

FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

Please fill in the highlighted areas
all sections (IA, IB, IC, etc.) must be addressed or the application will be considered invalid

I. APPLICANT INFORMATION

- A. Applicant Name: Lower Clark Fork Watershed Group
- B. Mailing Address: P.O. Box 1329
- C. City: Trout Creek State: MT Zip: 59874
 Telephone: (208) 304-3852 E-mail: info@lowerclarkforkwatershedgroup.org
- D. Contact Person: Brita Olson
 Address if different from Applicant: Same as above
 City: _____ State: _____ Zip: _____
 Telephone: (208) 304-3852 E-mail: brita@lowerclarkforkwatershedgroup.org
- E. Landowner and/or Lessee Name (if other than Applicant): Lolo National Forest
 Mailing Address: 24 Fort Missoula Rd
 City: Missoula State: MT Zip: 59804
 Telephone: (406) 240-7328 E-mail: jrhanon@fs.fed.us

II. PROJECT INFORMATION*

- A. Project Name: Crow Creek Stream and Riparian Restoration, Phase II
 River, stream, or lake: Crow Creek
 Location: Township: 20N Range: 31W Section: 4
 Latitude: 47.5275 Longitude: 115.5578 *within project (decimal degrees)*
 County: Sanders County
- B. Purpose of Project:
To restore a degraded segment of stream and floodplain to improve and protect native fish habitat.
- C. Brief Project Description:

This project is to continue stream restoration in Crow Creek involving channel reconstruction and enhancement through reconfiguring the stream alignment to provide grade control, habitat complexity and floodplain connectivity; installing grade control structures using large woody debris and rock; and planting riparian vegetation to provide shade for in-stream habitat and improve bank stability.

D. Length of stream or size of lake that will be treated: 600 feet

E. Project Budget:

Grant Request (Dollars): \$ \$23,000

Contribution by Applicant (Dollars): \$ 0 In-kind \$ 0

(salaries of government employees are not considered as matching contributions)

Contribution from other Sources (Dollars): \$ 81,134 In-kind \$ 0

(attach verification - See page 2 budget template)

Total Project Cost: \$ \$104,134

F. Attach itemized (line item) budget – see template

Attach **specific project plans, detailed sketches, plan views, photographs, maps, evidence of landowner consent, evidence of public support and fish biologist support, and/or other**

G. **information necessary to evaluate the merits of the project. If project involves water leasing or water salvage complete a *supplemental questionnaire***

(fwp.mt.gov/habitat/futurefisheries/supplement2.doc).

H. **Attach land management & maintenance plans that will ensure protection of the reclaimed area.**

III. PROJECT BENEFITS*

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

Bull Trout, Westslope Cutthroat Trout and Cedar Sculpin, all native fish species. Lengthy intermittent sections of stream near the Crow Creek confluence with Prospect Creek has enabled the stream to retain an entirely native fish species assemblage.

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

This restoration will help restore channel function and will increase habitat complexity and diversity by increasing meanders, pools and shade. By re-creating natural channel conditions, this project may help increase the carrying capacity for native salmonids in this portion of Crow Creek. The project would start at the downstream portion of channel restoration that was completed in 2007, which has shown a positive response from native fish.

C. Will the project improve fish populations and/or fishing? To what extent?:

Monitoring has shown a positive response from both Bull Trout and Westslope Cutthroat Trout following the 2007 restoration. A similar positive response from the fish community is expected by continuing the restoration to this downstream segment. Preliminary results indicate that two sites within the 2007 restoration reach had the highest abundance of both Bull Trout and Westslope Cutthroat Trout observed in the entire Crow Creek drainage in 2017. Biomass for Westslope Cutthroat Trout has more than doubled per 100 square meters in the restored reach (Blakney, *In prep* - See attached project description).

- D. Will the project increase public fishing opportunity for wild fish and, if so, how?:

This project will increase the potential for native fish populations to thrive in Crow Creek, thereby increasing opportunities for fishing of Westslope Cutthroat Trout. Public fishing opportunities on U.S. Forest Service lands in Sanders County are popular with both locals and visitors, and fly fishing is a growing pastime nationally.

- E. The project agreement includes a 20-year maintenance commitment. Please discuss your ability to meet this commitment.

The project is located on the Plains-Thompson Falls Ranger District of the Lolo National Forest. The Lolo National Forest will be responsible for the long-term maintenance of this project.

- F. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?:

Historically, the Crow Creek valley bottom was comprised of a dark riparian forest. Two major power line corridors owned by Bonneville Power Administration (BPA) and NorthWestern Energy (NWE) now travel up the drainage, leaving large cedar stumps as evidence of historical conditions. Installation and maintenance of utility corridors resulted in persistent loss of old growth riparian conifers in Crow Creek over approximately 1/3 of a mile of riparian forest. As a result, the channel is over-widened, shallow, braided, and lacking pools, shade, and habitat complexity associated with inputs of large and small woody debris. Channel realignment and installation of a variety of grade control structures, including cobble patches and boulder clusters, will increase stability and complexity of the stream and address lack of existing stabilizing materials while riparian vegetation gets established. Large woody debris structures will be added to dissipate energy in meander bend pools and to enhance aquatic habitat. Aggressive planting of riparian vegetation will restore shade and stabilize the streambanks over the long term. Reconnecting the stream with the floodplain will ensure the long-term survival of the riparian vegetation, which will be primarily willows, alder, dogwood and other low-profile native vegetation that won't interfere with power lines.

- G. What public benefits will be realized from this project?:

The continued restoration of Crow Creek provides the public benefit of ensuring survival of native fish species, including the federally listed Bull Trout, in the Prospect Creek watershed and the larger Lower Clark Fork Watershed. Improving habitat for native fish in the drainage will increase the opportunities for fishing Westslope Cutthroat Trout, a popular sports fishery, on accessible public lands. Providing recreational fishing opportunities is important to the local economy. Increasing the stability of the stream channel in Crow Creek also reduces the risk of damage to utility infrastructure during flood or rain on snow events.

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

No

- I. Will the project result in the development of commercial recreational use on the site?: (explain):
-

No

J. 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.

IV. 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:

11/30/2018

Sponsor (if applicable):

*Highlighted boxes will automatically expand.

Mail To: Montana Fish, Wildlife & Parks
Fisheries Division
PO Box 200701
Helena, MT 59620-0701

E-mail To: Michelle McGree
mmcgree@mt.gov
(electronic submissions MUST be signed)

Incomplete or late applications will be rejected and returned to applicant.
Applications may be rejected if this form is modified.

*****Applications must be signed and received by the Future Fisheries Program Officer in Helena before December 1 and June 1 of each year to be considered for the subsequent funding period.*****



**Attachments to Future Fisheries Improvement Program Application
Crow Creek Stream and Riparian Restoration Project, Phase II**

Section II, Item F

- Budget (2 pages)

Section II, Item G

- Project Narrative (8 pages)
- Crow Creek Phase I – As-Built Monitoring Report (21 pages)
- Crow Creek Phase I – Construction Plan Set (19 pages)
- Crow Creek Phase II – Preliminary Design Concepts (8 pages)
- Letter from Jason Blakney, Fisheries Biologist, MFWP (2 pages)
- Letter of support from Avista (1 page)
- Letter of support from NorthWestern Energy (1 page)
- Letter of Support from the Green Mountain Conservation District (1 page)

Section II, Item H

- Letter from the Lolo National Forest establishing landowner consent and commitment to management and maintenance of site (1 page)

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

WORK ITEMS (ITEMIZE BY CATEGORY)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	CONTRIBUTIONS			
					FUTURE FISHERIES REQUEST	IN-KIND SERVICES**	IN-KIND CASH	TOTAL
Personnel								
Construction oversight	1	Lump sum	\$16,250.00	\$ 16,250.00	-	-	16,250.00	\$ 16,250.00
Project coordination	40	Hours	\$28.35	\$ 1,134.00	-	-	1,134.00	\$ 1,134.00
		Sub-Total		\$ 17,384.00	\$ -	\$ -	\$ 17,384.00	\$ 17,384.00
Equipment and Labor								
Clear and grub	1	Lump sum	\$1,500.00	\$ 1,500.00	-	-	1,500.00	\$ 1,500.00
Construct and decommission clearwater diversion	1	Each	\$1,500.00	\$ 1,500.00	-	-	1,500.00	\$ 1,500.00
Salvage, preserve and transplant existing vegetation	1	Lump sum	\$2,500.00	\$ 2,500.00	-	-	2,500.00	\$ 2,500.00
Construct and improve roads and staging areas	1	Lump sum	\$1,000.00	\$ 1,000.00	-	-	1,000.00	\$ 1,000.00
Earth work	2500	Cubic yards	\$3.00	\$ 7,500.00	2,500.00	-	5,000.00	\$ 7,500.00
Collect and install willow cuttings	6000	Each	\$1.00	\$ 6,000.00	3,000.00	-	3,000.00	\$ 6,000.00
Construct channel streambed	500	Linear feet	\$25.00	\$ 12,500.00	2,500.00	-	10,000.00	\$ 12,500.00
Construct large wood structures	10	Each	\$1,250.00	\$ 12,500.00	5,000.00	-	7,500.00	\$ 12,500.00
Construct vegetated wood matrix type 1	900	Linear feet	\$15.00	\$ 13,500.00	5,000.00	-	8,500.00	\$ 13,500.00
Construct vegetated wood matrix type 2	150	Linear feet	\$20.00	\$ 3,000.00	1,000.00	-	2,000.00	\$ 3,000.00
Construct vegetated wood matrix type 3	150	Linear feet	\$5.00	\$ 750.00	250.00	-	500.00	\$ 750.00
Install beaver dam analogs	2	Each	\$250.00	\$ 500.00	250.00	-	250.00	\$ 500.00
Install channel log step pools	8	Each	\$1,250.00	\$ 10,000.00	2,500.00	-	7,500.00	\$ 10,000.00

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Install floodplain roughness and woody debris	2 Acres	\$2,000.00	\$ 4,000.00	1,000.00	-	3,000.00	\$ 4,000.00
		Sub-Total	\$ 76,750.00	\$ 23,000.00	\$ -	\$ 53,750.00	\$ 76,750.00
Mobilization							
Mobilization, GPS equipment, and crew per diem	1 Lump sum	\$10,000.00	\$ 10,000.00	-	-	10,000.00	\$ 10,000.00
		Sub-Total	\$ 10,000.00	\$ -	\$ -	\$ 10,000.00	\$ 10,000.00
TOTALS			\$ 104,134.00	\$ 23,000.00	\$ -	\$ 81,134.00	\$ 104,134.00

MATCHING CONTRIBUTIONS (do not include requested funds)

CONTRIBUTOR	IN-KIND SERVICE	IN-KIND CASH	TOTAL	Secured? (Y/N)
Avista (Clark Fork Settlement Agreement Appendix B) - LCFWG Coordination	\$ -	\$ 1,134.00	\$ 1,134.00	Partially*
Avista (Clark Fork Settlement Agreement Appendix B) - Implementation	\$ -	\$ 40,000.00	\$ 40,000.00	N**
NorthWestern Energy (Thompson Falls Technical Advisory Committee) - Implementation	\$ -	\$ 40,000.00	\$ 40,000.00	Y
	\$ -	\$ -	\$ -	
TOTALS	\$ -	\$ 81,134.00	\$ 81,134.00	

*The LCFWG has received annual funding from Avista for the coordination of projects within Avista's project area for 15+ years. While 2019 funding will not be officially approved until March 2019, it is expected.

**Avista contributed to the design of this project. Implementation is expected to rank similarly in the 2019 funding cycle.

G. Project Narrative

Supplement to Future Fisheries Application, Crow Creek Phase II

Project summary

This project is a continuation of restoration efforts in a degraded segment of stream and floodplain to improve and protect native fish habitat in Crow Creek, a tributary of upper Prospect Creek on the Lolo National Forest. The stream is a high priority tributary due to the presence of native Bull Trout and Westslope Cutthroat Trout. Additional fish species present include native Cedar Sculpin. This project will improve stream stability and in-stream habitat, increasing the potential for native fish populations to thrive in Crow Creek and enhancing opportunities for recreational fishing of Westslope Cutthroat Trout.

Tasks will include re-shaping of the stream channel, installation of in-stream wood and rock structures, re-construction of the flood plain surface and a riparian planting program to re-establish native vegetation that will help stabilize the stream over time. Monitoring of fish abundance, physical characteristics, and riparian vegetation will be key components of this project. This project builds on an earlier restoration effort (Crow Creek Phase I) immediately upstream that has shown positive results.

Background

In 2007, approximately 1,200 feet of new channel were constructed beneath the BPA power lines just downstream of the confluence of the East and West Forks of Crow Creek. Grade control structures including native cobble patches, boulder clusters, log and rock cross-vanes, and log j-hook vanes were installed to maintain the designed channel dimensions until riparian vegetation could become established and lend permanence to the constructed project. Large woody debris structures were added to dissipate energy in meander bend pools and to enhance aquatic habitat. Single and double soil lifts were incorporated into the project to enhance bank stability and promote riparian vegetation growth. Approximately 1,750 willow cuttings were added to the 670 linear feet of soil lifts constructed. An additional 1,250 root stock were planted near stream banks, primarily alder and dogwood species. From 2016 through 2018, Montana Fish, Wildlife & Parks (MFWP) and Lower Clark Fork Watershed Group (LCFWG) built ten exclosures and planted an additional 900 riparian shrubs in the restoration reach to supplement the original plantings.

