FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

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

I. APPLICANT INFORMATION

A. Applicant Name: Big Blackfoot Chapter of Trout Unlimited

Mailing Address: PO Box 1

City: Ovando State: MT Zip: 59868

Telephone: 406-240-4824 E-mail: ryen@montanatu.org

B. Contact Person (if different than applicant): See above

Address:

City: State: Zip:

Telephone: E-mail:

C. Landowner and/or Lessee Name (if different than applicant): US Forest Service-Seeley Lake Ranger Station

Mailing Address: 3583 MT-HWY 83

City: Seeley Lake State: MT Zip: 59868

Telephone: 406-677-2233 E-mail:

II. PROJECT INFORMATION

A. Project Name: Benedict Creek Fish Passage Project

River, stream, or lake: Benedict Creek

Location: Township: 17N Range: 15W Section: 8

Latitude: 47.248007 Longitude: -113.527041 *Within project (decimal degrees)*

County: Missoula

B. Purpose of Project:

The purpose of this project is to upgrade an existing irrigation diversion that creates several issues for Benedict Creek including: channel impairments, fish passage restrictions, and is currently not screened to prevent entrainment. The project will benefit populations of westslope cutthroat trout, a species of special concern.

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

Benedict Creek is a first-order tributary to the Clearwater River and supports populations of westslope cutthroat trout and bull trout. An existing irrigation diversion is impacting the stream by restricting upstream fish passage, limiting channel function and potentially entraining trout and other aquatic species.

This project will install a Zinvent fish screen along with a headgate and valve at the existing point of diversion. To improve water conveyance, an 80 foot pipeline will also be installed to transport diverted flows into the existing storage tank the landowner uses for water. The existing diversion infrastructure restricting fish passage and impacting channel function will be replaced with a channel step-pool comprised of wood and rock.

The goal of this project involves working with the private landowner and USFS on upgrading the diversion point with a fish screen and step-pool to 1) improve fish passage, 2) prevent entrainment, and 3) regulate flows for water conservation benefits. This project will benefit trout within Benedict Creek and improve trout recruitment and cold-water input to the lower Clearwater River.

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

The existing irrigation diversion is a fish passage issue and creates channel impairments to Benedict Creek.

E. Length of stream or size of lake that will be treated (project extent): 150 feet

Length/size of impact, if larger than project extent (e.g., stream miles opened): 2 miles

F. Project Budget Summary:

Grant Request (Dollars):	**$**	**11,400**
Matching Dollars:	**$**	**21,875**
Matching In-Kind Services:*	**$**	**4,434.05**

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

Other Contributions (not part of this app)	**$**	
Total Project Cost:	**$**	**$37,709.05**

G. Attach itemized (line item) budget – *see budget template*

H. Attach project location map(s) that include:

- ☐ Extent of the project, including context (relation to major landmark or town)
- ☐ Indication of public and private property
- ☐ Riparian buffer locations and widths (if applicable) and grazing locations

I. Attach project plans:

- ☐ Detailed sketches or plan views with the location and proposed restoration
- ☐ Pre-project photographs (GPS location strongly recommended)
- ☐ If water leasing or water salvage is involved, attach a supplemental questionnaire (*https://myfwp.mt.gov/getRepositoryFile?objectID=36110*)

J. Attach letters or statements of support (e.g., landowner consent, community or public support, and FWP fisheries support). List any other project partners:

FWP and USFWS Support Letters are attached.

III. MAINTENANCE AND MONITORING (attach additional information to end of application):

A. A 20-year maintenance commitment is required*. Please confirm that you will ensure this protection and describe your approach. Attach any relevant maintenance plans. Yes [x] No [ ]

**If it is a water leasing project, describe the length of the agreement.*

The landowner will sign a 20-year landowner agreement outlining how the new diversion will be operated.

B. Will grazing be part of or adjacent to the project? If so, describe or attach land management plans, including short term and long-term grazing regimes. If the landowner is not the applicant, please describe their involvement in the project. *If you want assistance with grazing plan development, note your need.*

Grazing is not a project component.

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

Post-project as-built surveys will be conducted to ensure the project was installed according to design specifications and standards. The design outlines details for fish passage, bedload transport and instream and riparian habitat conditions.

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

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

Primarily westslope cutthroat trout.

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

The project will restore aquatic organism passage and channel function by removing a dam used for irrigation. Screening irrigation diversions is an important strategy in our efforts to conserve and restore native trout populations in the Blackfoot River watershed.

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

The project will eliminate a limiting factor impacting westslope cutthroat trout, a species of special concern and will protect wild trout recruitment to the Clearwater River fishery.

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

The project is located on USFS land and there is access to the stream at different locations. By improving a migration corridor for westslope cutthroat trout, we hope this will improve downstream recruitment into the Clearwater River, an important river system in the Seeley Lake area.

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

This project advances the overall Blackfoot River Restoration program, in this case by benefiting native trout conservation, wild trout fishery enhancement and irrigation infrastructure upgrades that are fish-friendly. Specific public benefits include: 1) expanding suitable habitat and fish passage conditions for westslope cutthroat trout and 2) eliminating a limiting factor for trout populations and 3) conserving instream flows and contributing cold water to the Clearwater River.

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

There are no other irrigation diversions on Benedict Creek and the project is designed around a valid water right that has been adjudicated.

G. Will the project result in the development of commercial recreational use on the site (including paid access)? Explain:

No.

H. Is this project associated with the reclamation of past mining activity?

No.

Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.

V. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature: Ryan Nendecker Date: November 10, 2023

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

Mail to:	FWP Future Fisheries Fish Habitat Bureau PO Box 200701 Helena, MT 59620-0701	Email:	Future Fisheries Coordinator FWPFFIP@mt.gov (electronic submissions must be signed) For files over 10MB, use https://transfer.mt.gov and send to mmcgree@mt.gov

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Both tables must be completed or the application will be returned

