



FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

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



I. APPLICANT INFORMATION

- A. Applicant Name: Clark Fork Coalition
- Mailing Address: 140 S 4th St W #1
- City: Missoula State: MT Zip: 59801
- Telephone: 406-542-0539 E-mail: karen@clarkfork.org
- B. Contact Person (if different than applicant): Jed Whiteley
- Address: 1401 S 4th St W #1
- City: Missoula State: MT Zip: 59801
- Telephone: 406-531-0256 E-mail: jed@clarkfork.org
- C. Landowner and/or Lessee Name (if different than applicant): O'Brien Creek Meadows HOA
- Mailing Address: PO Box 3502
- City: Missoula State: MT Zip: 59806
- Telephone: 406-360-3327 E-mail: w.r.darling@hotmail.com

II. PROJECT INFORMATION

- A. Project Name: O'Brien Creek Meadows Stream Restoration
- River, stream, or lake: O'Brien Creek
- Location: Township: T13N Range: R20W Section: S27, S34
- Latitude: 46.8494 Longitude: -114.1108 *Within project (decimal degrees)*
- County: Missoula
- B. Purpose of Project:

The purpose of the project is to increase wild and native trout populations in the O'Brien Creek and Bitterroot watersheds. The project will achieve this by creating habitat for trout, promoting migration of trout from the Bitterroot River to spawning areas and cold water refugia, and by decreasing the impacts of sediment on the salmonid populations of O'Brien Creek and the Bitterroot River.

C. Brief Project Description (attach additional information to end of application):

The 25.4 square-mile O'Brien Creek watershed in Missoula County is an important tributary to the Bitterroot River due to it being a key spawning tributary and stronghold for native Westslope cutthroat trout. O'Brien Creek lies directly adjacent to Missoula populace in area with extremely high fishing demand and few small tribs producing recruitment. The creek has experienced extensive human uses for more than a century, including a railroad in the valley bottom for timber extraction, a grain mill at the confluence with the Bitterroot, severe manipulation from ditching and irrigation withdrawals, road development and timber harvest in the uplands, among others uses.

These land uses contributed to degradation of the fishery but the Clark Fork Coalition (CFC), along with state and federal agencies, have been working for decades to restore the creek and it's riparian habitat. FWP took the lead on upgrading the crossing at Blue Mountain Road and restoring the reach below Blue Mountain Road to the confluence with the Bitterroot River while the Lolo National Forest has completed large scale road decommissioning in the uplands of the O'Brien Creek drainage. In 2014 CFC completed the acquisition of all the senior water rights and converted them to instream flow, permanently reconnecting the creek to the Bitterroot. Now CFC is working with private landowners, the State of Montana and the Forest Service to address habitat, passage and sediment issues on the creek. All of these were identified as limiting factors on O'Brien Creek in the Bitterroot Watershed Restoration Plan that was updated in 2020.

For this project CFC is working with the O'brien Creek Meadows HOA and the upstream landowner to restore a ~900 ft reach of O'brien Creek that is immediately upstream of the Blue Mountain Road reach FWP previously restored. The project will reduce sediment loading, restore stream and floodplain function, improve riparian and instream wildlife habitat, and dissipate flood energy.

The following treatments are proposed on approximately 900 feet of O'Brien Creek:

- Channel Reshaping and Realignment
- Floodplain reconnection
- Large wood installation
- Riparian planting
- Installation of two 36" relief culverts

Our goal is to construct the project in the fall of 2023. In addition to this project CFC is working with the Lolo National Forest, FWP, River Design Group and Geum Environmental to survey over 1.5 miles of O'Brien Creek that lies on the National Forest in order to identify ~2,500 ft of the stream to restore with the goal of increasing/improving Westslope cutthroat trout habitat and spawning sites.

Please note that we have removed Reach 1 from the project as called out on the plan set after reviewing cost vs benefits gained with the local FWP fish biologist and MT DEQ 319 personnel.

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

The habitat was degraded by the historic removal of wood from the stream, straightening of the creek by the construction of O'Brien Creek Road and an undersized culvert at the Tripple Creek Road crossing. This project will address all 3 negative impacts by adding LWD habitat structures, meandering the creek through a new channel in the meadow and adding two 36" relief culverts to the Tripple Creek Rd crossing that will handle up to a q100 streamflow event.

- E. Length of stream or size of lake that will be treated (project extent): 925 ft
 Length/size of impact, if larger than project extent (e.g., stream miles opened): 10 miles
- F. Project Budget Summary:
- | | |
|--|-----------------------------|
| Grant Request (Dollars): | \$ <u>43,888.00</u> |
| Matching Dollars: | \$ <u>125,287.00</u> |
| Matching In-Kind Services:* | \$ _____ |
| <i>*salaries of government employees are not considered matching contributions</i> | |
| Other Contributions (not part of this app) | \$ _____ |
| Total Project Cost: | \$ <u>169,175.00</u> |
- G. Attach itemized (line item) budget – see *budget template*
- H. Attach project location map(s) that include:
- ☒ Extent of the project, including context (relation to major landmark or town)
 - ☒ Indication of public and private property
 - ☒ Riparian buffer locations and widths (if applicable) and grazing locations
- I. Attach project plans:
- ☒ Detailed sketches or plan views with the location and proposed restoration
 - ☒ Pre-project photographs (GPS location strongly recommended)
 - ☒ If water leasing or water salvage is involved, attach a supplemental questionnaire (<https://myfwp.mt.gov/getRepositoryFile?objectID=36110>)
- J. Attach letters or statements of support (e.g., landowner consent, community or public support, and fish biologist support). List any other project partners:
- Lolo National Forest, Hillsdale Estates, MT FWP, MT DEQ, Westslope Chapter Trout Unlimited, Missoula Valley Water Quality District

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.*

CFC and the landowner have a signed landowner agreement formalizing a commitment to maintaining and protecting the project for a 20 year period. CFC has a flow monitoring site at the bottom of the project reach and will be visiting the site at least 5-8 times a year so any violation of this agreement will be quickly noticed and rectified.

- 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.*

No grazing will take place in or adjacent to the project area.

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

Yes. CFC is planning to conduct pre-project monitoring during the summer of 2023 and DEQ has already conducted Bank Erosion Hazard Index (BEHI) monitoring on the project reach. Our monitoring pre- and post- project monitoring plans include R1\R4 (abridged) fish habitat monitoring, Greenline, photo points, and container plant survival monitoring. With help from FWP, we hope to collect post-project fish population data (FWP has conducted pre-project fish population monitoring). These monitoring efforts will help inform us of project effectiveness, as well as keep us aware of any maintenance that needs to happen on site. All data will be shared with FWP.

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

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

Westslope cutthroat trout, rainbow trout, brown trout, brook trout, mountain whitefish. In addition O'Brien Creek is designated as Critical Bull Trout habitat but there is no clear evidence of their presence at the current time.

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

The project will enhance wild and native fish habitat by improving instream habitat complexity; enhancing riparian cover and function; decreasing water temperatures and sediment load to the creek. Adding large woody debris into the system which is currently nearly devoid of wood and building a new meandering channel to replace the current straightened reach will greatly increase complexity and lowering floodplains will improve floodplain-channel connectivity. This new connectivity in an entrenched stream will help riparian plants become established, providing riparian cover for wild trout and cooling water temperatures. These treatments are also expected to reduce sediment load to the creek by preventing new erosion and allowing the channelized section of stream an opportunity to slow down and disperse high flows.

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

The lower Bitterroot River is a recruitment-limited fishery with intense fishing pressure. O'Brien Creek supports high trout densities and high conservation value for native cutthroat trout. O'Brien Creek is one of three primary tributaries within the lower Bitterroot River system that provide trout recruitment to the fishery.

In the short term, this project will provide increased aquatic habitat and riparian cover for wild trout, leading to higher densities in this reach. In the long term, this project, in conjunction with other completed flow and habitat restoration projects in O'Brien Creek should result in improved fish passage and habitat and greater numbers of wild trout in the Lower Bitterroot River

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

While the bottom of the project reach does cross under a county road giving the public legal fishing access below the high water mark the principle positive impact to fishing opportunities for the public is the positive impact on the Lower Bitterroot River fishery.

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

In addition to the fishery benefits this project will increase the riparian corridor on O'Brien Creek, reduce sediment from entering the Bitterroot River which was recently delisted for sediment and protect a county road from washing out during a flood event.

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

No water rights are involved with the project and there will be no interference with the property rights of adjacent landowners.

- 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:  Digitally signed by Karen Knudsen
Date: 2022.11.15 14:52:35 -07'00' Date: 11/15/2022

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

Mail to: FWP Future Fisheries Fish Habitat Bureau PO Box 200701 Helena, MT 59620-0701	Email: Future Fisheries Coordinator FWPFFIP@mt.gov (electronic submissions must be signed) For files over 10MB, use https://transfer.mt.gov and send to mmcgree@mt.gov
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O'Brien Creek Meadows Stream Restoration
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

009-2023

Both tables must be completed or the application will be returned

PROJECT COSTS					CONTRIBUTIONS			
WORK ITEMS (Itemize by Category)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	FUTURE FISHERIES REQUEST	MATCH (Cash or Services)**	OTHER (Not part of this application)	TOTAL
Personnel***								
Survey	1	LS	\$3,000.00	\$ 3,000.00		3,000.00		\$ 3,000.00
Design	1	LS	\$24,000.00	\$ 24,000.00		24,000.00		\$ 24,000.00
Engineering	1	LS		\$ -				\$ -
Permitting	1	LS	\$4,000.00	\$ 4,000.00		4,000.00		\$ 4,000.00
Oversight	1	LS	\$15,000.00	\$ 15,000.00		15,000.00		\$ 15,000.00
				\$ -				\$ -
			Sub-Total	\$ 46,000.00	\$ -	\$ 46,000.00	\$ -	\$ 46,000.00
Travel								
Mileage	400	mile	\$0.54	\$ 216.00		216.00		\$ 216.00
Per diem				\$ -				\$ -
			Sub-Total	\$ 216.00	\$ -	\$ 216.00	\$ -	\$ 216.00
Construction Materials****								
Alluvium	181	CY	\$20.00	\$ 3,620.00		3,620.00		\$ 3,620.00
Wood and Brush	1	LS	\$7,000.00	\$ 7,000.00	7,000.00			\$ 7,000.00
Willow Cuttings	4165	EA	\$1.00	\$ 4,165.00	4,165.00			\$ 4,165.00
Restoration plants	1	LS	\$2,500.00	\$ 2,500.00	2,500.00			\$ 2,500.00
40' 3ft dia CMP	2	EA	\$4,800.00	\$ 9,600.00	4,800.00	4,800.00		\$ 9,600.00
Crushed aggregate	110	CY	\$35.00	\$ 3,850.00		3,850.00		\$ 3,850.00
asphalt	960	SF	\$2.00	\$ 1,920.00		1,920.00		\$ 1,920.00
Exclosure fencing	2500	LF	\$6.00	\$ 15,000.00		15,000.00		\$ 15,000.00
				\$ -				\$ -
			Sub-Total	\$ 47,655.00	\$ 18,465.00	\$ 29,190.00	\$ -	\$ 47,655.00
Equipment, Labor, and Mobilization								
Mobilization	1	LS	\$10,000.00	\$ 10,000.00		10,000.00		\$ 10,000.00
Clearwater diversion, BMP's	1	LS	\$1,500.00	\$ 1,500.00		1,500.00		\$ 1,500.00
Excavate,Haul and Place Material	1070	CY	\$5.00	\$ 5,350.00	5,350.00			\$ 5,350.00
Install exclosures	1	LS	\$4,000.00	\$ 4,000.00		4,000.00		\$ 4,000.00

O'Brien Creek Meadows Stream Restoration
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

009-2023

Construct Channel Streambed	233	LF	\$23.00	\$ 5,359.00	5,359.00		\$ 5,359.00
Construct LWD Structures	4	EA	\$700.00	\$ 2,800.00	2,800.00		\$ 2,800.00
Construct Step Pool Structures	4	EA	\$500.00	\$ 2,000.00	2,000.00		\$ 2,000.00
Construct Vegetated Wood Matrix Type 1 (Riffles)	278	LF	\$13.00	\$ 3,614.00	3,614.00		\$ 3,614.00
Construct Vegetated Wood Matrix Type 2 (Transitions)	325	LF	\$18.00	\$ 5,850.00	5,850.00		\$ 5,850.00
Install Vegetated Brush Trench	150	LF	\$3.00	\$ 450.00	450.00		\$ 450.00
Culvert Install	1	LS	\$25,000.00	\$ 25,000.00		25,000.00	\$ 25,000.00
Contingency	1	LS	\$9,381.00	\$ 9,381.00		9,381.00	\$ 9,381.00
				\$ -			\$ -
			Sub-Total	\$ 75,304.00	\$ 25,423.00	\$ 49,881.00	\$ - \$ 75,304.00
TOTALS				\$ 169,175.00	\$ 43,888.00	\$ 125,287.00	\$ - \$ 169,175.00

OTHER REQUIREMENTS:

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

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

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

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

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

Additional details:

APPLICATION MATCHING CONTRIBUTIONS				
(do not include requested funds or contributions not associated with the application)				
CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
DEQ 319	\$ -	\$ 82,287.00	\$ 82,287.00	Y
DEQ 319	\$ -	\$ 38,000.00	\$ 38,000.00	N

O'Brien Creek Meadows Stream Restoration
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

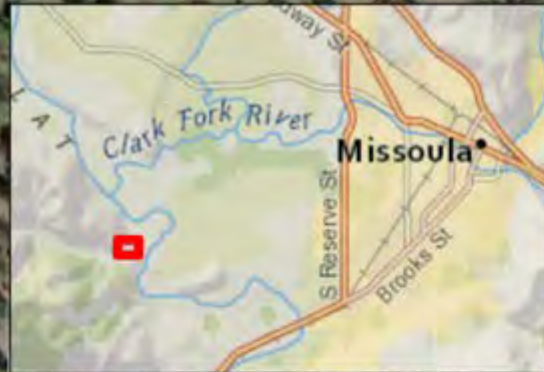
009-2023

Landowners		\$ 5,000.00	\$ 5,000.00	N
				Y
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ -	\$ 125,287.00	\$ 125,287.00	

OTHER CONTRIBUTIONS

(contributions not associated with the application)

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



O'Brien Creek

O'BRIEN CREEK
MEADOWS

O'BRIEN CREEK
MEADOWS

HILLSDALE
ESTATES
HOA

Legend

- Project extent
- 50 ft riparian buffer
- Private parcels

0 0.05 0.1 0.2 Miles

O'brien Creek Spring 2019 Photos



Large cut bank at the top of Reach 3



O'Brien Creek left its banks spring of 2019 and flooded large areas due to massive sediment aggradation



Out migrating spawning Westslope Cutthroat trout stranded due to large sediment plug choking creek

O'BRIEN CREEK RESTORATION PROJECT FINAL DESIGN PLAN SET

PROJECT PARTNERS



CLARK FORK COALITION
140 S 4TH STREET WEST #1
MISSOULA, MONTANA 59801



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



HILLSDALE ESTATES PROPERTY
MANAGERS ASSOCIATION

O'BRIEN CREEK MEADOWS
HOMEOWNERS ASSOCIATION

O'BRIEN CREEK VICINITY MAP



LEGAL DESCRIPTION: NW 1/4 S34, T13N, R20W; AND SE 1/4 S27, T13N, R20W
MISSOULA COUNTY, MONTANA

PROJECT DESCRIPTION

CLARK FORK COALITION, IN PARTNERSHIP WITH MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ), HILLSDALE ESTATES PROPERTY MANAGERS ASSOCIATION, AND O'BRIEN CREEK MEADOWS HOMEOWNERS ASSOCIATION, RETAINED RIVER DESIGN GROUP, INC. TO PREPARE A RESTORATION PLAN FOR A 0.3-MILE REACH OF LOWER O'BRIEN CREEK, A TRIBUTARY TO THE BITTERROOT RIVER NEAR MISSOULA, MONTANA. BOTH WATERBODIES HAVE BEEN IDENTIFIED AS IMPAIRED BY THE DEQ. THE DRAWINGS CONTAINED IN THIS PLAN SET REPRESENT A 95% DESIGN LEVEL EQUIVALENT.