Post-restoration fisheries monitoring associated with the 2007 restoration project has shown positive results including steady increases of both abundance and biomass of Westslope Cutthroat Trout (FIGURES 1 and 2). In 2016 and 2017, a study was conducted to quantify habitat variables and assess their influence on Bull Trout abundance in Crow Creek and a neighboring stream, Cooper Gulch (Blakney, *In prep*). Cooper Gulch has a comparably robust Bull Trout population and one of the major objectives of this study was to determine factors important to the species abundance to better direct future restoration in the upper Prospect Creek watershed, including this proposed project in Crow Creek. Preliminary results indicate that the two sites within the 2007 restoration reach had the highest abundance of both Bull Trout and Westslope Cutthroat Trout observed in the entire Crow Creek drainage in 2017 (FIGURES 3 and 4).

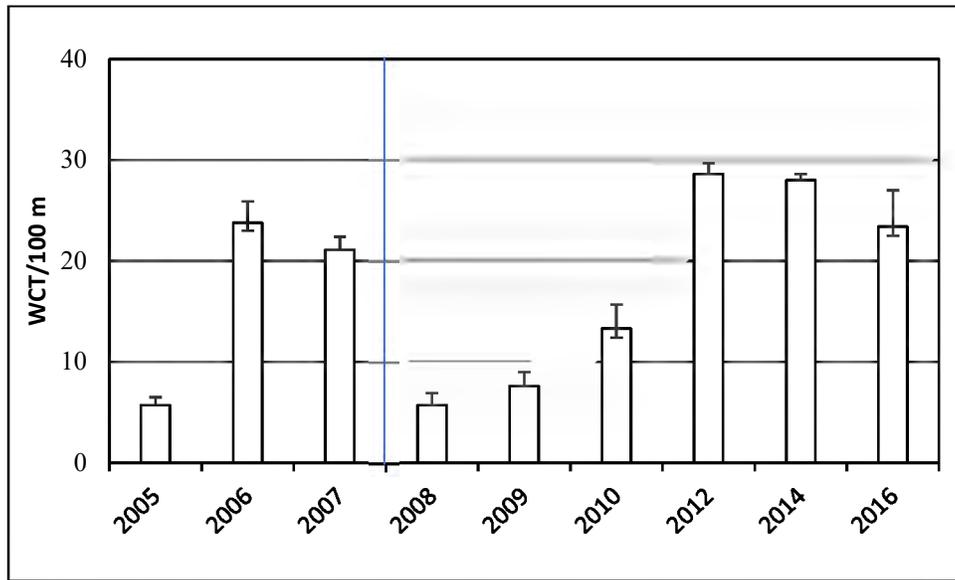


FIGURE 1. Linear abundance estimates (fish/100 m) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) sampled within the 2007 restoration reach in Crow Creek. The blue line represents the timing of the restoration work.

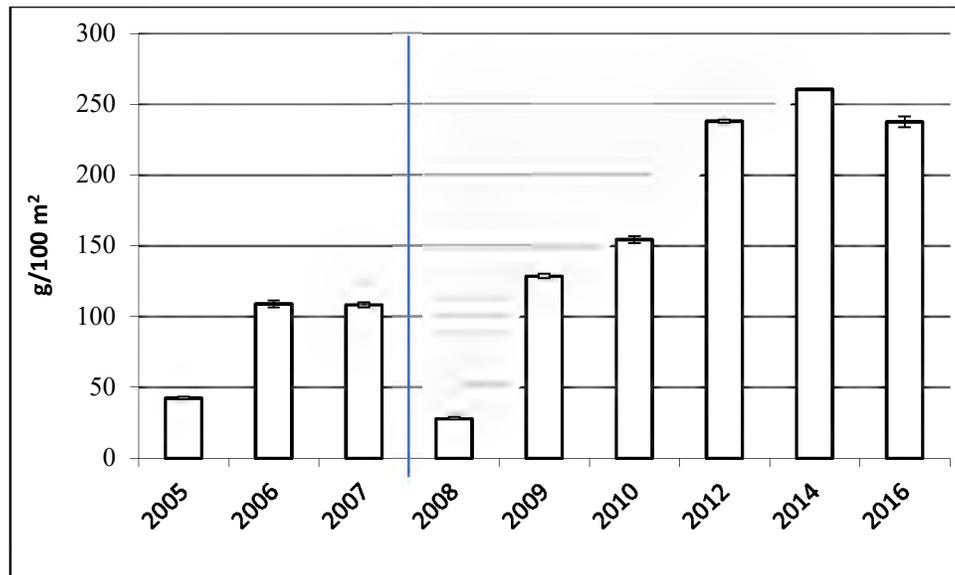


FIGURE 2. Biomass ($\text{g}/100 \text{ m}^2$) with 95% confidence intervals for Westslope Cutthroat Trout (WCT) sampled within the 2007 restoration reach in Crow Creek. The blue line represents the timing of the restoration work.

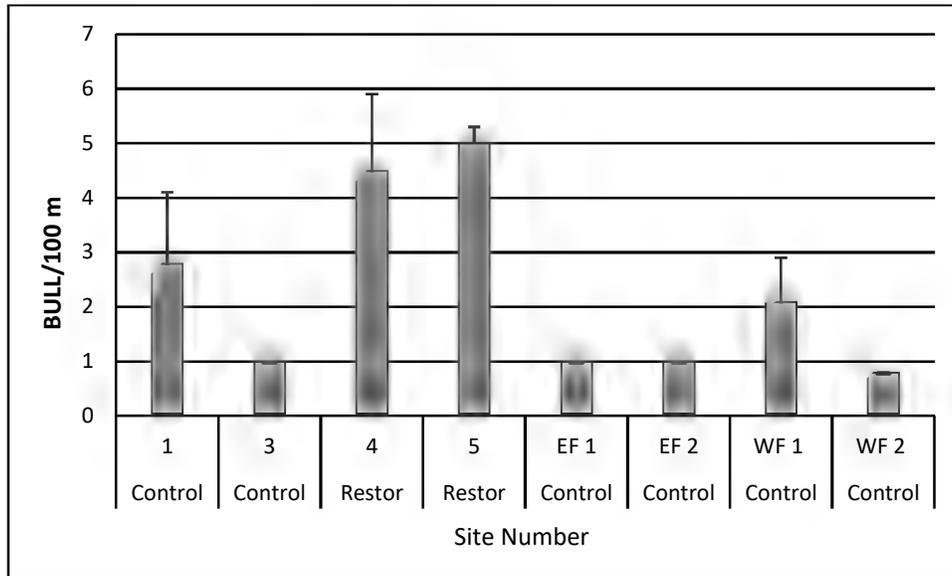


FIGURE 3. Standardized linear abundance estimates (#/100m) for Bull Trout (>75 mm) sampled in the Crow Creek drainage in 2017. Sites located within the 2007 restoration reach are labeled “Restor”, while all other sites are labeled “Control”.

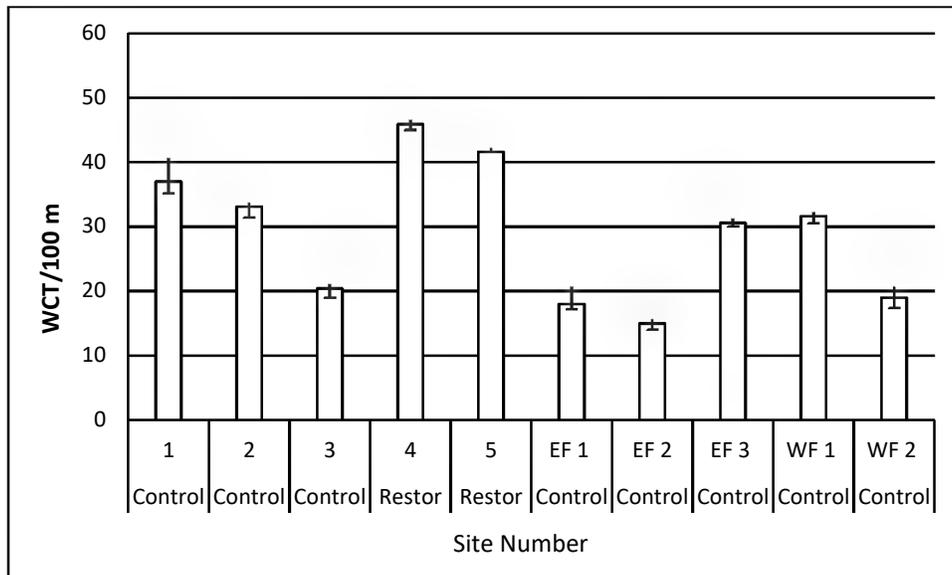


FIGURE 4. Standardized linear abundance estimates (#/100m) for Westslope Cutthroat Trout (>75 mm) sampled in the Crow Creek drainage in 2017. Sites located within the 2007 restoration reach are labeled “Restor”, while all other sites are labeled “Control”.

Existing conditions

The legacy effects of removing one-third mile of large riparian conifers are still evident in the Crow Creek drainage (FIGURES 5–7). Below the restored reach, approximately 600 feet of adversely impacted stream channel still exist before the creek re-enters an intact cedar forest. This channel lacks meanders, pools, shade, and complexity similar to the upstream reach prior to restoration. It is expected that restoration of this reach would result in a similar, positive response from the native fish community. The upstream portion of the reach is classified as a multi-

channel, braided D3 stream type characterized by extensive sediment deposition and simplified aquatic habitat conditions. The downstream segment transitions to an entrenched, over-widened F3 stream type with low floodplain connectivity. Bank erosion is prevalent throughout the reach. Bankfull channel width ranges from 18-feet to over 30-feet in over-widened segments. Instream habitat is dominated by riffle habitat units and deep pools are generally lacking due to removal of large woody debris and channel instability. Channel substrate is characterized by coarse gravel and small cobble, with larger boulders forming shallow pocket pools that provide limited cover for the focal fish species. Sediment transport capacity is impaired in the upper segment of the reach resulting in mid-channel bar deposits and high near-bank stress.



FIGURE 5. Unstable, braided channel in proposed restoration reach.



FIGURE 6. Recent removal of large streamside cedars within the proposed restoration reach.



FIGURE 7. Over-widened, low complexity channel within the proposed restoration reach.

Causes of existing impairment:

Two major power line corridors owned by Bonneville Power Administration (BPA) and NorthWestern Energy (NWE) travel up the drainage and have adversely affected the stream and riparian area. Installation and maintenance of road and utility corridors have resulted in persistent loss of old growth riparian conifers in Crow Creek over approximately 1/3 of a mile of riparian forest. As a result, the channel is over-widened, shallow, braided, and lacking pools, shade, and habitat complexity associated with inputs of large and small woody debris. Historically, the Crow Creek valley bottom was comprised of a dark riparian forest (RDG and USFS 2004). Large cedar stumps beneath the power lines provide evidence of this historical condition. In upstream areas of the East and West Forks of Crow Creek, decadent stands of large diameter cedar and fir still dominate riparian areas.

Restoration in Crow Creek ranked second highest after Cooper Gulch among the 40 sub-watersheds assessed in the lower Clark Fork River. The stream was designated as a “focus area” based on the fish community present, the quality of spawning and rearing habitat and opportunities for restoration/enhancement (GEI 2005).

Objectives and Expected Improvements to Existing Conditions:

The overall project objective is to complete the physical construction work for the second phase of a channel reconstruction project in Crow Creek. This project begins directly adjacent and downstream to a reach of Crow Creek where channel restoration was completed in 2007. This project will improve channel pattern and profile, sinuosity, habitat diversity and complexity. Ultimately, this restoration project will create more stable habitat conditions that benefit stream function and is anticipated to increase the carrying capacity of the reach for the entirely native fish community that resides in the stream.

Expected improved conditions include:

- Increased stability, sinuosity and complexity in the stream channel, featuring more pools and spawning and rearing habitat for fish;
- Overall increased abundance and biomass of native fish, namely Bull Trout and Westslope Cutthroat Trout;
- Increased shade to Crow Creek, by establishing a robust riparian community along 600 feet of stream.

Project design:

The proposed Phase II project will reconstruct 600 feet of channel and floodplain immediately downstream of the Phase I project (see FIGURE 8). Design of the project, contracted to River Design Group (RDG), is underway. In November 2018, RDG proposed two alternatives for channel alignments (See attached “Crow Creek Phase II – Preliminary Design Concepts”). Project partners (LCFWG, MFWP, Lolo National Forest, and RDG) have reviewed the proposed alignments, and selected Alternative A. The channel will be reconstructed within the current belt width, and utilize existing floodplain surfaces that are well vegetated and meet the desired condition for floodplain vegetation communities. The floodplain would be expanded into existing terraces slightly, but this alternative maximizes existing high-quality features and incorporates them into the design. Existing high-quality vegetation would be salvaged and preserved to the greatest extent practical. Relative to Alternative B, Alternative A could achieve comparable benefits at a reduced cost and overall disturbance.



