2024 Nonpoint Source Application - On-the-Ground Projects

General Information

Project Name: Miller Creek 7 Mile Restoration

Applicant Name: Adam Switalski/Clark Fork Coalition

Is your organization registered with the Montana Secretary of State? Y

Explanation: Each applicant must be registered with the Montana Secretary of State to do business in the state of Montana. Registration with the Secretary of State may be completed via the following website: https://sosmt.gov/business/

Is your organization registered with the federal System for Award Management (SAM)? Y

Explanation: Each applicant is required to register with SAM. To register or check your organization's status, go to https://sam.gov/content/home. If you get an "Unsupported Browser" error, copy, and paste the link into a Google Chrome browser window.

Your organization's Unique Entity Identifier number (UEI #): J389TMMMS3J5

Explanation: Each applicant is required to have a current UEI number. The UEI number replaces the old DUNS number. If your organization had a DUNS number, you should have received a notification from the federal government indicating that your DUNS number has been changed to a UEI number. If you did not receive this notification, or if you never had a DUNS number, you will need to go to the federal government's System for Award Management (SAM - https://sam.gov/content/home) to obtain your UEI number. DEQ recommends starting this process early as it is very time-consuming, requires providing documentation-sometimes with follow-up requests for additional information, and can take up to 2 months to complete. If you need assistance, you may contact the federal help desk at 866-606-8220 Monday-Friday 8:00 a.m. through 8:00 p.m. EST.

Does your organization have adequate liability insurance for the risks associated with your project? Y

Explanation: Each applicant must have or obtain liability insurance coverage meeting the requirements stated in the Draft Sample Contract and/or requirements negotiated based on the appropriate level of risk associated with the project.

Primary Contact: Karen Knudsen Title: Executive Director

Address: 140 S 4th W #1 City: Missoula State: MT Zip Code: 59801

Phone Number: 406-541-3078 Email: karen@clarkfork.org

Signature: Karen Knudsen Digitally signed by Karen Knudsen Date: 2024.04.04 14:03:03 -06'00'

Explanation: This is the person who DEQ would routinely contact to discuss project progress, billing, etc.

Signatory: Karen Knudsen Title: Executive Director

Address: 140 S 4th W #1 City: Missoula State: MT Zip Code: 59801

Phone Number: 406-541-3078 Email: karen@clarkfork.org

Signature: Karen Knudsen Digitally signed by Karen Knudsen Date: 2024.04.04 14:03:49 -06'00'

Explanation: This is the person who can legally sign contracts and other binding documents on behalf of the applicant (e.g., a board

chair)

Note: The primary contact and the signatory must both sign the application. Signatures must be either signed electronically, or wet-signed, scanned and emailed.

Describe the technical and administrative skills your organization will use to effectively and efficiently complete your proposed project(s).

CFC brings an experienced technical and grant management team to these projects and a proven track record of performance on government funded projects during its 33 year history. CFC's Restore team is led by CFC's Stream Restoration Director Jed Whiteley. Jed has completed over $15 million dollars of restoration projects in Western Montana and the Idaho Panhandle. He is Rosgen Level III certified with 20+ years experience in heavy equipment stream restoration. Adam Switalski and Gretchen Watkins round out CFC's Bitterroot project management team with over 35 years of restoration experience between them. Geum Environmental is the design firm for this project with Amy Sacry, a principal in the company, as their lead on the project. Accounting for this grant will be handled by CFC's accounting manager Chloe Gibson.

Budget Form

Please fill out the On-the-Ground Project Budget Template (Excel file). Cells highlighted in yellow may be edited to fit the needs of your particular project. DEQ uses a template to construct nonpoint source grant contracts. The Budget Template contains tasks and typical deliverables that match up with the grant contract template. Please see the Example Contract and Scope of Work Template for a more detailed look at typical task requirements and deliverables.

Project Form

A separate Project Form (including providing separate attachments) must be submitted for each project included in your application. Use the following examples to help determine when to lump and when to split projects.

Splitting Examples (fill out multiple Project Forms)

- Stream restoration work occurring on two separate streams..
- Two projects with significantly different sets of project partners.
- Two projects that address substantially different pollution sources (e.g., one project move a corral off of a streambank, and another removes mine tailings, with both projects being on the same property).

Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels.
- Three projects that address similar sources of pollution on a single land parcel (e.g., moving a corral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)

Required Attachments

- [x] Letter of support from the author of the DEQ-accepted Watershed Restoration Plan or EPA-approved Tribal Nonpoint Source Management Plan.
- [x] Letter of support from EACH landowner, lessee, or land manager associated with the proposed project area.
- [x] Budget Table (see attached Microsoft Excel Template).
- [x] Project Form
- [x] **Detailed Project site map(s)** Attach a map or set of maps showing the location and size of proposed activity. The map scale must be between 1:1,000 and 1:12,500. The map(s) must have an aerial photo background (e.g., USDA NAIP photography, Google Earth imagery, etc.). The map(s) must show the latitude, longitude, site name, and landowner for the activity site. The map(s) should also identify waterbodies affected by the pollution that the activity is designed to address.

Optional Attachments

Attach additional items and information that could help reviewers better understand your project. Information could describe public health risks, opportunities to leverage other funding sources, etc. However, application reviewers may have limited time available, and excessively long, optional attachments might not get reviewed. Do not attach copies of TMDL documents, TMDL implementation evaluations, Watershed Restoration Plans, Tribal Nonpoint Source Plans, or large comprehensive studies. The following attachments may be included.

- [x] Project Design Plans/Drawings
- [ ] Preliminary Engineering Reports / Site Evaluations
- [ ] Landowner Agreements / Construction Permits / Floodplain Permits
- [x] Site photos
- [ ] Additional Letters of Support
- [ ] Other: _____
- [ ] Other: _____
- [ ] Other: _____

Project Name

Miller Creek 7 Mile Restoration

PROJECT AREA: Use the tools below to provide as detailed a description of the project area as possible.

List the counties in which the project will be located.

Missoula

List the 12-digit Hydrologic Unit Codes (HUCs), sometimes referred to as Sixth Code HUCs, in which the project will take place. If you need assistance in determining the HUCs, please contact DEQ.

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In addition to providing your own project site map, please go to the following website and follow the instructions to add your project location to the map.

https://gis.mtdeq.us/portal/apps/storymaps/stories/42f4a668285c4ef6aa94b1623f10df57

Connection to a Previous or Ongoing Project

Is this project tied to a previous or ongoing project? If so, please describe the connection.

Yes, this funding is to supplement funding allocated in 2022 for the project "Miller and O'Brien Creek Restoration and Sediment Reduction" (DEQ Contract No.: 223004). Specifically, this proposal is for supplemental funding for Task 5 - Miller Creek Restoration Planning and Implementation. While we received an additional $69,790 from Montana Fish Wildlife and Parks Future Fisheries Program in non-Federal match, we are still significantly below the anticipated cost for implementation. The engineers estimate from Geum Environmental Consulting was significantly higher than the Wustner Project primarily due to inflation. We had underestimated the cost when we applied for the previous funding package.

Additionally, this is a downstream continuation of the Miller Creek- Wustner 319 project that was completed in October 2021. This project continues the Wustner project an additional 1500 feet immediately downstream and is the fourth DEQ funded project on the creek to reduce sediment and water temperatures. Other completed projects include a mile of stream restoration on the mainstem of Miller Creek on the Spooner Creek Ranch in 2019 and the MPG Ranch project completed in the fall of 2022. CFC's ultimate goal for Miller Creek is to collaborate with the DEQ 319 program to restore the creek to a state that it is no longer listed as impaired.

Project Purpose

Select the watershed restoration plan or tribal nonpoint source plan that your project will help implement (please type in if missing from list).

Miller Creek - Missoula Valley Water Quality Protection District

Y — Letter of support from author entity attached? *(If no, explain why below.)*

IMPAIRMENT LISTINGS: Unless addressing healthy watersheds (see below), all projects must address probable causes of impairment on a waterbody identified in the 2020 List of Impaired Waters.

Waterbody name from the 2020 List of Impaired Waters	Miller Creek
Probable causes of impairment to be addressed	Sediment and Temperature
Waterbody name from the 2020 List of Impaired Waters	
Probable causes of impairment to be addressed	

HEALTHY WATERSHEDS: While the majority of the project funding is dedicated to addressing known impairments, a limited amount of funding can be used to protect non-impaired waters (healthy waters) from becoming impaired.

Name of healthy waterbody to be protected	
Description of identified threat to non-impairment status	
Name of healthy waterbody to be protected	
Description of identified threat to non-impairment status	

Project Partners

Identify each of the project partners and describe their contribution to the project. Include landowners, land managers, project designers, funders, and your own organization. Indicate whether each partner, other than your organization, has provided a letter of support. (*Note: each landowner must provide a letter of support.*)

Landowner	Contributions to Project	Letter of Support Attached?
Thomas and Donna Leik	Timber for brush matrix and LWD structures ($6,000)	☑
		☐
		☐
		☐

Project Partner	Contributions to Project	Letter of Support Attached?
Montana Fish Wildlife and Parks	Supportive of project, monitors the fishery, and assistance with designing and permitting the project.	☐
Missoula Valley Water Quality District	Supportive of project, monitors water quality on Miller Creek	☑
		☐
		☐
		☐

Project Coordination and Planning Task

This task would include completion of all applicable planning tasks from the list below, as well as coordination and oversight of the efforts of all project partners.

Identify the status of the following project planning tasks, where applicable.

	Completed?	Copy Attached?	To Be Completed Pre-Contract (Oct 2024)?	To Be Completed as Contract Deliverable?
***Draft Project Designs	☑	☐	☐	☐
***Final Project Designs	☑	☑	☐	☐
Consultation With Potential Regulators	☐	☐	☑	☐
Necessary Permits	☐	☐	☑	☐
Cultural Resources Inventory *(may be relevant)*	☐	☐	☐	☐
Other:	☐	☐	☐	☐
Other:	☐	☐	☐	☐
Other:	☐	☐	☐	☐

***See Call for Applications Section 5.1 for minimum design standards.*

Describe any additional project planning that *will have been completed prior* to execution of a contract (October 2024).

Describe any additional project planning and coordination that will need to be completed after the execution of a contract (October 2024).

Landowner Agreement Task

DEQ includes the following language in every nonpoint source contract involving on-the-ground activities:

Contractor shall submit signed landowner agreement(s) verifying that Contractor and DEQ staff may access the project site, at reasonable times and with prior notification, for the purposes of project planning, implementation, and post-implementation monitoring. The agreement(s) must ensure appropriate operation and maintenance of all structures, vegetation, and management measures for the life of the project (typically 10 years). If grazing will be allowed within the project area, the agreement(s) must include a sustainable management plan for livestock grazing, designed to protect and enhance riparian function. If a signed landowner agreement does not meet the above-stated minimum requirements, Contractor shall negotiate an amended agreement with the landowner that ensures appropriate operation and maintenance of all structures, vegetation, management measures, and includes a sustainable management plan for any livestock grazing for the life of the project (typically 10 years).

Identify the status of the following landowner agreement tasks, where applicable.

	Completed?	Copy Attached?	To Be Completed Pre-Contract (Aug 2024)?	To Be Completed as Contract Deliverable?
Draft Landowner Agreement(s)	☐	☐	☑	☐
Final Landowner Agreement(s)	☐	☐	☑	☐
Grazing Management Plan	☐	☐	☑	☐
Other:	☐	☐	☐	☐
Other:	☐	☐	☐	☐

Project Effectiveness Monitoring Task

If you will be conducting any on-the-ground implementation work, you will be required to complete the monitoring activities described in the task language below, as applicable. Describe below how you plan to determine the effectiveness of your project.

If you are applying for nonpoint source grant funding for project design only, and not for project implementation, you may either skip this task, or describe below which parts of this task you intend to complete:

This task is funded through our existing DEQ contract "Miller and O'Brien Creek Restoration and Sediment Reduction" (DEQ Contract No.: 223004). The following protocols will be used:

• Pre and post project construction photo point monitoring will occur on major restoration features. Monitoring will take place pre-project in the fall of 2024 and then 2 years later at similar time of year. 10-12 photo points will be taken and photo point monitoring methodologies will be consistent with the "Oregon Watershed Enhancement Board Guide to Photo Monitoring". Photo points will include exact coordinates and bearing recorded by the Solocator app.

• Pre-project BEHI data will be collected in September 2024. This information will be used to estimate a sediment load reduction.

• CFC will conduct plant mortality counts on installed woody riparian container stock in the late summer of 2025. CFC plans to oversee 2 seasons of site maintenance including weekly watering in July and August. If plant survival #'s are below 75% after the 2025 mortality count occurs CFC plans to replace at least 50% of the dead plants.

Example Task Language

Contractor shall, in consultation with the DEQ Project Manager, develop a reasonable method or set of methods for evaluating and reporting on the effectiveness of the project in addressing water quality issues. Contractor shall complete a monitoring plan to guide monitoring activities. Contractor shall complete the following monitoring activities:

- *Estimate the sediment load reductions (tons/year) achieved through implementation of the proposed restoration activities and management practices.*
- *Estimate the nitrogen load reductions (pounds/year) achieved through implementation of the proposed restoration activities and management practices.*
- *Estimate the phosphorus load reductions (pounds/year) achieved through implementation of the proposed restoration activities and management practices.*
- *For projects designed to address pollution from pollutants other than nitrogen, phosphorus and sediment, evaluate and report on the effectiveness of the project in addressing water quality issues.*
- *Contractor shall collect data, as directed by the DEQ Project Manager, to be used in estimating sediment, nitrogen, and phosphorus load reductions achieved through implementation of restoration activities and management practices designed to address these pollutants.*
- *Use the following measures to evaluate the sustainability of restoration activities and management practices:*
    - *[Vegetation mortality rate.]*
    - *Pre- and post-construction photo point monitoring consistent with the "Oregon Watershed Enhancement Board Guide to Photo Monitoring" methodologies, or a similar published photo point monitoring method accepted by DEQ. The U.S. Forest Service provides additional photo point monitoring guidance in the "United Stated Forest Service Photo Point Monitoring Handbook".*
    - *[Riparian survey.]*
    - *[Other.]*

Please describe any additional monitoring you intend to do as part of the project.

Project Implementation Task

Provide a detailed description of the solution you are proposing to implement to address a nonpoint source pollution problem. Describe the practices you intend to design and/or implement to solve the problem (what, where, when, how much or how many). Describe the anticipated maintenance needs (what, where, who, how long). Refer to the minimum design standards in the Call for Applications. ***Please fill out this section to the best of your ability, even if you are only seeking funding for project design.***

The Clark Fork Coalition and project partners are proposing a restoration project on Miller Creek that improves natural stream function, enhances fish habitat and addresses the creek's TMDLs for temperature and sediment. Miller Creek is located in Missoula County, and flows west for 18 miles from the Sapphire Mountains to its confluence with the Bitterroot River near the city of Missoula. The watershed encompasses 48 square miles and supports a variety of land uses, from silviculture and agriculture to residential subdivisions. This project builds upon previous and ongoing work in adjacent stream reaches. DEQ contributed funds to three similar projects on the mainstem Miller Creek in 2019 and 2020, one of which is directly upstream from the currently proposed project.

Miller Creek is listed as impaired for sediment and temperature. A Watershed Restoration Plan, written by the Missoula Valley Water Quality District, and a Habitat Assessment, written by the Clark Fork Coalition, were completed in 2018. Both found impacts from sediment throughout the watershed, primarily due to channel incisement. Flow and temperature monitoring in 2018 corroborated past findings of high water temperatures and de-watering in the lower to mid reaches. The high levels of sediment are affecting landowners' infrastructure by constricting road culverts, filling irrigation diversions, and adding to channel instability. Additionally, the high sediment load, high water temperatures and de-watering are negatively affecting the fishery, translating to lost angling opportunities on Miller Creek and the Bitterroot River. Miller Creek is a historically productive fishery, an important tributary for spawning genetically pure westslope cutthroat, and key for fish recruitment in the lower Bitterroot River.

The source of much of the sediment in Miller Creek is active bank erosion. Streambanks have been prone to erosion due to a number of historic impacts. When the Miller Creek road was constructed the channel was moved and straightened increasing the rate of high flows, much of the riparian vegetation that protected the banks was removed or grazed in the past and replaced with introduced pasture grasses, and beaver activity that slowed streamflow and trapped sediment has been dramatically reduced. Together these impacts have caused the creek to be entrenched, prone to erosion, and more simplified aquatic habitat.

For this proposal, the Clark Fork Coalition would directly address one of the most impactful reaches on Miller Creek on approximately 1500 feet of Thomas and Donna Leik's property, immediately downstream of the 2021 Wustner project. This reach has vertically eroding banks of up to 6 feet chronically delivering large amounts of sediment into the stream. Additionally, there is a loss of connectivity between the channel and floodplain, reduced habitat diversity, and reduced riparian vegetation and cover - all of which contribute to this being one of the most impactful reaches of Miller Creek. The landowners board and own several horses, and while they are committed to limiting livestock access to the creek, their water gap is currently another source of sediment.

In order to address these legacy impacts, sedimentation issues, and increase habitat on this section of creek, the Clark Fork Coalition would employ a variety of restoration techniques that act as a continuation of the upstream project. Treatments such as floodplain grading, woody debris matrix, riparian shrub plantings with exclosure fences, a hardened crossing for horses, and other treatments to re-connect the creek to its floodplain, slow and disperse high flows, and increase riparian habitat will be used.

Through the lessons learned on the 3 similar upstream projects, CFC has zeroed in on what treatments are most effective for treating each restoration issue on Miller Creek. For example, we will go lower on our floodplain treatments to ensure that they will be activated during high flow. Additionally, we will deepen pools to ensure that they are maintained over time. Another important lesson is to water the riparian vegetation for 2 years during July and August. We will also treat noxious weeds before and after treatment through a combination of herbicides and hand pulling. Finally, we change our willow source populations because the Bitterroot source has significantly less success than the willow source in the Upper Lolo.

Education, Outreach and Training Task

To get good projects on the ground, trained staff and board members and educated, enthusiastic landowners are required. To promote the development of future projects, DEQ encourages project sponsors to use up to $5,000 of funding to support training and conduct education and outreach. Example training topics might include: project management, public procurement, technical writing, GIS, water quality monitoring, web design, public speaking, human resource management, photo journalism, UAV (drone) piloting, financial management, and restoration techniques. Education and outreach activities might include targeted landowner outreach, conducting project site tours for local landowners, tabling at community events, holding a watershed festival, providing stipends and travel reimbursements for speakers and participants to attend a nonpoint source pollution prevention workshop, or generating articles for social media. The primary requirement for training and outreach is clearly explaining how the activity will support efforts to address nonpoint source pollution. Funding may not be used to pay for food and beverages, or for honorariums and gifts.

Describe the education and outreach activities you will complete to promote or facilitate future efforts to reduce nonpoint source pollution.

This task is funded through our existing DEQ contract "Miller and O'Brien Creek Restoration and Sediment Reduction" (DEQ Contract No.: 223004). The Clark Fork Coalition will implement this component of the project whether or not this proposal is funded. Tasks include:

Contractor shall conduct the following education and outreach activities in the Miller Creek drainages:
-Identify target audiences for future projects
-Outreach to target landowners via phone calls, emails, or mailers
-Conduct at least one project tour
-Publish a press release and provide associated news articles about the Miller Creek projects

Identify the specific target audience.

Miller Creek landowners with creek front property that needs restoration

Describe how the proposed training and/or outreach will increase local capacity and interest for addressing nonpoint source pollution.

Identify the goals of the education and outreach and describe how you will evaluate the effectiveness of the proposed activities.

Project Administration Task

Please use the task description below as a guide when calculating your budget for project administration. DEQ typically includes these requirements in every nonpoint source grant contract, with only minor variation. Funding applied to Project Administration must not exceed 10% of the total amount of funding requested, or $12,000, whichever is lower.

Example Task Language

Contractor shall oversee and be accountable for the completion of all tasks. Contractor shall maintain regular contact with the DEQ project manager. Contractor shall prepare and submit Mid-Year, Interim, Annual, and Final Reports and Attachment B Billing Statements according to the format and schedule described below.

Report Format

- *Contractor shall submit each Attachment B Billing Statement, Mid-Year Report, Interim Report, Annual Report, and Final Report using the most current reporting guidance and templates provided by the DEQ project manager.*
- *Contractor shall ensure each Mid-Year, Interim, Annual, and Final Report contains adequate documentation to justify accompanying reimbursement requests and match reporting, to the satisfaction of the DEQ project manager.*
- *Contractor shall ensure that the Final Report is a standalone document describing all contract activities and containing copies of all contract deliverables (even if the deliverables were previously submitted).*

Reporting Schedule

- *Mid-Year Reports: Due June 1st of each year the Contract is in effect.*
- *Annual Reports: Due December 1st of each year the Contract is in effect.*
- *Interim Reports: Due whenever reimbursement is requested outside of the normal Mid-Year, Annual and Final reporting periods while the Contract is in effect.*
- *Draft Final Report: Contractor shall submit a complete draft Final Report for DEQ review and comment at least 15 days prior to the contract expiration date.*
- *Final Report: Contractor shall submit a Final Report, addressing DEQ comments on the draft Final Report, on or before the Contract expiration date.*
- *Attachment B Billing Statements: Contractor shall submit an Attachment B Billing Statement with each Mid-Year, Interim, Annual, or Final Report submitted to DEQ while the Contract is in effect. To maintain cash flow, Contractor may submit interim Attachment B Billing Statements as frequently as monthly during the term of the Contract. However, each interim Attachment B Billing Statement must be accompanied by an Interim Report.*
- *Exception to the Reporting Schedule: The Final Report and associated Attachment B Billing Statement will replace the last required Mid-Year or Annual Report.*

Project Timeline

	4Q 2024	1Q 2025	2Q 2025	3Q 2025	4Q 2025	1Q 2026	2Q 2026	3Q 2026	4Q 2026	1Q 2027	2Q 2027	3Q 2027
Project Coordination and Planning Task	✔											
Landowner Agreement Task	✔											
Project Effectiveness Monitoring Task				✔	✔							
Project Implementation Task	✔											
Education, Outreach and Training Task	✔	✔	✔	✔	✔							
Project Administration Task	✔	✔	✔	✔	✔							

Environmental Justice

Environmental justice can be defined as: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys:

- The same degree of protection from environmental and health hazards, and
- Equal access to the decision-making process to have a healthy environment in which to live, learn, and work

DEQ is committed to carrying out the nonpoint source pollution reduction projects in an environmentally just manner. We encourage applicants to apply the principles of environmental justice in their development and implementation of nonpoint source pollution prevention projects. Below are a few examples of how applicants might apply these principles. DEQ will award additional points in the scoring form for projects that address environmental justice.