DRAWING INDEX

1.0 COVER SHEET AND NOTES	6.0 CHANNEL CROSS SECTION DIMENSIONS
2.0 EXISTING CONDITIONS	6.1 DESIGN CRITERIA
3.0 SITE PLAN AND INDEX	7.0 CROSS SECTIONS
3.1 DEWATERING PLAN	7.1 CROSS SECTIONS
4.0 MATERIALS AND QUANTITIES	8.0 LARGE WOOD STRUCTURE DETAIL
5.0 PLAN VIEW AND DATA SHEET REACH 1	8.1 VEGETATED WOOD MATRIX DETAIL
5.1 GRADING PLAN AND PROFILE REACH 1	8.2 CONSTRUCTED CHANNEL STREAMBED DETAIL
5.2 PLAN VIEW AND DATA SHEET REACH 2	8.3 CHANNEL LOG STEP POOL DETAIL
5.3 GRADING PLAN AND PROFILE REACH 2	8.4 VEGETATED BRUSH TRENCH DETAIL
5.4 PLAN VIEW AND PROFILE REACH 3	9.0 PLANTING AND FENCING PLAN
5.5 ROTATIONAL SLOPE FAILURE PLAN	9.1 SEEDING PLAN

GENERAL NOTES

- CONTOUR INTERVAL IS NOTED ON DRAWINGS.
- SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
- DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
- SURVEY DATA WAS COLLECTED UTILIZING SURVEY GRADE GPS IN SEPTEMBER 2021. FIELD DATA SUPPLEMENTED LIDAR DATA COLLECTED IN SPRING, 2019 TO COMPLETE THE EXISTING GROUND SURFACE. ALL SURVEY DATA WAS COORDINATED BY RDG.
- 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.
- CONTRACTOR TO VERIFY LOCATIONS OF ALL EXISTING UTILITIES PRIOR TO COMMENCEMENT OF WORK.
- 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.
- 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.
- THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS AND EASEMENTS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
- 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.
- 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.
- AT LEAST ONE EXCAVATOR 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)).
- ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
- VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
- CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

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 RECURRENT INTERVAL DISCHARGE FLOOD. REGIONAL CURVES WERE USED TO EVALUATE BANKFULL DISCHARGE, AND HIGHER RETURN INTERVAL DISCHARGES INCLUDING THE 100-YEAR FLOW.

REUSE OF DRAWINGS

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



COVER PAGE AND NOTES
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-169

DRAWING NUMBER
1.0

Drawing 1 of 22



IMAGE: DigitalGlobe 2016

1 O'BRIEN CREEK PLAN VIEW
1" = 200'

O'BRIEN CREEK WATERSHED DESCRIPTION

THE O'BRIEN CREEK WATERSHED ENCOMPASSES 25.4 SQUARE MILES AND IS A MAJOR TRIBUTARY TO THE BITTERROOT RIVER UPSTREAM OF THE CONFLUENCE WITH THE CLARK FORK RIVER. ONE OF THE MOST IMPORTANT TRIBUTARIES IN THE LOWER BITTERROOT RIVER FOR RAINBOW AND CUTTHROAT TROUT (MT FWP, 2019). LAND OWNERSHIP IN THE WATERSHED IS A MIX OF US FOREST SERVICE AND PRIVATE OWNERSHIP. SIMILAR TO MOST FORESTED WATERSHEDS IN THE REGION, O'BRIEN CREEK HAS EXPERIENCED HUMAN-CAUSED IMPACTS FROM FORESTRY, GRAZING, MILL OPERATIONS, DEWATERING, CHANNELIZATION, AND DEVELOPMENT. IN THE LOWER WATERSHED, WATER MANIPULATION AND WITHDRAWALS CREATED FLOW INTERMITTENCY AND CHANNEL DEWATERING. RECENT EFFORTS TO BRING AWARENESS TO THIS ISSUE, AND SENIOR WATER RIGHT PURCHASES, HAVE RETURNED PERENNIAL OR YEAR-ROUND FLOW TO ALL REACHES OF O'BRIEN CREEK.

PROJECT BACKGROUND

STREAM INVENTORIES COMPLETED BY THE US FOREST SERVICE IN 2019 IDENTIFIED OPPORTUNITIES TO IMPROVE AQUATIC HABITAT AND STREAM CHANNEL CONDITIONS THROUGHOUT THE O'BRIEN CREEK WATERSHED (USFS, 2019). THESE EFFORTS WERE UNDERTAKEN, IN PART, TO SUPPORT TMDL SEDIMENT LOAD REDUCTION TARGETS FOR THE BITTERROOT RIVER, WHICH HAS BEEN IDENTIFIED AS AN IMPAIRED WATERBODY BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY. EPISODIC MASS FAILURE EVENTS HAVE OCCURRED IN THE O'BRIEN CREEK WATERSHED, INCLUDING A MASSIVE BANK FAILURE IN 2019 THAT RESULTED IN LARGE-SCALE CHANNEL DEPOSITIONS AND INSTABILITY IN THE LOWER REACHES OF O'BRIEN CREEK UPSTREAM OF TRIPPLE CREEK ROAD. AFTER THE BANK FAILURE, THE O'BRIEN CREEK MEADOW HOMEOWNER'S ASSOCIATION WAS GRANTED A TWO-PHASE 310 PERMIT BY MISSOULA CONSERVATION DISTRICT TO CONDUCT EMERGENCY ACTIONS TO REMOVE

THE SUBSTRATE DEPOSITION. PHASE 1 WORK WAS COMPLETED IN 2019 AND INVOLVED REMOVING SUBSTRATE DEPOSITION AND RETURNING WOOD TO THE CHANNEL.

RIVER DESIGN GROUP, INC. WAS RETAINED BY CLARK FORK COALITION, IN PARTNERSHIP WITH PRIVATE LANDOWNERS AND MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY, TO PREPARE RESTORATION PLANS FOR IMPLEMENTATION OF PHASE 2 WORK WHICH HAS NOT BEEN COMPLETED AND WILL INVOLVE REHABILITATING THE CHANNEL TO IMPROVE STREAM FUNCTION AND REDUCE OR ALTOGETHER ELIMINATE THE NEED FOR FUTURE MAINTENANCE. CONCEPTUAL RESTORATION PLAN DRAWINGS INCLUDED IN THIS PLAN SET ILLUSTRATE THE PREFERRED RESTORATION ALTERNATIVE FOR THE SITE, WHICH INCLUDES RESTORING CONDITIONS THAT SUPPORT THE RECOVERY OF RIVER, FLOODPLAIN, AND AQUATIC HABITAT CONDITIONS.



EXISTING CONDITIONS
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/1/2022	LS	DESIGN	NW
2	1/25/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-169

DRAWING NUMBER
2.0

Drawing 2 of 22



IMAGE: RDG ORTHOPHOTO

1 O'BRIEN CREEK PLAN VIEW

1" = 200'

LEGEND



NOTES: CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ACCESS ROADS AND TEMPORARY HAUL ROADS. EQUIPMENT, MAINTENANCE AND MATERIALS TO BE STAGED MINIMUM 150' FROM RIVER.

RESTORATION GOALS

THE O'BRIEN CREEK RESTORATION DESIGN ADDRESSES LIMITING FACTORS IDENTIFIED BY PROJECT STAKEHOLDER BASED ON PREVIOUS STUDIES AND INVESTIGATIONS. THE PRIMARY GOALS OF THE PROJECT ARE TO RESTORE CHANNEL AND FLOODPLAIN CONDITIONS THAT SUPPORT HIGH QUALITY AQUATIC HABITAT CONDITIONS, PROMOTE THE ESTABLISHMENT OF A DIVERSE RIPARIAN FLOODPLAIN CORRIDOR THAT IS HYDROLOGICALLY CONNECTED TO THE CHANNEL, AND IMPROVE WATER QUALITY TO SUPPORT DOWNSTREAM BENEFICIAL USES. SPECIFIC GOALS FOR THIS PROJECT INCLUDE:

- REDUCE SEDIMENT LOADING TO O'BRIEN CREEK BY: 1) REALIGNING O'BRIEN CREEK THROUGH HISTORICAL MEANDER SCROLLS IN ORDER TO ISOLATE THE CHANNEL FROM CHRONIC SOURCES OF SEDIMENT ASSOCIATED WITH O'BRIEN CREEK ROAD; AND 2) ISOLATING O'BRIEN CREEK FROM ROTATIONAL SLOPE FAILURES THROUGH FLOODPLAIN CONSTRUCTION.
- CONSTRUCTING A NEW MODERATELY ENTRENCHED, RIFFLE-POOL, B3 STREAM TYPE WITHIN A TERRACED VALLEY, CONNECTED TO A BROAD AND WELL-VEGETATED BANKFULL FLOODPLAIN.
- IMPLEMENTING STREAMBANK, FLOODPLAIN, AND RIPARIAN REVEGETATION TECHNIQUES TO INCREASE THE COVER OF WOODY RIPARIAN SHRUBS AND TREES.
- REDUCING FLOOD HAZARD RISK TO PRIVATE PROPERTY BY CREATING A FUNCTIONAL, INSET FLOODPLAIN THAT IS CONNECTED TO THE CHANNEL AND WILL PROVIDE FLOOD ENERGY DISSIPATION.

RESTORATION TREATMENTS

RESTORATION WILL OCCUR ALONG 0.3 MILES OF O'BRIEN CREEK AND WILL BE COMPLETED IN THE DRY DURING FALL 2022. IMPLEMENTATION WILL BE CLOSELY INTEGRATED WITH CLARK FORK COALITION, MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY, PRIVATE LANDOWNERS, AND STAKEHOLDERS. IN REACH 1, O'BRIEN CREEK IS CHANNELIZED AND IS BRACKETED AGAINST THE O'BRIEN CREEK ROAD FILLSLOPE, A CHRONIC SOURCE OF SEDIMENT AND OTHER POLLUTANTS TO O'BRIEN CREEK. IN THIS REACH, THE CHANNEL WILL BE RELOCATED TO THE SOUTH THROUGH HISTORICAL CHANNEL SCROLLS AND RECONNECTED WITH WELL VEGETATED FLOODPLAIN SURFACES, INCREASING STREAM LENGTH BY 20%.

