



Paul Parson, PE

Clark Fork Restoration Coordinator

November 1, 2019

Mark Ockey
Water Quality Specialist
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Ockey:

Enclosed is a copy of the FY 2020 319 grant application including:

- Signed Application Form
- Photographs of the project area
- Project Map
- Design Drawings
- Letters of Support

If I can be of further assistance, please contact me directly at 406-543-1192 or via email at pparson@tu.org.

Kindest Regards,

Paul Parson



2020 319 Application Form

PART A—GENERAL INFORMATION

Project Name Upper Ninemile Creek Placer Mine Reclamation Reach 4-5

Sponsor Name Trout Unlimited

Registered with the Secretary of State?

Registered with SAM?

Duns # 051698132

Does your organization have liability insurance?

Primary Contact Paul Parson

Signatory Paul Parson

Title Middle Clark Fork Restoration Coordinator

Title Middle Clark Fork Restoration Coordinator

Address 312 N. Higgins Ave. Suite 200

Address 312 N. Higgins Ave. Suite 200

City Missoula State MT Zip Code 59802

City Missoula State MT Zip Code 59801

Phone Number 406.218.8635

Phone Number 406.218.8635

Email Address pparson@tu.org

Email Address pparson@tu.org

Signature **Paul Parson**
Digitally signed by Paul Parson
 DN: cn=Paul Parson, o=Trout Unlimited, ou,
 email=pparson@tu.org, c=US
 Date: 2019.11.01 13:43:26 -0600

Signature **Paul Parson**
Digitally signed by Paul Parson
 DN: cn=Paul Parson, o=Trout Unlimited, ou,
 email=pparson@tu.org, c=US
 Date: 2019.11.01 13:43:48 -0600

Technical and Administrative Qualifications

Trout Unlimited has experience with managing reclamation projects throughout the West. The project team will be lead by Paul Parson, a Civil Engineer with over 15 years of experience surveying, designing, permitting and managing the construction of stream, floodplain and mining reclamation projects. Additionally, Catherine Redfern is the Trout Unlimited grant accountant with over 12 years of grant management and will be assisting with reporting and accounting.

The design team includes River Design Group and Geum Environmental. This team has successfully implemented large scale projects in the Ninemile Valley and throughout Montana, including the Milltown Dam removal and the Mike Horse mine.

Past and Current Projects

Project Name	Grant or Contract Amount	Funding Entity (<i>entity name/program, contact person, phone, email</i>)	Completion Date
Placer Mine Reclamation in Ninemile Creek Mainstem (3 reaches)	\$ 1,130,000.00	DEQ 319 Eric Trum 406.444.0531 etrum@mt.gov	2014 2016 2018
Placer Mine Reclamation in Ninemile Creek Mainstem	\$ 850,000.00	Montana DNRC-Missoula County Heidi Anderson Fohnagy, RDG Program Manager 406 444.6691 hfohnagy@mt.gov	2014 2016
Flat Creek Mine Cleanup	\$ 720,000.00	R-1 USFS Bob Wintergerst, R-1 Environmental Engineer c: 406-544-1438 robert.wintergerst@usda.gov	2018-present

FUNDING REQUEST

319 Funds Requested (<i>including administrative fee</i>)	\$ 300,000.00	Administrative Fee (<i>not to exceed 10% of total 319 funding request</i>)	\$ 30,000.00
State Cash Match	\$ 440,000.00	Total Non-Federal Match	\$ 481,000.00
Local Cash Match	\$ 20,000.00		
In-Kind Match	\$ 21,000.00		
Federal Funds			
Other Funds (<i>not 319, not match, not federal</i>)	\$ 0.00		
Total Project Cost	\$ 1,500,000.00		

PART B—PROJECT INFORMATION

Part B must be filled out separately (*including providing separate attachments*) for each project included in your application. Use the following examples to help determine when to lump and when to split projects. If additional clarification is needed, contact Mark Ockey, at 406-444-5351 or mockey@mt.gov.

Splitting Examples (fill out multiple Part B's)

- Stream restoration work occurring on two separate streams, on parcels owned by two separate individuals
- Two projects with significantly different sets of project partners
- Two projects that address substantially different pollution sources (e.g., one project that moves a corral off of a stream, and another to remove mine tailings, with both projects being on the same 800-acre recreational property)

Lumping Examples

- Contiguous stream restoration work spanning multiple land parcels
- 3 projects that address similar sources of pollution on a single land parcel (e.g., moving a coral off a stream, implementing a grazing management plan, and relocating a manure storage facility out of the floodplain, all on the same ranch)
- A mini-grant program designed to address numerous failing septic systems scattered throughout a watershed

Project (sub-project) Name Ninemile Placer Mine Reclamation Reach 4-5

Total Project Cost Include costs already incurred, as well as anticipated costs, from all sources, for all aspects of the project.

\$ 1,500,000.00

Latitude 47.207958° Longitude -114.620605°

Latitude _____ Longitude _____

Latitude _____ Longitude _____

Map Y

12 Digit HUC #(s) 170102040302

Waterbody Name from 2018 List of Impaired Waters Ninemile Creek

Probable Causes of Impairment to be Addressed Sedimentation/Siltation

Waterbody Name from 2018 List of Impaired Waters _____

Probable Causes of Impairment to be Addressed _____

Project Summary - Briefly describe the **nature and extent** of the problem, the **root causes** of the problem, and your **proposed solution**.

The Ninemile Creek valley and tributaries have a long history of mining, agriculture and resource extraction in . Records indicate that a gold boom occurred on Ninemile Creek between 1874 and 1877. Placer mining, including large scale dredge mining, continued in the watershed until the 1940s and then resurfaced in the 1970s and 1980s.

Nearly five miles of Ninemile Creek and the confluence areas with four major tributaries - estimated at more than 500 acres - have been dredged and placer mined. Problems include piles of placer mine tailings that range from 6 to 40 feet tall, a lack of floodplain connectivity and excessive erosion. Large settling ponds dot the landscape and riparian vegetation throughout the site is insufficient to maintain adequate bank stability, provide shade, and filter out sediments and other pollutants from the stream. The valley bottom was essentially turned upside down during the mining process. Because subsurface fines and small gravels were washed away downstream as part of the processing, what remains are large piles of coarse cobble and boulders which confine the stream channel and have been slow to revegetate. Bank erosion surveys show that an estimated 2,850 tons per year of sediment is entering the stream due to mining impacts. The intent of the project is to reclaim the mine damage and return Ninemile Creek, it's tributaries, floodplain and wetlands to a self maintaining, naturally functioning system that will protect water quality.

The proposed Upper Ninemile Placer Mine Reclamation Project along reaches 4 and 5 is a multi-phased approach. The solution includes the removal and regrading of approximately 260,000 cubic yards of remnant dredge piles that confine Ninemile Creek and the surrounding area. Through the regrading process, a new stream channel will replace the existing downcut-straightened channel and wetland and riparian habitat will be created in a newly graded floodplain, essentially replacing the existing piles of placer mine overburden and stagnant dredge ponds. The combined phases will create approximately 41 acres of floodplain and riparian area with approximately 7,500 feet of properly graded sinuous stream channel from the confluence with the Burnt Fork down to the confluence with Soldier Creek.

Continuation of previous or ongoing activity? If "Yes", please explain the relationship.

This will be the third and fourth phase of a 6 phase multi-year effort to mitigate sediment loading caused by historic placer mining along Ninemile Creek. The project team completed the first phase in 2014 providing a template for placer mine reclamation along the remaining sediment loading reaches of Ninemile Creek. Phase 2 was completed along reach 3 in the Fall of 2016 and included the creation of 3,300 feet of Ninemile Creek, floodplain, wetlands and the reconnection of two previously reclaimed tributaries, Martina Creek and Mattie V Creek. This proposed third and fourth phase continues downstream from the confluence with Burnt Fork Creek and moves downstream 3,500 feet to the confluence with the previously reclaimed tributary, Twin Creek (phase 3) and subsequently reclaims Ninemile Creek and the floodplain downstream to the confluence with Soldier Creek.

Watershed Restoration Plan (WRP) and authoring entity

Ninemile Creek - Trout Unlimited

Letter of support from WRP authoring entity? If "No", please explain.

Y

How will this project implement recommendations in the WRP?

This project directly implements the WRP recommendations by significantly reducing the sediment loading along Ninemile Creek due to historic placer mining. Through the removal and regrading of the eroding mine piles and significant revegetation along the damaged reaches of Ninemile Creek, the sediment reduction is modeled to be nearly 2,850 tons per year.

Nonpoint Source Goals

The nonpoint source goals for the Ninemile placer mine reclamation project include significant sediment loading reductions through regrading and removal of existing placer mine piles. Additional benefits include increased water storage through floodplain and wetland creation, habitat improvement and educational opportunities.

Partners and Roles

Landowner(s)

Name

Thisted Family

Letter of Support Attached?

 Y

 N

 N

Other Partners

Name

Role

Letter of Support Attached?

Lolo National Forest	Permitting and technical assistance.
Fish, Wildlife and Parks	Fisheries sampling and funding
University of Montana	Research, monitoring and educational opportunities.
Missoula County-DNRC	Funding, monitoring and public outreach
National Wildlife Federation - Turner Foundation	Funding and public outreach
Westslope Chapter of Trout Unlimited	Volunteer Efforts and funding

 Y

 Y

 Y

 Y

 N

 N

Planning and Coordination

Planning and coordination includes permitting, design development, landowner agreements, volunteer labor recruitment, partnering and collaboration, alignment with watershed planning efforts, procurement and oversight of contractors, etc.

Planning Activities Already Completed	Documentation Attached?
Project Design and Permitting for Phase 3 (Reach 4a and partial 4b)	<input type="checkbox" value="Y"/>
Lidar Mapping and Preliminary Grading Plan for Phase 4 (Reach 4b and 5a)	<input type="checkbox" value="Y"/>
BEHI and Monitoring Plan for Phase 3	<input type="checkbox" value="N"/>
Education (Capstone Students from the U of M School of Forestry are completing Capstone project)	<input type="checkbox" value="N"/>
Consultant Selected for Phase 4	<input type="checkbox" value="N"/>
Contractor Bid for Phase 3 is due November 19, 2019	<input type="checkbox" value="N"/>

Task Description

The final design for the project will include final engineering drawings and design specifications for permitting and construction. More specifically, the design team will build upon the existing grading plan for reach 4 and 5 to develop the construction documents. The final design for reach 4B and portions of reach 5 will also incorporate confluence designs for two tributaries, Twin Creek and Soldier Creek. TU and partners will also evaluate vegetation salvage areas, identify soil borrow sources, delineate jurisdictional wetlands, develop a construction phasing plan and prepare bid documents, required permitting and contracting procedures. The final design will focus on cost effective reclamation implementation to provide a self sustaining, naturally functioning river corridor.

Trout Unlimited will lead the contracting and procurement of the project.

Deliverables

Planning and coordination deliverables include the final construction documents in both hard copy and electronic format for the Ninemile Creek reclamation project within reach 4b and 5. The construction documents will include the final design construction plans, vegetation salvage identification, construction phasing plan, engineer's estimate, permits and construction bid documents.

Additionally, the landowner agreements and contracting documents will be delivered to DEQ for phases 3 and 4.

Funding

319 Funds	<input type="text" value="\$ 20,000.00"/>
Non-Federal Match	<input type="text" value="\$ 15,000.00"/>
Federal Funds	<input type="text" value="\$ 0.00"/>
Other Funds	<input type="text" value="\$ 0.00"/>
Total Cost	<input type="text" value="\$ 35,000.00"/>
Is Match Secured	<input type="checkbox" value="Y"/>

Timeline June 2020-May 2022

Match Source DNRC

Project Implementation

Task Description

The project implementation will include regrading of approximately 260,000 cubic yards of dredge overburden, based upon the preliminary grading plan within the identified areas of reach 4 and 5a. Approximately 7,500 feet of stream channel will be reconstructed with an average slope of 1% and a belt width of 125 to 300 feet. The channel will be a C3-4 stream type with a sinuosity of 1.4 to 1.5. The project will also include reclamation work on Burnt Fork Creek at the confluence with Ninemile Creek and will tie in to the existing reclaimed confluence with Twin Creek and the confluence with Soldier Creek. Phase 3 will be completed in 2020 and Phase 4 will be completed in 2021.

The implementation will be similar to the previous phases of reclamation on Ninemile Creek directly upstream of this reach. The initial work on the project will include woody debris and stream substrate salvage while simultaneously regrading the existing mine waste piles and dredge ponds into the new valley and floodplain configuration. The project will include stable channel construction and wetland creation with large woody debris for stability and habitat and appropriate vegetative remediation including sod and brush transplants, willow cuttings, pine, larch and cottonwood seedlings, and native nursery container stock.

Deliverables

Deliverables for this task include the creation of floodplain through the regrading of placer mine piles and dredge ponds and the construction of approximately 7,500 feet of Ninemile Creek. The deliverable will also include the reconnection of Burnt Fork creek and Twin creek with revegetation and creation of off-channel wetland areas.

Funding

319 Funds	\$ 245,000.00
Non-Federal Match	\$ 430,000.00
Federal Funds	\$ 0.00
Other Funds	\$ 0.00
Total Cost	\$ 675,000.00
Is Match Secured	Y

Timeline June 2020 - December 2021

Match Source DNRC

Appropriate Next Step

The next step will be the continuation of work for approximately two more phases. As the work continues downstream, the placer mine piles decrease in magnitude, therefore work is projected to become more cost effective per linear foot of reclamation work.

Additionally, Trout Unlimited will continue to engage the landowners, public and provide educational opportunities on the restored sites.

Sustainability

The project partners in conjunction with the landowners continue to monitor and maintain the previously restored reaches of Ninemile Creek. With proper project design and implementation, the stream channel and riparian corridor will continue to evolve into a more vegetated and dynamic system. Beaver colonies continue to expand into previously restored reaches of Ninemile Creek, providing sustained resiliency and water storage for the watershed.

Natural Processes

Natural processes are a continual goal for the project partners with an eye for long term sustainable watershed. The current design concepts provide for natural processes with connected floodplains, designed wetland and side channels along with riparian vegetation. The designs and construction will allow for frequent flooding which introduces organic material and seed sources to the floodplain and wetland systems.

Beaver colonies exist above the damaged reaches of Ninemile Creek but cannot sustain in the mined reaches due to the straightened channels, lack of floodplain and non-existent vegetation. With proper project implementation, the natural process includes beaver recolonization along the restored reaches.

Project Effectiveness Evaluation

Task Description

The project effectiveness evaluation for the project will include post-project sediment load calculations. The project team has completed bank erosion surveys for nearly 5 miles of the Upper Ninemile Creek mining area. Post-project monitoring will be compared to pre-project data to estimate sediment load reductions. Vegetative success will also be monitored along streambank, riparian and wetland transects. Additionally, photopoints will be established and UAV flights will be utilized to record pre and post project conditions.

A collaborative effort with the University of Montana is currently underway to establish long term monitoring of reference, reclaimed and disturbed reaches on the main-stem of Ninemile Creek. The monitoring includes macro-invertebrate sampling, habitat structure (quantity and quality), temperature evaluation and substrate analysis.

Deliverables

Project effectiveness evaluation will include bank erosion surveys to provide post project sediment load results. Additional deliverables will include vegetative success and results obtained through efforts with the University of Montana. These efforts include macro invertebrate population analysis, habitat structure surveys, temperature and substrate analysis. Photologs with date and location will document pre and post-project conditions.

Funding

319 Funds	\$ 2,500.00
Non-Federal Match	\$ 5,000.00
Federal Funds	\$ 0.00
Other Funds	\$ 0.00
Total Cost	\$ 7,500.00
Is Match Secured	Y

Timeline June 2020 - May 2022

Match Source FWP

The Bigger Picture

Other Natural Resources

The Ninemile placer mine reclamation project has proven to benefit natural resources. Through proper channel, floodplain and wetland creation, the project not only mitigates sediment and temperature loading to Ninemile Creek, but also provides for enhanced ecosystem connectivity and habitat. The University of Montana has documented increases in macro-invertebrate populations, song bird populations and diversity in plant communities. Additionally, the Lolo National Forest and Trout Unlimited have seen an increase in wild trout spawning within the restored reaches. Beaver have recolonized the Phase 1 restoration project.

Climate Resiliency

The mitigation activity increases climate resiliency as a whole. More specifically the landowners and community members will benefit directly with decreased peak runoff, floodplain storage and increase in drought resiliency. Additionally, students and community members will benefit through education and outreach opportunities to learn about the benefits of properly functioning streams, floodplains and wetlands. Agricultural land owners downstream will realize benefits associated with aquifer storage and the subsequent increased late season flow. The associated storage and constructed floodplain are shown to provide over 1 acre-foot/day for every mile of stream channel-floodplain restored. This increase in late season flow will mitigate crop loss.

Public Visibility

The Ninemile projects have been increasingly accessible to the public as the landscape continues to improve. In 2018-2019, Trout Unlimited provided over 15 site visits to various groups, including students, landowners, interested citizens, volunteers, project partners and agencies. Anglers have recently discovered the restored reaches to be a destination and are frequently seen on the project sites during the summer. Multiple articles have been written in the Missoulian and Missoula Current and a short film titled "Rewinding a River" documenting the Ninemile work and won best labs film at the International Wildlife Film Festival in 2017.

Point Source / Nonpoint Source Relationships

N/A

Source Water Protection

N/A

Healthy Watersheds

N/A

PART C—EDUCATION AND OUTREACH

Task Description

TU will work with local organizations and press to educate the community about the project through site tours, presentations and earned media. The WRP for Ninemile Creek also identifies a need for landowner outreach and project development on private land. Under this grant, TU will contact landowners to further develop projects that focus on establishing riparian buffers and other water quality improvement projects on agricultural and residential properties.

In addition, TU will continue to coordinate efforts with several programs from the University of Montana including restoration ecology and stream entomology.

Deliverables

TU will conduct site tours to showcase past projects and existing damage within the project area to show reclamation success and future projects. TU will also provide presentations to local community groups, landowners and government officials. Trout Unlimited will work with agricultural landowners to provide best practice solutions and technical support.

While working with the University of Montana, TU will help coordinate field trips, labs, guest lecturing, mentoring and evaluating monitoring proposals.

Funding

319 Funds	\$ 2,500.00
Non-Federal Match	\$ 5,000.00
Federal Funds	\$ 0.00
Other Funds	\$ 0.00
Total Cost	\$ 7,500.00
Is Match Secured	Y

Timeline June 2020 - May 2022

Match Source Turner Foundation - National Wildlife Federation

PART D—PROJECT ADMINISTRATION

Task Description

Project administration will include project management, contracting, billing and grant reporting over the three year grant contract.

Deliverables

Task 6 deliverables include status reports, annual reports, final report as well as billing and contract management.

Funding

319 Funds	\$ 30,000.00
Non-Federal Match	\$ 20,000.00
Federal Funds	\$ 0.00
Other Funds	\$ 21,000.00
Total Cost	\$ 71,000.00
Is Match Secured	Y

Timeline June 2020 - May 2022

Match Source DNRC and Trout Unlimited

Declaration Form Dark Money Spending Disclosure Requirements

Contracting Entity shall comply with the State of Montana [Executive Order No. 15-2018](#) requiring the disclosure of dark money spending.

Definitions. As used in this declaration form, the following definitions apply:

Electioneering Communication: A paid communication that is publicly distributed by radio, television, cable, satellite, internet website, mobile device, newspaper, periodical, billboard, mail, or any other distribution of printed or electronic materials, that is made within 60 days of the initiation of voting in an election in Montana, that can be received by more than 100 recipients in the district in Montana voting on the candidate or ballot issue, and that:

- a. refers to one or more clearly identified candidates in that election in Montana;
- b. depicts the name, image, likeness, or voice of one or more clearly identified candidates in that election in Montana; or
- c. refers to a political party, ballot issue, or other question submitted to the voters in that election in Montana.

The term does not mean:

- a. a bona fide news story, commentary, blog, or editorial distributed through the facilities of any broadcasting station, newspaper, magazine, internet website, or other periodical publication of general circulation unless the facilities are owned or controlled by a candidate or political committee;
- b. a communication by any membership organization or corporation to its members, stockholders, or employees;
- c. a commercial communication that depicts a candidate's name, image, likeness, or voice only in the candidate's capacity as owner, operator, or employee of a business that existed prior to the candidacy; or
- d. a communication that constitutes a candidate debate or forum or that solely promotes a candidate debate or forum and is made by or on behalf of the person sponsoring the debate or forum.

In this definition, the phrase "made within 60 days of the initiation of voting in an election" means:

- a. in the case of mail ballot elections, the initiation of voting occurs when official ballot packets are mailed to qualified electors pursuant to [13-19-206](#), MCA; or

- b. in other elections the initiation of voting occurs when absentee ballot packets are mailed to or otherwise delivered to qualified electors pursuant to [13-13-214](#), MCA.

Contracting Entity: A bidder, offeror, or contractor.

Covered Expenditure means:

- a. A contribution, expenditure, or transfer made by the Contracting Entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control, that:
 - i. is to or on behalf of a candidate for office, a political party, or a party committee in Montana; or
 - ii. is to another entity, regardless of the entity's tax status, that pays for an Electioneering Communication, or that makes contributions, transfers, or expenditures to another entity, regardless of its tax status, that pays for Electioneering Communication; and
- b. The term excludes an expenditure made by the Contracting Entity, any of its parent entities, or any affiliates or subsidiaries within the entity's control made in the ordinary course of business conducted by the entity making the expenditure; investments; or expenditures or contributions where the entity making the expenditure or contribution and the recipient agree that it will not be used to contribute to candidates, parties, or Electioneering Communication.

Solicitation Requirements. The Contracting Entity shall disclose Covered Expenditures that the Contracting Entity has made within two years prior to submission of its bid or offer.

The disclosure of Covered Expenditures is only required by the bidder/offeror whenever the aggregate amount of Covered Expenditures made within a 24-month period by the bidder/offeror, any parent entities, or any affiliates or subsidiaries within the bidder/offeror's control exceeds \$2,500.

If the bidder/offeror meets the disclosure requirements, the bidder/offeror shall submit this signed declaration form indicating "Yes" AND the required disclosure form with its bid/proposal.

If the bidder/offeror does NOT meet the disclosure requirements, the bidder/offeror shall submit this signed declaration form with its bid/proposal indicating "No."

Annual Contract Requirements. The Contracting Entity agrees that if awarded a contract and the contract term exceeds, or has the potential to exceed 24 months, it must annually review and complete a new declaration form and disclosure form, if necessary.

Yes- I have read, understand, and meet the disclosure requirements for the 24 months immediately preceding the submission of this form. I will complete the necessary disclosure form and submit it with this form.

Company Name (Clearly Printed):

Authorized Signature:

Date: _____

No - I have read, understand, and do NOT meet the disclosure requirements. I certify that the Contracting Entity has not made Covered Expenditures in excess of \$2,500 in the 24 months immediately preceding the submission of this form.

Company Name (Clearly Printed):

Trout Unlimited

Authorized Signature:

Matthew Renaud

Date: 23 January, 2019

Letters of Support

Letters of Support

Betty Thisted
28850 Ninemile Road
Huson, Montana 59846

Robert Ray
319 Grant Program
Montana DEQ
1520 E. Sixth Avenue
P.O. Box 200901
Helena, Montana. 59620-0901

Dear Mr. Ray,

As an owner of patented mining claims on Ninemile Creek and Josephine Creek, and a long time resident of the valley, I am keenly aware of the impact historic mining has had on the Ninemile Creek watershed. I and my late husband, Ralph Thisted have been working with Trout Unlimited and partners for a number of years to support their reclamation efforts on Ninemile Creek. I continue to lend my support of reclamation efforts by Trout Unlimited as I am deeply interested in restoring the Creek and surrounding land to it's original condition in order to benefit fisheries and wildlife habitat.

I have worked with Trout Unlimited on past successful reclamation projects in the valley's watershed, including Mattie V Creek and Twin Creek. I believe Trout Unlimited's efforts to reclaim historic mining areas is important not just to the valley but to it's overall significance in the stream flow into the Clark Fork of the Columbia.

Thank you for your time and efforts expended in this matter.

Sincerely,
Betty Thisted



Ben Colman
ECOSYSTEM AND CONSERVATION SCIENCES
32 CAMPUS DRIVE
MISSOULA, MT 59812

ben.colman@umontana.edu
TELEPHONE (406) 243-6315
FAX (406) 243-6829
October 23, 2019

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Ray:

Please accept this letter as our endorsement of the Upper Ninemile Creek reclamation project in the Ninemile Creek watershed. Trout Unlimited is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

Trout Unlimited (TU), Missoula County, Montana DNRC, Montana FWP, as well as the Lolo National Forest have been working on cooperative projects in the Ninemile Creek drainage for over a decade. This broad-based group also includes private landowners, state agencies, watershed groups, volunteers, and other conservation organizations. To date, the cooperative effort has led to the reclamation and reconnection of eight tributary streams and three reclamation phases on Ninemile Creek, with survey and design efforts on two other tributaries ongoing. TU has dedicated staff time and financial resources to these and other projects in the drainage and raised more than \$2 million for mine reclamation and watershed restoration in the area.

Here at UM, we use the Ninemile restoration site to train undergraduates in three of our undergraduate majors: Ecosystem Science and Restoration; Wildlife Biology; and Environmental Studies. The site serves as a natural laboratory to assess the intersection between resource extraction, water quality, and restoration. Classes visit the site for field trips and for research projects. Students that have gone to the site for field trips with Paul Parson and TU consistently rank it as their top field trip experience during their time at UM.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing for nearly eleven years, and this grant continues the large-scale implementation effort to rehabilitate nearly five miles of the creek. Funds from the NPS Program are essential to completing on-the-ground reclamation projects and will be matched by state, federal and private funds.

Sincerely,

Ben Colman, PhD
Assistant Professor of Aquatic Ecosystem Ecology

October 18, 2019

Diana Six, PhD
Professor of Forest Entomology
Chair, Department of Ecosystem and Conservation Sciences
University of Montana, Missoula
Diana.six@cfc.umt.edu

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Ray:

Please accept this letter supporting the reclamation project in the Ninemile Creek watershed. Trout Unlimited is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

As you are aware, planning, monitoring, and data collection on the main stem of Ninemile Creek have been ongoing for nearly ten years. Uninterrupted data collection is integral to the success of the project. It is also integral to adaptive management and restoration approaches.

I am currently participating in the project as part of my aquatic invertebrate ecology course and the ecological restoration major at the University of Montana. We are using the Ninemile restoration site to train undergraduates in our restoration ecology and wildlife biology programs on the use of macroinvertebrates to assess stream quality and efficacy and value of restoration efforts. This project is an integral part of the lab of my course as well as for the capstone and practicum training which combines training in taxonomy and ecology with field experience.

We are using DEQ protocols and will be monitoring the project over the long term (assessments will be made annually, we hope, for at least ten years). We are in our fifth year of monitoring. The students are extremely engaged because the project is 'real science' and they feel so excited to be part of something that is making a difference. Support for this project will allow us to continue our monitoring and education efforts. In turn, our data sets and analyses will be shared with TU to support the project.

Sincerely,





October 14, 2019

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Ray:

Please accept this letter as the Lolo National Forest's endorsement of the Upper Ninemile Creek reclamation project in the Ninemile Creek watershed. Trout Unlimited, working with the Lolo National Forest, Missoula County, private landowners, State agencies, watershed groups, volunteers, and other conservation organizations have been working on cooperative projects in the Ninemile Creek drainage for over a decade. To date, over two miles of Ninemile Creek have been reclaimed and eight tributaries reconnected. TU has dedicated staff time and financial resources to these and other projects in the drainage and raised more than \$3 million for both placer and hard rock mine reclamation and stream restoration.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing with multi-fold benefits. A recent highlight exceeded our expectations – we now have quantitative results of increased stream baseflow discharge as a result of increased water table and floodplain water storage. With your continued support we will carry on our goals of sediment reductions, native fish connectivity, habitat improvement, and further contributions towards education and community involvement.

We are very grateful for the Montana Department of Environmental Quality's past support of this important endeavor, which is causal to discernable influences positively affecting aquatic resources, water quality, the local restoration industry, and jobs. Funds from the NPS Program are essential to continuing and completing these efforts and are matched by state, federal and private funds. Thank you for your consideration.

Sincerely,

/s/ Traci Sylte

Traci L. Sylte, PE
Water, Soils, and Fisheries Program Manager
Lolo National Forest





Region 2 Headquarters
3201 Spurgin Road
Missoula, MT 59804
Phone 406-542-5500
October 16, 2019

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Dear Mr. Ray:

Please accept this letter of support for continued remediation and restoration work in the Upper Ninemile Creek watershed. Trout Unlimited (TU) is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

TU, Missoula County, the Lolo National Forest, and Montana Fish, Wildlife, and Parks have been working on cooperative projects in the Ninemile Creek drainage for over a decade. This broad-based group also includes private landowners, state agencies, watershed groups, volunteers, and other conservation organizations. To date, the cooperative effort has led to the reclamation and reconnection of eight tributary streams and three reclamation phases on Ninemile Creek, with survey and design efforts on two other tributaries ongoing. TU has dedicated staff time and financial resources to these and other projects in the drainage and raised more than \$2 million for mine reclamation and watershed restoration in the area.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing for nearly 11 years, and this grant would continue the large-scale implementation effort to rehabilitate nearly five miles of the creek. Funds from the NPS Program are essential in completing on-the-ground reclamation projects and will be matched by state, federal and private funds.

Please give this funding application strong consideration and feel free to contact me if you would like more information related to aquatic resources in the Ninemile Creek watershed.

Sincerely,

William Ladd Knotek
Fisheries Management Biologist



Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

October 22, 2019

Dear Mr. Ray:

Please accept this letter as our enthusiastic endorsement of the Upper Ninemile Creek reclamation project in the Ninemile Creek watershed. Trout Unlimited is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

Trout Unlimited (TU), Missoula County, Montana DNRC, Montana FWP, and the Lolo National Forest have been working on cooperative projects in the Ninemile Creek drainage for over a decade. This broad-based group also includes private landowners, watershed groups, volunteers, and other conservation organizations. To date, the cooperative effort has led to the reclamation and reconnection of eight tributary streams and three reclamation phases on Ninemile Creek, with survey and design efforts on two other tributaries ongoing. TU has dedicated staff time and financial resources to these and other projects in the drainage and raised more than \$2 million for mine reclamation and watershed restoration in the area.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing for nearly eleven years, and this grant continues the large-scale implementation effort to rehabilitate nearly five miles of the creek. Funds from the NPS Program are essential to completing on-the-ground reclamation projects and will be matched by state, federal and private funds.

Sincerely,

Chet Crowser
Community and Planning Services Officer

CC:

Missoula County Board of County Commissioners
Kylie Paul, Natural Resource Specialist, Missoula County CAPS

David D. Pontrelli
28235 Ninemile Road
Huson, MT 59846

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

October 14, 2019

Dear Mr. Ray:

Please accept this letter as my personal endorsement for the Upper Ninemile Creek reclamation project in the Ninemile Creek watershed. Trout Unlimited is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

Trout Unlimited (TU), Missoula County, several private consulting firms, as well as the Lolo National Forest have been working on cooperative projects in the Ninemile Creek drainage for over a decade. These projects have resulted in resounding successes thanks in part to this broad-based group including private landowners, state agencies, watershed groups, volunteers, and other conservation organizations. This cooperative effort has led to the reclamation and subsequent reconnection of at least eight tributary streams and three reclamation phases on Ninemile Creek to date. With continued help from the DEQ grant program, hopefully these types of beneficial mining reclamation projects continue in the Ninemile watershed to better enhance Ninemile Creek's vitality as it is of critical importance as a tributary stream to the Middle Clark Fork River system.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing for nearly twelve years. This grant would help continue the large scale implementation effort to rehabilitate nearly five miles of the creek helping to provide watershed connectivity and vital habitat for fish in the Middle Clark Fork River system. Funds from the NPS Program are essential to completing on-the-ground reclamation projects and will be matched by state, federal and private funds.

Sincerely,

David D. Pontrelli
Ninemile Landowner and Conservationist



October 31, 2019

Eric Trum
Water Quality Planning Bureau
Montana Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620

Re: 319 grant for Ninemile Creek Restoration

Eric:

Montana Trout Unlimited heartily endorses the application for Clean Water Act Section 319 funding submitted by the watershed restoration team of our national organization for the third phase of its Upper Ninemile Creek Reclamation Project. We, the grassroots side of TU, work hand-in-glove with our national restoration staff, and highly value the investment they have made in improving watershed and water quality conditions in the Ninemile Creek drainage. One of the largest of our 13 statewide chapters has also invested heavily in numerous phases of this work and is eager to see that work continue. Improvements to Ninemile Creek's water quality and quantity, as well as habitat, which this project will continue to achieve are a great benefit to the Clark Fork fishery and its associated recreational value.

Our investment in the watershed reaches back to small restoration ventures we contributed to back in the early 1990s. The Ninemile Creek watershed was also where we negotiated and implemented the first lease in Montana of a private consumptive water right for instream flows. The Ninemile Creek Reclamation Project has built on those early efforts, but at several orders of magnitude in scale.

The cooperative nature of this project, involving private landowners, the U.S. Forest Service, Missoula County, Montana FWP, Montana DEQ, the local conservation district and watershed group has produced measurable and significant improvements in water quality and fish habitat. This includes reclamation and reconnection of eight tributary streams that were significantly damaged by placer mining, as well as restoration of damaged channel on two large reaches of Ninemile Creek. This 319 grant funding will extend those improvements for an additional mile of Ninemile Creek. Importantly, the 319 grant will enable TU to leverage significant private, county and state funding.

The Ninemile ventures have proven to be excellent investments in reclamation, restoration and water quality improvements. The improvements have been measurable with twelve abandoned mines reclaimed to date. This phase will build on the popular success of years of good work. We urge DEQ to fully fund the request.

Thank you for considering Montana Trout Unlimited's perspective on this valuable work and the reasons it deserves 319 funding. By all means contact me if you have questions.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Brooks', written in a cursive style.

David Brooks
Executive Director, Montana Trout Unlimited

Lisa Eby
Professor of Aquatic Ecology
Ecological Restoration Program Director
University of Montana, Missoula MT 59812

Robert Ray
Water Quality Planning Bureau
Department of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

October 30, 2019

Dear Mr. Ray:

Please accept this letter as our endorsement of the Upper Ninemile Creek reclamation project in the Ninemile Creek watershed. Trout Unlimited is applying for grant funds from the Clean Water Act Section 319 Nonpoint Source (NPS) Program to work with the US Forest Service and private landowners to improve these mine sites, which have severe impacts from historical mining activity, including impaired water quality, altered stream geomorphology and altered hydrology.

Trout Unlimited (TU), Missoula County, Montana DNRC, Montana FWP, as well as the Lolo National Forest have been working on cooperative projects in the Ninemile Creek drainage for over a decade. This broad-based group also includes private landowners, state agencies, watershed groups, volunteers, and other conservation organizations. To date, the cooperative effort has led to the reclamation and reconnection of eight tributary streams and three reclamation phases on Ninemile Creek, with survey and design efforts on two other tributaries ongoing. TU has dedicated staff time and financial resources to these and other projects in the drainage and raised more than \$2 million for mine reclamation and watershed restoration in the area.

Planning, monitoring, and data collection on mainstem Ninemile Creek have been ongoing for nearly eleven years, and this grant continues the large-scale implementation effort to rehabilitate nearly five miles of the creek. Funds from the NPS Program are essential to completing on-the-ground reclamation projects and will be matched by state, federal and private funds. In addition to the excellent restoration work associated with this project, Trout Unlimited has been an integral partner with UM's Restoration Capstone classes and our Aquatic Macroinvertebrate Ecology class. A group of Ecological Restoration students have been using Ninemile Creek to develop macroinvertebrate monitoring protocols, collect data on pre- and post-treatment stream health, and design a volunteer data collection plan. We also regularly have UM volunteer days and tours of the site this fall associated with our 200-level Elements of Restoration Class that are open to any UM student. The site provides UM students with excellent opportunities to learn about mine reclamation, stream restoration, and monitoring. Support for this project will allow future Ecological Restoration students to learn from the site.