PROJECT COSTS					CONTRIBUTIONS			
WORK ITEMS (Itemize by Category)	**NUMBER OF UNITS**	**UNIT DESCRIPTION***	**COST/UNIT**	**TOTAL COST**	**FUTURE FISHERIES REQUEST**	**MATCH (Cash or Services)****	**OTHER (Not part of this application)**	**TOTAL**
Personnel* **								
Survey	19	Hrs	$125.00	$ 2,375.00		$ 2,375.00		$ 2,375.00
Design	30	Hrs	$125.00	$ 3,750.00		$ 3,750.00		$ 3,750.00
Engineering	36	Hrs	$125.00	$ 4,500.00		$ 4,500.00		$ 4,500.00
Permitting	20	Hrs	$50.00	$ 1,000.00		$ 1,000.00		$ 1,000.00
Oversight	20	Hrs	$100.00	$ 2,000.00	1,000.00	$ 1,000.00		$ 2,000.00
Project Mgmt	62	Hrs	$50.00	$ 3,100.00		$ 3,100.00		$ 3,100.00
			Sub-Total	$ 16,725.00	$ 1,000.00	$ 15,725.00	$ -	$ 16,725.00
Travel								
Mileage	510	miles	$0.66	$ 334.05		334.05		$ 334.05
Per diem				$ -				$ -
			Sub-Total	$ 334.05	$ -	$ 334.05	$ -	$ 334.05
Construction Materials** **								
Fish Screen	1	LS	$2,000.00	$ 2,000.00	1,000.00	1,000.00		$ 2,000.00
Headgate	1	LS	$2,500.00	$ 2,500.00	1,000.00	1,500.00		$ 2,500.00
Valve	2	LS	$800.00	$ 1,600.00	600.00	1,000.00		$ 1,600.00
PVC pipe	90	LF	$5.00	$ 450.00		450.00		$ 450.00
Various fittings	1	LS	$1,500.00	$ 1,500.00	500.00	1,000.00		$ 1,500.00
			Sub-Total	$ 8,050.00	$ 3,100.00	$ 4,950.00	$ -	$ 8,050.00
Equipment, Labor, and Mobilization								
Excavator	60	hrs	$155.00	$ 9,300.00	6,000.00	3,300.00		$ 9,300.00
Labor	40	hrs	$45.00	$ 1,800.00	800.00	1,000.00		$ 1,800.00
Mob	1	LS	$1,500.00	$ 1,500.00	500.00	1,000.00		$ 1,500.00
			Sub-Total	$ 12,600.00	$ 7,300.00	$ 5,300.00	$ -	$ 12,600.00
			TOTALS	$ 37,709.05	$ 11,400.00	$ 26,309.05	$ -	$ 37,709.05

OTHER REQUIREMENTS:

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

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

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

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

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

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Additional details:

APPLICATION MATCHING CONTRIBUTIONS

(do not include requested funds or contributions not associated with the application)

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
USFWS	$ -	$ 5,000.00	$ 5,000.00	Yes
Montana Trout Unlimited		$ 3,000.00	$ 3,000.00	Yes
USFS		$ 13,875.00	$ 13,875.00	Yes
BBCTU	$ 4,434.05		$ 4,434.05	Yes
TOTALS	$ 4,434.05	$ 21,875.00	$ 26,309.05	

OTHER CONTRIBUTIONS

(contributions not associated with the application)

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

Existing Irrigation Diversion on Benedict Creek

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Partners for Fish and Wildlife Program
Upsata Lake, 196 Lower Lake Side Lane
P.O. Box 66
Ovando, MT 59854

November 9th, 2023

Montana Fish, Wildlife and Parks
Attn: Michelle McGree
1420 East 6th Ave.
Helena, MT 59620

RE: Support for the Big Blackfoot Chapter of Trout Unlimited Application to Future Fisheries for fish passage restoration on Benedict Creek

Dear Future Fisheries Panel:

The U.S. Fish and Wildlife Service (Service) strongly endorses projects that support our mission to conserve and manage federal trust and at-risk species, including westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), such as the proposal submitted by the Big Blackfoot Chapter of Trout Unlimited (BBCTU) for the Benedict Creek fish screen. This project will improve passage and instream habitat for aquatic species and prevent fish entrainment in diversion infrastructure within an important cold-water tributary to the Clearwater River. Adding a flow control mechanism to this diversion, which currently lacks a headgate or other valve, will also help conserve instream flows and will contribute to improved water quality and quantity in downstream habitats that support bull trout (*Salvelinus confluentus*).

The Service's Partners for Fish and Wildlife Program has a long history of working with private landowners and other partners collaborating to restore the native trout fisheries in the Blackfoot Watershed. The Clearwater River and associated tributaries are a very high priority watershed for the Service and important tributaries to the Blackfoot River. The funding through this grant will advance BBCTU and the Service's efforts to address large-landscape conservation issues with a locally led collaborative and inclusive approach. We are excited to support the BBCTU proposal and continue to work in this landscape.

We urge the Future Fisheries Panel to provide funding for this collaborative effort. If you have any questions regarding this letter of support, please contact me at (406) 351-3078 or by email at rebecca_reeves@fws.gov. Thank you for considering this request.

Sincerely,

Rebecca A Reeves

Rebecca Reeves
Partners for Fish and Wildlife

Region 2 Headquarters
3201 Spurgin Road
Missoula, MT 59804
Phone 406-542-5500
11-01-2023

Future Fisheries Improvement Program
c/o Michelle McGree
Montana Fish, Wildlife & Parks
P.O. Box 200701
1420 E. 6th Avenue
Helena, MT 59620-0701

RE: Future Fisheries Funding Support Letter Benedict Creek Diversion Upgrade and Fish Screen

Dear Panel Members:

This letter is written in support of the 2023 Future Fisheries Improvement Program (FFIP) application submitted by Big Blackfoot Trout Unlimited for fisheries and water management improvements at a private irrigation diversion on Benedict Creek. Benedict Creek is a small tributary of the Clearwater River that enters the main stem just north of Seeley Lake. This stream supports migratory and stream-resident Westslope Cutthroat Trout (WCT) and stream-resident brook trout in lower reaches.

The Clearwater Basin has been a focus area for native trout enhancement work within the Blackfoot Watershed over the past 15 years. This basin supports numerous stream-resident and migratory WCT populations and still represents a stronghold for migratory (adfluvial) bull trout. The proposed project complements numerous other projects and investments in the in the Clearwater system that have been supported by Future Fisheries (FFIP) and numerous other funding sources. Recent efforts include 4 mains stem fish passage improvements, previously installed fish screens in the Morrell-Trail Creek system, large-scale road decommissioning in tributary headwater basins, and acquisition of > 80,000 acres of former timber company lands by public agencies and The Nature Conservancy.

I encourage you to join local conservation groups, water users, and public agency representatives in support of the proposed application, as the project will supplement and complement previous investments for wild and native fisheries in the watershed. If you have any questions about the project, the fish populations, or history of restoration in Benedict Creek or the Clearwater Basin, please feel free to contact our regional fisheries biologist, Ladd Knotek, at 406-552-9415 or lknotek@mt.gov.