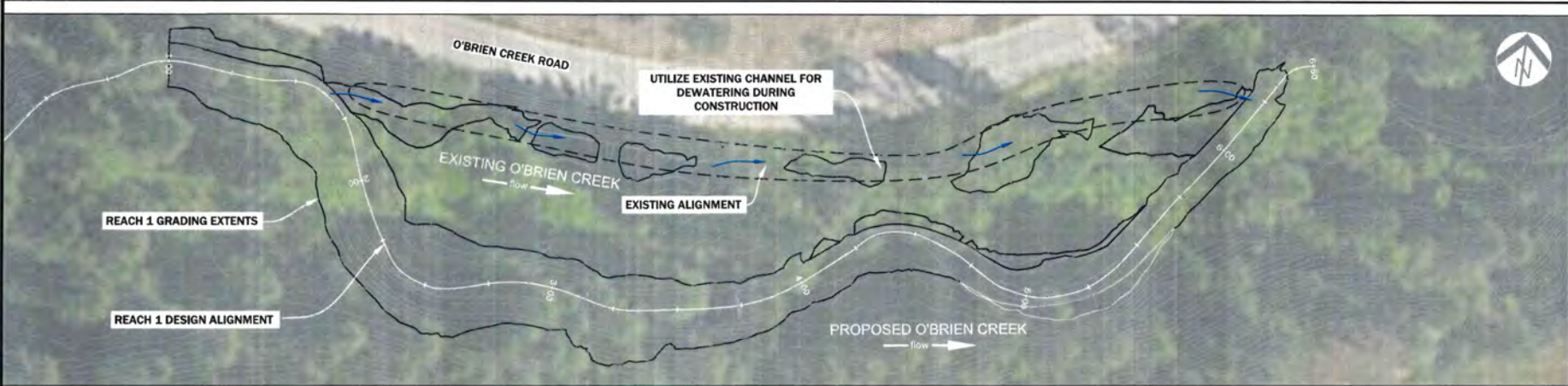
IN REACH 2, A NEW CHANNEL WILL BE CONSTRUCTED TO ADDRESS EXISTING IMPAIRMENTS INCLUDING DEGRADED HABITAT CONDITIONS, HIGH SEDIMENT LOADING FROM BANK EROSION, AND DECREASED SEDIMENT TRANSPORT CAPACITY. A MODERATELY ENTRENCHED, COBBLE DOMINATED, RIFFLE-POOL B3 STREAM TYPE WILL BE CONSTRUCTED WITHIN A BROAD, WELL VEGETATED FLOODPLAIN CORRIDOR. A VARIETY OF STREAMBED, STREAMBANK, FLOODPLAIN AND REVEGETATION TREATMENTS WILL BE IMPLEMENTED TO SUPPORT THE RESTORATION GOALS AND DESIRED OUTCOMES. TREATMENTS ARE NATIVE MATERIALS BASED AND DESIGNED TO MIMIC REFERENCE REACH CONDITIONS OBSERVED UPSTREAM IN RELATIVELY UNDISTURBED SEGMENTS OF O'BRIEN CREEK. STREAMBED TREATMENTS WILL CONSIST OF COMPLEX AQUATIC HABITAT FEATURES INCLUDING RIFFLES, PLUNGE POOLS, LATERAL POOLS AND GLIDES. STREAMBANK TREATMENTS WILL BE COMPOSED OF WOOD, ALLUVIUM, AND VEGETATION, AND WILL INCREASE BANK RESILIENCY TO EROSION. PROVIDING SHORT-TERM STREAMBED AND STREAMBANK STABILITY IS REQUIRED TO SUPPORT THE VEGETATION DESIGN WHICH EMPHASIZES CREATING A SELF-SUSTAINING MOSAIC OF RIPARIAN AND WETLAND COMMUNITIES ON A FLOODPLAIN SURFACE THAT IS HYDROLOGICALLY CONNECTED TO THE CHANNEL. FLOODPLAIN TREATMENTS WILL INCLUDE A VARIETY OF VEGETATION COVER TYPES THAT INTEGRATE PLANT SPECIES COMPOSITION WITH GEOMORPHOLOGY AND HYDROLOGY, AND ACCOUNT FOR ECOLOGICAL PROCESSES THAT SUPPORT PLANT COMMUNITY DEVELOPMENT OVER TIME.

ACTIVE CHANNEL RESTORATION IS NOT PROPOSED IN REACH 3. RESTORATION GOALS IN REACH 3 FOCUS ON LOWERING HIGH, ERODING BANKS TO BANKFULL ELEVATION, AND CREATING A 35-FT. WIDE, WELL-VEGETATED FLOODPLAIN CORRIDOR THAT INTERACTS WITH THE CHANNEL AT BANKFULL STAGE.

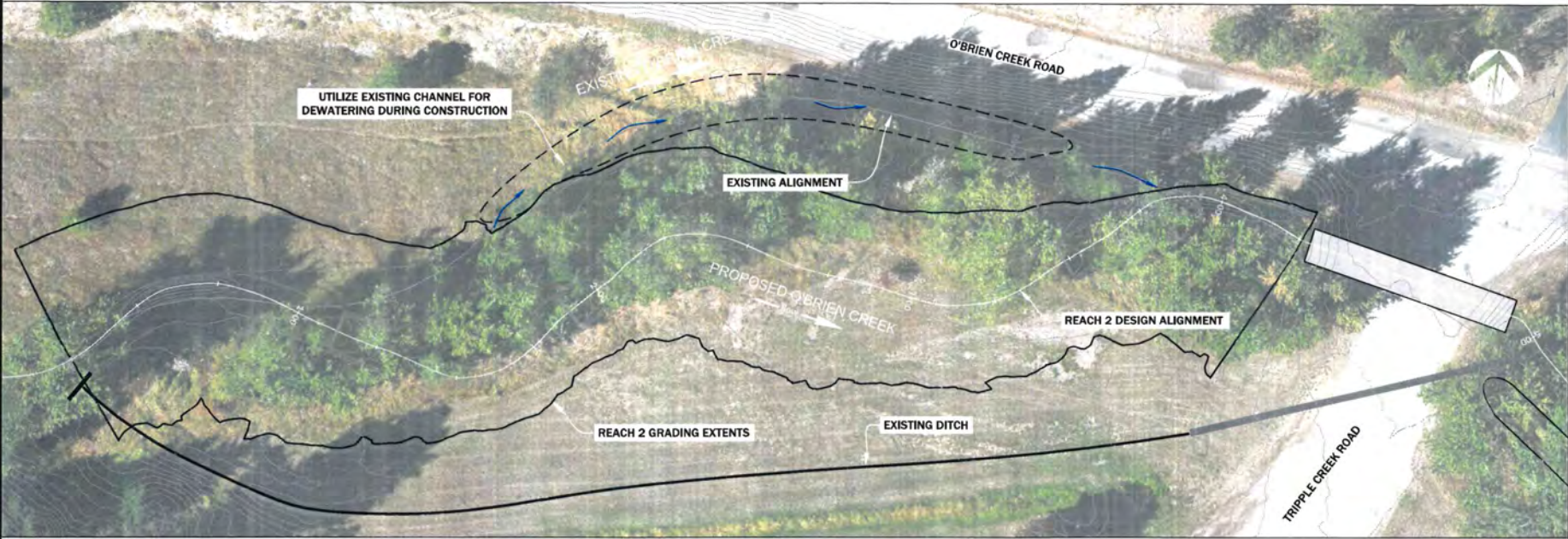


SITE PLAN AND INDEX
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/1/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
PROJECT NUMBER RDG-21-169				
DRAWING NUMBER 3.0				
Drawing 3 of 22				



1 O'BRIEN CREEK PLAN VIEW - REACH 1
1" = 40'



1 O'BRIEN CREEK PLAN VIEW - REACH 2
1" = 30'



DEWATERING PLAN
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/1/22	LS	DESIGN	NW
2	1/2/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDO-21-169
DRAWING NUMBER
3.1
Drawing 4 of 22

TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	38	10 - 14 IN	20 FT	YES
CATEGORY 2 WOOD	763	6 - 12 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	2,142	< 3 IN	10 - 12 FT	OPTIONAL
WILLOW CUTTINGS	8,485	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 EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	1,845
BACKFILL	160
NET CUT	1,685

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

TOTAL ROCK QUANTITIES

ITEM	QUANTITY	DIAMETER
CATEGORY 1 ROCK	166 EA	10 - 12 IN
ITEM	QUANTITY	GRADATION
STREAMBED/STREAMBANK FILL	416 CY	
SIZE (IN)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
10	95	D100
8	90-95	D95
5	85-90	D84
3	65-85	D65
2	50-65	D50
1	30-50	D35
0.5	10-30	D15
Fines	0-10	

TOTAL REVEGETATION - QUANTITIES**PLANT AND SEED QUANTITIES**

ITEM	QUANTITY	UNITS	DIMENSIONS
TALL 1-GAL CONTAINERIZED PLANTS	241	EA	VARIES
5-GAL CONTAINERIZED PLANTS	13	EA	DEPENDING
FLOODPLAIN SEEDMIX	16.43	LBS (PLS)	ON SOURCE
UPLAND RECLAMATION SEEDMIX	6.67	LBS (PLS)	

FENCE QUANTITIES

ITEM	QUANTITY	UNITS	DIMENSIONS
POLYPROPYLENE MESH FENCE	2,250	EA	7.5' TALL
STEEL T-POSTS (15-FT SPACING)	150	EA	10' TALL
HEAVY-DUTY ZIP TIES	600	EA	

REACH 1 - QUANTITIES**WOOD QUANTITIES**

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	16	10 - 14 IN	20 FT	YES
CATEGORY 2 WOOD	324	6 - 12 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	1,052	< 3 IN	10 - 12 FT	OPTIONAL
WILLOW CUTTINGS	4,605	0.25 - 1.0 IN	8 FT	NO

ROCK QUANTITIES

ITEM	QUANTITY	SIZE
CATEGORY 1 ROCK	96 EA	10 - 12 IN
STREAMBED FILL	239 CY	10 INCH MINUS

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	775
BACKFILL	75
NET CUT	700

MISC. QUANTITIES

ITEM	QUANTITY
FABRIC	51 LF
NAILS	60 EA

REACH 2 - QUANTITIES**WOOD QUANTITIES**

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	20	10 - 14 IN	20 FT	YES
CATEGORY 2 WOOD	339	6 - 12 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	890	< 3 IN	10 - 12 FT	OPTIONAL
WILLOW CUTTINGS	3,630	0.25 - 1.0 IN	8 FT	NO

ROCK QUANTITIES

ITEM	QUANTITY	SIZE
CATEGORY 1 ROCK	70 EA	10 - 12 IN
STREAMBED FILL	167 CY	10 IN MINUS

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	870
BACKFILL	85
NET CUT	785

MISC. QUANTITIES

ITEM	QUANTITY
FABRIC	65 LF
NAILS	80 EA

ROTATIONAL SLOPE TREATMENT - QUANTITIES**WOOD QUANTITIES**

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 2 WOOD	50	6 - 12 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	100	< 3 IN	10 - 12 FT	OPTIONAL
WILLOW CUTTINGS	125	0.25 - 1.0 IN	8 FT	NO

ROCK QUANTITIES

ITEM	QUANTITY	SIZE
STREAMBED FILL	5 CY	10 IN MINUS

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	100
BACKFILL	0
NET CUT	100

LARGE WOOD STRUCTURE QUANTITIES

ITEM	QUANTITY
LARGE WOOD STRUCTURES	8 EA
CATEGORY 1 WOOD	24 EA
CATEGORY 2 WOOD	32 EA
CATEGORY 3 WOOD	48 EA
WILLOW CUTTINGS	1,600 EA

VEGETATED WOOD MATRIX QUANTITIES

ITEM	QUANTITY
VEGETATED WOOD MATRIX TYPE 1	788 LF
VEGETATED WOOD MATRIX TYPE 2	561 LF
CATEGORY 2 WOOD	730 EA
CATEGORY 3 WOOD	2,010 EA
WILLOW CUTTINGS	6,745 EA
STREAMBANK FILL	200 CY

**CONSTRUCTED CHANNEL
STREAMBED QUANTITIES**

ITEM	QUANTITY
CONSTRUCTED RIFFLE	820 LF
CATEGORY 1 ROCK	124 EA
STREAMBED FILL	217 CY

VEGETATED BRUSH TRENCH QUANTITIES

ITEM	QUANTITY
VEGETATED BRUSH TRENCH	280 LF
CATEGORY 3 WOOD	84 EA
WILLOW CUTTINGS	140 EA

LOG STEP POOL QUANTITIES

ITEM	QUANTITY
LOG STEP STRUCTURES	7 EA
CATEGORY 1 WOOD	14 EA
CATEGORY 2 WOOD	21 EA
CATEGORY 3 WOOD	42 EA
FILTER FABRIC	68 EA
RING SHANK NAILS	80 EA



MATERIALS AND QUANTITIES O'BRIEN CREEK RESTORATION PROJECT MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11/22/22	LS	DESIGN	NW
2	1/26/23	LS	DESIGN REVISION	JM
3	3/20/23	LS	DESIGN REVISION	JM