Sincerely,

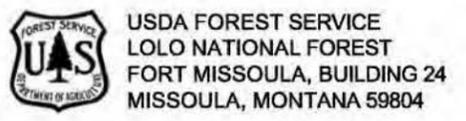
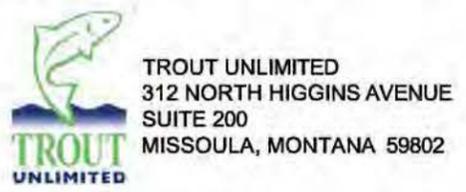


Lisa Eby, Professor of Aquatic Ecology

Maps, Designs, Other Attachments

UPPER NINEMILE CREEK - HOUSUM PLACER RESTORATION PROJECT REACH 3, 4A AND 4B FINAL DESIGN

PROJECT PARTNERS



PROJECT DESCRIPTION

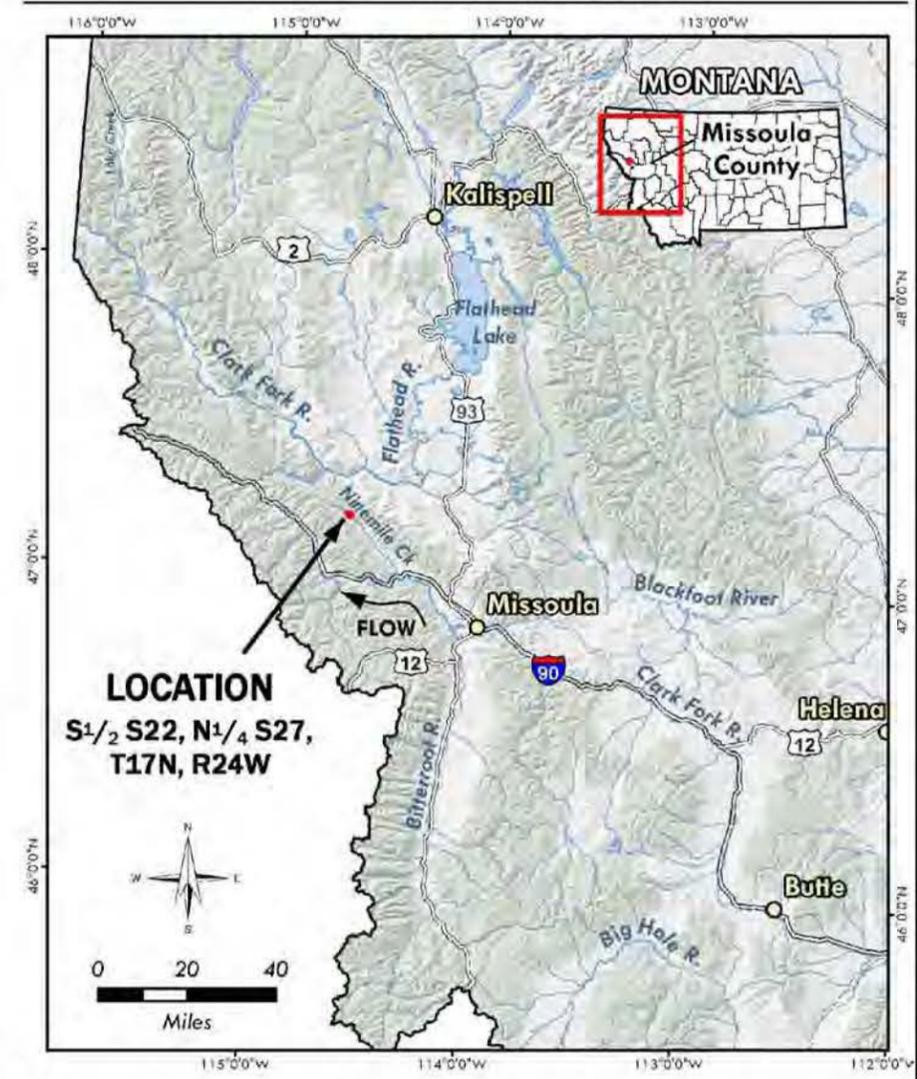
THE NINEMILE CREEK WATERSHED IS LOCATED IN THE MIDDLE CLARK FORK RIVER WATERSHED APPROXIMATELY 20 MILES WEST OF MISSOULA, MONTANA. WITH A CONTRIBUTING AREA OF APPROXIMATELY 186 MI², THE WATERSHED ORIGINATES IN THE NINEMILE AND RESERVATION DIVIDES OF THE LOLO NATIONAL FOREST AND FLOWS 26 MILES TO THE CONFLUENCE WITH THE CLARK FORK RIVER. HISTORICAL MINING ACTIVITIES SIGNIFICANTLY ALTERED THE MORPHOLOGY AND LANDSCAPE OF THE NINEMILE CREEK VALLEY. RECORDS INDICATE THAT A PLACER GOLD BOOM OCCURRED ON NINEMILE CREEK BETWEEN 1874 AND 1977 AND MINING WITH DRAGLINES, DREDGES, HYDRAULIC HOSES AND SLUICING CONTINUED ON NINEMILE CREEK AND PRIMARY TRIBUTARIES UNTIL THE LATE 1940. THE MINING PROCESS REWORKED THE GLACIAL AND FLUVIAL SEDIMENTS COMPRISING THE VALLEY BOTTOM. ALLUVIAL GRAVELS AND COBBLES WERE WORKED INTO NUMEROUS TAILINGS PILES RANGING FROM 10 FEET TO 40 FEET IN ELEVATION ABOVE THE STREAM CHANNEL. MINING ACTIVITIES COMPROMISED THE INTEGRITY OF THE RIVER AND FLOODPLAIN ECOSYSTEM BY SIMPLIFYING AQUATIC HABITAT CONDITIONS, INCREASING STREAM ENERGY, AND REDUCING FLOODPLAIN CONNECTION AND FUNCTION.

IN 2009, TROUT UNLIMITED IN COLLABORATION WITH THE LOLO NATIONAL FOREST INITIATED A PLANNING PROCESS TO EVALUATE RESTORATION FEASIBILITY AND DESIGN AND IMPLEMENT RESTORATION EFFORTS ON A SIX MILE SECTION OF NINEMILE CREEK COMMONLY REFERRED TO AS THE HOUSUM PLACER, A PRIVATE, 250-ACRE MINING CLAIM LOCATED IN TOWNSHIP 17 NORTH, RANGE 24 WEST, IN SECTIONS 21, 22, 23, 25, 26, 27 AND 36. THIS DRAWING SET IS A FINAL DESIGN FOR A 3,575 FOOT SECTION OF NINEMILE CREEK IN REACH 3, REACH 4A AND REACH 4B LOCATED IN TOWNSHIP 17N, RANGE 24 WEST, IN SECTIONS 22 AND 27 OF THE PROJECT AREA, INCLUDING BURNT FORK CREEK. THE GOALS OF THIS PROJECT ARE TO: 1) REHABILITATE STREAM, FLOODPLAIN AND HILLSLOPE PROCESSES IMPAIRED BY PREVIOUS PLACER MINING OPERATIONS; 2) PROMOTE AQUATIC HABITAT CONDITIONS THAT SUPPORT ALL LIFE STAGES OF FISH; AND 3) RECONNECT THE MAJOR TRIBUTARY BURNT FORK CREEK WITH THE MAINSTEM NINEMILE CREEK, AND 4) INCORPORATE THE DESIRES AND NEEDS OF THE LANDOWNERS AND MULTIPLE STAKEHOLDERS.

GENERAL NOTES

1. CONTOUR INTERVAL IS NOTED ON DRAWINGS.
2. SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
3. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED FROM JULY TO SEPTEMBER 2013 AND 2012 LIDAR DATA WAS CREATED IN OCTOBER 2011 AND PROVIDED BY TROUT UNLIMITED. ALL LIDAR DATA WAS COORDINATED BY RDG.
5. ALL EXISTING CONDITIONS ARE TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION AND ANY ADJUSTMENTS TO THE DRAWINGS SHALL BE MADE AS DIRECTED BY THE ENGINEER.
6. EXISTING PRIVATE IMPROVEMENTS, WHICH LIE WITHIN THE CONSTRUCTION LIMITS, UNLESS OTHERWISE NOTED WILL BE REMOVED BY THE OWNER PRIOR TO CONSTRUCTION, OR ABANDONED IN PLACE.
7. PROTECT ALL TREES AND LAND AREAS NOT LOCATED WITHIN THE PROJECT CONSTRUCTION, STAGING OR EARTHWORK LIMITS. EXERCISE CARE IN AREAS NOT SO MARKED TO AVOID UNNECESSARY DAMAGE TO NATURAL VEGETATION.
8. THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS AND EASEMENTS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
9. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK, THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.
10. EXCAVATION SHALL MEET THE REQUIREMENTS OF OSHA 29 CFR PART 1926, SUBPART P, EXCAVATIONS. ACTUAL SLOPES SHALL NOT EXCEED THE SLOPES AS INDICATED ON DRAWINGS.
11. ALL EXCAVATORS AND BULLDOZERS SHALL BE EQUIPPED WITH MACHINE GRADE GPS ((L1/L2/GLONASS)). CONSTRUCTION AREAS WILL BE STAKED OUT PRIOR TO CONSTRUCTION USING SURVEY GRADE GPS (L1/L2/GLONASS).
12. ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
13. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
14. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

NINEMILE CREEK VICINITY MAP

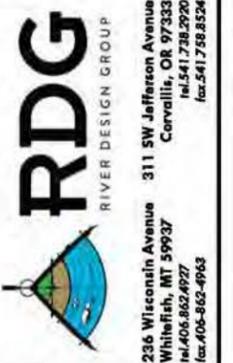


STANDARD OF PRACTICE

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

REUSE OF DRAWINGS

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



COVER SHEET AND NOTES UPPER NINEMILE CREEK RESTORATION PROJECT NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-18	NW	DESIGN	JM
PROJECT NUMBER RDG-19-001				
SHEET NUMBER 1.0				

DRAWING INDEX

- 1.0 COVER SHEET AND NOTES
- 1.1 DRAWING INDEX
- 2.0 EXISTING CONDITIONS - REACH 3, 4A & 4B
- 3.0 SITE PLAN - REACH 3, 4A & 4B
- 3.1 PLAN VIEW INDEX - REACH 3, 4A & 4B
- 3.2 ACCESS, STAGING AND DEWATERING PLAN - REACH 3, 4A & 4B
- 3.3 SPECIFICATIONS
- 4.0 SURVEY CONTROL PLAN - REACH 3, 4A & 4B
- 4.1 PRESERVATION AREAS, VEGETATION AND SOIL SALVAGE AREAS - REACH 3, 4A & 4B
- 5.0 PLAN VIEW AND STRUCTURE LAYOUT - REACH 3 & 4A
- 5.1 GRADING PLAN AND PROFILE - REACH 3 & 4A
- 5.2 PLAN VIEW AND STRUCTURE LAYOUT - REACH 4A & 4B
- 5.3 GRADING PLAN AND PROFILE - REACH 4A & 4B
- 5.4 PLAN VIEW AND STRUCTURE LAYOUT - REACH 4B
- 5.5 GRADING PLAN AND PROFILE - REACH 4B
- 5.6 PLAN AND PROFILE - REACH 4A & 4B SIDE CHANNEL 1 & 2
- 5.7 PLAN AND PROFILE - REACH 4A & 4B SIDE CHANNEL 3 & 4
- 5.8 PLAN AND PROFILE - BURNT FORK CREEK
- 6.0 CROSS SECTIONS - REACH 3 & 4A
- 6.1 CROSS SECTIONS - REACH 4A & 4B
- 6.2 CROSS SECTIONS - REACH 4B
- 7.0 CHANNEL CROSS SECTION DIMENSIONS REACH 3
- 7.1 CHANNEL CROSS SECTION DIMENSIONS REACH 4A-1 & 4B-1
- 7.2 CHANNEL CROSS SECTION DIMENSIONS REACH 4A-2
- 8.0 LARGE WOOD STRUCTURE DETAIL
- 8.1 VEGETATED WOOD MATRIX DETAIL
- 8.2 CONSTRUCTED CHANNEL STREAMBED DETAIL
- 8.3 WILDLIFE SNAG AND BEAVER DAM ANALOG DETAILS
- 8.4 BMP DETAILS
- 9.0 FLOODPLAIN TREATMENT PLAN - REACH 3, 4A & 4B
- 9.1 FLOODPLAIN ROUGHNESS DETAIL
- 10.0 MATERIALS LIST



DRAWING INDEX

UPPER NINEMILE CREEK RESTORATION PROJECT NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-18	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

1.1



RDG RIVER DESIGN GROUP
 236 Wisconsin Avenue
 Whitefish, MT 59937
 tel: 406.862.4927
 fax: 406-862-4963

311 SW Jefferson Avenue
 Corvallis, OR 97333
 tel: 541.738.2920
 fax: 541.758.8524

MATERIALS LIST
 UPPER NINEMILE CREEK RESTORATION PROJECT
 NEAR HUSON, MONTANA

REACH 3, 4A, 4B MATERIALS LIST

Category	Item	Quantity	Units	Diameter	Length
Wood	Category 2 Wood 10"-24" 25'	775	ea	10 in - 24 in	25 ft
	Category 3 Wood 6"-12" 10'-12'L	8,182	ea	6 in - 12 in	10 ft - 12 ft
	Category 4 Wood <6" 8'-12'L	9,545	ea	< 6 in	8 ft - 12 ft
	Riparian Cuttings	26,794	ea	0.25 in	6 ft

Category	Item	Quantity	Units	Quantity	Units
Rock	Category 1 Rock 18"-30"	1,093	ea	137	yd ³
	Category 2 Rock 12" Minus	6,422	yd ³		
	Native Fill	129	yd ³		

Category	Item	Quantity	Units
Earthwork	Cut	72,700	yd ³
	Fill	14,900	yd ³
	Net	57,800	yd ³

Structure Quantities

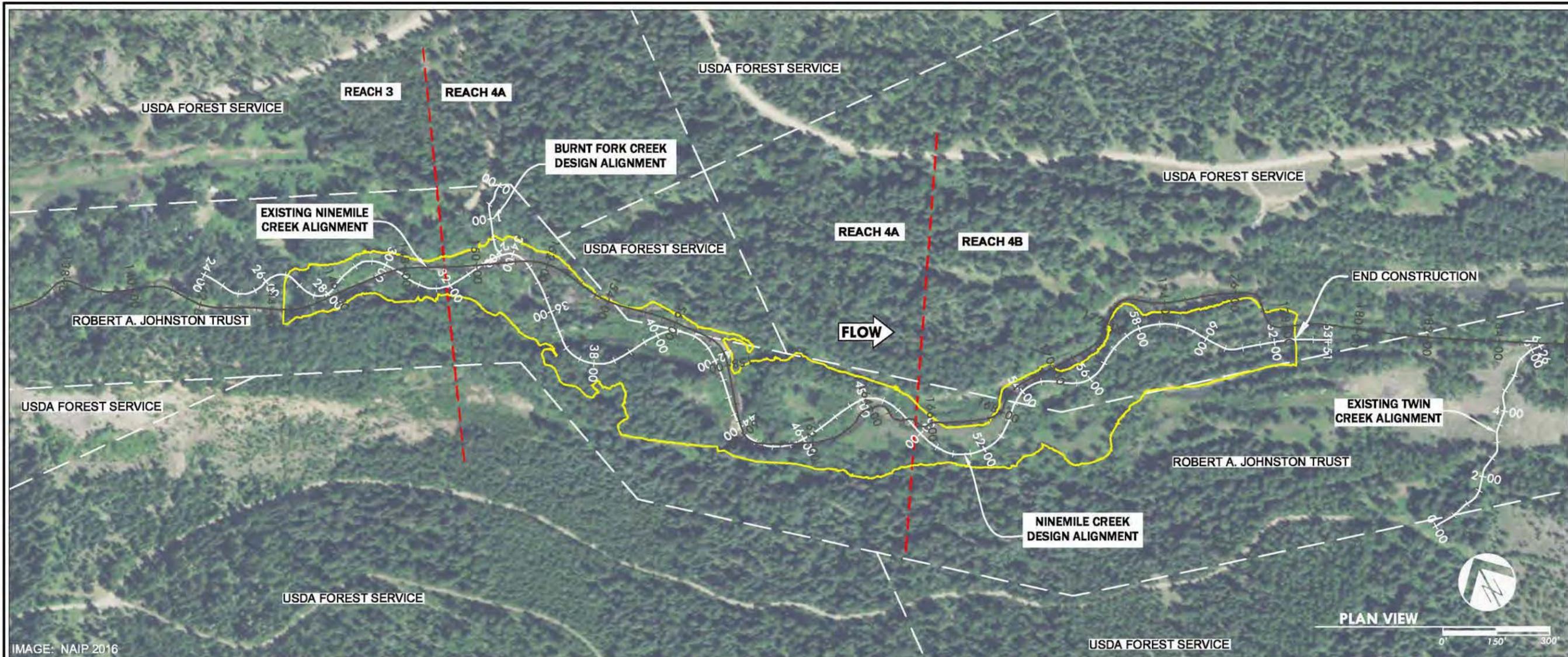
Structure	Quantity	Units
Large Wood Structure	18	ea
Constructed Channel Streambed	2,463	lf
Vegetated Wood Matrix Type 1	4,214	lf
Vegetated Wood Matrix Type 2	1,457	lf
Vegetated Wood Matrix Type 3	837	lf
Beaver Dam Analog	8	ea
Microtopography	10	ac

NO.	DATE	BY	DESCRIPTION	CHK
				JM/GD
1	2-15-18	NW	FINAL DESIGN	

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

10.0



SITE PLAN - 3, 4A & 4B
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

RESTORATION ALTERNATIVES

RESTORATION ALTERNATIVES FOR THE UPPER NINEMILE CREEK-HOUSUM PLACER RESTORATION PROJECT AREA WERE DEVELOPED BY A MULTI-DISCIPLINARY TEAM CONSISTING OF RESOURCE PROFESSIONALS FROM TROUT UNLIMITED, US FOREST SERVICE, RIVER DESIGN GROUP, INC., AND GEUM ENVIRONMENTAL CONSULTING. ALTERNATIVES RANGED FROM NO ACTION (ALTERNATIVE A) TO EXPANDING THE FLOODPLAIN AND CONVERTING THE EXISTING CHANNEL MORPHOLOGY TO A MORE NATURAL STREAM TYPE (ALTERNATIVE E). A PREFERRED RESTORATION SCENARIO WAS DEVELOPED FOR THE PROJECT AREA BY ASSIGNING ALTERNATIVES TO EACH REACH AND SUB-REACH, BASED ON REACH-SPECIFIC LIMITING FACTORS, CONSTRAINTS, AND RESTORATION FEASIBILITY.

RESTORATION OBJECTIVES

THE REACH 3, 4A AND 4B DESIGN ADDRESSES REACH-SCALE LIMITING FACTORS AND CONSTRAINTS IDENTIFIED IN THE 2012 UPPER NINEMILE CREEK-HOUSUM PLACER RESTORATION PROJECT PHASE 1 ALTERNATIVES DEVELOPMENT REPORT (TROUT UNLIMITED, 2012). OBJECTIVES RELATED TO CHANNEL MORPHOLOGY, AQUATIC HABITAT, FLOODPLAIN RESOURCES, AND RIPARIAN VEGETATION CONDITIONS INCLUDE:

- PRODUCE CLEAN WATER CONSISTENT WITH SUPPORTING AQUATIC LIFE AND BENEFICIAL USES.
- CREATE COMPLEX AQUATIC HABITAT COMPONENTS SUCH AS DEPTH, VELOCITY, SUBSTRATE, COVER, AND POOLS THAT SUPPORT POPULATIONS OF WILD TROUT AND OTHER AQUATIC ORGANISMS.
- CONSTRUCT A STREAM CHANNEL THAT IS CONNECTED TO THE FLOODPLAIN AND INTERACTS WITH THE CHANNEL IN TERMS OF SURFACE FLOW AND SEDIMENT AND NUTRIENT EXCHANGE.
- MAXIMIZE RIPARIAN AND FLOODPLAIN HABITATS AND FUNCTIONS.
- INCORPORATE, TO THE GREATEST EXTENT FEASIBLE, HISTORICAL FLOODPLAIN AND TERRACE SURFACES.
- RECONNECT THE BURNT FORK CREEK CONFLUENCE TO IMPROVE FISH PASSAGE AND AQUATIC HABITAT CONDITIONS.
- PRESERVE AS MUCH EXISTING RIPARIAN AND WETLAND AREAS WHILE RESTORING CHANNEL PATTERN AND PROFILE THROUGH THE PROJECT AREA.
- ADD LARGE WOOD TO WETLAND AREAS FOR USE BY AMPHIBIANS AND REPTILES AND IF WETLANDS ARE LARGE, ADD MOUNDS IN THE MIDDLE TO INCREASE DIVERSITY.
- INSTALL INDIVIDUAL SNAGS AND MULTIPLE SNAG "PODS" IN THE FLOODPLAIN TO IMPROVE AVIAN PERCHING AND NESTING HABITAT. SPECIFIC CRITERIA IS INCLUDED IN THE STRUCTURAL DESIGN SHEETS.

RESTORATION TREATMENTS

RESTORATION WORK WILL OCCUR ALONG 3,575 FEET OF CHANNEL BEGINNING UPSTREAM OF THE CONFLUENCE OF BURNT FORK CREEK, AND CONTINUING DOWNSTREAM TO APPROXIMATELY 300 FEET UPSTREAM OF THE CONFLUENCE WITH TWIN CREEK. RESTORATION WORK WILL BE COMPLETED OVER A FOUR MONTH PERIOD AND WILL BE CLOSELY INTEGRATED WITH PRIVATE LANDOWNERS, THE LOLO NATIONAL FOREST, TROUT UNLIMITED, AND PERMITTING AGENCIES. THE PROJECT WILL BE IMPLEMENTED IN TWO PHASES.

PHASE ONE INCLUDES INSTALLATION OF THE CLEARWATER BYPASS CHANNEL TO TEMPORARILY ISOLATE NINEMILE CREEK FROM THE WORK AREA. EXISTING DREDGE PILES WITHIN THE CONSTRUCTION LIMITS WILL BE EXCAVATED AND EXISTING PONDS WILL BE FILLED AS SHOWN ON THE DRAWINGS. THE FLOODPLAIN WILL BE SHAPED TO FINISH GRADE ELEVATION. UNDER PHASE ONE, THE MAINSTEM NINEMILE CREEK WILL BE EXCAVATED TO SUB-GRADE ELEVATION. PHASE ONE WILL ALSO INCLUDE THE CONSTRUCTION OF BURNT FORK CREEK.

PHASE TWO INCLUDES SHAPING OF THE CHANNEL STREAMBED, INCLUDING RIFFLES, RUNS, POOLS AND GLIDES, AND INSTALLING THE CHANNEL ALLUVIUM AND STREAMBANK STRUCTURES. TREATMENTS ARE NATIVE MATERIAL BASED AND DESIGNED TO MIMIC NATURALLY OCCURRING COMPONENTS OF A HEALTHY, FUNCTIONING STREAM CHANNEL AND FLOODPLAIN ECOSYSTEM. STREAMBANK TREATMENTS WILL BE COMPOSED OF WOOD, ALLUVIUM, AND VEGETATION, AND WILL INCREASE BANK RESISTANCE TO EROSION, PROVIDING FOR SHORT-TERM STREAMBED STABILITY REQUIRED TO SUPPORT THE VEGETATION DESIGN WHICH EMPHASIZES CREATING A SELF-SUSTAINING MOSAIC OF RIPARIAN AND WETLAND COMMUNITIES ON A FLOODPLAIN THAT IS HYDROLOGICALLY CONNECTED TO THE CHANNEL. PHASE 2 CULMINATES IN THE IMPLEMENTATION OF THE FLOODPLAIN TREATMENTS WHICH INCLUDE SIDE CHANNELS AND A VARIETY OF VEGETATION COVER TYPES THAT INTEGRATE PLANT SPECIES COMPOSITION WITH GEOMORPHOLOGY AND HYDROLOGY, AND ACCOUNT FOR ECOLOGICAL PROCESSES THAT SUPPORT PLANT COMMUNITY DEVELOPMENT OVER TIME. FLOODPLAIN TREATMENTS WILL INCLUDE THE USE OF SWALES, SIDE CHANNELS, OFF-CHANNEL WETLANDS, MICROTOPOGRAPHY, COARSE WOOD, PLANTINGS, AND SEEDING, AS SHOWN IN THE ACCOMPANYING REVEGETATION DESIGN. FOLLOWING INSTALLATION OF FLOODPLAIN, CHANNEL AND STREAMBANK TREATMENTS, STREAMFLOW WILL BE INCREMENTALLY INTRODUCED INTO THE NEW CHANNEL, AND THE CONSTRUCTED BYPASS CHANNEL RECLAIMED.

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER
3.0

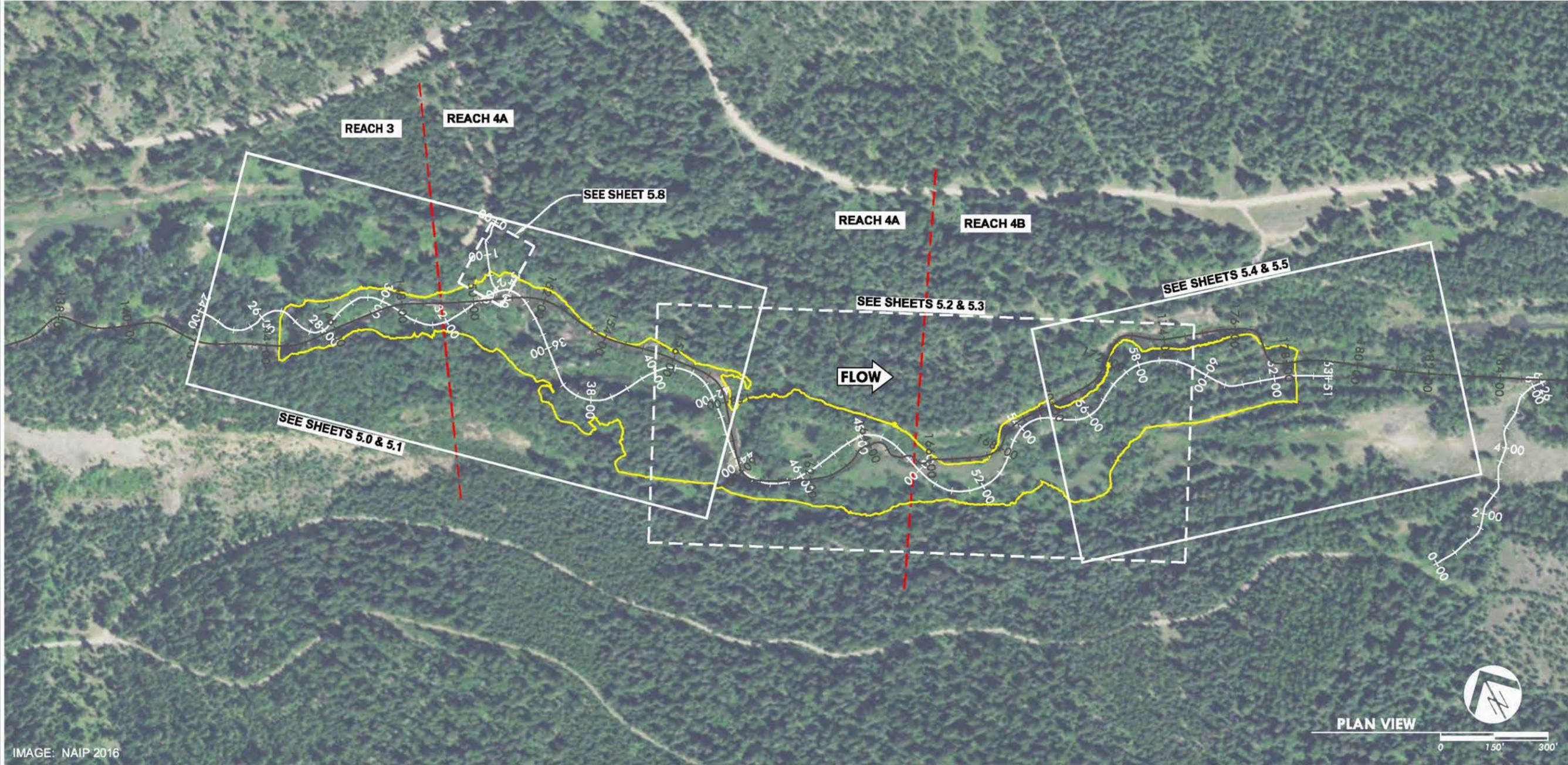


IMAGE: NAIP 2016

PLAN VIEW



0 150' 300'

--- REACH BREAK

PLAN VIEW INDEX - 3, 4A & 4B

UPPER NINEMILE CREEK RESTORATION PROJECT

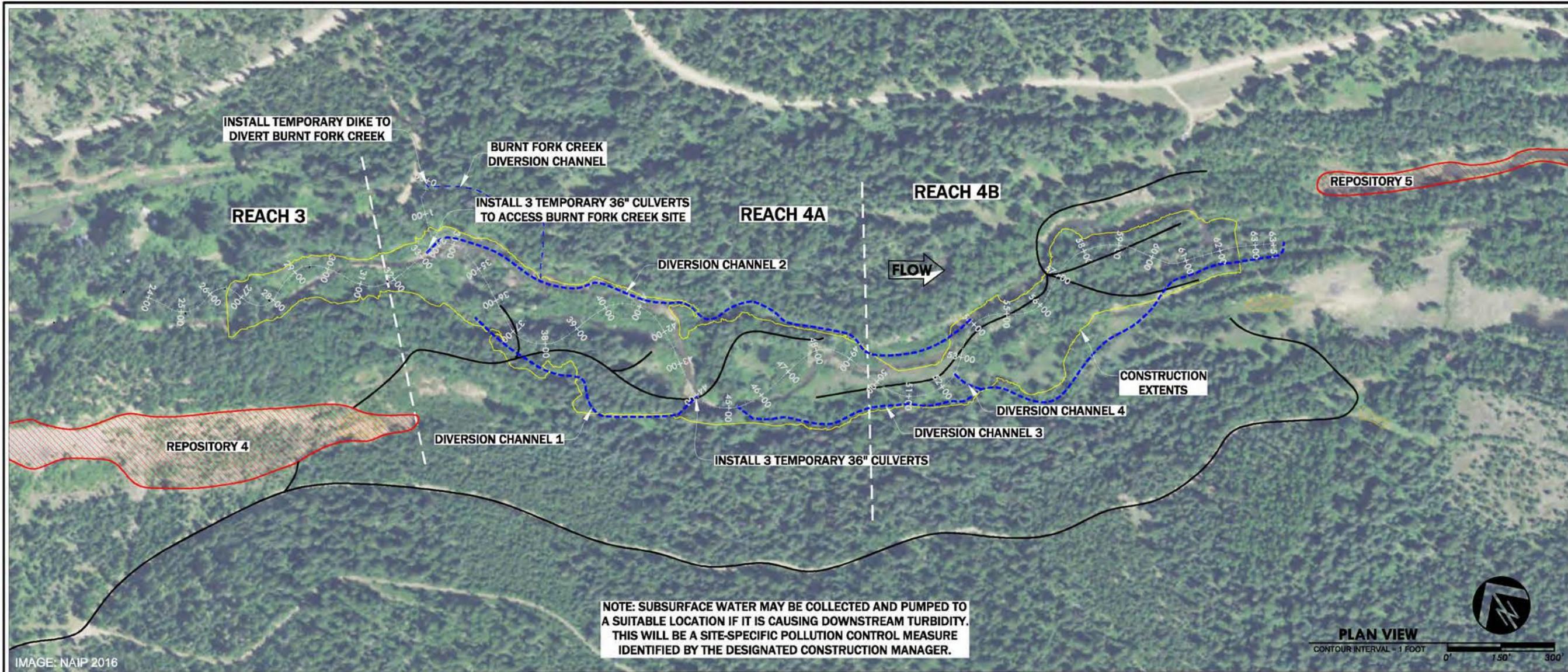
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

3.1



**ACCESS, STAGING AND
DEWATERING PLAN - REACH 3, 4A & 4B**
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

CLEARWATER DIVERSION SEQUENCING

ALL EQUIPMENT ACCESS TO REACHES 3, 4A AND 4B WILL BE FROM THE FOREST ROAD ON THE SOUTH SIDE AS SHOWN. TWO ACCESS POINTS WILL BE CONSTRUCTED IN THE VICINITY SHOWN. ANY CHANGES TO THE PROPOSED ACCESS PLAN, CLEARWATER DIVERSION PLAN, OR CONSTRUCTION SEQUENCING MUST BE APPROVED BY CONSTRUCTION MANAGER AND TROUT UNLIMITED PRIOR TO EQUIPMENT MOBILIZATION TO THE SITE.

PROPOSED SEQUENCING IS AS FOLLOWS:

- AS STREAM FLOWS DECLINE TO A WORKABLE LEVEL, DIVERT ALL WATER TO THE NORTH SIDE OF THE PROJECT AREA SHOWN AS "DIVERSION CHANNEL 1".
- EXCAVATE AND HAUL EXCESS FILL FROM APPROXIMATELY STATION 36+00 TO 48+00 TO REPOSITORY 4.
- SALVAGED VEGETATION THAT CANNOT BE IMMEDIATELY TRANSPLANTED SHALL BE PLACED IN A TEMPORARY NURSERY APPROVED BY THE CONSTRUCTION MANAGER.
- DIVERT FLOWS SOUTH INTO "DIVERSION CHANNEL 2".
- EXCAVATE AND HAUL EXCESS FILL MATERIAL FROM APPROXIMATELY STATION 48+00 TO 62+00 TO REPOSITORY 4 AND 5.
- SALVAGED VEGETATION THAT CANNOT BE IMMEDIATELY TRANSPLANTED SHALL BE PLACED IN A TEMPORARY NURSERY APPROVED BY THE CONSTRUCTION MANAGER
- PROCEED WITH CHANNEL AND FLOODPLAIN CONSTRUCTION FROM STATION 36+00 TO 48+00.
- BANK TREATMENTS SHOULD BE LEFT INCOMPLETE UNTIL AFTER OCTOBER 1 WHEN WILLOWS CAN BE PLACED AND BACKFILLED.
- ONCE EXCESS FILL MATERIAL IS REMOVED FROM STATION 48+00 TO 62+00, PROCEED WITH CHANNEL AND FLOODPLAIN CONSTRUCTION.

LEGEND

--- CLEARWATER DIVERSION CHANNEL
 ——— TEMPORARY HAUL ROAD
 STAGING AREA
 REPOSITORY

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

3.2

IMAGE: NAIP 2016

GENERAL SPECIFICATIONS

1. THE PROJECT SHALL BE CONSTRUCTED ACCORDING TO THE PLAN SET. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY CHANGES PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER FOR THIS PROJECT SHALL BE A DESIGNATED RIVER DESIGN GROUP REPRESENTATIVE.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. CALL U-DIG PRIOR TO CONSTRUCTION.
3. COSTS INCURRED DUE TO PROJECT DELAYS RESULTING FROM FAILURE OF THE CONTRACTOR TO MEET THE REQUIREMENTS OF THE GENERAL SPECIFICATIONS, CONTRACTOR QUALIFICATIONS, CONSTRUCTION SPECIFICATIONS, MATERIALS SPECIFICATIONS AND REVEGETATION SPECIFICATIONS SHALL BE THE EXPENSE OF THE CONTRACTOR.
4. IN-WATER WORK PERIOD SHALL BE COORDINATED WITH MONTANA FISH, WILDLIFE AND PARKS AND SHALL BE LIMITED TO JULY 15 - OCTOBER 15. NO IN-STREAM WORK SHALL BE PERMITTED OUTSIDE OF THIS WINDOW.

CONTRACTOR QUALIFICATIONS

1. THE CONTRACTOR SHALL HAVE AT LEAST TWO (2) YEARS OF RIVER RESTORATION CONSTRUCTION EXPERIENCE AND SHALL HAVE COMPLETED AT LEAST FIVE (5) RIVER RESTORATION PROJECTS. OR, THE CONTRACTOR SHALL HAVE AT LEAST ONE (1) YEAR OF RIVER RESTORATION EXPERIENCE, SHALL HAVE COMPLETED AT LEAST THREE (3) RIVER RESTORATION PROJECTS, AND SHALL HAVE COMPLETED AN APPROVED RIVER RESTORATION TRAINING CLASS. APPROVED TRAINING CLASSES INCLUDE THOSE SPONSORED BY WILDLAND HYDROLOGY, INC., OR A SIMILARLY QUALIFIED PRACTITIONER OF NATURAL CHANNEL DESIGN STREAM RESTORATION PRINCIPLES.
2. IF THE CONTRACTOR CHOOSES TO DESIGNATE AN EMPLOYEE WITHOUT QUALIFIED STREAM RESTORATION EXPERIENCE, THE CONTRACTOR SHALL BE ON-SITE AT ALL TIMES WHEN THE EMPLOYEE IS PERFORMING RIVER RESTORATION WORK. FAILURE TO ABIDE BY THIS CONDITION WITHOUT PREVIOUS AGREEMENT WITH THE CONSTRUCTION MANAGER WOULD BE GROUNDS FOR TERMINATION.
3. THE CONTRACTOR SHALL MAINTAIN AT LEAST \$2,000,000 IN LIABILITY INSURANCE AND HAVE PROOF OF LIABILITY INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.
4. THE CONTRACTOR SHALL HAVE PROOF OF WORKER'S COMPENSATION INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.
5. COPIES OF ALL PROJECT PERMITS SHALL BE POSTED ON-SITE IN A VISIBLE LOCATION. THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF THE PERMITS. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY KNOWN CHANGES OR ACTIVITIES THAT COULD VIOLATE PERMIT REQUIREMENTS PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER SHALL BE RESPONSIBLE FOR ALL CORRESPONDENCE WITH PERMIT AGENCIES.

TEMPORARY DIVERSION PROCEDURES

1. TU SHALL BE NOTIFIED AT LEAST 72 HOURS PRIOR TO ACTIVATION OR DEACTIVATION OF ALL TEMPORARY BYPASS CHANNELS. THE PHONE NUMBER FOR THE TU OFFICE IS 406-543-0054. TU SHALL DETERMINE IF IT IS NECESSARY TO CONDUCT A FISH RESCUE.
2. TEMPORARY DIVERSIONS SHALL BE ACTIVATED OR DEACTIVATED INCREMENTALLY IN THREE EQUAL STAGES TO ALLOW RESIDENT AQUATIC LIFE TO EXIT THE DEWATERED AREA.
3. A PERIOD OF APPROXIMATELY ONE HOUR SHALL BE ALLOWED BETWEEN THE FIRST TWO STAGES.
4. A PERIOD OF APPROXIMATELY 12 HOURS SHALL BE ALLOWED BEFORE THE FINAL STAGE. TU SHALL CONDUCT FISH RESCUES DURING THE 12 HOUR PERIOD.
5. UPON NOTIFICATION FROM TU, THE REMAINING FLOW SHALL BE DIVERTED.
6. EFFORTS SHALL BE MADE TO LIMIT TURBIDITY DURING DIVERSION ACTIVATION AND DEACTIVATION. MATERIAL USED TO DIVERT FLOW DURING STAGED DIVERSIONS SHALL BE CLEAN AND DEVOID OF FINES.
7. EFFORTS SHALL BE MADE TO LIMIT DISTURBANCE TO VEGETATION.
8. EFFORTS SHALL BE MADE TO AVOID FATALITIES OF AQUATIC LIFE.

MATERIALS SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL MATERIALS NECESSARY TO CONSTRUCT THE PROJECT. THE CONTRACTOR SHALL DELIVER ALL MATERIALS TO THE DESIGNATED STOCKPILE LOCATIONS LABELED ON THE PLAN SET OR TO A LOCATION SPECIFIED BY THE CONSTRUCTION MANAGER. IF A MATERIAL SOURCE HAS BEEN PRE-DETERMINED, THE CONSTRUCTION MANAGER SHALL PROVIDE DIRECTIONS TO THE CONTRACTOR.
2. MATERIAL QUANTITIES, DIMENSIONS AND SIZES SHALL CONFORM TO THE NOTES AND SPECIFICATIONS PROVIDED ON THE PLAN SET OR ON THE MATERIALS LIST.
3. THE CONSTRUCTION MANAGER SHALL 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 CONSTRUCTION MANAGER SHALL REJECT THE MATERIALS.

EQUIPMENT SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT NECESSARY TO CONSTRUCT THE PROJECT. THE CONTRACTOR SHALL MOBILIZE ALL EQUIPMENT TO THE PROJECT AREA AS DIRECTED BY THE CONSTRUCTION MANAGER.
2. AT A MINIMUM, THE CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT FOR THIS PROJECT:

EXCAVATOR - TWO (2) EXCAVATOR(S) SHALL BE REQUIRED. THE EQUIPMENT SHALL BE MINIMUM 200 CLASS. ONE EXCAVATOR SHALL BE EQUIPPED WITH MACHINE GRADE GPS (L1/L2/GLONASS). THE BUCKET VOLUME SHALL BE MINIMUM OF ONE (1) CUBIC YARD. THE BUCKET SHALL BE EQUIPPED WITH A HYDRAULIC THUMB FOR GRASPING LOGS, ROCKS, AND OTHER MATERIALS. THE EQUIPMENT MUST BE CAPABLE OF CROSSING WATER AND WORKING ON OR ADJACENT TO STEEP SLOPES. A CHAIN OR STRAP SHALL BE AVAILABLE FOR ATTACHING CULVERTS, PUMPS AND OTHER EQUIPMENT OR MATERIALS TO THE BUCKET FOR TRANSPORT ON-SITE.