- Project planning included consultation with Tribal Nations
- Project will benefit socially or economically disadvantaged communities
- Project will occur in a community that has not previously received nonpoint source pollution reduction grant funding
- Project will address nonpoint source pollution in a community that has been disproportionately burdened by impacts from legacy pollution (e.g., SuperFund sites, legacy mine waste, etc)

Please use this section to highlight connections your project may have to addressing environmental justice. .

Does not fit criteria

BUDGET

2024 Nonpoint Source Pollution Reduction Application - On-the-Ground Project Budget Template

Project Title:	Miller Creek 7 Mile Restoration							
Instructions	**Tasks and Potential Deliverables**	**319 Funding Request***	**Non-Federal Match****	**Other Funding*****	**Match Source**	**Match Secured? (Y/N)**	**Total Project Cost**	**Additional Information********
This task includes completion of all planning tasks and coordination and oversight of the efforts of all project partners. Provide a detailed budget and add a row if needed.	**Project Planning**							
	Preliminary site investigation data and site maps						$ -	
	Required Permits						$ -	
	Draft Project Designs						$ -	
	Final Project Designs						$ -	
							$ -	
							$ -	
	Total	$ -	$ -	$ -			$ -	
This task includes costs for developing and managing landowner agreements and developing grazing management plans as applicable. Provide a detailed budget and add a row if needed.	**Landowner Agreements**							
	Draft Landowner Agreement						$ -	
	Final Landowner Agreement						$ -	
	Grazing Management Plan						$ -	
							$ -	
							$ -	
	Total	$ -	$ -	$ -			$ -	
This task includes costs for developing and implementing a monitoring plan to evaluate effectiveness to reduce nonpoint source pollution. See example contract template or application instructions for required monitoring activities. Provide a detailed budget and add a row if needed.	**?**							
	Draft Monitoring Plan						$ -	
	Final Monitoring Plan						$ -	
	Written Summary of all Monitoring Activities						$ -	
							$ -	
							$ -	
							$ -	
	Total	$ -	$ -	$ -			$ -	
This tasks includes all costs for implementation of the plans developed in the Project Planning task. If you are requesting funding for design only, leave this task blank. Provide a detailed budget and add a row if needed.	**Project Implementation**							
	Materials	$ 12,758.00	$ 7,000.00		Future Fisheries	Y	$ 19,758.00	
	Labor						$ -	
	Equipment costs	$ 33,917.00	$ 17,290.00		Future Fisheries	Y	$ 51,207.00	
	Construction oversight						$ -	
	As-built surveys						$ -	
	Photo documentation						$ -	
	Landowner recommendation letter						$ -	
							$ -	
							$ -	
							$ -	
	Total	$ 46,675.00	$ 24,290.00	$ -			$ 70,965.00	
This task includes costs to develop and improve organizational capacity and to incorporate education and outreach into on-the ground projects. Provide a detailed budget and add a row if needed.	**Education and Outreach**							
	Volunteer Coordination						$ -	
	Event/Tour Planning						$ -	
	Outreach/Publication materials						$ -	
							$ -	
							$ -	
	Total	$ -	$ -	$ -			$ -	
319 Funding applied to Project Administration must not exceed 10% of the total amount of 319 funding requested, or $12,000, whichever is lower. Project includes normal business expenses and reporting requirements.	**Administration**							
	Mid/Annual/Interim Reports and Billing Statements						$ -	
	Draft/Final Report and Billing Statements						$ -	
	Communication with DEQ						$ -	
							$ -	
							$ -	
	Total	$ -	$ -	$ -			$ -	
		319 Funding Request*	**Non-Federal Match****	**Other Funding*****			**Total Project Cost**	
	Grand Totals	$ 46,675.00	$ 24,290.00	$ -			**$ 70,965.00**	

*319 Request - Must not exceed $300,000

**Non-Federal Match - Can include in-kind materials.

***Other Funding -Use this space for funding that will be used to support creation of task deliverables, but will not be reported as match.

****Additional Information - Use to justify cost if needed. (Hourly rates, rental costs, etc.)

MAPS/ DESIGNS

Mile 7 Miller Creek Proposed Restoration Project

Landowner: Thomas and Donna Leik
Polluted Waterbody: Miller Creek

GRAHAM RODNEY E

LEIK THOMAS H & DONNA A

WUSTNER JACOB C

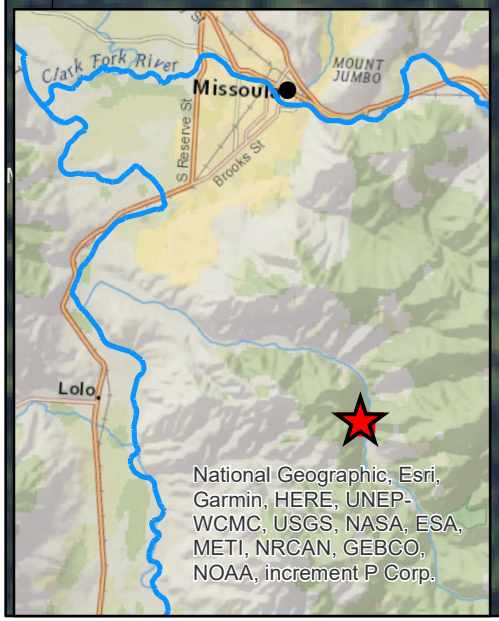
Bottom of reach
Lat/Long: 46.777425, -113.961966

Miller Creek

Top of reach
Lat/Long: 46.776455, -113.956950

LEIK THOMAS H & DONNA A

WUSTNER JACOB C



N

0 400 Feet

CLARK FORK COALITION

MILLER CREEK LEIK PARCEL RESTORATION PROJECT

Missouri County, Montana

PREPARED FOR:

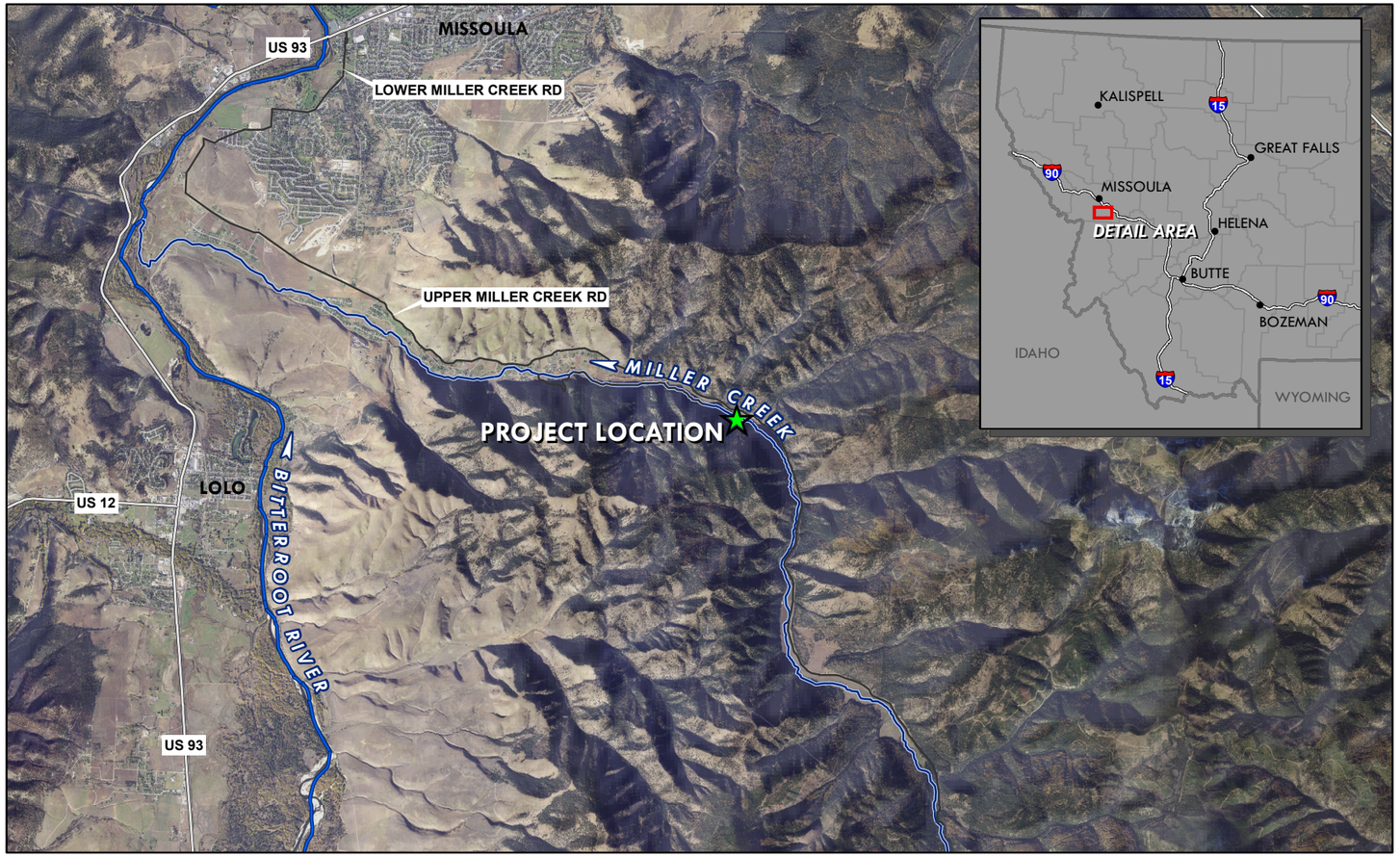
CLARK FORK COALITION

Clark Fork Coalition
140 South 4th West, Suite 1
Missoula, MT 59801
(406) 542-0539

PREPARED BY:

Geum Environmental Consulting

Geum Environmental Consulting, Inc.
307 State Street
Hamilton, Montana 59840
(406) 363-2353



SHEET INDEX

PROJECT DESCRIPTION

Miller Creek is listed for temperature and sediment impairments on the 2016 Clean Water Act 303(d) list. A water body is determined to be impaired if it does not meet all of its potential beneficial uses, such as recreation, fishery, agriculture, etc. Miller Creek is located in Missoula County, Montana. The Clark Fork Coalition, along with other partners are pursuing opportunities to reduce temperature and sediment impairments and improve aquatic habitat within the watershed. The project site is located on private land approximately 6.5 miles upstream from the confluence with the Bitterroot River.

DIRECTIONS TO SITE

From Missoula, Montana: Take Brooks Street/US Highway 93 South to the intersection with Lower Miller Creek Road. Turn east onto Lower Miller Creek Road and travel ~5.5 miles. Continue on Miller Creek Road/Upper Miller Creek Road, and travel 4.5 miles to the project site located on the right.

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DATUM: North American Datum 1983

PROJECTION: Montana State Plane

UNIT: INTL Foot

DATA SOURCES:
USDA NAIP Imagery, 2017
ESRI Terrain Basemap
NHD Streams
MSL Roads, Towns, Borders

COVER SHEET

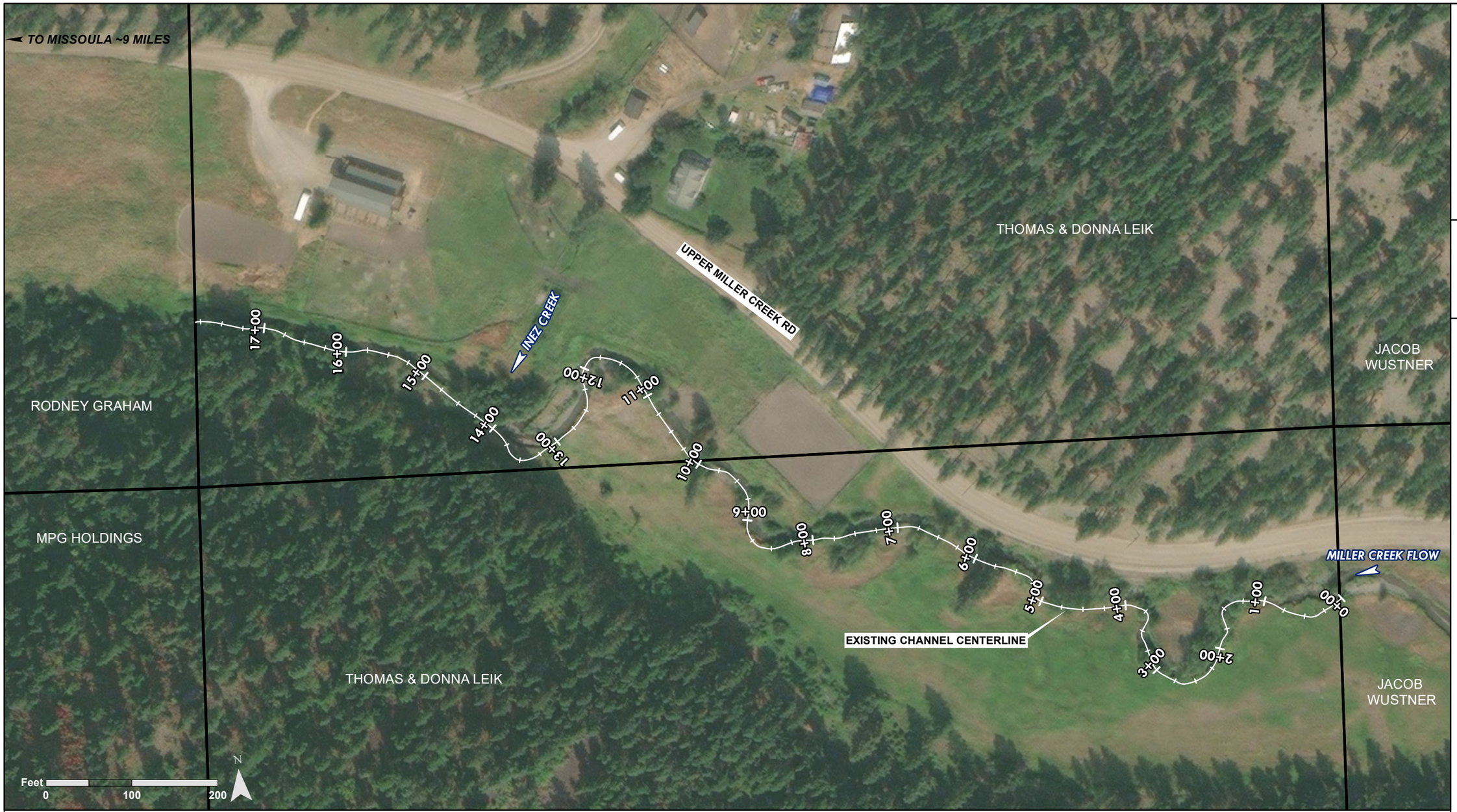
MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

DESIGNED BY: Geum

DATE: February 2024

SHEET
1.0



Miller Creek is located in Missoula County, Montana. It flows west for 18 miles from the Sapphire Mountains to its confluence with the Bitterroot River near Missoula, Montana. The watershed is 47.9 square miles in size and supports a variety of land uses such as silviculture, agriculture, road construction, and residential subdivisions. These land uses have reduced riparian vegetation cover and straightened the channel which has led to channel incision and reduced floodplain connectivity, increased active erosion, reduced aquatic habitat diversity, increased stream temperatures, dewatering and reduced the number of beaver active in the watershed.

The project site includes 1,775 feet of Miller Creek. Elevation ranges from 3,759 feet at the upstream end to 3,738 feet at the downstream end. The project site is characterized by disturbed conditions from road construction, channel straightening, removal of riparian vegetation, and decreased beaver activity. Inez Creek enters Miller Creek in this reach. This reach is bounded by the road and terraced pasture in the upstream end and a steep hillside and developed pasture in the downstream end. Habitat is simplified due to the straightened planform and entrenchment, but some pools are present. There are several actively eroding streambanks contributing sediment to the channel. Woody riparian vegetation is present along some of the channel and in some depositional areas, but streambanks and the riparian area consist primarily of introduced pasture grasses.

UPPER MILLER CREEK STREAM CHARACTERISTICS

DRAINAGE AREA (*Upstream of site*)	34.2 sq. miles
MEAN ANNUAL PRECIPITATION	29 inches
FOREST COVER	80% Forested
BASEFLOW DISCHARGE	5-7 cfs
EST. BANKFULL DISCHARGE	70-80 cfs
EST. 10-YEAR DISCHARGE	360 cfs
EST. 100-YEAR DISCHARGE	632 cfs
VALLEY GRADIENT	0.016 ft/ft (1.6%)
CHANNEL GRADIENT	0.012 ft/ft (1.2%)
STREAMBED D50	1.8-inch gravel
STREAMBED D84	3-inch small cobble
EXISTING STREAM TYPE	G4 (upstream) and C4 (downstream)

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DATA SOURCES:
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Missoula County Cadastral, 2020

EXISTING CONDITION

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

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RESTORATION GOALS

- INCREASE RIPARIAN WOODY VEGETATION COVER
- REDUCE FINE SEDIMENT INPUTS
- INCREASE AQUATIC HABITAT DIVERSITY
- INCREASE FLOODPLAIN CONNECTIVITY AND FUNCTION

INEZ CREEK REALIGNMENT

DESIGN CHANNEL CENTERLINE

FLOW

16+00 15+00 14+00 13+00 12+00 11+00 10+00 9+00 8+00 7+00 6+00 5+00 4+00 3+00 2+00 1+00 0+00

Feet
0 100 200

N

DESIGN RESTORATION TREATMENTS

- CHANNEL REALIGNMENT
- HIGH FLOW CHANNEL
- INEZ CREEK REALIGNMENT
- ALCOVE
- FLOODPLAIN GRADING & ENHANCEMENT
- EXISTING CHANNEL FILL TO CREATE FLOODPLAIN
- HARDENED CROSSING
- FLOODPLAIN TREATMENT
- WOODY DEBRIS MATRIX
- HIGH FLOW CHANNEL WOODY DEBRIS MATRIX
- WILLOW BRUSH TRENCH
- LARGE WOOD STRUCTURE
- STEP POOL STRUCTURE
- PARCEL BOUNDARY

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PROJECTION: Montana State Plane

UNIT: INTL Foot

DATA SOURCES:
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Missoula County Cadastral, 2020

RESTORATION TREATMENT OVERVIEW

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

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DATUM: North American Datum 1983

PROJECT: Montana State Plane

UNIT: INTL Foot

DATA SOURCES:
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ESRI Basemap Imagery, 2018
Missoula County Cadastral, 2020

SITE PLAN

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

DESIGNED BY: Geum

DATE: February 2024

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GENERAL SPECIFICATIONS

1. The project will be constructed according to the plan set. The contractor will notify the project manager of any changes prior to implementation.

2. It is the contractors' responsibility to identify all underground utilities prior to construction.

3. Elevations in the plan set are based on survey work performed by Geum and Coldwater in 2023. Survey control points have been established for the work. Earthwork quantities reported on the drawings are approximate. The project manager will provide staking and layout to guide work.

4. All existing conditions are to be verified in the field prior to construction and any adjustments to the drawings will be made as directed by the project manager.

5. Drawings are not intended to provide means or methods of construction.

6. Excavation will meet the requirements of OSHA 29 CFR Part 1926, Subpart P, Excavations.

7. Copies of all project permits will be provided to the contractor. The contractor will comply with the provisions of the permits. The contractor will notify the project manager of any known changes or activities that could violate permit requirements prior to implementation. The project manager will be responsible for all correspondence with permitting agencies.

DEWATERING PLAN and EROSION CONTROLS

1. Work will occur during seasonal low flows between August and December. Mean daily flow conditions during construction are expected to be between 5 and 10 cfs.

2. The following is the anticipated erosion control and water management strategy for the work:

   a. Streambanks:

      i. Install sediment control measures at the downstream of each work site.

      ii. Minimize disturbance of the channel bed at each site.

   b. Channel Realignments:

      i. Complete segments of channel that can be constructed in the dry first.

      ii. Where the new channel intersects the existing channel, working in flowing conditions will be required. Where feasible, coffer dams should be constructed to isolate channel excavation areas.

      iii. Install temporary erosion control measures at the downstream end of each channel realignment segment.

      iv. Observe all abandoned channel segments for stranded fish and relocate fish to flowing channels.

3. Contractor may propose an alternate dewatering plan and must submit the plan in writing prior to start of work.

4. Efforts should be made to limit turbidity during in water work.

5. Efforts should be made to limit disturbance to vegetation.

6. Efforts should be made to avoid fatalities of aquatic life.

CONSTRUCTION SPECIFICATIONS

1. Construction will occur as specified in the plan set, general specifications, materials specifications, dewatering and erosion control procedures, and construction specifications.

2. Access routes will be determined by the project manager and landowner. Construction equipment will not cross private land unless permission is obtained from the landowner. The contractor will leave all gates, whether open or closed, as found.