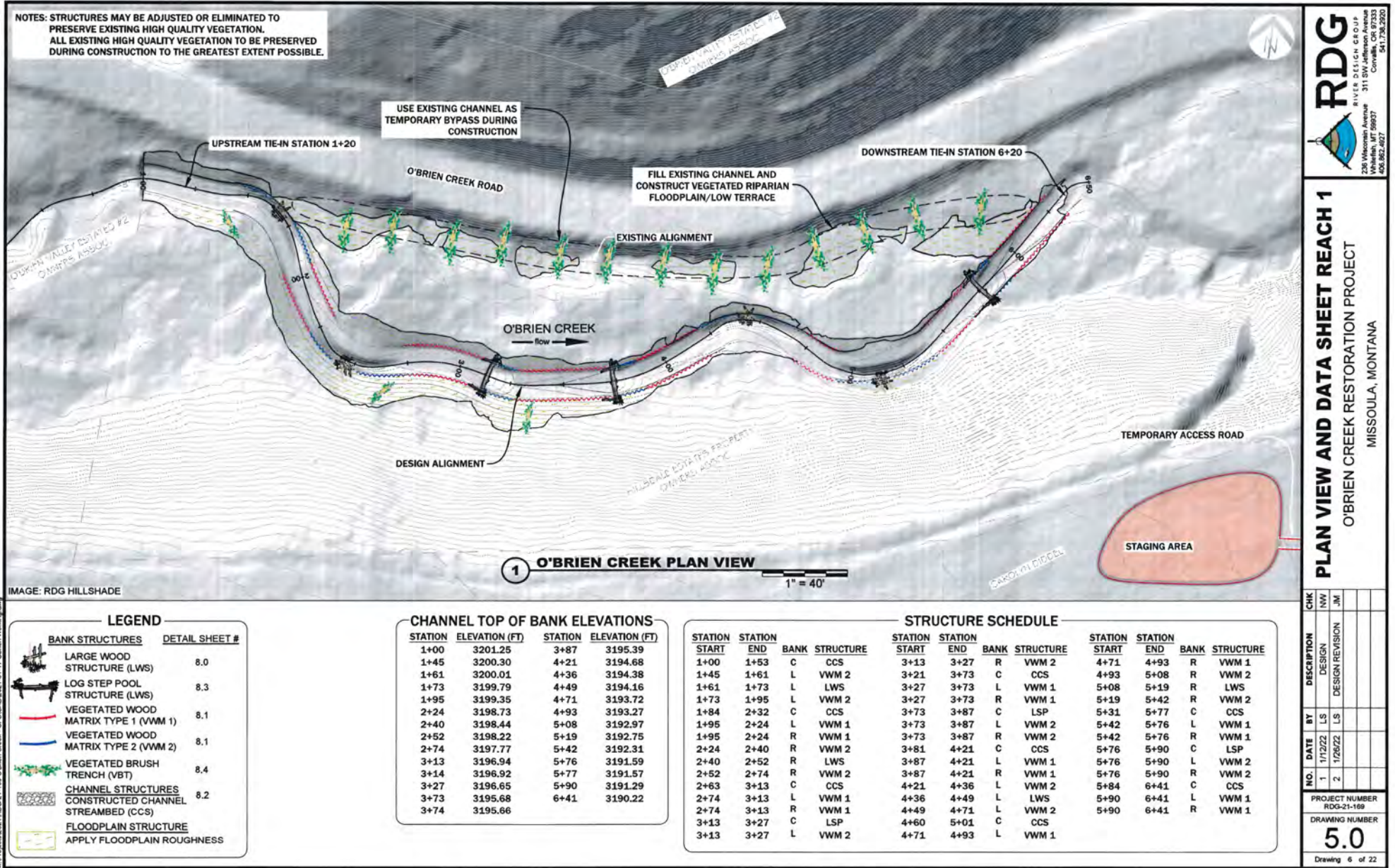
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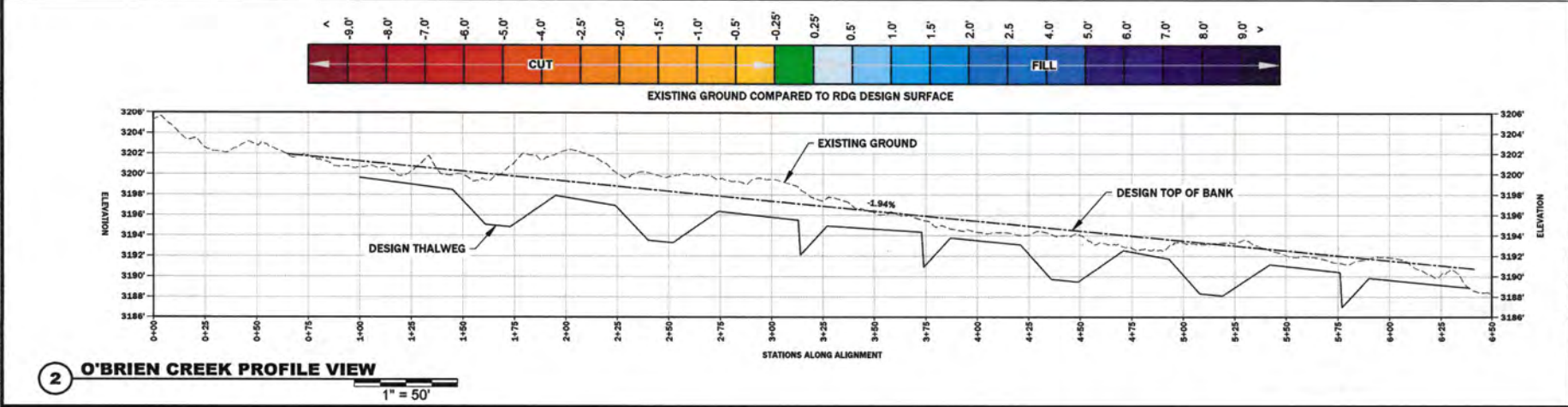
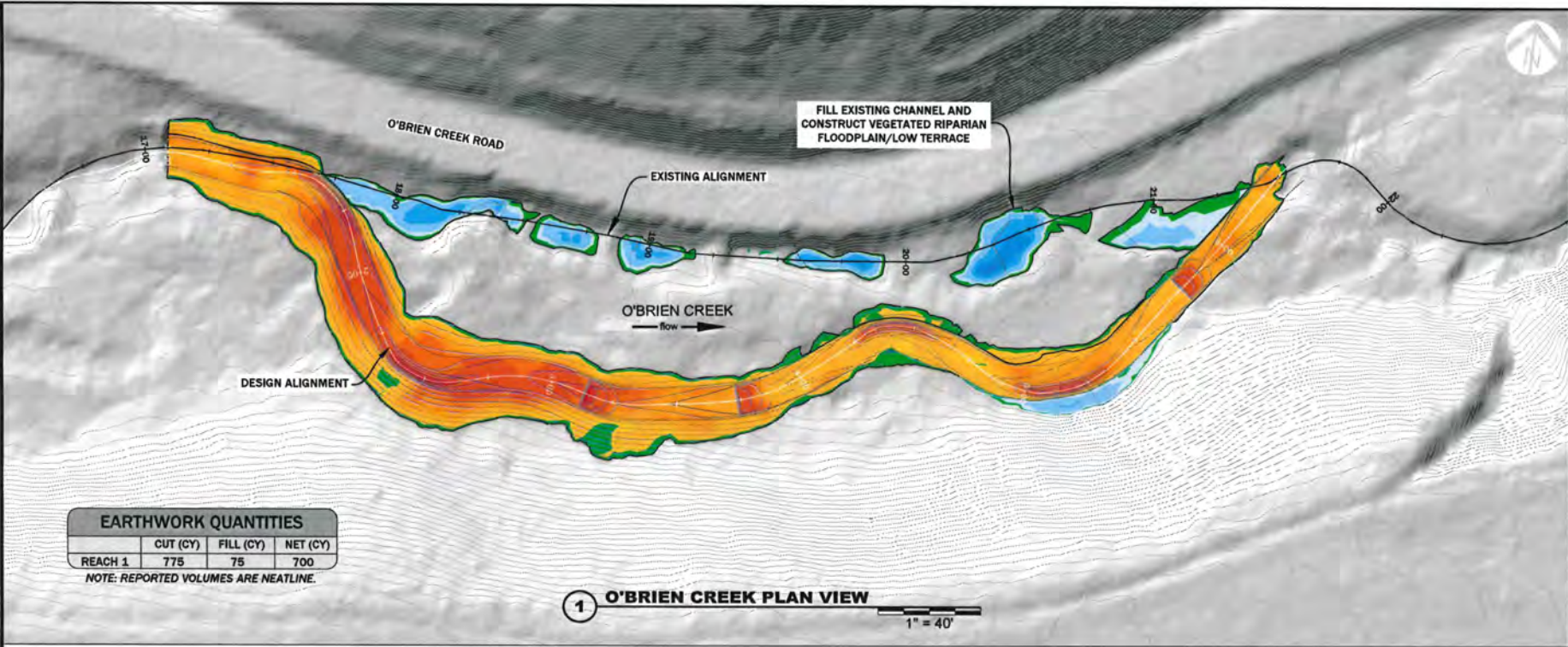
RDG-21-169

DRAWING NUMBER

4.0

Drawing 5 of 22





RDG
RIVER DESIGN GROUP
235 Wisconsin Avenue
Whitefish, MT 59907
406.862.4827
541.739.2020

GRADING AND PROFILE - REACH 1

O'BRIEN CREEK RESTORATION PROJECT

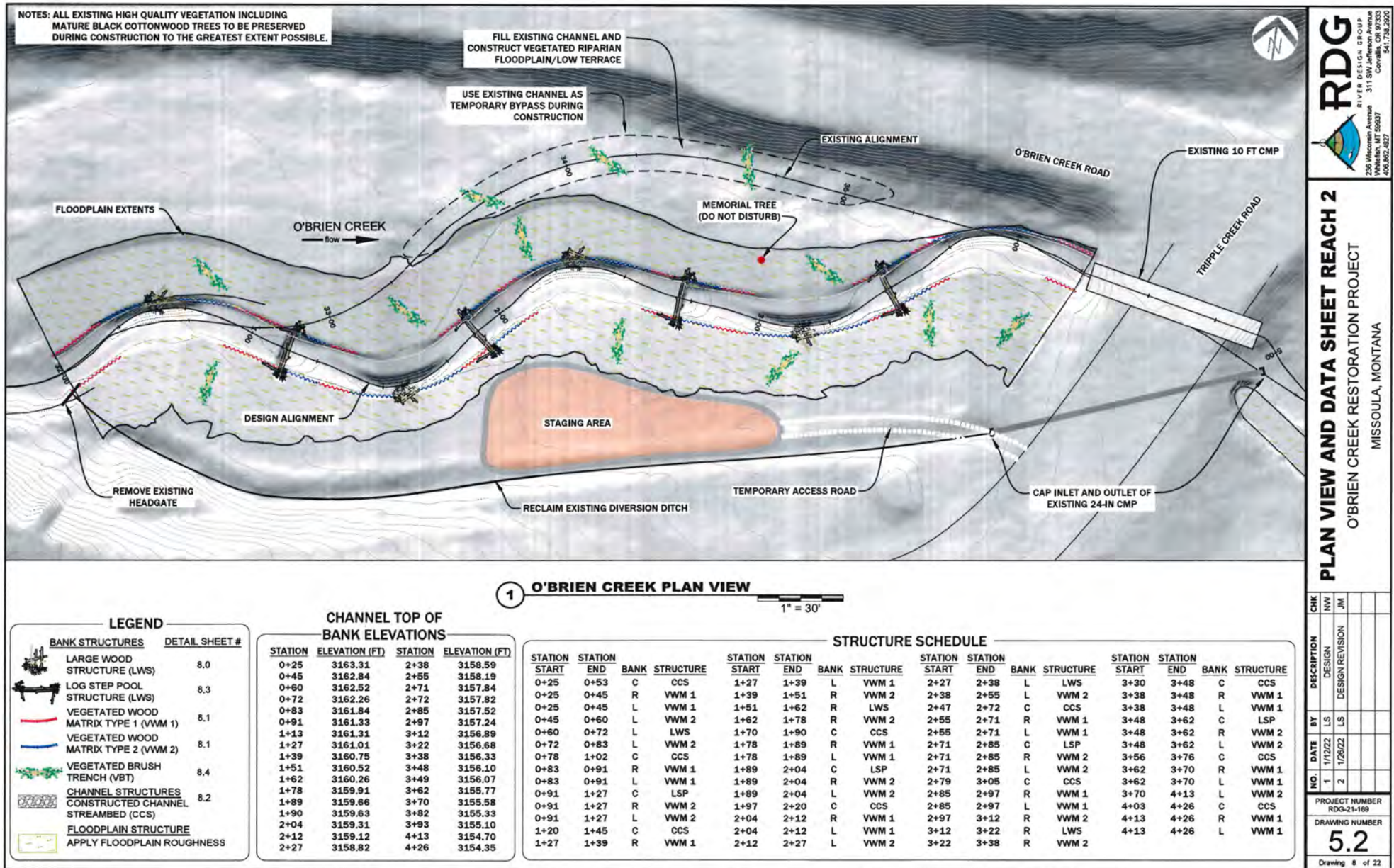
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
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2	1/26/22	LS	DESIGN REVISION	JM

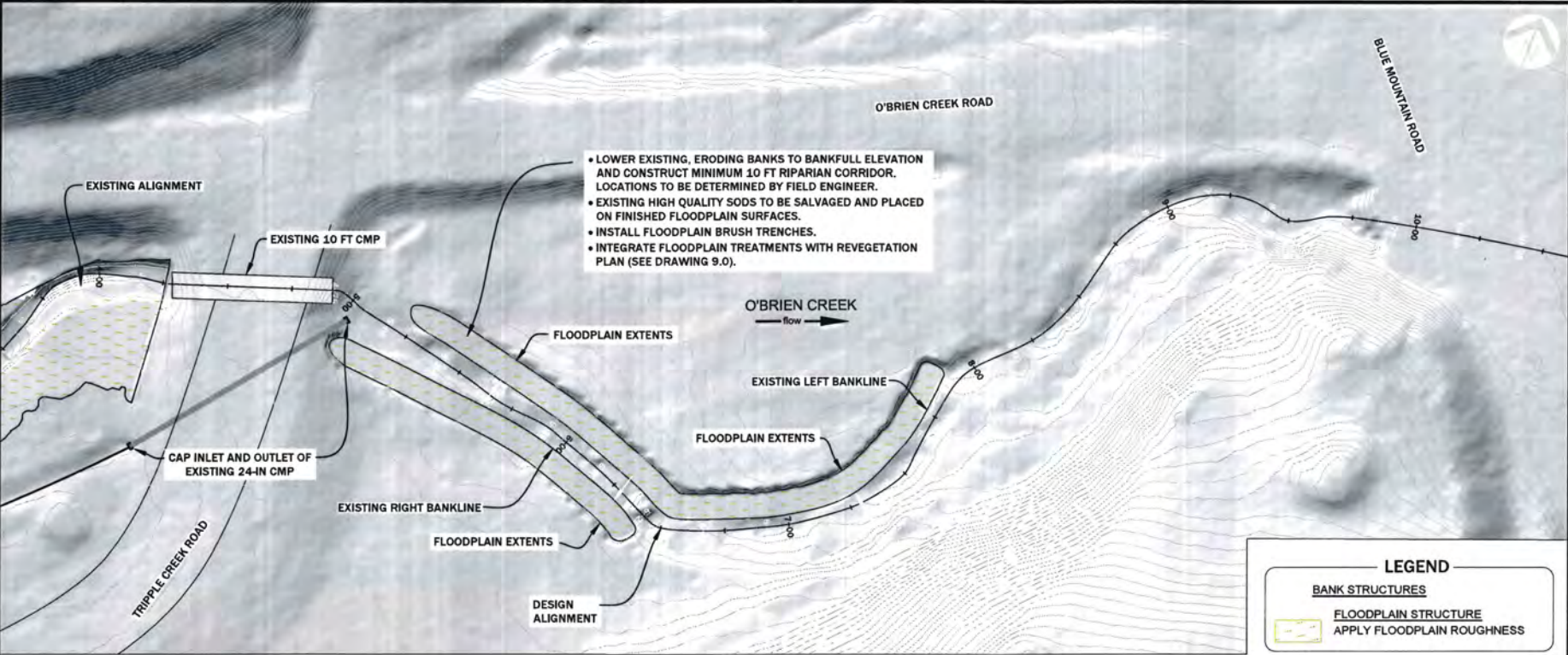
PROJECT NUMBER
RDG-21-169

DRAWING NUMBER
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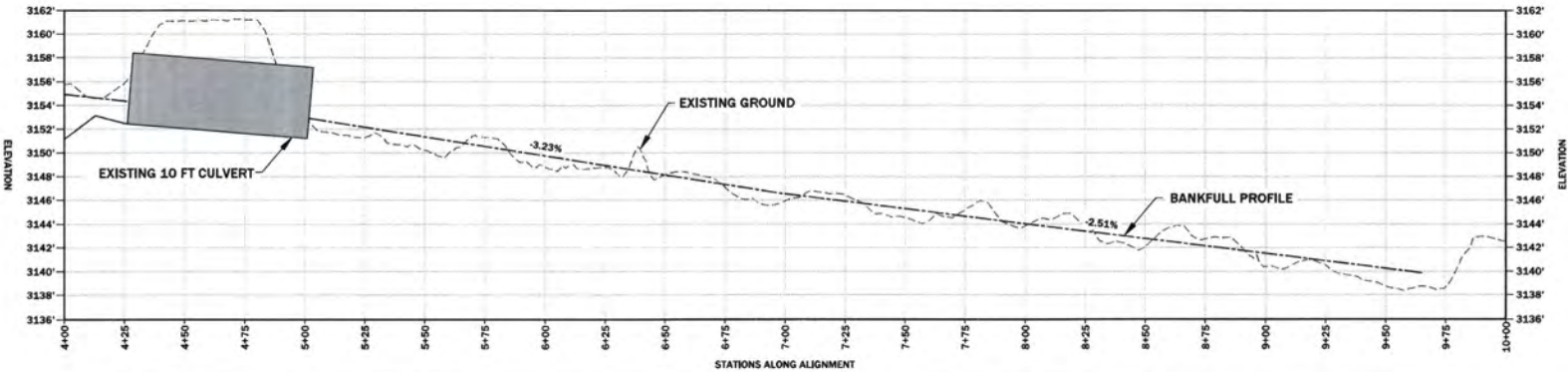
Drawing 7 of 22







