION INFRASTRUCTURE, EITHER CONCURRENTLY WITH IMPROVEMENTS TO THE DIVERSION STRUCTURE, OR AT A LATER DATE;
- EVALUATE HOW THE UPGRADED STRUCTURE WILL IMPACT BACKWATER CONDITIONS, SINCE ISSUING OF THE RFP. BBCTU HAS INDICATED ADDRESSING BACKWATER CONDITIONS IS BEYOND THE SCOPE OF THIS PROJECT DUE TO FUNDING LIMITATIONS AND LANDOWNERSHIP CONSTRAINTS;
- ADDRESS CHRONIC TERRACE EROSION DOWNSTREAM OF THE DIVERSION STRUCTURE ON RIVER RIGHT; AND
- DESIGN IN-CHANNEL STRUCTURES THAT DO NOT POSE HAZARDS TO BOATERS AND RECREATIONISTS UTILIZING THIS REACH OF THE CLEARWATER RIVER.

RESTORATION TREATMENTS

ENGINEERED CASCADE: INTERSPERSED CASCADES CONSIST OF HIGHER GRADIENT RIFFLE HABITAT FEATURES THAT INTEGRATE LARGE ROUGHNESS ELEMENTS (LARGE WOOD, BOULDERS) TO PROVIDE ENERGY DISSIPATION AND VERTICAL BED STABILITY. THE STRUCTURE CONSISTS OF A SPECIFIED STREAMBED GRADATION BASED ON MODELED MOBILE PARTICLE SIZES. FOR THE CLEARWATER RIVER, HYDRAULIC MODELING RESULTS INDICATE A BANKFULL MOBILE PARTICLE SIZE OF 13.4-INCHES. A FRAMEWORK SUPPORTED BED CONSISTING OF LARGER MATERIAL (24-INCH TO 36-INCH PARTICLES) SUPPLEMENTED WITH ENGINEERING FILL OR ALLUVIUM (1/8-INCH AND FINER) WOULD BE INTERSPERSED BETWEEN STEP-POOL WEIRS TO EMULATE A RIFFLE-POOL BEDFORM. INTEGRATED CASCADES OR HIGHER GRADIENT RIFFLE HABITAT FEATURES WOULD DECREASE THE NUMBER OF STEP-POOL WEIRS AND PROVIDE ADDITIONAL HYDRAULIC DIVERSITY AND LONGITUDINAL PROFILE HETEROGENEITY COMPARED TO THE USE OF STEP-POOL WEIRS SOLELY. THE CASCADES WOULD REFLECT A STAGE-PROGRESSIVE CROSS-SECTION DESIGN TO CONSOLIDATE AND PARTITION BASE FLOWS FOR FISH PASSAGE.

STREAMBANK AND FLOODPLAIN TREATMENTS: STREAMBANK TREATMENTS ARE PROPOSED TO ADDRESS TERRACE EROSION AND TO ACCOMMODATE CONSTRUCTION OF INSET FLOODPLAIN SURFACES. CONSTRUCTED STREAMBANKS WOULD CONSIST OF VEGETATED WOOD MATRIXES (VWM) COMPRISED OF ALTERNATING LIFTS OF ALLUVIUM, COARSE WOOD, AND WILLOW CUTTINGS. VWM STRUCTURES ADD STABILITY TO NEWLY CONSTRUCTED STREAMBANKS WHILE PROVIDING A SURFACE TO PROMOTE VEGETATION ESTABLISHMENT. FLOODPLAINS WILL BE CONSTRUCTED BY PLACING FLOODPLAIN FILL MATERIAL AT ELEVATIONS SUITABLE FOR ESTABLISHMENT OF PERMANENT WOODY VEGETATION WITH THE GOAL OF PROVIDING LONG-TERM STABILIZATION THROUGH THE ESTABLISHMENT OF SELF-SUSTAINING VEGETATION. THE FLOODPLAIN WILL BE GRADED TO INCORPORATE HIGHER AND LOWER AREAS (MICROTOPOGRAPHY) TO CREATE COMPLEXITY AND PROVIDE DIVERSE HABITAT FOR TERRESTRIAL SPECIES. ROWS OF WILLOWS OR OTHER SUITABLE WOODY SPECIES WILL BE PLANTED TO PROVIDE A SEED SOURCE FOR FLOODPLAIN VEGETATION. A SIDE CHANNEL WILL BE INTEGRATED IN THE RIGHT FLOODPLAIN FILL TO ACCOMMODATE OVERBANK FLOWS THAT CURRENTLY ROUTE AROUND THE DIVERSION STRUCTURE, AND TO PROVIDE SECONDARY MEANS FOR LOW FLOW FISH PASSAGE.

NO.	DATE	BY	DESCRIPTION	CHK
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IMAGE: RDG UAS 2024