3. Stream crossings will occur in designated locations only.

4. Disturbance to riparian vegetation, wetland areas, channel banks, and existing infrastructure outside of work limits will be minimized. Any desirable vegetation within construction limits will be salvaged and transplanted into streambank treatments or floodplains as directed by the project manager.

5. Storm water will be routed away from active construction areas as needed into natural depressions in existing topography or constructed ditches as required. Practices will be monitored for effectiveness to determine if additional control measures are warranted. Additional control measures may include use of straw bales (certified weed-free only), coir wattles, or other BMPs effective at minimizing surface erosion and delivery of sediment to water bodies. Where wetlands are adjacent to the project boundary, silt fence may be required so there is no direct sediment delivery to the wetland. Temporary erosion controls will be in place before any significant alteration of the site occurs

6. The contractor will furnish all equipment necessary to construct the project. The contractor will mobilize all equipment to the project area as directed by the project manager. All vehicle staging, fueling, storage, and washout areas will be located at least 150 feet away from aquatic areas and adequately buffered such that runoff is incapable of being delivered to surface water or wetlands.

7. All equipment will be washed prior to mobilization to the site to minimize the introduction of foreign materials and fluids to the project site. All equipment will be free of oil, hydraulic fluid, and diesel fuel leaks. To prevent invasion of noxious weeds or the spread of aquatic invasive species, all equipment will be power washed or cleaned to remove mud and soil prior to mobilization into the project area. It will be the contractor's responsibility to ensure that adequate measures have been taken.

8. Equipment will be in a well-maintained condition to minimize the likelihood of a fluid leak. If a fluid leak does occur, the project manager will be notified immediately, and all work ceased until the leak has been rectified. All power equipment will be cleaned and leaks repaired at least 150 feet from any natural waterbody or wetland. At all times during construction, fluid spill containment equipment (e.g. oil-absorbing floating boom and absorbent pads) will be present on-site and ready for deployment should an accidental spill occur. The contractor will remove soil from the project site if the soil is tainted with petroleum-based fluids.

MATERIALS SPECIFICATIONS

1. The contractor will furnish all materials necessary to construct the project unless otherwise specified in the plan set. The contractor will deliver all materials to designated stockpile or staging locations labeled on the plan set or otherwise determined by the project manager.

2. Material quantities, dimensions and sizes will conform to the notes and specifications provided on the plan set or on the materials list. Whole trees with rootwads intact will be harvested on site. Contractor is responsible for cutting trees to dimensions required to complete work.

3. The project manager will inspect and approve all materials prior to construction. If materials do not meet the minimum requirements specified in the plan set or material list, the project manager reserves the right to reject the materials.

4. Excess material will be hauled to the general location shown on Sheet 4.0. Top soil will be stockpiled separately from gravel and alluvium. Material will be spread into the existing ditch and adjacent slope as directed by the project manager.

5. Overexcavation may be required if unsuitable soils (i.e. excessive organic matter, sand, etc.) are encountered in channel realignment or streambank treatment locations.

6. Willow cuttings will be provided by CFC and will be available starting Oct. 15.

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CONSTRUCTION NOTES and SPECIFICATIONS

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum
DESIGNED BY: Geum
DATE: February 2024

SHEET
5.0

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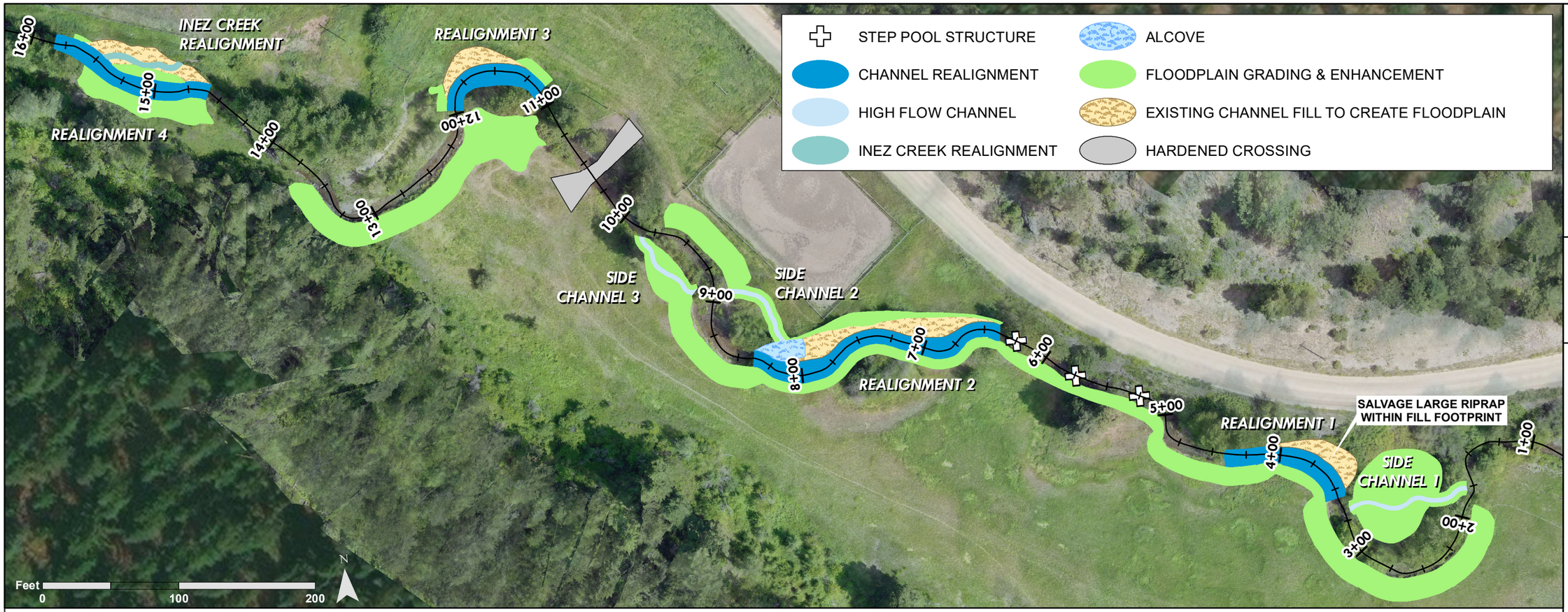
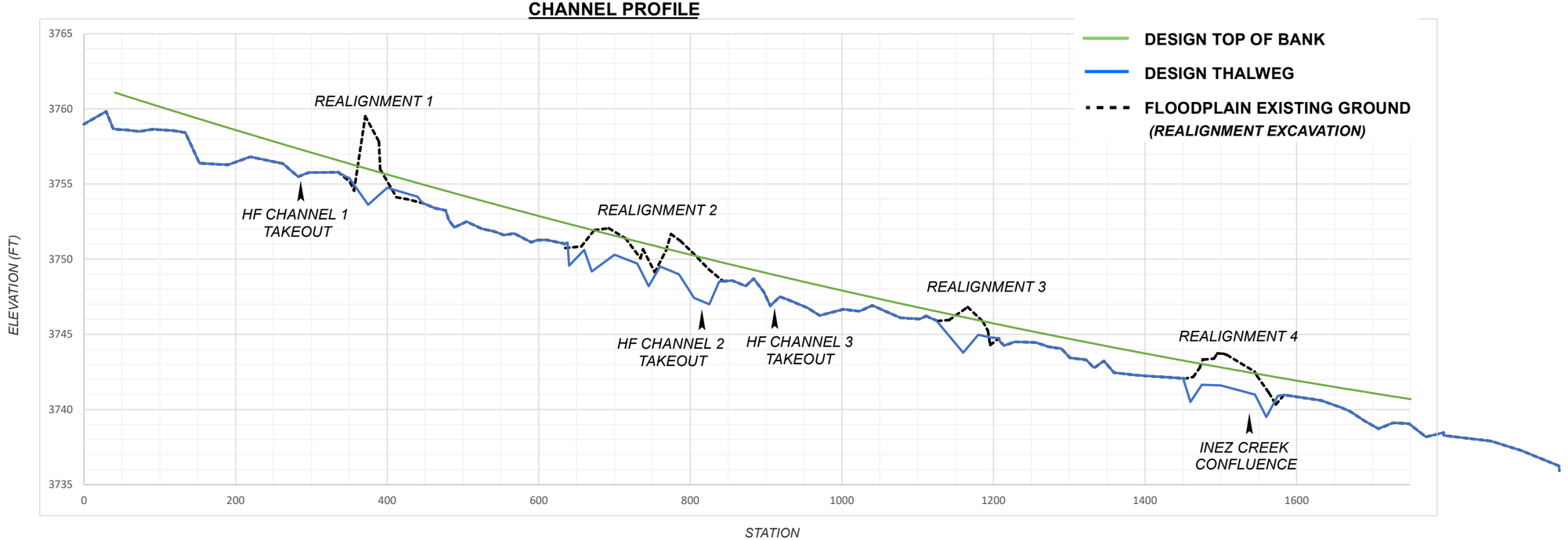


CHANNEL PROFILE



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DATUM: North American Datum 1983

PROJECTION: Montana State Plane

UNIT: INTL Foot

DATA SOURCES:
Geum UAS Imagery, 07/23

CHANNEL PLAN VIEW and PROFILE

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

DESIGNED BY: Geum

DATE: February 2024

SHEET
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CHANNEL REALIGNMENT 1

STATION START	TOB ELEVATION	THALWEG ELEVATION	FEATURE
345	3756.6	3755.5	TIE IN RIFFLE
350	3756.6	3755.4	POOL
375	3756.2	3753.6	POOL MAX
400	3755.9	3754.8	RIFFLE
440	3755.3	3754.2	TIE IN RIFFLE

CHANNEL REALIGNMENT 2

STATION START	TOB ELEVATION	THALWEG ELEVATION	FEATURE
638	3752.2	3751.1	TIE IN RIFFLE
640	3752.2	3749.6	POOL MAX
660	3751.9	3750.6	RUN
670	3751.8	3749.2	POOL MAX
700	3751.4	3750.3	RIFFLE
730	3751.0	3749.7	POOL
745	3750.8	3748.2	POOL MAX
760	3750.6	3749.5	RIFFLE
785	3750.3	3749.0	POOL
805	3750.0	3747.4	POOL MAX
825	3749.8	N/A	ALCOVE
838	3749.6	3748.5	TIE IN RIFFLE

CHANNEL REALIGNMENT 3

STATION START	TOB ELEVATION	THALWEG ELEVATION	FEATURE
1112	3747.3	3746.2	TIE IN RIFFLE
1125	3747.2	3745.9	POOL
1160	3746.4	3743.8	POOL MAX
1180	3746.1	3745.0	RIFFLE
1195	3745.9	3744.8	TIE IN RIFFLE

CHANNEL REALIGNMENT 4

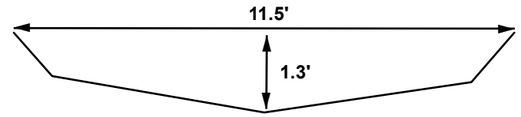
STATION START	TOB ELEVATION	THALWEG ELEVATION	FEATURE
1450	3743.2	3742.1	TIE IN RIFFLE
1460	3743.1	3740.5	POOL MAX
1475	3743.0	3741.7	RUN
1500	3742.7	3741.6	RIFFLE
1545	3742.3	3741.0	POOL
1560	3742.1	3739.5	POOL MAX
1575	3742.0	3740.9	TIE IN RIFFLE

HIGH FLOW AND INEZ CREEK CHANNEL DATA

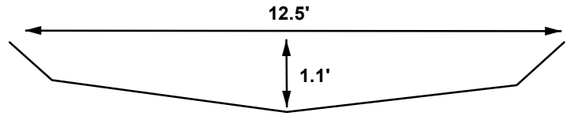
FEATURE NAME	MAIN CHANNEL STATION	UPSTREAM TAKEOUT ELEVATION	DOWNSTREAM TIE-IN ELEVATION
HIGH FLOW CHANNEL 1	1+75	3758.5	3756.2
HIGH FLOW CHANNEL 2	8+00	3749	3748.3
HIGH FLOW CHANNEL 3	9+00	3748.8	3747.3
INEZ CREEK REALIGNMENT	15+50	3742.1	3741.3

CHANNEL DESIGN TEMPLATES

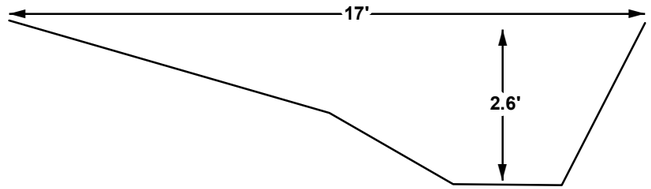
TYPICAL RUN CROSS SECTION



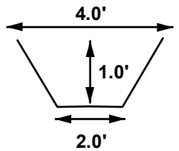
TYPICAL RIFFLE CROSS SECTION



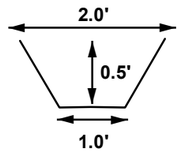
TYPICAL POOL CROSS SECTION



TYPICAL HIGH FLOW CHANNEL CROSS SECTION



INEZ CREEK REALIGNMENT CHANNEL



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CHANNEL TEMPLATES

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum
DESIGNED BY: Geum
DATE: February 2024

SHEET
6.1

MAIN CHANNEL STRUCTURE SCHEDULE

STATION START	STATION END	BANK	TOB ELEVATION START	TOB ELEVATION END	STRUCTURE
1+90	3+40	L	3758.8	3756.8	WDM1
2+50		L			LWS
3+00		L			LWS
3+40	4+20	L	3756.8	3755.9	WBT1
3+45	4+40	ENTIRE CHANNEL	3756.6	3755.3	REALIGNMENT 1
3+50	4+10	R	3756.9	3756.0	WDM1.5
3+90		R			LWS
4+20	4+85	L	3755.9	3754.5	WDM2
4+75		L			LWS
5+25		ACROSS			STEP POOL
5+75		ACROSS			STEP POOL
6+25		ACROSS			STEP POOL
6+35	6+60	L	3752.3	3752.1	WBT2
6+38	8+38	ENTIRE CHANNEL	3752.2	3749.6	REALIGNMENT 2
6+40	6+65	R	3752.3	3752.1	WDM3
6+50		R			LWS
6+60	7+20	L	3752.1	3751.7	WDM4
6+65	7+15	R	3752.1	3751.9	WBT3
6+80		L			LWS
7+15	7+70	R	3751.9	3750.8	WDM5
7+20	7+65	L	3751.7	3750.9	WBT4
7+50		R			LWS
7+65	8+35	L	3750.9	3750.2	WDM6
7+70	8+15	R	3750.8	3750.6	WBT5
8+00		L			LWS
8+40	9+00	L	3750.2	3749.1	WDM7
8+80		L			LWS
9+10	9+70	R	3749.1	3748.2	WDM8
11+10	11+95	R	3747.0	3746.4	WDM9
11+12	11+95	ENTIRE CHANNEL	3747.3	3745.9	REALIGNMENT 3
11+65		R			LWS
12+05	13+55	L	3746.4	3744.0	WDM10
13+10					LWS
13+35					LWS
14+50	15+75	ENTIRE CHANNEL	3743.2	3742.0	REALIGNMENT 4
14+60	14+80	L	3743.2	3743.2	WBT6
14+60	14+90	R	3743.2	3743.0	WDM11
14+70		R			LWS
14+80	15+35	L	3743.2	3742.5	WDM12
15+30	15+75	R	3742.6	3742.5	WDM13
15+35	15+50	L	3742.5	3742.4	WBT7
15+70		R			LWS

HIGH FLOW CHANNEL STRUCTURE SCHEDULE

	STATION START	STATION END	BANK	TOB ELEVATION START	TOB ELEVATION END	STRUCTURE
HF CHANNEL 1	0+00	0+90	R	3758.8	3756.9	HFCWDM1
HF CHANNEL 1	0+00	0+90	L	3758.8	3757.0	HFCWDM2
HF CHANNEL 1	0+30		ACROSS			WBT
HF CHANNEL 1	0+45		ACROSS			WBT
HF CHANNEL 1	0+60		ACROSS			WBT
HF CHANNEL 1	0+85		ACROSS			WBT
HF CHANNEL 2	0+00	0+60	L	3750.5	3749.1	HFCWDM3
HF CHANNEL 2	0+00	0+65	R	3750.6	3749.1	HFCWDM4
HF CHANNEL 2	0+10		ACROSS			WBT
HF CHANNEL 2	0+20		ACROSS			WBT
HF CHANNEL 2	0+30		ACROSS			WBT
HF CHANNEL 2	0+45		ACROSS			WBT
HF CHANNEL 2	0+60		ACROSS			WBT
HF CHANNEL 3	0+00	0+65	L	3749.1	3748.1	HFCWDM5
HF CHANNEL 3	0+00	0+60	R	3748.9	3748.1	HFCWDM6
HF CHANNEL 3	0+05		ACROSS			WBT
HF CHANNEL 3	0+15		ACROSS			WBT
HF CHANNEL 3	0+25		ACROSS			WBT
HF CHANNEL 3	0+35		ACROSS			WBT
HF CHANNEL 3	0+45		ACROSS			WBT
INEZ CREEK REALIGN	0+00	0+60	L	3743.1	3742.5	HFCWDM7
INEZ CREEK REALIGN	0+00	0+60	R	3743.0	3742.5	HFCWDM8

STRUCTURE TYPE LEGEND

WDM: WOODY DEBRIS MATRIX STREAMBANK TREATMENT

LWS: LARGE WOODY DEBRIS STRUCTURE

WBT: WILLOW BRUSH TRENCH

HFCWDM: HIGH FLOW CHANNEL WOODY DEBRIS MATRIX STREAMBANK TREATMENT

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STRUCTURE SCHEDULE

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum
DESIGNED BY: Geum
DATE: February 2024

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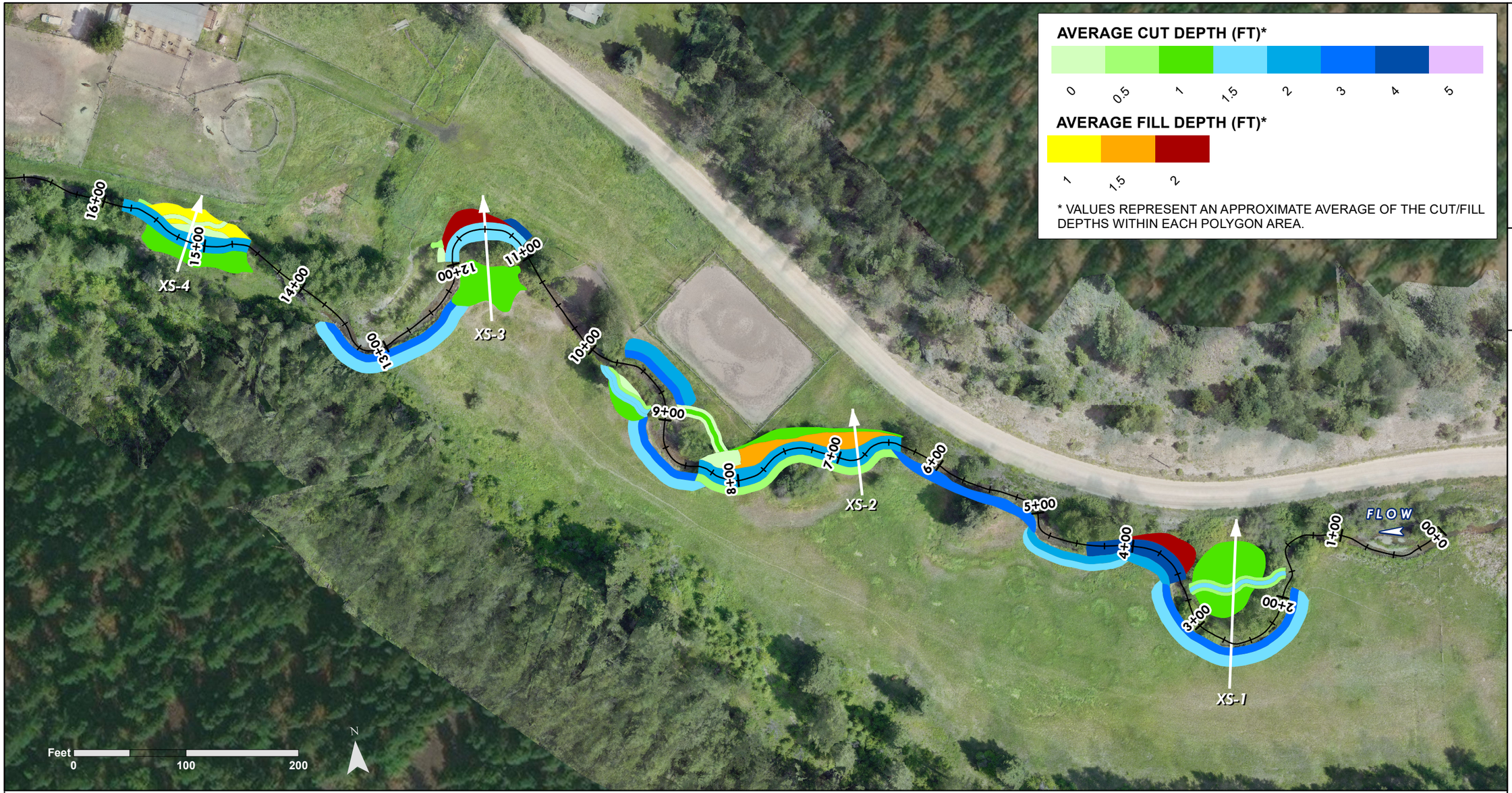