1 O'BRIEN CREEK PLAN VIEW



PLAN AND PROFILE - REACH 3
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/1/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
3	3/30/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-189

DRAWING NUMBER
5.4

Drawing 10 of 22

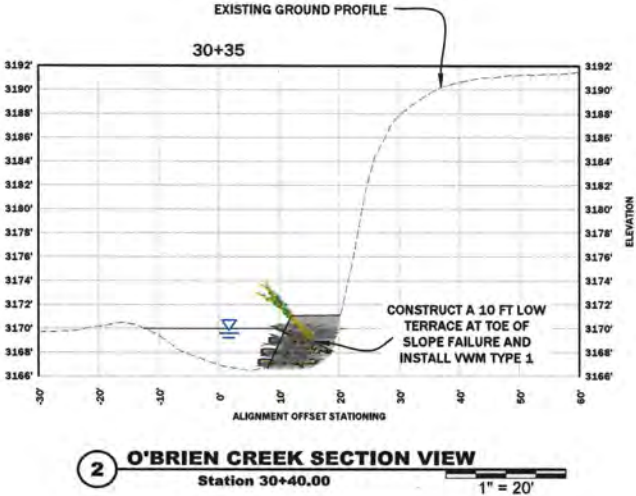
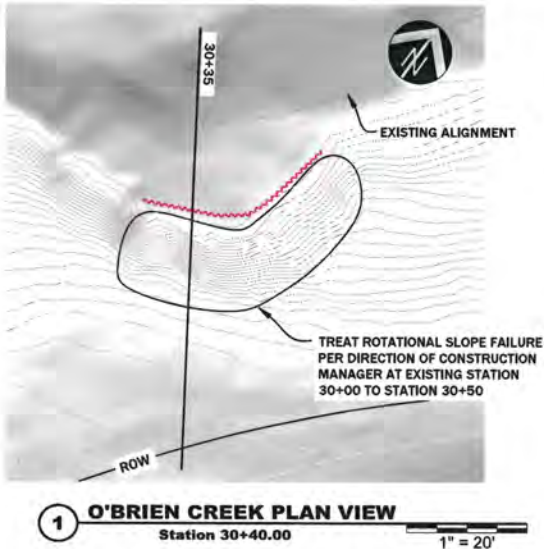


PHOTO OF EXISTING ROTATIONAL SLOPE FAILURE AT STATION 30+35

LEGEND	
BANK STRUCTURE	DETAIL SHEET #
VEGETATED WOOD MATRIX TYPE 1 (VWM 1)	8.1



ROTATIONAL SLOPE FAILURE PLAN
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
3	3/30/22	LS	DESIGN REVISION	JM

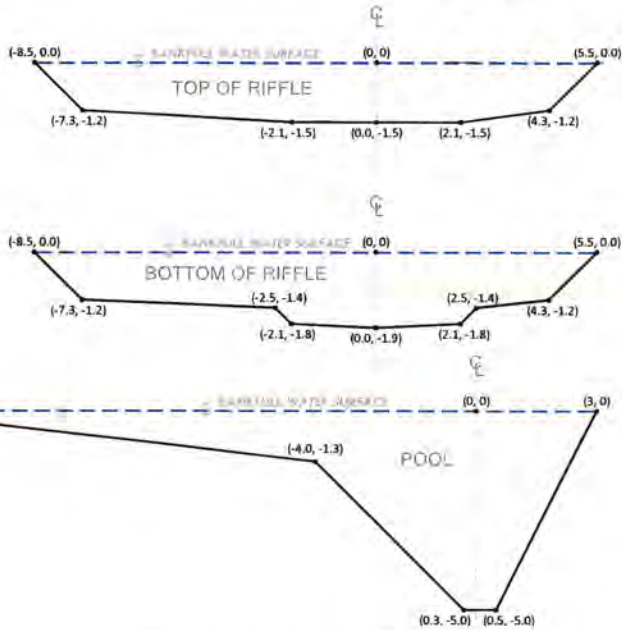
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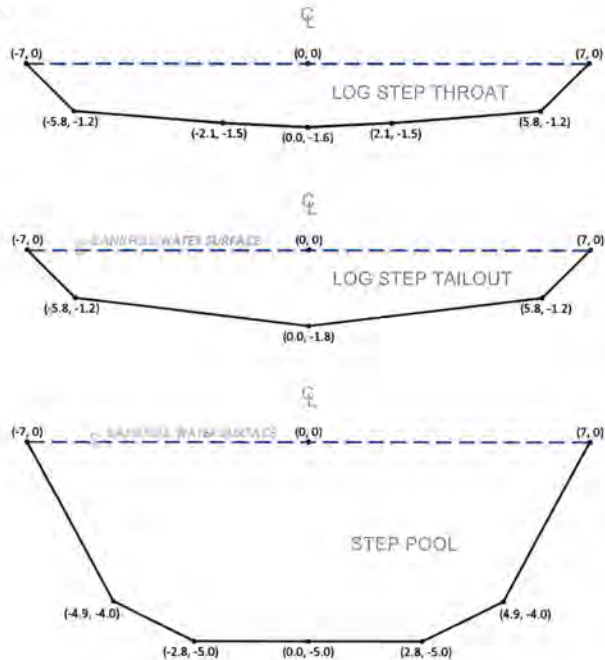
5.5

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BANKFULL CROSS SECTION DESIGN DIMENSIONS			
	Riffle Value (ft)	Run Value (ft)	Pool Value (ft)
Area	17	18	24
Width/Depth	12	9	14
Range (Low)	10	7	12
Range (High)	14	11	16
Width			
Average	14	13	18
Range (Low)	13	11	17
Range (High)	16	14	20
Avg. Depth			
Average	1.2	1.4	1.3
Range (Low)	1.1	1.3	1.2
Range (High)	1.3	1.6	1.4
Max. Depth			
Average	1.8	2.4	4.3
Range (Low)	1.6	2.1	3.7
Range (High)	2.1	2.8	4.9
Max. Scour	2.4	3.0	5.1



CHANNEL CROSS SECTIONS
TYPICAL



CHANNEL CROSS SECTIONS
TYPICAL



NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK THALWEG



DESIGN CROSS SECTIONS
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-169

DRAWING NUMBER
6.0

Drawing 12 of 22

REACH 1 AND 2**BANKFULL CHANNEL HYDRAULIC
DESIGN CRITERIA**

Stream Type	B3/4 (Cobble/Gravel Bed)
Valley Type	Confined Alluvial Valley
Bankfull Discharge	80 cfs (+/-15cfs)
Valley Slope	0.024 ft/ft
Sinuosity	1.2
Channel Slope	0.019 ft/ft to 0.22 ft/ft
Reach Average Slope	0.009 ft/ft
Bed Shear Stress	1.6 lbs/ft ²
Mobile Particle Size	77 mm - 123 mm (LC-SB)
Mean Velocity	4.1 fps - 4.6 fps

PLANFORM GEOMETRY DESIGN CRITERIA

Variable	Value (ft)	Dimensionless Ratio
Bankfull Width	14	
Radius of Curvature		
Average	35	2.5
Range (Low)	42	3
Range (High)	56	4.0
Meander Length		
Average	197	14.0
Range (Low)	141	10.0
Range (High)	254	18.0
Belt Width		
Average	85	6.0
Range (Low)	42	3.0
Range (High)	113	8.0
Sinuosity	1.1 - 1.2	

LONGITUDINAL PROFILE DESIGN CRITERIA

Variable	Feature Length (ft)	Dimensionless Ratio*	Slope Range (ft/ft)	Dimensionless Ratio**
Rifle				
Average	40	2.8	0.0380	1.9
Range (Low)	13	1.0	0.0280	1.4
Range (High)	70	4.5	0.0480	2.4
Run				
Average	14	1.0	0.0360	1.8
Range (Low)	11	0.8	0.0220	1.1
Range (High)	19	1.2	0.0500	2.5
Pool				
Average	35	2.5	0.0040	0.2
Range (Low)	13	1.0	0.0020	0.1
Range (High)	70	4.5	0.0060	0.3
Glide				
Average	16	1.15	0.0030	0.15
Range (Low)	14	1.1	0.0020	0.1
Range (High)	20	1.3	0.0040	0.2
	#REF!			
Pool Spacing				
Average	71	5.0		
Range (Low)	39	3.0	N/A	N/A
Range (High)	124	8.0		

* Relative to bankfull riffle width (14 ft).

** Relative to reach-averaged water surface slope (0.02 ft/ft).

PARTICLE SIZE DISTRIBUTION

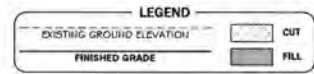
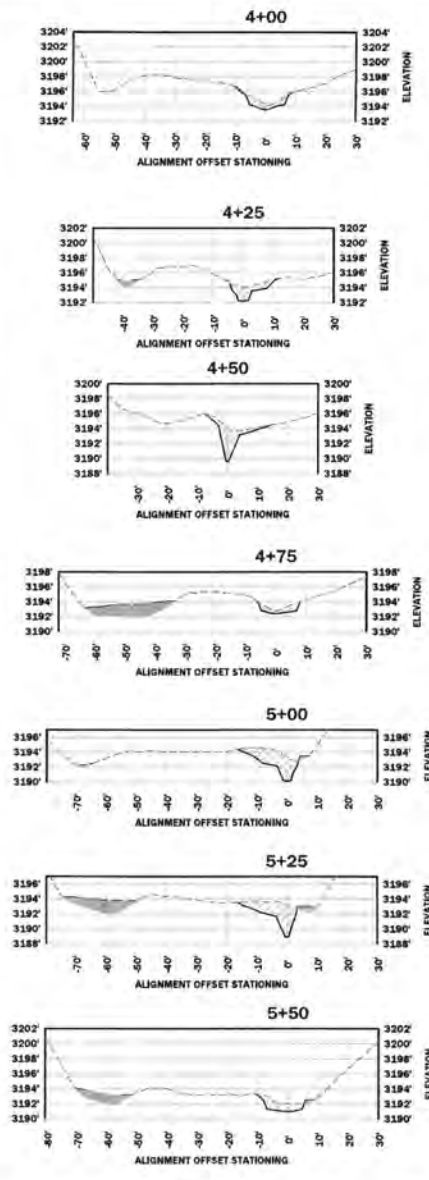
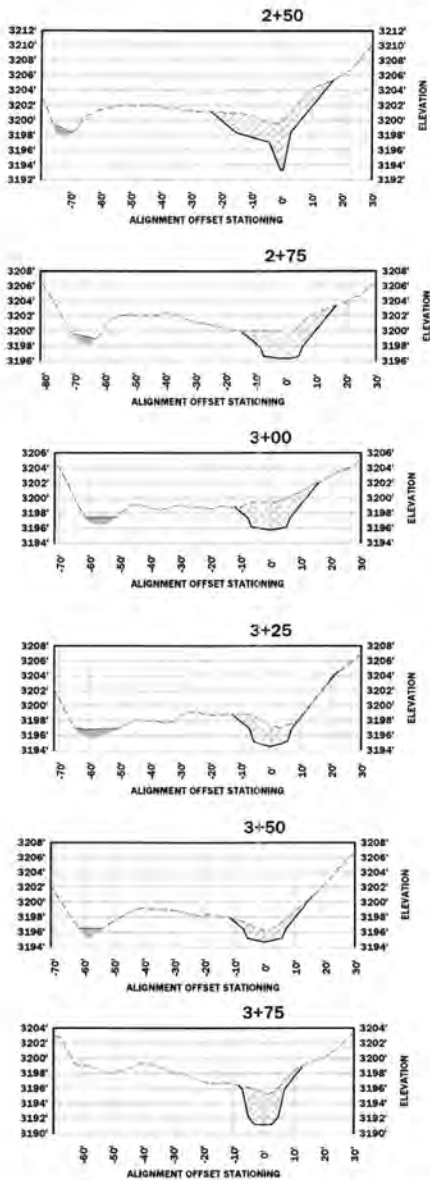
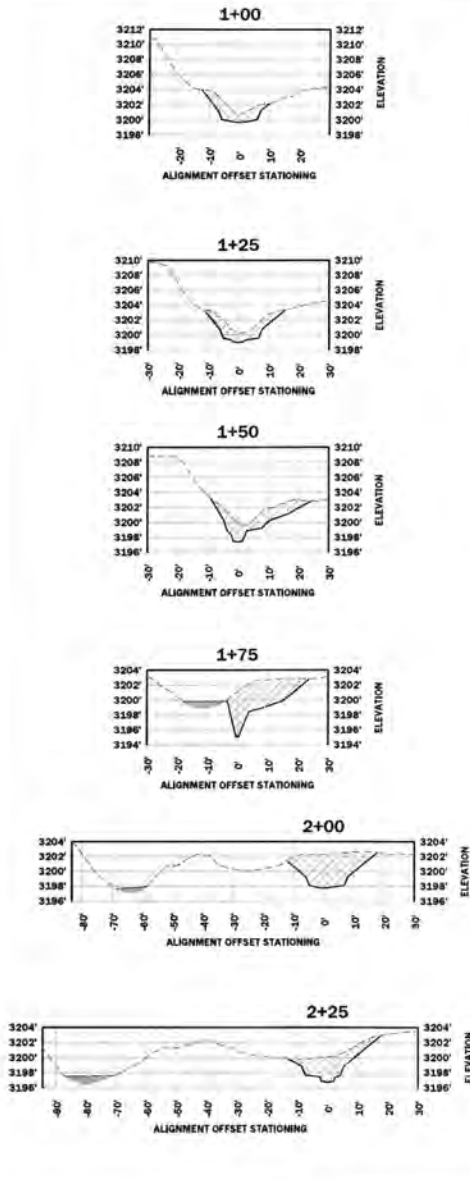
Size Class	Proposed Millimeter	Inches	% Passing
D16	12.7	0.5	10-30
D35	25.4	1	30-50
D60	50.8	2	50-65
D65	76.2	3	65-85
D84	127	5	85-90
D95	203.2	8	90-95
D100	254	10	95