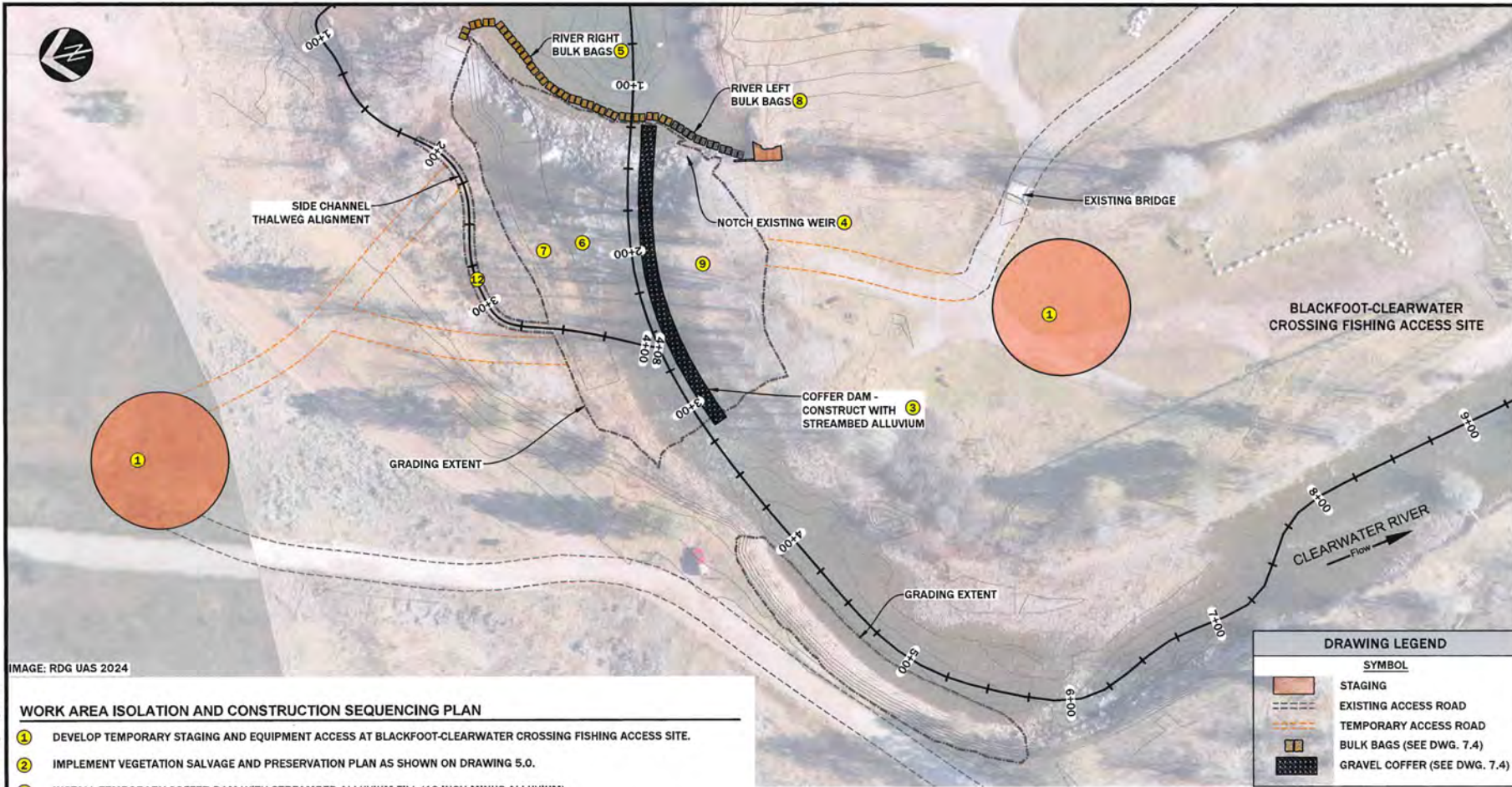


IMAGE: RDG UAS 2024

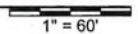
WORK AREA ISOLATION AND CONSTRUCTION SEQUENCING PLAN

- 1 DEVELOP TEMPORARY STAGING AND EQUIPMENT ACCESS AT BLACKFOOT-CLEARWATER CROSSING FISHING ACCESS SITE.
- 2 IMPLEMENT VEGETATION SALVAGE AND PRESERVATION PLAN AS SHOWN ON DRAWING 5.0.
- 3 INSTALL TEMPORARY COFFER DAM WITH STREAMBED ALLUVIUM FILL (16-INCH MINUS ALLUVIUM).
- 4 NOTCH APPROXIMATELY 50-FT OF EXISTING DIVERSION WEIR FROM RIVER CENTERLINE TO EXISTING HEADGATE STRUCTURE.
- 5 PLACE BULK BAGS ALONG THE RIVER RIGHT FACE OF EXISTING DIVERSION WEIR AND DIVERT STREAMFLOW TO LEFT (SOUTH) SIDE OF CLEARWATER RIVER.
- 6 INSTALL CHANNEL CASCADE FROM STA. 1+25 TO STA. 3+10 ON NORTH SIDE OF CLEARWATER RIVER.
- 7 INSTALL VWM TYPE 1 AND CONSTRUCT INSET FLOODPLAIN SURFACE ON NORTH SIDE OF CLEARWATER RIVER TAKING CARE TO MINIMIZE DISTURBANCE TO EXISTING VEGETATION AND AQUATIC RESOURCES.
- 8 REMOVE BULK BAGS ALONG THE RIVER RIGHT FACE OF EXISTING DIVERSION WEIR. PLACE BULK BAGS ALONG THE RIVER LEFT FACE OF EXISTING DIVERSION WEIR AND ACTIVATE STREAMFLOW IN CONSTRUCTED CHANNEL CASCADE ON NORTH SIDE OF RIVER.
- 9 INSTALL CHANNEL CASCADE FROM STA. 1+25 TO STA. 3+10 ON SOUTH SIDE OF CLEARWATER RIVER. DECOMMISSION COFFER DAM AND BLEND STREAMBED ALLUVIUM FILL IN RIVER RIGHT CHANNEL CASCADE. REMOVE BULK BAGS FROM RIVER LEFT FACE OF EXISTING DIVERSION WEIR AND ACTIVATE STREAMFLOW IN CONSTRUCTED CHANNEL CASCADE. INSTALL VWM TYPE 1 STREAMBANK AND FLOODPLAIN TREATMENTS ON RIVER RIGHT.

DRAWING LEGEND

SYMBOL	DESCRIPTION
[Orange circle]	STAGING
[Dashed line]	EXISTING ACCESS ROAD
[Dotted line]	TEMPORARY ACCESS ROAD
[Black rectangle]	BULK BAGS (SEE DWG. 7.4)
[Black rectangle with dots]	GRAVEL COFFER (SEE DWG. 7.4)

1 DEWATERING PLAN PLAN VIEW



WORK AREA ISOLATION AND CONSTRUCTION SEQUENCING PLAN (CONT.)

- 10 DEMOBILIZE EQUIPMENT AND EXCESS MATERIALS FROM BLACKFOOT-CLEARWATER CROSSING FISHING ACCESS SITE.
- 11 TRANSPLANT SALVAGED VEGETATION ON INSET FLOODPLAIN SURFACE AND APPLY FLOODPLAIN ROUGHNESS TO FINISH GRADE SURFACE.
- 12 CONSTRUCT SIDE CHANNEL AND VWM TYPE 1 BANK TREATMENTS.
- 13 TRANSPLANT SALVAGED VEGETATION ON SIDE CHANNEL STREAMBANKS AND DISTURBED FLOODPLAIN AREAS.
- 14 APPLY FLOODPLAIN ROUGHNESS TO TEMPORARY ACCESS ROADS. SCARIFY AND SEED STAGING AREAS AND DEMOBILIZE EQUIPMENT.