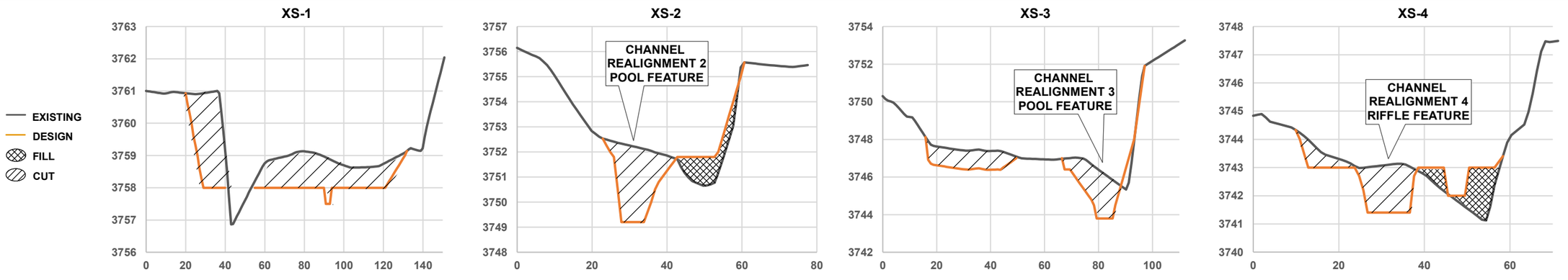

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DATUM: North American Datum 1983

PROJECTION: Montana State Plane

UNIT: INTL Foot

DATA SOURCES:
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Missoula County Cadastral, 2020

FLOODPLAIN GRADING PLAN

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

DESIGNED BY: Geum

DATE: February 2024

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TREATMENT TYPE	UNITS	ESTIMATED QUANTITY
CHANNEL REALIGNMENT	LINEAR FEET	463
WOODY DEBRIS MATRIX STREAMBANK TREATMENT	LINEAR FEET	1,081
LARGE WOODY DEBRIS STRUCTURE	EACH	14
FLOODPLAIN ROUGHNESS	ACRES	0.3
HIGH FLOW CHANNEL	LINEAR FEET	304
HIGH FLOW CHANNEL BRUSH MATRIX STREAMBANK TREATMENT	LINEAR FEET	553
WILLOW BRUSH TRENCH	LINEAR FEET	692
STEP POOL STRUCTURE	EACH	3

EXCAVATION	UNITS	ESTIMATED QUANTITY
ESTIMATED EXCAVATION	CUBIC YARD	2,300
ESTIMATED FILL	CUBIC YARD	250
ESTIMATED VOLUME OF EXCAVATED MATERIAL TO BE HAULED TO EXCESS MATERIAL DISPOSAL SITE	CUBIC YARD	2,050

MATERIALS	UNITS	ESTIMATED QUANTITY
WOOD*		
LOGS W/ ROOTWADS (12" D x 10-15' L)	EACH	56
LOGS W/OUT ROOTWADS (6-12" D x 10-15' L)	EACH	70
LARGE LOG W/ ROOTWAD (12" D x 25' L)	EACH	3
MEDIUM LOG W/ OPTIONAL ROOTWAD (12" D x 20' L)	EACH	6
BACKER LOG W/OUT ROOTWAD (12" D x 20' L)	EACH	3
BRUSH AND SMALL WOOD (3-8" x 8-10' L)	EACH	3,590
ROCK		
24-36" (ROUND) or 18" (ANGULAR) BOULDERS/FOOTER ROCKS	EACH	115
12" LARGE ROCK	EACH	15
4-6" TOE COBBLE**	CUBIC YARDS	324
REVEGETATION		
WILLOW CUTTINGS*	EACH	13,031

*PROVIDED BY CFC AFTER OCTOBER 15TH
**WILL ONLY BE IMPORTED AS NEEDED

HARDENED CHANNEL CROSSING MATERIALS	UNITS	ESTIMATED QUANTITY
6"+ COBBLE	CUBIC YARD	5
4" CRUSHED ROCK	CUBIC YARD	5

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DATUM:
PROJECT:
UNITS: INTL Feet
DATA SOURCES:

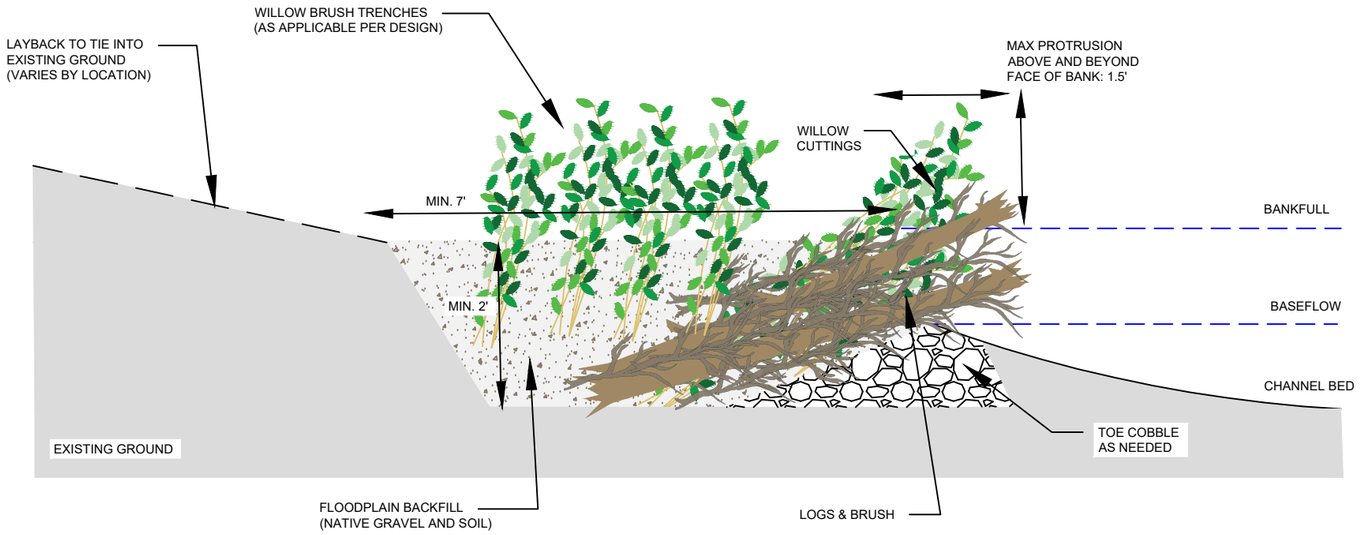
PROJECT MATERIALS AND QUANTITIES

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum
DESIGNED BY: Geum
DATE: February 2024

SHEET
8.0

WOODY DEBRIS MATRIX
SECTION VIEW



EXAMPLES OF WOODY DEBRIS MATRIX STREAMBANK TREATMENTS

GENERAL NOTES

THIS WORK INCLUDES INSTALLATION OF WOODY DEBRIS MATRIX STREAMBANK TREATMENTS AT THE LOCATIONS SHOWN ON SHEET 3.0. THE INTENT OF THESE STRUCTURES IS TO PROVIDE TEMPORARY BANK STABILIZATION AND CREATE A COMPLEX, VEGETATED BANK MARGIN THAT CREATES AQUATIC HABITAT AND SUPPORTS VEGETATION ESTABLISHMENT.

NOTES ON WOODY DEBRIS MATRIX STREAMBANK INSTALLATION

1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
2. CONSTRUCT STREAMBANK TOE WHERE NEEDED AND ACCORDING TO SPECIFIED DIMENSIONS.
3. INSTALL MATRIX OF LOGS AND BRUSH. LOGS CAN OVERLAP AND CAN BE ORIENTED FACING UPSTREAM OR DOWNSTREAM, BUT SHOULD BE PLACED BELOW THE BANKFULL ELEVATION.
4. PLACE WILLOW CUTTINGS INTO THE MATRIX AS SHOWN IN THE DRAWING WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND TOPS AT OR ABOVE THE BANKFULL ELEVATION.
5. BACKFILL STREAMBANK WITH FLOODPLAIN BACKFILL TO DESIGN ELEVATIONS. WASH FINES INTO THE FLOODPLAIN BACKFILL TO SEAL VOIDS.
6. LAY BACK THE GROUND BY EXCAVATING MATERIAL TO FORM A SLOPE AT A MINIMUM OF 3H:1V TO BLEND WOODY DEBRIS MATRIX STREAMBANK TO ADJACENT EXISTING GROUND.
7. ROUGHEN FLOODPLAIN BENCH AND SLOPE AND INSTALL TREES AND SHRUBS.

MAIN CHANNEL - MATERIAL SCHEDULE

ITEM	DIMENSIONS	QUANTITY/LINEAR FOOT
BRUSH AND SMALL WOOD	3-8" D, 8-10' L	2
WILLOW CUTTINGS*	MIN. $\frac{1}{2}$" D, 8' L	5
TOE COBBLE MIX**	4-6"	0.3 CY
FLOODPLAIN BACKFILL	NATIVE	1 CY

*PROVIDED BY CFC AFTER OCTOBER 15TH
**WILL ONLY BE IMPORTED AS NEEDED

HIGH FLOW CHANNEL - MATERIAL SCHEDULE

ITEM	DIMENSIONS	QUANTITY/LINEAR FOOT
BRUSH AND SMALL WOOD	3-8" D, 8-10' L	1
WILLOW CUTTINGS*	MIN. $\frac{1}{2}$" D, 8' L	5
FLOODPLAIN BACKFILL	NATIVE	1 CY

*PROVIDED BY CFC AFTER OCTOBER 15TH

Geum Environmental Consulting
307 STATE ST.
HAMILTON, MT 59840
406.363.2353
geumconsulting.com

DATUM:

PROJECTION:

UNITS: INTL Feet

DATA SOURCES:

WOODY DEBRIS MATRIX STREAMBANK TREATMENT

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

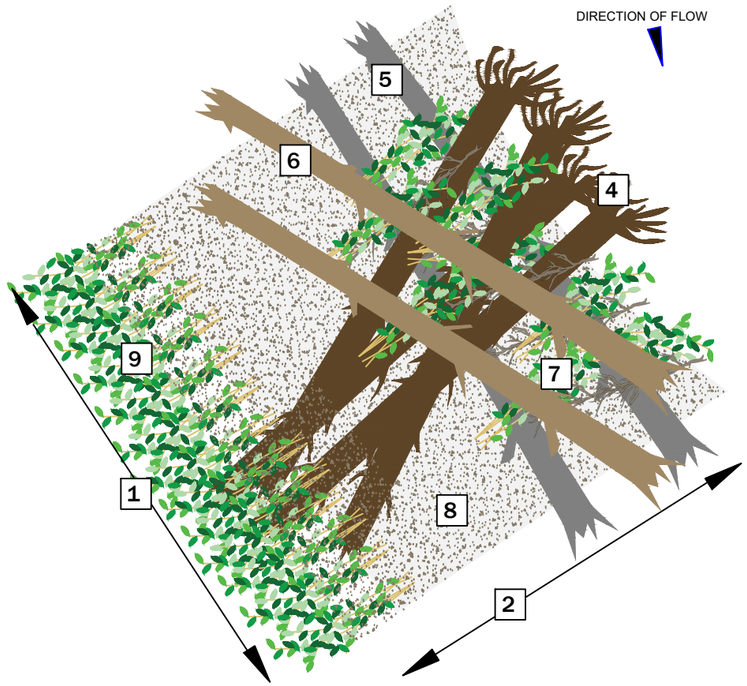
DRAWN BY:Geum

DESIGNED BY: Geum

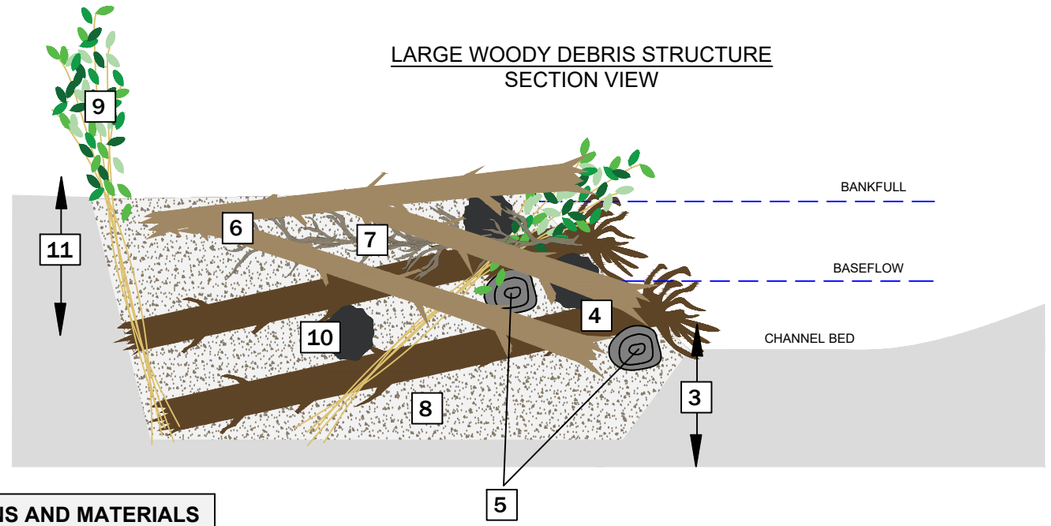
DATE: February 2024

SHEET
D1

LARGE WOODY DEBRIS STRUCTURE
PLAN VIEW



LARGE WOODY DEBRIS STRUCTURE
SECTION VIEW



DIMENSIONS AND MATERIALS	
1	AVERAGE STRUCTURE LENGTH: 10-15'
2	AVERAGE STRUCTURE WIDTH: 10'
3	MAXIMUM SCOUR DEPTH: 3'
4	ROOTWAD LOG
5	FOOTER LOG
6	DEFLECTOR LOG
7	BRUSH AND SMALL WOOD
8	STREAMBANK FILL
9	WILLOW CUTTINGS
10	BOULDERS
11	AVERAGE STRUCTURE HEIGHT: 2'

MATERIAL SCHEDULE

ITEM	DIMENSIONS	QUANTITY/STRUCTURE
ROOTWAD LOG	3' MIN. ROOTWAD D, 12" MIN. D, 15' L	4
FOOTER LOG	8-12" D, 15' L	2
DEFLECTOR LOG	6-10" D, 10-15' L	2
BRUSH AND SMALL WOOD	3-8" D, 8-12' L	8
WILLOW CUTTINGS*	05-1" D, 6-8' L	100
STREAMBANK FILL	NATIVE	5 CY
SUBGRADE EXCAVATION	17 CY	10 CY
BOULDER	24-36" (ROUND) or 18" (ANGULAR)	5

*PROVIDED BY CFC AFTER OCTOBER 15TH

GENERAL NOTES
THIS WORK INCLUDES INSTALLATION OF LARGE WOODY DEBRIS STRUCTURES AT THE LOCATIONS SHOWN ON SHEET 3.0. THE INTENT OF THIS STRUCTURE IS TO PROVIDE TEMPORARY BANK STABILIZATION BY DIRECTING THE FLOW AWAY FROM THE STREAMBANK AND TO CREATE HYDRAULIC CONDITIONS THAT MAINTAIN A POOL. THIS STRUCTURE ALSO PROVIDES A LOW STRESS AREA FOR BANK VEGETATION TO ESTABLISH. THE STRUCTURE PROVIDES MULTIPLE LAYERS OF WOOD AND BRUSH TO INCREASE CHANNEL ROUGHNESS ALONG THE BANK AND INCREASE AQUATIC HABITAT DIVERSITY. THIS STRUCTURE IS USED IN CONJUNCTION WITH OTHER STRUCTURES SUCH AS THE WOODY DEBRIS MATRIX, AND SMOOTH TRANSITIONS BETWEEN STRUCTURE TYPES IS KEY TO OVERALL FUNCTION AND STABILITY.

NOTES ON LARGE WOODY DEBRIS STRUCTURE INSTALLATION
1. EXCAVATE TO SUBGRADE ELEVATIONS AND STOCKPILE SUITABLE EXCAVATED MATERIAL FOR BACKFILL.
2. INSTALL THE TIER OF FOOTER LOGS (TIER 1) AND TIER OF ROOTWAD LOGS (TIER 2) AS SPECIFIED. THE UPSTREAM ROOTWAD SHOULD NOT PROJECT INTO THE CHANNEL, AND SHOULD BE FLUSH WITH THE BANKLINE. THE DOWNSTREAM-MOST ROOTWAD SHOULD PROJECT 2' TO 3' INTO THE CHANNEL.
3. BACKFILL WITH STREAMBANK FILL UP TO THE TOP OF THE ROOTWAD LOGS AND COMPACT VIA BUCKET COMPACTION. WASH FINES AND WATER FROM ON-SITE INTO THE STREAMBANK FILL TO SEAL VOIDS IN THE BACKFILL.
4. INSTALL THE TIER OF DEFLECTOR LOGS, BRUSH, AND SMALL WOOD (TIER 3) WITHIN THE MATRIX OF FOOTER LOGS AND ROOTWAD LOGS. LOGS SHALL BE WOVEN BETWEEN OTHER LOGS TO PREVENT MOVEMENT. DEFLECTOR LOGS SHALL POINT DOWNSTREAM AND MAY EXTEND UP TO ONE FOOT ABOVE THE TOP OF BANK ELEVATION.
5. INSTALL DORMANT WILLOW CUTTINGS IN MATRIX OF LOGS AND BRUSH ALONG THE BANKLINE OR BACK EDGE OF EXCAVATION.
6. BACKFILL STREAMBANK WITH STREAMBANK FILL AND WASH FINES FROM ON-SITE INTO THE STREAMBANK FILL TO SEAL VOIDS.

EXAMPLES OF LARGE WOODY DEBRIS STRUCTURE TREATMENTS

Geum Environmental Consulting
307 STATE ST.
HAMILTON, MT 59840
406.363.2353
geumconsulting.com

DATUM:

PROJECTION:

UNITS: INTL Feet

DATA SOURCES:

LARGE WOODY DEBRIS STRUCTURE DETAIL

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

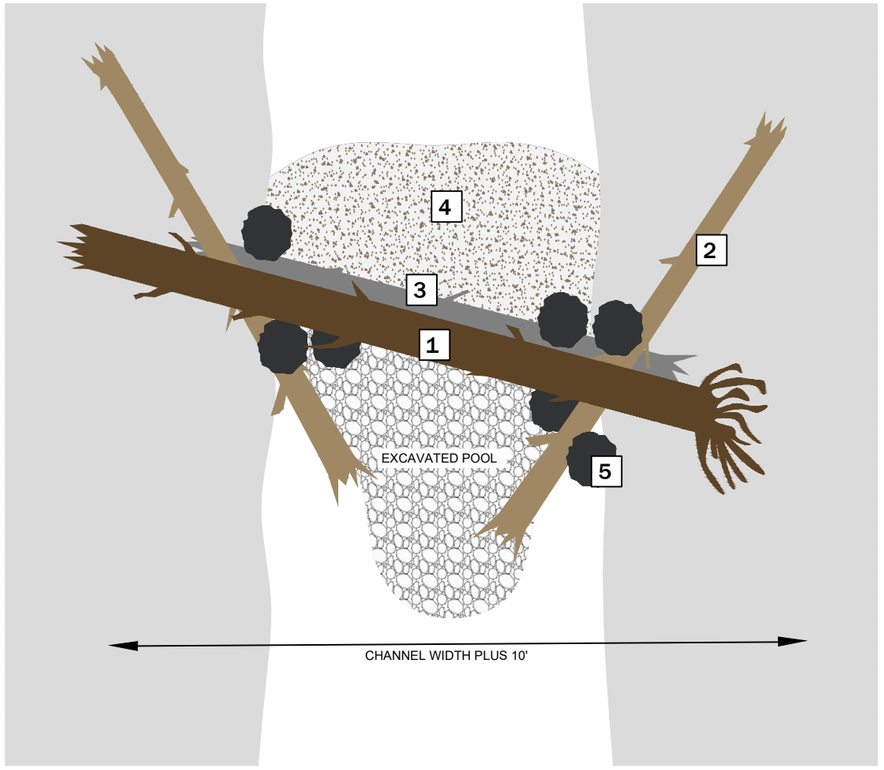
DRAWN BY: Geum

DESIGNED BY: Geum

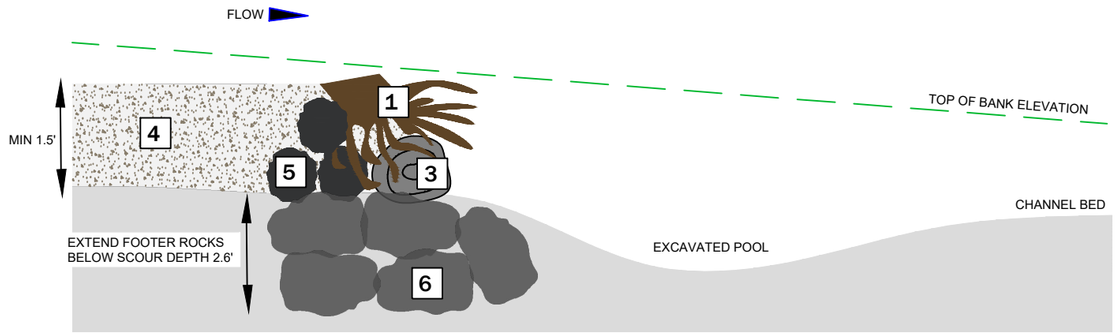
DATE: February 2024

SHEET
D2

STEP POOL STRUCTURE
PLAN VIEW



STEP POOL STRUCTURE
PROFILE VIEW



MATERIAL TYPES	
1	LARGE LOG
2	MEDIUM LOG
3	BACKER LOG
4	STREAMBED FILL (EXCAVATED FROM POOL)
5	LARGE ROCK
6	FOOTER ROCK

MATERIAL SCHEDULE

ITEM	DIMENSIONS	QUANTITY/STRUCTURE
LARGE LOG	3' MIN. ROOTWAD D, 12" MIN. D, 25' L	1
MEDIUM LOG	ROOTWAD OPTIONAL, 12" MIN. D, 20' L	2
BACKER LOG	12-15" D, 20' L	1
STREAMBED FILL	NATIVE	2 CY
LARGE ROCK	12"	5
FOOTER ROCK	24-36" (ROUND) or 18" (ANGULAR)	15

GENERAL NOTES

THIS WORK INCLUDES INSTALLATION OF STEP POOL STRUCTURES AT LOCATIONS SHOWN ON SHEET 3.0. THE INTENT OF THIS STRUCTURE IS TO CREATE ADDITIONAL POOL HABITAT WITHIN STREAM REACHES WHERE CHANNEL MORPHOLOGY HAS BEEN SIMPLIFIED, AND TO PROVIDE STABILITY WITHIN THE REACH. THE STRUCTURES ARE DESIGNED TO MIMIC NATURALLY OCCURRING STEP POOL DOMINATED CHANNELS AND BEDFORMS. THE STRUCTURE IS COMPOSED OF LARGE LOGS AND NATIVE STREAMBED SUBSTRATE.