DESIGN CRITERIA
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
PROJECT NUMBER RDG-21-169				
DRAWING NUMBER 6.1				
Drawing 13 of 22				

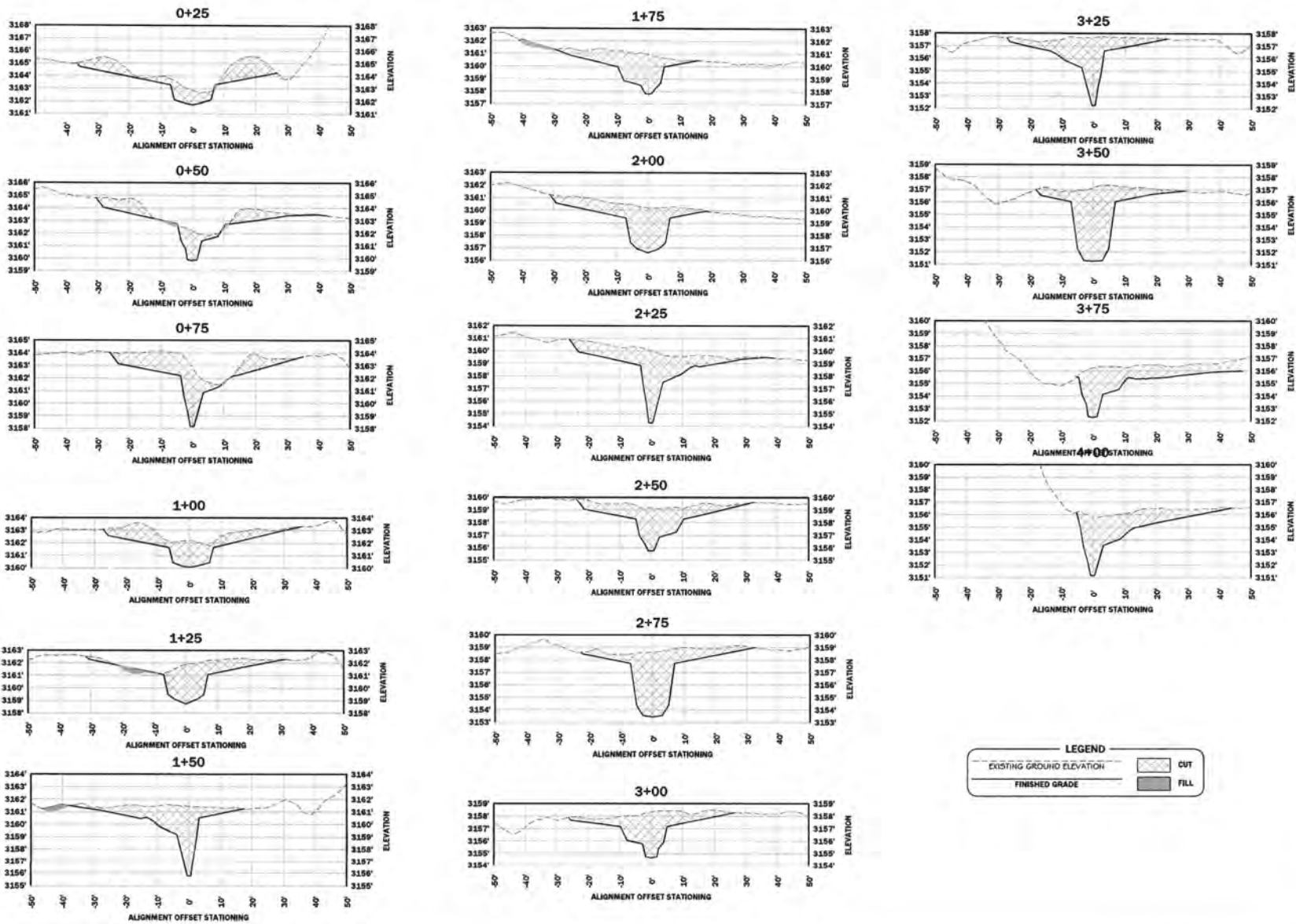
M:\Projects\2023\RDG-21-168 O'Brien Creek - CPO\CAD\2023\1417 O'Brien Working.dwg



REACH 1 CROSS SECTIONS
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
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2	1/26/22	LS	DESIGN REVISION	JM

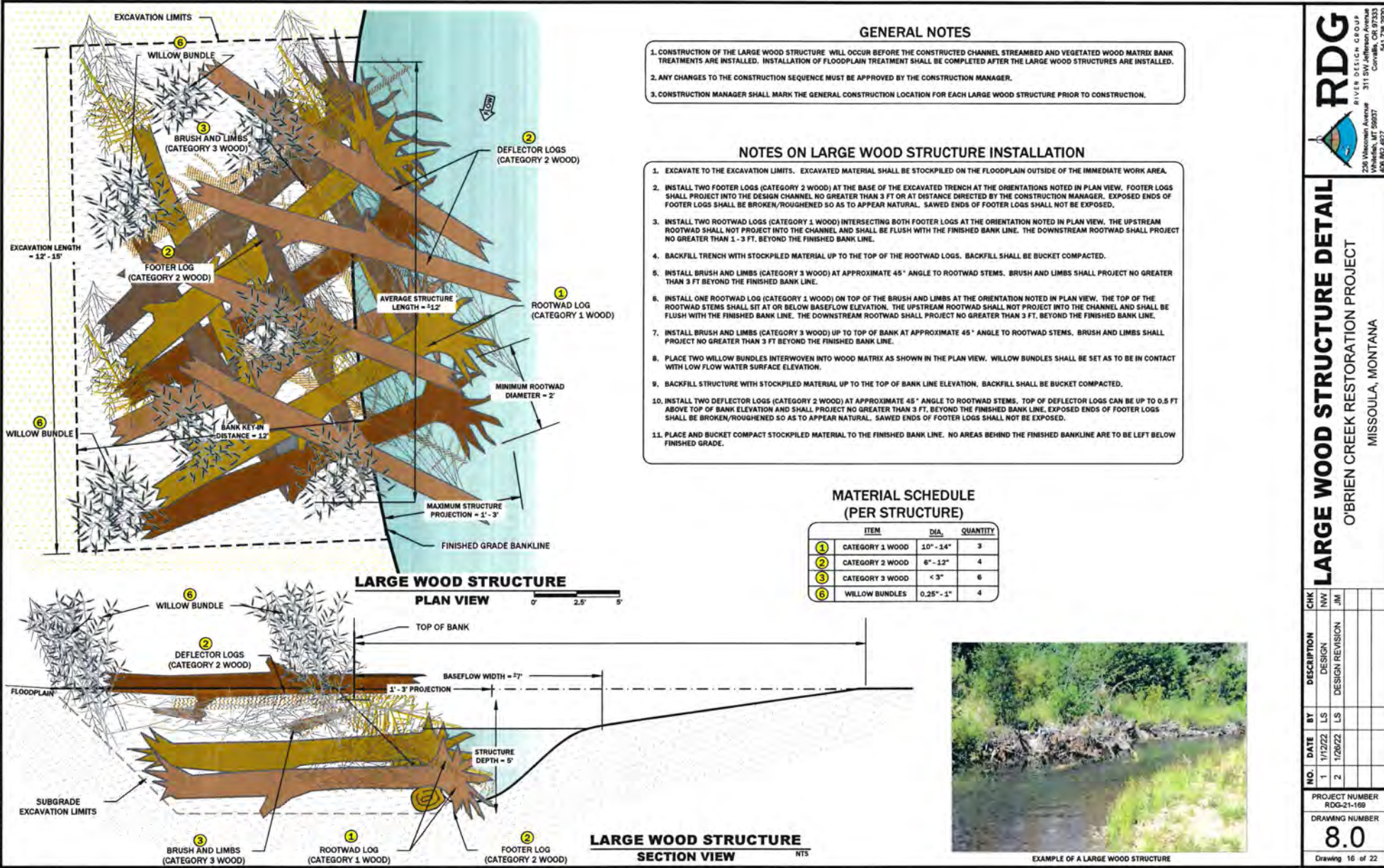
PROJECT NUMBER
RDG-21-168
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7.0
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REACH 2 CROSS SECTIONS
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
PROJECT NUMBER RDG-21-189				
DRAWING NUMBER 7.1				
Drawing 15 of 22				

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LARGE WOOD STRUCTURE DETAIL

O'BRIEN CREEK RESTORATION PROJECT

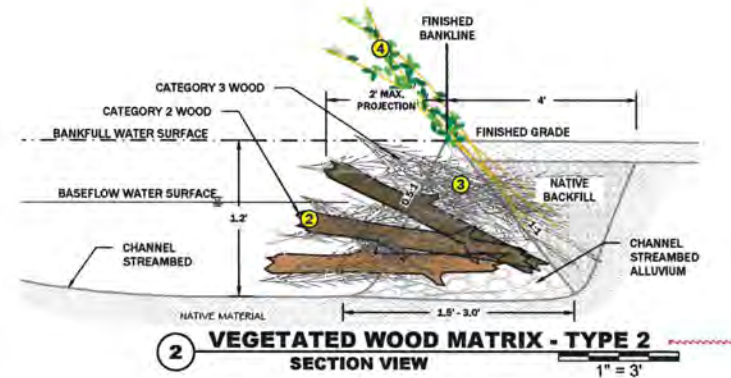
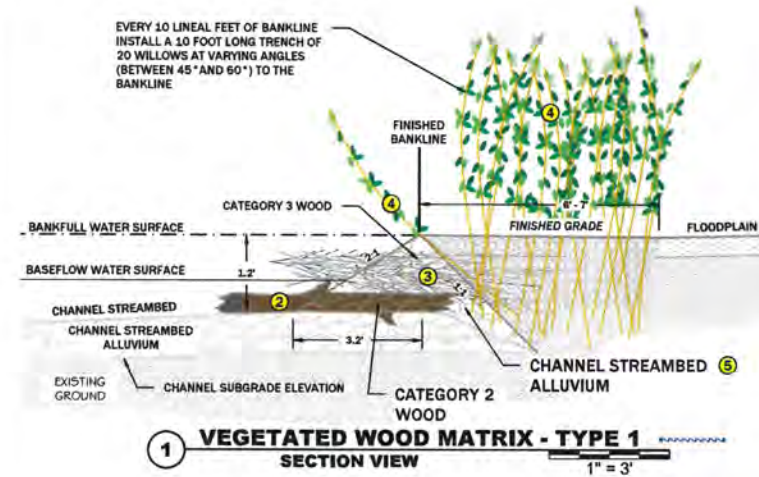
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
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2	1/26/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-189

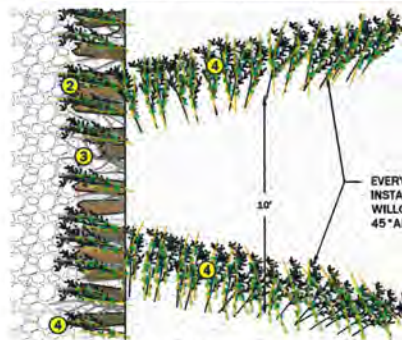
DRAWING NUMBER
8.0

Drawing 16 of 22



MATERIAL SCHEDULE (PER LINEAL FOOT)

ITEM	DIA.	QUANTITY	
		TYPE 1	TYPE 2
② CATEGORY 2 WOOD	3" - 6"	0.25	2
③ CATEGORY 3 WOOD	< 3"	2	4
④ WILLOW CUTTINGS	0.25" - 1"	5	5
⑤ STREAMBED ALLUVIUM	6" MINUS	0.2 CY	0.6 CY