DUMP TRUCK - TWO (2) OFF ROAD DUMP TRUCK(S) SHALL BE REQUIRED FOR THIS PROJECT. THE TRUCK(S) SHALL BE ARTICULATED WITH A 25 TON MINIMUM CAPACITY AND CAPABLE OF DRIVING ON NON-ASPHALT SURFACES AND OFF-ROAD SURFACES.

BULL DOZER - ONE (1) BULL DOZER SHALL BE REQUIRED FOR THIS PROJECT. THE EQUIPMENT SHALL BE A MINIMUM OF CAT D7 OR EQUIVALENT. BULL DOZER SHALL BE EQUIPPED WITH MACHINE GRADE GPS (L1/L2/GLONASS).

ALL SURFACE VEHICLE - ONE (1) ALL-SURFACE VEHICLE (ASV) SHALL BE REQUIRED. THE EQUIPMENT SHALL BE EQUIPPED WITH SOD TRACKS TO MINIMIZE DISTURBANCE TO FRAGILE AREAS. ONE TREE SPADE SHALL BE PROVIDED AND BE OF SUFFICIENT SIZE TO TRANSPLANT LARGE, MATURE WILLOWS. A HARROW RAKE OR SIMILAR ATTACHMENT SHALL BE AVAILABLE TO RIP COMPACTED SURFACES AND TEMPORARY CONSTRUCTION ACCESS ROADS AT THE TERMINATION OF THE PROJECT.

CHAINSAW - TWO (2) CHAINSAW SHALL BE REQUIRED. THE CHAINSAW MUST BE CAPABLE OF COMPLETELY SAWING LOGS OF THE DIAMETER SPECIFIED IN THE MATERIAL SPECIFICATIONS. ALSO, THE CHAINSAW MUST BE CAPABLE OF SAWING HDPE OR PVC CULVERTS OR PIPES AS NOTED IN THE MATERIAL SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE WASHED PRIOR TO MOBILIZATION TO THE SITE TO MINIMIZE THE INTRODUCTION OF FOREIGN MATERIALS AND FLUIDS TO THE PROJECT SITE. ALL EQUIPMENT SHALL BE FREE OF OIL, HYDRAULIC FLUID, AND DIESEL FUEL LEAKS. TO PREVENT INVASION OF NOXIOUS WEEDS OR THE SPREAD OF WHIRLING DISEASE SPORES, ALL EQUIPMENT SHALL 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 INSURE THAT ADEQUATE MEASURES HAVE BEEN TAKEN.
4. EQUIPMENT SHALL BE IN A WELL-MAINTAINED CONDITION TO MINIMIZE THE LIKELIHOOD OF A FLUID LEAK. IF A FLUID LEAK DOES OCCUR, THE CONSTRUCTION MANAGER SHALL BE NOTIFIED IMMEDIATELY, AND ALL WORK CEASED UNTIL THE LEAK HAS BEEN RECTIFIED. AT ALL TIMES DURING THE CONSTRUCTION PHASE, FLUID SPILL CONTAINMENT EQUIPMENT SHALL BE PRESENT ON-SITE AND READY FOR DEPLOYMENT SHOULD AN ACCIDENTAL SPILL OCCUR.
5. THE CONTRACTOR SHALL MAINTAIN A COMPLETE TOOL SET WITH COMMONLY REPLACED PARTS (E.G. O-RINGS) TO MINIMIZE DOWNTIME IN THE EVENT OF EQUIPMENT MALFUNCTION. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ON SITE DURING THE PROJECT.

CONSTRUCTION SPECIFICATIONS

1. CONSTRUCTION SHALL OCCUR IN ACCORDANCE WITH THE PLAN SET, CONSTRUCTION SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, MATERIAL SPECIFICATIONS, REVEGETATION SPECIFICATIONS AND GENERAL SPECIFICATIONS.
2. CONSTRUCTION ACCESS SHALL BE DETERMINED BY THE CONSTRUCTION MANAGER. CONSTRUCTION EQUIPMENT SHALL NOT CROSS PRIVATE LAND UNLESS PERMISSION IS OBTAINED FROM THE LANDOWNER. THE CONTRACTOR SHALL LEAVE ALL GATES, WHETHER OPEN OR CLOSED, AS FOUND.
3. STREAM CROSSINGS SHALL BE MINIMIZED DURING CONSTRUCTION. KNOWN STREAM CROSSINGS AND CULVERT RECOMMENDATIONS ARE FOUND ON SHEET 8.4 SO THAT EQUIPMENT CAN CROSS THE STREAM WITHOUT GENERATING EXCESS TURBIDITY.
4. STRAW BALES AND SILT FENCING SHALL BE AVAILABLE AND INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER. CONSTRUCTION FENCING (LIMITS OF DISTURBANCE) SHALL BE INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER.
5. INITIALLY, THE CONTRACTOR SHALL EXCAVATE THE CHANNEL TO APPROXIMATE DESIGN DIMENSIONS. EXCAVATION SHALL COMPLY WITH CONSTRUCTION STAKES AND THE PLAN SET. EXCAVATION SHALL ESTABLISH CHANNEL ELEVATIONS WITHIN ONE-HALF FOOT OF FINAL ELEVATIONS. THE CONSTRUCTION MANAGER SHALL INSPECT THE CHANNEL EXCAVATION FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED OFF-SITE OR USED ON-SITE. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED. EXCAVATED SOD AND RIPARIAN SHRUB TRANSPLANTS SHALL BE CAREFULLY STOCKPILED AND REUSED FOR PLANTING FLOODPLAINS OR STREAM BANKS.
6. AFTER EXCAVATING THE CHANNEL, THE CONTRACTOR SHALL INSTALL BANK STABILIZATION AND HABITAT STRUCTURES USING THE EXCAVATOR. EACH STRUCTURE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LOCATIONS AND SPECIFICATIONS PROVIDED IN THE PLAN SET. THE CONSTRUCTION MANAGER SHALL INSPECT AND APPROVE ALL STRUCTURES PRIOR TO BACKFILLING.
7. AFTER ALL STRUCTURES ARE INSTALLED, THE CHANNEL WILL BE SHAPED TO WITHIN 0.3 FEET OF THE FINAL ELEVATIONS SPECIFIED ON THE PLAN SET USING AN EXCAVATOR. THE CONSTRUCTION MANAGER SHALL CHECK THE FINAL ELEVATIONS FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED OFF-SITE OR USED ON-SITE. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED.
8. THE CONTRACTOR SHALL REMOVE EXCESS MATERIALS, TEMPORARY CULVERTS AND EQUIPMENT FROM THE SITE. THE CONTRACTOR SHALL REGRADE DISTURBED AREAS AND CONSTRUCTION ACCESS ROADS TO THEIR ORIGINAL GRADES. THE CONTRACTOR SHALL TREAT COMPACTED SOIL AREAS INCLUDING ACCESS ROADS AND MATERIAL STOCKPILE AREAS. THE CONTRACTOR SHALL REMOVE SOIL FROM THE PROJECT SITE IF THE SOIL IS TAINTED WITH PETROLEUM-BASED FLUIDS.



SPECIFICATIONS
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	FINAL DESIGN	JM
PROJECT NUMBER RDG-19-001				
SHEET NUMBER 3.3				

SPATIAL REFERENCE

THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:

HORIZONTAL PROJECTION: STATE PLANE
 HORIZONTAL DATUM: NAD83 (CORS 96)
 UNITS: SURVEY FEET
 VERTICAL DATUM: NAVD88 (GEOID 12A)

Point #	Latitude	Longitude	Northing	Easting	Elevation	Description
1	N047° 12' 41.40"	W114° 38' 03.62"	1121428.2430'	694088.7230'	3856.793'	set rdg
2	N047° 12' 39.96"	W114° 38' 00.70"	1121270.0970'	694279.6670'	3859.525'	set rdg
7	N047° 12' 34.00"	W114° 37' 16.58"	1120468.4610'	697277.8690'	3797.144'	set rdg
45	N047° 12' 29.17"	W114° 37' 25.02"	1120018.5020'	696665.0440'	3794.652'	set nail
97	N047° 12' 48.24"	W114° 37' 46.31"	1122042.1110'	695325.3060'	3851.745'	set rdg
98	N047° 12' 48.51"	W114° 37' 39.81"	1122039.0620'	695775.0560'	3849.051'	set rdg

*ALL "SET RDG" POINTS ARE 5/8" X 24" REBAR WITH 2" ALUMINUM CAP OR 8" X 60D NAIL

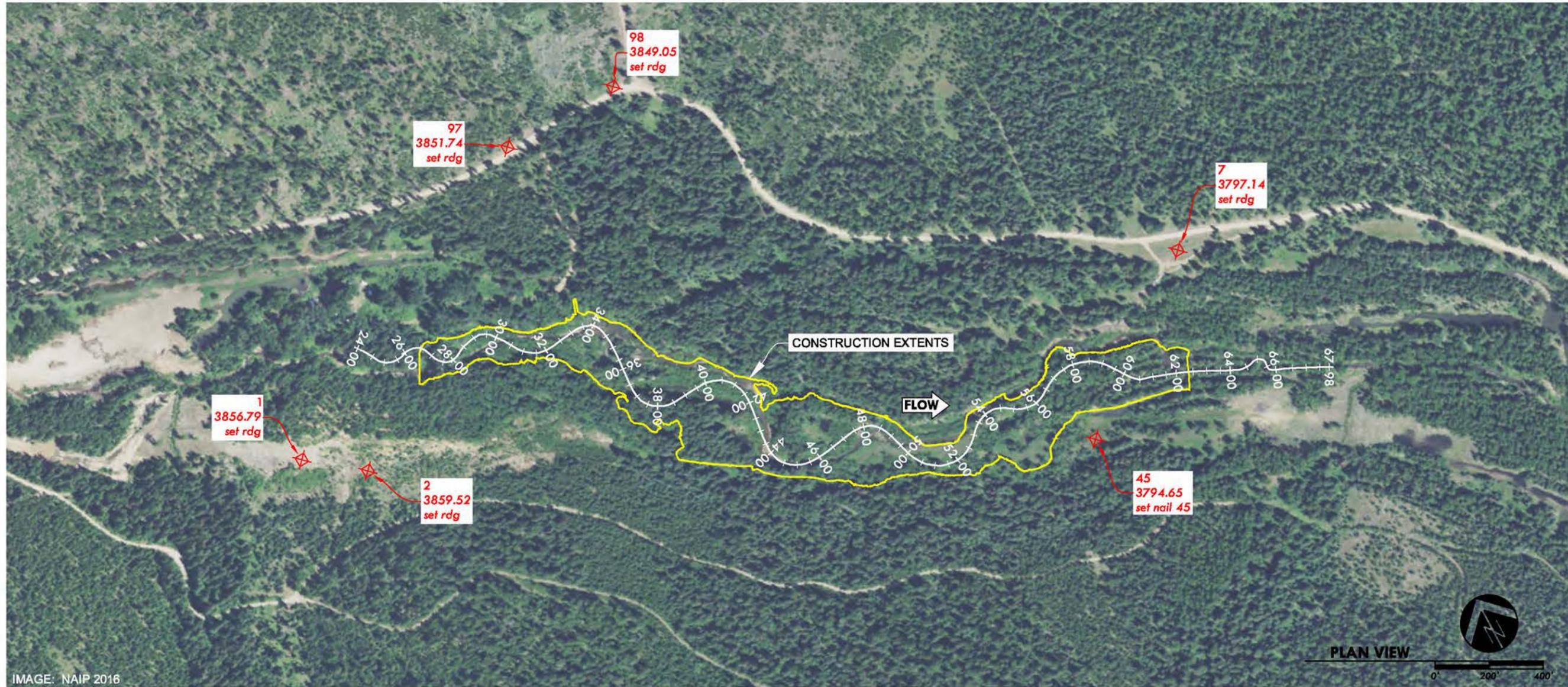


IMAGE: NAIP 2016

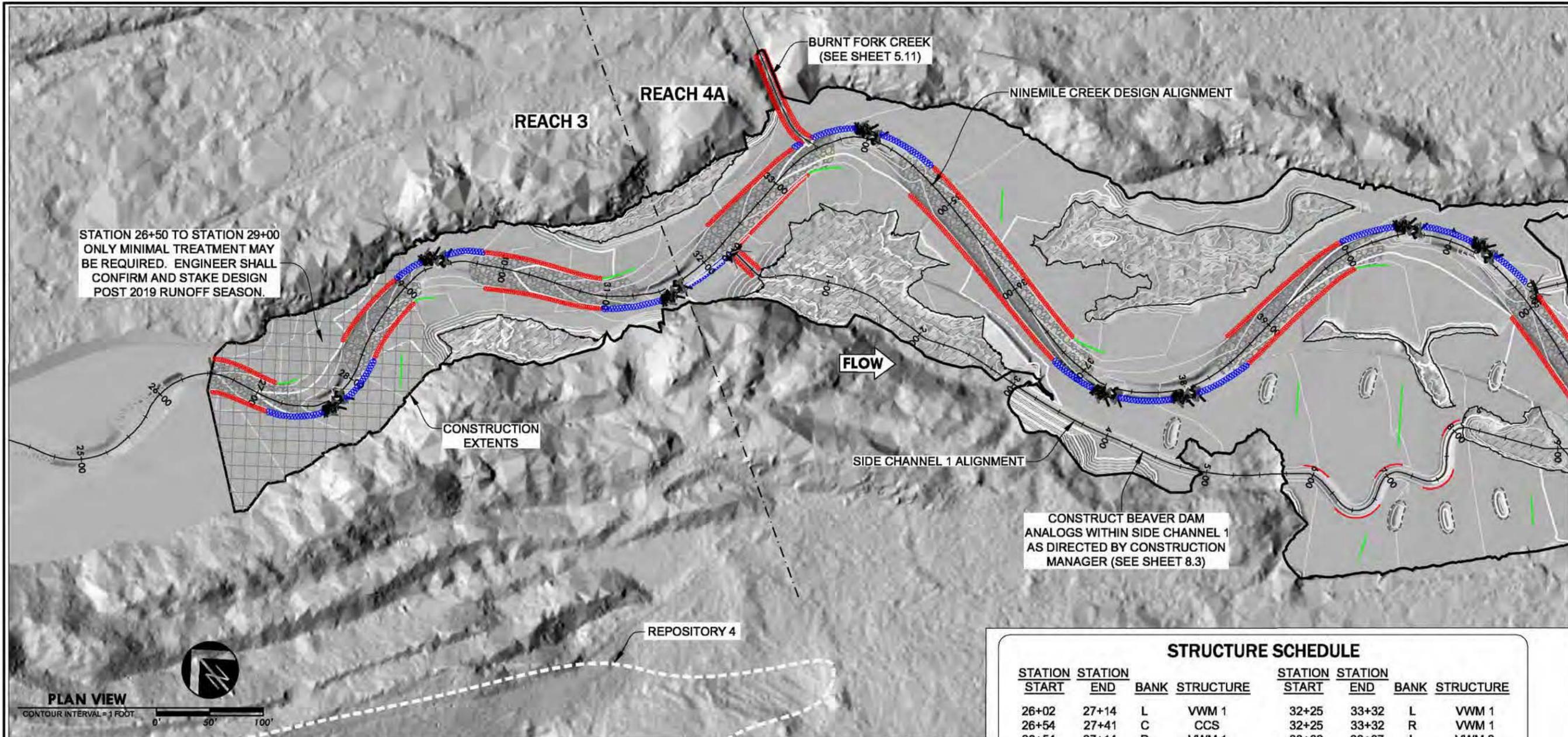


SURVEY CONTROL PLAN REACH 3, 4A & 4B UPPER NINEMILE CREEK RESTORATION PROJECT NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER
4.0

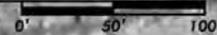


STATION 26+50 TO STATION 29+00
ONLY MINIMAL TREATMENT MAY
BE REQUIRED. ENGINEER SHALL
CONFIRM AND STAKE DESIGN
POST 2019 RUNOFF SEASON.

CONSTRUCT BEAVER DAM
ANALOGS WITHIN SIDE CHANNEL 1
AS DIRECTED BY CONSTRUCTION
MANAGER (SEE SHEET 8.3)

PLAN VIEW

CONTOUR INTERVAL = 1 FOOT



LEGEND

BANK STRUCTURES

- LARGE WOOD STRUCTURE (LWS) 8.0
- VEGETATED WOOD MATRIX TYPE 1 (VWM 1) 8.1
- VEGETATED WOOD MATRIX TYPE 2 (VWM 2) 8.1
- VEGETATED WOOD MATRIX TYPE 3 (VWM 3) 8.1

CHANNEL STRUCTURES

- CONSTRUCTED CHANNEL STREAMBED (CCS) 8.2

FLOODPLAIN FEATURES

- FLOODPLAIN SWALE
- PRESERVATION AREA/WETLAND

**CHANNEL TOP OF BANK
ELEVATIONS**

STATION	ELEVATION (FT)
27+00	3827.48
28+00	3825.72
29+00	3823.97
30+00	3822.18
31+00	3820.37
32+00	3818.82
33+00	3817.41
34+00	3816.34
35+00	3815.49
36+00	3814.74
37+00	3814.06
38+00	3813.31
39+00	3812.56
40+00	3811.80
41+00	3811.04

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
26+02	27+14	L	VWM 1	32+25	33+32	L	VWM 1
26+54	27+41	C	CCS	32+25	33+32	R	VWM 1
26+54	27+14	R	VWM 1	33+32	33+87	L	VWM 2
27+14	27+41	L	VWM 2	33+32	33+69	R	VWM 3
27+14	27+59	R	VWM 2	33+87	34+12	L	LWS
27+59	27+84	R	LWS	34+12	34+65	L	VWM 2
27+84	28+27	R	VWM 2	34+37	37+08	C	CCS
28+04	29+12	C	CCS	34+65	36+72	L	VWM 1
28+27	28+98	L	VWM 1	34+65	36+72	R	VWM 1
28+27	28+98	R	VWM 1	36+72	37+15	R	VWM 2
28+98	29+23	L	VWM 2	36+72	37+08	L	VWM 3
28+98	29+26	R	VWM 3	37+15	37+40	R	LWS
29+23	29+48	L	LWS	37+40	37+86	R	VWM 2
29+48	29+82	L	VWM 2	37+86	38+11	R	LWS
29+64	31+32	C	CCS	38+11	38+62	R	VWM 2
29+82	30+95	L	VWM 1	38+34	40+35	C	CCS
29+82	30+95	R	VWM 1	38+62	39+99	L	VWM 1
30+95	31+48	R	VWM 2	38+62	39+99	R	VWM 1
30+95	31+32	L	VWM 3	39+99	40+48	L	VWM 2
31+48	31+73	R	LWS	39+99	40+35	R	VWM 3
31+73	32+25	R	VWM 2	40+48	40+73	L	LWS
31+97	33+69	C	CCS				

Structure Description	Abbreviation	Drawing Sheet
Large Wood Structure	LWS	8.0
Vegetated Wood Matrix Type 1	VWM1	8.1
Vegetated Wood Matrix Type 2	VWM2	8.1
Vegetated Wood Matrix Type 3	VWM3	8.1
Constructed Channel Streambed	CCS	8.2

**PLAN VIEW AND STRUCTURE LAYOUT
REACH 3 AND 4A
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA**

NO.	DATE	BY	DESCRIPTION	CHK	J/M
1	4-01-19	NW	DESIGN		

PROJECT NUMBER
RDG-19-001

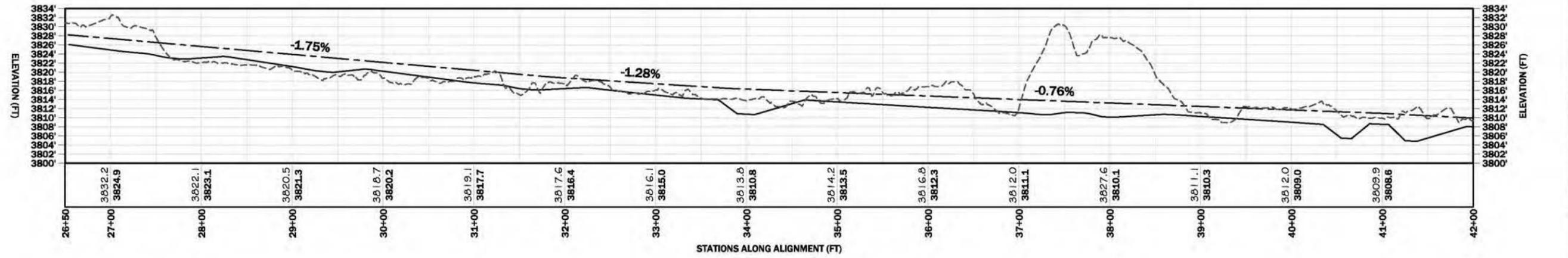
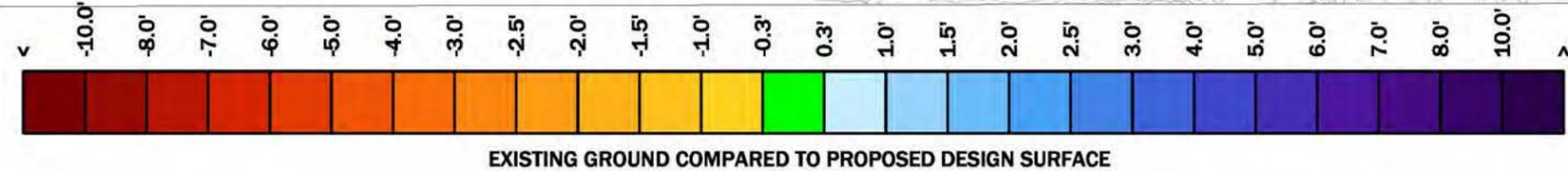
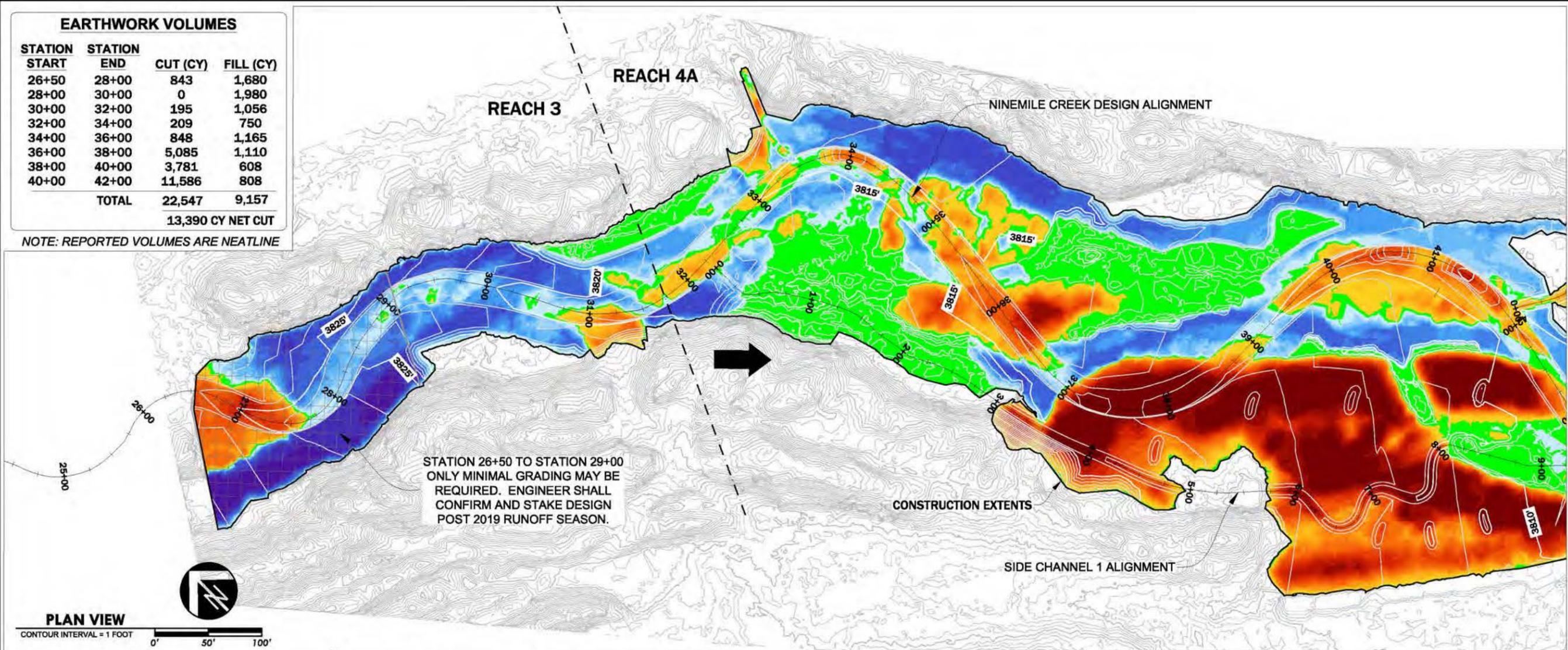
SHEET NUMBER

5.0

EARTHWORK VOLUMES

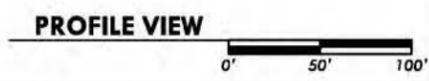
STATION START	STATION END	CUT (CY)	FILL (CY)
26+50	28+00	843	1,680
28+00	30+00	0	1,980
30+00	32+00	195	1,056
32+00	34+00	209	750
34+00	36+00	848	1,165
36+00	38+00	5,085	1,110
38+00	40+00	3,781	608
40+00	42+00	11,586	808
TOTAL		22,547	9,157
		13,390 CY NET CUT	

NOTE: REPORTED VOLUMES ARE NEATLINE



LEGEND

	EXISTING GROUND
	DESIGN BANKFULL
	DESIGN THALWEG



RDG
RIVER DESIGN GROUP

236 Wisconsin Avenue
Whitefish, MT 59937
Tel: 406.862.4927
Fax: 406.862.4963

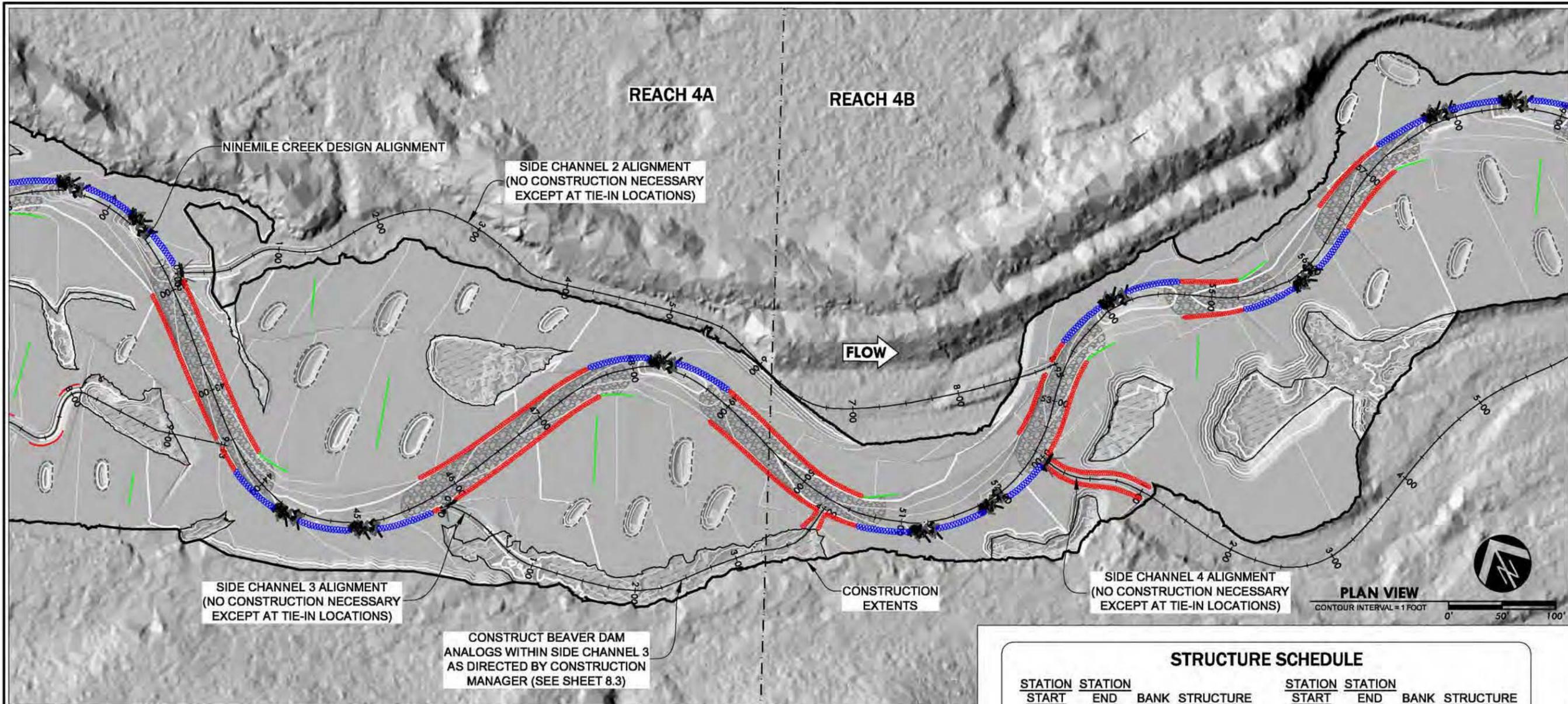
311 SW Jefferson Avenue
Corvallis, OR 97333
Tel: 541.758.8920
Fax: 541.758.8524

GRADING PLAN AND PROFILE
REACH 3 AND 4A
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	CHK	DESCRIPTION
1	4-01-19	NW	JM	DESIGN

PROJECT NUMBER
RDG-19-001

SHEET NUMBER
5.1



SIDE CHANNEL 3 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

SIDE CHANNEL 2 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

SIDE CHANNEL 4 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

CONSTRUCT BEAVER DAM ANALOGS WITHIN SIDE CHANNEL 3 AS DIRECTED BY CONSTRUCTION MANAGER (SEE SHEET 8.3)

FLOW

CONSTRUCTION EXTENTS

PLAN VIEW
CONTOUR INTERVAL = 1 FOOT

LEGEND		
BANK STRUCTURES		DETAIL SHEET #
	LARGE WOOD STRUCTURE (LWS)	8.0
	VEGETATED WOOD MATRIX TYPE 1 (VWM 1)	8.1
	VEGETATED WOOD MATRIX TYPE 2 (VWM 2)	8.1
	VEGETATED WOOD MATRIX TYPE 3 (VWM 3)	8.1
CHANNEL STRUCTURES		
	CONSTRUCTED CHANNEL STREAMBED (CCS)	8.2
FLOODPLAIN FEATURES		
	FLOODPLAIN SWALE	
	PRESERVATION AREA WETLAND	

CHANNEL TOP OF BANK ELEVATIONS	
STATION	ELEVATION (FT)
42+00	3810.12
43+00	3809.12
44+00	3808.12
45+00	3807.08
46+00	3806.02
47+00	3804.96
48+00	3803.91
49+00	3802.85
50+00	3801.84
51+00	3800.84
52+00	3799.84
53+00	3798.85
54+00	3797.85
55+00	3796.85
56+00	3795.85
57+00	3794.86

STRUCTURE SCHEDULE							
STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
40+73	41+19	L	VWM 2	48+92	50+60	R	VWM 1
41+19	41+44	L	LWS	50+60	51+08	R	VWM 2
41+44	41+94	L	VWM 2	50+60	50+96	L	VWM 3
41+66	44+11	C	CCS	51+08	51+33	R	LWS
41+94	43+75	L	VWM 1	51+33	51+79	R	VWM 2
41+94	43+75	R	VWM 1	51+79	52+04	R	LWS
43+75	44+24	R	VWM 2	52+04	52+54	R	VWM 2
43+75	44+11	L	VWM 3	52+26	53+87	C	CCS
44+24	44+49	R	LWS	52+54	53+51	L	VWM 1
44+49	44+95	R	VWM 2	52+54	53+51	R	VWM 1
44+95	45+20	R	LWS	53+51	53+97	L	VWM 2
45+20	45+70	R	VWM 2	53+51	53+87	R	VWM 3
45+42	47+97	C	CCS	53+97	54+22	L	LWS
45+70	47+61	L	VWM 1	54+22	54+72	L	VWM 2
45+70	47+61	R	VWM 1	54+45	55+65	C	CCS
47+61	48+14	L	VWM 2	54+72	55+27	L	VWM 1
47+61	47+97	R	VWM 3	54+72	55+27	R	VWM 1
48+14	48+39	L	LWS	55+27	55+74	R	VWM 2
48+39	48+92	L	VWM 2	55+27	55+65	L	VWM 3
48+64	50+96	C	CCS	55+74	55+99	R	LWS
48+92	50+60	L	VWM 1	55+99	56+48	R	VWM 2

Structure Description	Abbreviation	Drawing Sheet
Large Wood Structure	LWS	8.0
Vegetated Wood Matrix Type 1	VWM1	8.1
Vegetated Wood Matrix Type 2	VWM2	8.1
Vegetated Wood Matrix Type 3	VWM3	8.1
Constructed Channel Streambed	CCS	8.2

PLAN VIEW AND STRUCTURE LAYOUT
REACH 4A AND 4B
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER	RDG-19-001
SHEET NUMBER	5.2

EARTHWORK VOLUMES

STATION START	STATION END	CUT (CY)	FILL (CY)
42+00	44+00	3,852	485
44+00	46+00	11,628	136
46+00	48+00	3,913	552
48+00	50+00	2,894	684
50+00	52+00	2,086	380
52+00	54+00	1,845	1,085
54+00	56+00	4,298	1,218
TOTAL		30,516	4,540
		25,976 CY NET CUT	

NOTE: REPORTED VOLUMES ARE NEATLINE

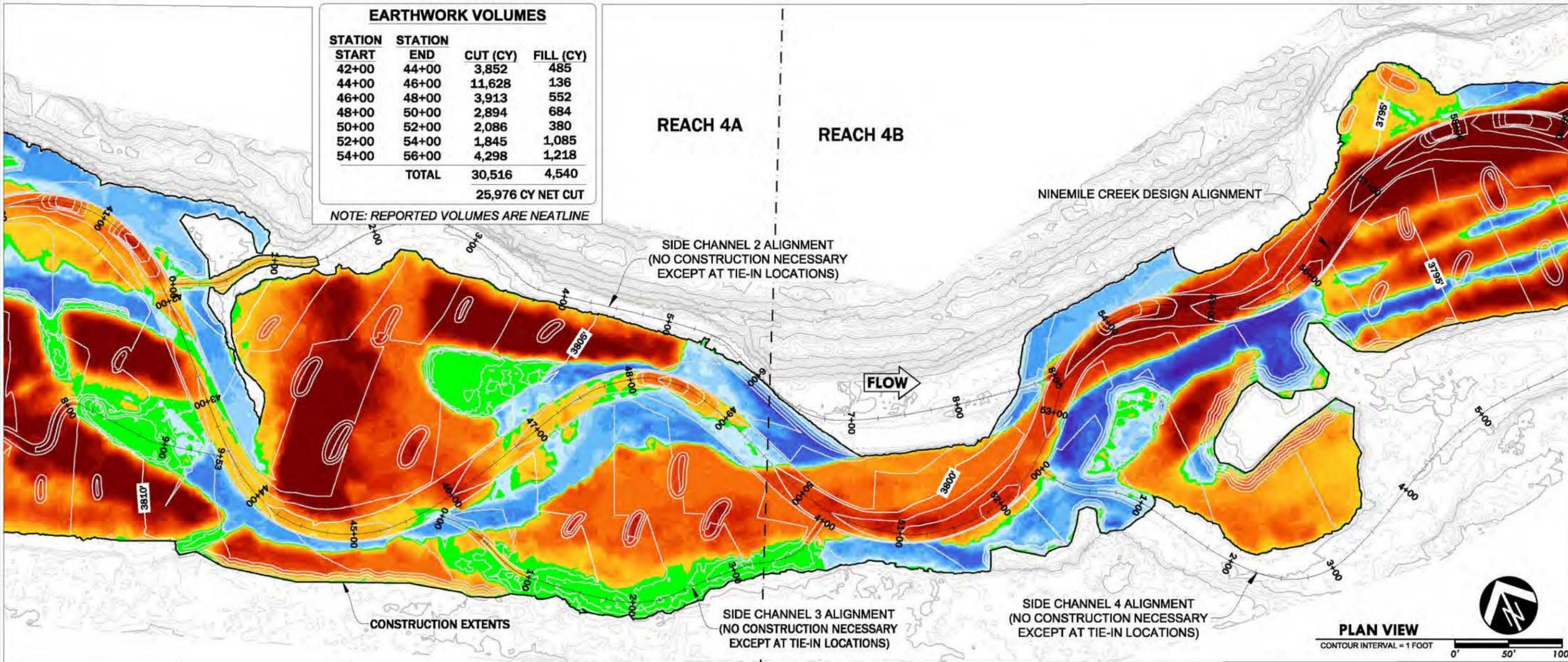
REACH 4A REACH 4B

SIDE CHANNEL 2 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

SIDE CHANNEL 3 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

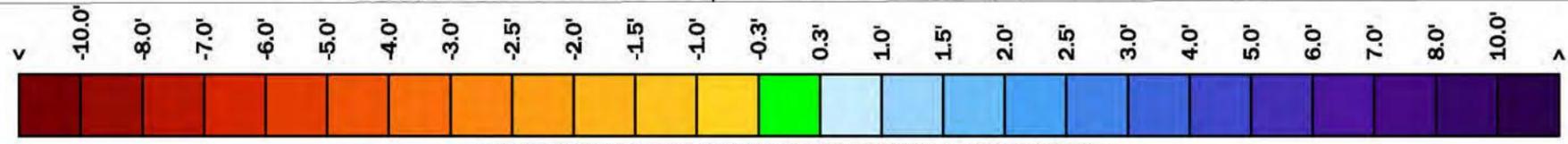
SIDE CHANNEL 4 ALIGNMENT
(NO CONSTRUCTION NECESSARY EXCEPT AT TIE-IN LOCATIONS)