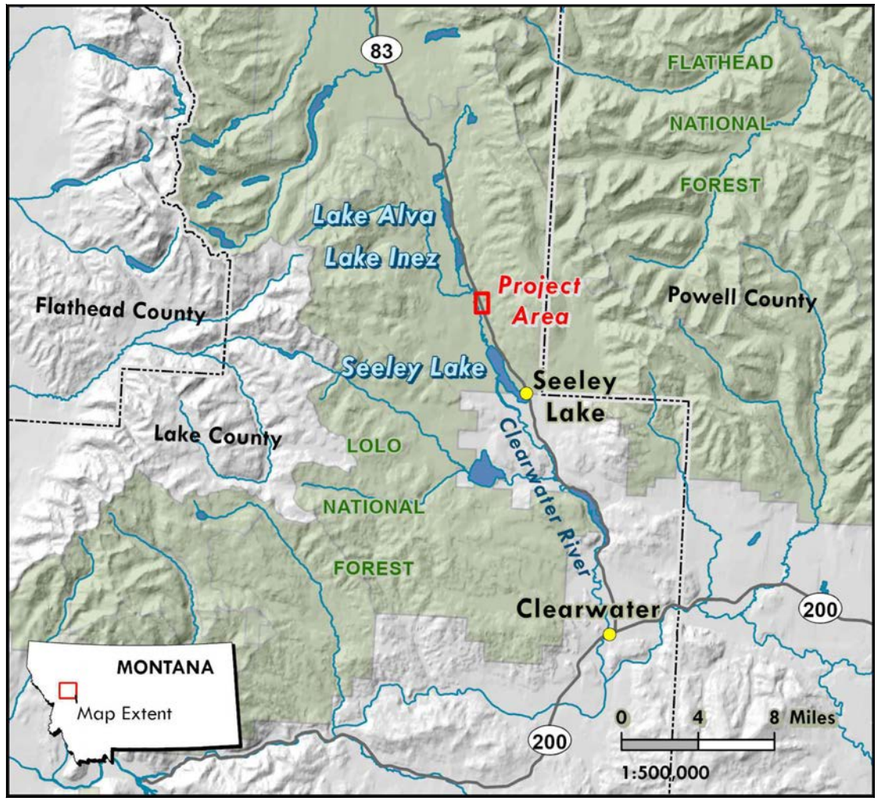
Thanks for your consideration.

Sincerely,

Randy Arnold
Region 2 Supervisor

BENEDICT CREEK FISH SCREEN PROJECT
95% DESIGN PLAN SET

BENEDICT CREEK VICINITY MAP



LEGAL DESCRIPTION: S08, T17 N, R15 W, ACRES 1, TR 1 IN W1/2 NW1/4 SE1/4 MISSOULA COUNTY, MONTANA

DRAWING INDEX

PROJECT PARTNERS

BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED
PO BOX 1
OVANDO, MONTANA 59854

US FOREST SERVICE
SEELEY LAKE RANGER DISTRICT
3583 HIGHWAY 83
SEELEY LAKE, MT 59868

MONTANA FISH, WILDLIFE & PARKS
3201 SPURGIN ROAD
MISSOULA, MT 59804

LANDOWNER
JERALD W. MILLER

PROJECT DESCRIPTION

BENEDICT CREEK, A TRIBUTARY TO THE CLEARWATER RIVER, IS LOCATED ON THE WEST FACE OF THE SWAN RANGE APPROXIMATELY TWO MILES NORTH OF SEELEY, MONTANA. BENEDICT CREEK IS AN IMPORTANT THIRD ORDER COLDWATER TRIBITARY TO THE CLEARWATER RIVER. BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED, IN PARTNERSHIP WITH THE U.S. FOREST SERVICE, MONTANA FISH, WILDLIFE & PARKS, AND JERALD MILLER (LANDOWNER), RETAINED RIVER DESIGN GROUP, INC. TO EVALUATE AN EXISTING DOMESTIC WATER DIVERSION ON BENEDICT CREEK THAT DELIVERS WATER TO AN EXISTING 200-GALLON BURIED STORAGE TANK AND PRIVATE RESIDENCE. THE EXISTING DIVERSION CONSISTS OF A WOODEN PLANK STRUCTURE SUPPORTED BY FENCE POSTS AND LOGS WITH A PVC PIPE MANIFOLD. THE MANIFOLD IS UNSCREENED AND LACKS A HEADGATE STRUCTURE TO CONTROL FLOW INTO THE 4-INCH PIPE, AND THE WOODEN PLANK STRUCTURE IS A SEASONAL FISH PASSAGE BARRIER.

THE GOALS OF THE BENEDICT CREEK FISH SCREEN PROJECT ARE TO IMPROVE FISH PASSAGE, PREVENT FISH ENTRAINMENT, CONSERVE INSTREAM FLOWS, AND ENSURE THE LANDOWNER CAN DIVERT HIS LEGAL WATER RIGHT YEAR-ROUND. SPECIFIC OBJECTIVES INCLUDE:

- IMPROVE PASSAGE FOR RESIDENT AND MIGRATORY FISH SPECIES.
- PREVENT FISH ENTRAINMENT BY INSTALLING A FISH SCREEN THAT REQUIRES MINIMAL MAINTENANCE.
- MAINTAIN OR IMPROVE DIVERSION SYSTEM EFFICIENCY.
- PROVIDE A MEANS OF CONTROLLING FLOW INTO THE EXISTING 4-INCH PVC PIPE.
- MINIMIZE REQUIRED MAINTENANCE OF THE SYSTEM.

THESE DRAWINGS REPRESENT A 95% DESIGN LEVEL PLAN SET. THE DRAWINGS ILLUSTRATE MODIFICATIONS TO THE EXISTING DIVERSION WHICH INCLUDE RELOCATING THE POINT OF DIVERSION APPROXIMATELY 80-FEET UPSTREAM, INSTALLING A STATIC SCREEN ATTACHED TO A LOG STEP-POOL STRUCTURE, AND RUNNING A BURIED 4-INCH PVC PIPE TO THE EXISTING 4-INCH PVC PIPE AT THE EXISTING DIVERSION LOCATION.

STANDARD OF PRACTICE

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

...