DEWATERING AND CONSTRUCTION SEQUENCING PLAN
CLEARWATER DIVERSION UPGRADE PROJECT
 CLEARWATER, MONTANA

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TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 2 WOOD	1,593	2-4 IN	10-12 FT	OPTIONAL
CATEGORY 3 WOOD	2,370	< 2 IN	10-12 FT	OPTIONAL
WILLOW CUTTINGS	9,420	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	350	24-36	
ITEM	QUANTITY (CY)	GRADATION	
6" MINUS FILL	233	SIZE (IN)	PERCENT PASSING
		6	95
		5	90-95
		4	85-90
		3	65-85
		2	50-65
		1	30-50
		0.5	20-30
16" MINUS FILL	1,889	SIZE (IN)	PERCENT PASSING
		16	100
		10	90-100
		6	50-80
		4	30-50
		2	10-30
		<1	10

TOTAL EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	206
BACKFILL	2,416
NET CUT	2,210

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

VEGETATED WOOD MATRIX QUANTITIES

ITEM	QUANTITY
VEGETATED WOOD MATRIX TYPE 1	738 LF
VEGETATED WOOD MATRIX TYPE 2	204 LF
CATEGORY 2 WOOD	1,554 EA
CATEGORY 3 WOOD	2,292 EA
WILLOW CUTTINGS	9,420 EA
STREAMBANK FILL (16" MINUS)	524 CY

MAIN CHANNEL CASCADE QUANTITIES

ITEM	QUANTITY
CATEGORY 1 ROCK	350 EA
STREAMBED FILL (16" MINUS)	834 CY
STREAMBED FILL (6" MINUS)	233 CY
CATEGORY 2 WOOD	28 EA

SIDE CHANNEL CASCADE QUANTITIES

ITEM	QUANTITY (EA)
STREAMBED FILL (16" MINUS)	59 CY

FLOODPLAIN TREATMENT

ITEM	QUANTITY
ACRES OF FLOODPLAIN	0.31 AC
CATEGORY 2 WOOD	11 EA
CATEGORY 3 WOOD	76 EA

RIGHT BANK FLOODPLAIN FILL

ITEM	QUANTITY (EA)
STREAMBED FILL (16" MINUS)	531 CY



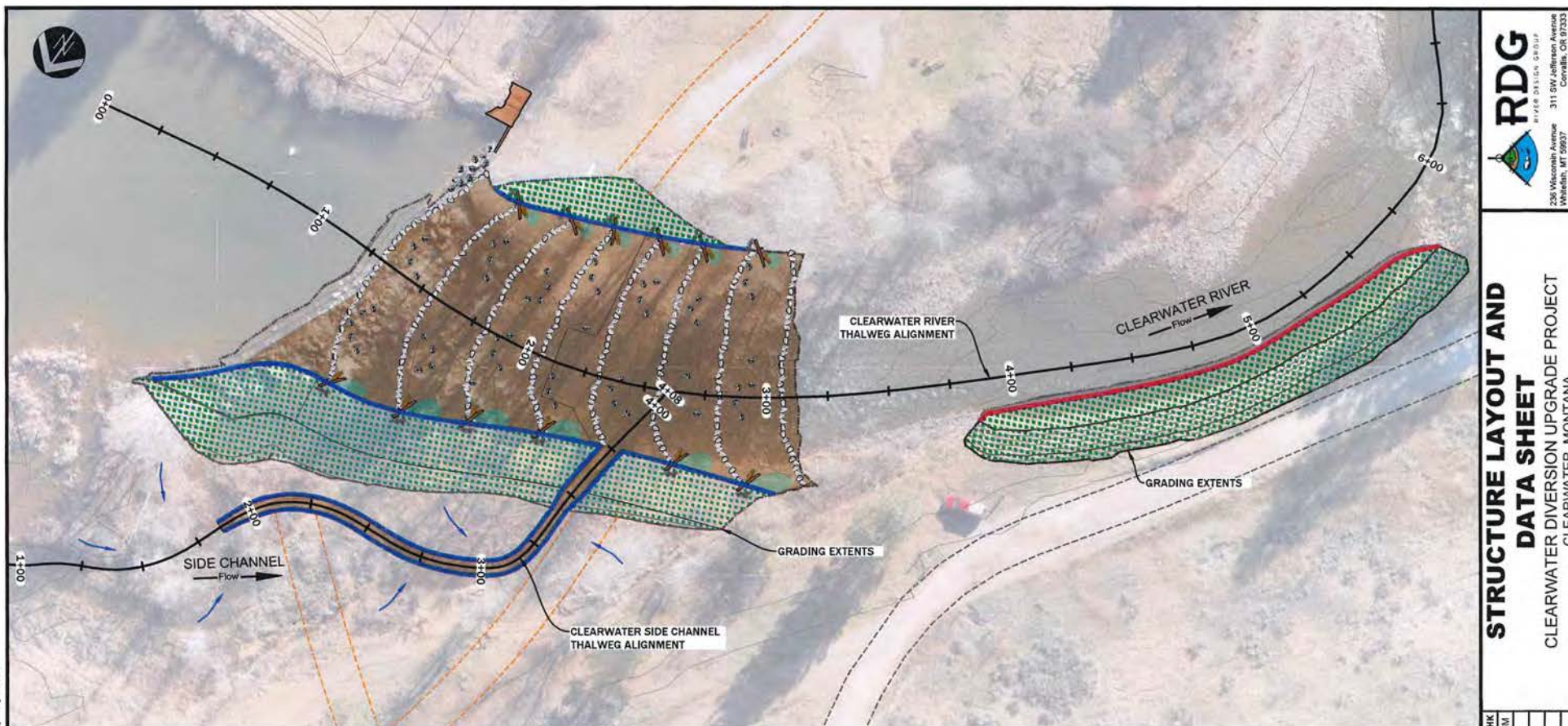
MATERIALS AND QUANTITIES
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION
1	8/9/24	ll	Final Design

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1 MAIN CHANNEL STRUCTURE LAYOUT PLAN VIEW
1" = 40'

MAIN CHANNEL STRUCTURE SCHEDULE			
STATION START	STATION END	BANK	STRUCTURE
0+70	3+04	R	VWM 1
1+31	3+13	C	CCS
1+51	2+88	L	VWM 1
3+84	5+75	R	VWM 2

SIDE CHANNEL STRUCTURE SCHEDULE			
STATION START	STATION END	BANK	STRUCTURE
1+76	3+76	R	VWM 1
1+76	3+76	C	CCS
1+76	3+76	L	VWM 1

CHANNEL TOP OF BANK ELEVATIONS	
STATION START	ELEVATIONS (FT)
0+50	3820.2
1+00	3820.2
1+50	3819.6
2+00	3818.1
2+50	3816.5
3+00	3815.3
3+50	3815.0
4+00	3814.9
4+50	3814.9
5+00	3814.9
5+50	3814.9
6+00	3814.7

DRAWING LEGEND	
SYMBOL	
	GRADING EXTENTS
	EXISTING ACCESS ROAD
	TEMPORARY ACCESS ROAD
	VEGETATED WOOD MATRIX TYPE 1
	VEGETATED WOOD MATRIX TYPE 2
	CONSTRUCTED CASCADE
	FLOODPLAIN ROUGHNESS
	SCOUR POOL
	SCOUR POOL STRUCTURE
	FLOODPLAIN DRAINAGE