NINEMILE CREEK DESIGN ALIGNMENT

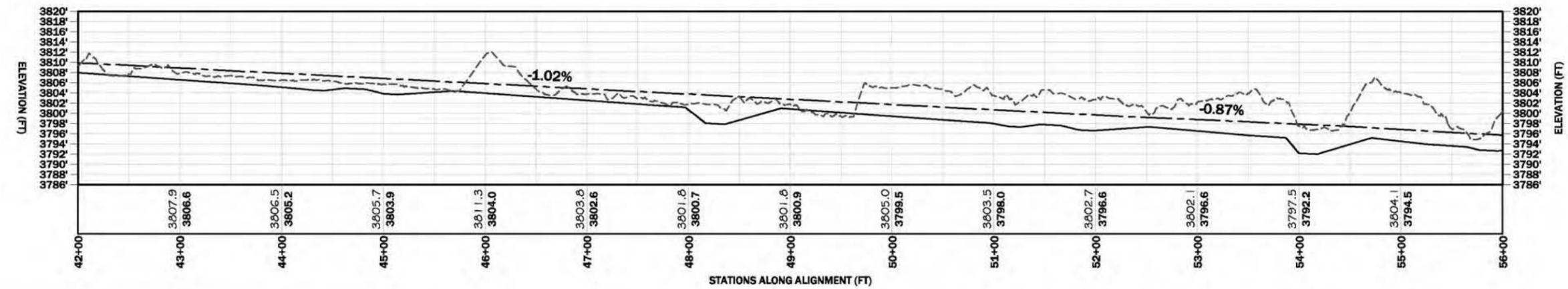


PLAN VIEW

CONTOUR INTERVAL = 1 FOOT
0' 50' 100'



EXISTING GROUND COMPARED TO PROPOSED DESIGN SURFACE

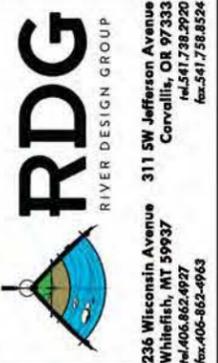


LEGEND

EXISTING GROUND DESIGN BANKFULL DESIGN THALWEG

PROFILE VIEW

0' 60' 120'



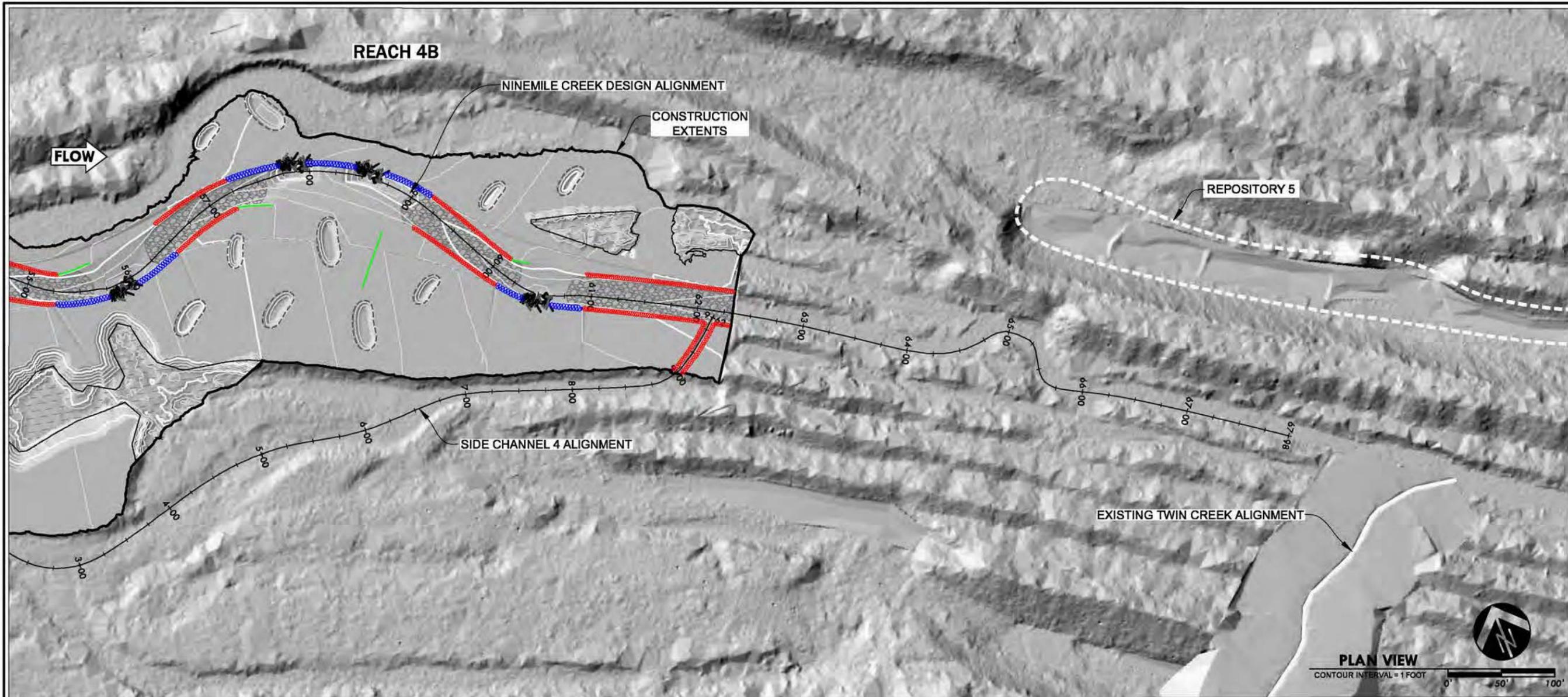
GRADING PLAN AND PROFILE
REACH 4A AND 4B
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

5.3



PLAN VIEW AND STRUCTURE LAYOUT
REACH 4B
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

LEGEND

BANK STRUCTURES		DETAIL SHEET #
	LARGE WOOD STRUCTURE (LWS)	8.0
	VEGETATED WOOD MATRIX TYPE 1 (VWM 1)	8.1
	VEGETATED WOOD MATRIX TYPE 2 (VWM 2)	8.1
	VEGETATED WOOD MATRIX TYPE 3 (VWM 3)	8.1
CHANNEL STRUCTURES		
	CONSTRUCTED CHANNEL STREAMBED (CCS)	8.2
FLOODPLAIN FEATURES		
	FLOODPLAIN SWALE	
	PRESERVATION AREA/WETLAND	

CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)
58+00	3793.74
59+00	3792.59
60+00	3791.44
61+00	3790.57
62+00	3789.79

STRUCTURE SCHEDULE

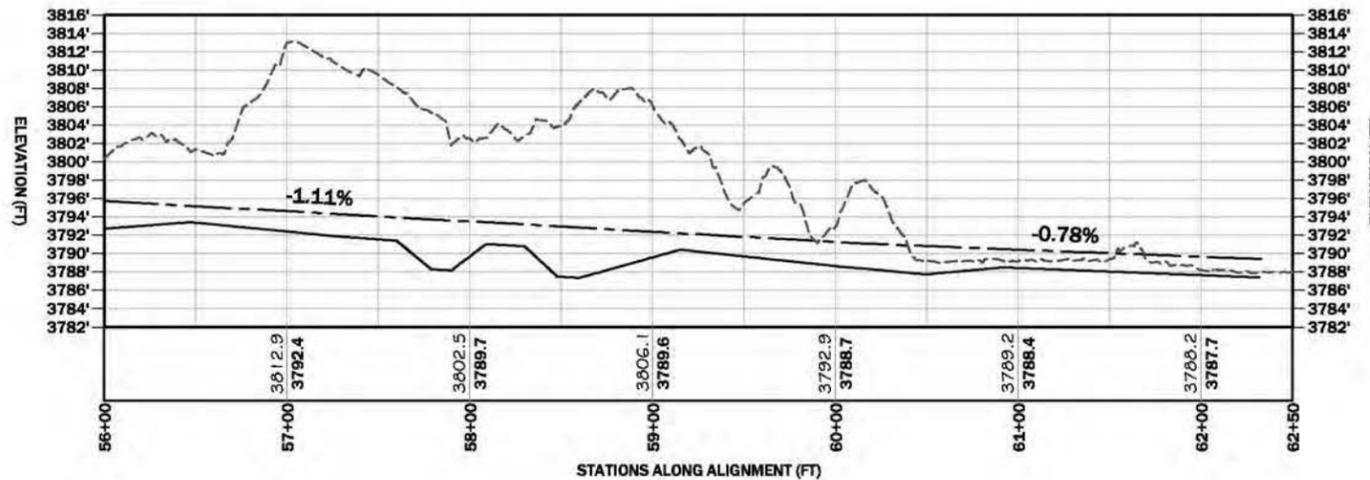
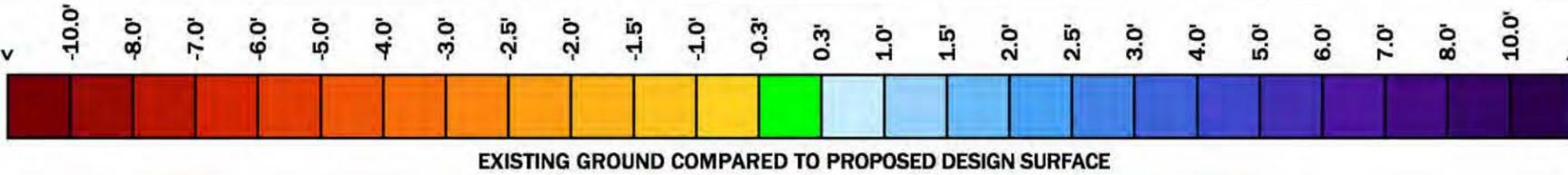
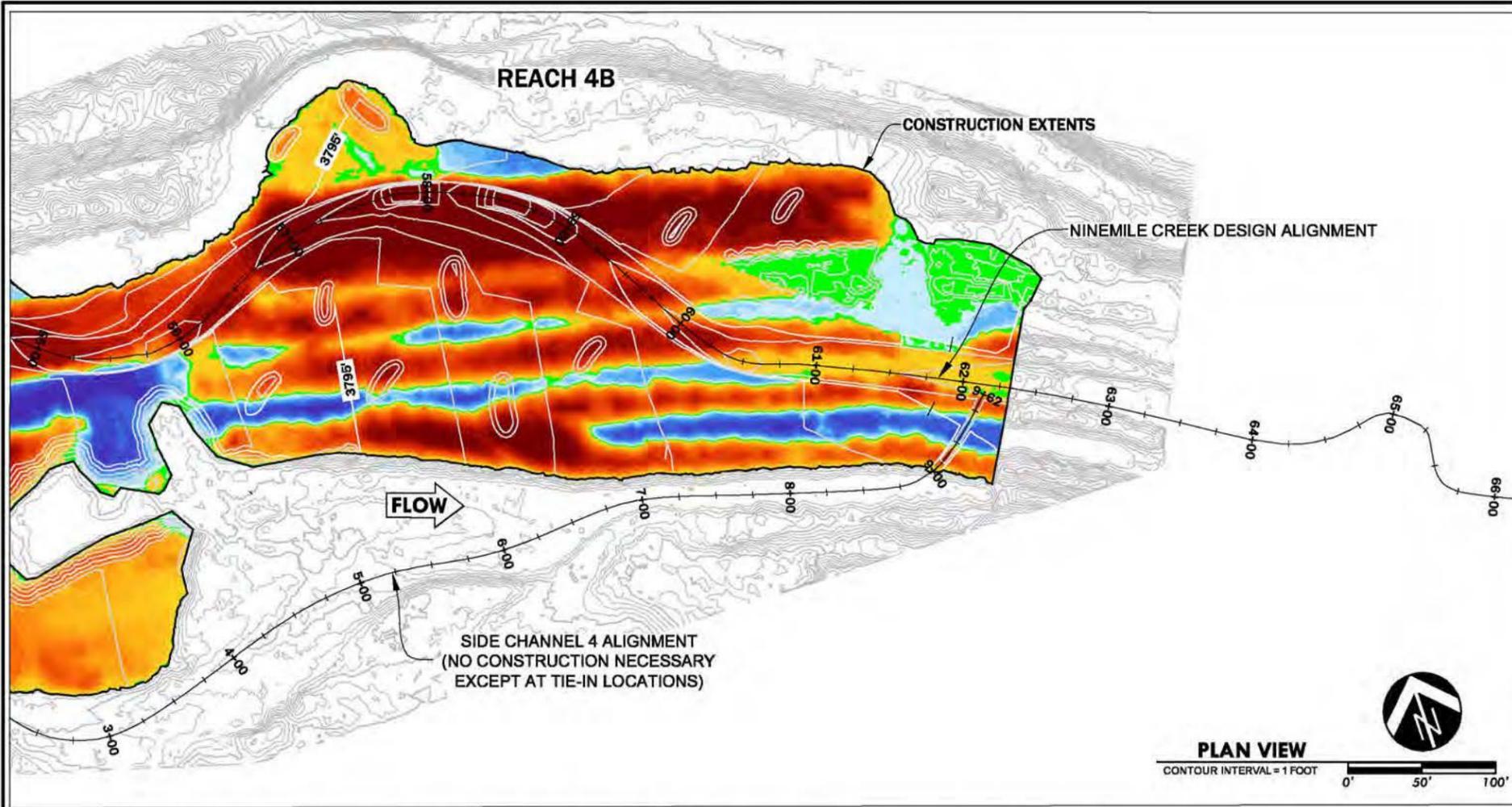
STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
56+22	57+60	C	CCS	58+88	60+31	C	CCS
56+48	57+24	L	VWM 1	59+16	60+12	L	VWM 1
56+48	57+24	R	VWM 1	59+16	60+12	R	VWM 1
57+24	57+72	L	VWM 2	60+12	60+37	R	VWM 2
57+24	57+60	R	VWM 3	60+12	60+31	L	VWM 3
57+72	57+97	L	LWS	60+37	60+62	R	LWS
57+97	58+42	L	VWM 2	60+62	60+93	R	VWM 2
58+42	58+67	L	LWS	60+71	62+32	C	CCS
58+67	59+16	L	VWM 2	60+93	62+32	L	VWM 1
				60+93	62+32	R	VWM 1

Structure Description	Abbreviation	Drawing Sheet
Large Wood Structure	LWS	8.0
Vegetated Wood Matrix Type 1	VWM1	8.1
Vegetated Wood Matrix Type 2	VWM2	8.1
Vegetated Wood Matrix Type 3	VWM3	8.1
Constructed Channel Streambed	CCS	8.2

NO.	DATE	BY	DESCRIPTION	CHK	JM
1	4-01-19	NW	DESIGN		

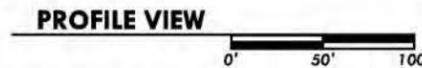
PROJECT NUMBER
RDG-19-001

SHEET NUMBER
5.4



LEGEND

EXISTING GROUND	DESIGN BANKFULL	DESIGN THALWEG
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EARTHWORK VOLUMES

STATION START	STATION END	CUT (CY)	FILL (CY)
56+00	58+00	7,294	284
58+00	60+00	8,400	295
60+00	62+00	3,728	524
62+00	62+30	215	100
TOTAL		19,637	1,203
		18,434 CY NET CUT	

NOTE: REPORTED VOLUMES ARE NEATLINE

GRADING PLAN AND PROFILE

REACH 4B

UPPER NINEMILE CREEK RESTORATION PROJECT

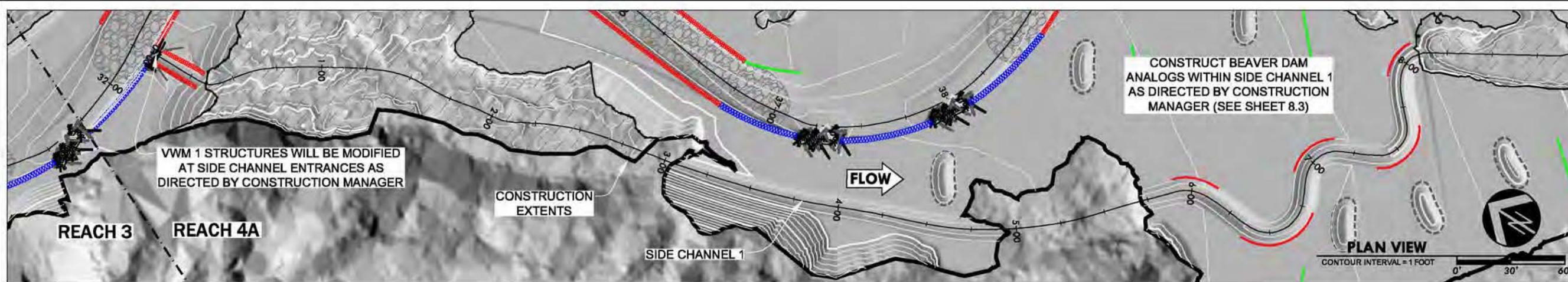
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

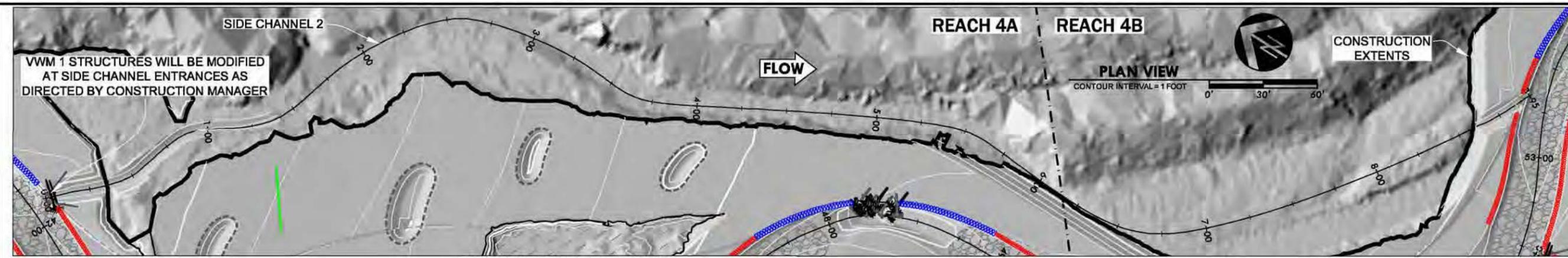
5.5



STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
0+00	0+30	L	VWM 1
0+00	0+30	R	VWM 1
5+90	6+12	L	VWM 1
6+37	6+75	R	VWM 1
6+90	7+15	L	VWM 1
7+38	7+65	R	VWM 1
7+90	8+08	L	VWM 1

Structure Description: Vegetated Wood Matrix Type 1
Abbreviation: VWM 1
Drawing Sheet: 8.1



STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
0+00	0+35	L	VWM 1
0+00	0+35	R	VWM 1
8+60	8+90	L	VWM 1
8+60	8+90	R	VWM 1

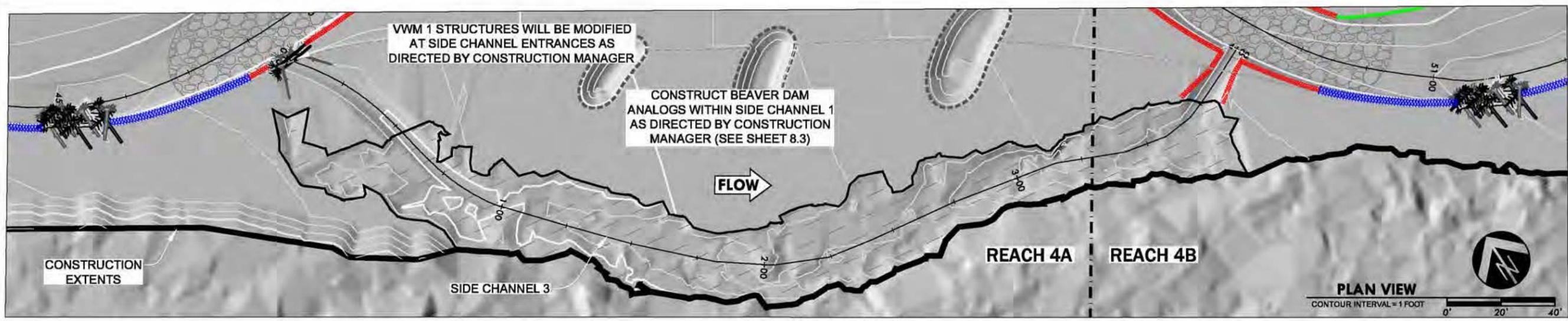
Structure Description: Vegetated Wood Matrix Type 1
Abbreviation: VWM 1
Drawing Sheet: 8.1

PLAN VIEW AND PROFILE
REACH 4A & 4B SIDE CHANNEL 1 & 2
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

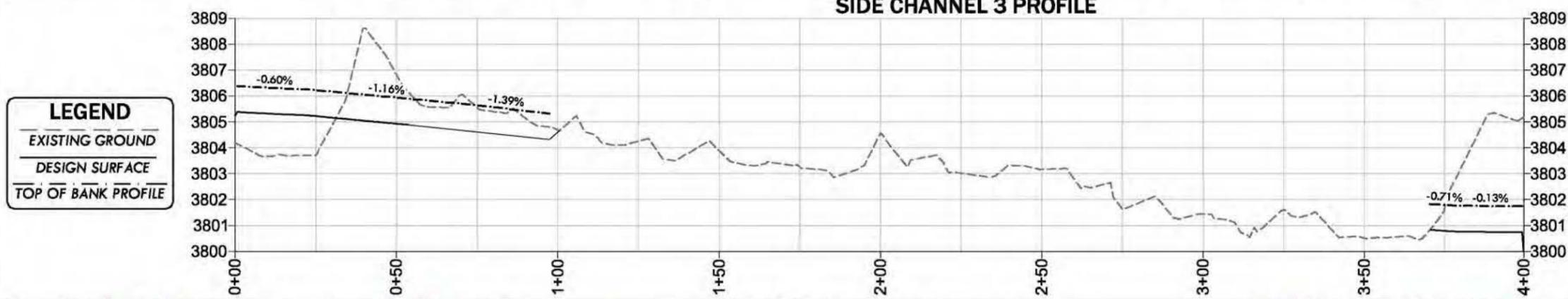
NO.	DATE	BY	DESCRIPTION	CHK	JM
1	4-01-19	NW	DESIGN		

PROJECT NUMBER: RDG-19-001
SHEET NUMBER: **5.6**

PLAN VIEW AND PROFILE
REACH 4A & 4B SIDE CHANNEL 3 & 4
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA



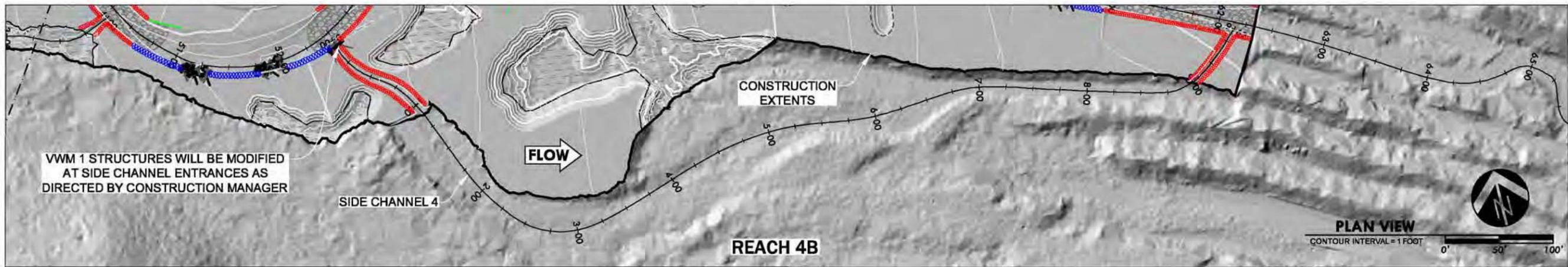
SIDE CHANNEL 3 PROFILE



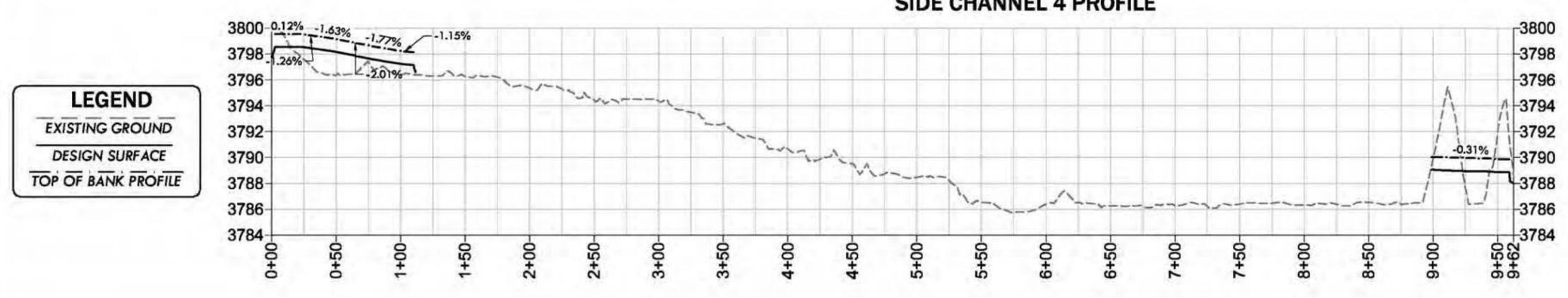
STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
0+00	0+50	L	VWM 1
0+00	0+50	R	VWM 1
3+77	4+00	L	VWM 1
3+77	4+00	R	VWM 1

Structure Description	Abbreviation	Drawing Sheet
Vegetated Wood Matrix Type 1	VWM 1	8.1



SIDE CHANNEL 4 PROFILE



STRUCTURE SCHEDULE

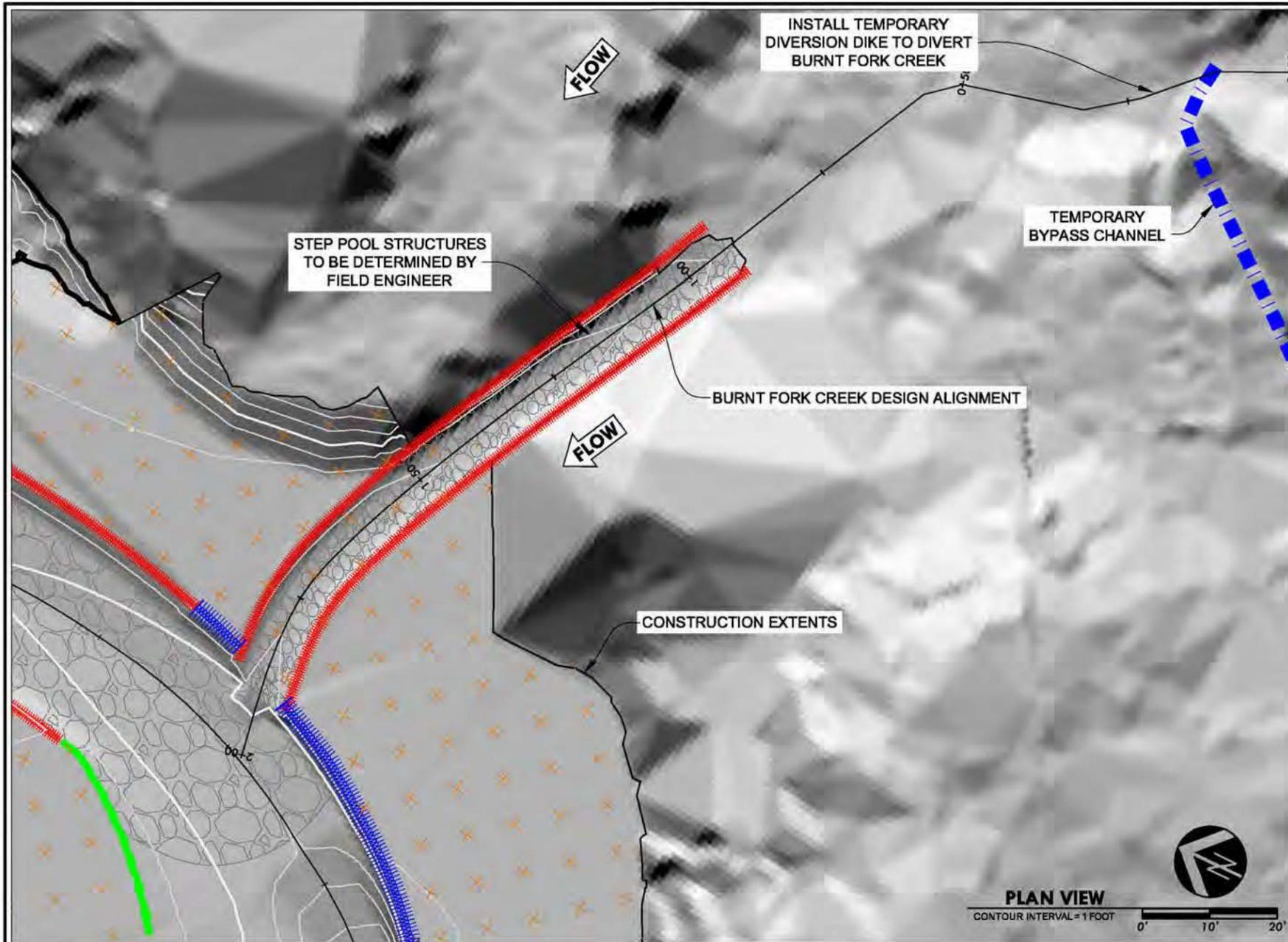
STATION START	STATION END	BANK	STRUCTURE
0+05	1+00	L	VWM 1
0+05	1+00	R	VWM 1
9+00	9+55	L	VWM 1
9+00	9+55	R	VWM 1

Structure Description	Abbreviation	Drawing Sheet
Vegetated Wood Matrix Type 1	VWM 1	8.1

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER
5.7



CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)
0+92	3820.29
1+00	3819.71
1+25	3818.60
1+50	3817.88
1+75	3817.16
1+91	3816.70

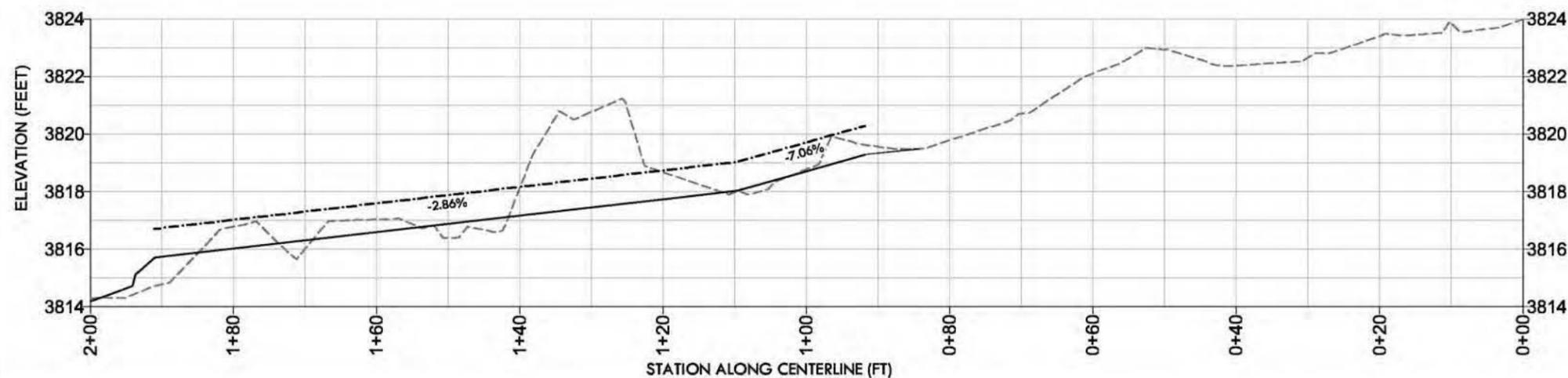
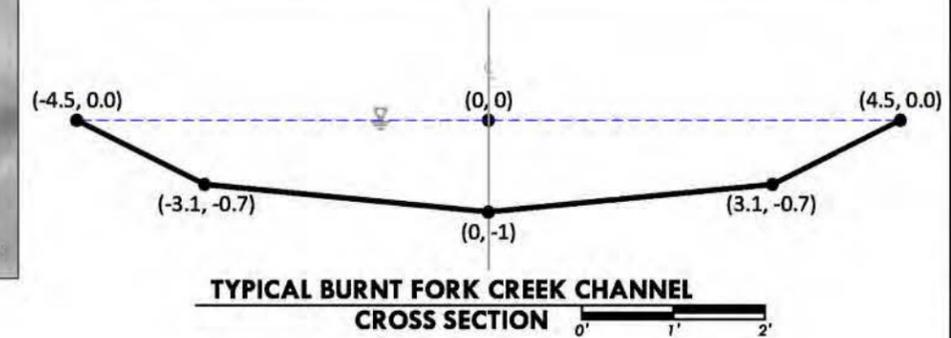
LEGEND

BANK STRUCTURES		DETAIL SHEET #
	LARGE WOOD STRUCTURE TYPE (LWST 1)	8.0
	VEGETATED WOOD MATRIX TYPE 1 (VWBF 1)	8.1
CHANNEL STRUCTURES		
	CONSTRUCTED CHANNEL STREAMBED (CCS)	8.2

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
0+92	1+91	R	VWBF1
0+92	1+91	L	VWBF1
0+92	1+91	C	CR

Structure Description	Abbreviation	Drawing Sheet
Vegetated Wood Matrix Type 1	VWM1	8.1
Constructed Channel Streambed	CCS	8.2



LEGEND

	EXISTING GROUND
	DESIGN BANKFULL
	DESIGN SURFACE

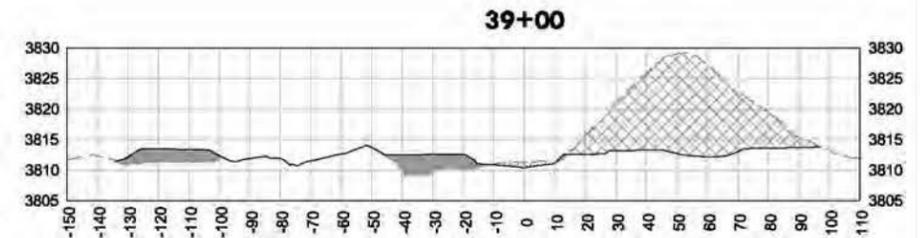
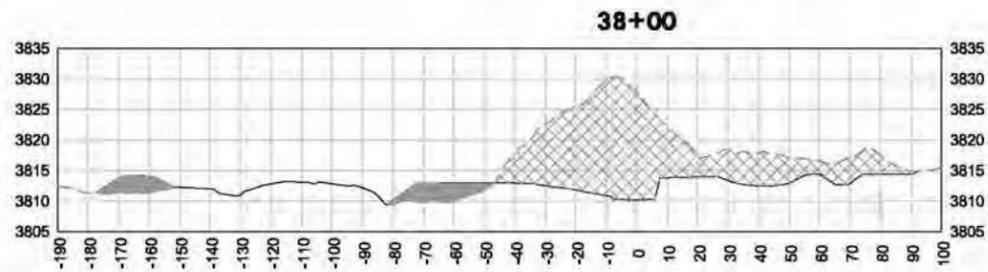
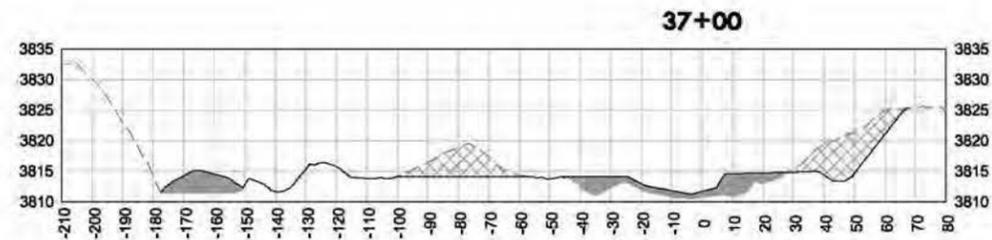
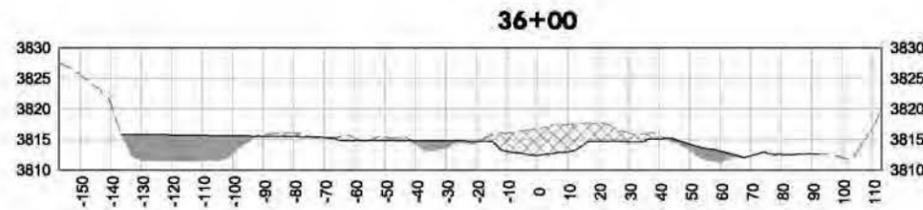
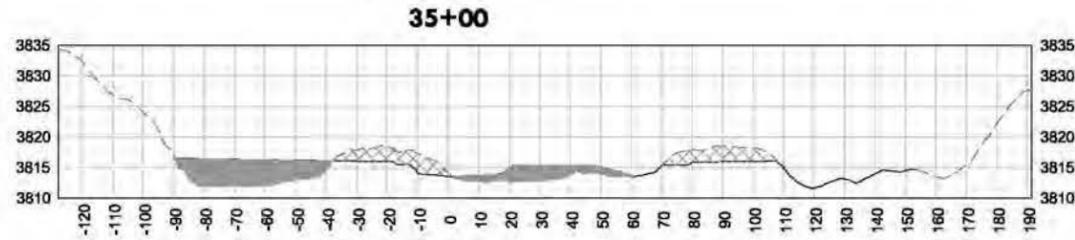
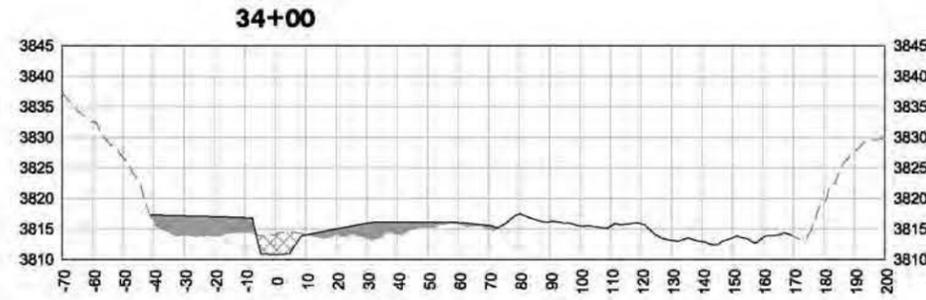
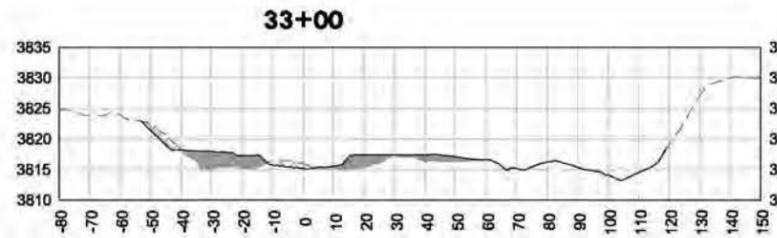
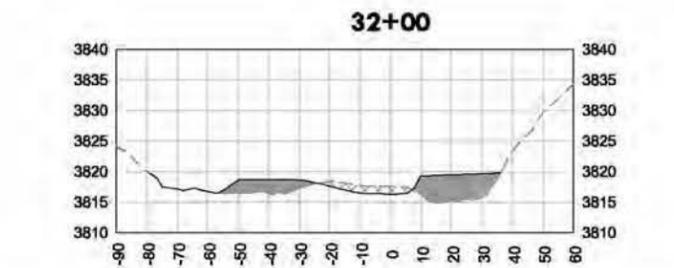
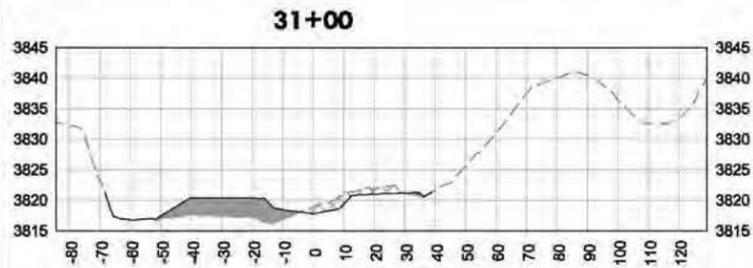
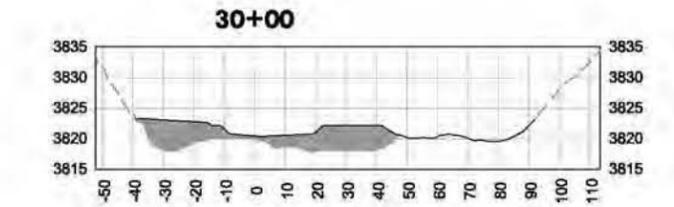
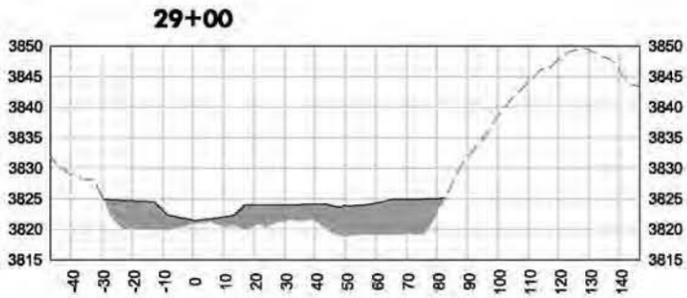
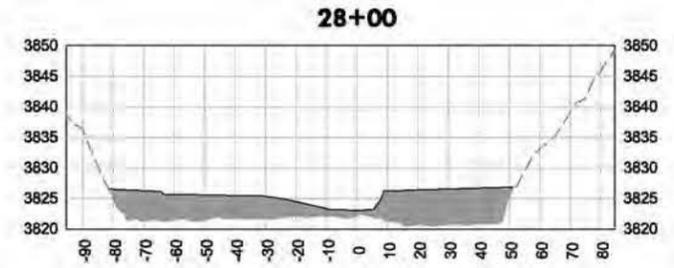
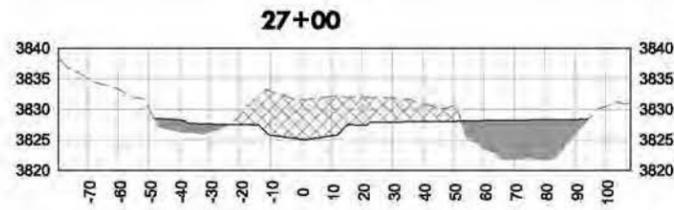
PROFILE VIEW

**PLAN AND PROFILE
BURNT FORK CREEK
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA**

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM

PROJECT NUMBER
RDG-19-001

SHEET NUMBER
5.8



NOTE: CROSS SECTIONS ARE SHOWN LOOKING DOWNSTREAM PERPENDICULAR TO THE VALLEY ALONG THE CHANNEL ALIGNMENT.