REUSE OF DRAWINGS

RDG RIVER DESIGN GROUP

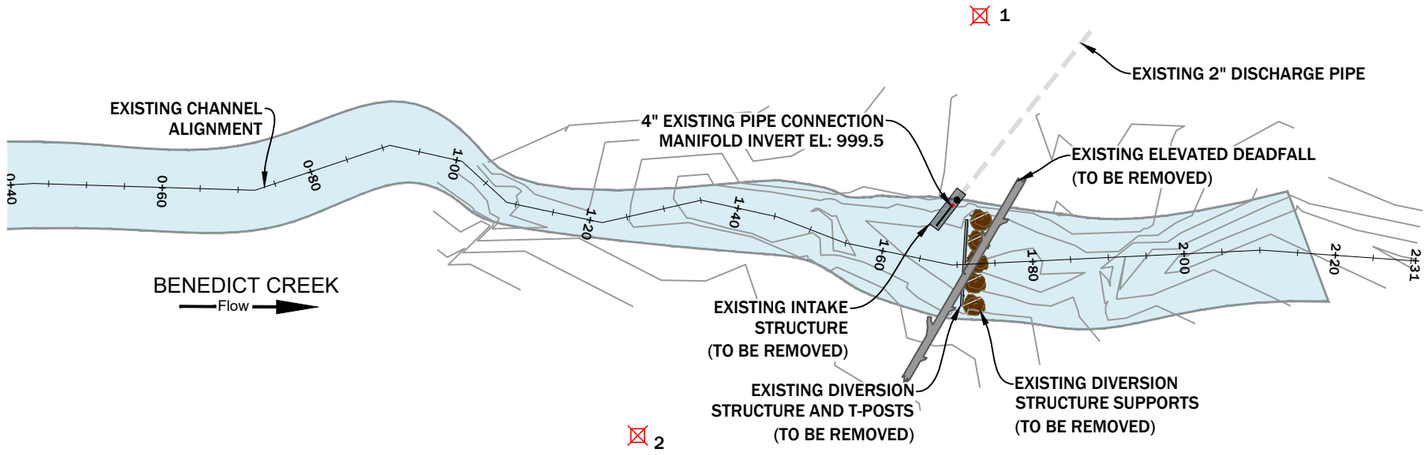
COVER SHEET AND NOTES
BENEDICT CREEK - MILLER DIVERSION
SEELY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
0	09-02-23	LS	75% DESIGN	JM
0	10-30-23	LS	95% DESIGN	JM

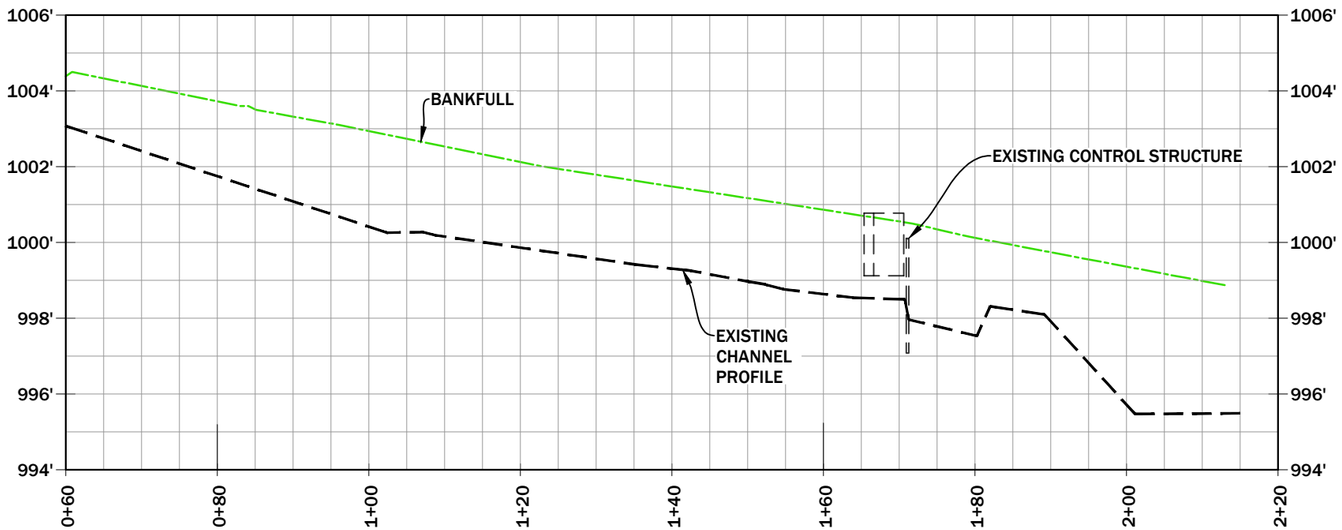
PROJECT NUMBER
RDG-23-152

DRAWING NUMBER
1.0

M:\Projects\2023\RDG-23-152 Benedict Creek\CAD\Benedict Creek Diversion.dwg



1 EXISTING CONDITIONS - MILLER DIVERSION
PLAN VIEW
1" = 20'

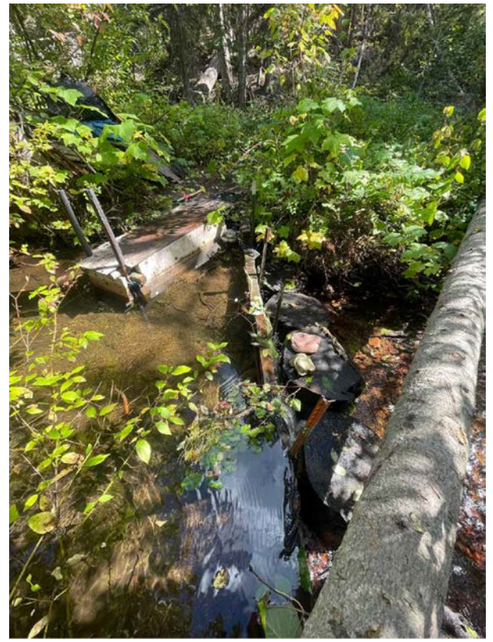


2 EXISTING CONDITIONS - MILLER DIVERSION
PROFILE VIEW
HORIZ 1" = 20'
VERT 1" = 4'

CONTROL POINTS

POINT NUMBER	EASTING	NORTHING	POINT ELEVATION	RAW DESCRIPTION
1	10000.000	10000.000	1004.98'	SET RDG
2	10064.000	9968.665	1002.33'	SET CAP

THE SURVEY COORDINATES ARE BASED ON LOCAL COORDINATES.