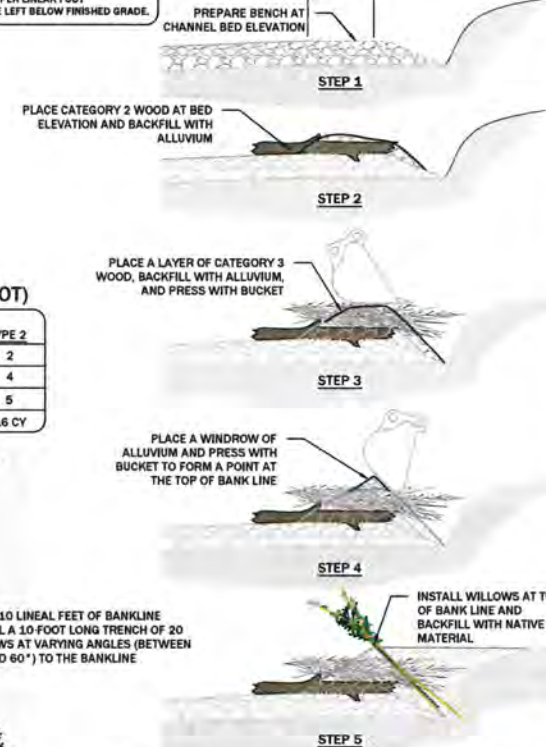


GENERAL NOTES

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

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

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



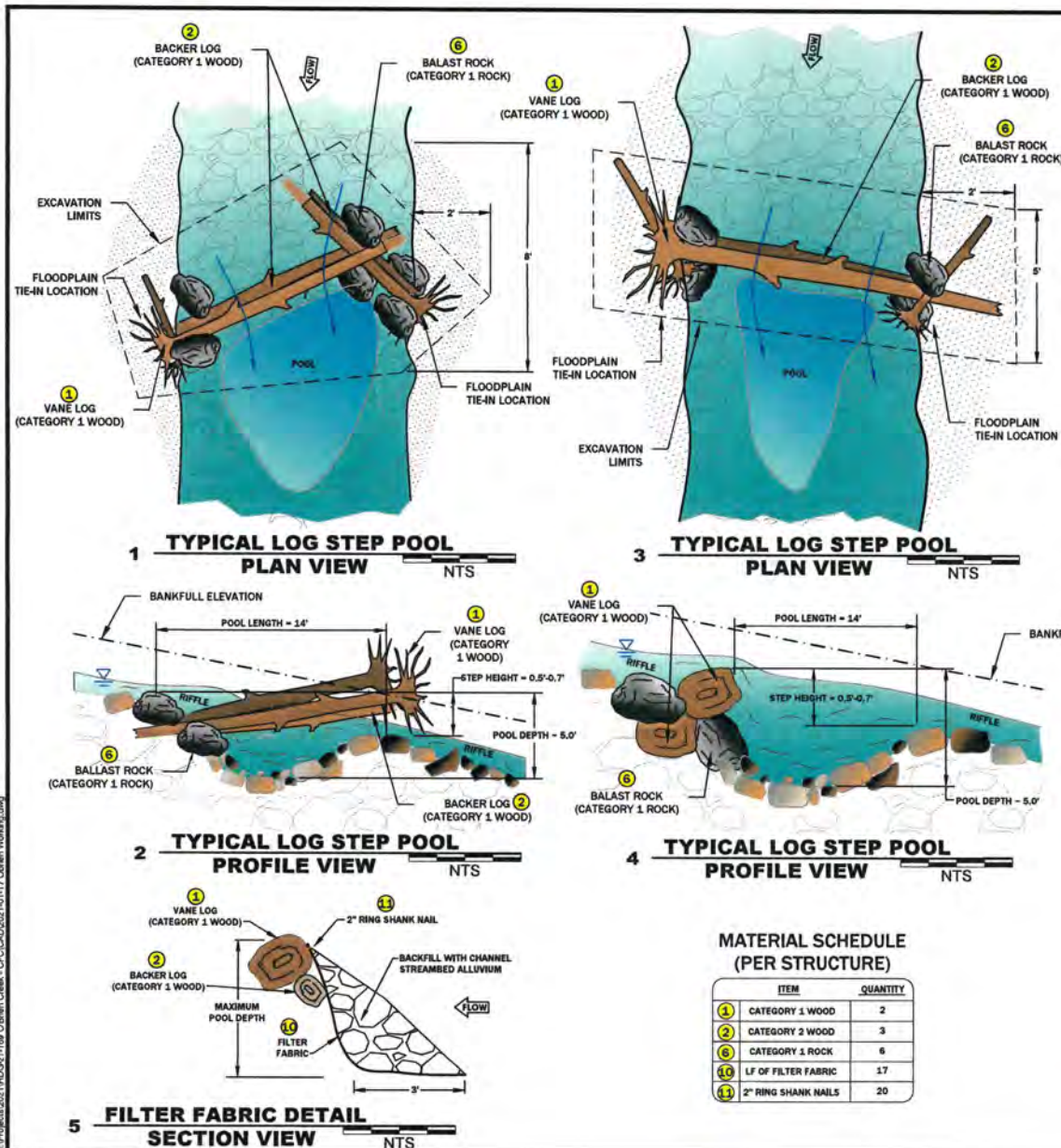
VEGETATED WOOD MATRIX DETAIL
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/17/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM

PROJECT NUMBER
RDG-21-169

DRAWING NUMBER
8.1

Drawing 17 of 22



GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL LOG STEP POOL WILL OCCUR PRIOR TO THE CONSTRUCTED CHANNEL.
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 ENGINEER.
4. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE FLOODPLAIN AND CHANNEL STREAMBED TIE-IN LOCATIONS.

NOTES ON CONSTRUCTED CHANNEL LOG STEP POOL INSTALLATION

1. PRIOR TO CONSTRUCTION OF THE CHANNEL LOG STEP POOL, ENGINEER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS.
2. CONTRACTOR SHALL STOCKPILE WOOD AND ROCK PER SPECIFICATIONS NOTED ON THE DRAWINGS.
3. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
4. INSTALL VANE LOGS (CATEGORY 1 WOOD) AT THE FLOODPLAIN TIE-IN LOCATIONS AND TO THE ORIENTATIONS NOTED ON THE DRAWING. VANE LOGS SHALL BE PLACED ON CHANNEL ALLUVIUM AND THE ROOTWADS SHALL BE EMBEDDED INTO THE STREAMBANK A MINIMUM OF 2-FT. RELATIVE TO FINISHED BANK LINE.
5. ORIENT VANE LOGS IN CONTACT WITH THE CHANNEL STREAMBED AS SHOWN ON THE DRAWING. EMBED VANE LOG TIPS INTO THE CHANNEL STREAMBED A MINIMUM OF 3-FT. SLOPING AT AN ANGLE NO GREATER THAN 6% RELATIVE TO FLOODPLAIN ELEVATION. VANE LOG TIPS SHALL BE A MINIMUM OF 1-FT. BELOW THE CHANNEL STREAMBED FINISHED GRADE.
6. INSTALL BACKER LOGS (CATEGORY 1 WOOD) ON THE UPSTREAM SIDE OF THE VANE LOGS AS SHOWN ON THE DRAWINGS. BACKER LOGS SHALL BE FLUSH WITH THE VANE LOGS AND EXTEND FROM THE FLOODPLAIN TIE-IN LOCATIONS TO THE TIPS OF THE VANE LOGS.
7. INSTALL CATEGORY 1 ROCK UPSTREAM AND DOWNSTREAM OF THE STREAMBANK TIE-IN LOCATIONS AND VANE LOG TIPS. ROCK SHALL BE IN CONTACT WITH VANE LOGS AND BACKER LOGS TO PROVIDE BALLAST AND TO PREVENT THE STRUCTURE FROM SHIFTING WHILE THE STRUCTURE IS BACKFILLED.
8. ATTACH NON-WOVEN GEOTEXTILE FABRIC TO VANE LOGS AND EXTEND VERTICALLY TO THE MAXIMUM DEPTH OF THE POOL. CHANNEL CROSS-SECTION ON THE UPSTREAM SIDE OF THE STRUCTURE, AS SHOWN ON DRAWING. BACKFILL VANE LOGS WITH EXCAVATED CHANNEL STREAMBED ALLUVIUM TO CHANNEL STREAMBED FINISHED GRADE.
9. REGRADE UPSTREAM AND DOWNSTREAM CHANNEL STREAMBED FINISHED GRADE ELEVATIONS. IF EXCESS MATERIAL IS SIDECAST IN POOL DURING CONSTRUCTION, CONTRACTOR SHALL RE-EXCAVATE POOL TO THE DESIGN DIMENSIONS AS APPROVED BY ENGINEER.



EXAMPLE OF A CONSTRUCTED LOG STEP POOL

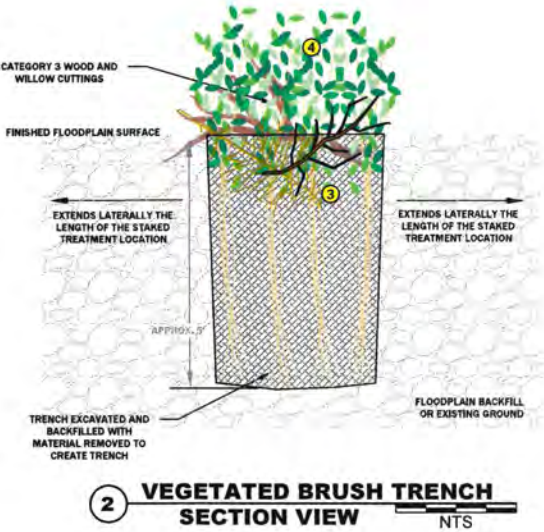
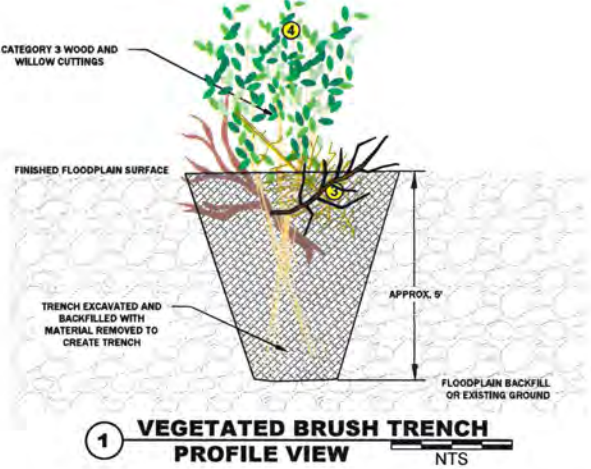


CHANNEL LOG STEP POOL

O'BRIEN CREEK RESTORATION PROJECT

MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/17/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
PROJECT NUMBER RDG-21-169				
DRAWING NUMBER 8.3				
Drawing 19 of 22				

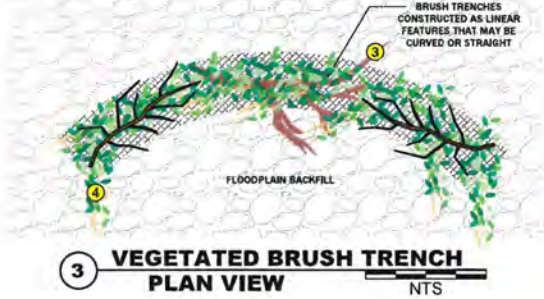


MATERIAL SCHEDULE
(PER LINEAR FOOT)

ITEM	DIA.	QUANTITY
3 CATEGORY 3 WOOD	< 3"	2
4 WILLOW CUTTINGS	0.25" - 1"	5

- GENERAL NOTES**
1. VEGETATED BRUSH TRENCHES WILL BE CONSTRUCTED TO INCREASE FLOODPLAIN CONNECTIVITY, DISPERSE SURFACE FLOWS AND PROMOTE REVEGETATION. CONSTRUCTION OF VEGETATED BRUSH TRENCHES WILL OCCUR AFTER SEPTEMBER 15TH AND BEFORE THE END OF THE CONSTRUCTION SEASON.
 2. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED BRUSH TRENCH PRIOR TO CONSTRUCTION.

- NOTES ON VEGETATED BRUSH TRENCH INSTALLATION**
1. VEGETATED BRUSH TRENCHES WILL BE CONSTRUCTED WITHIN THE FLOODPLAIN AT THE DIRECTION OF THE CONSTRUCTION MANAGER.
 2. A TRENCH WILL BE CONSTRUCTED APPROXIMATELY 9' DEEP AND EXTEND THE LENGTH OF THE STAKED TREATMENT LOCATION. LIVE WILLOW CUTTINGS AND CATEGORY 3 WOOD WILL BE PLACED IN THE TRENCH SUCH THAT THEY ARE INTERMIXED AND ORIENTED AT A NEAR VERTICAL ANGLE.
 3. 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.



EXAMPLE OF A VEGETATED BRUSH TRENCH INSTALLATION



EXAMPLE OF A CONSTRUCTED VEGETATED BRUSH TRENCH



VEGETATED BRUSH TRENCH DETAIL
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM


PROJECT NUMBER
RDG-21-169


DRAWING NUMBER
8.4


Drawing 20 of 22


PLANTING NOTES

- 1. STOCKPILE ALL WOODY MATERIAL, NATIVE VEGETATION, TOPSOIL, AND NATURAL RIVER MATERIAL DISPLACED DURING CONSTRUCTION AND USE FOR SITE RESTORATION. THE STOCKPILED MATERIALS SHALL BE INCORPORATED INTO COVER OF DISTURBED AREAS TO RESTORE THE SITE TO NATURAL CONDITIONS WHILE MINIMIZING THE POTENTIAL FOR EROSION.
- 2. LONG-TERM, PERMANENT REVEGETATION SHALL BE INSTALLED IN ACCORDANCE WITH REVEGETATION SCHEDULE INCORPORATED IN THIS DRAWING SET. PLANTINGS WILL BE FIELD FIT BETWEEN WILLOW TRENCHES AND FINAL PLACEMENT WILL CONSIDER FLOODPLAIN ROUGHNESS AND FIELD CONDITIONS.
- 3. WILDLIFE BROWSE PROTECTION AROUND PLANTINGS WILL BE COMPRISED OF WILDLIFE EXCLOSURE FENCING UNITS. EXCLOSURE FENCING UNITS CAN BE INSTALLED PRIOR TO PLANTING. FINAL PLACEMENT OF EXCLOSURE UNITS WILL VARY BASED ON FLOODPLAIN ROUGHNESS AND FIELD CONDITIONS.