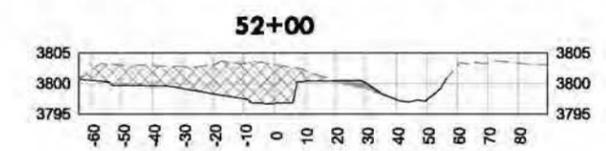
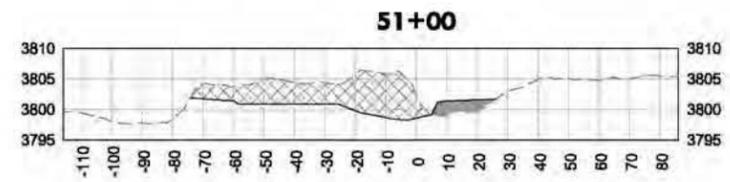
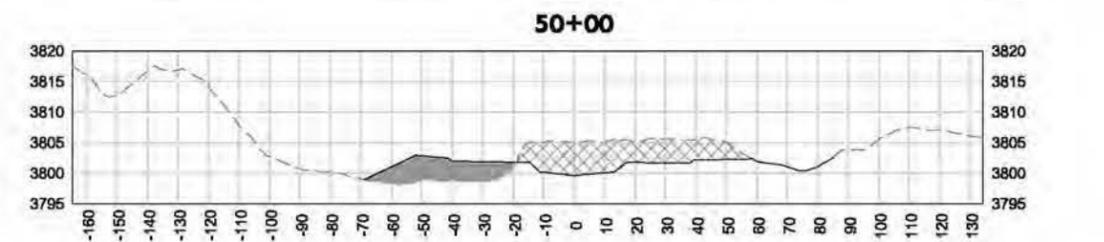
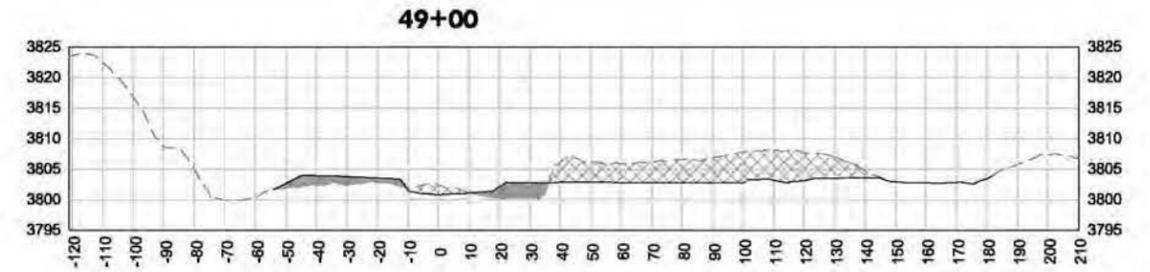
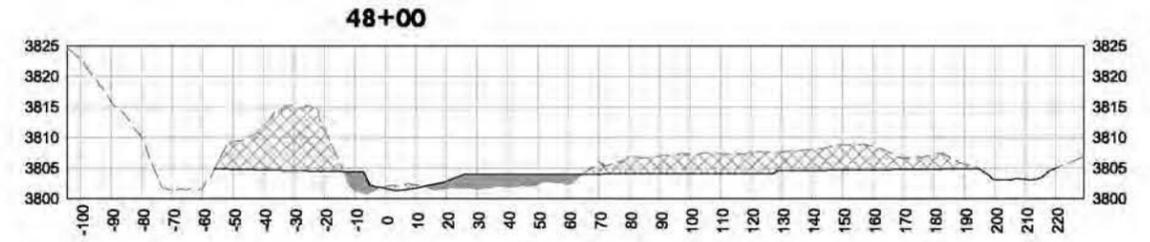
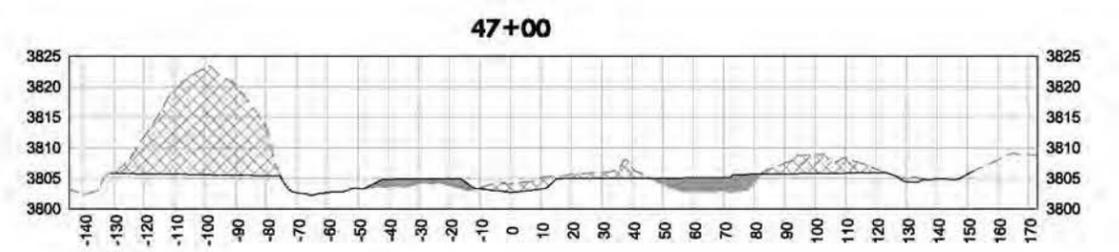
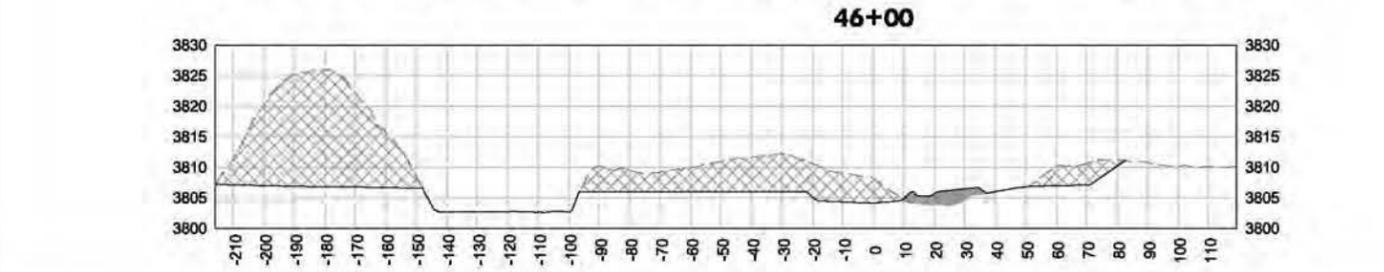
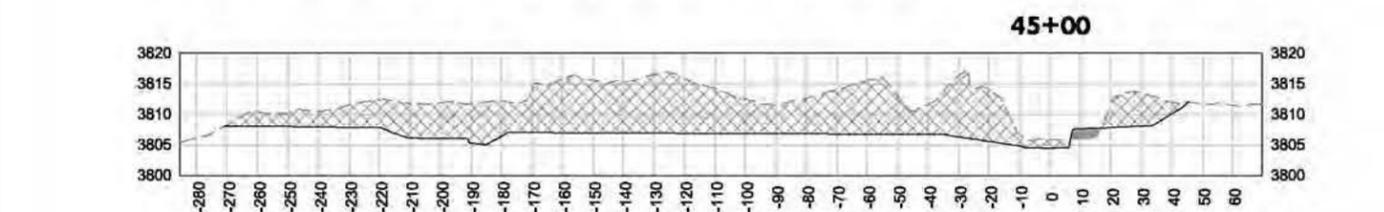
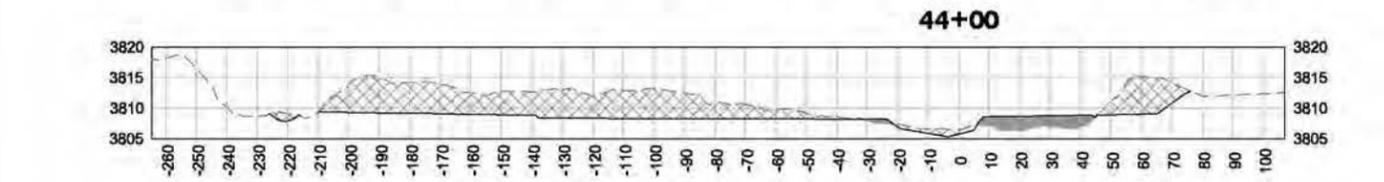
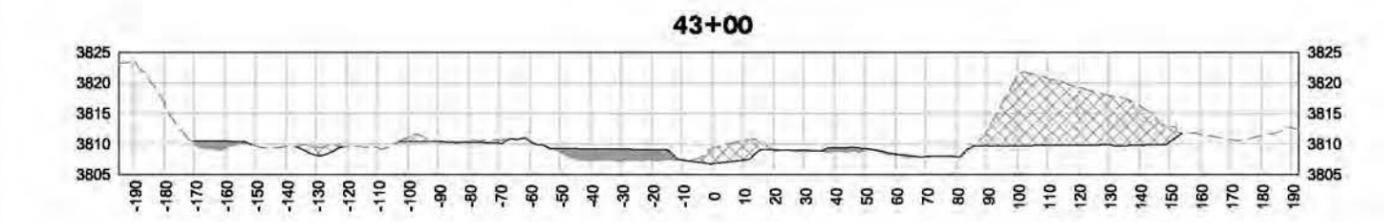
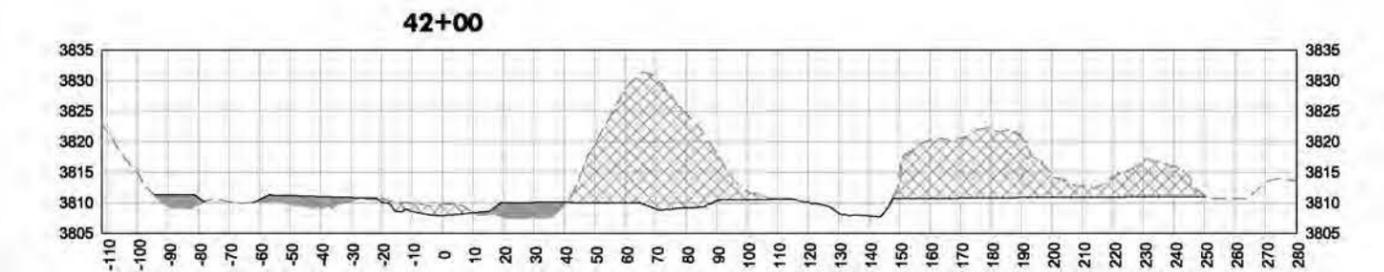
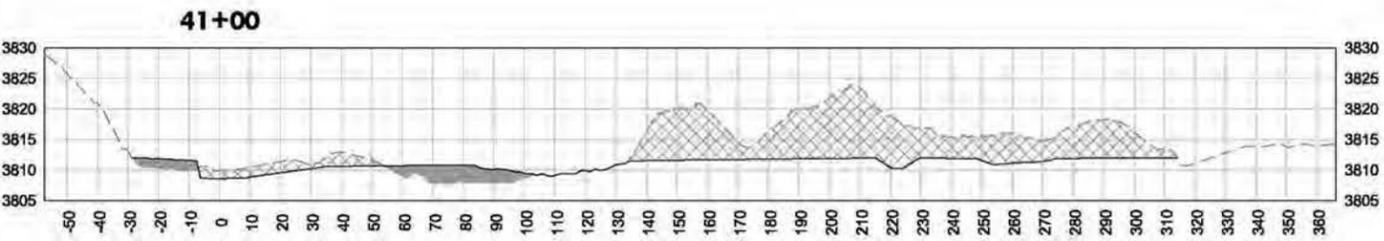
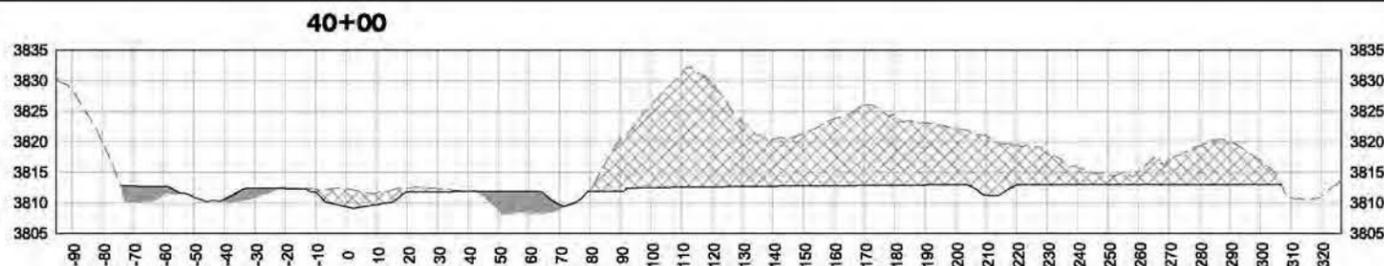
CROSS SECTIONS
REACH 3 & 4A
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM/GC

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

6.0



LEGEND

--- EXISTING GROUND [Cross-hatched] CUT

— DESIGN SURFACE [Solid Grey] FILL

NOTE: CROSS SECTIONS ARE SHOWN LOOKING DOWNSTREAM PERPENDICULAR TO THE VALLEY ALONG THE CHANNEL ALIGNMENT.

CROSS SECTIONS
REACH 4A & 4B
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

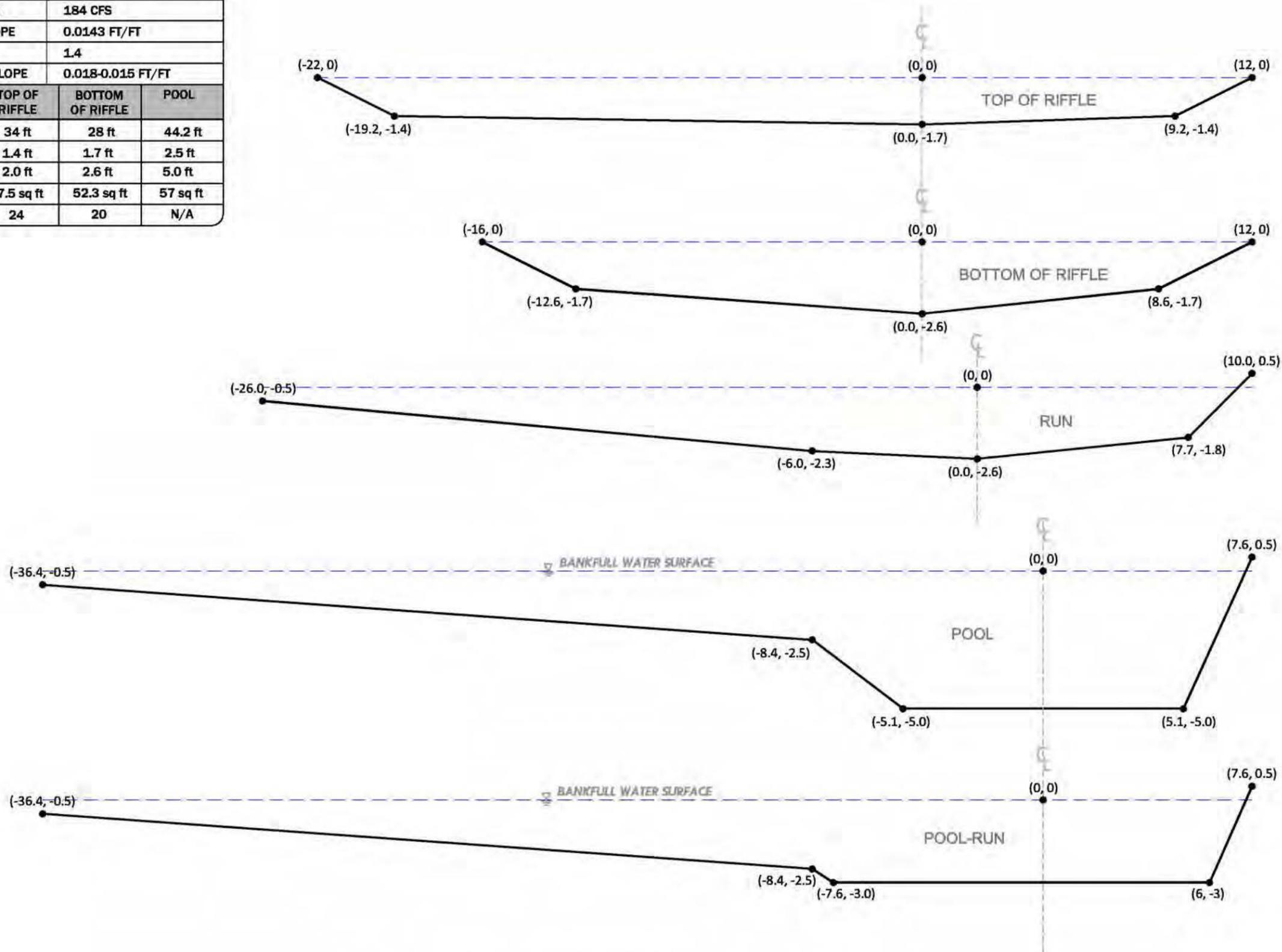
NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM/GC

PROJECT NUMBER
RDG-19-001

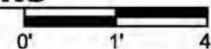
SHEET NUMBER

STATION 26+53 TO 34+00

BANKFULL CHANNEL DESIGN CRITERIA			
STREAM TYPE	C3		
DISCHARGE	184 CFS		
VALLEY SLOPE	0.0143 FT/FT		
SINUOSITY	1.4		
CHANNEL SLOPE	0.018-0.015 FT/FT		
PARAMETER	TOP OF RIFFLE	BOTTOM OF RIFFLE	POOL
FEATURE			
WIDTH	34 ft	28 ft	44.2 ft
MEAN DEPTH	1.4 ft	1.7 ft	2.5 ft
MAX. DEPTH	2.0 ft	2.6 ft	5.0 ft
XS AREA	47.5 sq ft	52.3 sq ft	57 sq ft
WIDTH:DEPTH	24	20	N/A



**CHANNEL CROSS SECTIONS
TYPICAL**



NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK CENTERLINE



**CHANNEL CROSS SECTION DIMENSIONS
REACH 3
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA**

NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	DESIGN	JM/GC

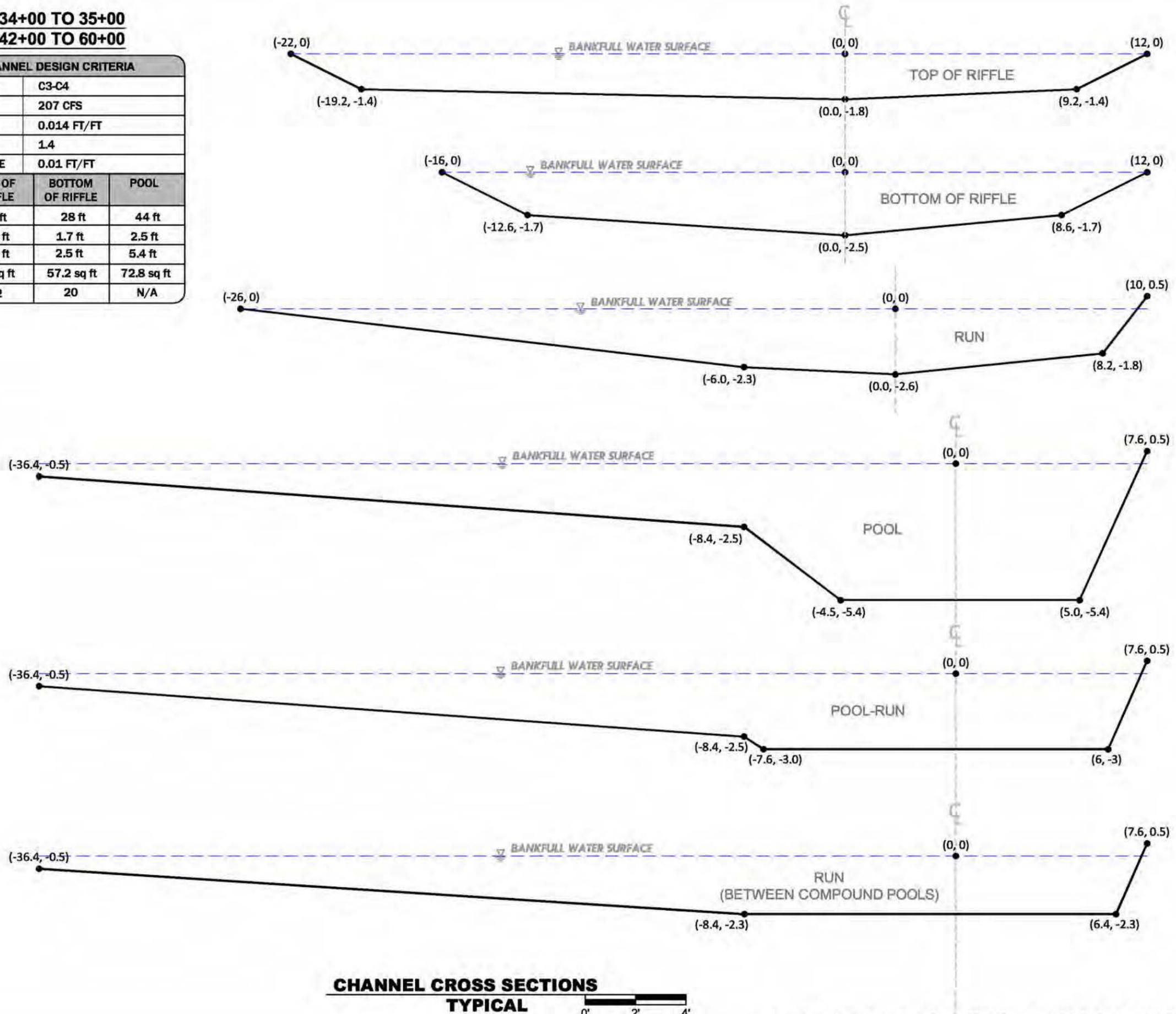
PROJECT NUMBER
RDG-19-001

SHEET NUMBER

7.0

STATION 34+00 TO 35+00
STATION 42+00 TO 60+00

BANKFULL CHANNEL DESIGN CRITERIA			
STREAM TYPE	C3-C4		
DISCHARGE	207 CFS		
VALLEY SLOPE	0.014 FT/FT		
SINUOSITY	1.4		
CHANNEL SLOPE	0.01 FT/FT		
PARAMETER	TOP OF RIFFLE	BOTTOM OF RIFFLE	POOL
WIDTH	34 ft	28 ft	44 ft
MEAN DEPTH	1.4 ft	1.7 ft	2.5 ft
MAX. DEPTH	1.8 ft	2.5 ft	5.4 ft
XS AREA	52 sq ft	57.2 sq ft	72.8 sq ft
WIDTH:DEPTH	22	20	N/A



CHANNEL CROSS SECTIONS
TYPICAL



NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK CENTERLINE



CHANNEL CROSS SECTION DIMENSIONS
REACH 4A-1 & 4B-1
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
				JM/GC
1	4-01-19	NW	DESIGN	

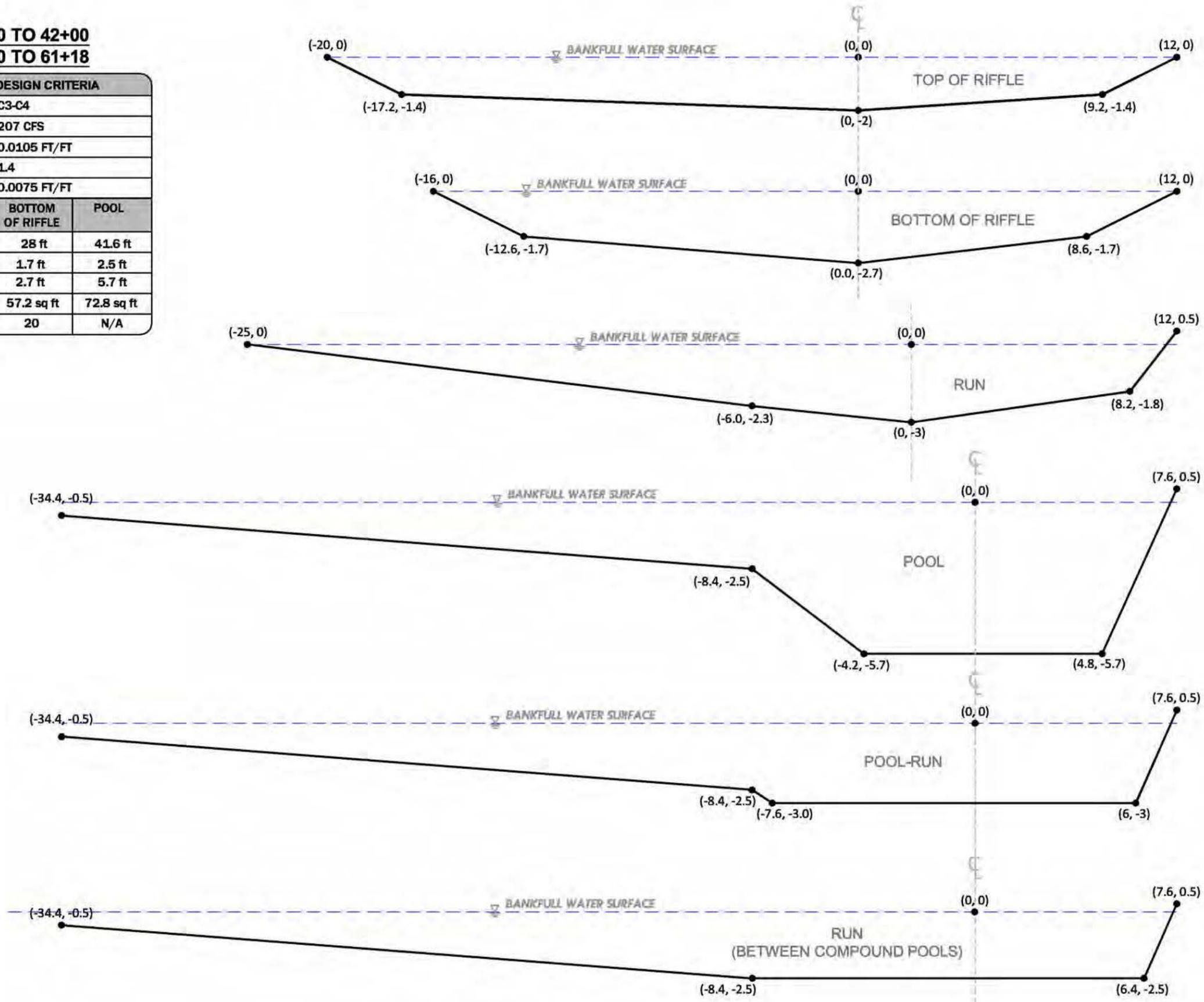
PROJECT NUMBER
RDG-19-001

SHEET NUMBER

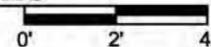
7.1

STATION 35+00 TO 42+00
STATION 60+00 TO 61+18

BANKFULL CHANNEL DESIGN CRITERIA			
STREAM TYPE	C3-C4		
DISCHARGE	207 CFS		
VALLEY SLOPE	0.0105 FT/FT		
SINUOSITY	1.4		
CHANNEL SLOPE	0.0075 FT/FT		
PARAMETER	TOP OF RIFFLE	BOTTOM OF RIFFLE	POOL
WIDTH	32 ft	28 ft	41.6 ft
MEAN DEPTH	1.4 ft	1.7 ft	2.5 ft
MAX. DEPTH	2.0 ft	2.7 ft	5.7 ft
XS AREA	52 sq ft	57.2 sq ft	72.8 sq ft
WIDTH:DEPTH	19.7	20	N/A



CHANNEL CROSS SECTIONS
TYPICAL



NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK CENTERLINE



CHANNEL CROSS SECTION DIMENSIONS
REACH 4A-2
UPPER NINEMILE CREEK RESTORATION PROJECT
NEAR HUSON, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
				JM/GC
1	4-01-19	NW	DESIGN	

PROJECT NUMBER
RDG-19-001

SHEET NUMBER

7.2

GENERAL NOTES

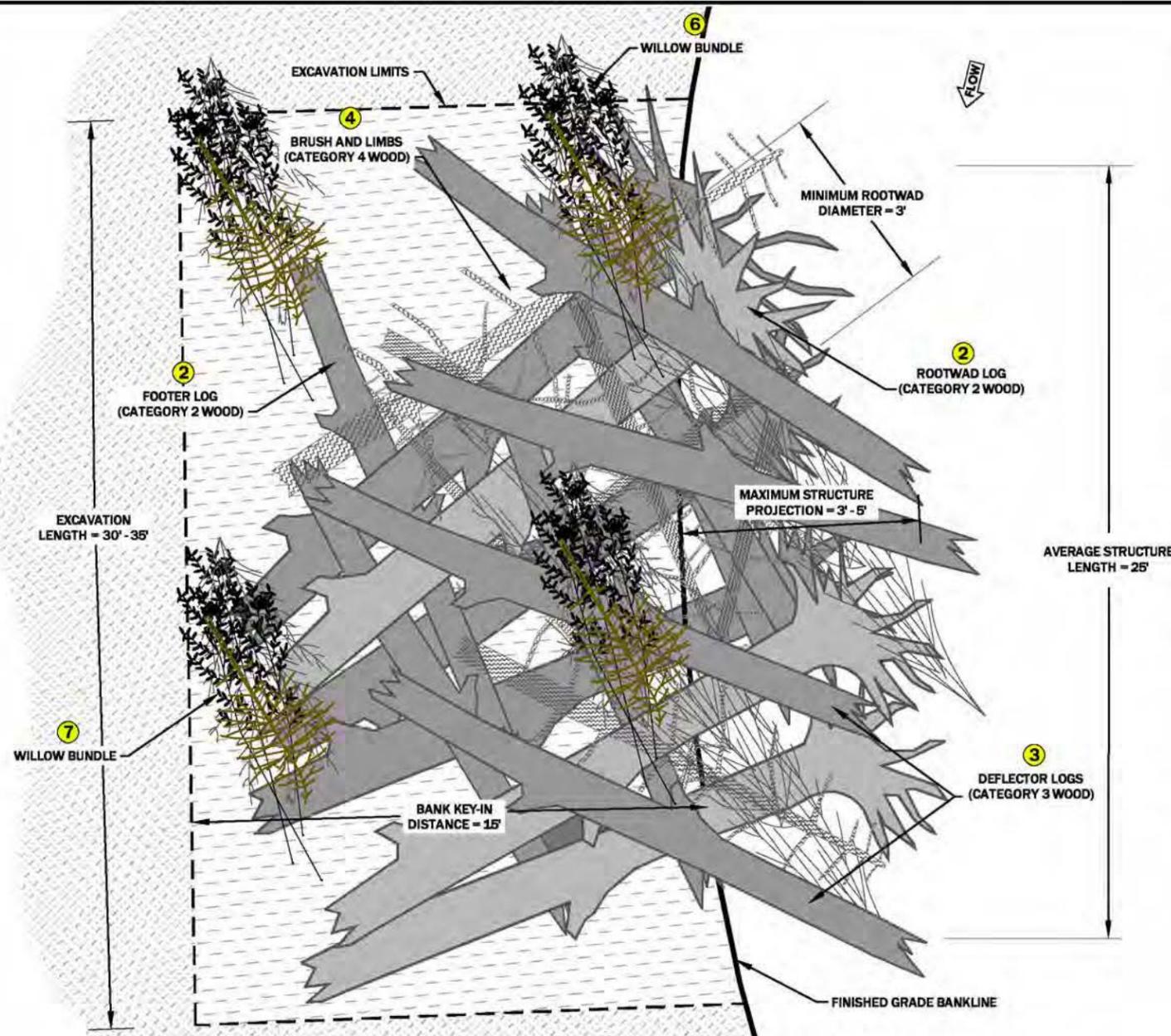
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR PRIOR TO CONSTRUCTION OF CHANNEL STREAMBED AND IN COORDINATION WITH INSTALLATION OF VEGETATED WOOD MATRIX TYPE 1 AND VEGETATED WOOD MATRIX TYPE 2.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
3. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY ENGINEER.
4. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION

NOTES ON LARGE WOOD STRUCTURE INSTALLATION

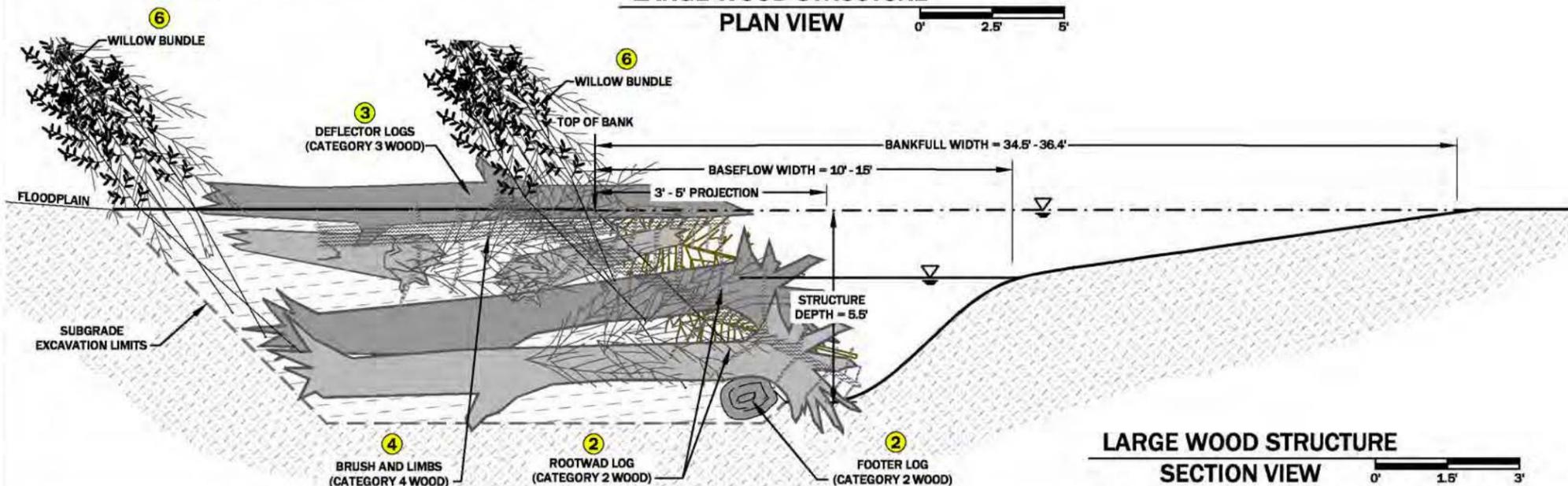
1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
3. INSTALL THREE TO FOUR ROOTWAD LOGS (CATEGORY 2 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 3 - 5 FT. BEYOND THE FINISHED BANK LINE.
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL BRUSH AND LIMBS (CATEGORY 4 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 5 - 8 FT. BEYOND THE FINISHED BANK LINE.
6. INSTALL THREE TO FOUR ROOTWAD LOGS (CATEGORY 2 WOOD) ON TOP OF THE BRUSH AND LIMBS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 3 - 5 FT. BEYOND THE FINISHED BANK LINE.
8. PLACE FOUR WILLOW BUNDLES INTERWOVEN INTO WOOD MATRIX AS SHOWN IN THE PLAN VIEW. WILLOW BUNDLES SHALL BE SET AS TO BE IN CONTACT WITH LOW FLOW WATER SURFACE ELEVATION.
9. BACKFILL STRUCTURE WITH STOCKPILED MATERIAL UP TO THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED.
10. INSTALL BRUSH AND LIMBS (CATEGORY 4 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 5 - 8 FT. BEYOND THE FINISHED BANK LINE.
11. INSTALL THREE TO FOUR DEFLECTOR LOGS (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. TOP OF DEFLECTOR LOGS CAN BE UP TO 0.5 FT ABOVE TOP OF BANK ELEVATION AND SHALL PROJECT NO GREATER THAN 6 FT. BEYOND THE FINISHED BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
12. PLACE AND BUCKET COMPACT STOCKPILED MATERIAL TO THE FINISHED BANK LINE. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

MATERIAL SCHEDULE (PER STRUCTURE)