EXISTING WATER CONTROL STRUCTURE

EXISTING PIPE MANIFOLD STRUCTURE

RDG ENGINEERING & DESIGN GROUP
SEELY, MONTANA

EXISTING CONDITIONS AND SURVEY CONTROL PLAN
BENEDICT CREEK - MILLER DIVERSION
SEELY, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
0	09-02-23	LS	75% DESIGN	JM
1	10-30-23	LS	95% DESIGN	JM

PROJECT NUMBER
RDG-22-152

DRAWING NUMBER
2.0

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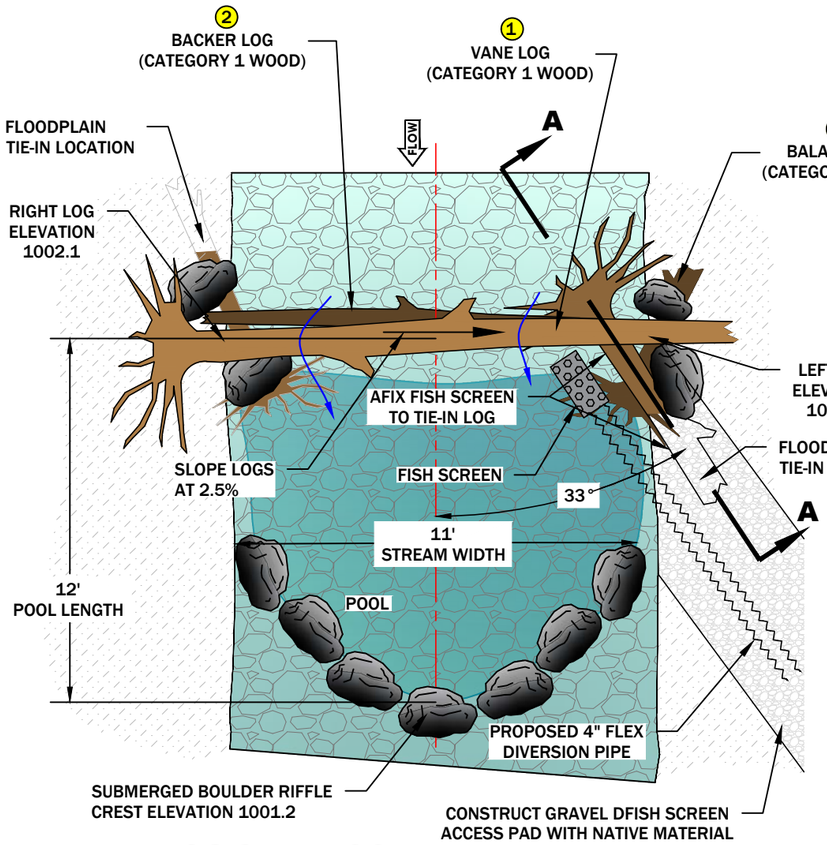
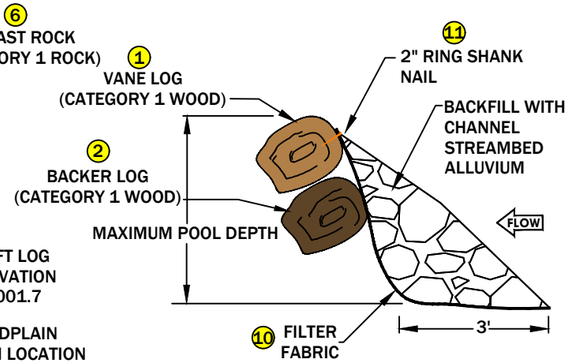
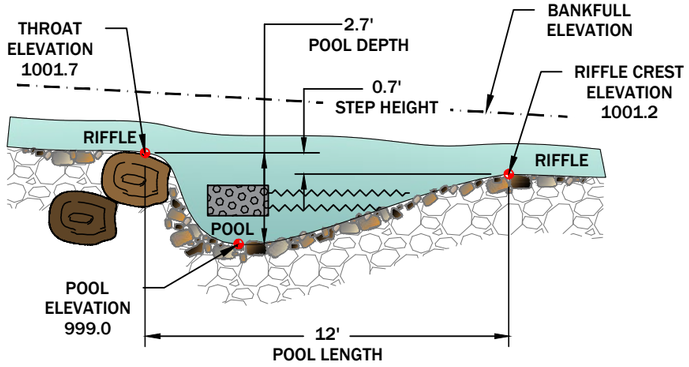


1 LOG STEP POOL
PLAN VIEW
1"=5'

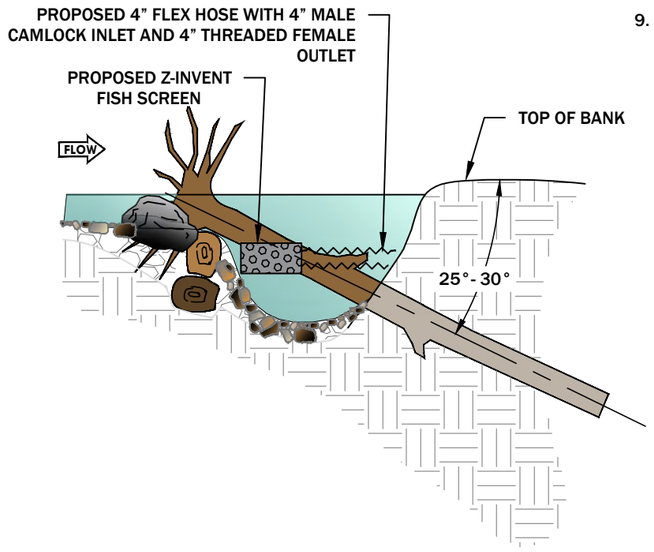


4 FILTER FABRIC DETAIL
SECTION VIEW
NTS

MATERIAL SCHEDULE (PER STRUCTURE)			
	ITEM	SIZE	QTY.
1	CATEGORY 1 WOOD	12-18 IN	2 EA
2	CATEGORY 2 WOOD	8-12 IN	3 EA
3	CATEGORY 1 ROCK	10-12 IN	20 EA
4	LF OF FILTER FABRIC		20 LF
5	2" RING SHANK NAILS		20 EA



2 LOG STEP POOL
PROFILE VIEW
1"=5'



3 LOG STEP POOL
SECTION A-A
1"=5'

GENERAL NOTES

1. CONSTRUCTION OF THE LOG STEP POOL WILL OCCUR PRIOR TO THE CHANNEL CONSTRUCTION.
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 STREAMBED TIE-IN LOCATIONS.