**FLOODPLAIN PLANTING UNIT**

**RIPARIAN PROTECTION FENCE**

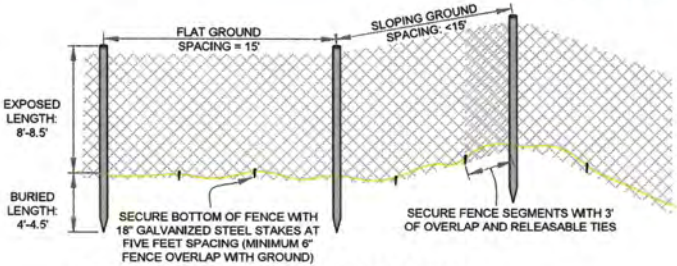
**TEMPORARY ACCESS ROAD**

**STAGING AREA**

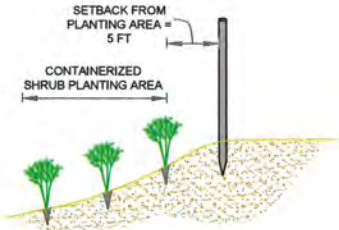
PLANTING SCHEDULE				
COMMON NAME	SCIENTIFIC NAME	CONTAINER SIZE (GALLON)	MINIMUM SPACING (FT)	TOTAL NUMBER
BLACK COTTONWOOD	POPULUS TRICHOCARPA	TALL 1	15	15
WATER BIRCH	BETULA OCCIDENTALIS	5 GAL	15	13
SERVICE BERRY	AMELANCHIER ALNIFOLIA	TALL 1	10	17
GOLDEN CURRANT	RIBES AUREUM	TALL 1	8	54
WESTERN SNOWBERRY	SYMPHORICARPOS OCCIDENTALIS	TALL 1	8	54
RED-OSIER DOGWOOD	CORNUS SERICEA	TALL 1	8	82
TOTAL				254



1 PLANTING PLAN
REACH 2 AND 3
1" = 60'



1 RIPARIAN PROTECTION FENCE
SIDE VIEW
1" = 6'

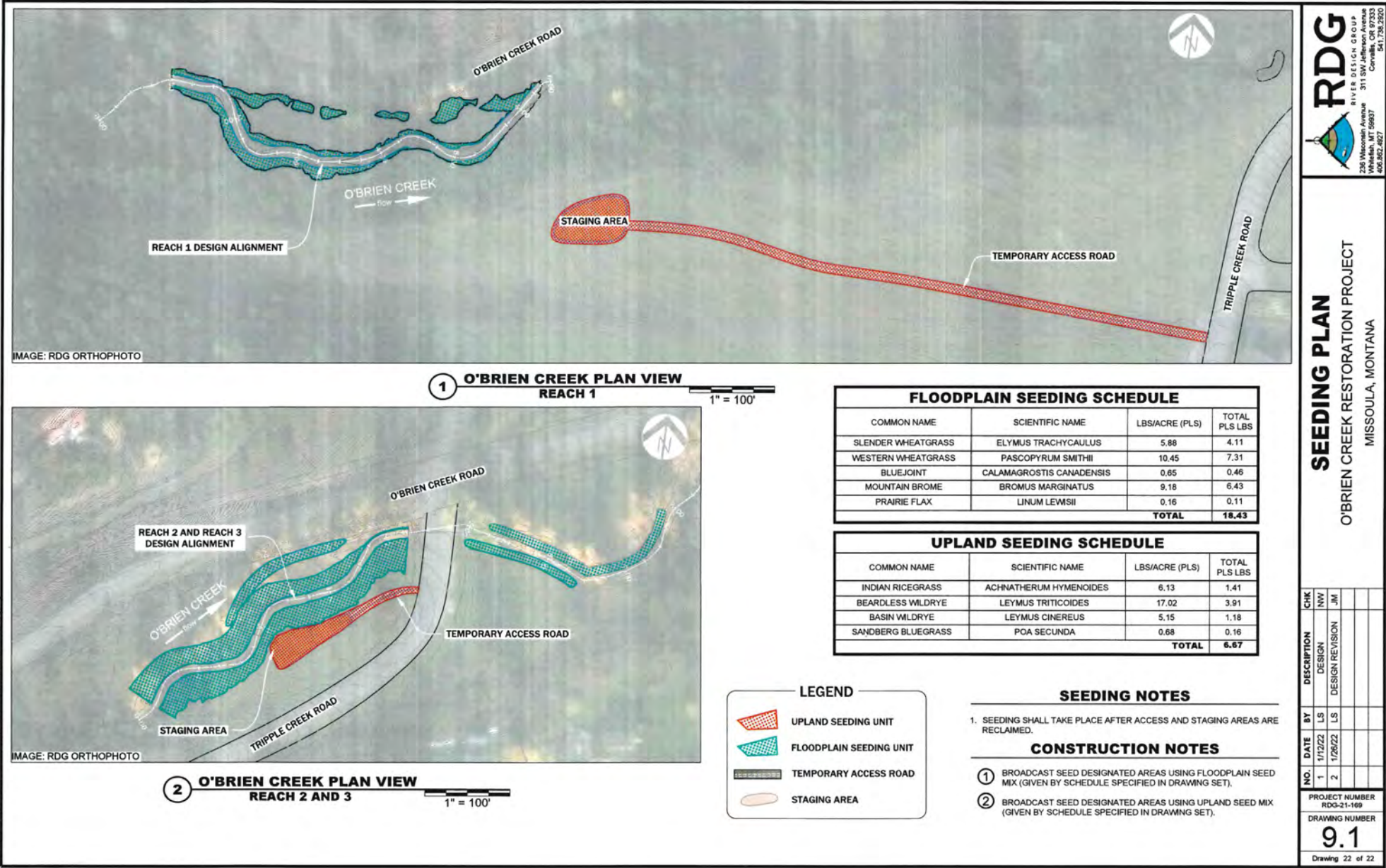


2 RIPARIAN PROTECTION FENCE
SECTION VIEW
1" = 6'

**RDG**
RIVER DESIGN GROUP
311 SW Jefferson Avenue
Portland, OR 97207
408.862.4827

PLANTING AND FENCING PLAN
O'BRIEN CREEK RESTORATION PROJECT
MISSOULA, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	1/12/22	LS	DESIGN	NW
2	1/26/22	LS	DESIGN REVISION	JM
PROJECT NUMBER RDG-21-169				
DRAWING NUMBER 9.0				
Drawing 21 of 22				



COOPERATIVE AGREEMENT
between
Clark Fork Coalition
and
O'Brien Creek Meadows HOA (Landowner)

This Cooperative AGREEMENT, dated as of August 4, 2021 (the "Effective Date") is entered into between the Clark Fork Coalition, a Montana nonprofit corporation, at 140 S. 4th Street West, Unit 1, Missoula, MT 59801 ("CFC"), and the O'Brien Creek Meadows Home Owners Association, PO Box 3502, Missoula, MT 59806 ("Landowner"). CFC and Landowner are sometimes referred to collectively herein as the "PARTIES." In consideration of the mutual covenants and stipulations described below, CFC and the Landowner agree as follows:

1. PURPOSE AND GENERAL PROJECT DESCRIPTION: The purpose of this Agreement is for the Clark Fork Coalition and the Landowner to agree on restoration work to be performed by the Coalition on O'Brien Creek on Landowner's property (the "Project"). The Project will include work on or near Landowner's communal property, located generally south of O'Brien Creek Road, in the S2S2 of Section 27, and the N2N2 of Section 34, both in Twp 13N, Rge 20W in Missoula County. CFC and Landowner have the mutual desire to cooperate in carrying out the activities contemplated herein and this Agreement sets forth the obligations of both CFC and Landowner.

2. BACKGROUND AND SCOPE OF WORK: In 2019, a stream bank failure into O'Brien Creek resulted in deposition of sediment into the channel and floodplain of the O'Brien Creek Meadows HOA's common area (i.e. the Project area). In 2019, CFC oversaw emergency actions taken to remove the substrate deposition in the main channel and return wood into the stream channel (Phase 1). This Agreement will allow CFC to implement Phase 2 of the Project to rehabilitate the stream channel, improve stream function and enhance the ecological function of the stream and adjacent riparian area. Phase 2 will include increasing stream sinuosity, raising channel profile access to the floodplain, adding log step pools, re-aligning the channel into existing channels to avoid road fill erosion, and revegetating the riparian area. The Scope of Work for CFC is further described in the Project Plan Set attached as Exh. A.

3. PERIOD OF PERFORMANCE: This Agreement shall begin on the Signing Date of this Agreement and terminate on December 31, 2041. All work described in the Scope of Work except for post-project monitoring will take place between July, 2022 and December, 2022.

4. COST OF THE PROJECT: As consideration for Landowner's consent under this Agreement, the CFC will raise funds and pay for all costs for the Project. Landowner may contribute funding toward the Project, but CFC's responsibilities under this Agreement are not contingent upon the receipt of such funds from the Landowner.

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

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

- b. Provide oversight of the Project, including but not limited to grant writing, acquisition of necessary permits, Project coordination, management and oversight of construction activities and all other activities related to the Project;
- c. Perform long-term monitoring of the Project;
- d. Provide prompt notice to Landowner of any specific areas of concern related to the Project, and repair or replace Project improvements should they become endangered, change or destroyed through natural means; and
- e. Prepare any and all reports.

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

- f. Guarantee ownership of the above-described lands and warrant that there are no outstanding rights that will interfere with this cooperative Agreement;
- g. Allow for and maintain a minimum riparian buffer of 25-feet as measured horizontally from the ordinary high-water mark;
- h. Use reasonable efforts to protect the restoration improvements and, except in cases of emergency or Force Majeure as described in paragraph 10, refrain from removing or impeding the restoration investments for a minimum of 20 years following completion of the Project.
- i. Allow access for post-treatment monitoring for the life of the agreement.

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

8. COOPERATION AND ACCESS: The Parties shall cooperate as needed in the performance of the Scope of Work. Landowner shall give unrestricted access to CFC for the Project site as needed for CFC to perform its obligations under this Agreement, including any required inspections. CFC will give 24-hour notice to Landowner of any required visits.

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

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

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

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

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

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

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

16. PRINCIPAL CONTACTS:

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

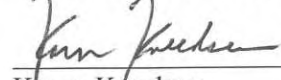
CFC Project/Contract Officer:

Adam Switalski
Clark Fork Coalition
PO Box 7593
Missoula, MT 59807
Tel. 406-396-1941
Email: Adam@clarkfork.org

Landowner

Bill Darling, HOA President
O'Brien Creek Meadows HOA
PO Box 3502
Missoula, MT 59806
Tel. 406-360-3327
Email: w.r.darling@hotmail.com

CLARK FORK COALITION



Karen Knudsen
Executive Director

Date:

O'BRIEN CREEK MEADOWS HOA



Bill Darling
HOA President

8.4.21

Date:



Missoula City-County Health Department

WATER QUALITY DISTRICT

301 W Alder | Missoula MT 59802-4123

www.missoulacounty.us/wqd

Phone | 406.258.4890

Fax | 406.258.4781

October 26, 2021

319 Review Committee

Montana Department of Environmental Quality

P.O. Box 200901

Helena, MT 59620

RE: Clark Fork Coalition 319 Grant Application

Dear 319 Review Committee,

The Missoula Valley Water Quality District would like to extend our support for the Clark Fork Coalition 319 application to reduce pollutant loading to Miller and O'Brien Creeks. This project aligns with the goals of the Missoula Valley Water Quality District to improve water quality across the district and within the watershed that supplies our sole source aquifer.

Thank you for the opportunity to demonstrate our support for this project.

Sincerely,

A handwritten signature in black ink that reads "Elena Evans".

Elena Evans

Hydrogeologist

Missoula Valley Water Quality District

O'Brien Creek Meadow HOA, INC
PO Box 3502
Missoula, MT 59806-3502

O'Brien Creek Meadow HOA, Inc.
PO Box 3502
MT 59806-3502

October 29, 2019

Department of Environmental Quality -- 319 Program
P.O. Box 200901
Helena, MT 59620-0901

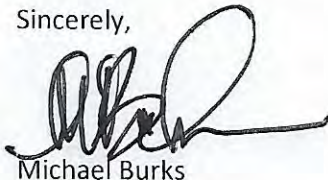
To Whom It May Concern:

Please accept this letter as the O'Brien Creek Meadow HOA's endorsement of the proposed rehabilitation work for the segment of O'Brien Creek that flows through our common area. We understand that the Clark Fork Coalition is working on our behalf to assist with funding support for necessary rehabilitation that will fulfill both our 310 stream permit requirements and contribute to the overall watershed restoration planning efforts.

We have learned a lot about O'Brien Creek since our segment of stream jumped its banks this year (and two years prior). We have a diverse group of landowners that largely are genuinely interested in helping to improve stream conditions, and as importantly, we realize that stream maintenance and associated costs will return until the stream is functioning better. The process of grant writing and all the parties involved to make projects happen is very complex, and we welcome the assistance from the Clark Fork Coalition. We also have several landowners that have helped with the stream work this year, and we plan to provide additional assistance as we have the expertise, time, resources, and majority support.

We are just learning of the Montana Department of Environmental Quality's role in managing streams to improve water quality and perform watershed restoration planning and funding. We greatly appreciate your support of this important proposal. As we've also come to understand, funding support is very limited, making funding from your 319 Program critical to our success. To help ourselves and our mutual success, we want to hire very experienced stream professionals and will do all that we can to produce a very high quality product. With this in mind, we hope that restoration work on our property may also provide the state and local agencies with an example that can be used on other work in O'Brien Creek and perhaps other watersheds. Thank you for your consideration.

Sincerely,



Michael Burks

President

O'Brien Creek Meadow Home Owners Association, Inc





October 28, 2021

To Whom it may concern,

The WestSlope Chapter of Trout Unlimited (WSCTU) works to preserve, protect and restore cold water fisheries in the Missoula area. Collectively, the chapter represents over 900 passionate anglers that care deeply about our mission. We write to express our support for three different projects being proposed by the Clark Fork Coalition on tributaries of the lower Bitterroot River:

- **O'brien Creek Meadows Stream Restoration:** This project aims to use a variety of treatments to reduce sediment loading, restore stream and floodplain function, improve riparian and in-stream wildlife habitat, and dissipate flood energy on a 2500 foot section of O'brien Creek.
- **Upper O'Brien Creek Stream Restoration:** This project proposes to address non-point sediment issues and fish habitat on upper O'Brien Creek by working with the Forest Service to reduce sediment loading, restore stream and floodplain function, and improve in-stream wildlife habitat. The project is focused on a 1.5 mile section of the creek where the stream is entrenched, has little in-stream wood, and is encroaching into road fills.
- **Miller Creek Mile 7 Project:** This project proposes to address sedimentation issues and degraded habitat on a section of Miller Creek. Treatments such as floodplain grading, woody debris matrix, riparian shrub plantings with enclosure fences, a hardened crossing for livestock, and other treatments to re-connect the creek to its floodplain, slow and disperse high flows, and increase riparian habitat will be used.

Given the benefits these projects will have for cold-water fisheries and watershed health, WSCTU supports their implementation. Thank you for the opportunity to comment.

Sincerely,

Mark Kuipers President