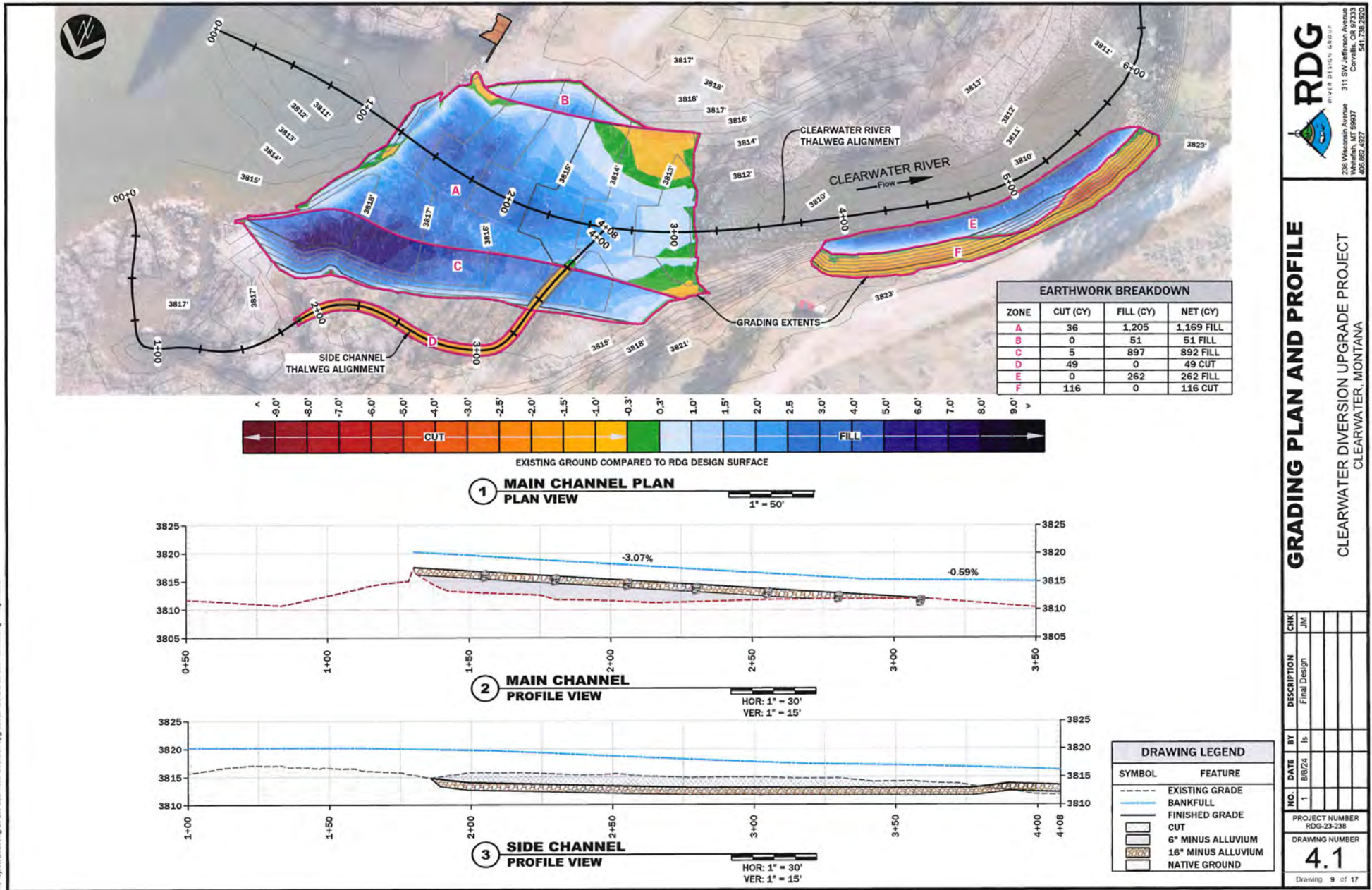


STRUCTURE LAYOUT AND DATA SHEET
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
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GRADING PLAN AND PROFILE
CLEARWATER DIVERSION/UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	8/24	ls	Final Design	JM

PROJECT NUMBER: R00-23-238
DRAWING NUMBER: **4.1**
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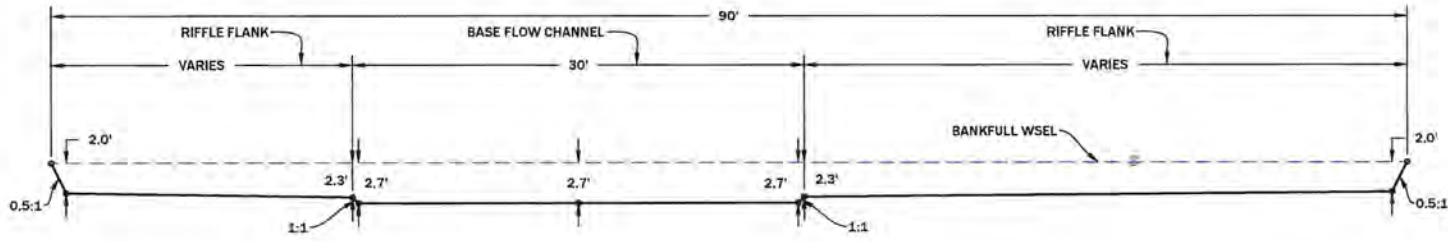
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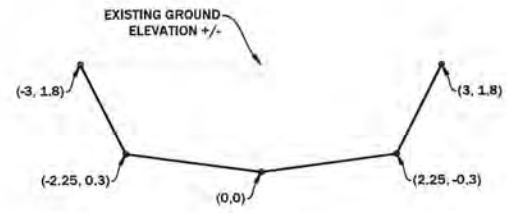
CHANNEL CROSS SECTION DIMENSIONS
 CLEARWATER DIVERSION UPGRADE PROJECT
 CLEARWATER, MONTANA