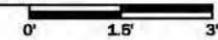
ITEM	QUANTITY
② CATEGORY 2 WOOD	15
③ CATEGORY 3 WOOD	6
④ CATEGORY 4 WOOD	6
⑥ CATEGORY 1 ROCK	6
⑦ WILLOW BUNDLE	4



**LARGE WOOD STRUCTURE
PLAN VIEW**



**LARGE WOOD STRUCTURE
SECTION VIEW**

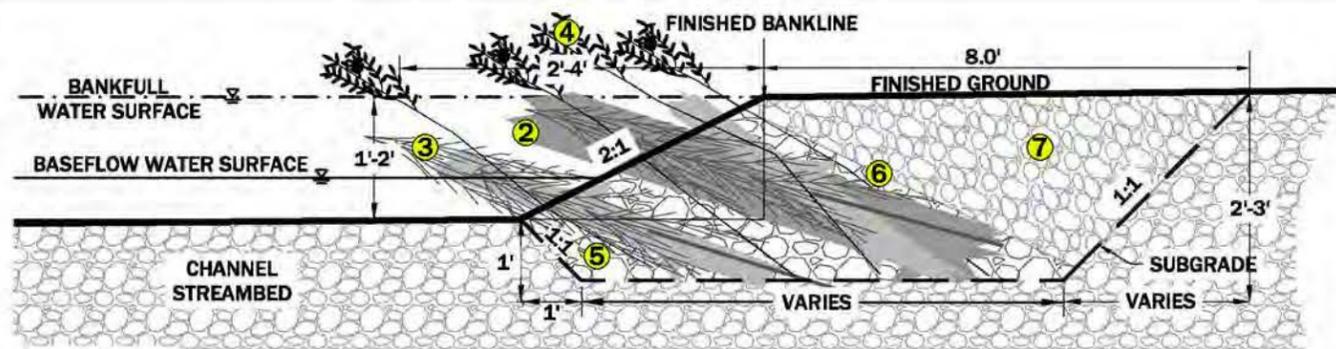


EXAMPLE OF A LARGE WOOD STRUCTURE IN REACH 4A

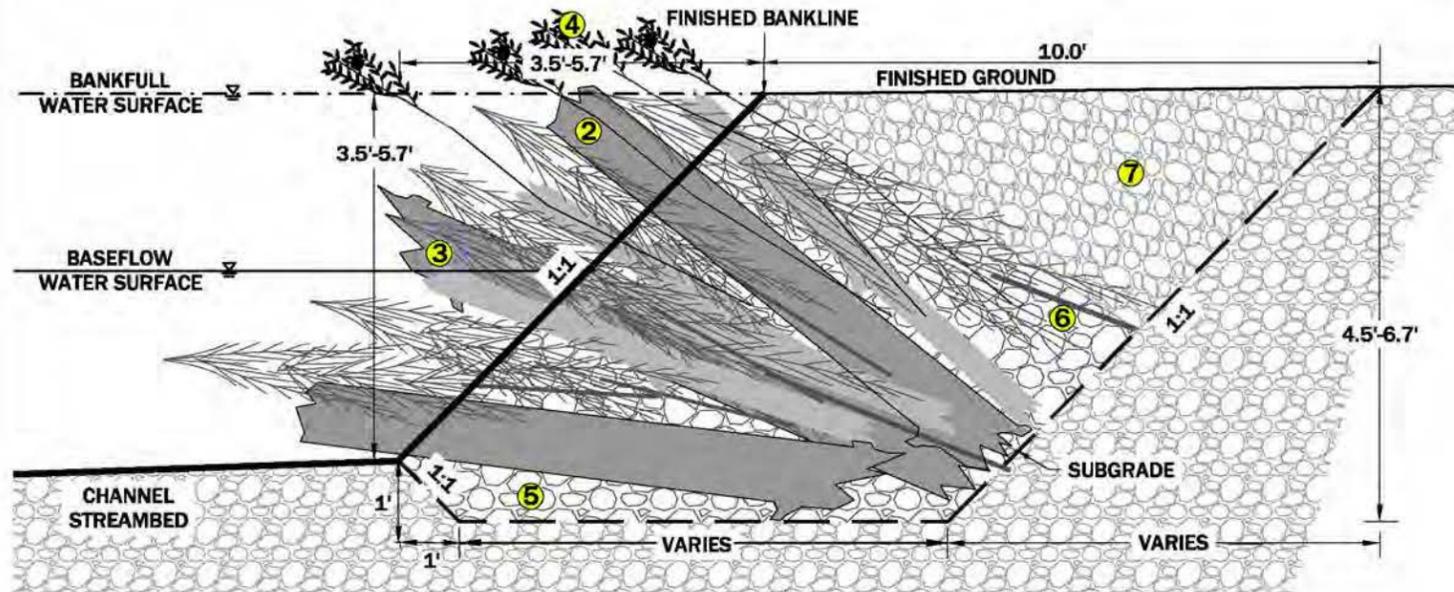
NO.	DATE	BY	DESCRIPTION	CHK
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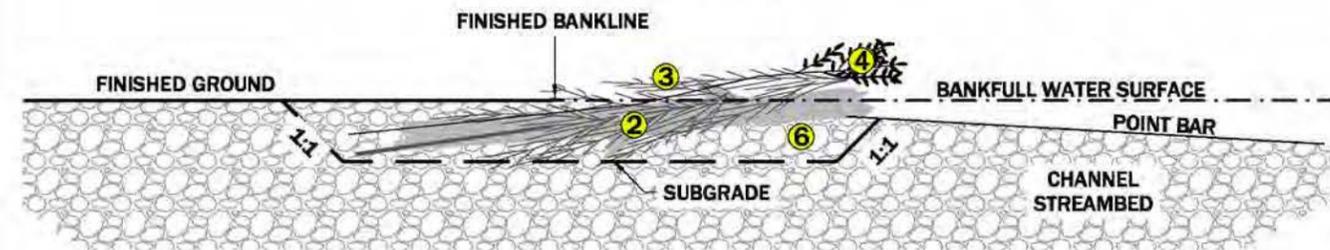
SHEET NUMBER
8.0



VEGETATED WOOD MATRIX TYPE 1 - RIFFLE
SECTION VIEW



VEGETATED WOOD MATRIX TYPE 2 - RUN/GLIDE
SECTION VIEW



VEGETATED WOOD MATRIX TYPE 3 - POINT BAR
SECTION VIEW

CATEGORY 2 ROCK GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
12	95	D100
10	90-95	D95
8	85-90	D84
6	85-85	D65
4	50-65	D50
2	30-50	D35
0.5	10-30	D15
FINES	0-10	

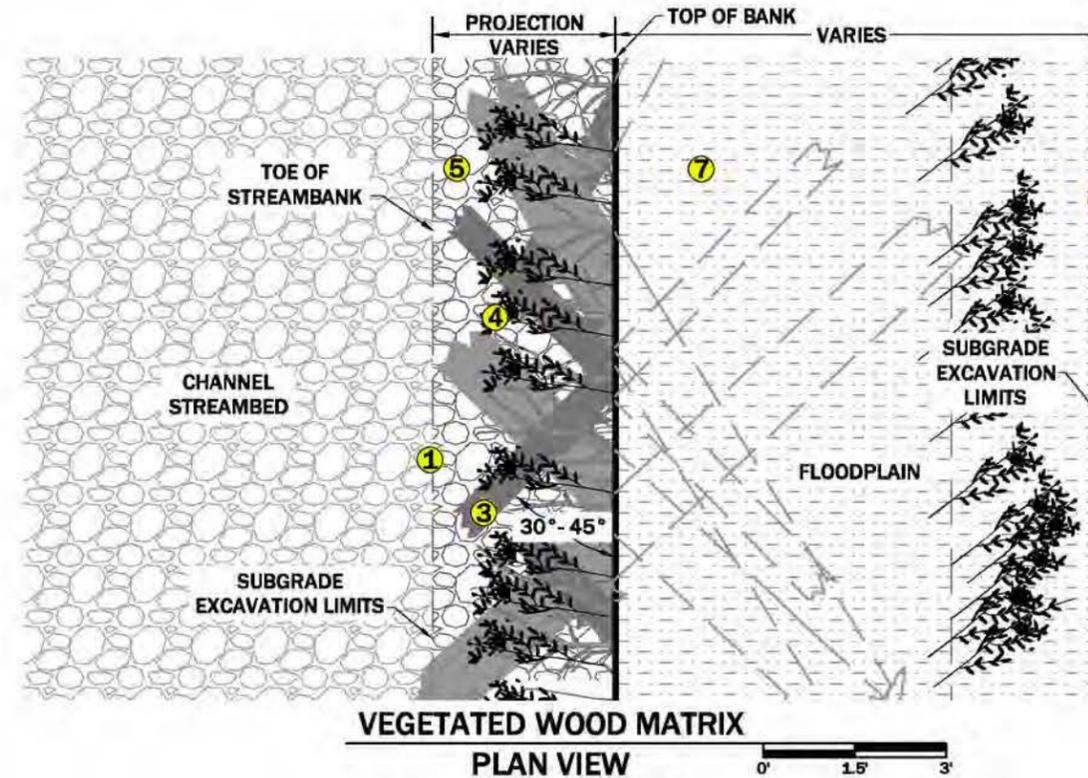
NOTE: ALL GRADATIONS TO BE APPROVED BY THE CONTRACTING OFFICER. ON-SITE MATERIALS MAY NEED TO BE SUPPLEMENTED WITH IMPORTED ROCK. IMPORTED ROCK QUANTITY TO BE DETERMINED BY THE CONTRACTING OFFICER AND WILL BE CONTRACTED AS A CHANGE ORDER USING HOURLY EQUIPMENT RATES.

GENERAL NOTES

1. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
2. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED WOOD MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
2. FOR EACH TIER (2 TIERS FOR RIFFLE, 3-4 TIERS FOR RUN/GLIDE), PLACE SMALL LOGS IN THE STREAMBANK AT SKEWED ANGLE TO THE STREAMBANK. LOGS SHALL BE PLACED BELOW THE TOP OF BANK ELEVATION. LOGS SHALL OVERLAP.
3. FOR EACH TIER (2 TIERS FOR RIFFLE, 3-4 TIERS FOR RUN/GLIDE), PLACE BRUSH WITHIN THE MATRIX OF SMALL LOGS. BRUSH MAY EXTEND ABOVE THE TOP OF BANK ELEVATION BY UP TO ONE FOOT.
4. AFTER ALL TIERS ARE CONSTRUCTED PLACE ROOTED STOCK INTO THE LOG/BRUSH MATRIX WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND THE LEAVES AT OR ABOVE THE BANKFULL WATER SURFACE ELEVATION.
5. BACKFILL STREAMBANK WITH STREAMBANK FILL PER THE GRADATION SHOWN ON THE DRAWINGS.
6. WASH FINES AND WATER FROM ONSITE INTO THE STREAMBANK FILL TO SEAL THE VOIDS IN THE BACKFILL.
7. GRADE THE TOP OF BANK WITH NATIVE FILL TO MATCH FINISHED GROUND ELEVATIONS APPLY FLOODPLAIN ROUGHNESS (SHEET 9.2).



VEGETATED WOOD MATRIX
PLAN VIEW

MATERIAL SCHEDULE (PER LINEAR FOOT)

ITEM	RIFFLER QUANTITY	RUN/GLIDE QUANTITY	POINT BAR QUANTITY
2	0.8	1.25	0.4
3	1.25	2.5	0.6
4	10	10	10
5	0.7	1.2	
6			0.15

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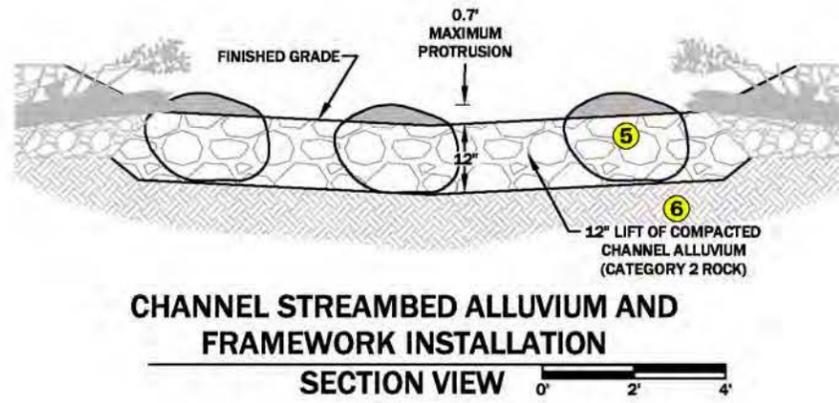
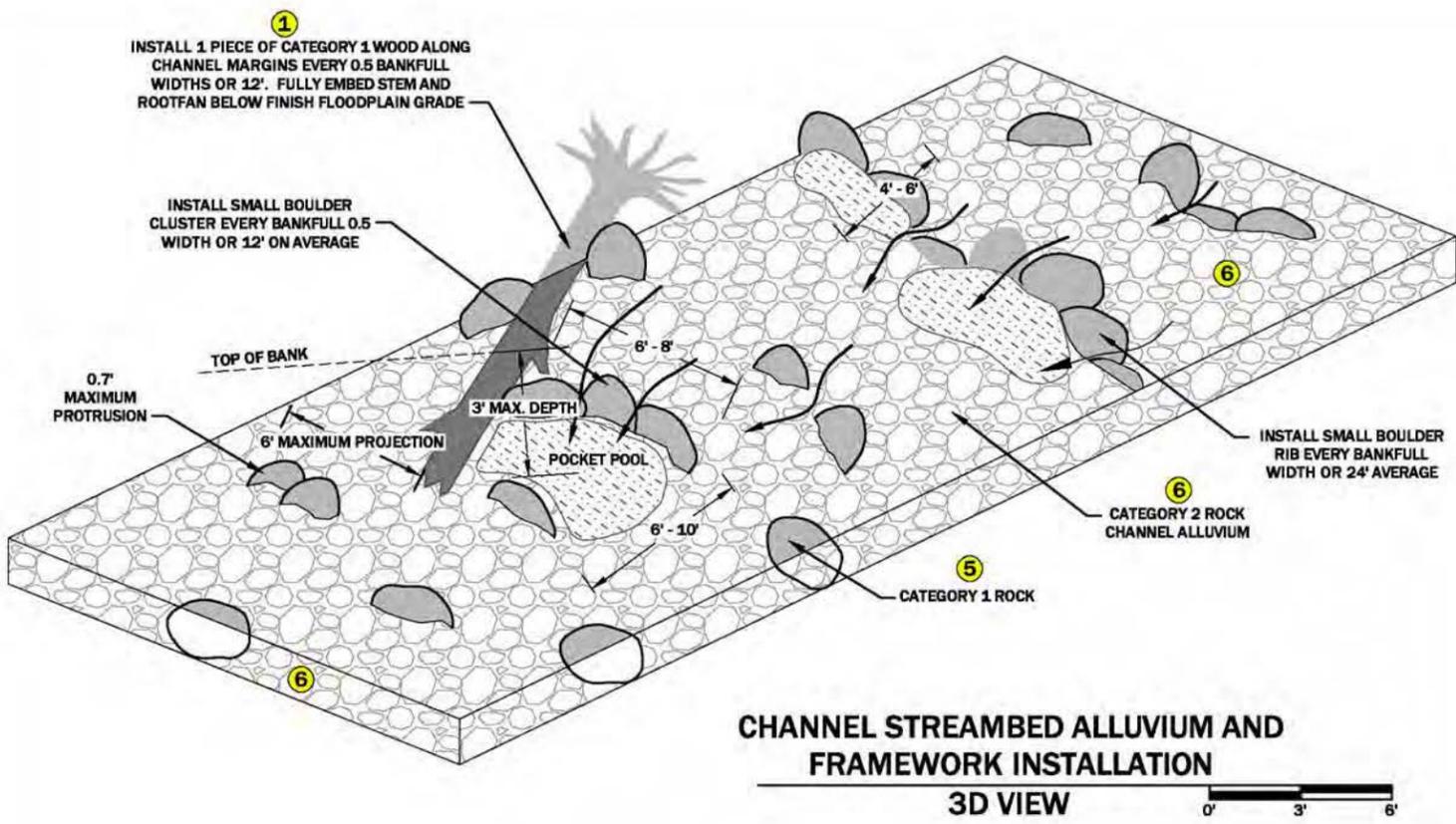
NO.	DATE	BY	DESCRIPTION	CHK
1	4-01-19	NW	FINAL DESIGN	JM

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL STREAMBED WILL OCCUR AFTER THE LARGE WOOD STRUCTURES ARE INSTALLED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.
3. IT IS THE CONTRACTORS RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES INCLUDING CONSTRUCTED POCKET POOLS AND RIB FEATURES.

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

1. PRIOR TO CONSTRUCTION OF THE CHANNEL STREAMBED, ENGINEER SHALL VERIFY CHANNEL SUBGRADE WHICH WILL SERVE AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM AND CATEGORY 2 ROCK PER SPECIFICATIONS NOTED ON THE DRAWINGS.
3. PREPARE THE FRAMEWORK. CONTRACTOR SHALL PLACE 18-INCH TO 24-INCH BOULDERS (CATEGORY 2 ROCK) ON THE SURFACE OF THE CHANNEL SUBGRADE AS INDICATED ON THE DRAWING. DUE TO THE INHERENT VARIABILITY IN MATERIALS, BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE WILL BE NO GREATER THAN 0.7-FT.
4. CONTRACTOR SHALL INSTALL 18-INCH TO 24-INCH BOULDERS (CATEGORY 2 ROCK) IN CLUSTERS, AS DIRECTED BY THE ENGINEER, TO CREATE A COMPLEX SERIES OF POCKET POOLS THAT EFFECTIVELY DISSIPATE ENERGY AND PROVIDE PATHWAYS FOR FISH MOVEMENT. BOULDER ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.7-FT.
5. SMALL BOULDER RIBS SHALL BE INSTALLED AS A COMPONENT OF THE CONSTRUCTED CHANNEL STREAMBED. AS SHOWN ON THE DRAWINGS, CONTRACTOR SHALL PLACE 18-INCH TO 24-INCH BOULDERS (CATEGORY 1 ROCK) IN AN IRREGULAR PATTERN SPANNING THE FULL WIDTH OF THE BANKFULL CHANNEL, AS DIRECTED BY THE ENGINEER. THE ROCKS SHALL INTERLOCK WITH NO GAPS BETWEEN ROCKS GREATER THAN 0.5-FT. ELEVATIONS SHALL BE ADJUSTED TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE IS NO GREATER THAN 0.7-FT.
6. CONTRACTOR SHALL INSTALL CHANNEL MARGIN WOOD (CATEGORY 1 WOOD) TO PROVIDE CHANNEL MARGIN AQUATIC HABITAT COMPLEXITY AND ROUGHNESS. WOOD SHALL PROJECT NO GREATER THAN 6 FEET. INTO THE CONSTRUCTED STREAMBED IN VARIOUS ORIENTATIONS TO FLOW, AS DIRECTED BY ENGINEER. WOOD SHALL BE INSTALLED EMBEDDED INTO THE CHANNEL STREAMBED A MINIMUM OF ONE-HALF THE LOG DIAMETER, AS SHOWN ON THE DRAWINGS.
7. PREPARE THE MATRIX. AFTER THE FRAMEWORK, BOULDER CLUSTERS, AND SMALL BOULDER RIBS ARE INSTALLED AND INSPECTED BY ENGINEER, PLACE APPROPRIATE CHANNEL ALLUVIUM GRADATION AND WASH FINES INTO STREAMBED. CHANNEL ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS IN LIFTS OF 9-INCHES TO FINISHED GRADE. INDIVIDUAL COURSES SHALL BE BUCKET COMPACTED.



MATERIAL SCHEDULE (PER LINEAR FOOT)

ITEM	QUANTITY
1 CATEGORY 1 WOOD	0.08
5 CATEGORY 1 ROCK	0.4
6 CATEGORY 2 ROCK	0.7

CATEGORY 2 ROCK GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
12	95	D100
10	90-95	D95
8	85-90	D84
6	65 - 85	D65
4	50 - 65	D50
2	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

PROVIDE MINIMUM 20% RETAINED IN 0.08" SIZE CLASS



TYPICAL CONSTRUCTED CHANNEL STREAMBED



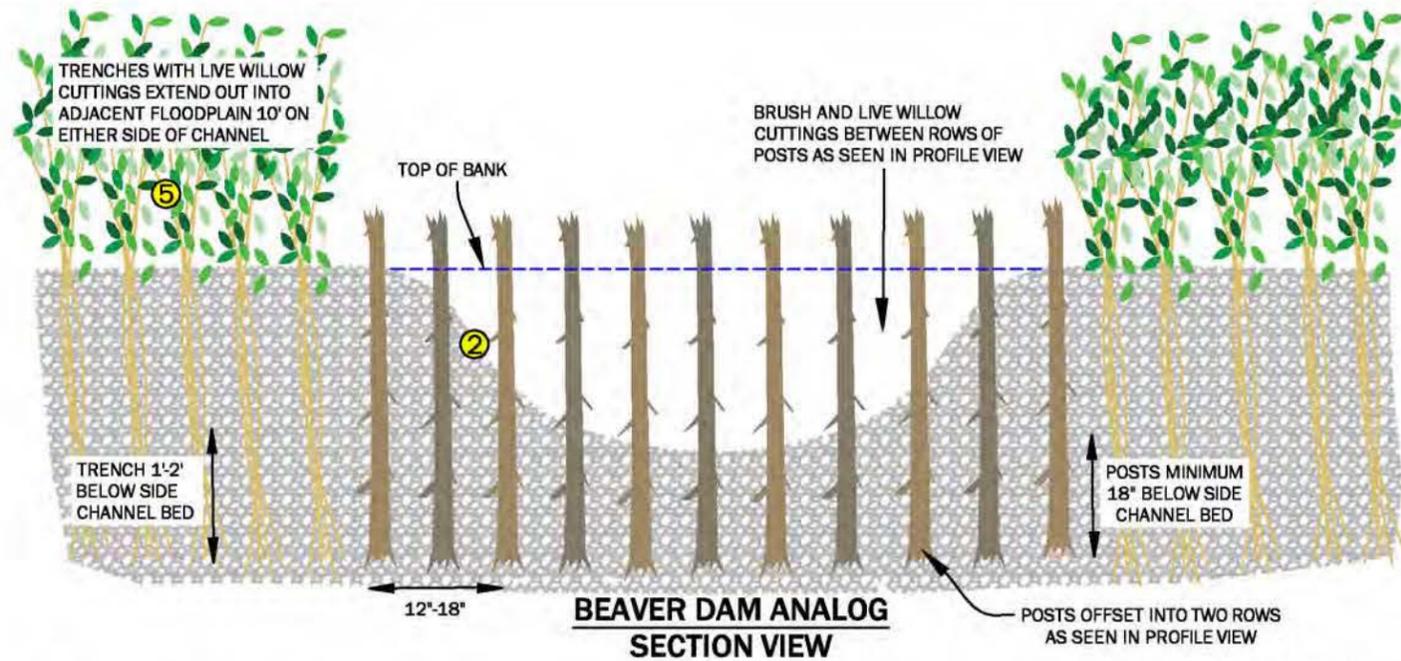
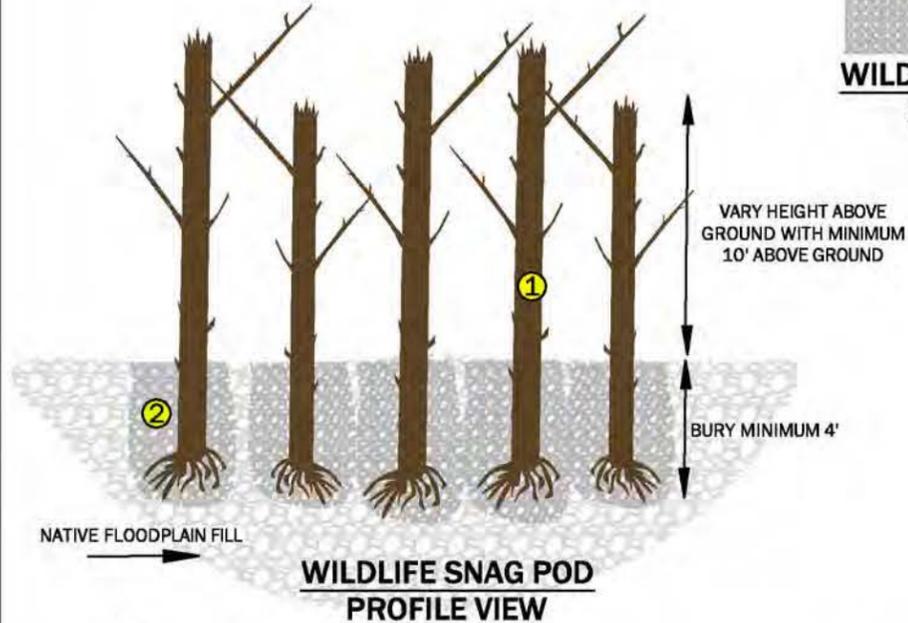
TYPICAL POCKET POOL (CROW CREEK PHASE 1)



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

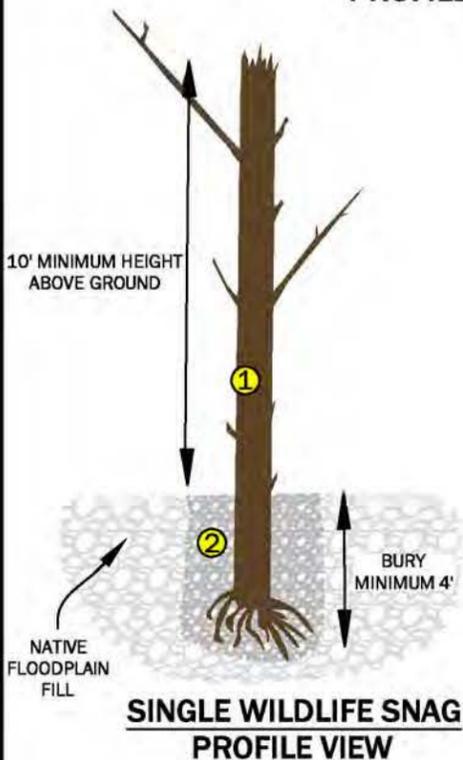
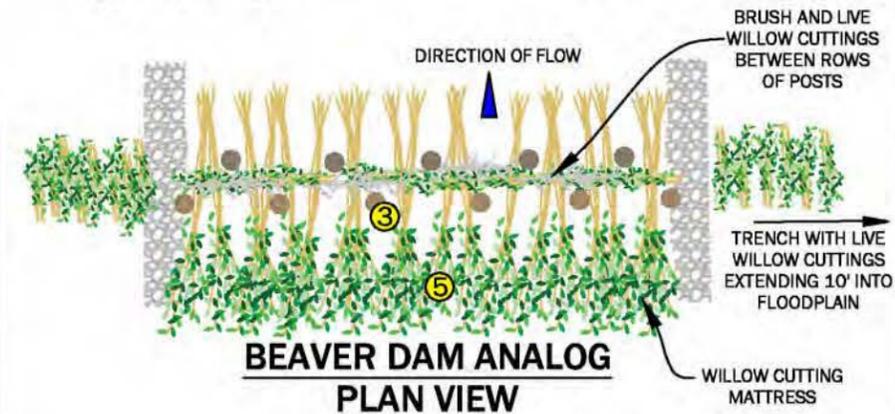
GENERAL NOTES

1. CONSTRUCTION OF THE WILDLIFE SNAGS AND BEAVER DAM ANALOGS WILL OCCUR AFTER THE SIDE CHANNEL AND FLOODPLAIN SUBGRADE BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH WILDLIFE SNAG AND BEAVER DAM ANALOG PRIOR TO CONSTRUCTION.



NOTES ON BEAVER DAM ANALOG (BDA) INSTALLATION

1. CONSTRUCT BEAVER DAM ANALOGS AT LOCATIONS STAKED BY ENGINEER AFTER COMPLETION OF SIDE CHANNEL CONSTRUCTION.
2. EXCAVATE A TRENCH EXTENDING APPROXIMATELY 10 FT INTO THE FLOODPLAIN ON EITHER SIDE OF THE STAKED BEAVER DAM ANALOG LOCATION. THE TRENCH SHOULD EXTEND APPROXIMATELY 1-2 FT BELOW THE BED OF THE SIDE CHANNEL. PLACE WILLOW CUTTINGS AT A SPACING OF 5'/LINEAR FOOT INTO THE TRENCH AND BACKFILL WITH EXCAVATED NATIVE FLOODPLAIN FILL.
3. INSTALL TWO ROWS OF POSTS SPANNING THE WIDTH OF THE SIDE CHANNEL BETWEEN THE TWO FLOODPLAIN TRENCHES. SPACE ROWS 12 IN APART. SPACE POSTS IN EACH ROW APPROXIMATELY 12-18 IN APART AND ENSURE THAT AT LEAST ONE ROW OF STAKES HAS ONE STAKE INSTALLED IN THE BANK OF THE SIDE CHANNEL. STAKES SHOULD BE DRIVEN A MINIMUM OF 18 IN BELOW THE BED OF THE SIDE CHANNEL.
4. INSTALL BRUSH (GREEN CONIFER BRANCHES PREFERRED) AND LIVE WILLOW CUTTINGS IN THE 12 IN SPACE BETWEEN THE TWO ROWS OF POSTS. INSTALL BRUSH AND CUTTINGS IN 0.5 FT LAYERS AND COMPACT EACH LAYER AFTER INSTALLATION.
5. PRIOR TO INSTALLING THE FINAL LAYER (0.5 FT) OF BRUSH, INSTALL A MATTRESS OF WILLOW CUTTINGS ON THE DOWNSTREAM SIDE OF THE BEAVER DAM ANALOG. ORIENT CUTTINGS IN AN UPSTREAM DIRECTION WITH THE CUT ENDS BURIED INTO THE SIDE CHANNEL BED AND THE BRANCH TIPS EXTENDING UPSTREAM AND ON TOP OF THE LAST PLACED LAYER OF BRUSH BETWEEN THE POSTS. INSTALL THE FINAL LAYER OF BRUSH BETWEEN THE POSTS ON TOP OF THE WILLOW MATTRESS CUTTINGS TO SECURE THEM.
6. INSTALL A WEDGE OF COBBLE, GRAVEL, MUD AND ORGANIC MATTER ALONG THE UPSTREAM ROW OF POSTS. COMPACT MATERIAL TO ENSURE GOOD CONTACT WITH THE POSTS, BRUSH, CHANNEL BED AND CHANNEL BANKS.



NOTES ON WILDLIFE SNAG INSTALLATION

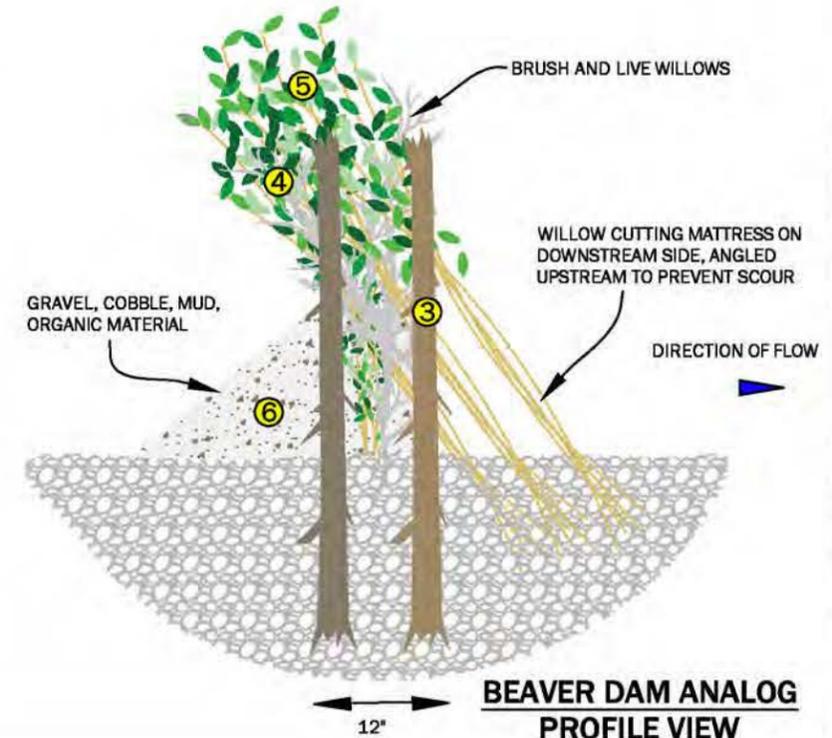
1. TRANSPORT SNAG TREES FROM DESIGNATED STOCKPILE AREAS TO THE TREATMENT SITES DESIGNATED BY CONSTRUCTION MANAGER.
2. INSTALL WILDLIFE SNAGS IN THE FLOODPLAIN SO THEY STAND VERTICALLY WITH NO LEAN AND WILL STAY STANDING AS THEY DECAY OVER TIME. DIG A HOLE A MINIMUM OF 4 FT DEEP AND LARGE ENOUGH FOR THE SNAG TO BE BACKFILLED WITH 6" PLUS COBBLE AND SOIL TO PROVIDE SUFFICIENT STABILITY. PLACE SNAG IN THE HOLE STANDING VERTICALLY AND BACKFILL UNTIL FLUSH WITH SURROUNDING FLOODPLAIN SURFACE.
3. SNAGS SHALL STAND A MINIMUM OF 10 FT ABOVE GROUND AFTER INSTALLATION.
4. INDIVIDUAL AND PODS OF SNAGS WILL BE INSTALLED AND THE LOCATION OF EACH TYPE WILL BE DIRECTED BY THE CONSTRUCTION MANAGER IN THE FIELD. SNAG PODS SHALL CONSIST OF 4-6 TREES PER POD WITH A MINIMUM OF 6 FT BETWEEN TREES.

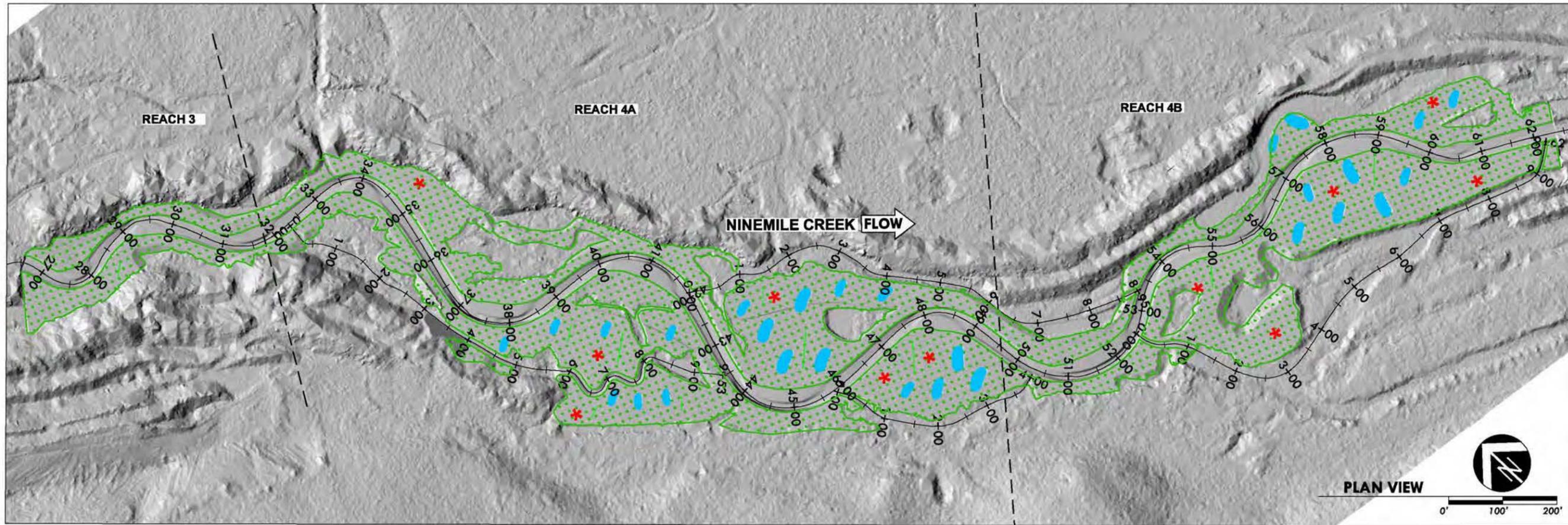
WILDLIFE SNAG MATERIAL SCHEDULE (PER LINEAR FOOT)

ITEM	DIMENSIONS	QUANTITY
1	SNAG TREES MIN. 12" DBH, MIN. 15' WITH ROOTWAD AND BRANCHES INTACT, MIX OF CONIFERS AND COTTONWOOD AS AVAILABLE	1 EA
2	CATEGORY 2 ROCK 6" PLUS COBBLE	1.5 CY

BEAVER DAM ANALOG MATERIAL SCHEDULE (PER LINEAR FOOT)

ITEM	DIMENSIONS	QUANTITY
3	UNTREATED OR SALVAGED WOODEN POSTS 3"D, 4' L	1 EA
4	BRUSH 1"-3" D, 4'-8' L, GREEN CONIFER BRANCHES PREFERRED	3 EA
5	LIVE WILLOWS 0.5"-1" D, 4'-6' L	5 EA
6	GRAVEL/COBBLE/MUD VARIES	0.4 EA





LEGEND

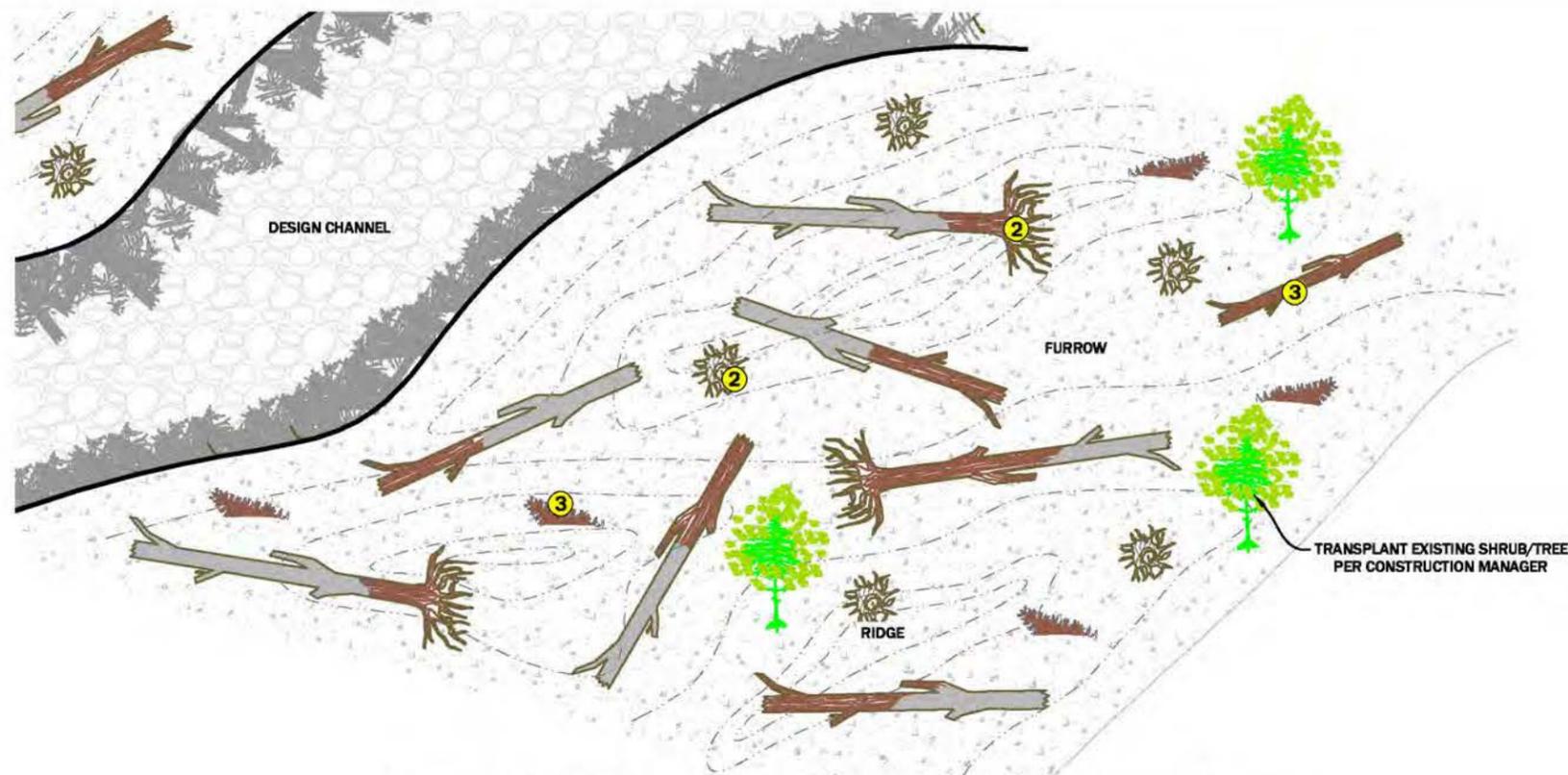
-  FLOODPLAIN ROUGHNESS
-  FLOODPLAIN SWALE
-  VEGETATED WOOD MATRIX TYPE 3
-  WILDLIFE SNAG

FLOODPLAIN TREATMENT PLAN
REACH 3, 4A & 4B
 UPPER NINEMILE CREEK RESTORATION PROJECT
 NEAR HUSON, MONTANA

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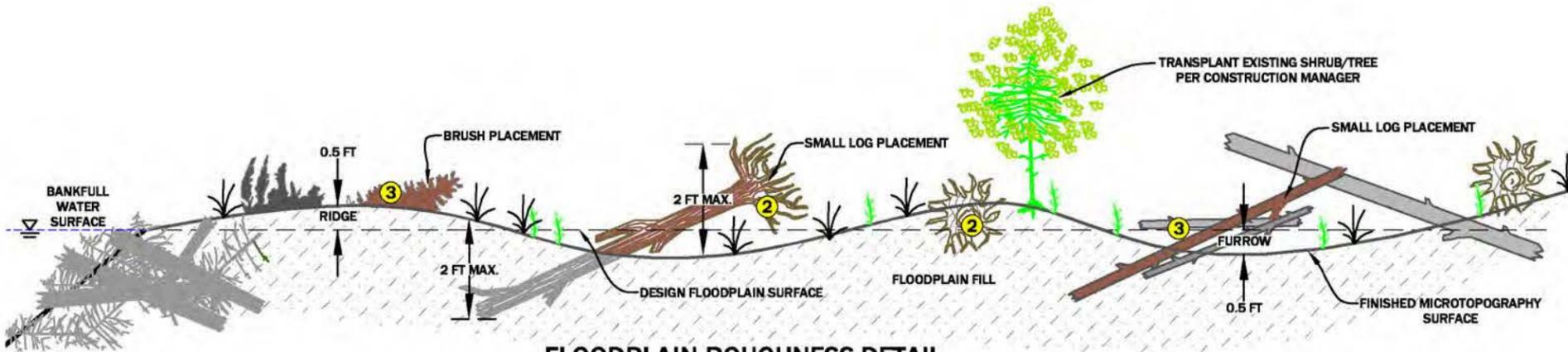
SHEET NUMBER
9.0



MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT

3D VIEW

NTS



FLOODPLAIN ROUGHNESS DETAIL

TYPICAL CROSS SECTION

NTS

GENERAL NOTES

1. CONSTRUCTION OF FLOODPLAIN ROUGHNESS WILL OCCUR AFTER CONSTRUCTION OF THE CHANNEL STREAMBED, INSTALLATION OF LARGE WOOD STRUCTURE BANK TREATMENT, AND INSTALLATION OF VEGETATED WOOD MATRIX BANK TREATMENTS.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY ENGINEER.