FIGURE 8. Aerial view of Crow Creek Restoration, Phase I, completed in 2007 and proposed restoration reach.

The proposed modifications to the stream channel, including re-alignment and installation of stabilizing structures combined with riparian planting, will follow the model of the upstream restoration project that was implemented in 2007. The 2019 project will feature similar design techniques to the Phase I project, which can be reviewed in the attached Construction Plan Set

for the 2007 project as well as the As-Built Monitoring Report for that project (See attached “Crow Creek Phase I – Construction Plan Set” and “Crow Creek Phase I – As-Built Monitoring Report”). Revised techniques include (1) replacing vegetated soil lifts with vegetated wood and brush matrices, a more recently developed technique which has been extensively applied on other stream restoration projects in the Clark Fork River basin. These structures are less costly than vegetated soil lifts and provide improved habitat complexity along the stream channel margins; and (2) replacing rock cross vane structures with channel log step pool structures to maintain high pool frequency and habitat complexity (See attached “Crow Creek Phase II – Preliminary Design Concepts for examples of typical structures).

Hardened grade control structures are not proposed for this project. The channel streambed will be constructed with an alluvial gradation that emulates reference reach conditions. The constructed channel streambed will maintain design channel dimension until riparian vegetation can establish and lend permanence to the constructed project. Large woody debris structures will be added to dissipate energy in pools and meander bends and to enhance aquatic habitat.

Construction work will be accompanied and followed by a riparian planting program to restore native vegetation, including approximately 6,000 willow cuttings for bank stabilization. Native vegetation that will mature at a low profile will be planted to avoid potential conflicts with overhead powerlines and avoid the need for future plantings.

Timeline:

- NEPA completion – Fall 2018
- Submittal of relevant permits (MFWP/Conservation District 310/124, Army Corps 404 and MTDEQ 318) – February 2019
- Final design and cost estimate – March 2019
- Implement instream work – August through October 2019
- As-built monitoring report – March 2020

Monitoring and Evaluating Project Results:

Monitoring and evaluation will include:

- As-built (2019) survey upon completion of construction, including:
 1. Longitudinal channel profile
 2. Representative riffle and pool channel cross-sections
 3. Wolman composite pebble count
 4. Fixed photo points
- Post-runoff survey in 2020 to document how the restored channel responds to a channel forming discharge event;
- Post-restoration fisheries monitoring of abundance and biomass will be conducted by MFWP to determine the response of native fish to the changes in stream morphology and habitat.
- Wetland re-delineation to confirm no net loss of jurisdictional wetlands, which is a requirement of the US Army Corps of Engineers

Project Partners:

Funding and implementation of this project will be a collaborative team effort involving the LCFWG, MFWP, Lolo National Forest, project contractors (including River Design Group), Avista, NorthWestern Energy, and other partners. LCFWG will administer project funds, contracts and coordinate project activities. Key technical advice will be provided by MFWP and Lolo National Forest. Construction oversight, permitting compliance, and related monitoring services will be provided by River Design Group. Fish salvage efforts and fisheries monitoring will be overseen by MFWP.

Supporting Documents included in Attachments:

- Crow Creek Phase I – Construction Plan Set
- Crow Creek Phase I – As-Built Monitoring Report
- Crow Creek Phase II – Preliminary Design Concepts
- Letter from the Lolo National Forest establishing landowner consent and commitment to management and maintenance of site
- Letter from Jason Blakney, Fisheries Biologist, MFWP
- Letter of support from Avista
- Letter of support from NorthWestern Energy
- Letter of Support from the Green Mountain Conservation District

Literature Cited

Blakney, J. *In prep.* Factors influencing abundance and biomass of native salmonids in neighboring headwater streams, Crow Creek and Cooper Gulch. Including a synopsis of Bull Trout in the Crow Creek drainage. Montana Fish, Wildlife, and Parks, Thompson Falls, Montana. Report to Avista Corporation, Noxon, Montana and Montana Fish, Wildlife and Parks, Helena, Montana

Geotechnical, Environmental, and Water Resource Engineers (GEI). 2005. Lower Clark Fork River Drainage Habitat Problem Assessment. Submitted to Avista Corporation, Natural Resources Field Office, Noxon, Montana.

River Design Group (RDG) and U.S. Forest Service(USFS). 2004. Final Prospect Creek Watershed Assessment and Water Quality Restoration Plan. Prepared for: Prospect Creek Watershed Council and Green Mountain Conservation District, Trout Creek, Montana.

PRELIMINARY DESIGN CONCEPTS CROW CREEK PHASE 2 RESTORATION PROJECT

PROJECT PARTNERS



MONTANA FISH, WILDLIFE & PARKS
601 NORTH COLUMBIA STREET
THOMPSON FALLS, MONTANA 59873



NORTHWEST ENERGY, LLC
THOMPSON FALLS, MONTANA 59873



USDA FOREST SERVICE
209 RIVERSIDE AVENUE WEST
SUPERIOR, MONTANA 59872



LOWER CLARK FORK WATERSHED GROUP
P.O. BOX 1329
TROUT CREEK, MONTANA 59874



AVISTA UTILITIES
150 NOXON RAPIDS DAM ROAD
NOXON, MONTANA 59853

PROJECT DESCRIPTION

IN 2007, APPROXIMATELY 1,200 FEET OF NEW CHANNEL WAS CONSTRUCTED BENEATH THE BPA POWER LINES JUST DOWNSTREAM OF THE CONFLUENCE OF THE EAST AND WEST FORKS OF CROW CREEK. LARGE WOODY DEBRIS STRUCTURES WERE ADDED TO DISSIPATE ENERGY IN MEANDER BEND POOLS AND TO ENHANCE AQUATIC HABITAT. SINGLE AND DOUBLE SOIL LIFTS WERE INCORPORATED INTO THE PROJECT TO ENHANCE BANK STABILITY AND PROMOTE RIPARIAN VEGETATION GROWTH. APPROXIMATELY 1,750 WILLOW CUTTINGS WERE ADDED TO THE 670 LINEAR FEET OF SOIL LIFTS CONSTRUCTED. AN ADDITIONAL 1,250 ROOT STOCK WERE PLANTED NEAR STREAM BANKS, PRIMARILY ALDER AND DOGWOOD SPECIES. FROM 2016 THROUGH 2018, MONTANA FISH, WILDLIFE & PARKS (MFWP) AND LOWER CLARK FORK WATERSHED GROUP (LCFWG) BUILT TEN ENCLOSURES AND PLANTED AN ADDITIONAL 900 RIPARIAN SHRUBS IN THE RESTORATION REACH TO SUPPLEMENT THE ORIGINAL PLANTINGS.

THIS PROJECT IS A CONTINUATION OF RESTORATION EFFORTS IN A DEGRADED SEGMENT OF STREAM AND FLOODPLAIN TO IMPROVE AND PROTECT NATIVE FISH HABITAT IN CROW CREEK, A TRIBUTARY OF UPPER PROSPECT CREEK ON THE LOLO NATIONAL FOREST. THE STREAM IS A HIGH PRIORITY TRIBUTARY DUE TO THE PRESENCE OF NATIVE BULL TROUT AND WESTSLOPE CUTTHROAT TROUT. THIS PROJECT WILL IMPROVE STREAM STABILITY AND IN-STREAM HABITAT, INCREASING THE POTENTIAL FOR NATIVE FISH POPULATIONS TO THRIVE IN CROW CREEK AND ENHANCING OPPORTUNITIES FOR RECREATIONAL FISHING OF WESTSLOPE CUTTHROAT TROUT.

TASKS WILL INCLUDE RE-SHAPING OF THE STREAM CHANNEL, INSTALLATION OF IN-STREAM WOOD AND ROCK BASED STRUCTURES, RE-CONSTRUCTION OF THE FLOODPLAIN SURFACE AND A RIPARIAN PLANTING PROGRAM TO RE-ESTABLISH NATIVE VEGETATION THAT WILL HELP STABILIZE THE STREAM OVER TIME. MONITORING OF FISH ABUNDANCE, PHYSICAL CHARACTERISTICS, AND RIPARIAN VEGETATION WILL BE KEY COMPONENTS OF THIS PROJECT. THIS PROJECT BUILDS ON AN EARLIER RESTORATION EFFORT (CROW CREEK PHASE I) IMMEDIATELY UPSTREAM THAT HAS SHOWN POSITIVE BIOLOGICAL AND GEOMORPHIC RESULTS.

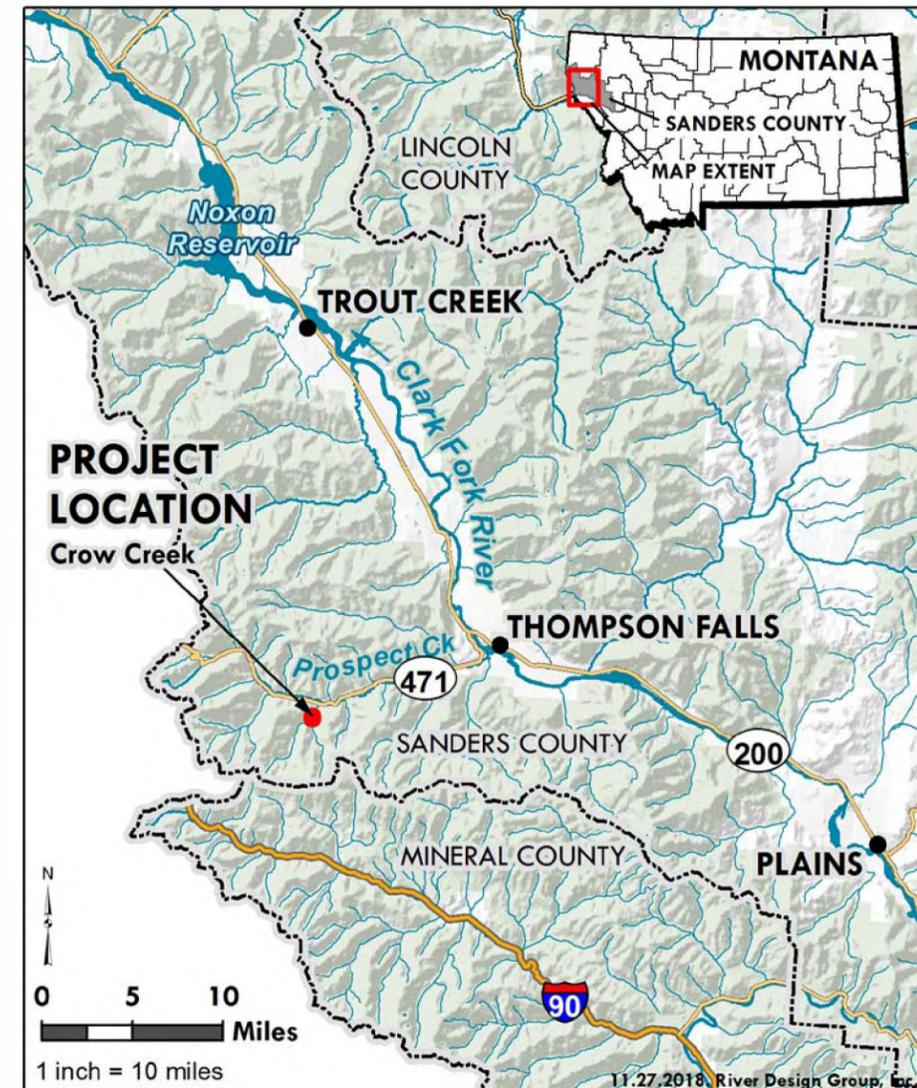
GENERAL NOTES

1. CONTOUR INTERVAL IS NOTED ON DRAWINGS.
2. SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
3. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED BY RDG IN SEPTEMBER 2018. LIDAR DATA WAS COORDINATED BY RDG AND COLLECTED IN OCTOBER 2018.
5. ALL EXISTING CONDITIONS ARE TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION AND ANY ADJUSTMENTS TO THE DRAWINGS SHALL BE MADE AS DIRECTED BY THE ENGINEER.
6. EXISTING PRIVATE IMPROVEMENTS, WHICH LIE WITHIN THE CONSTRUCTION LIMITS, UNLESS OTHERWISE NOTED WILL BE REMOVED BY THE OWNER PRIOR TO CONSTRUCTION, OR ABANDONED IN PLACE.
7. PROTECT ALL TREES AND LAND AREAS NOT LOCATED WITHIN THE PROJECT CONSTRUCTION, STAGING OR EARTHWORK LIMITS. EXERCISE CARE IN AREAS NOT SO MARKED TO AVOID UNNECESSARY DAMAGE TO NATURAL VEGETATION.
8. THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS AND EASEMENTS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
9. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK, THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.
10. EXCAVATION SHALL MEET THE REQUIREMENTS OF OSHA 29 CFR PART 1926, SUBPART P, EXCAVATIONS. ACTUAL SLOPES SHALL NOT EXCEED THE SLOPES AS INDICATED ON DRAWINGS.
11. ALL EXCAVATORS AND BULLDOZERS SHALL BE EQUIPPED WITH MACHINE GRADE GPS ((L1/L2/GLONASS)). CONSTRUCTION AREAS WILL BE STAKED OUT PRIOR TO CONSTRUCTION USING SURVEY GRADE GPS (L1/L2/GLONASS).
12. ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
13. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
14. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