INSTALLATION NOTES

1. INSTALL VANE LOG (CATEGORY 1 WOOD) AT THE FLOODPLAIN TIE-IN LOCATIONS AND TO THE ORIENTATIONS NOTED ON THE DRAWING. VANE LOGS SHALL BE PLACED ON CHANNEL ALLUVIUM AND THE ROOTWADS SHALL BE EMBEDDED INTO THE STREAMBANK A MINIMUM OF 2-FT. RELATIVE TO FINISHED BANK ELEVATION.
2. PRIOR TO CONSTRUCTION OF THE LOG STEP POOL, ENGINEER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS.
3. CONTRACTOR SHALL STOCKPILE WOOD AND ROCK PER SPECIFICATIONS NOTED ON THE DRAWINGS.
4. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
5. ORIENT VANE LOGS IN CONTACT WITH ADDITIONAL ROOTWADS AND THE CHANNEL STREAMBED AS SHOWN ON THE DRAWING. EMBED VANE LOG TIPS INTO THE CHANNEL STREAMBED A MINIMUM OF 3-FT. SLOPING AT AN ANGLE NO GREATER THAN 2.5%. VANE LOG TIPS SHALL BE A MINIMUM OF 1-FT. BELOW THE CHANNEL STREAMBED FINISHED GRADE.
6. INSTALL BACKER LOGS (CATEGORY 1 WOOD) ON THE UPSTREAM SIDE OF THE VANE LOGS AS SHOWN ON THE DRAWINGS. BACKER LOGS SHALL BE FLUSH WITH THE VANE LOGS AND EXTEND FROM THE FLOODPLAIN TIE-IN LOCATIONS TO THE TIPS OF THE VANE LOGS.
7. INSTALL CATEGORY 1 ROOTWAD LOGS AT FLOODPLAIN TIE IN LOCATIONS AS SHOWN. INSTALL CATEGORY 1 ROCK UPSTREAM AND DOWNSTREAM OF THE STREAMBANK TIE-IN LOCATIONS AND VANE LOG TIPS. ROCK SHALL BE IN CONTACT WITH VANE LOGS AND BACKER LOGS TO PROVIDE BALLAST AND TO PREVENT THE STRUCTURE FROM SHIFTING WHILE THE STRUCTURE IS BACKFILLED.
8. ATTACH NON-WOVEN GEOTEXTILE FABRIC TO VANE LOGS AND EXTEND VERTICALLY TO THE MAXIMUM DEPTH OF THE POOL ON THE UPSTREAM SIDE OF THE STRUCTURE. BACKFILL VANE LOGS WITH EXCAVATED STREAMBED ALLUVIUM TO STREAMBED FINISHED GRADE.
9. REGRADE UPSTREAM AND DOWNSTREAM STREAMBED TO TIE INTO THE EXISTING CHANNEL ELEVATIONS (IF EXCESS MATERIAL IS SIDECAST IN POOL DURING CONSTRUCTION, CONTRACTOR SHALL RE-EXCAVATE POOL TO THE DESIGN DIMENSIONS AS APPROVED BY ENGINEER).

EXAMPLE OF A CONSTRUCTED LOG STEP POOL

RDG RIVER DESIGN GROUP

LOG STEP POOL DETAIL

BENEDICT CREEK - MILLER DIVERSION
BONNER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
0	09-02-23	LS	75% DESIGN	JM
1	10-30-23	LS	95% DESIGN	JM

PROJECT NUMBER
RDG-23-152

DRAWING NUMBER
5.0

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TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	2	10-12 IN	25 FT	YES
CATEGORY 2 WOOD	8	8-12 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	18	2"-4"	10-12 FT	OPTIONAL
CATEGORY 4 WOOD	22	< 2" IN	10-12 FT	OPTIONAL
WILLOW CUTTINGS	210	0.25"-1.0"	8 FT	NO

NOTE:
WOOD LENGTHS SHOWN WILL PRODUCE THE PROPER AMOUNT MATERIAL FOR STRUCTURES WHEN SPLIT INTO APPROPRIATE SIZES DURING CONSTRUCTION. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.

TOTAL ROCK QUANTITIES

ITEM	QUANTITY (EA)	DIAMETER (IN)	
CATEGORY 1 ROCK	50	10-12	
ITEM	QUANTITY (CY)	GRADATION	
		SIZE (IN)	PERCENT PASSING
STREAMBED/STREAMBANK FILL	6.5	10	100
		6	90-100
		4	50-80
		3	30-50
		1	10-30
		0.08	10

TOTAL EARTHWORK QUANTITIES

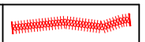
ITEM	QUANTITY (CY)
CUT	7.0
FILL	10

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

PIPE, FITTINGS, AND HARDWARE

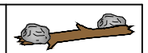
ITEM	QUANTITY
4" PVC PIPE	90 LF
30 DEGREE 4" PVC SWEEP	2 EA
45 DEGREE 4" PVC SWEEP	1 EA
4" PVC WYE	1 EA
4" PVC CLEANOUT	3 EA
4" PVC CLEANOUT RISER	3 EA
4" BUTTERFLY VALVES WITH 4" PVC CONNECTIONS	3 EA
4" PVC TO MALE PIPE THREAD (MPT)	1 EA
3/8" X 8" STAINLESS STEEL EYEBOLT	2 EA
3/8" X 5' STAINLESS STEEL CHAIN	2 EA
3/8" STAINLESS STEEL SNAP HOOK (CARIBINER)	4 EA

VEGETATED WOOD MATRIX QUANTITIES



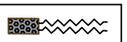
ITEM	QUANTITY
VEGETATED WOOD MATRIX TYPE 2	70 LF
CATEGORY 3 WOOD	18 LF
CATEGORY 4 WOOD	140 LF
WILLOW CUTTINGS	210 LF
STREAMBANK FILL	7.0 CY

LOG STEP POOL STRUCTURE QUANTITIES



ITEM	QUANTITY (EA)
LOG STEP POOL STRUCTURES	1
CATEGORY 1 WOOD	2
CATEGORY 2 WOOD	3
CATEGORY 1 ROCK	10
FILTER FABRIC	20
RING SHANK NAILS	20

FISH SCREEN QUANTITIES



ITEM	QUANTITY
Z-INVENT 'ULTRA HEAVY-DUTY 75 GPM GREENSCREEN' FISH SCREEN WITH 4" MALE CAM-LOCK	1
4" FLEX HOSE WITH 4" MALE CAMLOCK INLET AND 4" THREADED FEMALE OUTLET	10 (LF)