NOTES ON FLOODPLAIN ROUGHNESS INSTALLATION

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

MATERIAL SCHEDULE (PER ACRE)

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

*APPROXIMATELY 250 PIECES/ACRE



EXAMPLE OF CONSTRUCTED FLOODPLAIN SWALE



EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS ELEMENT



EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS ELEMENT

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NINEMILE CREEK - HOUSUM PLACER RESTORATION PROJECT GRADING PLAN DESIGN

PROJECT PARTNERS



TROUT UNLIMITED
111 NORTH HIGGINS AVENUE, SUITE 500
MISSOULA, MONTANA 59802



USDA FOREST SERVICE
LOLO NATIONAL FOREST
FORT MISSOULA, BUILDING 24
MISSOULA, MONTANA 59804



WESTWATER CONSULTANTS, INC.
1112 CATHERINE LANE
CORVALLIS, MONTANA 59828



GEUM ENVIRONMENTAL CONSULTING, INC.
307 STATE STREET
HAMILTON, MONTANA 59870

PROJECT DESCRIPTION

THE NINEMILE CREEK WATERSHED IS LOCATED IN THE MIDDLE CLARK FORK RIVER WATERSHED APPROXIMATELY 20 MILES WEST OF MISSOULA, MONTANA. WITH A CONTRIBUTING AREA OF APPROXIMATELY 186 MP, THE WATERSHED ORIGINATES IN THE NINEMILE AND RESERVATION DIVIDES OF THE LOLO NATIONAL FOREST AND FLOWS 26 MILES TO THE CONFLUENCE WITH THE CLARK FORK RIVER. HISTORICAL MINING ACTIVITIES SIGNIFICANTLY ALTERED THE MORPHOLOGY AND LANDSCAPE OF THE NINEMILE CREEK VALLEY. RECORDS INDICATE THAT A PLACER GOLD BOOM OCCURRED ON NINEMILE CREEK BETWEEN 1874 AND 1977 AND MINING WITH DRAGLINES, DREDGES, HYDRAULIC HOSES AND SLUICING CONTINUED ON NINEMILE CREEK AND PRIMARY TRIBUTARIES UNTIL THE LATE 1940. THE MINING PROCESS REWORKED THE GLACIAL AND FLUVIAL SEDIMENTS COMPRISING THE VALLEY BOTTOM. ALLUVIAL GRAVELS AND COBBLES WERE WORKED INTO NUMEROUS TAILINGS PILES RANGING FROM 10 FEET TO 40 FEET IN ELEVATION ABOVE THE STREAM CHANNEL. MINING ACTIVITIES COMPROMISED THE INTEGRITY OF THE RIVER AND FLOODPLAIN ECOSYSTEM BY SIMPLIFYING AQUATIC HABITAT CONDITIONS, INCREASING STREAM ENERGY, AND REDUCING FLOODPLAIN CONNECTION AND FUNCTION.

IN 2009, TROUT UNLIMITED (TU) IN COLLABORATION WITH THE LOLO NATIONAL FOREST (LNF) INITIATED A PLANNING PROCESS TO EVALUATE RESTORATION ALTERNATIVES FOR A SIX MILE REACH OF NINEMILE CREEK FROM APPROXIMATELY 1,000 FEET UPSTREAM OF SAWPIT CREEK (REACH 1) DOWNSTREAM TO THE APPROXIMATE CONFLUENCE WITH BIG BLUE CREEK (REACH 7). THE GOALS ESTABLISHED BY TU AND LNF INCLUDED: 1) REHABILITATING STREAM, FLOODPLAIN AND HILLSLOPE PROCESSES IMPAIRED BY PREVIOUS PLACER MINING OPERATIONS; 2) PROMOTING AQUATIC HABITAT CONDITIONS THAT SUPPORT ALL LIFE STAGES OF FISH; 3) RECONNECTING MAJOR TRIBUTARIES IMPACTED BY PAST PLACER MINING ACTIVITIES; AND 4) INCORPORATING THE DESIRES AND NEEDS OF THE LANDOWNERS AND MULTIPLE STAKEHOLDERS. DURING THE PLANNING PROCESS, A RANGE OF ALTERNATIVES WERE CONSIDERED AT THE REACH-SCALE INCLUDING:

ALTERNATIVE A: NO ACTION.

ALTERNATIVE B: STABILIZING EXISTING CHANNEL AND ENHANCING AQUATIC HABITAT WITH NO INCREASE IN FLOODPLAIN CONNECTIVITY.

ALTERNATIVE C: EXPAND THE FLOODPLAIN AND CONVERT THE STREAM TYPE TO A SLIGHTLY MEANDERING, RIFFLE-POOL STREAM TYPE WITH ENHANCED AQUATIC HABITAT AND AN EXPANDED, CONNECTED FLOODPLAIN. UNDER ALTERNATIVE D, FLOODPLAIN EXPANSION WOULD OCCUR THROUGH PARTIAL OR FULL REMOVAL OF LEVEES AND BERMS, OR OPPORTUNISTICALLY THROUGH LOCALIZED BED ELEVATION CHANGES. THE MEANDER BELT WIDTH WOULD AVERAGE 100 FEET.

ALTERNATIVE D: ELIMINATED FROM FURTHER CONSIDERATION DURING THE PLANNING PROCESS.

ALTERNATIVE E: CONVERT THE STREAM TYPE AND EXPAND THE FLOODPLAIN AND MEANDER BELT WIDTH TO THE MOST PROBABLE HISTORICAL CONDITION RECOGNIZING THE EXISTING CONSTRAINTS TO RESTORATION. THE BED ELEVATION OF NINEMILE CREEK WOULD BE RAISED TO RECONNECT HISTORICAL FLOODPLAIN SURFACES AT THE REACH-SCALE. THE CHANNEL WOULD RESEMBLE A SLIGHTLY TO MODERATELY SINUOUS, RIFFLE-POOL STREAM TYPE WITH A BROAD FLOODPLAIN CHARACTERIZED BY WETLAND AND RIPARIAN VEGETATION. THE MEANDER BELT WIDTH WOULD BE BRACKETED BY FLUVIAL TERRACES AND AVERAGE 200 FEET.

ALTERNATIVE F: NO ACTIVE CHANNEL RESTORATION WOULD OCCUR, AND ONLY ACTIONS THAT ENHANCE THE FUNCTIONS AND VALUES OF EXISTING OFF-CHANNEL WETLANDS AND DRAGLINE PONDS WOULD BE CONSIDERED.

BASED ON THE ALTERNATIVES DESCRIBED ABOVE, A PREFERRED RESTORATION SCENARIO WAS DEVELOPED FOR THE SIX MILE SECTION OF NINEMILE CREEK (SEE TABLE). THE PREFERRED RESTORATION SCENARIO WAS BASED ON THE FOLLOWING FACTORS: 1) MAXIMUM BENEFIT TO ECOLOGICAL RESOURCES; 2) CONTINUITY OF TREATMENT BETWEEN REACHES AND SUB-REACHES; 3) CONSIDERATION OF EXISTING INFRASTRUCTURE; AND 4) TRIBUTARY PROJECTS ALREADY IN PROGRESS.

THIS GRADING PLAN DESIGN INTEGRATES THE ALTERNATIVES DEVELOPED AT THE REACH-SCALE AND REPRESENTS A 35% DESIGN LEVEL EQUIVALENT TO HELP GUIDE FUTURE PLANNING EFFORTS ON NINEMILE CREEK.

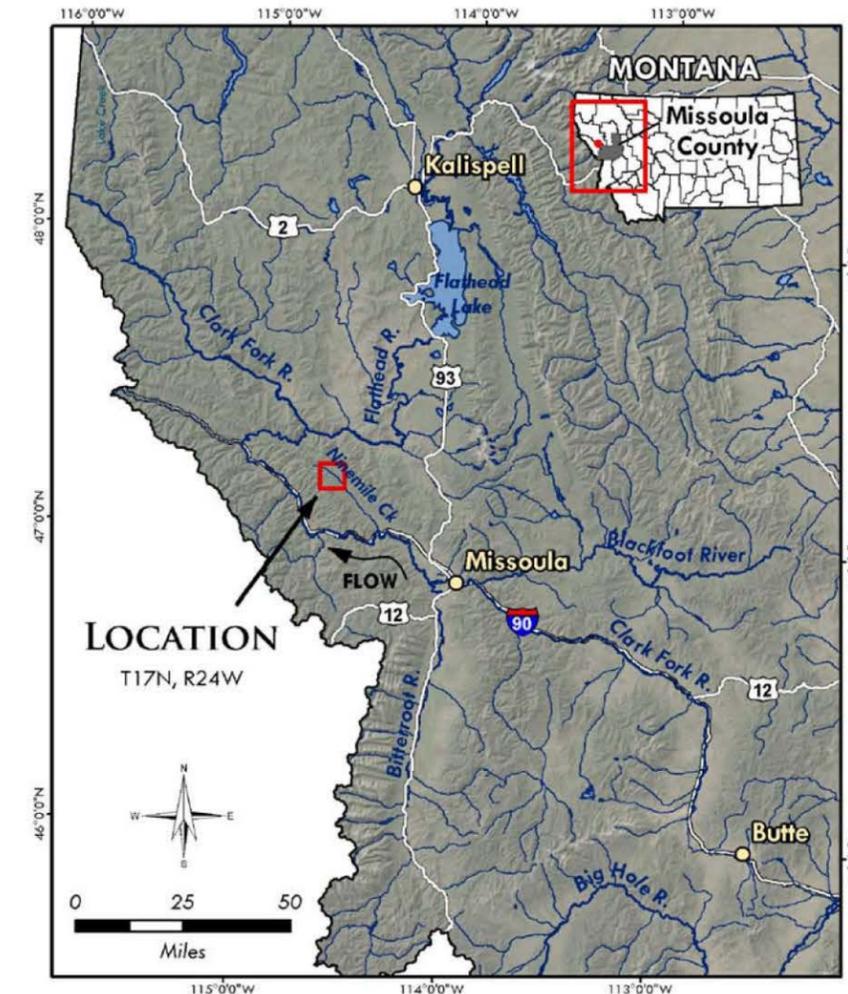
GENERAL NOTES

1. CONTOUR INTERVAL IS NOTED ON DRAWINGS.
2. SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
3. DIMENSIONS ARE GIVEN IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED FROM JULY 2012 TO SEPTEMBER 2013 AND 2012 LIDAR DATA WAS CREATED IN OCTOBER 2011 AND PROVIDED BY TROUT UNLIMITED. ALL LIDAR DATA WAS COORDINATED BY RDG.

DRAWING INDEX

- 1.0 COVER PAGE
- 2.0 SURVEY CONTROL PLAN
- 3.0 PLAN VIEW INDEX
- 4.0 RESTORATION PLAN - REACH 2
- 4.1 PLAN AND PROFILE - REACH 2A & 2B
- 4.2 GRADING PLAN - REACH 2A & 2B
- 4.3 PLAN AND PROFILE - REACH 2B
- 4.4 GRADING PLAN - REACH 2B
- 4.5 PLAN AND PROFILE - REACH 2B & 2C
- 4.6 GRADING PLAN - REACH 2B & 2C
- 4.7 PLAN AND PROFILE - REACH 2C
- 4.8 GRADING PLAN - REACH 2C
- 5.0 RESTORATION PLAN - REACH 3
- 5.1 PLAN AND PROFILE - REACH 2E & 3
- 5.2 GRADING PLAN - REACH 2E & 3
- 5.3 PLAN AND PROFILE - REACH 3
- 5.4 GRADING PLAN - REACH 3
- 6.0 RESTORATION PLAN - REACH 4
- 6.1 PLAN AND PROFILE - REACH 3 & 4A
- 6.2 GRADING PLAN - REACH 3 & 4A
- 6.3 PLAN AND PROFILE - REACH 4A & 4B
- 6.4 GRADING PLAN - REACH 4A & 4B
- 6.5 PLAN AND PROFILE - REACH 4B
- 6.6 GRADING PLAN - REACH 4B
- 6.7 PLAN AND PROFILE - REACH 4B & 5A
- 6.8 GRADING PLAN - REACH 4B & 5A
- 7.0 RESTORATION PLAN - REACH 5
- 7.1 PLAN AND PROFILE - REACH 5A & 5B
- 7.2 GRADING PLAN - REACH 5A & 5B
- 7.3 PLAN AND PROFILE - REACH 5B & 6
- 7.4 GRADING PLAN - REACH 5B & 6
- 8.0 RESTORATION PLAN - REACH 7
- 8.1 PLAN AND PROFILE - REACH 7
- 8.2 GRADING PLAN - REACH 7
- 8.3 PLAN AND PROFILE - REACH 7
- 8.4 GRADING PLAN - REACH 7
- 9.0 CHANNEL CROSS SECTION DESIGN CRITERIA
- 9.1 CHANNEL CROSS SECTION DESIGN CRITERIA
- 9.2 CHANNEL CROSS SECTION DESIGN CRITERIA
- 9.3 CHANNEL CROSS SECTION DESIGN CRITERIA
- 9.4 CHANNEL CROSS SECTION DESIGN CRITERIA
- 9.5 CHANNEL CROSS SECTION DESIGN CRITERIA
- 10.0 CROSS SECTIONS
- 10.1 CROSS SECTIONS
- 10.2 CROSS SECTIONS
- 10.3 CROSS SECTIONS
- 10.4 CROSS SECTIONS
- 10.5 CROSS SECTIONS
- 10.6 CROSS SECTIONS
- 10.7 CROSS SECTIONS
- 11.0 REPOSITORY DETAIL
- 12.0 EARTHWORK SUMMARY
- 12.1 EARTHWORK SUMMARY
- 12.2 EARTHWORK SUMMARY

NINEMILE VICINITY MAP



LOCATION
T17N, R24W

STANDARD OF PRACTICE

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

RIVER DESIGN GROUP, INC.
 5098 Hwy 93 South
 Whitefish, MT 59907
 Tel: 406.862.4927
 Fax: 406.862.4968
 311 SW Jefferson Avenue
 Corvallis, OR 97333
 Tel: 541.738.2920
 Fax: 541.738.8524

COVER PAGE

NO.	DATE	BY	DESCRIPTION	CHK
1	03-15-14	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-13-001

SHEET NUMBER
1.0

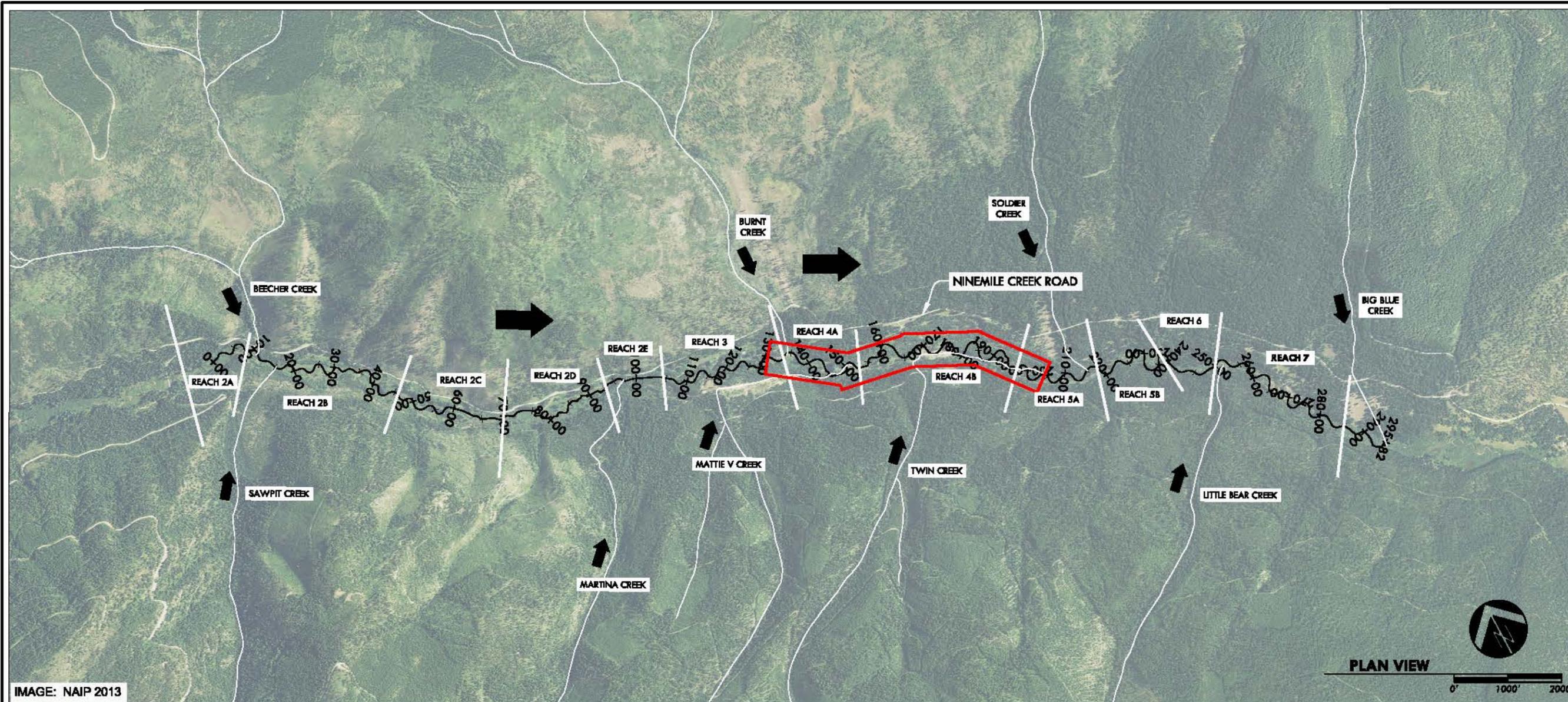


IMAGE: NAIP 2013

RESTORATION PLAN - REACH 4

EXISTING CONDITIONS AND LIMITING FACTORS

REACH 4 EXTENDS FROM THE CONFLUENCE OF BURNT CREEK AND THE MAINSTEM NINEMILE CREEK DOWNSTREAM APPROXIMATELY 1.2 MILES. REACH 4 IS CHARACTERIZED BY A MULTI-THREAD CHANNEL FORM WITH AN AVERAGE SLOPE OF 0.77% AND AN AVERAGE WIDTH TO DEPTH RATIO OF GREATER THAN 40. EXTENSIVE LEVIES AND DREDGE PILES BRACKET THE FLOODPLAIN AND ARE A CHRONIC SOURCE OF SEDIMENT TO THE CHANNEL. CHANNEL BEDFORMS ARE PRIMARILY DOMINATED BY RIFFLE HABITAT UNITS WITH FREQUENT SCOUR POOLS FORMED BY SMALL WOODY DEBRIS AGGREGATES. VEGETATION PATTERNS IN REACH 4 REFLECT A DYNAMIC CHANNEL ENVIRONMENT CHARACTERIZED BY SCOUR AND SEDIMENT DEPOSITION. VEGETATED ISLANDS AND FLOODPLAIN SURFACES PROVIDE PROTECTED SITES FOR PLANT ESTABLISHMENT, AND A MORE DIVERSE AGE CLASS OF WOODY RIPARIAN VEGETATION IS PRESENT COMPARED TO UPSTREAM AND DOWNSTREAM REACHES.

CONSTRAINTS AND LIMITING FACTORS IN REACH 4 INCLUDE:

- THE PRE-DISTURBANCE MORPHOLOGY OF THE VALLEY AND FLOODPLAIN IS UNCERTAIN AT THIS TIME.
- REACH 4 IS A DEPOSITIONAL, SEDIMENT TRANSPORT-LIMITED REACH. RESTORATION WILL NEED TO ACCOMMODATE MORE COMPLEX SEDIMENT AND DEBRIS TRANSPORT PROCESSES GIVEN THE GEOMORPHIC SETTING.
- DRAGLINE PONDS IMPACT STREAM TEMPERATURE AND GROUNDWATER-SURFACE WATER EXCHANGE. SUBSTANTIAL FILL WILL BE REQUIRED TO BACKFILL THE PONDS.
- TAILINGS PILES BRACKET THE CHANNEL AND LIMIT FLOODPLAIN CONNECTIVITY AND FUNCTION. SUBSTANTIAL REMOVAL MAY BE REQUIRED. EXCAVATED MATERIAL CAN BE USED TO BACKFILL THE DRAGLINE PONDS.

RESTORATION ALTERNATIVES

REACH 4A AND 4B
 ALTERNATIVE E IS APPLIED TO THIS REACH. THIS ALTERNATIVE INCLUDES THE FOLLOWING GRADING AND RESTORATION ACTIONS:

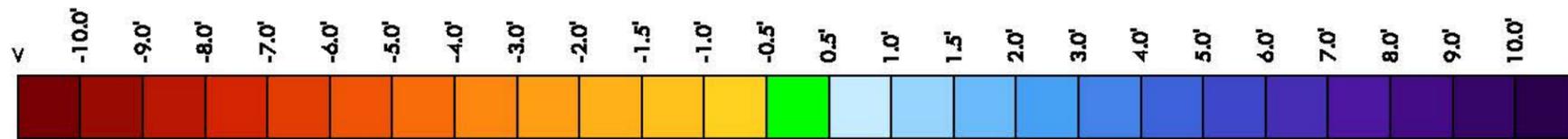
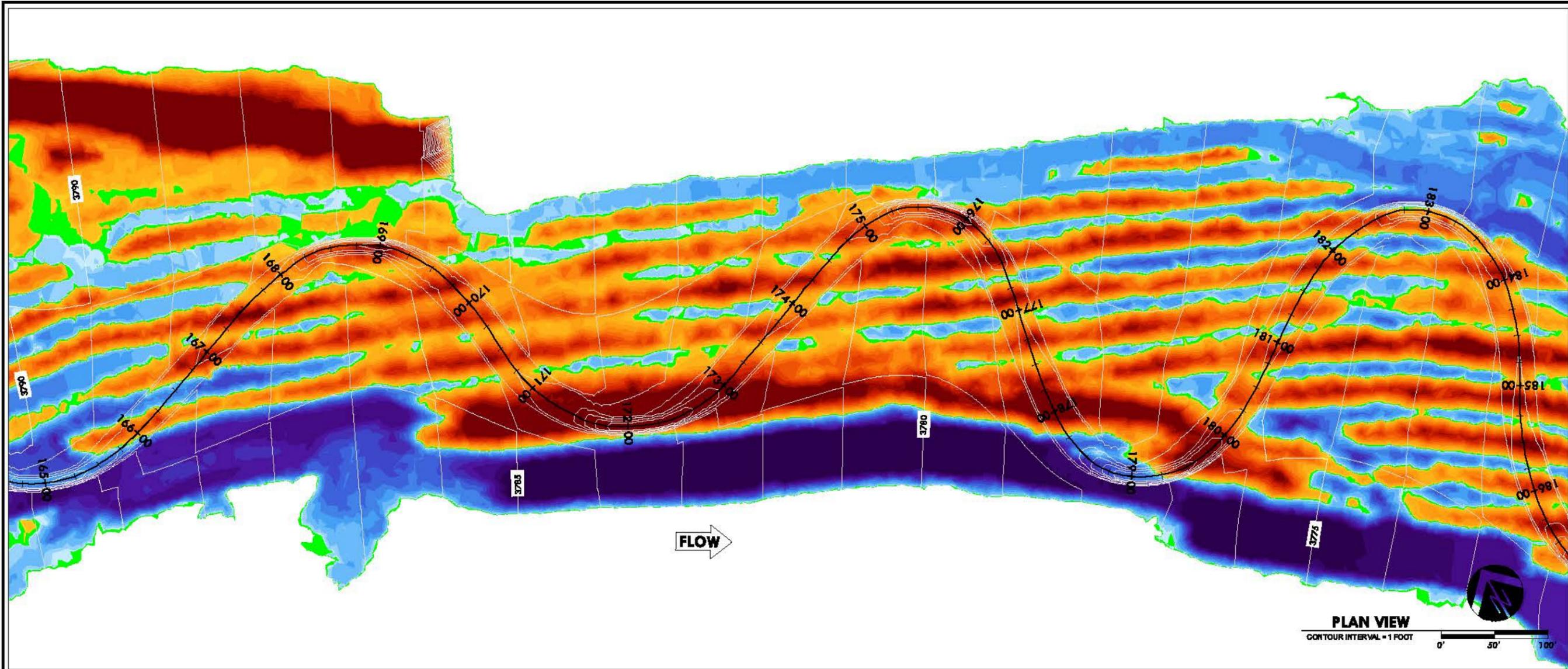
- PRESERVE EXISTING AREAS OF HIGH QUALITY COLONIZING RIPARIAN VEGETATION.
- REMOVE DREDGE PILES THAT ARE RESTRICTING FLOODPLAIN CONNECTIVITY.
- TIE FLOODPLAIN GRADING INTO HISTORIC TERRACE ALONG THE NORTHEAST BOUNDARY.
- RAISE CHANNEL BED BETWEEN 0 AND 1 FOOT TO CONNECT TO HIGH QUALITY WETLAND AND FLOODPLAIN VEGETATION.
- EXPAND CONNECTED FLOODPLAIN WIDTH BETWEEN 300 AND 400 FEET.
- SALVAGE AND TRANSPLANT NATIVE RIPARIAN SHRUBS AND TREES, SOIL AND ORGANIC MATTER FOR USE IN FLOODPLAIN AND STREAMBANK REVEGETATION.
- CONSTRUCT AN ALTERNATING RIFFLE-POOL, GRAVEL BED, SLIGHTLY ENTRENCHED C STREAM TYPE WITH DIVERSE IN-STREAM HABITAT FEATURES INCLUDING RIFFLES, RUNS, POOLS AND GLIDES.
- CREATE DIVERSE AQUATIC HABITAT BY CONSTRUCTING WOOD BASED STRUCTURES AND INSTALLING BANK REVEGETATION STRUCTURES.
- CREATE FLOODPLAIN DIVERSITY THROUGH CONSTRUCTION OF OFF-CHANNEL WETLANDS, SIDE CHANNELS AND CONNECTED BACKWATER FEATURES.
- CREATE FLOODPLAIN ROUGHNESS THROUGH CONSTRUCTION OF FLOODPLAIN DEPRESSIONS AND PLACEMENT OF DENSE WOODY DEBRIS TO PROVIDE FLOODPLAIN STABILITY, CREATE MICROSITES FOR NATURALLY RECRUITED VEGETATION AND SUPPORT SOIL DEVELOPMENT.
- REVEGETATE FLOODPLAIN AND STREAMBANKS THROUGH PLACEMENT OF SALVAGED ORGANIC MATTER AND SOIL, INSTALLATION OF NATIVE PLANT MATERIAL, AND TRANSPLANT OF NATIVE VEGETATION.

NO.	DATE	BY	DESCRIPTION	CHK	AND
1	03-15-14	NW	GRADING PLAN DESIGN		

PROJECT NUMBER
RDG-13-001

SHEET NUMBER

6.0



EXISTING GROUND COMPARED TO PROPOSED DESIGN SURFACE

EARTHWORK VOLUMES			
STATION START	STATION END	CUT (CY)	FILL (CY)
166+00	168+00	8,812	3,210
168+00	170+00	8,878	3,200
170+00	172+00	5,793	2,898
172+00	174+00	6,045	4,041
174+00	176+00	5,441	4,347
176+00	178+00	3,351	2,321
178+00	180+00	6,520	3,431
180+00	182+00	2,580	2,459
182+00	184+00	4,372	6,113
184+00	186+00	2,562	2,853
TOTAL		54,354	34,873
		19,481 CY NET CUT	

NOTE: REPORTED VOLUMES ARE NEATLINE

**GRADING PLAN
 REACH 4B**

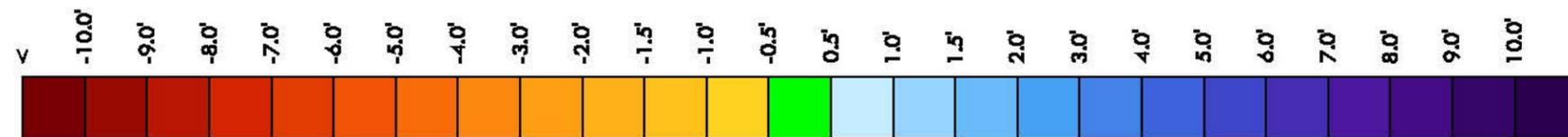
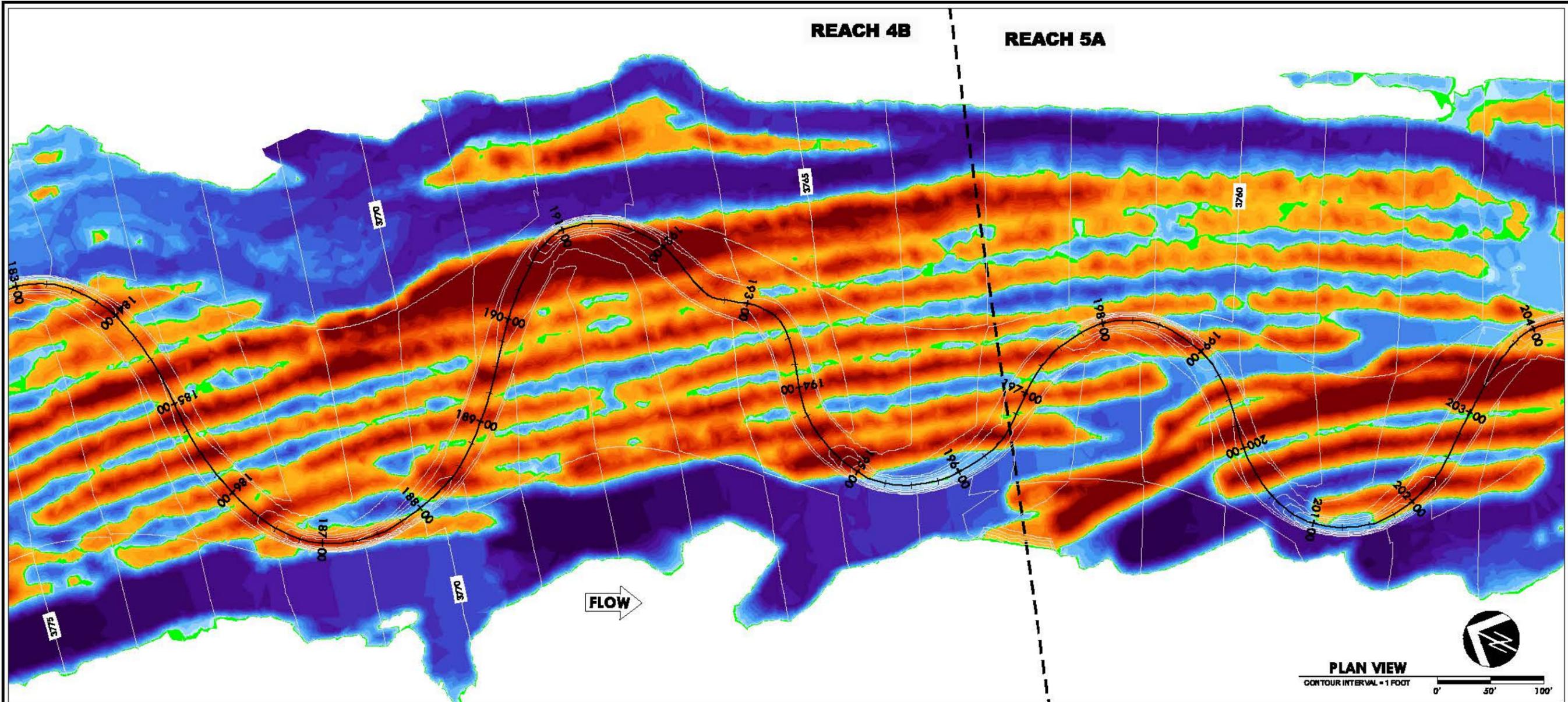
NO.	DATE	BY	DESCRIPTION	CHK	AD
1	03-15-14	NW	GRADING PLAN DESIGN		

PROJECT NUMBER
RDG-13-001

SHEET NUMBER

REACH 4B

REACH 5A



EXISTING GROUND COMPARED TO PROPOSED DESIGN SURFACE

EARTHWORK VOLUMES

STATION START	STATION END	CUT (CY)	FILL (CY)
186+00	188+00	5,339	8,044
188+00	190+00	5,317	6,593
190+00	192+00	8,323	7,252
192+00	194+00	4,995	5,158
194+00	196+00	6,839	5,721
196+00	198+00	5,128	3,525
198+00	200+00	4,037	5,207
200+00	202+00	6,011	4,850
202+00	204+00	4,175	3,893
TOTAL		50,163	50,243
		79 CY NET FILL	

NOTE: REPORTED VOLUMES ARE NEATLINE

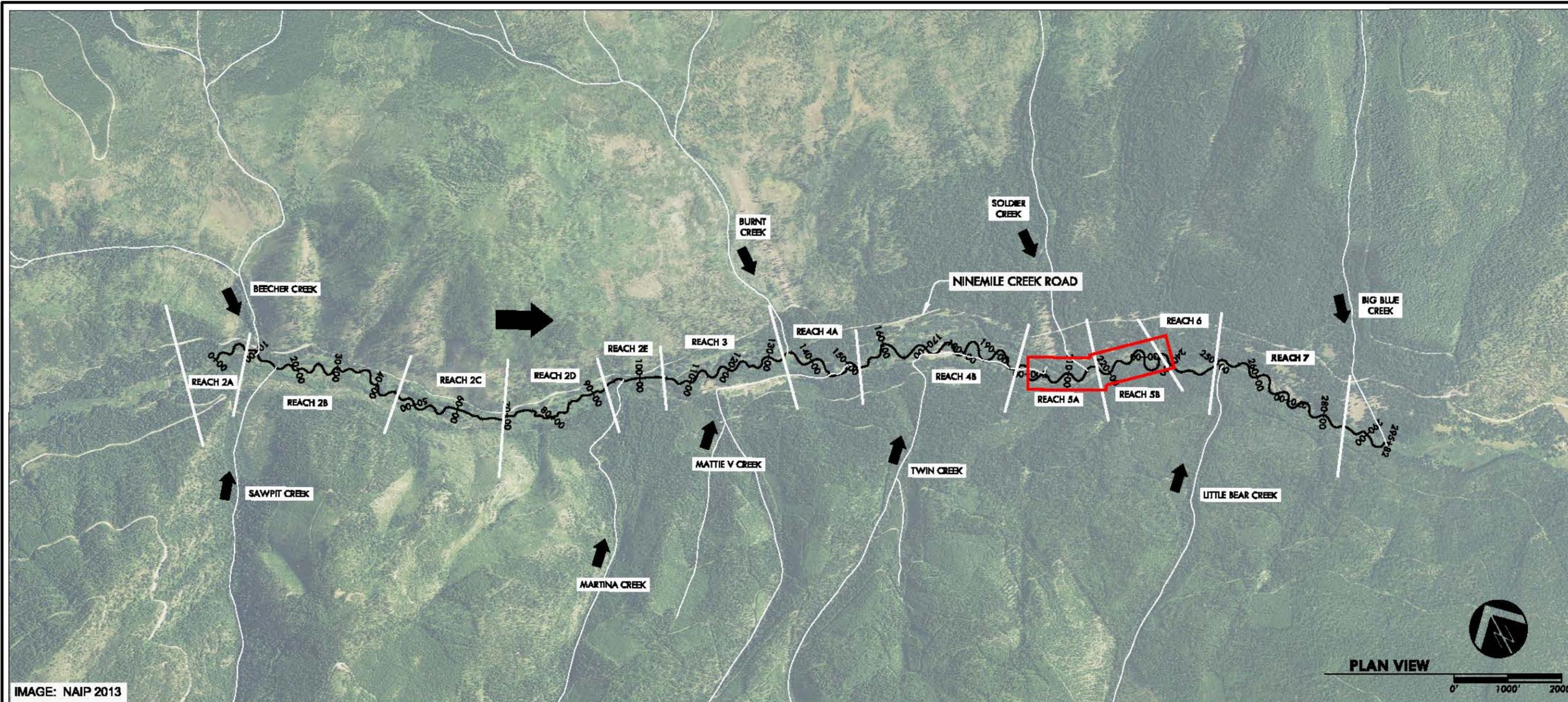
**GRADING PLAN
 REACH 4B & 5A**

NO.	DATE	BY	DESCRIPTION	CHK	AD
1	03-15-14	NW	GRADING PLAN DESIGN		

PROJECT NUMBER
 RDG-13-001

SHEET NUMBER

6.8



RESTORATION PLAN - REACH 5

EXISTING CONDITIONS AND LIMITING FACTORS

REACH 5 CONSISTS OF TWO SUB-REACHES (REACH 5A AND REACH 5B) AND INCLUDES APPROXIMATELY 4,000 FEET (0.8 MILES) OF CHANNEL. SOLDIER CREEK IS THE PRIMARY TRIBUTARY TO REACH 5 AND JOINS THE MAINSTEM NINEMILE CREEK AT THE TRANSITION BETWEEN REACH 5A AND REACH 5B. THE EXISTING CHANNEL MORPHOLOGY IS CHARACTERIZED BY A PREDOMINANTLY SINGLE-THREADED CHANNEL FORM WITH AN AVERAGE SLOPE OF 1.22%. THE CHANNEL CLASSIFIES AS A MODERATELY ENTRENCHED, COBBLE DOMINATED B3 STREAM TYPE WITH ENTRENCHED F STREAM TYPE INCLUSIONS. SIMILAR TO UPSTREAM REACHES, MINING DISTURBANCES HAVE RESULTED IN IMPAIRED AQUATIC HABITAT CONDITIONS WITH A MAJORITY OF THE REACH CHARACTERIZED BY LONG, EXTENDED RIFFLES WITH LIMITED POOL DEVELOPMENT. LEVIES AND MINE TAILINGS BRACKET THE CHANNEL AND SEVERELY LIMIT FLOODPLAIN CONNECTION IN REACH 5. DRAGLINE PONDS ON THE SOUTH SIDE OF THE VALLEY CONTRIBUTE WARM WATER DISCHARGE TO THE MAINSTEM NINEMILE CREEK, ADVERSELY IMPACTING STREAM TEMPERATURE. REACH-AVERAGED SINUOSITY IS 1.2.