DRAWING INDEX

- 1.0 COVER PAGE
- 2.0 CONCEPTUAL DESIGN ALTERNATIVES
- 3.0 CONCEPTUAL DESIGN ALTERNATIVES - EARTHWORK ANALYSIS
- 4.0 CONSTRUCTED CHANNEL STREAMBED DETAILS
- 5.0 CHANNEL LOG STEP POOL DETAIL
- 6.0 LARGE WOOD STRUCTURE DETAIL
- 7.0 VEGETATED WOOD AND BRUSH MATRIX DETAIL
- 8.0 FLOODPLAIN ROUGHNESS DETAIL

CROW CREEK VICINITY MAP



**SECTION 4, T20N R31W, P.M., M.
SANDERS COUNTY, MONTANA
LAT: 47.5275 , LONG: 115.5578**

STANDARD OF PRACTICE

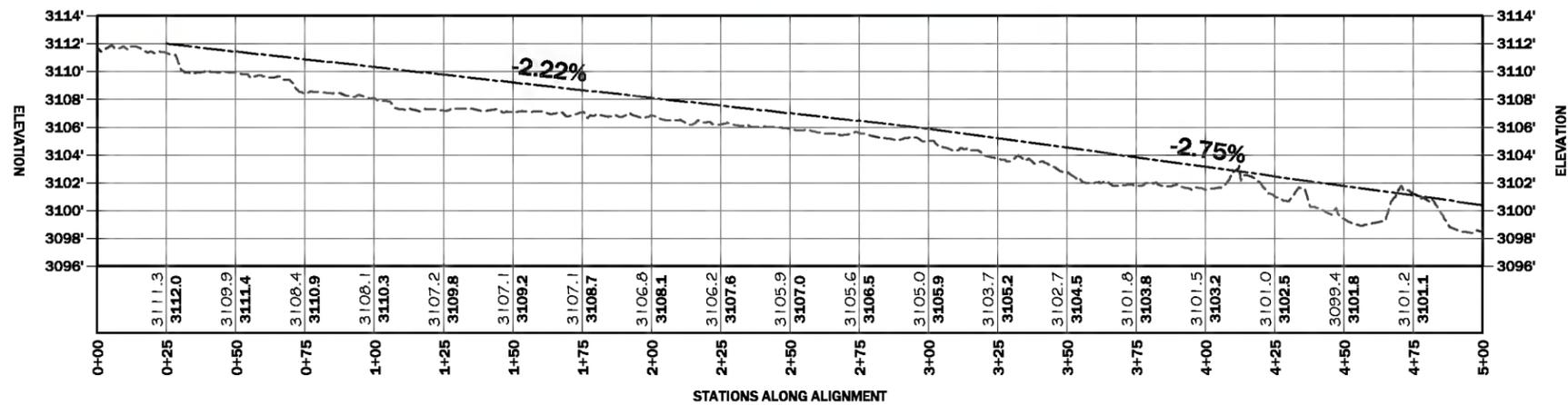
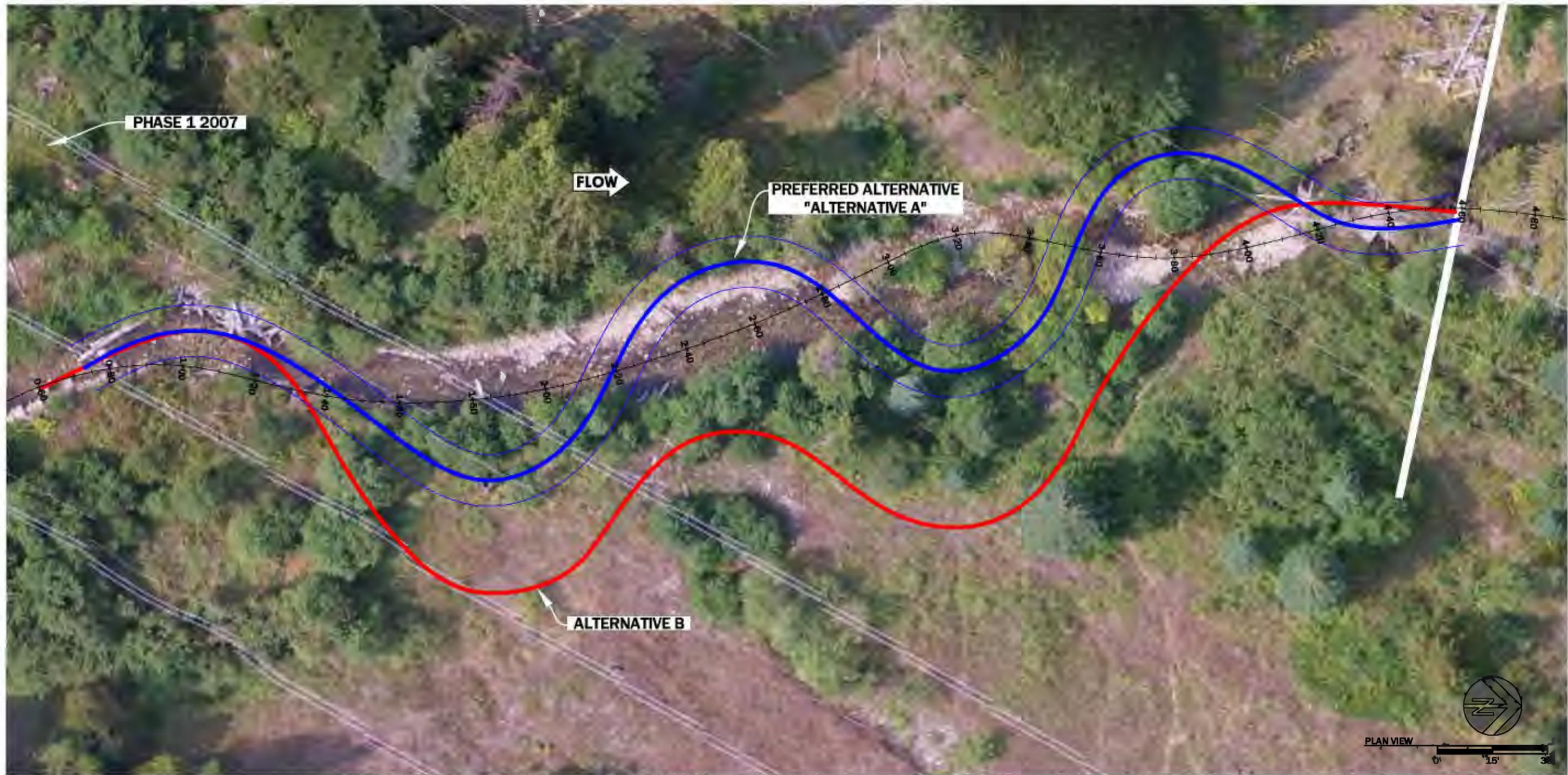
RIVER DESIGN GROUP, INC. WORKS EXCLUSIVELY IN THE RIVER ENVIRONMENT AND UTILIZES THE MOST CURRENT AND ACCEPTED PRACTICES AVAILABLE FOR PLANNING AND DESIGN OF RIVER, FLOODPLAIN, AND AQUATIC HABITAT RESTORATION PROJECTS. CURRENT STANDARDS FOR THE DESIGN OF RESTORATION PROJECTS VARY DEPENDING ON PROJECT GOALS. STABILITY CRITERIA INCLUDE DESIGNING STREAMBED AND STREAMBANK STRUCTURES FOR THE 25-YEAR RECURRENCE INTERVAL DISCHARGE FLOOD. HEC-RAS, A ONE-DIMENSIONAL RIVER ANALYSIS MODEL WAS USED TO COMPLETE HYDRAULIC MODELING AND EVALUATE WATER SURFACE ELEVATIONS, CHANNEL AND OVBANK SHEAR STRESSES, AND VELOCITIES FOR A RANGE OF FLOWS, INCLUDING BANKFULL DISCHARGE, THE 25-YEAR DESIGN STABILITY FLOW, AND HIGHER RETURN INTERVAL DISCHARGES INCLUDING THE 100-YEAR FLOW.



Wisconsin Avenue
311 SW Jefferson
Corvallis, OR
97331

**COVER PAGE
CROW CREEK PHASE 2
NEAR THOMPSON FALLS, MT**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	JL	CONCEPTUAL	JM
PROJECT NUMBER				
SHEET NUMBER				
				1.0



LEGEND
 - - - - - EXISTING GROUND ELEVATION
 _____ DESIGN BANKFULL

RDG
RIVER DESIGN GROUP
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Whitefish, MT 59937
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311 SW Jefferson Avenue
Corvallis, OR 97333
Tel: 541.738.2920
Fax: 541.738.8524

CONCEPTUAL DESIGN ALTERNATIVES

CROW CREEK PH 2

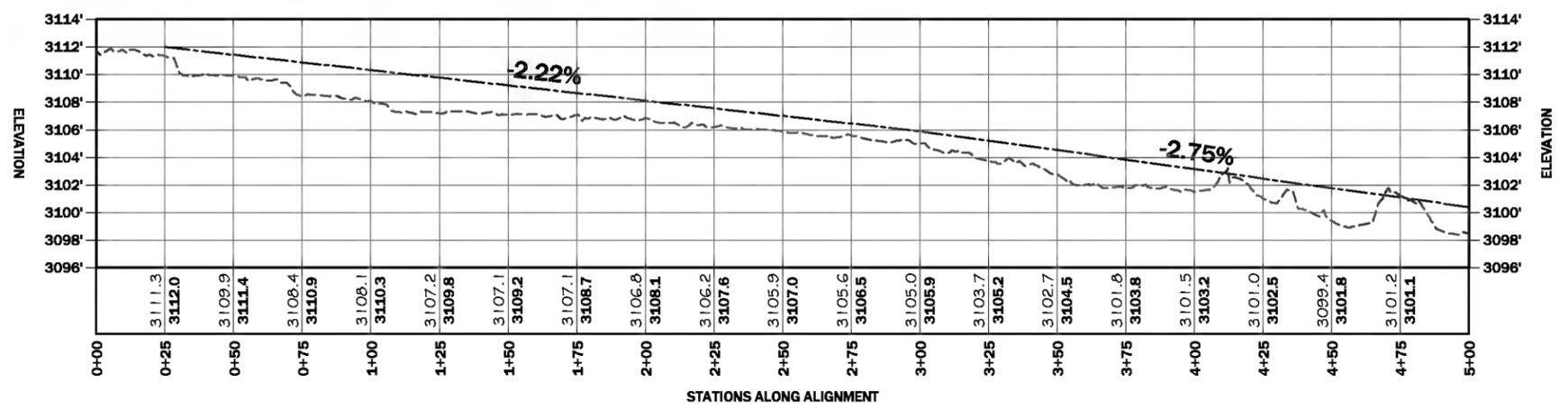
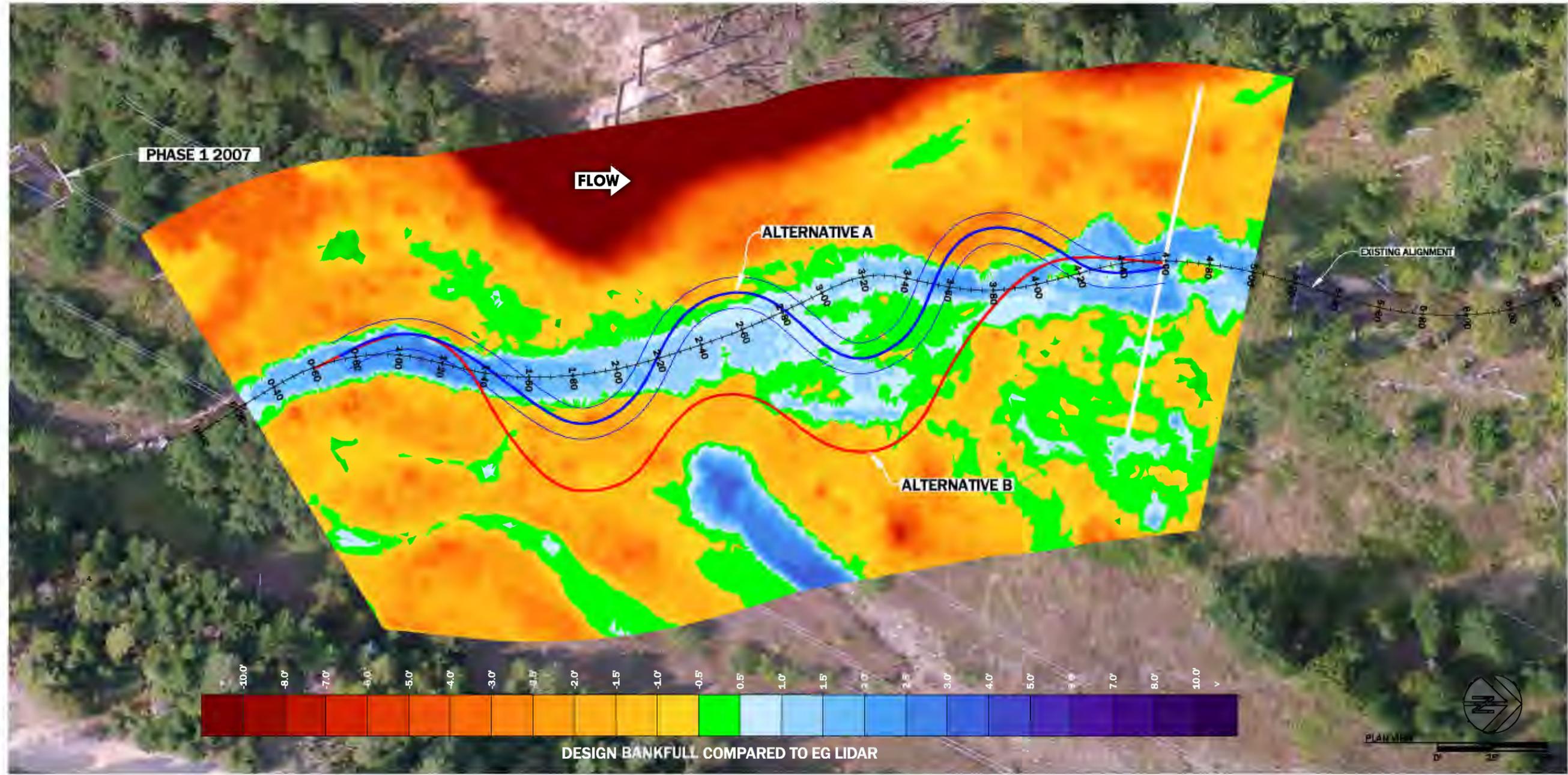
NEAR THOMPSON FALLS, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	NW	CONCEPTUAL	JM