NO.	DATE	BY	CHK	DESCRIPTION
1	8/9/24	ls	JM	Final Design

PROJECT NUMBER
RDG-23-238
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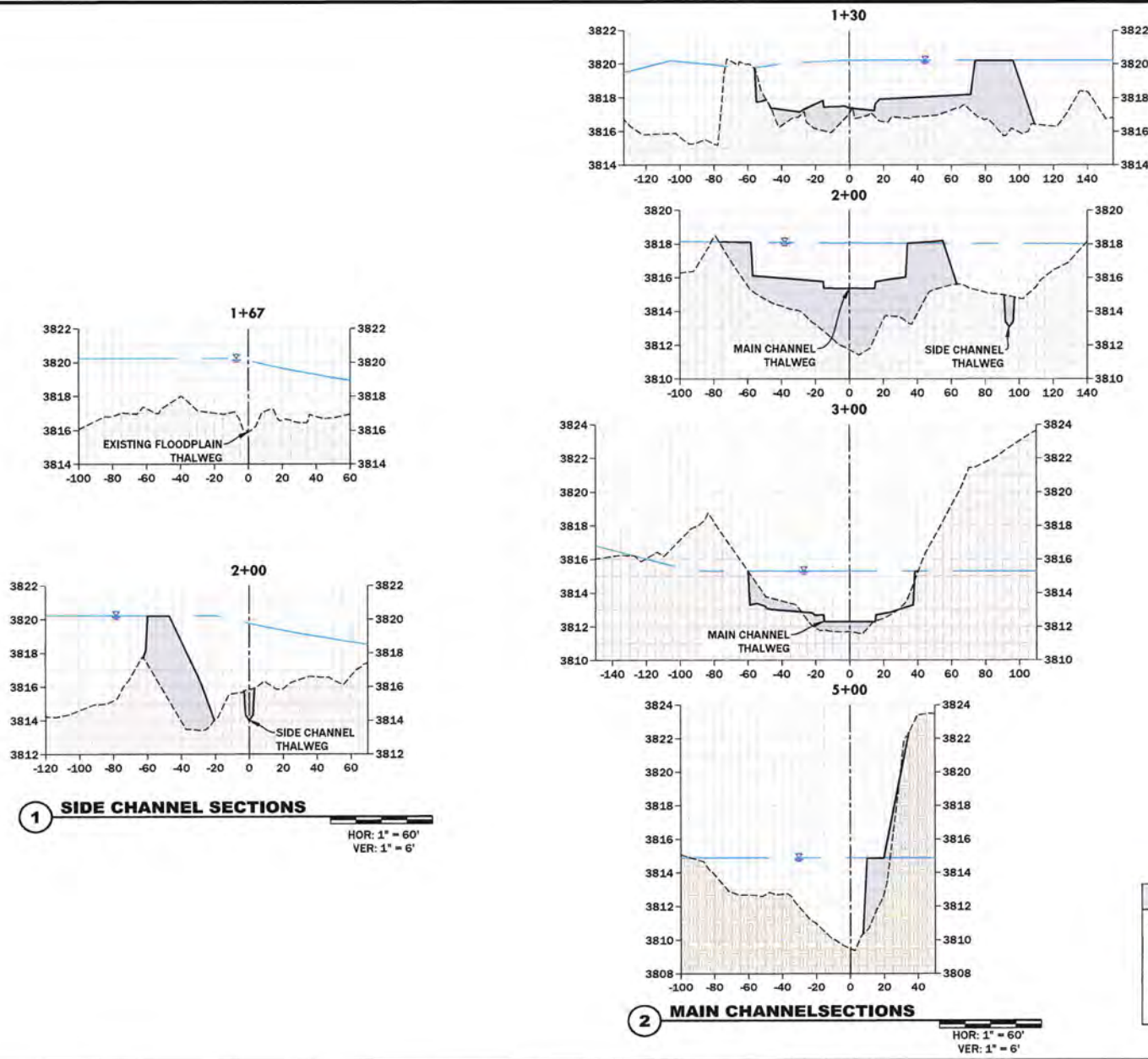
1 CASCADE TYPICAL SECTION
 1" = 8'



2 SIDE CHANNEL TYPICAL SECTION
 1" = 2'

CASCADE BANKFULL CROSS SECTION DESIGN CRITERIA	
	RIFFLE VALUE (FT)
Area	189.0
Width/Depth	45.0
Range (Low)	40.0
Range (High)	50.0
Width	
Average	90.0
Range (Low)	84.9
Range (High)	94.9
Avg. Depth	
Average	2.0
Range (Low)	1.9
Range (High)	2.1
Max. Depth	
Average	2.5
Range (Low)	2.5
Range (High)	2.7
Max. Scour	3.2

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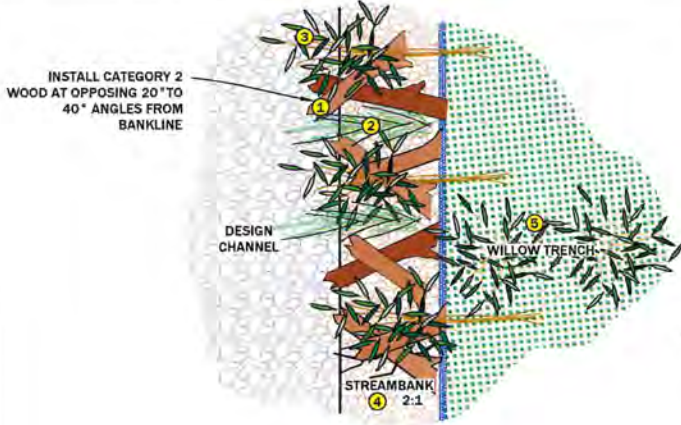


335 Mission Avenue
Whitefish, MT 59917
406.852.4927
311 SW Jefferson Avenue
Corvallis, OR 97333

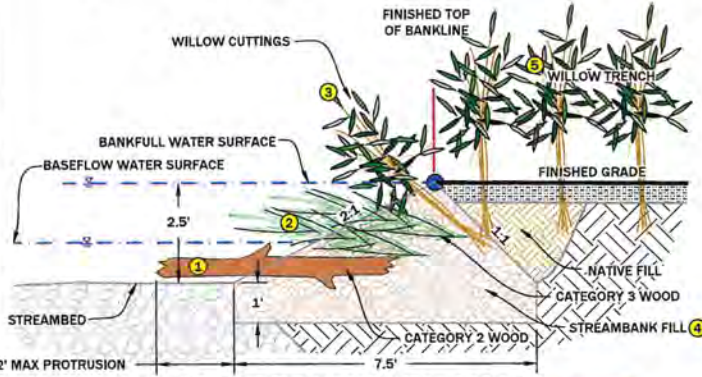
CROSS SECTIONS
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