CONSTRAINTS AND LIMITING FACTORS IN REACH 5 INCLUDE THE FOLLOWING:

- THE HISTORICAL FLOODPLAIN SURFACE IS NOT PRESENT AND A FLOODPLAIN MATCHING THE CURRENT CHANNEL BASE ELEVATION WILL NEED TO BE CREATED TO MEET RESTORATION OBJECTIVES.
- DRAGLINE PONDS IMPACT STREAM TEMPERATURE AND GROUNDWATER-SURFACE WATER EXCHANGE. SUBSTANTIAL FILL WILL BE NEEDED TO BACKFILL THE PONDS.
- TAILINGS PILES BRACKET THE CHANNEL AND LIMIT FLOODPLAIN CONNECTIVITY AND FUNCTION. SUBSTANTIAL REMOVAL OF THE PILES WILL BE REQUIRED. EXCAVATED MATERIAL CAN BE USED TO BACKFILL THE DRAGLINE PONDS.
- FLOODPLAIN RESTORATION ACTIVITIES THAT RESULT IN EXTENSIVE REMOVAL OF MATERIALS WILL LEAVE A RAW, EXPOSED SURFACE WITH LITTLE STRUCTURE OR COMPLEXITY TO MAINTAIN A STABLE STREAM MORPHOLOGY.

RESTORATION ALTERNATIVES

REACH 5A AND 5B

ALTERNATIVE E IS APPLIED TO REACH 5. THIS ALTERNATIVE INCLUDES THE FOLLOWING GRADING AND RESTORATION ACTIONS:

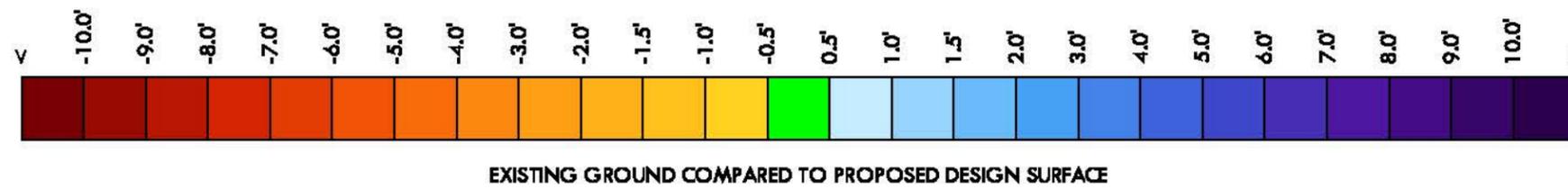
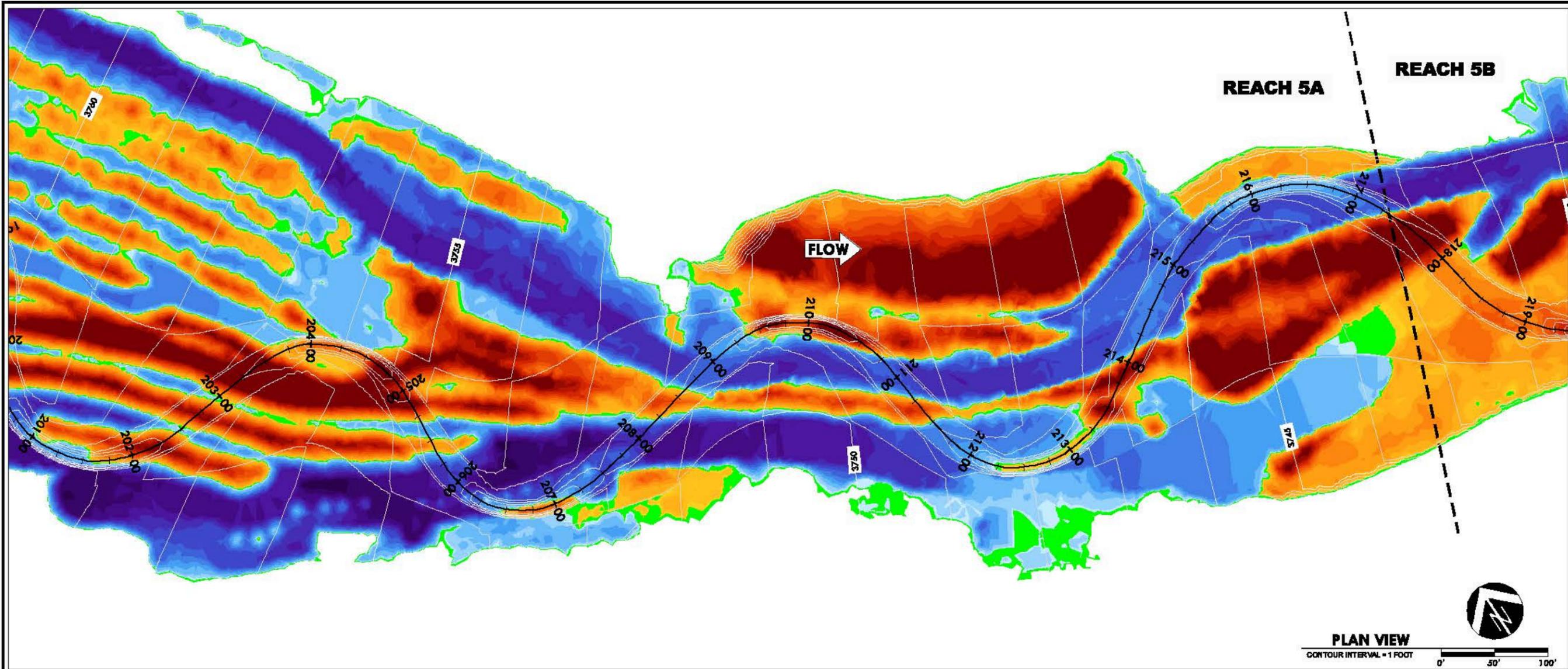
- PRESERVE EXISTING AREAS OF HIGH QUALITY COLONIZING RIPARIAN VEGETATION.
- REMOVE DREDGE PILES THAT ARE RESTRICTING FLOODPLAIN CONNECTIVITY.
- TIE FLOODPLAIN GRADING INTO HISTORIC TERRACE ALONG THE NORTHEAST BOUNDARY.
- RAISE CHANNEL BED BETWEEN 0 AND 5 FEET TO CONNECT TO HIGH QUALITY WETLAND AND FLOODPLAIN VEGETATION.
- EXPAND CONNECTED FLOODPLAIN WIDTH BETWEEN 300 AND 400 FEET.
- SALVAGE AND TRANSPLANT NATIVE RIPARIAN SHRUBS AND TREES, SOIL AND ORGANIC MATTER FOR USE IN FLOODPLAIN AND STREAMBANK REVEGETATION.
- CONSTRUCT AN ALTERNATING RIFFLE-POOL, GRAVEL BED, SLIGHTLY ENTRENCHED C STREAM TYPE WITH DIVERSE IN-STREAM HABITAT FEATURES INCLUDING RIFFLES, RUNS, POOLS AND GLIDES.
- CREATE DIVERSE AQUATIC HABITAT BY CONSTRUCTING WOOD BASED STRUCTURES AND INSTALLING BANK REVEGETATION STRUCTURES.
- CREATE FLOODPLAIN DIVERSITY THROUGH CONSTRUCTION OF OFF-CHANNEL WETLANDS, SIDE CHANNELS AND CONNECTED BACKWATER FEATURES.
- CREATE FLOODPLAIN ROUGHNESS THROUGH CONSTRUCTION OF FLOODPLAIN DEPRESSIONS AND PLACEMENT OF DENSE WOODY DEBRIS TO PROVIDE FLOODPLAIN STABILITY, CREATE MICROSITES FOR NATURALLY RECRUITED VEGETATION AND SUPPORT SOIL DEVELOPMENT.
- REVEGETATE FLOODPLAIN AND STREAMBANKS THROUGH PLACEMENT OF SALVAGED ORGANIC MATTER AND SOIL, INSTALLATION OF NATIVE PLANT MATERIAL, AND TRANSPLANT OF NATIVE VEGETATION.

NO.	DATE	BY	DESCRIPTION	CHK	AND
1	03-15-14	NW	GRADING PLAN DESIGN		

PROJECT NUMBER
RDG-13-001

SHEET NUMBER

7.0



EARTHWORK VOLUMES

STATION START	STATION END	CUT (CY)	FILL (CY)
204+00	206+00	5,510	6,749
206+00	208+00	2,312	5,493
208+00	210+00	2,626	3,480
210+00	212+00	5,764	2,986
212+00	214+00	7,058	2,793
214+00	216+00	5,497	3,119
216+00	218+00	5,683	1,478
TOTAL		34,451	26,098
		8,353 CY NET CUT	

NOTE: REPORTED VOLUMES ARE NEATLINE

**GRADING PLAN
REACH 5A & 5B**

NO.	DATE	BY	DESCRIPTION	CHK
1	03-15-14	NW	GRADING PLAN DESIGN	MD

PROJECT NUMBER
RDG-13-001

SHEET NUMBER

7.2

Upper Ninemile Creek
Placer Mine Reclamation Project
Reach 4-5



to



Montana 319 Nonpoint Source Project

Ninemile Valley

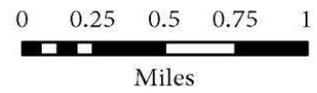


Attachments

1. Project Maps
2. Letters of Support
3. Design Drawings
4. Photos
5. Ninemile Restoration - Natural Storage

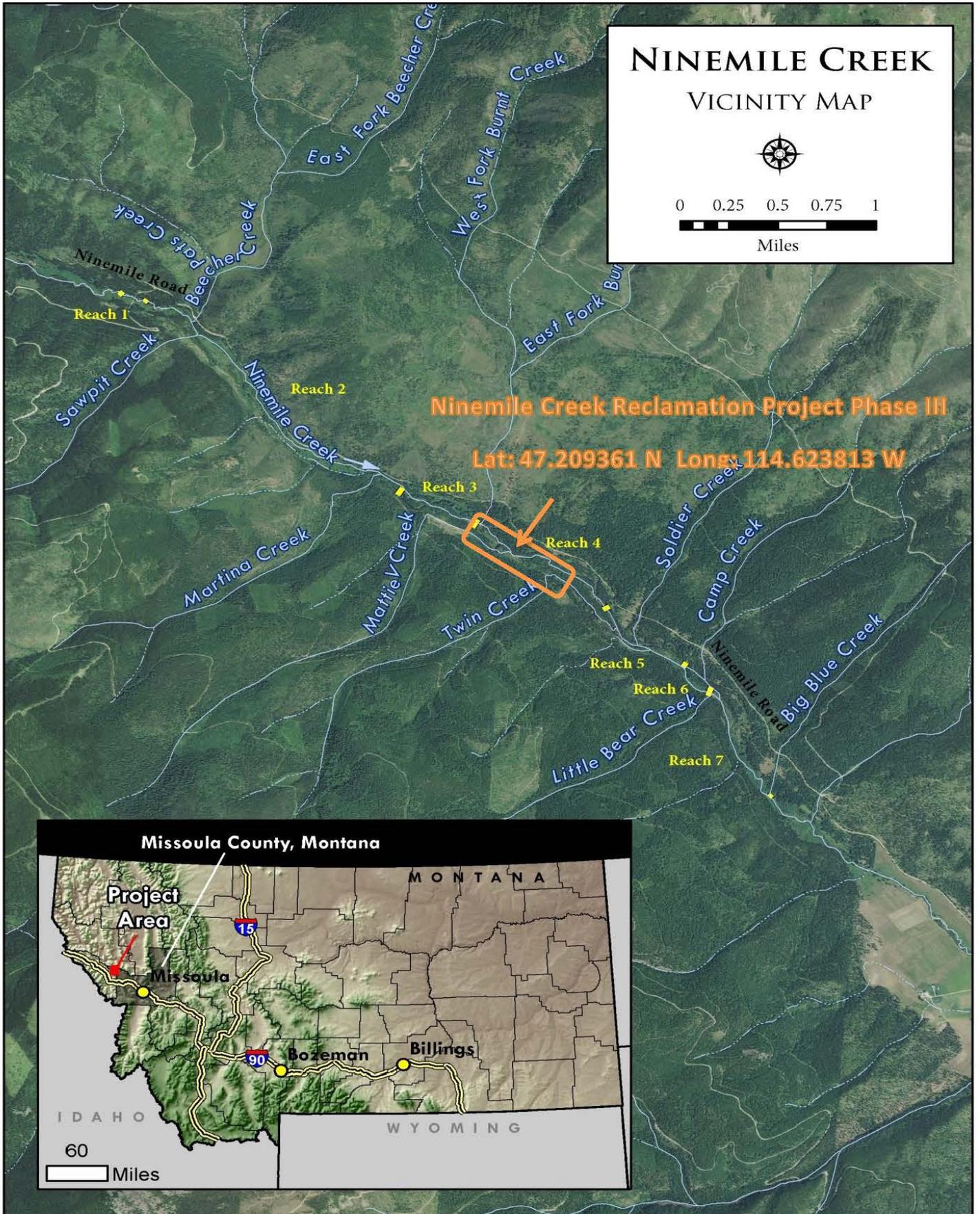
Project Maps

NINEMILE CREEK VICINITY MAP

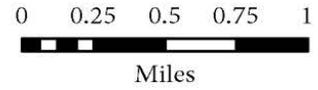


Ninemile Creek Reclamation Project Phase III

Lat: 47.209361 N Long: 114.623813 W

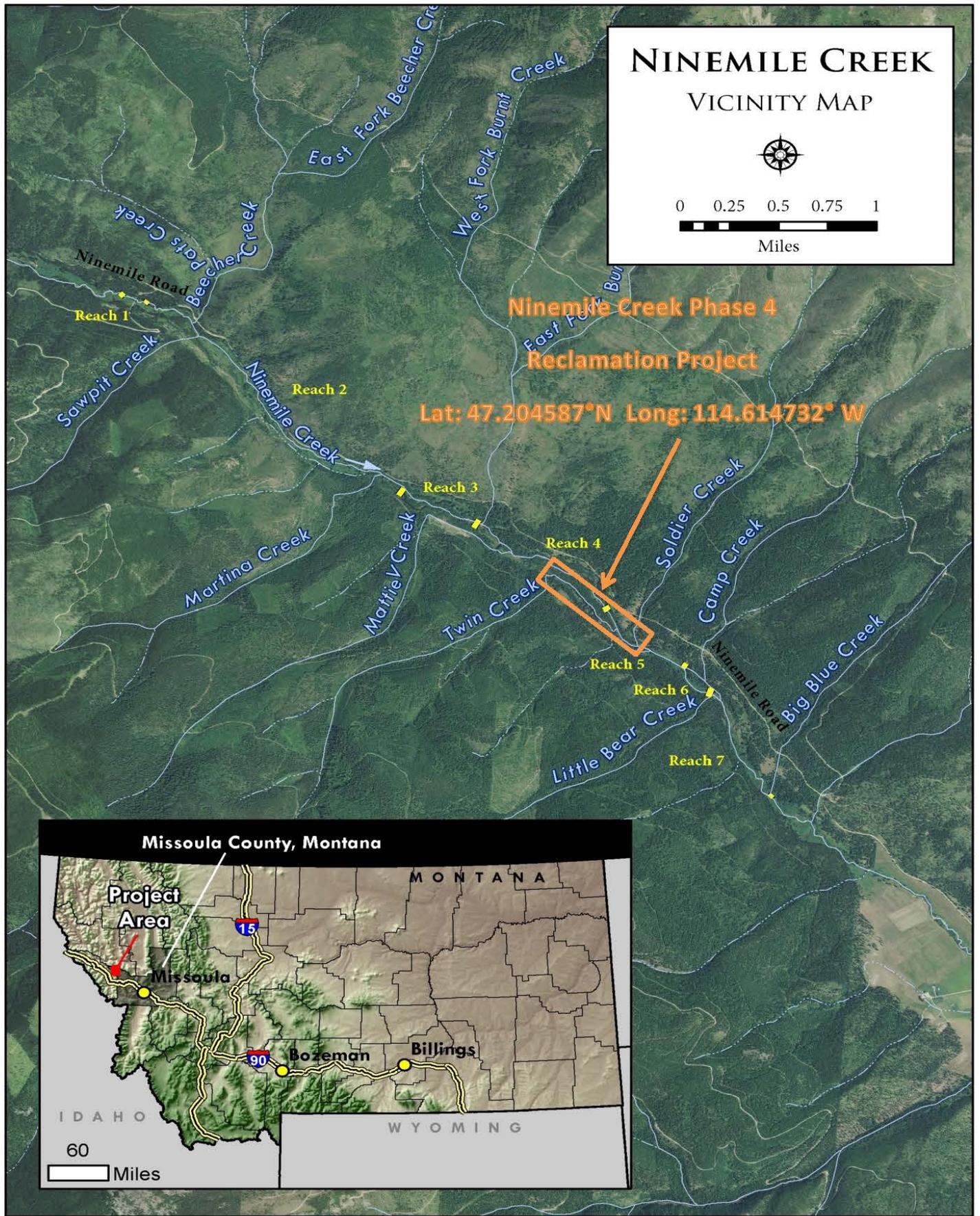


NINEMILE CREEK VICINITY MAP



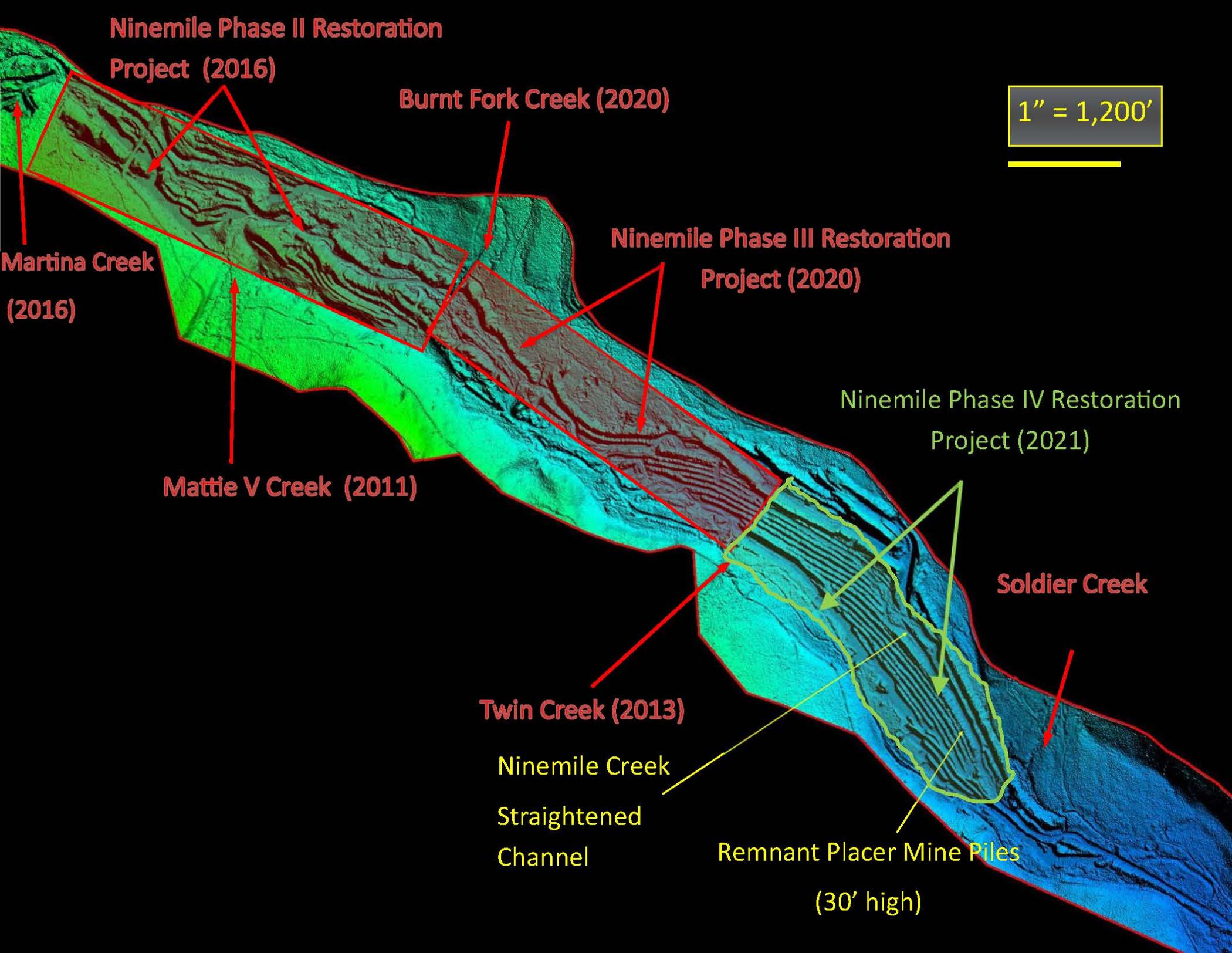
**Ninemile Creek Phase 4
Reclamation Project**

Lat: 47.204587°N Long: 114.614732° W



Missoula County, Montana





Ninemile Phase II Restoration

Project (2016)

Burnt Fork Creek (2020)

1" = 1,200'

Ninemile Phase III Restoration

Project (2020)

Martina Creek

(2016)

Ninemile Phase IV Restoration

Project (2021)

Mattie V Creek (2011)

Soldier Creek

Twin Creek (2013)

Ninemile Creek

Straightened

Channel

Remnant Placer Mine Piles

(30' high)

Design Drawings

Photos



Abandoned Placer Mine Pile Eroding along Reach 5 of Ninemile Creek



Abandoned Placer Mine Pile Eroding along Ninemile Creek



Noxious Weeds growing along abandoned placer mine piles



Abandoned Placer Mine Dredge Cut with poor water quality and temperature loading



Abandoned Placer Mine Pile Eroding along Ninemile Creek near Twin Creek



Eroding Placer mine banks on Ninemile Creek

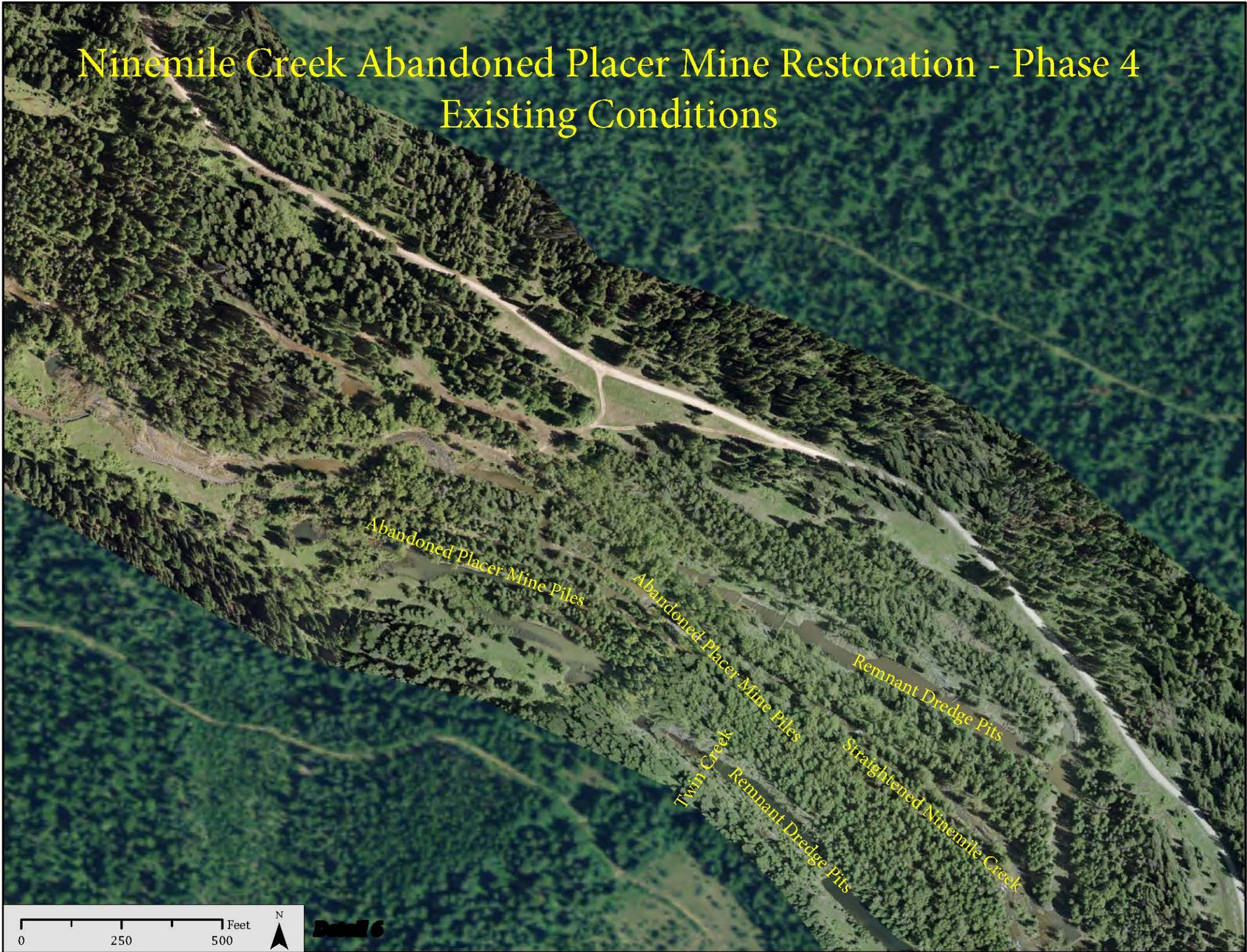


Abandoned Placer Mine Pile Eroding along Ninemile Creek at Twin Creek Confluence

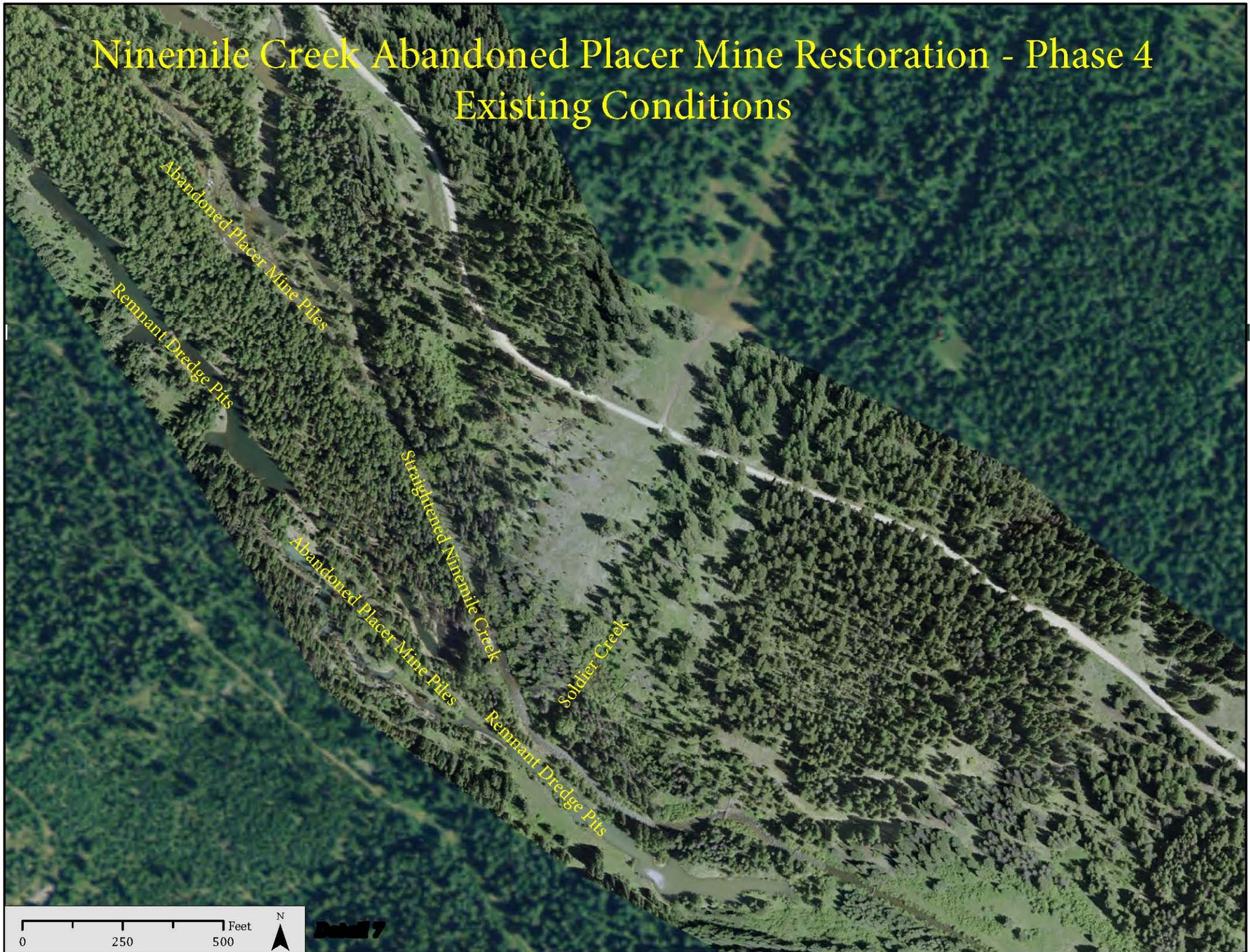


Straightened and Downcut Ninemile Creek Channel Near Soldier Creek

Ninemile Creek Abandoned Placer Mine Restoration - Phase 4 Existing Conditions



Ninemile Creek Abandoned Placer Mine Restoration - Phase 4 Existing Conditions



Detail 7

Ninemile Restoration - Natural Storage

Ninemile Creek restoration increases natural storage and supports in-stream flows

One of the most consistent climate change forecasts for watersheds of the Rocky Mountain West is a shift in spring snowmelt timing, resulting in earlier, more variable runoff, and amplified water shortages in mid-to-late-summer. These late-season flows are not only important for human use, but are essential for maintaining the cool in-stream temperatures required by threatened and endangered native trout species.

In response to these climate predictions, there is a growing interest in stream restoration techniques that could promote natural water storage, capturing Spring snowmelt and flood water in the landscape, and prolonging its release to the stream throughout the summer and fall. Over the last decade, Trout Unlimited and others have used stream restoration to increase water table heights, activate abandoned floodplain wetlands, and improve in-stream habitat for fish and other aquatic species. However, we still know very little about the effectiveness of stream restoration for increasing late-season streamflow. In 2016, Trout Unlimited partnered with the University of Montana to study the effect of restoration on seasonal patterns of aquifer storage and streamflow on Ninemile Creek, Montana.

Our project monitored the impact of TU's restoration work after extensive placer mining in the mid-1800's. We used chemical groundwater tracers (^{222}Rn) and synoptic stream discharge measurements to evaluate changes in aquifer storage and groundwater contributions to streamflow from June-November 2016. We found that restoration resulted in a longer period of aquifer storage in the Spring and a slower release of this stored water. Most importantly, at baseflow, restoration substantially increased groundwater contributions to streamflow. Based on our results, we estimate that for every mile of valley restored, an additional 1.01 acre-feet of groundwater entered the stream each day at baseflow. While results will vary across drainages, our work shows that restoration can have a substantial impact on storage and streamflow generation processes, and is a valuable tool for mitigating climate change effects on Western rivers and streams.

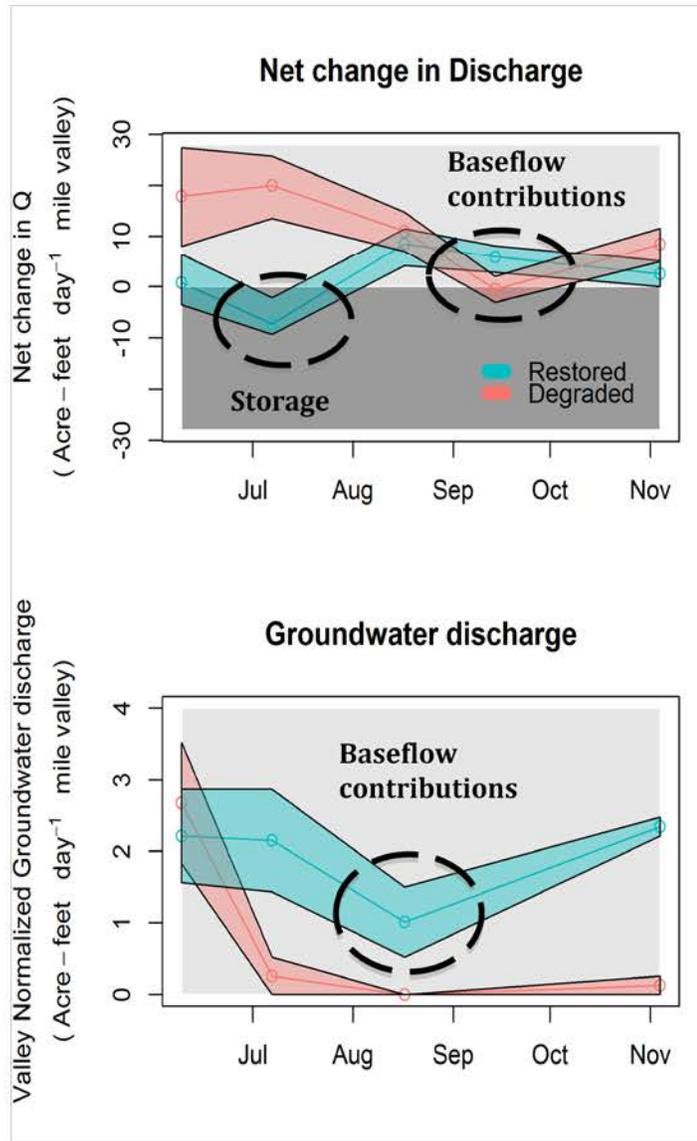


Degraded (top) and restored (bottom) reaches of Ninemile Creek. Restoration reduced channel incision, increased sinuosity and added riffle-pool sequences. Top image shows the degraded reach after overburden piles were removed, with the new, unconnected channel to the left.

Methods and Results:

Net change in discharge represents all gains and losses of streamflow over a given reach length (downstream discharge-upstream discharge). A negative value indicates losses from the stream to the alluvial aquifer (storage) while a positive value indicates aquifer contributions to streamflow. Our results show that restoration (blue) increased storage early in the season, allowing for increased contributions to streamflow at baseflow.

Groundwater discharge from the aquifer to the stream was also estimated using Radon-222. In the restored reach, we see less groundwater discharge early in the season (likely due to storage) and a more gradual decline in groundwater contributions to streamflow over time. At baseflow, the degraded reach has no measurable groundwater contributions, while the restored reach is contributing an additional 1.01 acre-feet of groundwater per day for every mile of stream restored.



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