NOTES ON STEP POOL STRUCTURE INSTALLATION

1. EXCAVATE CHANNEL BED AND STREAMBANKS TO ACCOMMODATE LOG PLACEMENT. STREAMBED DOWNSTREAM OF LOGS SHALL BE EXCAVATED TO A DEPTH EQUAL TO THE AVERAGE POOL DEPTH AS INDICATED ON SHEET 6.1.
2. INSTALL FOOTER ROCK, FOOTER LOG, LARGE LOG AND MEDIUM LOGS AS INDICATED ON DRAWINGS AND DESCRIBED BELOW.
3. INSTALL FOOTER ROCKS IN STREAMBED TO A DEPTH BELOW THE SCOUR DEPTH. FOOTER ROCKS SHALL BE PLACED SUCH THAT THEY PREVENT SLUMPING OF THE STRUCTURE AND PREVENT SCOUR.
4. INSTALL LARGE LOG AT A DOWNWARD ANGLE AND AT AN ELEVATION 0.5 FOOT BELOW THE BANKFLL ELEVATION, EMBEDDED INTO THE STREAMBANK AND CHANNEL BED A MINIMUM OF 1.5 FEET BELOW THE CHANNEL FINISH GRADE.
5. INSTALL MEDIUM LOGS AT THE CHANNEL TIE-IN POINTS FOR THE LARGE LOG AND THE BACKER LOG. ANGLE LOGS DOWNSTREAM AND INTO THE CHANNEL TOWARDS EXCAVATED POOL.
6. INSTALL BACKER LOG ON THE UPSTREAM SIDE OF LARGE LOG. BACKER LOG SHALL BE FLUSH WITH THE LARGE LOG AND EXTEND FROM THE FLOODPLAIN TIE-IN LOCATIONS TO THE TIP OF THE BURIED LARGE LOG.
7. INSTALL LARGE ROCK UPSTREAM AND DOWNSTREAM OF THE STREAMBANK TIE-IN LOCATIONS AND LARGE LOG TIPS. ROCK SHALL BE IN CONTACT WITH LOGS TO PROVIDE BALLAST AND PREVENT LOGS FROM SHIFTING WHEN BACKFILLED.
8. BACKFILL LOGS WITH STREAMBED FILL TO CHANNEL FINISH GRADE.

EXAMPLES OF STEP POOL STRUCTURE TREATMENTS

Geum Environmental Consulting
307 STATE ST.
HAMILTON, MT 59840
406.363.2353
geumconsulting.com

DATUM:

PROJECTION:

UNITS: INTL Feet

DATA SOURCES:

STEP POOL STRUCTURE DETAIL

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

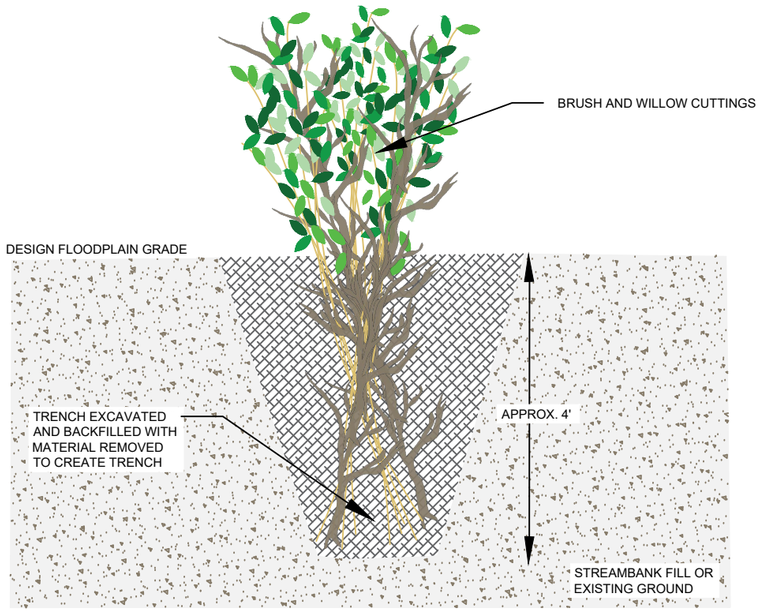
DRAWN BY: Geum

DESIGNED BY: Geum

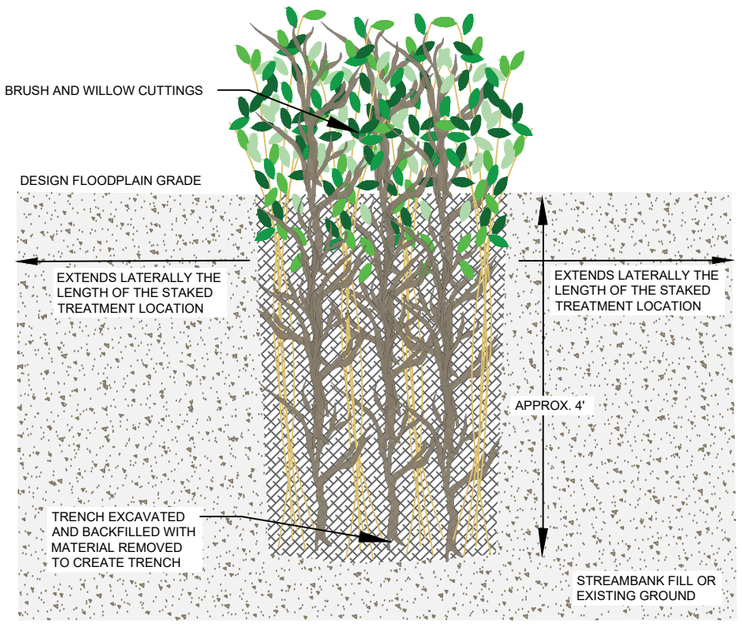
DATE: February 2024

SHEET
D3

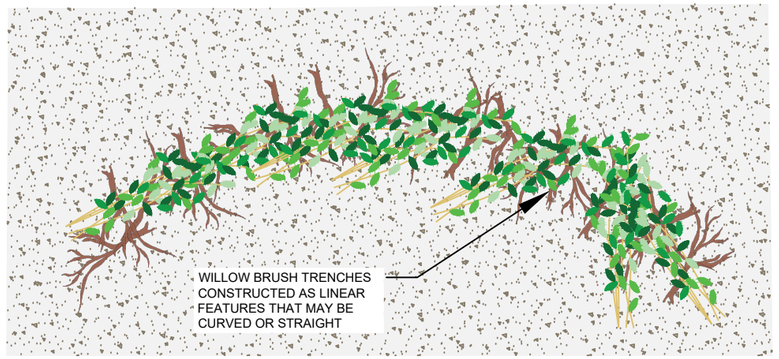
WILLOW BRUSH TRENCH
PROFILE VIEW



WILLOW BRUSH TRENCH
SECTION VIEW



WILLOW BRUSH TRENCH
PLAN VIEW



GENERAL NOTES

THIS WORK INCLUDES INSTALLATION OF WILLOW BRUSH TRENCHES IN APPROXIMATE LOCATIONS SHOWN ON SHEET 3.0. THE INTENT OF THESE FEATURES IS TO DISPERSE SURFACE FLOWS AND PROMOTE REVEGETATION. CONSTRUCTION OF WILLOW BRUSH TRENCHES WILL OCCUR IN CLOSE COORDINATION WITH INSTALLATION OF FLOODPLAIN ROUGHNESS AND CONSTRUCTION OF FLOODPLAIN SIDE CHANNELS. THE CONTRACTOR SHALL PROVIDE BRUSH AND WILLOW CUTTINGS.

NOTES ON WILLOW AND BRUSH TRENCH INSTALLATION

1. WILLOW BRUSH TRENCHES WILL BE CONSTRUCTED WITHIN THE FLOODPLAIN AND ACROSS SIDE CHANNELS IN APPROXIMATE LOCATIONS SHOWN ON SHEET 3.0. FINAL LOCATIONS WILL BE IDENTIFIED BY THE PROJECT MANAGER.
2. A TRENCH WILL BE CONSTRUCTED APPROXIMATELY 4' DEEP AND EXTEND THE LENGTH OF THE STAKED TREATMENT LOCATION. WILLOW CUTTINGS AND BRUSH 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.

MATERIAL SCHEDULE

ITEM	DIMENSIONS	QUANTITY/LINEAR FOOT
BRUSH AND SMALL WOOD	<6' D, 6-10' L (BRANCHES AND MULTIPLE STEMS PREFERRED)	1
WILLOW CUTTINGS*	MIN. $\frac{1}{2}$" D, 8' L	5

*PROVIDED BY CFC AFTER OCTOBER 15TH

EXAMPLES OF WILLOW BRUSH TRENCH TREATMENTS

Geum Environmental Consulting
307 STATE ST.
HAMILTON, MT 59840
406.363.2353
geumconsulting.com

DATUM:

PROJECT:

UNITS: INTL Feet

DATA SOURCES:

WILLOW BRUSH TRENCH DETAIL

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

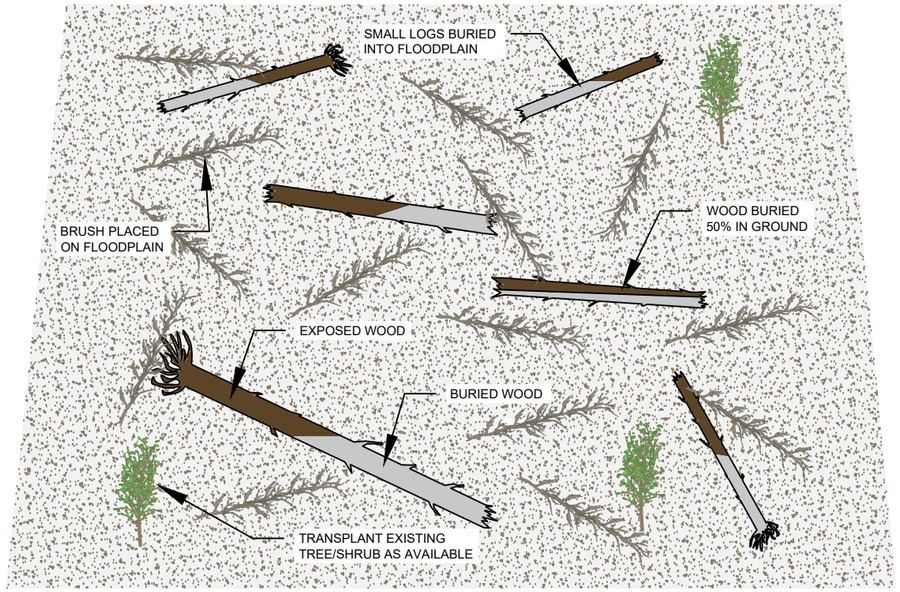
DRAWN BY: Geum

DESIGNED BY: Geum

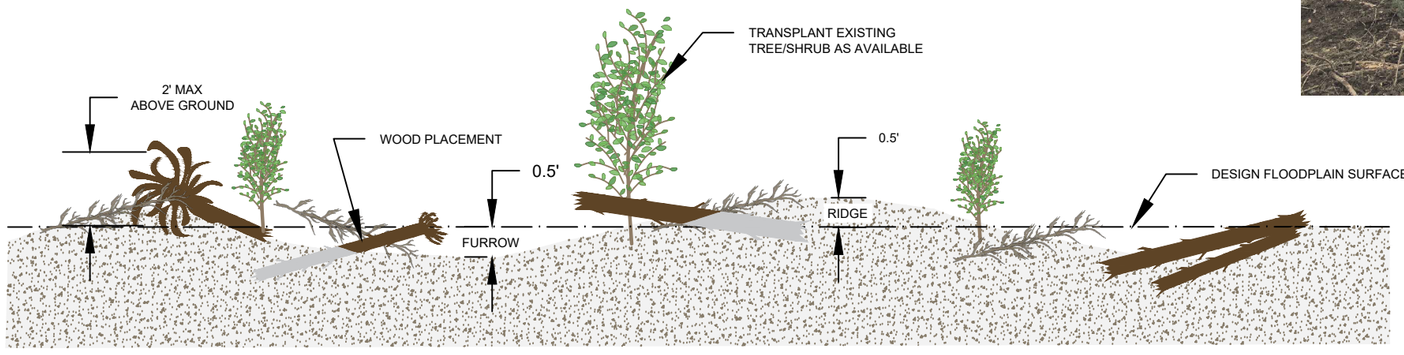
DATE: February 2024

SHEET
D4

FLOODPLAIN TREATMENT
PLAN VIEW



FLOODPLAIN TREATMENT
SECTION VIEW



GENERAL NOTES
THIS WORK INCLUDES CONSTRUCTION OF FLOODPLAIN TREATMENT AREAS. THE INTENT OF THIS TREATMENT IS TO PROVIDE MICROSITES AND ROUGHNESS TO SUPPORT SEED TRAPPING, ESTABLISHMENT OF VEGETATION AND DISPERSE OVERLAND FLOWS. WORK WILL OCCUR AFTER OR CONCURRENT WITH CONSTRUCTION OF THE FLOODPLAIN SIDE CHANNELS, WILLOW BRUSH TRENCHES AND STREAMBANK STRUCTURES.

NOTES ON FLOODPLAIN TREATMENT CONSTRUCTION
1. LOAD AND HAUL WOOD FROM THE STAGING AREAS TO THE TREATMENT LOCATIONS. HAUL AND STAGE THE WOOD AT THE INSTALLATION LOCATIONS IN A MANNER THAT PRESERVES THE SIZE, TYPE, AND INTEGRITY OF EACH PIECE TO BE INCORPORATED INTO THE WORK. HANDLE MATERIALS IN A MANNER THAT MINIMIZES DAMAGE TO BARK, LIMBS, AND ROOTWADS IF PRESENT (NO ROLLING, CRUNCHING, CRUSHING, ETC.)
2. PLACE SMALL LOGS AT A RATE OF 50 PIECES PER ACRE AND SPACED AT AN AVERAGE DISTANCE OF 15 FEET FROM OTHER LOGS. PLACE BRUSH SUCH THAT IS COVERS 25% OF THE FLOODPLAIN SURFACE (APPROXIMATELY 250 PIECES PER ACRE).
3. BURY SMALL LOGS WITHIN THE FLOODPLAIN SURFACE, WITH ONE HALF OF THE LENGTH BURIED TO A DEPTH OF 2 FEET AND ONE HALF EXPOSED A MAXIMUM OF 1 FOOT ABOVE FINISHED GRADE AS SHOWN ON DRAWING. PLACE BRUSH ON THE SURFACE, BRUSH DOES NOT NEED TO BE BURIED.
4. CONSTRUCT MICRO-TOPOGRAPHY CONSISTING OF LOW AND HIGH FEATURES (RIDGES AND FURROWS), WITH NO DISCERNABLE PATTERN (I.E NO ROWS), OVER THE ENTIRE LOWERED FLOODPLAIN AREA.

MATERIAL SCHEDULE

ITEM	DIMENSION	QUANTITY/ACRE
LOGS	6-12" D, 10-15' L	50 PIECES
BRUSH	<6" D, 6-10' L (BRANCHES AND MULTIPLE STEMS PREFERRED	APPROX. 250 PIECES (COVERING 25% OF THE AREA)

EXAMPLE OF FLOODPLAIN TREATMENT

geum Environmental Consulting
307 STATE ST.
HAMILTON, MT 59840
406.363.2353
geumconsulting.com

DATUM:

PROJECTION:

UNITS: INTL Feet

DATA SOURCES:

FLOODPLAIN TREATMENT DETAIL

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

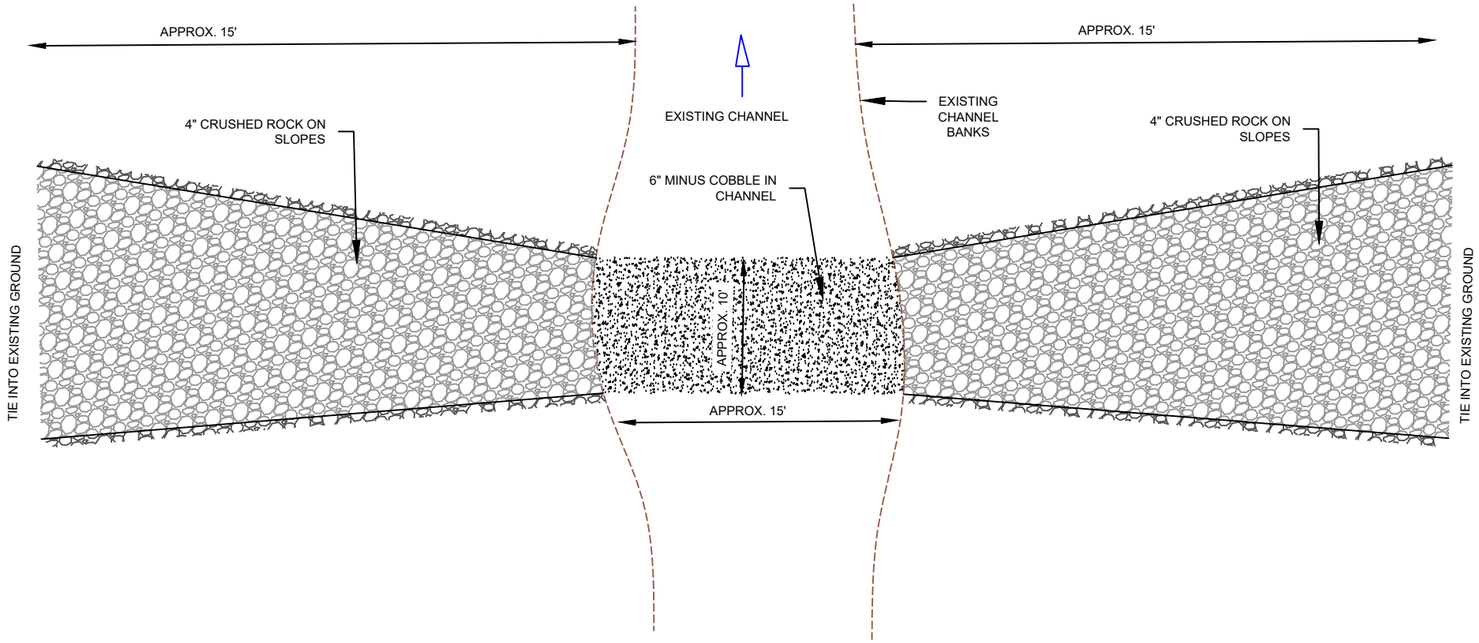
DRAWN BY: Geum

DESIGNED BY: Geum

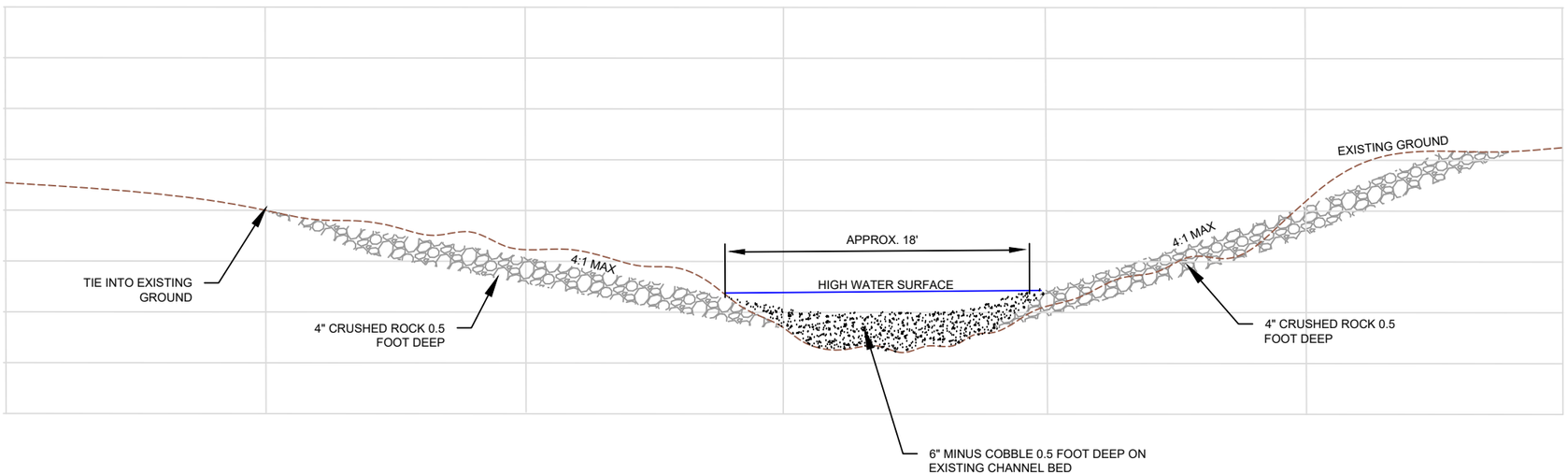
DATE: February 2024

SHEET
D5

HARDENED CROSSING DETAIL
PLAN VIEW



HARDENED CROSSING DETAIL
CROSS SECTION VIEW
(LOOKING DOWNSTREAM)



CONSTRUCTION NOTES

1. THIS WORK INCLUDES CONSTRUCTION OF A HARDENED CHANNEL CROSSING AT THE LOCATION SHOWN ON SHEET 3.0.
2. THE HARDENED CROSSING LOCATION WILL BE STAKED PRIOR TO CONSTRUCTION.
3. EXCAVATE SLOPE APPROACHES TO CHANNEL TO A MINIMUM DEPTH OF APPROXIMATELY ONE HALF FOOT TO CREATE A UNIFORM SURFACE FOR ROCK PLACEMENT.
4. PLACE 4" CRUSHED ROCK, AS DIRECTED BY PROJECT MANAGER, ON THE SLOPE APPROACHES. BLEND MATERIAL INTO EXISTING GROUND TO ENSURE SMOOTH TRANSITIONS.
5. PLACE 6" MINUS COBBLE ON CHANNEL BED TO A DEPTH OF APPROXIMATELY ONE FOOT.
6. BUCKET COMPACT ROCKY MATERIALS AFTER PLACEMENT ON HARDENED CROSSING SLOPES.