RDG RIVER DESIGN GROUP

MATERIALS AND QUANTITIES

BENEDICT CREEK - MILLER DIVERSION
BONNER, MONTANA

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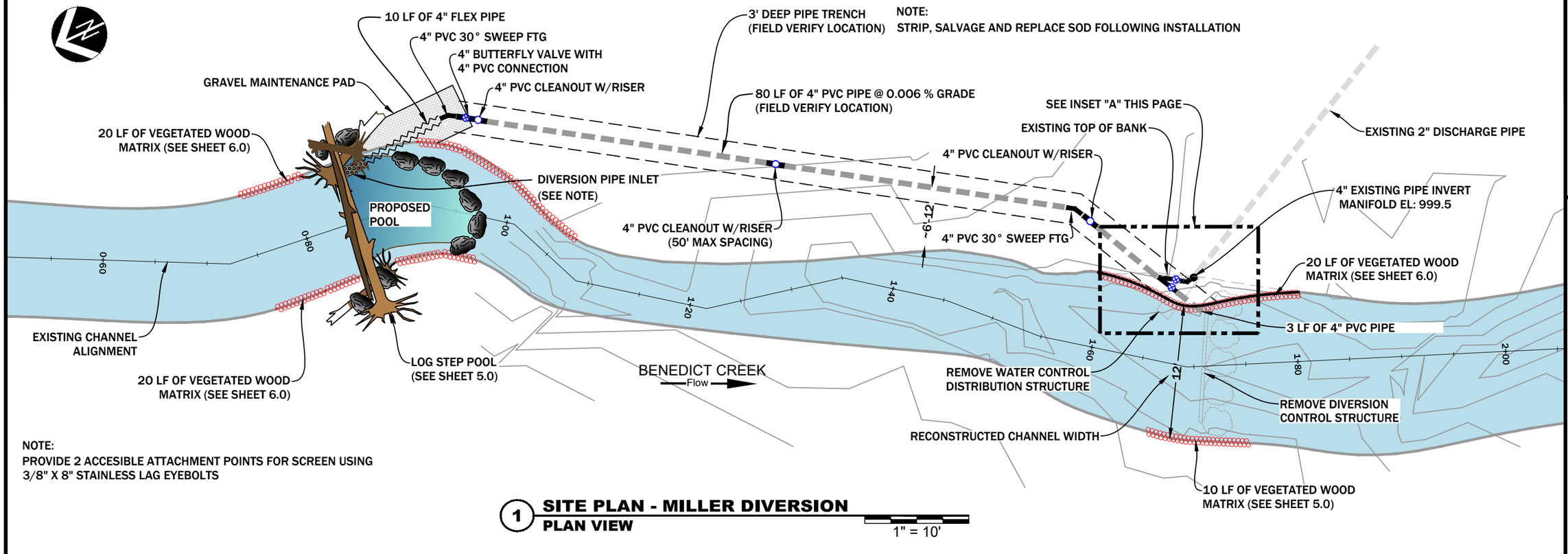
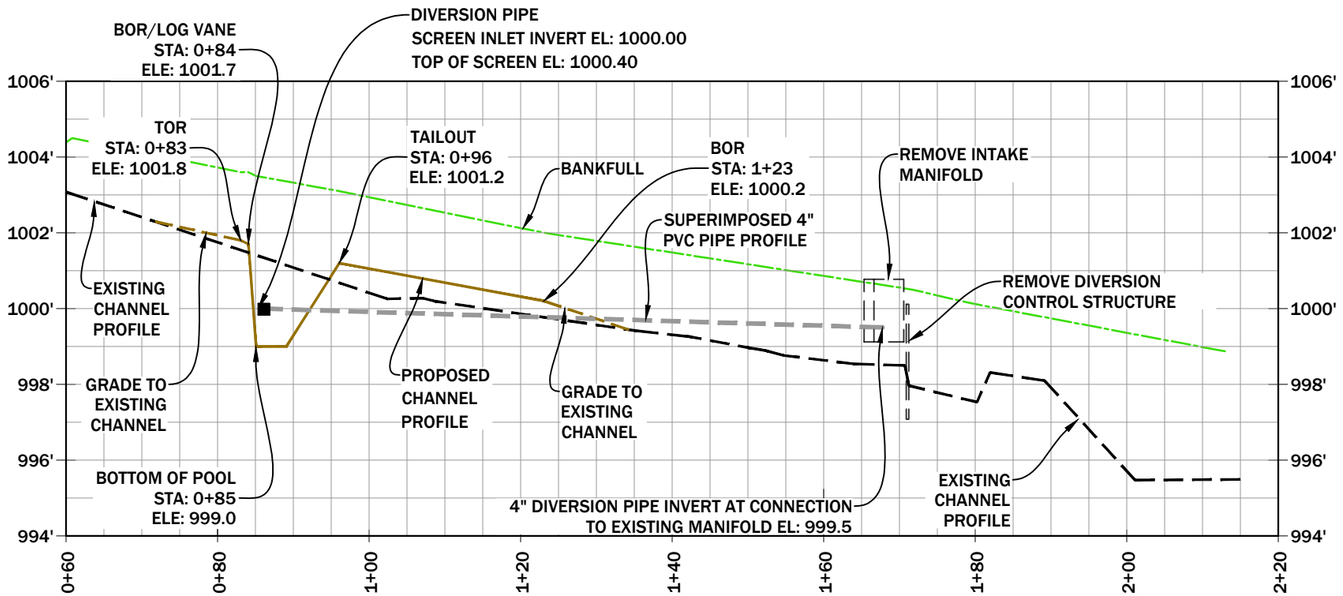
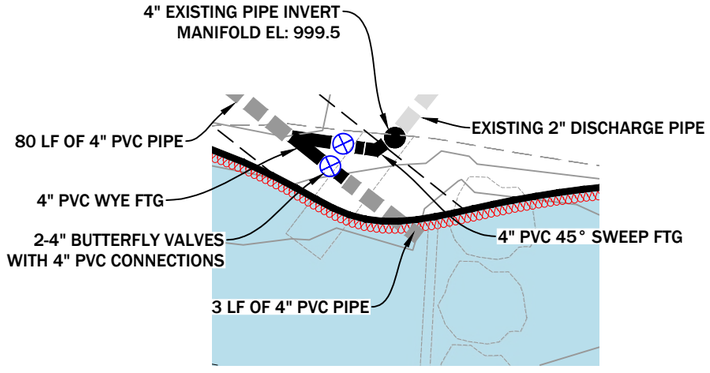