CHK	DESCRIPTION	DATE	BY
JM	Final Design	8/6/24	JB
1			

PROJECT NUMBER
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1 VEGETATED WOOD MATRIX - TYPE 1 PLAN VIEW NTS

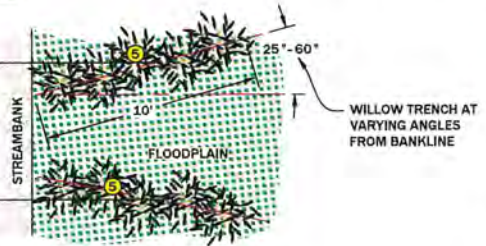


2 VEGETATED WOOD MATRIX - TYPE 1 SECTION VIEW 1" = 3'

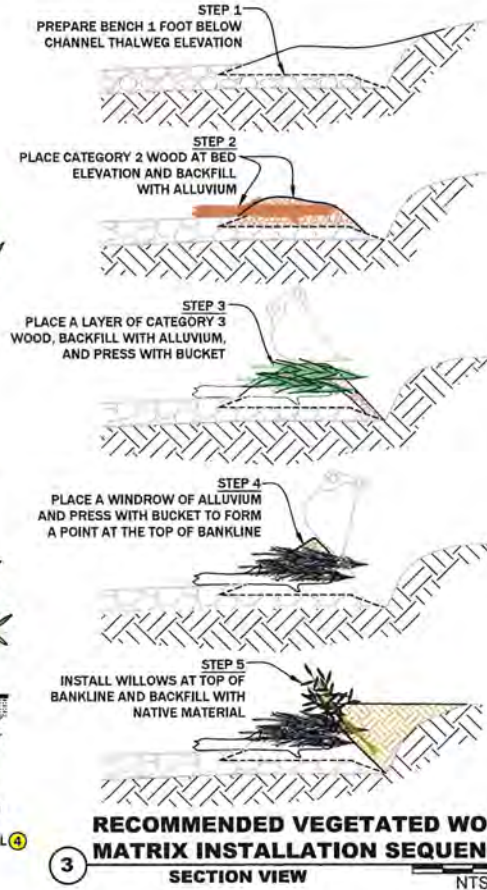


4 WILLOW TRENCH SECTION VIEW NTS

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



5 WILLOW TRENCH PLAN VIEW NTS



3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE NTS

GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER INSTALLATION OF THE CHANNEL STREAMBED.
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 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.

STREAMBANK FILL GRADATION	
SIZE (IN)	PERCENT PASSING
16	100
10	90-100
6	50-80
4	30-50
2	10-30
<1	10

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

TYPE 1 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAL FOOT)			
ITEM	DIA. (IN)	QTY.	
1	CATEGORY 2 WOOD	2"-4"	1
2	CATEGORY 3 WOOD	< 2"	2
3	WILLOW CUTTINGS	0.25"-1.0"	5
4	STREAMBANK ALLUVIUM	16" MINUS	0.53 CY

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

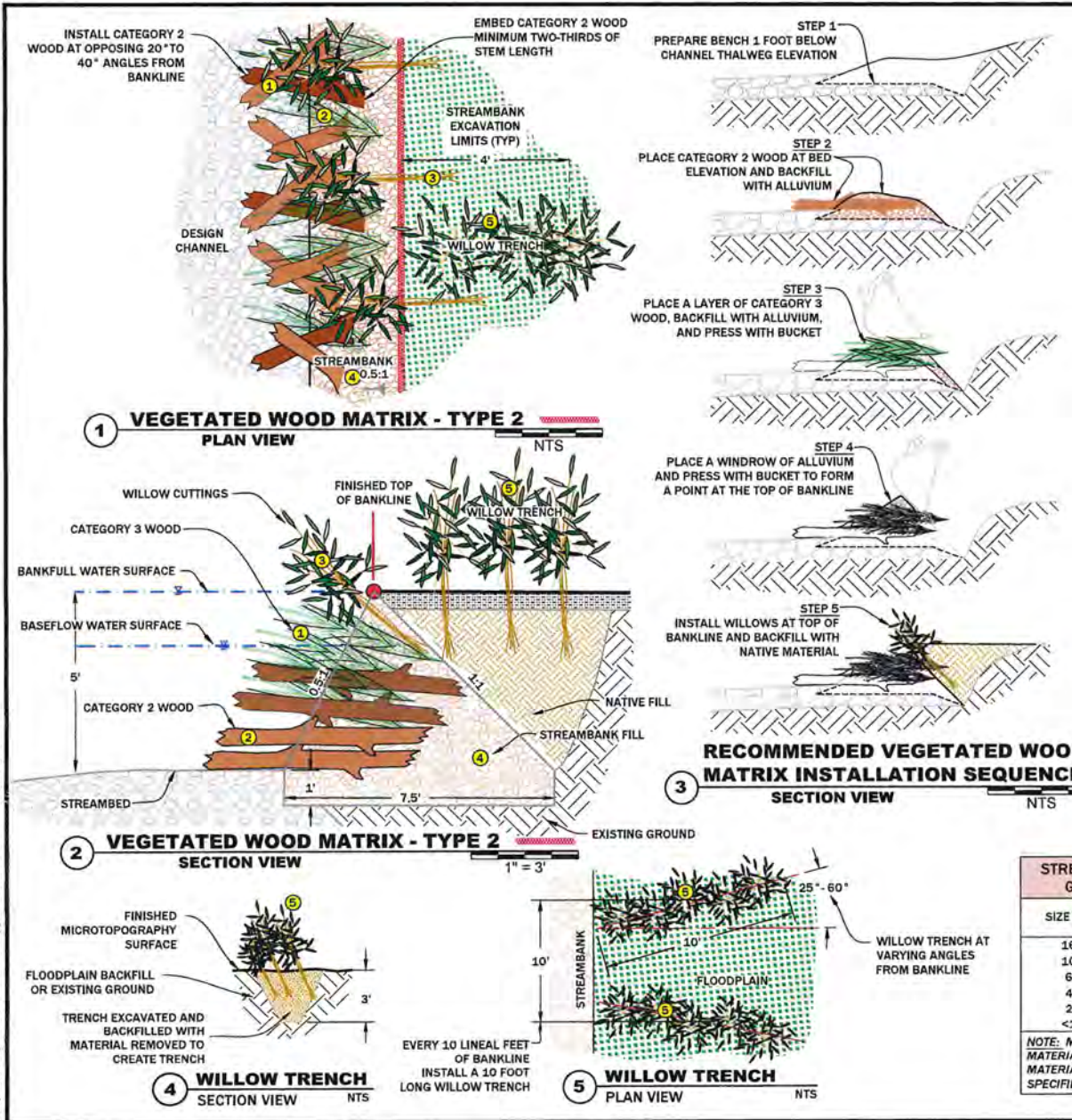


VEGETATED WOOD MATRIX TYPE 1 DETAIL
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	8/6/24	JK	Final Design	JK

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GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER INSTALLATION OF THE CHANNEL STREAMBED.
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 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.