ESTIMATED MATERIAL SCHEDULE

ITEM	QUANTITY	UNIT
6" MINUS COBBLE	APPROX. 5	CY
4" CRUSHED ROCK	APPROX. 5	CY

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DATA SOURCES:

HARDENED CHANNEL CROSSING DETAIL

MILLER CREEK LEIK PARCEL RESTORATION PROJECT
MISSOULA, MONTANA

DRAWN BY: Geum

DESIGNED BY: Geum

DATE: February 2024

SHEET
D6

LETTERS OF SUPPORT

October 22, 2021

To: Katie Racette, Project Manager

Clark Fork Coalition

PO Box 7593

Missoula, Montana 59807

From: Thomas and Donna Leik, Landowner

10832 Miller Creek Road

Missoula MT 59803

RE: Letter of Support for Leik- Miller Creek Sediment Reduction Project

We are landowners in the middle reach of Miller Creek, purchasing this 80 acre parcel in 1990. During the last 31 years we have observed changes and environmental events that impact the health of the creek. On the plus side we have added small pasture fencing to control grazing and have seen significant increases in the cottonwood and alders on the creek banks. On the negative side we have had several huge spring runoff events that have eroded the steam banks and flattened the channel by filling in the deep holes with cobble. In the last 20 years we have also experienced several very low water flow events both in the late summer and winter. We would like to support improvements to water quality, fisheries habitat, riparian conditions, and stream channel stability on this reach of Miller Creek. Conserving fish and wildlife habitat is important to us.

The Miller Creek Sediment Reduction Project, led by the Clark Fork Coalition (CFC), is proposed on a 1/4 mile reach of Miller Creek running through our property in order to reduce fine sediments, increase connectivity, enhance aquatic habitat, and to increase ecological function of the riparian and floodplain corridor. We support this project and will coordinate with CFC, DEQ, FWP, and contractors on granting permission for access to the site. Thank you.

Thomas Leik Date: 10/27/21

Thomas Leik

Donna Leik Date: 10/27/21

Donna Leik

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,

Elena Evans
Hydrogeologist
Missoula Valley Water Quality District

OTHER ATTACHMENTS

Photos of Sediment Sources on Leik Property October 2021

Miller Creek
Watershed Restoration Plan
2018

Missoula Valley Water Quality District

January 29, 2018

Acknowledgements

Many individuals and organizations helped support and guide the development of this Watershed Restoration Plan. The Soil and Water Conservation Districts of Montana provided funding, as well as advice and feedback. Kristy Fortman and Mark Ockey of Montana Department of Environmental Quality provided guidance and information during the process, as did Traci Sylte and Dustin Walters of the Lolo National Forest. Jed Whiteley, Will McDowell and Katie Racette at the Clark Fork Coalition provided input and reviewed the draft, as did Heather Barber of the Bitterroot Water Forum, Ladd Knotek of Montana Fish, Wildlife and Parks, Jen McBride of the Missoula Conservation District, Rob Roberts of Montana Trout Unlimited and Brian Sugden of Weyerhaeuser. Jim Nave of Montana Department of Natural Resources and Conservation, Water Resourced Division provided insight into water use within the watershed. Many residents and landowners provided feedback by completing and submitting surveys or through meetings and/or fieldtrips. Denny Anderson of Spooner Creek Ranch, Bart Morris of Oxbow Cattle Company, MPG Ranch, and staff from Montana Nature Conservancy, Five Valleys Land Trust and Northwestern Energy all offered time and information about the watershed and their operations. These contributors all helped to make this a better plan.

Table of Contents

Introduction

Miller Creek is located in Missoula County, Montana. It flows west for 18 miles from the Sapphire Mountains to its confluence with the Bitterroot River near the city of Missoula (Figure 1). The watershed encompasses 47.9 square miles and supports a variety of land uses, from silviculture and agriculture, to residential subdivisions. The watershed has been undergoing many changes in land use and ownership in recent decades, and this presents challenges and opportunities for management and restoration.

The Missoula Valley Water Quality District (MVWQD) is a local government agency charged with protecting and improving the quality of surface and groundwater within the district boundaries. MVWQD works with interested landowners and partnering agencies and organizations to conduct on-the-ground restoration work as well as educating residents on the importance of watershed health in protecting water quality. The District also collects surface and groundwater data to assess water quality and develops programs to detect and remedy contamination.

The goal of this Watershed Restoration Plan (WRP) is to present a broad framework to guide property owners and restoration organizations in developing and implementing projects that can make meaningful, measurable improvements to the condition of Miller Creek in the coming years.

This WRP was developed using the "Nine Minimum Elements of an Environmental Protection Agency (EPA) Watershed Restoration Plan" and guidance from the Montana Department of Environmental Quality (DEQ) (Figure 2).

The process of engaging local stakeholders took place in several ways. MVWQD conducted one-on-one interviews with major landowners including United States Forest Service (USFS), The Nature Conservancy, Northwestern Energy and three large ranch owners. Additional outreach was conducted using a postage-paid mail-in survey which was mailed out to any entity or individual that owned property adjacent to Miller Creek. Approximately 200 of these surveys were mailed out and 59 were returned (29.5% participation). This survey asked residents what they valued most about the watershed, and what changes they had observed (positive and negative). Residents were also asked about projects (riparian restoration, weed treatment, beaver re-introduction) that they would consider undertaking on their properties. Additionally, stakeholders such as the Montana Department of Natural Resources and Conservation (DNRC) Water Resources Division, Montana Fish Wildlife and Parks (FWP), Missoula Conservation District were contacted via phone and email for comments and thoughts about Miller Creek.

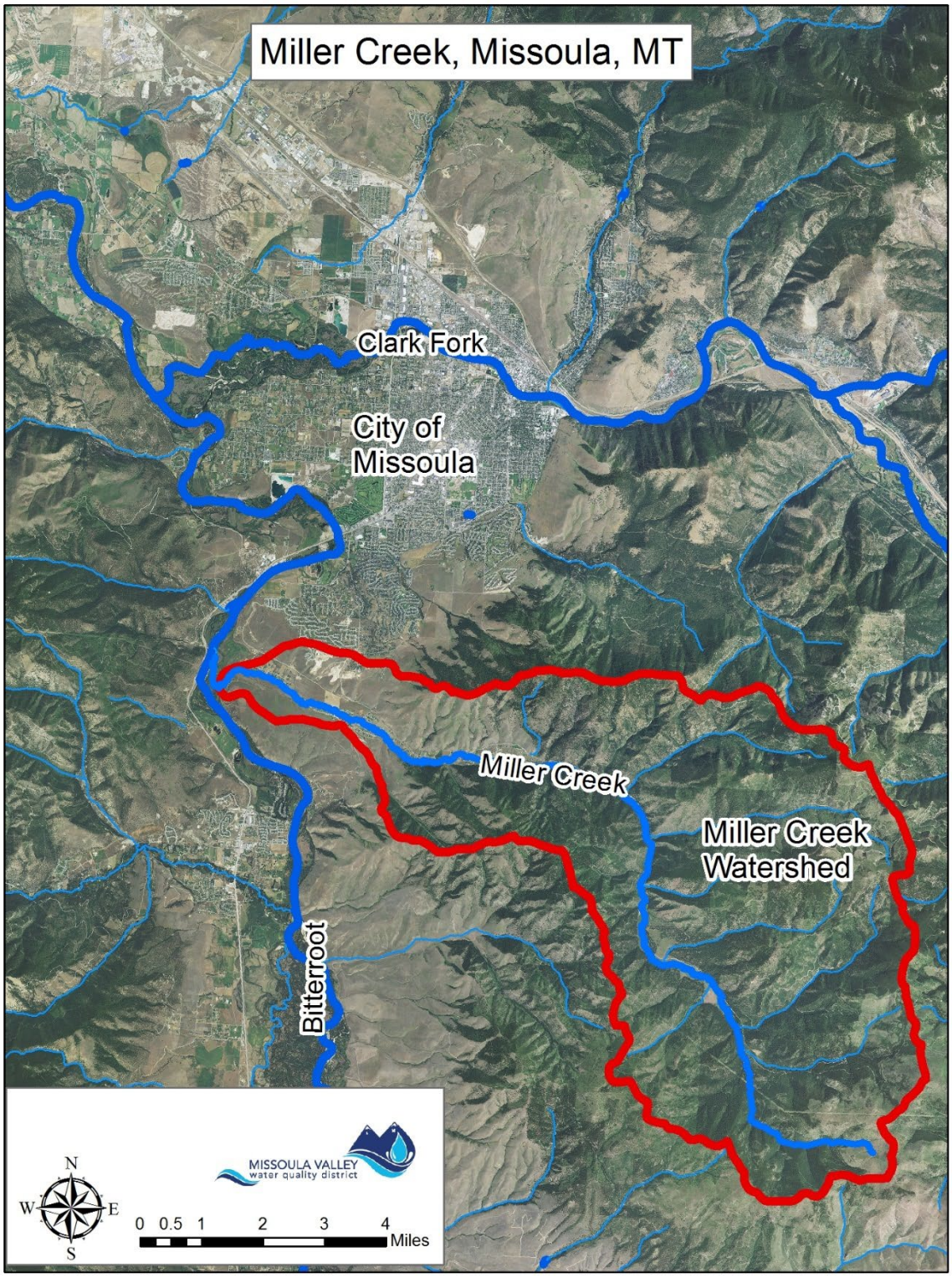


Figure 1: Miller Creek watershed

Environmental Protection Agency Nine Elements of a Watershed Restoration Plan

a. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan.

b. An estimate of the load reductions expected from management measures.

c. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in paragraph 2, and a description of the critical areas in which those measures will be needed to implement this plan.

d. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

e. An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

f. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

g. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item h immediately above.

Figure 2: EPA Nine Minimum Elements

Description of the Watershed

Silviculture is the dominant land use type within the Miller Creek watershed, with growing residential development along its lower reach (Table 1, Figure 3).

Table 1. Dominant Miller Creek Watershed Land Use

Property Type	Acres	Percent
Forest/Prairie	27399.87	89.83%
Agricultural (Valley Floor)	1026.50	3.37%
Residential	1988.62	6.52%
Total	30500.36	

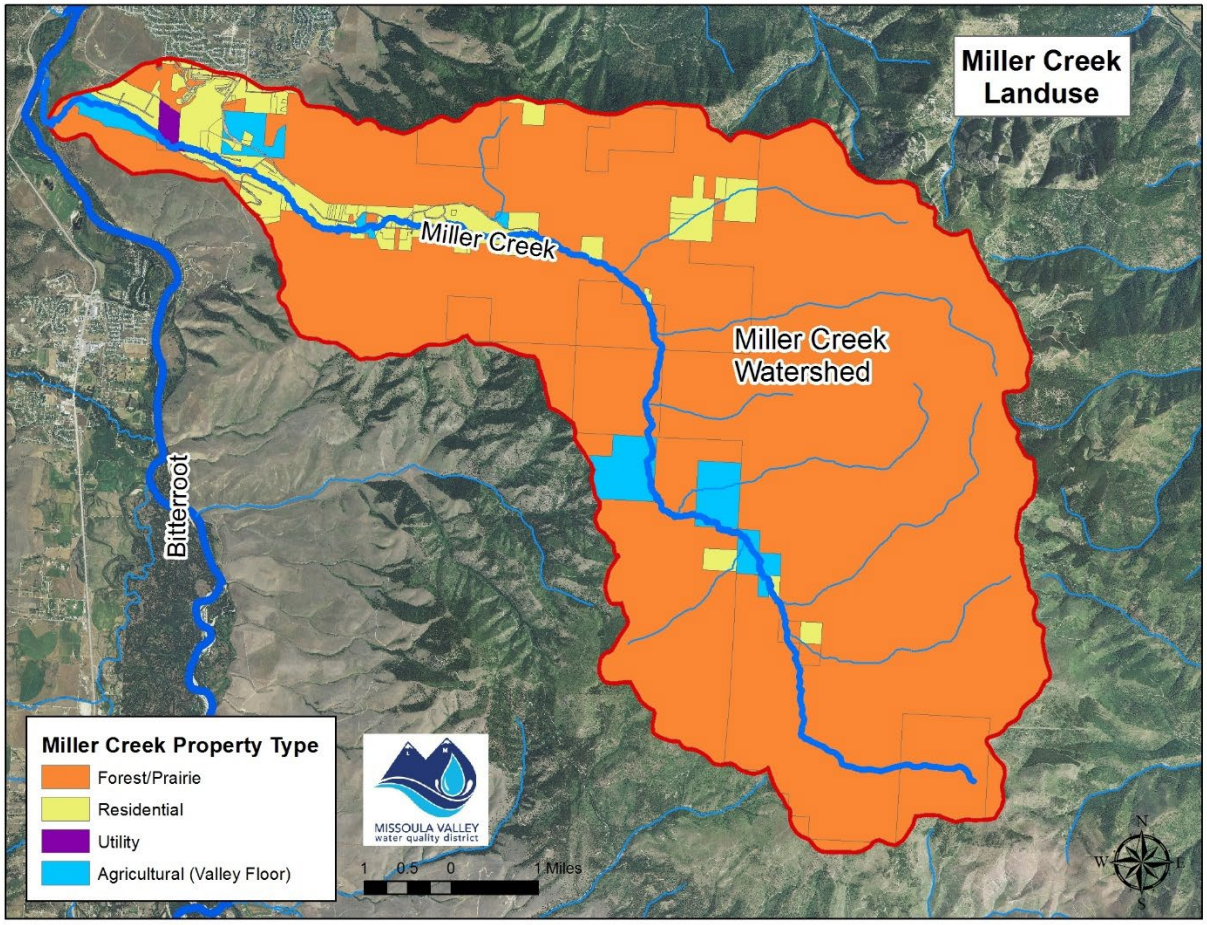


Figure 3: Miller Creek Land Use

With the exception of Weyerhaeuser land in the uppermost 1 mile of the stream which burned in 2003 and is regenerating, the upper 4 miles of the watershed are in excellent condition and exhibit little or no impairment. These areas will need to be protected, to prevent degradation, as the growing population in Miller Creek and beyond increases recreational pressure. Partnering with USFS and private forest owners will be important to ensure that these areas of the watershed are preserved (and improved, where needed), into the future.

As of the 2010 census, approximately 2,695 people live within the Miller Creek Watershed. This number is expected to more than double as two major subdivisions are expected to be completed totaling more than 1500 new homes by 2030 (Linda Vista Estates and Teton Addition Phasing Amendments, 2015)

According to a FWP fisheries biologist, the middle and lower perennial sections are dominated by rainbow trout/westslope cutthroat trout hybrids in addition to brook trout, with some brown trout in lower reaches (Knotek 2016 email). There is seasonal and limited connectivity with the Bitterroot River for migratory fish. In general, as one moves upstream into headwater tributaries, the proportion, density and genetic purity of westslope cutthroat trout (WCT) increases with some tributaries having only genetically pure WCT. According to FWP, road issues are of significant concern to fisheries within

this watershed (undersized, malfunctioning culverts and contribution of sediment from roads) (Figure 4). Fish passage obstructions in the watershed need to be assessed and a plan for mitigation developed and implemented (Knotek, 2017).

Figure 4 Miller Creek Headwaters: Though the headwaters are relatively healthy, undersized culverts carry high velocity flows that serve as a barrier to fish migration

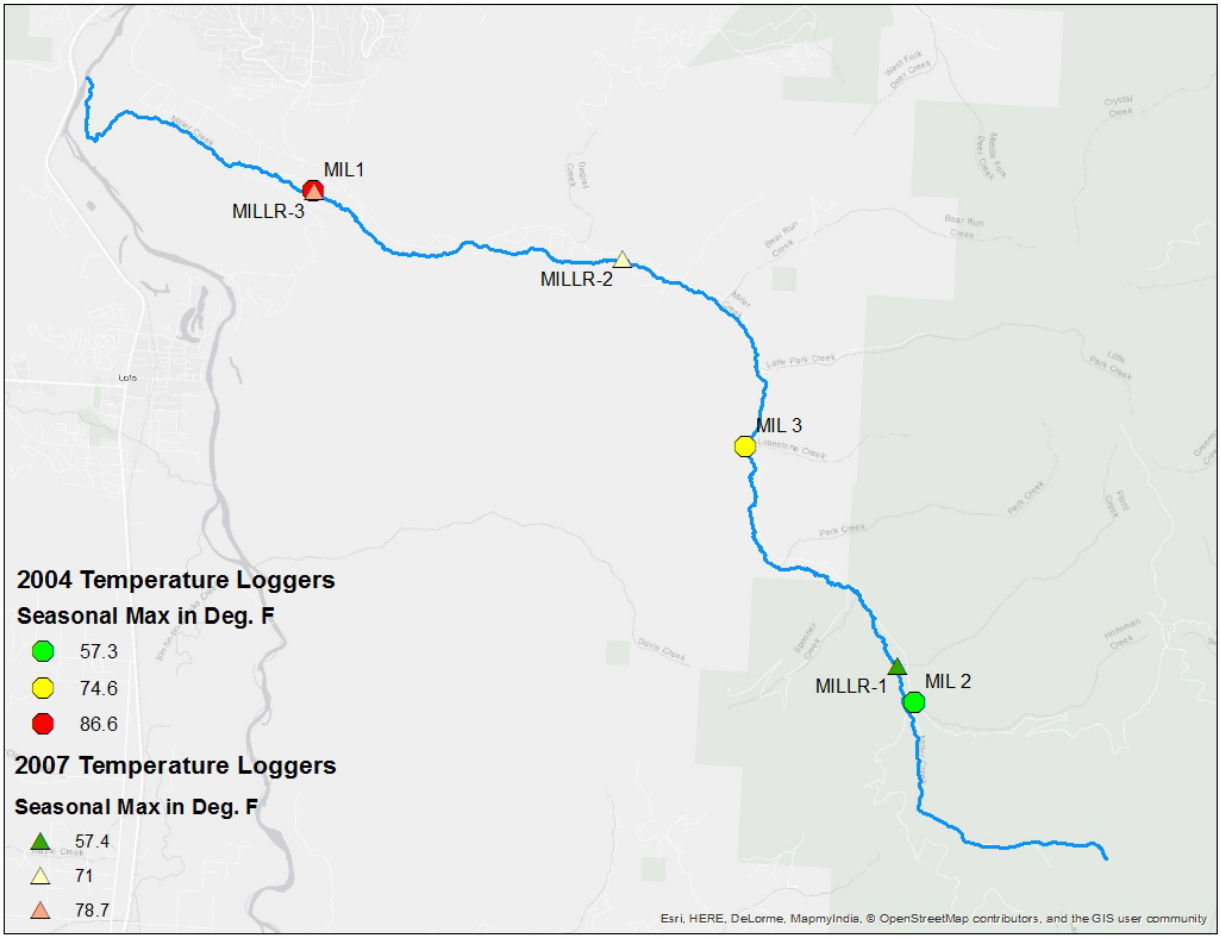
Impairment Causes and Pollutant Sources

(EPA Element a)

Miller Creek is listed for temperature and sediment impairments on the 2016 Clean Water Act section 303(d) list. A water body is determined to be impaired if it does not meet all of its potential beneficial uses, such as recreation, fishery, agriculture, etc. For all impaired water bodies in the state, the DEQ determines total maximum daily loads (TMDLs) of pollutants that need to be met in order for all beneficial uses to be supported. The status of Montana's waters is updated biennially by the DEQ in the Integrated Report. The Bitterroot TMDL document (DEQ, 2011), which includes Miller Creek, guided the development of this WRP.

Temperature

In 2007 and 2004, the DEQ conducted assessments at three sites on Miller Creek (Figure 5). Each showed measurable increases in stream temperature from up-gradient to down-gradient locations (Table 2). A thermal infrared flight (TIF) in 2004 also documented a rise in stream temperature. Monitoring in the warmest reaches of the stream showed 47 days with temperatures above 70 degrees Fahrenheit. This trend continues until Trails End Road, where most of the remaining warm water is diverted for irrigation. Groundwater and springs enter the stream below Trails End Rd, which sustains the creek until it disappears below the stream bed. The lower three miles of the stream often do not flow year-round.