PRELIMINARY
 NOT FOR CONSTRUCTION

PROJECT NUMBER
RDG-18-039

SHEET NUMBER
2.0



LEGEND

	EXISTING GROUND ELEVATION
	DESIGN BANKFULL

CONCEPTUAL DESIGN ALTERNATIVES EARTHWORK ANALYSIS

CROW CREEK PH 2 NEAR THOMPSON FALLS, MT

NO.	DATE	BY	DESCRIPTION	CHK
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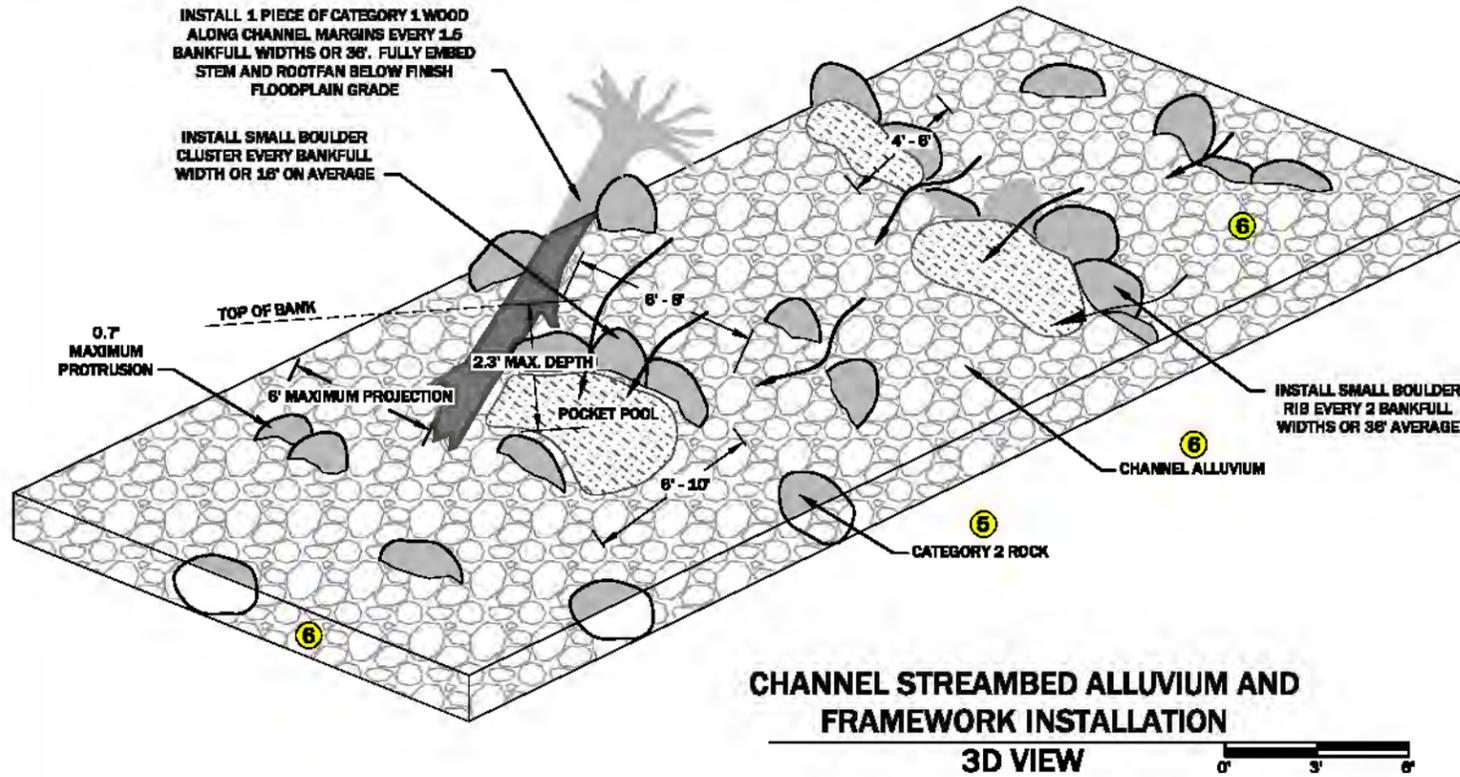
PROJECT NUMBER
RDG-18-039

SHEET NUMBER
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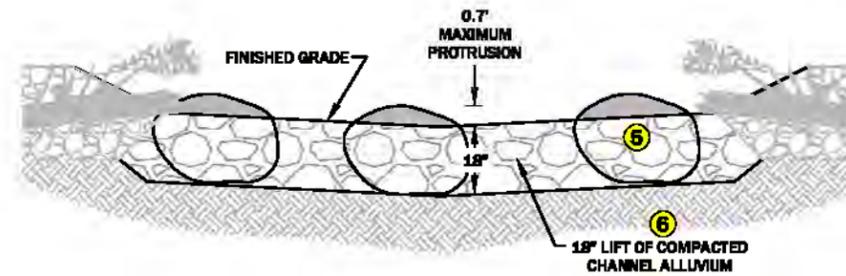
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CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION

3D VIEW



CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION

SECTION VIEW



TYPICAL CONSTRUCTED CHANNEL STREAMBED



TYPICAL POCKET POOL



EXAMPLE OF A SIMILAR NATURAL STREAMBED (YOCUM ET AL. 2014)

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL STREAMBED WILL OCCUR AFTER THE FLOODPLAIN BACKFILL IS PLACED AND BEFORE INSTALLATION OF THE VEGETATED WOOD AND BRUSH MATRIX STRUCTURES. INSTALLATION OF FLOODPLAIN ROUGHNESS WILL BE COMPLETED AFTER THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES ARE INSTALLED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES INCLUDING CONSTRUCTED POCKET POOLS AND RIB FEATURES.

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

1. PRIOR TO CONSTRUCTION OF THE CHANNEL STREAMBED, ENGINEER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS ESTABLISHED UNDER BID ITEM 4.1. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM AND CATEGORY 2 ROCK PER SPECIFICATIONS NOTED ON THE DRAWINGS.
3. PREPARE THE FRAMEWORK. CONTRACTOR SHALL PLACE 18-INCH TO 24-INCH BOULDERS (CATEGORY 2 ROCK) ON THE SURFACE OF THE CHANNEL SUBGRADE 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 0.7-FT.
4. CONTRACTOR SHALL INSTALL 18-INCH TO 24-INCH BOULDERS (CATEGORY 2 ROCK) IN CLUSTERS, AS DIRECTED BY THE ENGINEER, TO CREATE A COMPLEX SERIES OF POCKET POOLS THAT EFFECTIVELY DISSIPATE ENERGY AND PROVIDE PATHWAYS FOR FISH MOVEMENT. BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.7-FT.
5. SMALL BOULDER RIBS SHALL BE INSTALLED AS A COMPONENT OF THE CONSTRUCTED CHANNEL STREAMBED. AS SHOWN ON THE DRAWINGS, CONTRACTOR SHALL PLACE 18-INCH TO 24-INCH BOULDERS (CATEGORY 2 ROCK) IN AN IRREGULAR PATTERN SPANNING THE FULL WIDTH OF THE BANKFULL CHANNEL, AS DIRECTED BY THE ENGINEER. THE ROCKS SHALL INTERLOCK WITH NO GAPS BETWEEN ROCKS GREATER THAN 0.8-FT. ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.7-FT.
6. CONTRACTOR SHALL INSTALL CHANNEL MARGIN WOOD (CATEGORY 1 WOOD) TO PROVIDE CHANNEL MARGIN AQUATIC HABITAT COMPLEXITY AND ROUGHNESS. WOOD SHALL PROJECT NO GREATER THAN 6 FEET. INTO THE CONSTRUCTED STREAMBED IN VARIOUS ORIENTATIONS TO FLOW, AS DIRECTED BY ENGINEER. WOOD SHALL BE INSTALLED EMBEDDED INTO THE CHANNEL STREAMBED A MINIMUM OF ONE-HALF THE LOG DIAMETER, AS SHOWN ON THE DRAWINGS.
7. PREPARE THE MATRIX. AFTER THE FRAMEWORK, BOULDER CLUSTERS, AND SMALL BOULDER RIBS ARE INSTALLED AND INSPECTED BY ENGINEER, PLACE APPROPRIATE CHANNEL ALLUVIUM GRADATION AND WASH FINES INTO STREAMBED. CHANNEL ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS IN LIFTS OF 9-INCHES TO FINISHED GRADE. INDIVIDUAL COURSES SHALL BE BUCKET COMPACTED.

CHANNEL ALLUVIUM GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
10	95	D100
6	80 - 90	D84
4	45 - 55	D50
2	30 - 40	D35
1	20 - 30	D15
0.08	20	

PROVIDE MINIMUM 20% RETAINED IN 0.08" SIZE CLASS

CONSTRUCTED CHANNEL STREAMBED DETAIL
CROW CREEK PHASE 2
NEAR THOMPSON FALLS, MT

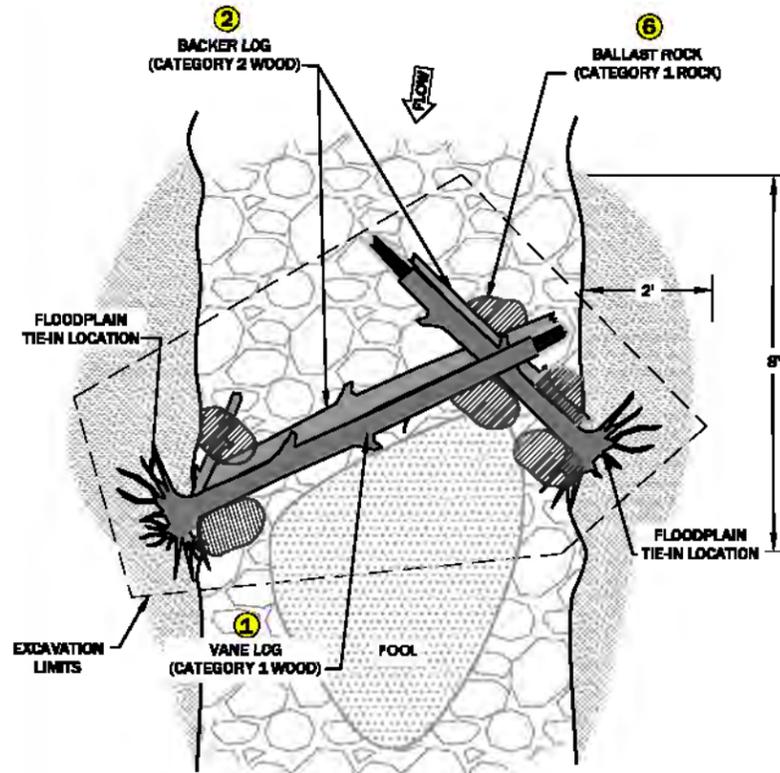
RDG
 RIVER DESIGN GROUP
 311 SW Jefferson Avenue
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 tel. 541.758.2820
 fax. 541.758.8624
 238 Wiscasset Avenue
 Whitefish, MT 59907
 tel. 406.862.4827
 fax. 406.862.4863

NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	NW	CONCEPTUAL	JM
PRELIMINARY NOT FOR CONSTRUCTION				

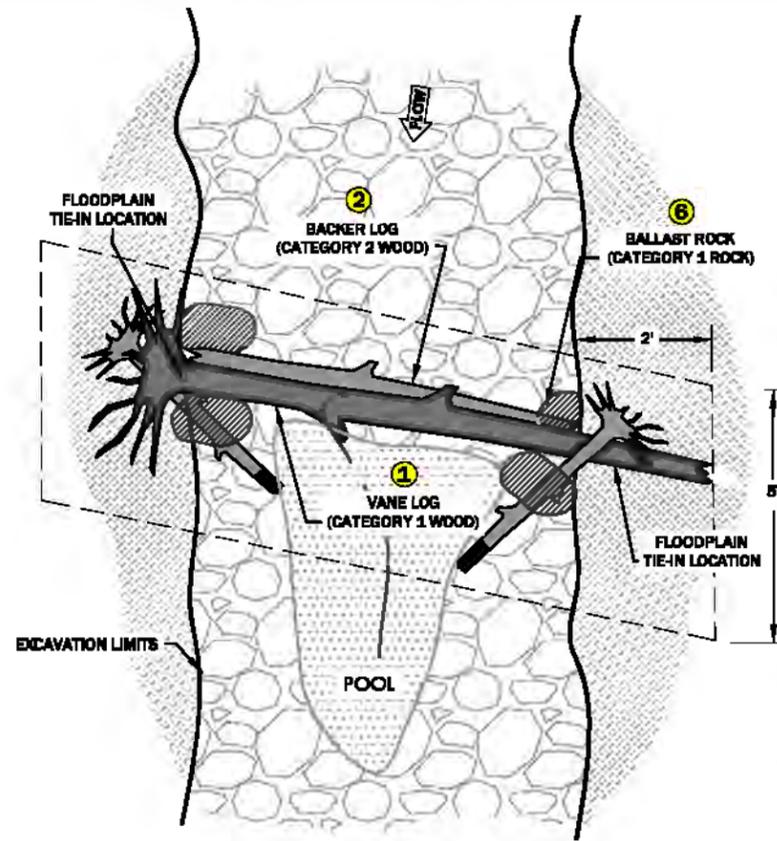
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RDG-18-039

SHEET NUMBER

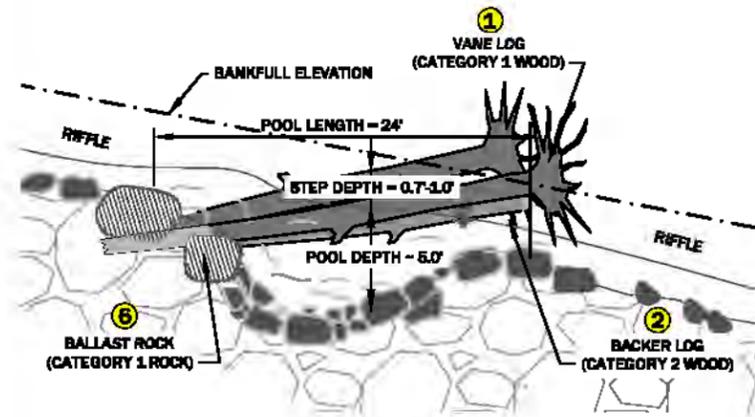
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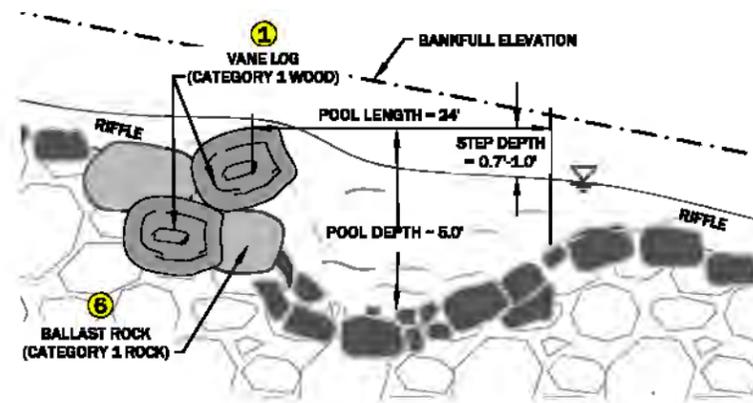
**TYPICAL LOG STEP POOL
PLAN VIEW**



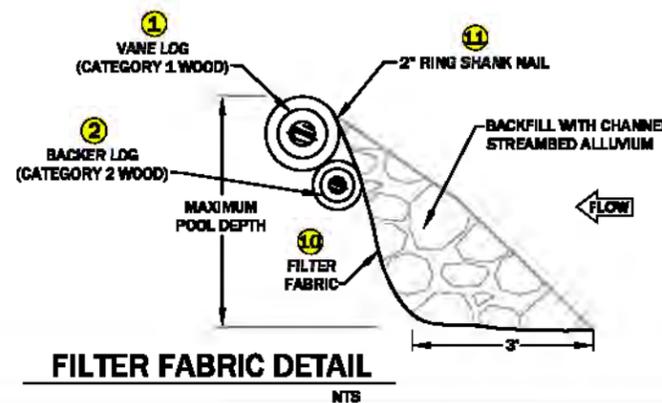
**TYPICAL LOG STEP POOL
PLAN VIEW**



**CHANNEL LOG STEP POOL DETAIL
PROFILE VIEW**



**CHANNEL LOG STEP POOL DETAIL
PROFILE VIEW**



**FILTER FABRIC DETAIL
NTS**

**MATERIAL SCHEDULE
(PER STRUCTURE)**

ITEM	QUANTITY
1 CATEGORY 1 WOOD	4
2 CATEGORY 2 WOOD	3
6 CATEGORY 2 ROCK	4
10 LF OF FILTER FABRIC	30
11 2" RING SHANK NAILS	30

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL LOG STEP POOL WILL OCCUR PRIOR TO THE CONSTRUCTED CHANNEL STREAMBED.
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 3-FT. BELOW THE CHANNEL STREAMBED FINISHED GRADE.
6. INSTALL BACKER LOGS (CATEGORY 2 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 DETAIL
CROW CREEK PHASE 2
NEAR THOMPSON FALLS, MT**

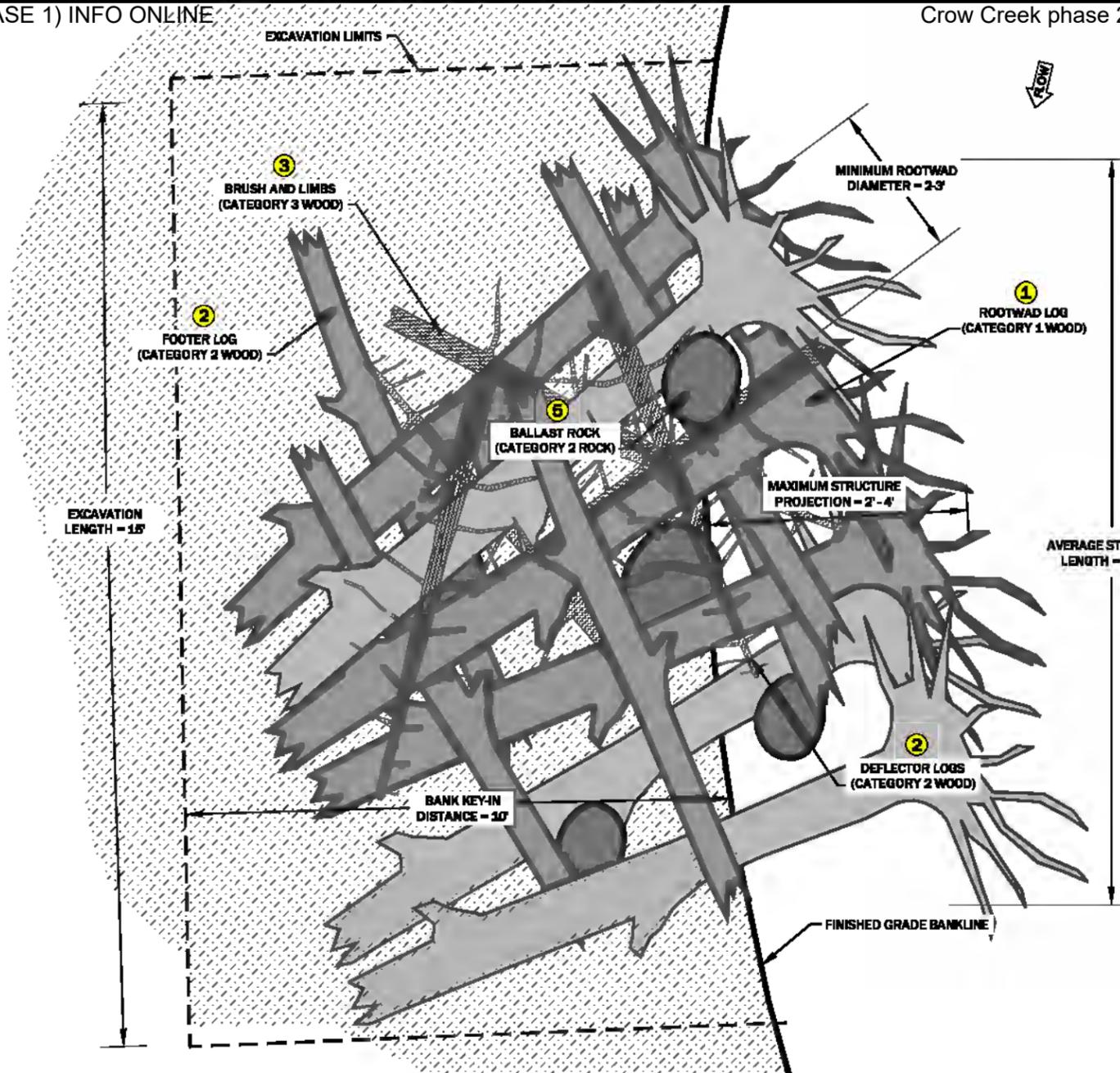
NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	NW	CONCEPTUAL	JM

PROJECT NUMBER
RDG-18-039

SHEET NUMBER
5.0

1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR AFTER THE FLOODPLAIN BACKFILL IS PLACED. INSTALLATION OF FLOODPLAIN ROUGHNESS SHALL BE COMPLETED AFTER THE LARGE WOOD STRUCTURES ARE INSTALLED.
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 GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION

- NOTES ON LARGE WOOD STRUCTURE INSTALLATION**
1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
 2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
 3. INSTALL THREE ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 2 - 4 FT. BEYOND THE FINISHED BANK LINE.
 4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS. BACKFILL SHALL BE BUCKET COMPACTED. PLACE CATEGORY 1 ROCK WHERE ROOTWAD LOGS INTERSECT FOOTER LOGS.
 5. INSTALL BRUSH AND LIMBS (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 3 - 6 FT. BEYOND THE FINISHED BANK LINE.
 6. INSTALL THREE ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING THE LOWER TIER OF ROOTWADS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 2 - 4 FT. BEYOND THE FINISHED BANK LINE.
 7. INSTALL BRUSH AND LIMBS (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 3 - 6 FT. BEYOND THE FINISHED BANK LINE.
 8. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED. PLACE CATEGORY 2 ROCK WHERE ROOTWAD LOGS INTERSECT LOWER ROOTWAD LOGS.
 9. INSTALL DEFLECTOR LOGS (CATEGORY 2 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL PROJECT NO GREATER THAN 3 - 6 FT. BEYOND THE FINISHED BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
 10. PLACE AND BUCKET COMPACT STOCKPILED MATERIAL TO THE FINISHED BANK LINE. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

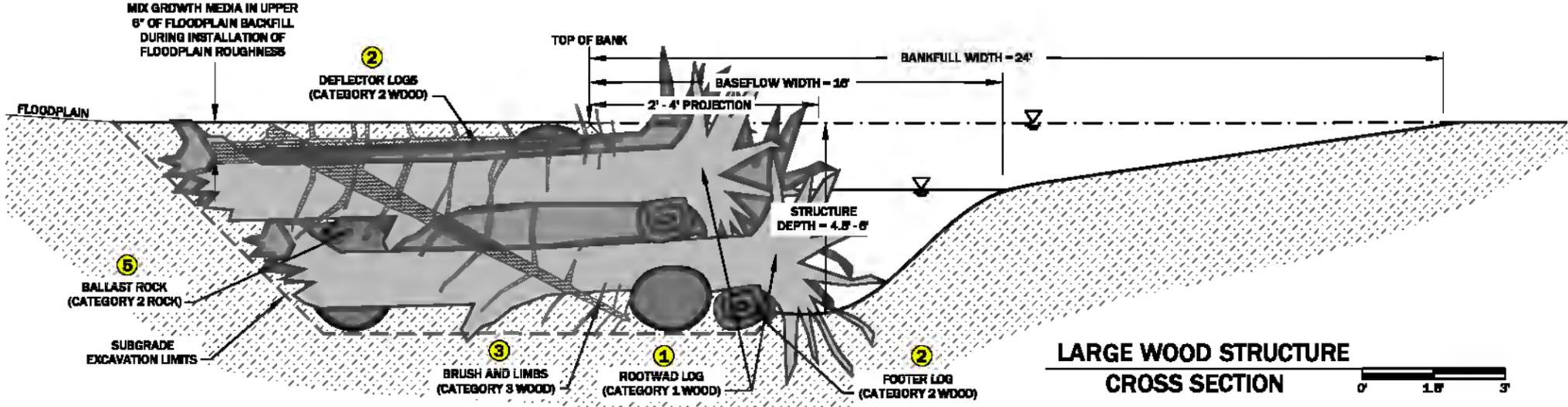


LARGE WOOD STRUCTURE PLAN VIEW

LARGE WOOD STRUCTURE TYPE 1

MATERIAL SCHEDULE (PER STRUCTURE)