STREAMBANK FILL GRADATION	
SIZE (IN)	PERCENT PASSING
16	100
10	90-100
6	50-80
4	30-50
2	10-30
<1	10

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

TYPE 2 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)		
ITEM	DIA. (IN)	QTY.
1	2"-4"	4
2	< 2"	4
3	0.25"-1.0"	5
4	16" MINUS	0.65 CY

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



VEGETATED WOOD MATRIX TYPE 2 DETAIL
 CLEARWATER DIVERSION UPGRADE PROJECT
 CLEARWATER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK	JM
1	8/6/24	It	Final Design		

PROJECT NUMBER: RDD-23-238
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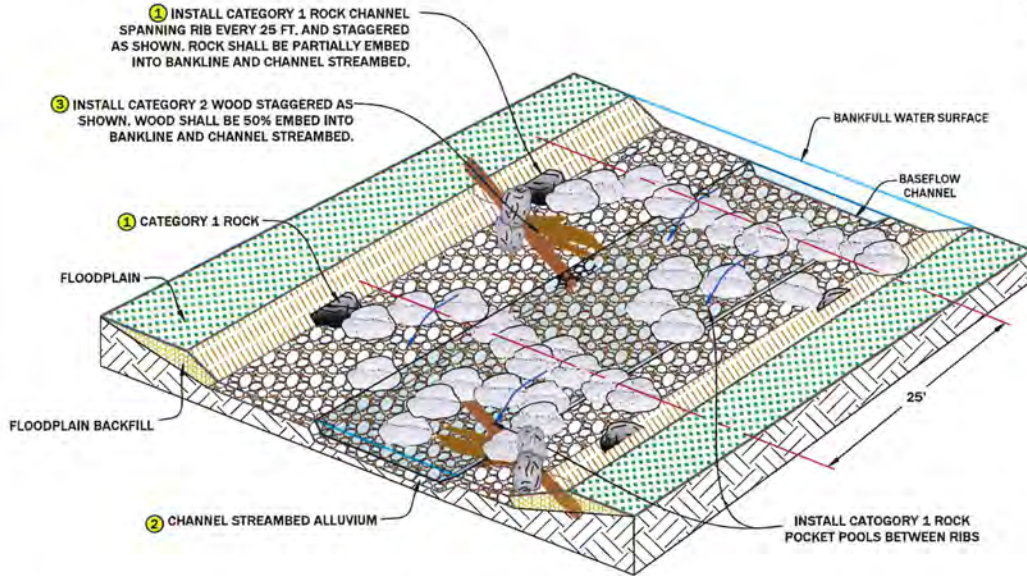
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GENERAL NOTES

1. CONSTRUCTION OF THE CASCADE WILL OCCUR AFTER THE CHANNEL SUBGRADE IS PREPARED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE CONSTRUCTION MANAGER.
3. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CASCADE STRUCTURES.

NOTES ON CASCADE INSTALLATION

1. PRIOR TO CONSTRUCTION OF THE CASCADE, THE CONSTRUCTION MANAGER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CASCADE.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.
3. PREPARE THE FRAMEWORK, CONTRACTOR SHALL PLACE 24-INCH TO 36-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 STREAMBED ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS OF 16-INCHES TO FINISHED GRADE.

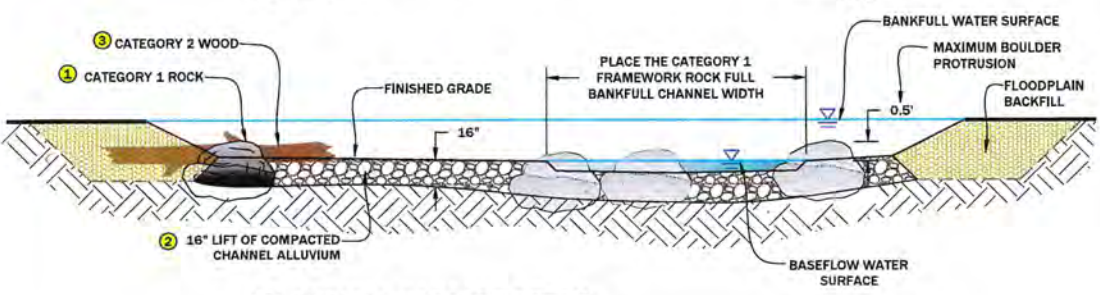


STREAMBANK FILL GRADATION	
SIZE (IN)	PERCENT PASSING
16	100
10	90-100
6	50-80
4	30-50
2	10-30
<1	10

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

MATERIAL SCHEDULE (PER 25 LINEAR FEET)		
ITEM	DIA. (IN)	QUANTITY (EA)
1	CATEGORY 1 ROCK	24" - 36" 50 EA
2	ALLUVIUM	16" MINUS 111 CY
3	CATEGORY 2 WOOD	2" - 4" 4 EA

1 TYPICAL CASCADE DETAIL 3D VIEW



2 TYPICAL CASCADE DETAIL SECTION VIEW



TYPICAL CASCADE POST CONSTRUCTION

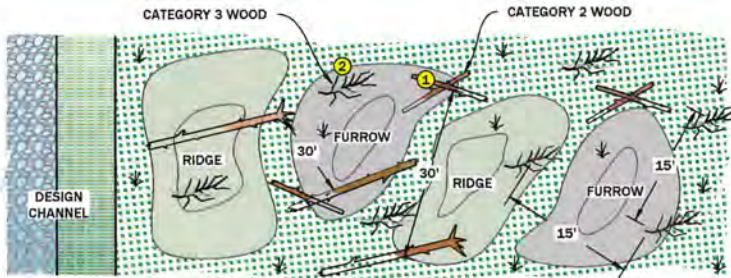


CASCADE CHANNEL DETAIL
CLEARWATER DIVERSION UPGRADE PROJECT
CLEARWATER, MONTANA

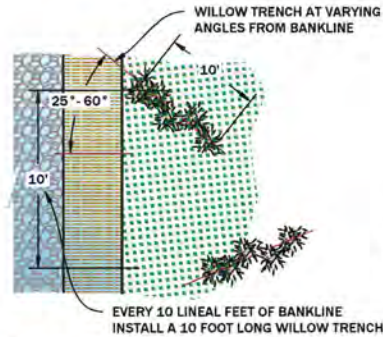
NO.	DATE	BY	DESCRIPTION	CHK
1	08/24	ls	Final Design	JM

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1 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
PLAN VIEW NTS