(MT DEQ, 2011)

Figure 5: Miller Creek Temperature Monitoring Locations; 2004 & 2007

Table 2. Temperature Data Summary								
SiteID	Seasonal Maximum		7-Day Average During Warmest Week of Summer				Days>	Days>
	Date	Value	Date	Daily Max	Daily Min	Delta T	59 °F	70 °F
Mil1	08/17/04	86.6	08/14/04	81.9	54.6	27.3	44	38
Mil2	07/17/04	57.3	08/14/04	55.9	48.4	7.6	0	0
Mil3	07/17/04	74.6	07/26/04	71.6	49.9	21.7	43	24
MILLR-1	07/28/07	57.4	07/28/07	56.7	50.0	6.7	0	0
MILLR-2	07/18/07	71.0	07/17/07	69.5	54.4	15.1	53	3
MILLR-3	07/28/07	78.7	07/28/07	76.5	58.5	18.0	69	47

The QUAL2K model was used to estimate anthropogenic causes of impairment in the Total Maximum Daily Load document (TMDL).The model indicated that the two major factors impacting stream water temperatures are shading from riparian vegetation and instream flow volume.

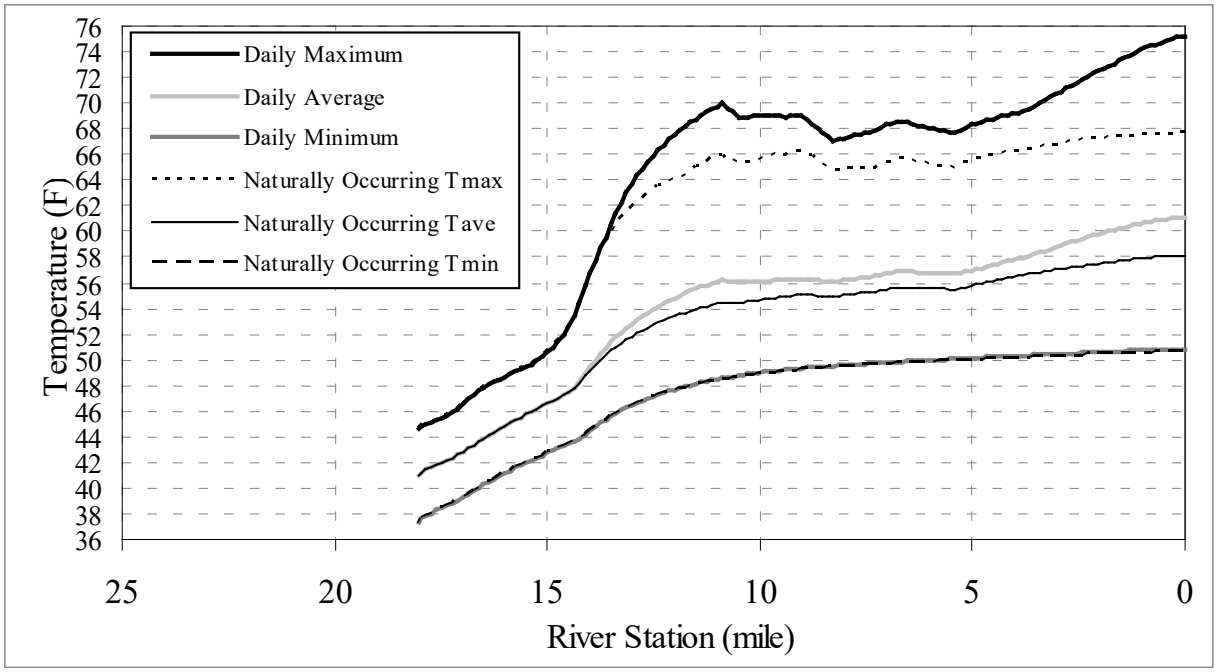


Figure 6: Model scenario results show impacts from irrigation diversions and riparian degradation in lower miles (MT DEQ, 2011)

Riparian and Stream Channel Conditions

In 2007 the DEQ conducted riparian assessments along each 500 meter section of the stream using aerial photography and stereoscope. From this assessment, effective shade percentage was developed along with a target condition (Figure 7).

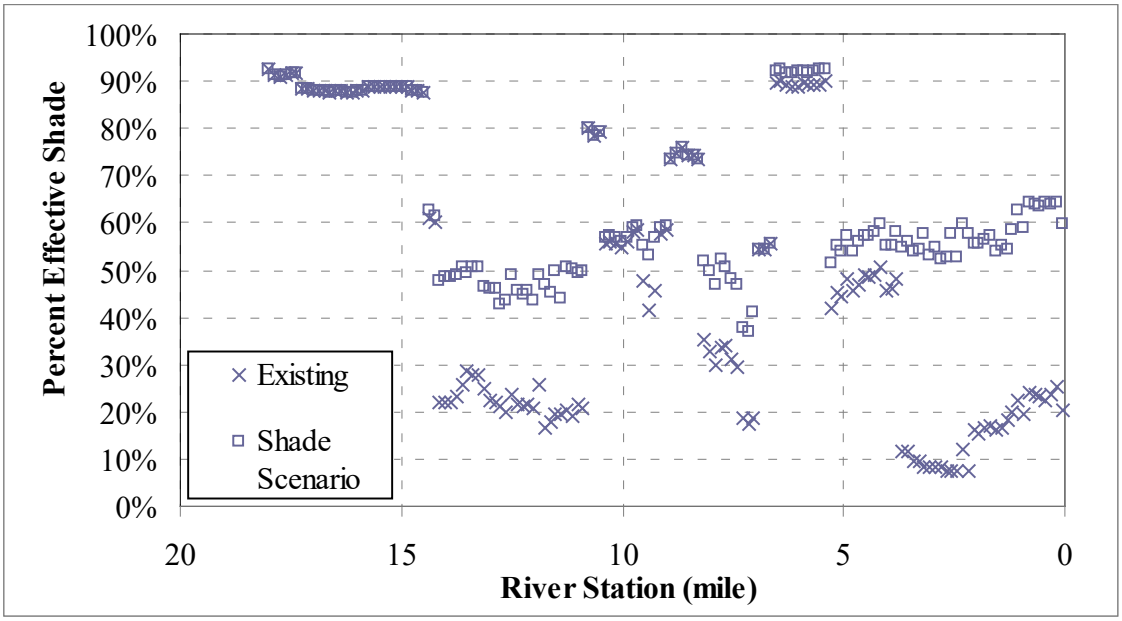


Figure 7: Existing vs potential shade (MT DEQ, 2011)

Daily effective shade ranged from 92% in the headwaters to 7% in the lower reaches. Because the creek is narrow, shading has a large effect on water temperature. Upstream reaches of riparian vegetation consist of douglas fir, ponderosa pine, dogwood, aspen and other native riparian species. Middle and lower reaches are dominated by irrigated fields and lawns. As agricultural practices have shifted from cattle production, some natural recruitment of native species has occurred. This has, however, coincided with invasive weed infestations. Average shade conditions in 2007 were estimated to be 48%. Restoring riparian vegetation to increase shade coverage to 65% would lower stream temperatures by an estimated 7.5^0 F.

The major human impacts reducing shade cover identified in the TMDL (DEQ, 2011) include livestock grazing and hay production in miles 0-4 and 11-15. Grazing and suburban developments are the primary impacts from miles 4-11.

Irrigation Water Use

The TMDL document identifies irrigation as a potential contributing factor to high stream temperatures. According to the model output, from stream mile 4-14, maximum stream temperatures during summer months were found to deviate significantly from naturally occurring maximum temperatures Figure 8.

Irrigation diversions may exacerbate warm temperatures by lowering instream flow. Lower stream flows become more easily warmed as the temperature buffering capacity is inhibited. Also, the water used for irrigation is often warmed when it is applied to the land surface, raising the stream temperature when it re-enters as return flow. Since this temperature assessment and model were completed, surface water withdrawals have changed. Nine of the lower-most surface water irrigation rights were retired in 2014 to mitigate impacts of public drinking water supply development in the lower watershed. 2017 withdraws from this well field total 187 acre feet with an allowed withdrawal up to 623 acre feet per year (Mountain Water Change of Use Application, DNRC page 38). As this area becomes more

developed, groundwater withdrawals could increase by 70% from the new public water supply well field consisting of three wells located in the alluvium at the mouth of Miller Creek. Miller Creek is hydraulically disconnected from groundwater over much of its course, and loses water rapidly through a highly permeable bed (Hewitt, 2004); Because of this disconnection, groundwater withdrawal is not projected to affect Miller Creek (Mountain Water Change of Use Application, DNRC page 25). To mitigate effects on the Bitterroot drainage as a whole, nine surface water irrigation rights on Miller Creek were retired, removing 345 irrigated acres from the watershed. These mitigation efforts may improve in-stream flow and thus reduce temperature. These nine retired water rights are the most senior in the drainage with priority dates of June 1, 1877, June 7, 1878 and September 1, 1878.

Developing a drought management plan in this basin may be beneficial in reducing temperature on Miller Creek. Climate change could play a major role in the temperature and flow profile of Miller Creek in the coming decades, making a drought management plan even more important. Also, temperature targets may need to be reevaluated in coming years to account for possible climatic changes.

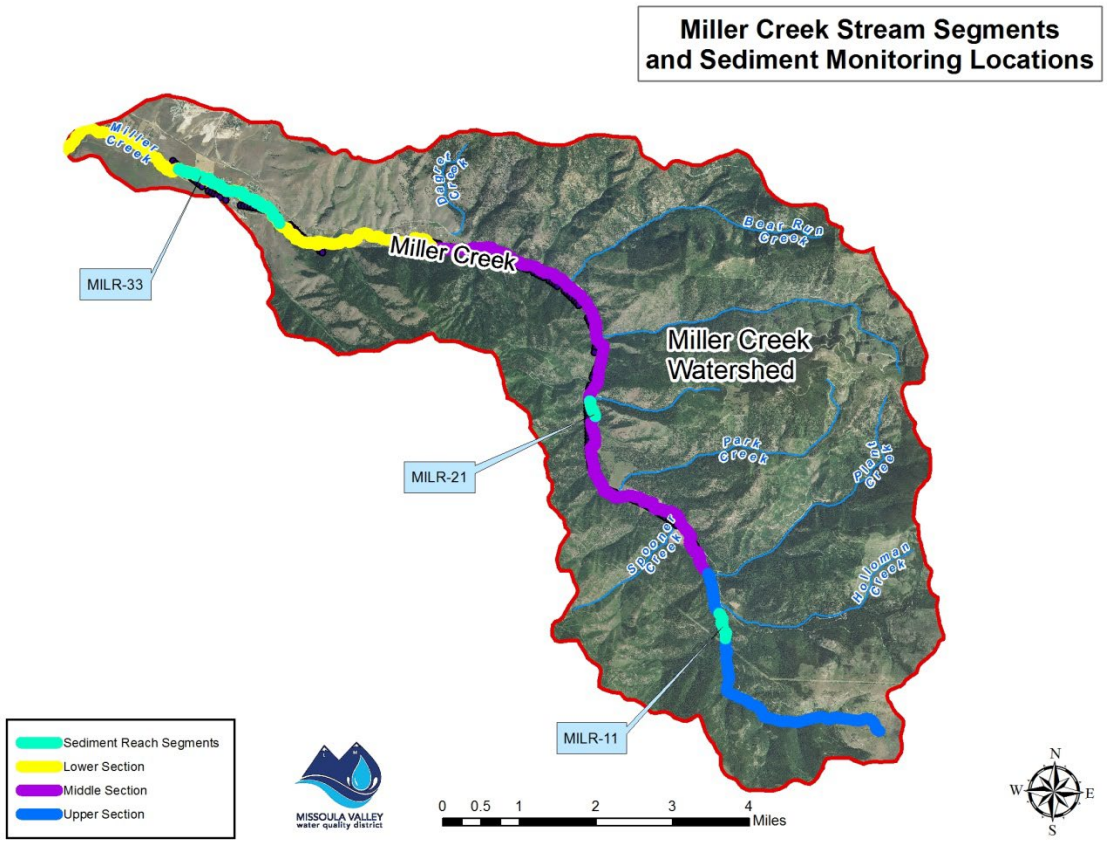


Figure 8: Sediment Monitoring Locations and Identified Stream Segments

Sediment

The Department of Environmental Quality (DEQ) carried out sediment assessments for the TMDL in 2007 at three locations (Figure 8). The upper reach was mainly coniferous forests with dense underbrush, and channel morphology was largely intact with no active erosion identified. Large woody debris provided pools with potential spawning gravels. This segment was classified as a potential Rosgen B4 channel type. The middle reach flows through meadows that showed evidence of recent logging and agricultural use. The channel was over-widened, and significant erosion was identified on the outside of meander bends. There were some pools at meander bends. Mostly grasses and wetland vegetation were found along the banks. This segment was classified as a potential Rosgen C4 channel. DEQ assessors described the lower segment of Miller Creek as "one continuous riffle" with no pools or large woody debris. The stream flowed through open space and suburban neighborhoods, and vegetation was primarily grass and weeds. (DEQ, 2011) (Table 4).

Table 4. Sediment and Habitat Data Compared with Targets
(Bold values indicate targets not met)

Reach	Mean BFW (ft)	Level III Ecoregion	Potential Stream Type	Riffle Pebble Count (Mean)		Grid Toss (Mean)		Channel Form (Median)		Instream Habitat			Riparian	Sediment Source
				% < 6 mm	% < 2 mm	Riffle % < 6mm	Pool % < 6mm	W/D Ratio	Entrenchment Ratio	Residual Pool Depth (ft)	Pools/Mile	LWD/Mile	Greenline % Shrub Cover	Riffle Stability Index
Milr-11	8.2	MR	B4	**27**	10	**21**	**11**	9.8	5.0	**0.6**	148	**570**	86	NC
Milr-21	23.5	MR	C4	**32**	**12**	**15**	**20**	**31.3**	3.9	**1.0**	69	**222**	**7**	NC
Milr-33	28.6	MR	C4	**24**	**14**	**24**	NC	**48**	5.1	**0.0**	**0**	**9**	**20**	NC

(MT DEQ, 2011)

Miller Creek has many sections where banks appear to be eroding excessively. This is the major source of sediment to the stream (DEQ, 2011).

An additional source of sediment is roads. Paved roads can contribute sediment when sanded during the winter months. Unpaved roads, such as the upper portion of Miller Creek Road, private drives, and forest management roads can contribute sediment to the creek and its tributaries throughout the year, especially during higher-intensity convective runoff events (Sugden and Woods 2007). In addition, stormwater runoff from road or other construction projects can carry sediment to the creek unless appropriate best management practices (BMPs) are implemented.

Load Reduction Estimates and Non-Point-Source Management Measures

(EPA Elements b and c)

Temperature

"The most influential non-point source restoration strategy for Miller Creek will be restoring shade-producing vegetation along the whole segment."
Miller Creek TMDL (2007)

During the summers of 2004 and 2007, the DEQ monitored instream temperature at three different locations. 2007 data showed the upper sections of the stream to be cool with a gradual warming in the middle section. The lower mile of Miller Creek experiences significant heating. A thermal infrared flight during the 2004 field season showed a similar warming trend from upstream to downstream on Miller Creek (Figure 9). This temperature gradient also corresponded well to riparian vegetation surveys (Figure 10).

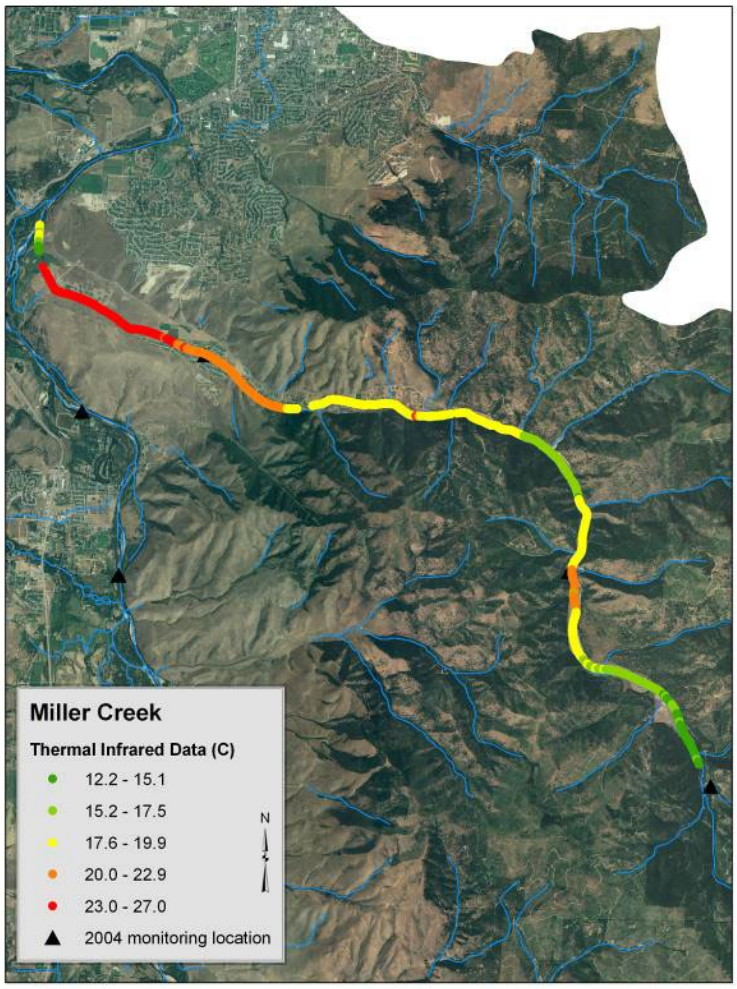


Figure 9: FLIR Stream Temperature Profile 2004 (MT DEQ)

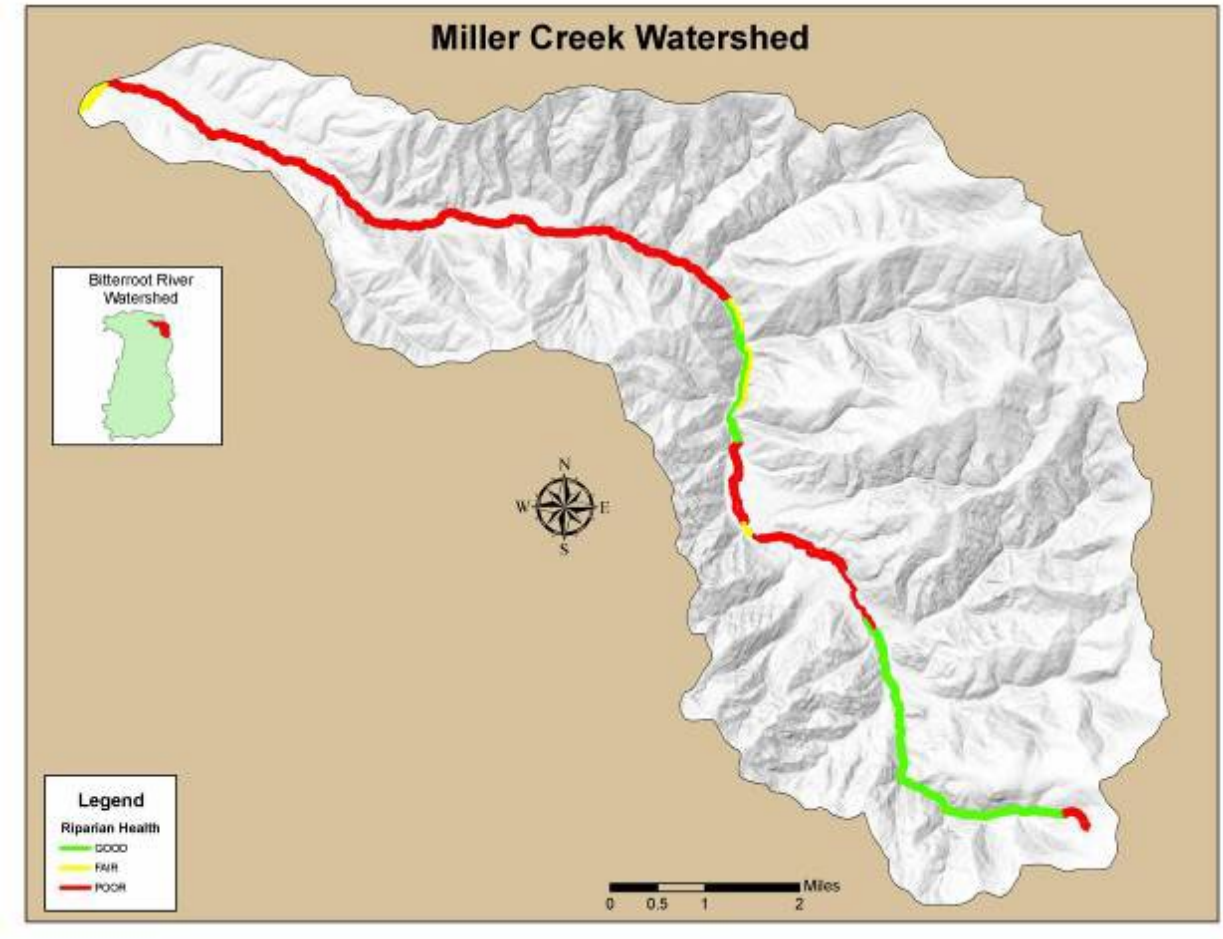


Figure 10: 2007 Riparian Conditions (MT DEQ)

Table 3. Temperature Target and Existing Conditions		
Water Quality Targets	Criteria	Existing Condition
Maximum allowable increase over naturally occurring temperature	B-1 Waters: 1°F maximum increase above naturally occurring water temperature is allowed within the range of 32°F – 66°F; within the naturally occurring range of 66°F – 66.5°F, no discharge is allowed that will cause water temperature to exceed 67°F; where naturally occurring water temperature is >/= 66.5°F, maximum allowable increase is 0.5°F.	QUAL2K modeling indicates Montana's temperature standard is not being met during average summer afternoon conditions. If conditions provided below for sources are met, daily maximum summertime temperatures would likely be reduced by at least 8°F.
OR meet ALL of the temperature influence restoration targets below		
Effective Shade	65% Effective Shade	48% Effective Shade
Channel Width/Depth Ratio	</= 16	9.8 – 48
Irrigation Water Management	15% improvement in irrigation efficiency with water saving applied to in-stream flow mid-June through August.	Irrigation systems need to be assessed on a case-by-case basis.
Irrigation Return Flow	Reduce warm return irrigation water entering stream by 75%.	Unknown

(From Bitterroot TMDL, MT DEQ, 2011)

High temperatures on Miller Creek correspond directly to poor riparian vegetation conditions. A 2005 survey of the banks and adjacent property found that 72% of streambank along Miller Creek had significant anthropogenic effects within 100 feet of the channel. 74% of the banks' riparian areas (27 miles) were rated in fair or poor condition. The focus for watershed restoration on this stream will be improving riparian health. However, other restorative techniques will reduce thermal load to the stream. There are three primary methods for improving temperature conditions on Miller Creek:

- Improve and protect riparian vegetation
- Increase flow
- Improve channel morphology in lower reaches through addition of meanders and woody debris

Increasing stream flow through irrigation efficiency and instream flow leases will put more water in the stream and bring temperatures down. Reducing warm-water irrigation returns may also help mitigate temperature impacts in some locations.