ITEM	QUANTITY
① CATEGORY 1 WOOD	4
② CATEGORY 2 WOOD	2
③ CATEGORY 3 WOOD	4
⑤ CATEGORY 2 ROCK	4



LARGE WOOD STRUCTURE CROSS SECTION



EXAMPLE OF A LARGE WOOD STRUCTURE

LARGE WOOD STRUCTURE DETAIL
CROW CREEK PHASE 2
NEAR THOMPSON FALLS, MT

CHK	JIN
DESCRIPTION	CONCEPTUAL
BY	NW
DATE	11-27-18
NO.	1

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT NUMBER
RDG-18-039

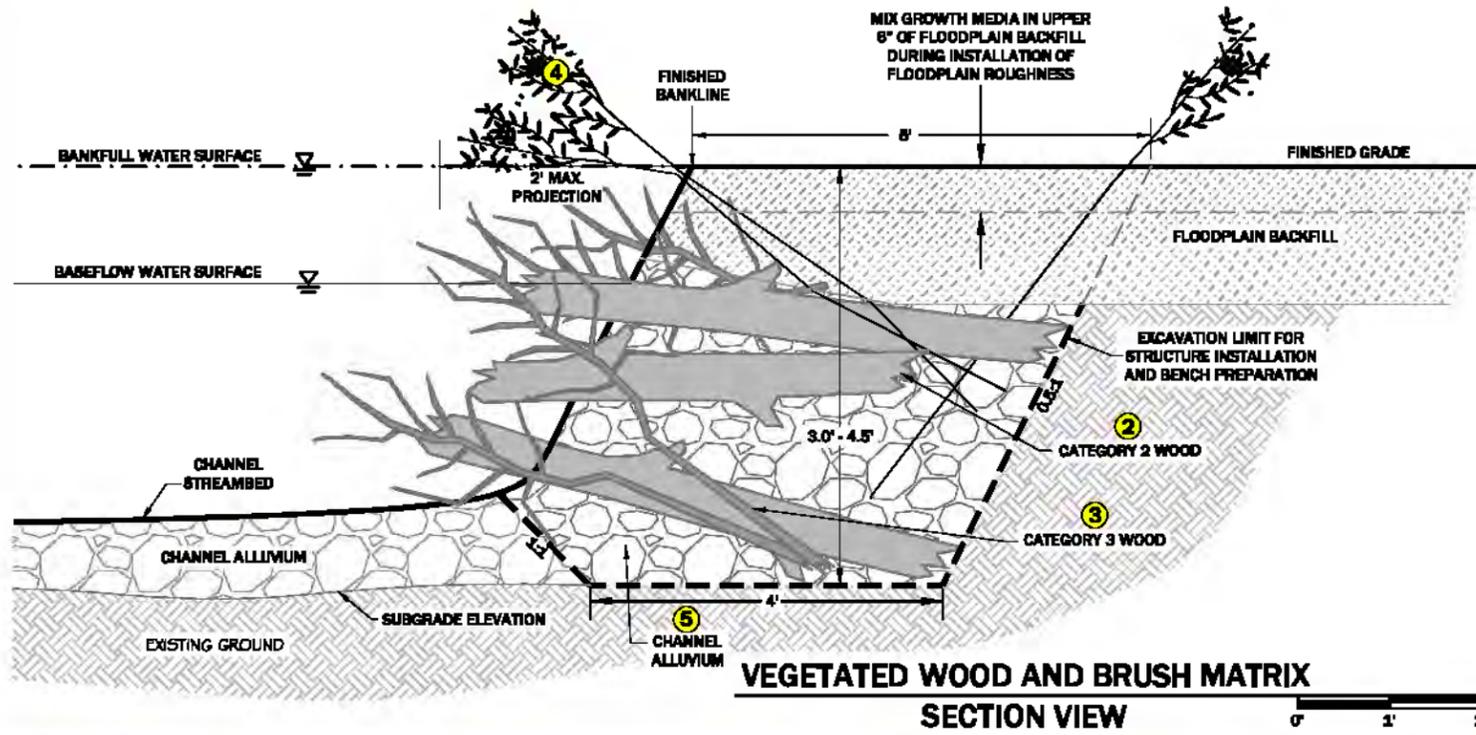
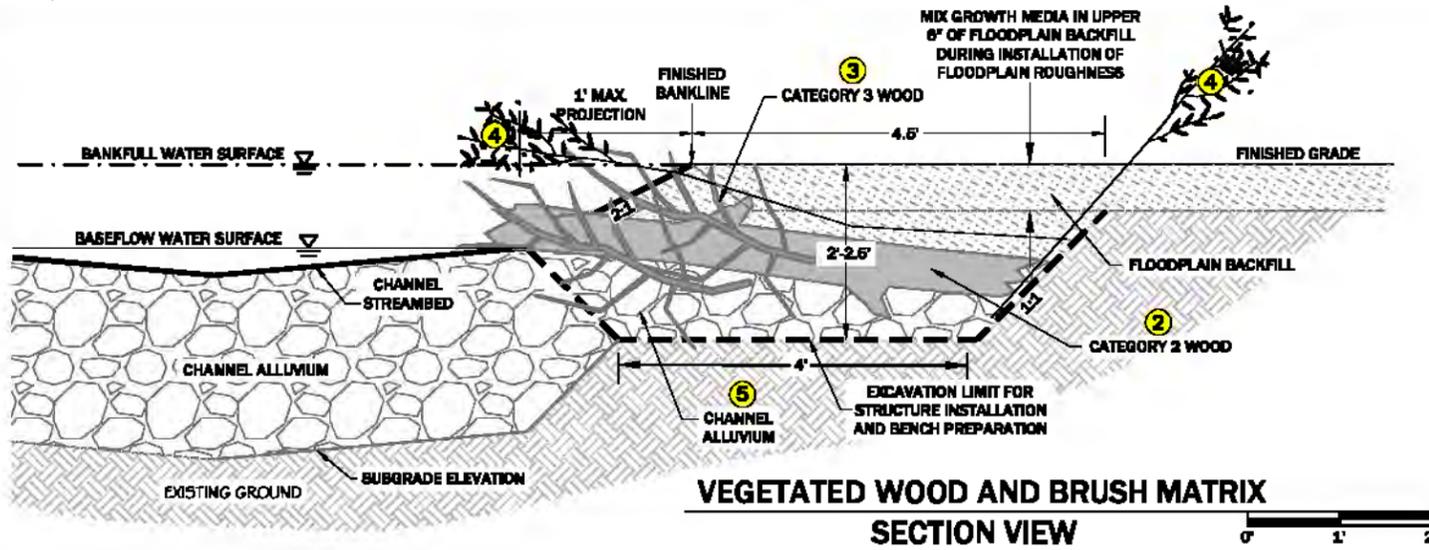
SHEET NUMBER
6.0

GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD AND BRUSH MATRIX WILL OCCUR AFTER THE FLOODPLAIN BACKFILL IS PLACED AND CHANNEL STREAMBED, INSTALLATION OF FLOODPLAIN ROUGHNESS WILL BE COMPLETED AFTER THE VEGETATED WOOD AND BRUSH MATRIX STRUCTURES ARE INSTALLED.
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 GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED WOOD AND BRUSH MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON VEGETATED WOOD AND BRUSH 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 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, CHANNEL ALLUVIUM, AND (6) TO EIGHT (8) FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 7 PER LINEAR FT. SHALL BE PLACED IN ALTERNATING LAYERS AND BUCKET COMPACTED AS IT IS CONSTRUCTED. WILLOW CUTTINGS SHALL SLOPE AT AN APPROXIMATE 2:1 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 SOIL LIFT OR TRENCH SO THAT APPROXIMATELY ONE-THIRD OF THE TOTAL CUTTING LENGTH IS EXPOSED BEYOND THE FRONT EDGE OF THE BASE.
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 2 ROCK AS APPROVED BY ENGINEER.
5. AFTER INSTALLATION OF THE VEGETATED WOOD AND BRUSH FASCINE, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE AND BUCKET COMPACT. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.



CHANNEL ALLUVIUM GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
10	98	D100
8	80 - 90	D84
4	48 - 55	D80
2	30 - 40	D35
1	20 - 30	D15
0.08	20	

PROVIDE MINIMUM 20% RETAINED IN 0.08" SIZE CLASS

MATERIAL SCHEDULE (PER LINEAR FOOT)

ITEM	REACH 3-4A QUANTITY	
	TYPE 1	TYPE 2
② CATEGORY 2 WOOD	1	2
③ CATEGORY 3 WOOD	1	2
④ RIPARIAN CUTTINGS	7	7
⑤ CHANNEL ALLUVIUM	0.11 CY	0.2 CY



EXAMPLE OF A CONSTRUCTED VEGETATED WOOD AND BRUSH MATRIX



EXAMPLE OF A CONSTRUCTED VEGETATED WOOD AND BRUSH MATRIX

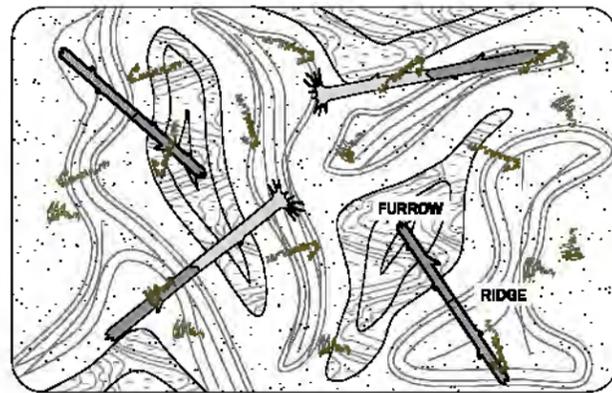
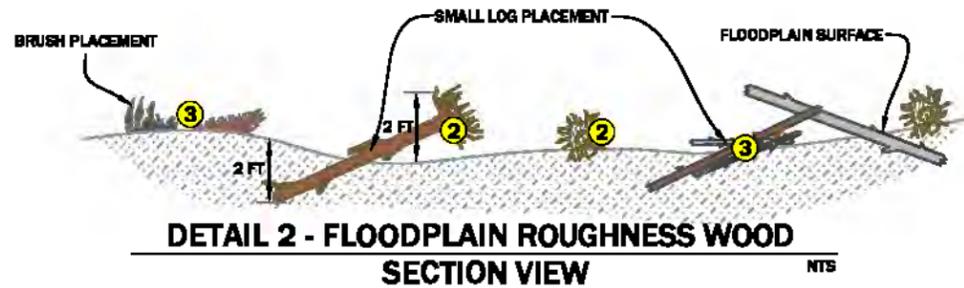
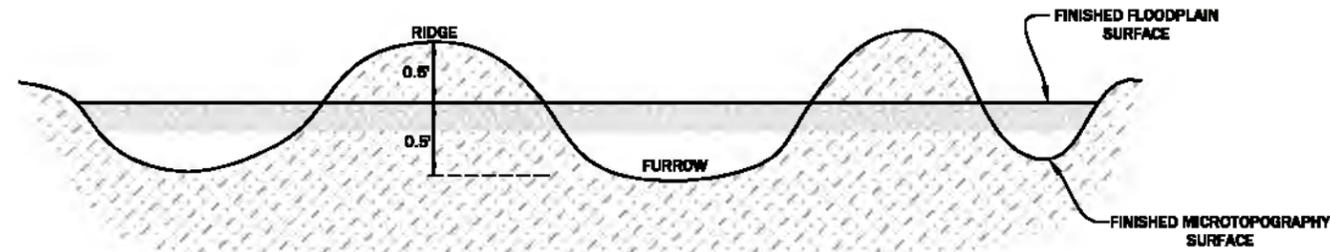
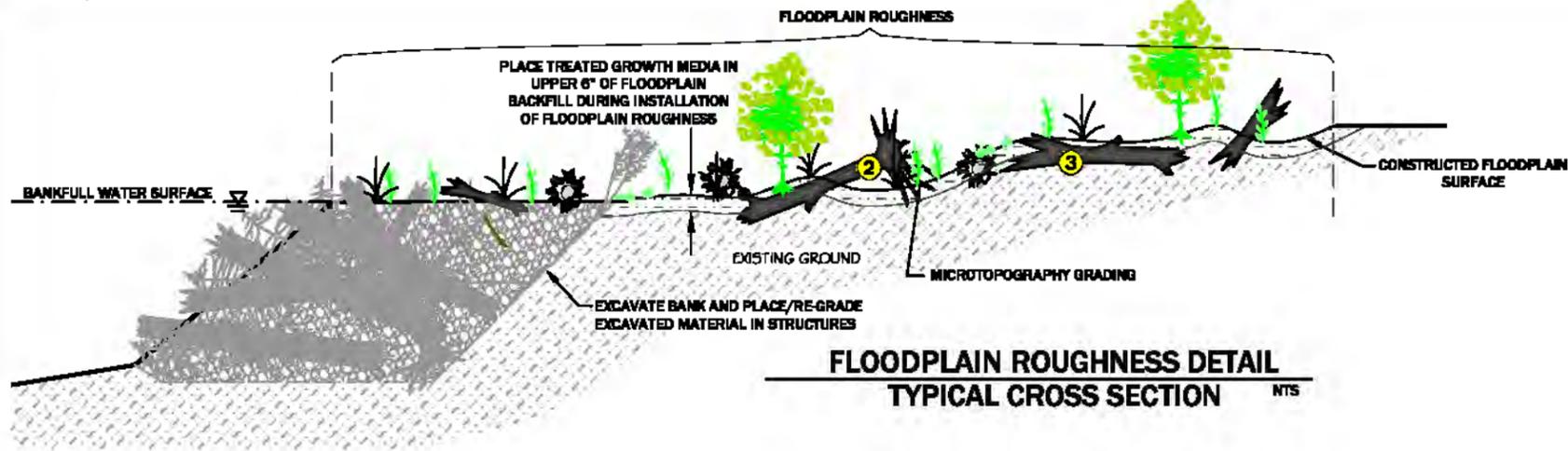
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 tel. 541.738.2820 fax. 541.758.8824