NOTE:
PROVIDE 2 ACCESIBLE ATTACHMENT POINTS FOR SCREEN USING 3/8" X 8" STAINLESS LAG EYEBOLTS

1 SITE PLAN - MILLER DIVERSION
PLAN VIEW
1" = 10'



2 SITE PLAN - MILLER DIVERSION
PROFILE VIEW
HORIZ 1" = 20'
VERT 1" = 4'



3 INSET "A"
PLAN VIEW
1" = 20'

RDG RIVER DESIGN GROUP

SITE PLAN AND PROFILE
BENEDICT CREEK - MILLER DIVERSION
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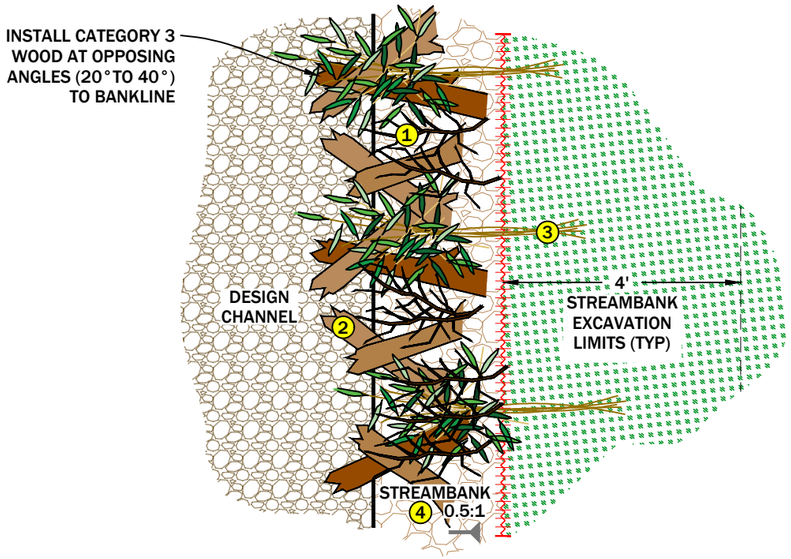
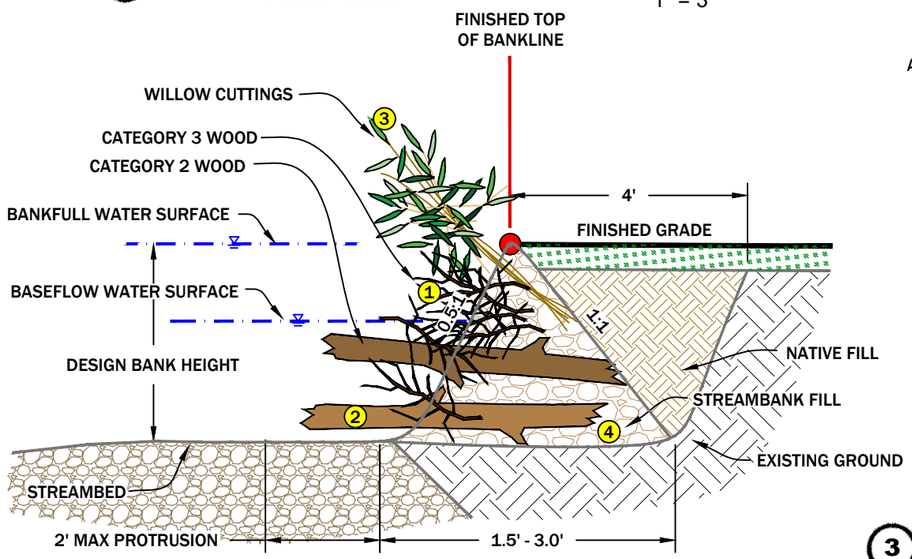
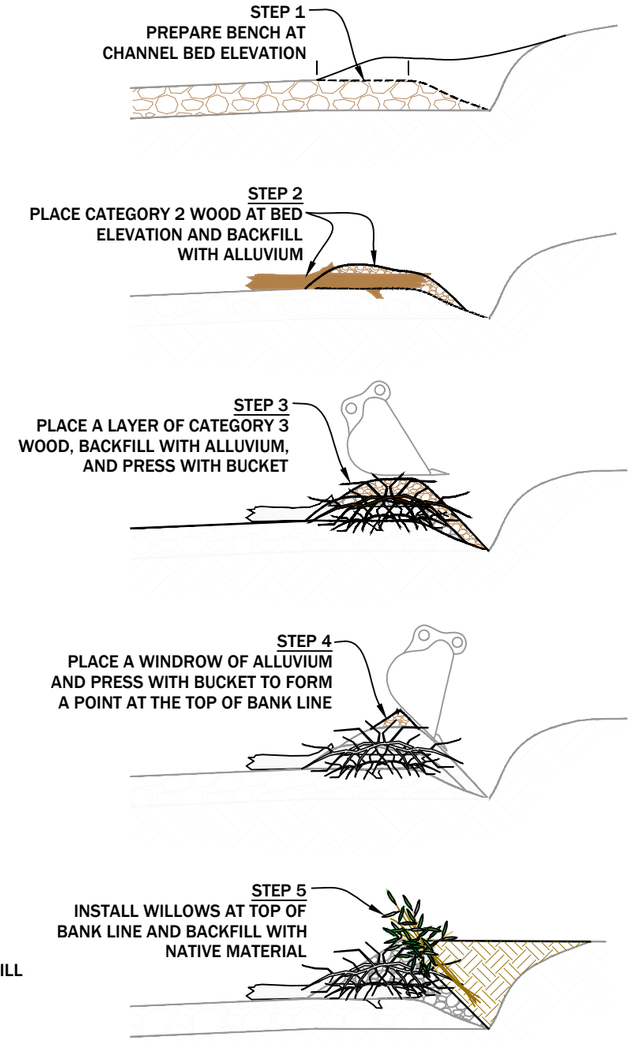


1 VEGETATED WOOD MATRIX - TYPE 2
PLAN VIEW
1" = 3'



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



3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE
SECTION VIEW
1" = 5'

GENERAL NOTES

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

INSTALLATION NOTES

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

TYPE 2 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA. (IN)	QTY.
1	CATEGORY 3 WOOD	2"-4"	0.2500
2	CATEGORY 4 WOOD	< 2"	2
3	WILLOW CUTTINGS	0.25"-1.0"	3
4	STREAMBANK ALLUVIUM	6" MINUS	0.1 CY

STREAMBANK FILL GRADATION

SIZE (IN)	PERCENT PASSING
10	100
6	90-100
4	50-80
3	30-50
1	10-30
0.08	10

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

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