3 FLOODPLAIN WILLOW TRENCH
PLAN VIEW NTS



4 FLOODPLAIN WILLOW TRENCH
SECTION VIEW NTS

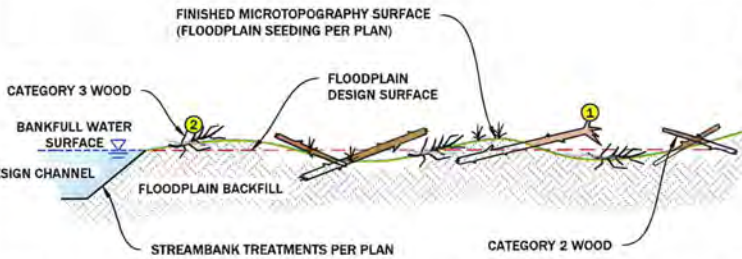
WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)			
ITEM	DIA.	QUANTITY (EA)	
3	WILLOW CUTTINGS	0.25" - 1"	5

NOTES ON WILLOW TRENCH INSTALLATION

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

NOTES ON FLOODPLAIN ROUGHNESS INSTALLATION

1. CONTRACTOR SHALL DEVELOP MICROTOPOGRAPHY AND PLACE WOODY MATERIAL IN THE CONSTRUCTED FLOODPLAIN.
2. TRANSPORT CATEGORY 2, AND CATEGORY 3 WOOD FROM DESIGNATED STOCKPILE AREAS. PLACE CATEGORY 2 WOOD AT A RATE OF 35 PIECES PER ACRE AND SPACED AT AN AVERAGE DISTANCE OF 20 FEET FROM OTHER CATEGORY 2 WOOD. PLACE CATEGORY 3 WOOD SO IT COVERS 25 PERCENT OF THE FLOODPLAIN SURFACE (APPROXIMATELY 250 PIECES PER ACRE).
3. BURY CATEGORY 2 WOOD WITHIN THE FLOODPLAIN SURFACE, WITH ONE HALF OF THE LENGTH BURIED TO A DEPTH OF 2-FT., AND ONE HALF EXPOSED A MAXIMUM OF 2-FT ABOVE FINISHED GRADE AS SHOWN ON DRAWING. PLACE CATEGORY 3 WOOD ON THE SURFACE. CATEGORY 3 WOOD DOES NOT NEED TO BE BURIED.
4. CONSTRUCT LOW AND HIGH FEATURES (RIDGES AND FURROWS) AS SHOWN ON THE DRAWINGS. MAXIMUM HEIGHT OF RIDGES AND DEPTH OF FURROWS SHALL BE NO GREATER THAN 0.5-FT. RELATIVE TO FINISHED FLOODPLAIN SURFACE.



2 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
SECTION VIEW NTS

FLOODPLAIN TREATMENT MATERIAL SCHEDULE (PER ACRE)					
ITEM	DIA. (IN)	LENGTH	QUANTITY (EA)	UNIT	
1	CATEGORY 2 WOOD	2" - 4"	10' - 12'	35	EA
2	CATEGORY 3 WOOD	<2"	10' - 12'	25	% COVER*

*APPROXIMATELY 250 PIECES/ACRE



EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS



EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS



EXAMPLE OF CONSTRUCTED FLOODPLAIN SWALE

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.

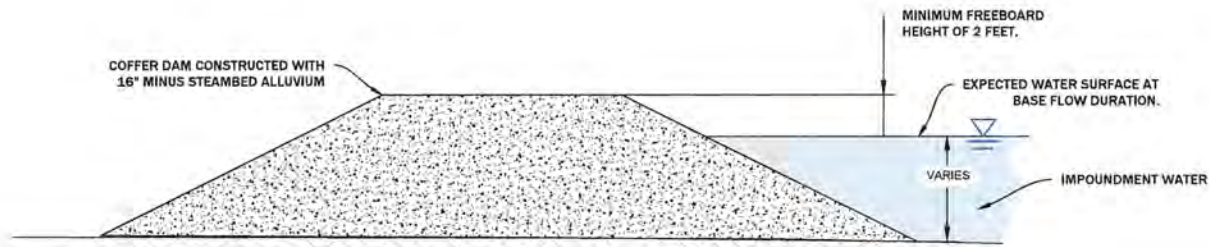
SUPPLEMENTAL INFORMATION: FLOODPLAIN ROUGHNESS TREATMENTS REDUCE THE RISK OF SURFACE EROSION AND INCREASE THE RETENTION OF SEDIMENT AND NUTRIENTS FOR THE DEVELOPMENT OF RIPARIAN VEGETATION. FLOODPLAIN ROUGHNESS IS APPLIED USING TWO METHODS: (1) MICROTOPOGRAPHY GRADING AND (2) WOODY DEBRIS PLACEMENT. 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.



FLOODPLAIN ROUGHNESS DETAIL
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1 COFFER DAM DETAIL
DETAIL NTS

NOTE:
CONTRACTOR RESPONSIBLE FOR COFFER DAM AND BULK BAG COFFER DAM HEIGHT AND WIDTH DESIGN



EXAMPLE OF BULK BAGS

BULK BAG FILL GRADATION	
SIZE (IN)	PERCENT PASSING
1 1/2	20
3/4	30
1/2	30
3/8	20

2 BULK BAG DETAIL
DETAIL NTS

BULK BAG NOTES:

1. BULK BAGS ARE ALSO CALLED FLEXIBLE INTERMEDIATE BULK CONTAINERS (FIBC) THAT CAN BE CUSTOM MADE FROM VARIOUS FABRIC. THE FOLLOWING REQUIREMENTS ARE NECESSARY FOR THE RIVER ENVIRONMENT:
2. **LARGE** BULK BAGS SHALL BE CONSTRUCTED OF 8 oz WOVEN FABRIC, 1200 HOUR UV RESISTANT WITH SEWN LIFTING LOOPS. FILL MATERIAL SHALL BE COMPRISED OF SPAWNING GRAVEL AND MEET THE GRADATION SHOWN IN FILL GRADATION TABLE. THE BAGS ARE APPROXIMATELY 6' WIDE x 6' LONG x 4' HIGH WHEN FILLED.
3. **SMALL** BULK BAGS SHALL BE CONSTRUCTED OF 8 oz WOVEN FABRIC, 1200 HOUR UV RESISTANT WITH SEWN LIFTING LOOPS. FILL MATERIAL SHALL BE COMPRISED OF SPAWNING GRAVEL AND MEET THE GRADATION GIVEN BY THE CITY OF BOISE SPECIFICATIONS (SHOWN BELOW). THE BAGS ARE APPROXIMATELY 3' WIDE x 3' LONG x 2.5' HIGH WHEN FILLED.
4. BULK BAGS SHALL BE CAREFULLY PLACED TO ENSURE NO TEARING OR CUTTING OF THE BAGS OCCURS.
5. BULK BAGS SHALL BE PLACED USING A HYDRAULIC CRANE OR TRACKHOE USING LIFTING BARS AND STEEL CABLES TO EQUALIZE LOAD ON LIFTING LOOPS.



COFFER DAM AND BULK BAG DETAILS
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