VEGETATED WOOD AND BRUSH MATRIX DETAIL
CROW CREEK PHASE 2
NEAR THOMPSON FALLS, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	NW	CONCEPTUAL	JM

PRELIMINARY
 NOT FOR CONSTRUCTION

PROJECT NUMBER
 RDG-18-039
 SHEET NUMBER
7.0



- ### GENERAL NOTES
1. FURNISHING WOOD AND CONSTRUCTION OF FLOODPLAIN ROUGHNESS WILL OCCUR AFTER PLACEMENT OF FLOODPLAIN BACKFILL, CONSTRUCTION OF THE CHANNEL, STREAMBED AS APPLICABLE, INSTALLATION OF CHANNEL STEP POOLS, INSTALLATION OF LARGE WOOD STRUCTURE BANK TREATMENT, AND INSTALLATION OF VEGETATED WOOD AND BRUSH MATRIX BANK TREATMENTS.
 2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY ENGINEER.

- ### 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 AND PLACE IT WITHIN THE FLOODPLAIN ROUGHNESS TREATMENT AREA AS SHOWN ON THE DRAWINGS.
 3. 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).
 4. 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.
 5. 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.

MATERIAL SCHEDULE (PER ACRE)

ITEM	QUANTITY	UNIT
② CATEGORY 2 WOOD	35	EA
③ CATEGORY 3 WOOD	25	% COVER*

*APPROXIMATELY 250 PIECES/ACRE



EXAMPLE OF CONSTRUCTED FLOODPLAIN SWALE



EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS ELEMENT



FLOODPLAIN ROUGHNESS DETAIL

CROW CREEK PHASE 2

NEAR THOMPSON FALLS, MT

NO.	DATE	BY	DESCRIPTION	CHK
1	11-27-18	NW	CONCEPTUAL	JIM
PRELIMINARY NOT FOR CONSTRUCTION				

PROJECT NUMBER
RDG-18-039

SHEET NUMBER

8.0



November 30, 2018

Michelle McGree
Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
Helena, MT 59620-0701

RE: Crow Creek Stream and Riparian Restoration Project, Phase II

Dear Michelle,

The purpose of this letter is to outline Montana Fish, Wildlife and Parks (MFWP) local and ongoing support for restoration activities in Crow Creek, and specifically to express support for the Lower Clark Fork Watershed Group (LCFWG)'s application to the Future Fisheries Improvement Program for this project. The LCFWG, Lolo National Forest, and other partners work closely with local fisheries biologists, including myself, to identify and pursue priority restoration efforts to benefit native fisheries in tributaries to the lower Clark Fork River.

Crow Creek is a tributary to Prospect Creek which enters the Clark Fork River just downstream of Thompson Falls Dam. Historical accounts from residents that lived in the area noted Prospect Creek once held large runs of migratory Bull Trout prior to dams being built on the mainstem Clark Fork River. Those were they heydays of Bull Trout throughout the Clark Fork River basin in Montana. Today, Bull Trout remain in three headwater streams in the upper Prospect Creek watershed; Crow Creek, Cooper Gulch, and the upper mainstem of Prospect Creek. Most of these fish now express a resident life history, where they carry-out their entire life cycle in just a few miles of stream. The upper Prospect Creek watershed represents a rare environment in the lower Clark Fork River drainage as this is one of the last remaining areas in which Bull Trout and Westslope Cutthroat Trout live in sympatry without non-native salmonids and the importance of the upper watershed to native salmonid conservation cannot be overstated.

The Crow Creek Stream and Riparian Restoration Project, Phase II has the full support of MFWP. We were partners in implementing the first phase of restoration on Crow Creek in 2007 and have been very involved in ongoing maintenance and planting efforts along Crow Creek as well as in monitoring the success of past project. In 2016 and 2017, MFWP designed and implemented a study in Crow Creek and a cosmetically similar neighboring headstream (Cooper Gulch) to quantify habitat variables and assess their influence on native fish abundance and biomass. Of the 10 reaches monitored through this study in 2017, the two reaches sampled within 2007 restoration reach had the highest abundance of Bull Trout and Westslope Cutthroat Trout in Crow Creek (Blakney, *In prep*). Furthermore, our long-term monitoring data portrays a nearly steady increase in Westslope Cutthroat Trout abundance and biomass since the 2007 project was implemented. In the last two years, we have released 30 Bull Trout (from young-of-the year to adult-sized resident fish) into Crow Creek that were captured in isolated pools in an ephemeral portion of Prospect Creek, near the Crow Creek confluence. The goal of this project is to boost Bull Trout production in the Crow Creek drainage by relocating fish to the stream that would otherwise perish. It is anticipated that the proposed restoration project will increase the carry capacity for both native salmonids in this reach of stream which directly supports our ongoing supplementation effort.

Fisheries monitoring data, along with observations of Bull Trout and Westslope Cutthroat use of reconstructed habitat and long-term photo points, demonstrates the success of the previous restoration effort in Crow Creek. We have been highly involved in developing the Phase II project, supporting fundraising efforts for both design and implementation, and advising River Design Group with fisheries considerations to incorporate in the final design. I have spent in excess of 60 days along Crow Creek in the last few years and believe the second phase of restoration will have similar positive benefits to the native fish community in this small yet important stream.

We will continue to be invested in this effort and along with our partners, are excited to implement another successful project in Crow Creek.

Sincerely,

Jason Blakney



Fisheries Biologist
Montana Fish, Wildlife & Parks, Region 1
P.O. Box 95
Thompson Falls, Montana 59873
(406) 827-9282

November 27, 2018

Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
Helena, MT 59620-0701

RE: Crow Creek Stream and Riparian Restoration Project, Phase II

Dear Michelle,

Please consider this letter of support from Avista for the Lower Clark Fork Watershed Group's application for a Future Fisheries grant to help fund stream restoration work on Crow Creek in the Lolo National Forest.

Avista is committed to protecting and enhancing native salmonid habitat and aquatic resources in the Lower Clark Fork watershed. This project will be presented to the Clark Fork Settlement Agreement's (CFSA) Management Committee in March 2019 with a request for Settlement Agreement funding. While those funds have yet to be committed, based on past project rankings by the Water Resource Technical Advisory Committee, this project should be viewed favorably by the Management Committee. Additionally, the cooperative funding aspect of this project with NorthWestern Energy and hopefully, with your Future Fisheries Program, not only adds to the above-mentioned ranking, but embodies the cooperative approach that provides the best opportunity for successful restoration and resource protection.

In the past Avista, through the cooperative CFSA process, was integral in completing the first and adjacent Crow Creek restoration project, funded a LiDAR flight which informed the design for this proposed project, and has supported a recent comparative fisheries habitat investigation, which helped inform the development of the proposed project.

We appreciate this opportunity to express support for this project.

Sincerely,



Nate Hall
Clark Fork License Manager, Avista

November 29, 2018

Michelle McGree
Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
Helena, MT 59620-0701

RE: Crow Creek Stream and Riparian Restoration Project, Phase II

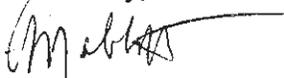
Dear Michelle,

NorthWestern Energy (NWE) is pleased to provide this letter of support for the Crow Creek Stream and Riparian Restoration Project grant proposal submitted by the Lower Clark Fork Watershed Group for Future Fisheries Improvement Program funding.

NorthWestern Energy has contributed funding through the Thompson Falls Technical Advisory Committee (TAC) to the design of this project because it is consistent with the commitment that our company has made to reduce impacts to Bull Trout due to the operation of the Thompson Falls dam (Thompson Falls Hydroelectric Project No. 1869). To that end, in 2018 NWE requested that the areas of the Prospect Creek watershed occupied by bull trout be eligible for offsite restoration or acquisition activities under the terms of our FERC license for the Thompson Falls dam. After this request was approved, NWE supported the design of Crow Creek Restoration, Phase II, and requests for implementation funds for this project will surely receive strong consideration from the Thompson Falls TAC along with other projects in the Prospect Creek, Thompson River and other sub-watersheds in our operational region that have a high likelihood of benefiting Bull Trout.

We hope you will agree that this project is worth funding. Please feel free to contact me with any questions as you consider this proposal.

Sincerely,



L. Brent Mabbott
Principle Compliance Professional
NorthWestern Energy
406-490-1801



November 27th, 2018

Michelle McGree
Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
Helena, MT 59620-0701

RE: Crow Creek Stream and Riparian Restoration Project, Phase II

Dear Michelle,

Please accept this letter of support from Green Mountain Conservation District for the Crow Creek Stream and Riparian Restoration Project grant proposal being submitted by the Lower Clark Fork Watershed Group for Future Fisheries Improvement Program funding.

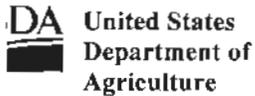
Green Mountain Conservation District is a member of the Lower Clark Fork Watershed Group and has taken a pro-active role in addressing stream habitat issues in Montana's lower Clark Fork River valley by involving local citizens in the protection and restoration of their watersheds and by partnering with area natural resource professionals to ensure that watershed restoration is based on good science. Based on the results of previous restoration efforts in Crow Creek, it appears that there's ample evidence that the methods proposed for this restoration reach are likely to achieve the project goal of improving habitat for native fisheries.

To this end, the District fully supports the Crow Creek Stream and Riparian Restoration Project. The project will complement previous on-the-ground work that has been accomplished in the drainage and will serve to provide healthy stream habitat to increase trout populations in the Prospect Creek drainage.

Thank you for your careful consideration of this project.

Sincerely,

Kent Wilby, Chair
Board of Supervisors



Forest
Service

Lolo National Forest
Plains/Thompson Falls
Ranger District

408 Clayton, P.O. Box 429
Plains, MT 59859
406-826-3821

File Code: 1950

Date: November 30, 2018

Michelle McGree
Montana Fish, Wildlife & Parks
Fisheries Division
1420 E. Sixth Ave.
Helena, MT 59620-0701

RE: Crow Creek Stream and Riparian Restoration Project, Phase II

Dear Michelle,

Please accept this letter of support from the Lolo National Forest for the Lower Clark Fork Watershed Group's application to the Montana Fish Wildlife and Parks Future Fisheries Grant Program. The Lower Clark Fork Watershed Group (LCFWG) is a valued partner in efforts to protect and restore water resources within the Lolo National Forest. We actively participate in the Thompson River and Lower Clark Fork Watershed Restoration Plans and this project is consistent with efforts to improve the water resources of the National Forest for recreation, aquatic life, and other beneficial uses.

We have worked closely with the LCFWG on planning future projects to re-introduce large woody debris to degraded streams on the Lolo National Forest and enhance riparian vegetation as a means to provide stream complexity and improve habitat for native fish. Crow Creek is a high priority project on the Forest because of the presence of native fish populations, including Bull Trout and Westslope Cutthroat Trout. Previous restoration work in this tributary has had promising results, justifying further investments to enhance fish habitat in this drainage.

Crow Creek is included in the Lolo National Forest's NEPA review of several opportunities to add large woody debris structures in tributary streams in the Lower Clark Fork watershed. Furthermore, the Lolo National Forest has been working with electric companies in the area to relocate powerlines away from streams and reduce impacts of powerline corridors on streams. These actions have in part enabled this restoration opportunity. The Lolo National Forest will continue to emphasize restoration in drainages that contain high native fish habitat values, such as Crow Creek.

Partnership with the LCFWG will be instrumental in advancing watershed restoration on the Lolo National Forest over the coming years. Funding for planning and design of these types of projects will result in a healthier and more resilient watershed, we urge you to support this application. Thank you for your consideration.

Regards,

A handwritten signature in blue ink, appearing to read 'S. Scott'.

Sharon A. Scott
Acting District Ranger