Figure 11: Lower section of Miller Creek was straightened by previous owners and large trees removed.

Physical assessment of the stream shows the lower reach to be partially channelized and separated from its floodplain by low berms in places (Figure 11). The lower reach is starved of large woody debris and is comprised of one continuous riffle. To restore this section of Miller Creek, a combination of fencing, revegetation, addition of large woody debris, passive restoration by elevating the stream bank through use of beaver analogs, and capturing and dispersing sediment will improve both sediment and temperature conditions. Relocation of the stream in order to reconnect it to its floodplains may be necessary in certain reaches. Increasing effective shade to 65% should result in a reduction of stream temperatures by 7.5-8 degrees Fahrenheit, according to the TMDL (DEQ, 2011). Consequently, a major goal of this WRP is to make progress toward achieving 65% effective shade per mile of stream. This will be focused in the lower and middle stream sections, where degradation of riparian vegetation and elevated temperatures are most severe. Physical assessments in the middle section of the stream noted that the stream was overly-wide due to grazing. Some important ways to improve temperature and sediment in these areas are through streamside protection efforts such as providing a buffer between tilled or grazed land and the stream using fences or management practices, and actively replanting some areas where natural regeneration is not likely to be successful in a reasonable timeframe. Some stretches of Miller Creek have conservation easements in place, and finding additional areas for protection could help achieve restoration goals. Planting projects carried out over the larger scale of agricultural lands can be challenging due to the need for watering, weeding and other maintenance for several years. Fencing and other management practice changes that allow natural regeneration may be more feasible and cost effective in many of these areas.

In residential areas, homeowners can be engaged to plant riparian vegetation and/or stop mowing along their stream segment. Providing technical assistance, matching grants and possibly coordinating volunteer labor would facilitate projects on residential lots. Homeowners could then provide for watering and maintenance of the restored vegetation. Technical assistance could help them identify native species that would work well in their landscape. There are three designated common areas that are owned by homeowners associations or the county within the middle reaches that would be ideal targets for restoration efforts (Figure 12).

Figure 12: Common Area of Stillwater Subdivision

Sediment

The major sources of sediment to Miller Creek (Table 5) – eroding banks, roads (including sanding and agricultural access (Figure 13)) and stormwater runoff– can be addressed by a number of restoration measures (Table 6). Many of the measures implemented to address temperature impairment, discussed above, would also be effective in reducing sediment loads to the stream. The primary measures that will be used to address sediment in Miller Creek are:

- Allowing riparian vegetation to regenerate naturally, and/or planting new vegetation where needed
- Modifying channel structure to create more stable banks, and allow access to floodplain (including beaver/beaver mimicry structures and/or woody debris structures)
- Decommissioning unneeded forest roads
- Implementing stormwater BMPs
- Improving agricultural stream crossings
- Upgrading or removing under-sized culverts

Figure 13: Agricultural creek crossing introduces sediment into Miller Creek

Planting and regeneration of riparian vegetation helps to stabilize banks and reduce excessive erosion. Beaver mimicry structures can help slow flow and create areas of aggradation, reducing sediment loading downstream. There are also some locations, including one near the intersection of Horseshoe Lane and Singletree Lane, where it appears the creek has avulsed and lost one or more meanders, due to some combination of flooding and informal flood mitigation (berms and channelization) measures, resulting in instability and excessive erosion. Restoring meanders and woody debris to the system will improve both temperature and sediment regimes.

Decommissioning forest management roads that are no longer needed in the watershed could reduce sediment loading to the creek depending on their condition and proximity to streams. The major forest road landowners and agencies do not have near-term plans for decommissioning, but working with these parties to prioritize and implement decommissioning will be important in the coming years, and at least one landowner has expressed an interest in exploring decommissioning. Water Erosion Prediction Project (WEPP) or USFS Geomorphic Road Analysis and Inventory Package (GRAIP) modeling could be used to help prioritize roads for decommissioning.

Another important periodic source of sediment is stormwater runoff. As the population in Miller Creek is projected to double by 2031 (Linda Vista Estates and Teton Addition Phasing Plans (2015) and adherence to stormwater permit provisions will be important to prevent impacts from construction activities and increase non-point source stormwater runoff as development continues in this fast-

growing area. As this area develops, it will also be important to plan for and mitigate effects of increased impervious area and increased stormwater runoff.

Table 5. Existing and Allowable Sediment Loads				
Sediment Sources		**Current Estimated Load (Tons/Year)**	**Total Allowable Load (Tons/Year)**	**Sediment Load Allocation (% Reduction)**
Roads		27	10	63%
Eroding Banks	Anthropogenically Influenced	1415	792	30%
	Natural	659	659	
Upland Erosion	All Land Uses	131	77	41%
Total Sediment Load		2232	1538	31%

(From Bitterroot TMDL, MT DEQ, 2011)

Temperature and Sediment Restoration Activity

Temperature and Sediment reductions will be primarily addressed through improvement of channel morphology, addition of woody debris to encourage a more natural sediment regime and restoration of riparian vegetation. Restoration measures are outlined in Table 6.

Table 6. Nonpoint Source Management Measures Needed To Address Temperature and Sediment Impairment	
Stream Reach (Mile)	**Restoration Activities**
0-5	Beaver Analog Riparian Planting Irrigation Efficiency Improve channel structure
5-10	Beaver Analog Riparian Planting Improve channel structure
10-15	Riparian Planting Riparian Fencing Decommissioning forest roads Improve channel structure Removing fish-passage barriers
15-18	Decommissioning forest roads Removing fish-passage barriers

Public Outreach and Education

(EPA Element e)

MVWQD met with landowners and in some cases visited properties to see previous restoration projects and get input on priorities for their land and the watershed as a whole. In addition, all landowners living along Miller Creek were sent a letter and survey to introduce the watershed planning process and to get their input regarding what they most value about Miller Creek, and what they think are the major challenges and priorities for the watershed. They were also asked whether or not they would be interested in participating in restoration activities on their land. This input was used in developing this WRP and will be used to identify restoration opportunities when the plan is implemented. The response

rate for this survey was 29.6%. Respondents could select as many values, concerns and restoration interests as desired, so percentages do not add up to 100. The top values that were reported in the survey were scenic (59%) and wildlife (57%). The top issues that respondents felt needed to be addressed were lack of streamside vegetation (45%), low stream flows (38%) and weed management (51%). 83% of survey respondents were willing to participate in restoration activities of some sort on their own property. The projects that garnered the most interest were weed management, stream flow enhancement projects and streamside vegetation restoration. Complete survey results can be found in appendix A.

Future outreach and education activities will be carried out periodically to keep the community informed of the importance of restoration, to encourage participation in restoration activities and to highlight progress toward restoration goals over time. MVWQD has previously carried out education activities in the Miller Creek watershed, and other watersheds, and will continue to provide education and outreach. However, establishment of a citizen-based watershed group for Miller Creek would be a more effective and participatory way to provide ongoing outreach and collective energy for restoration implementation. Alternatively, an existing organization could provide these services. MVWQD will explore interest and capacity for citizen involvement through a new or existing organization as implementation of the restoration plan gets underway.

Education and outreach strategies may include:

- Establishing Miller Creek watershed group or Miller Creek focus within existing group.
- Establishing Facebook page for Miller Creek.
- Presenting to homeowner associations regarding condition issues in the watershed and restoration opportunities for individual properties and common areas.
- Targeted mailing with information on restoration opportunities.
- Restoration project tours to highlight successful efforts in the watershed.
- Engaging students in restoration projects

Table 10. Education and Outreach Activities

Activity	Potential Partners
Miller Cr. Watershed Group	MVWQD, CFC
Miller Creek Facebook Page	MVWQD, new group, CFC
Present to HOAs	MVWQD, CFC, New group
Targeted Mailing	MVWQD
Project Tours	Property owners, MVWQD, CFC, New group
Engage primary/secondary students in restoration	CFC, Watershed Education Network (WEN)

Implementation Schedule

(EPA Element f)

Table 7 shows the proposed schedule for implementation of non-point-source management measures needed over the next five years to progress toward achieving load reductions required by the TMDL. Most of the listed measures will address both sediment and temperature. This schedule is an initial estimate of measures that are achievable in the coming years, and will be modified as restoration progresses. Watershed planning is a dynamic process that evolves as new information becomes available, as opportunities arise and as stakeholder priorities change.

Table 7. Implementation Schedule

Restoration Activity	T	S	H	2018	2019	2020	2021	2022	2023 -
Stream assessments	X	X	X						
Riparian planting	X	X	X						
Riparian Fencing	X	X	X						
Beaver/Beaver Analog Structures/Woody Debris	X	X	X						
Channel Structure Work	X	X	X						
Fish Passage Work			X						
Facilitate Watershed Group Formation	X	X	X						
Presentations to HOAs	X	X	X						
Student restoration work	X	X	X						
Road Decommissioning		X	X						

[T (temperature), S (sediment) or H (habitat) indicates impairments/issues that will be addressed]

Measurable Milestones

(EPA Element g)

Milestones represent targets for the first five years of implementation of WRP. These targets are based on prioritizing the most impacted reaches of the creek, and also potential opportunities for collaboration with interested partners, such as property owners (PO), homeowner associations (HOA), the Clark Fork Coalition (CFC), Trout Unlimited (TU), the Bitterroot Water Forum (BWF) and the Missoula Conservation District (MCD) (Table 8).

Table 8. Measurable Milestones

Milestone	Objective	Segment	Possible Partners
Plant 2500 native riparian trees and shrubs	Reduce summer temperature; provide woody debris; reduce bank erosion; improve channel structure/function	Mile 0 – 3 (from mouth)	HOAs, CFC, BWF, POs
Plant 5000 native riparian trees and shrubs	Reduce summer temperature; provide woody debris; reduce bank erosion; improve channel structure/function	Mile 3 – 10	HOAs, CFC, BWF, POs
Install 4000 feet of riparian fencing	Allow regeneration of riparian vegetation	Mile 0 – 10	BWF, MCD
Install 12 beaver analog structures	Storage; reduce summer temperature; improve channel structure/function; reduce sediment load	Mile 0 – 10 (from mouth)	BWF, CFC, TU, POs
Install irrigation efficiency infrastructure at 2 locations	Increase flow; decrease temperature	Mile 0 – 10 (from mouth)	MCD, CFC, BWF
Reconfigure avulsed section of creek	Improve channel structure/function; reduce bank erosion.	Mile 5 – 10	CFC, Missoula County
Present to 2 HOAs regarding restoration opportunities	Provide education regarding restoration objectives and opportunities		BWF, HOAs
Facilitate formation of Miller Cr.	Provide ongoing grassroots organization to		CFC, BWF, HOAs, POs

watershed group, or inclusion of Miller Cr. focus in existing group	prioritize projects and energize local residents to pursue restoration activities		
Engage 2 classes of students in restoration	Provide education on riparian vegetation and stream health.	0 – 10	CFC, WEN

Resources Needed

(EPA Element c)

Restoration costs are variable, depending on several factors. For example, buying, planting and maintaining new riparian vegetation can be expensive, whereas changing management practices so that vegetation can naturally regenerate over time could be much less expensive. Some organizations have significant volunteer pools that can provide free or low-cost technical assistance and labor, and for smaller scale actions in urban areas, homeowners may be able to provide their own labor and maintenance. Restoration strategies and activities will vary, depending on the needs of each restoration project, and the resources available to those carrying out the restoration.

This WRP provides an estimate of resources needed for different methods at the scales needed to achieve the WRP goals. Table 9 shows estimated resource needs for different restoration activities.

Table 9. Resources Needed

Measure	Treatment Cost per Unit	Units Needed for Goal	Total Cost	Potential Funding Sources
Road assessment and decommissioning	$10,000-$14,000/mile	unknown	n/a	USFS Partnership Grant DEQ 319, SWCDM Ranching For Rivers
Stream Assessment and Prioritization	$10,000	1	$10,000	DNRC Watershed Mgmt. Grant, NFWF Five Star, Trout Unlimited (TU), Montana DNRC Renewable Resource Grant and Loan, Private Funders
Beaver analog structures	$0 - $500 each	unknown	n/a	DEQ 319 Natl. Fish & Wildlife Fndn. (NFWF) Five Star Grant, Private Funding
Vegetation planting (incl. weed/browse protection)	$15 - $20/plant	7,500	$112,000 - $150,000	DEQ 319 NFWF Five Star, Missoula Conservation District, MVWQD, SWCDM Ranching for Rivers
Channel morphology work	$50 - $100/foot	Unknown	n/a	DNRC Watershed Mgmt. Grant NFWF Five Star, Trout Unlimited (TU), Montana DNRC Renewable Resource Grant and Loan
Culvert replacement	$27,000	unknown	n/a	FWP Future Fisheries Grant, Trout Unlimited,
Riparian fencing	$2-$7 per foot	2 - 5 miles	$8,000-$80,000	SWCDM Ranching for Rivers Grant, NRCS EQIP, DEQ 319
Irrigation Efficiency	$10-$50K per project	Unknown	n/a	NRCS EQIP, DNRC RRGL

Technical Assistance

Technical Assistance may be provided by the following:

- Fish Wildlife and Parks Biologist – Fisheries improvement and monitoring
- Missoula County Weed District – Weed management
- Missoula Valley Water Quality District – Groundwater/surface water interactions and restoration
- Clark Fork Coalition – Monitoring and Restoration methodologies, Road Decommissioning
- Trout Unlimited – Fisheries
- Bitterroot Water Forum – Restoration Methodologies
- Lolo National Forest – Hydrology
- DEQ Water Quality Specialist – Water Quality Monitoring
- Missoula Conservation District – Irrigation, Fencing, Agricultural practices

Monitoring Plan and Criteria for Measuring Progress

(EPA Elements h and i)

Information about restoration projects implemented will be tracked and compiled for the entire watershed. Monitoring will be conducted prior to and after restoration project implementation to assess the effectiveness of restoration strategies and guide future projects. Monitoring after restoration will take place at an interval appropriate to the practice to identify improvement over time, and will vary depending on the setting and method used.

Achievement of restoration objectives will be measured over time using the criteria outlined below, as well as additional criteria that may emerge, as restoration progresses.

Temperature Monitoring

Temperatures will be monitored periodically at the locations and approximate dates that were monitored for TMDL development, as well as above and below restoration sites, before and after restoration, when the restoration activity is anticipated to mitigate temperatures. Infrared surveys could be conducted as well if funding becomes available.

Sediment Monitoring

The following parameters were selected based on TMDL methodologies, and will be measured and compared to TMDL targets:

- Riffle Pebble Count using Wolman Pebble Count Methodology and/or 49-point grid tosses
- Residual Pool Depth Measurements
- NRCS Proper Functioning Condition (PFC)
- Bank Assessment for Non-point source Consequences of Sediment (BANCS) model/BEHI – Bank Erosion Hazard Index

Table 11. Monitoring			
Parameter	**Methods**	**Responsible Parties**	**Costs**
Temperature	Direct Measurement including synoptic Infrared Surveys	MVWQD CFC	$40 - $60/hour
Sediment	Riffle Pebble Count/49-point Grid Tosses Residual Pool Depth Measurements WEPP Modeling USFS GRAIP Modeling Macroinvertebrate surveys	MVWQD and others, including UM students	$40 - $60/hour or free
Vegetation	Greenline Assessment Photo Points NRCS Riparian Assessment	MVWQD and others, including UM students	$40-&60/hour or free
Fishery	Inventory fish-passage barriers Monitor WCT genetic composition Assess connectivity with Bitterroot River and wild trout fluvial component	FWP & TU	$50 -$ 60/hour
Education and Outreach	Tracking number of people attending events, receiving educational materials or participating in restoration activities.	MVWQD and others.	$40/hour

Additional information will be collected as needed based on future conditions. Some possible parameters include total suspended solids measurements, surveys of eroding bank areas, width-to-depth ratios, macroinvertebrate studies, and fish population surveys. WEPP road modeling will be used, as appropriate, to estimate expected load reductions from road decommissioning.

Table 12. Criteria for Measuring Progress		
Parameter	*Criteria*	*Timeframe*
Temperature	Reduce high temperature by 1 – 2°F	15 years
Sediment	Reduce sediment loading by 15%	15 years
Vegetation	Increase shade percentage by 10 – 15%	15 years
Fishery	Maintain WCT genetic purity in isolates Expand area of perennial flow in main stem reach Enhance connectivity with Bitterroot River Mitigate fish passage obstructions	15 years
Education and Outreach	>200 people reached Two HOAs participating in revegetation efforts Engaging students from one local school in restoration project	2 years

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Appendix A

Miller Creek Survey Results

Q1 - What is most important to you about Miller Creek?

Code	Response Item	Frequency	Percent
1	Scenic	9	16.67%
2	Fish & Wildlife	7	12.96%
3	Irrigation/Agriculture	1	1.85%
4	Other	5	9.26%
5	All of the Above	4	7.41%
6	Scenic, Fish & Wildlife, and Irrigation/Agriculture	3	5.56%
7	Scenic and Fish & Wildlife	13	24.07%
8	Scenic & Irrigation	1	1.85%
9	Scenic & Other	2	3.70%
10	Fish & Wildlife and Irrigation/Agriculture	1	1.85%
11	Fish & Wildlife and Other	3	5.56%
13	Did not Answer	1	1.85%
14	Scenic, Fish & Wildlife, and Other	4	7.41%
	TOTAL	**54**	

Q2 - What issues do you think need to be addressed to maintain and improve the health of the creek and the watershed?

Code	Response Item	Frequency	Percent
1	More streamside vegetation	2	3.77%
2	Opportunities to increase stream flow	7	13.21%
3	Fencing	0	0.00%
4	Culvert replacement	0	0.00%
5	Weed Management	5	9.43%
6	Other	5	9.43%
11	More streamside vegetation and Opportunities to increase stream flow	1	1.89%
14	More streamside vegetation and Weed Management	7	13.21%
15	More streamside vegetation and Other	2	3.77%
19	Opportunities to increase stream flow and Fencing	1	1.89%
21	Opportunities to increase stream flow and Weed Management	2	3.77%

22	Opportunities to increase stream flow and Other	3	5.66%
26	Fencing & Weed Management	1	1.89%
29	Culvert replacement and Weed Management	1	1.89%
31	Weed Management and Other	2	3.77%
32	Not Answered	2	3.77%
35	More steamside vegetation, Fencing, Culvert replacement and Weed management	1	1.89%
37	More streamside vegetation, Weed management and Other	1	1.89%
39	More streamside vegetation, Opportunities to increase stream flow and Weed management	6	11.32%
40	More steamside vegetation, Fencing and Other	2	3.77%
41	More streamside vegetation, Opportunities to increase stream flow, Fencing and Other	1	1.89%
42	More steamside vegetation, Opportunities to increase stream flow, Culvert replacement and Weed management	1	1.89%
	TOTAL	**53**	

Column1	Response Item	Frequency	Percent
	More streamside vegetation	2	3.57%
	Opportunities to increase stream flow	0	0.00%
	Fencing	1	1.79%
	Culvert replacement	0	0.00%
	Weed Management	8	14.29%
	Other	18	32.14%
	More streamside vegetation and Opportunities to increase stream flow	2	3.57%
	More streamside vegetation and Weed Management	4	7.14%
	More streamside vegetation and Other	2	3.57%
	Opportunities to increase stream flow and Weed Management	2	3.57%
	Fencing & Other	1	1.79%
	Culvert replacement and Weed Management	1	1.79%
	Culvert replacement and Other	1	1.79%
	Weed Management and Other	1	1.79%
	Not Answered	7	12.50%
	More steamside vegetation, Fencing, Culvert replacement and Weed management	1	1.79%
	More streamside vegetation, Weed management and Other	1	1.79%
	More streamside vegetation, Opportunities to increase stream flow and Weed management	3	5.36%

	More steamside vegetation, Opportunities to increase stream flow, Culvert replacement and Weed management	1	1.79%
		TOTAL	**56**

Top Values	
Scenic	59.26%
Wildlife	57.41%

Top Issues to be Addressed	
Streamside vegetation	45.28%
Increased stream flow	37.74%
Weed management	50.94%

Top Issues to be Addressed on Property	
Streamside Vegetation	28.57%
Increased Streamflow	14.29%
Weed management	37.50%
Total interested in projects on property	83.05%