FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

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

I. APPLICANT INFORMATION

A. Applicant Name: Pat Barnes Trout Unlimited Chapter and Helena Ranger District, Helena-Lewis and Clark National Forest

Mailing Address: PO Box 275

City: Helena State: MT Zip: 59624

Telephone: 406-461-8585 E-mail: shalonhastings@hotmail.com

B. Contact Person (if different than applicant): Allison Russell, Fisheries Biologist (USFS-HLC)

Address: 2880 Skyway Drive

City: Helena State: MT Zip: 59602

Telephone: 406-495-3923 E-mail: allison.russell@usda.gov

C. Landowner and/or Lessee Name (if different than applicant): USFS-Helena Ranger District

Mailing Address: 2880 Skyway Drive

City: Helena State: MT Zip: 59602

Telephone: 406-495-3924 E-mail: katherine.bushnell@usda.gov

II. PROJECT INFORMATION

A. Project Name: Beaver Creek Restoration Project-Phase II

River, stream, or lake: Beaver Creek

Location: Township: 12N Range: 2W Section: 16,17,20

Latitude: -111.8878 Longitude: 46.7888 *within project (decimal degrees)*

County: Lewis and Clark

B. Purpose of Project:

The Beaver Creek watershed is located in the upper Missouri River drainage approximately 14 miles northeast of Helena, MT. It is a large watershed, originating on National Forest lands and flows 18 miles to the confluence of the Missouri River just below Hauser Dam. Beaver Creek is an important spawning tributary for this reach of the Missouri River. Spawning runs of fluvial/adfluvial rainbow and brown trout, which are the focal species of this restoration project, utilize a large reach of Beaver Creek when flows are sufficient to allow access to the stream. Lower Beaver Creek restoration efforts has been the focus for many agencies for some time because it lacks floodplain connectivity, habitat complexity and a functioning riparian area due to decades of historic land use practices.

Last fall, the Helena-Lewis and Clark National Forest- Helena Ranger District and Pat Barnes Chapter Trout Unlimited in partnership with NorthWest Energy, and Montana Fish Wildlife and Parks successfully restored Phase I on lower Beaver Creek (0.5 miles). Beaver Creek Restoration Phase II will address the remaining portion of Beaver Creek within the proposed project area (0.7 miles). Similar to the first phase, Phase II restoration goals will improve connectivity to the Missouri River and provide for more consistent access for spawning runs that are comprised of a high percentage of trophy size trout. Rearing habitat would also be created, with the goal of increasing natural recruitment and supplementing the reduced hatchery plants in the Missouri River Reservoir system. Restoration goals were developed to restore hydrologic processes, reconstruct the stream channel and floodplain to more natural conditions that emulate historic stream sinuosity and morphology, improve water quality, and increase habitat complexity to provide spawning and rearing habitat, restore riparian areas and create additional wetland habitat.

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

The design of the new channel and floodplain was developed to provide a landscape capable of sustaining stream processes to support desired aquatic habitat and riparian conditions. The primary limiting factor driving geomorphic, vegetation, and aquatic habitat impairments in the project area is lack of floodplain connection due to the channel entrenchment or incision. The proposed design would reduce channel entrenchment, establish pools, modify channel hydraulics to produce flows that would support a mobile gravel bed i.e. functional and naturally maintained spawning areas. The shape of the new channel and adjacent floodplain work was determined through hydrologic analysis, terrain model development, earthwork analysis and hydraulic modeling. To achieve the desired condition of floodplain connectivity and habitat complexity, a combination of restoration strategies would be applied:

- Establish former floodplain surfaces
- Reconnect abandoned oxbows into the active channels to increase stream length and reduce channel slope
- Construct a new channel riffle-pool C4 stream type, within a terraced valley and broadly connected floodplain. Approximately 2,590 linear feet of constructed channel streambed
- Convert the existing channel to off-channel wetlands and connected alcoves (1.7 acres)
- Install streambank structures to allow bank vegetation to become established while also improving habitat complexity. Approximately 31 large wood structures would be constructed and 5,692 linear feet of vegetated/wood matrix streambank treatment.
- Riparian and upland planting with native seed mix (Sheets 9.0-9.2).
- Reconstruct floodplain surface with 6 acres of microtopography grading and placement of large wood material
- Install 4-6 wildlife snag pods

The final design plan set includes plan view and structure layout, grading plan and profiles, a vegetation salvage plan and revegetation specs, material list, design channel cross sections by station. Plans also include details for the large wood structures, vegetated woody matrix for streambank construction, the constructed streambed and log step pools.

The project would use Forest Service Road #138 and a temporary access road south of the project area. This temporary haul route on an existing road prism would be decommissioned once the project was complete. Phase II construction would begin summer/fall of 2022.

D. Length of stream or size of lake that will be treated (project extent): 0.7 miles and 6 floodplain acres

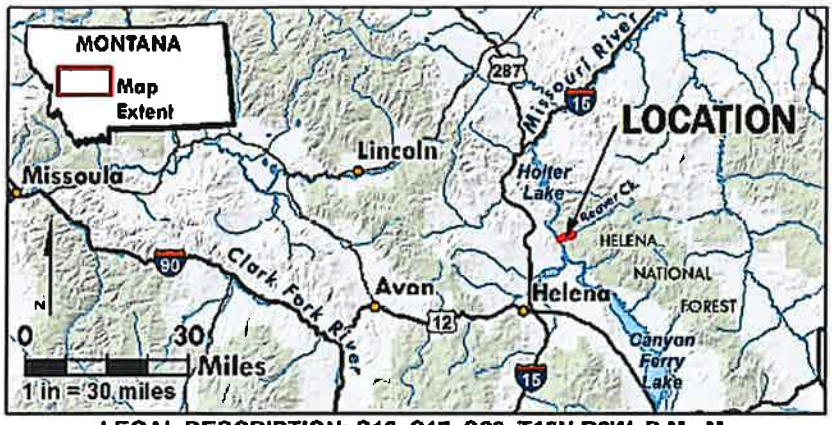
Length/size of impact, if larger than project extent (e.g. stream miles opened): 1.2 miles (Total project area)

E. Project Budget:

Grant Request (Dollars):	**$**	**50,000**
Matching Dollars:	**$**	**429,520.76**
Matching In-Kind Services:*	**$**	**6,417.60**
**salaries of government employees are not considered matching contributions*		
Other Contributions (not part of this app)	**$**	**12,272.40**
Total Project Cost:	**$**	**498,210.76**

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

G. **Insert** or **attach** a project location map showing the project area in relation to a major landmark or town. Please indicate if the project location is on public or private property.



LEGAL DESCRIPTION: S16, S17, S20, T12N R2W, P.M., M
LEWIS AND CLARK COUNTY, MONTANA

The project is located on public lands, Helena-Lewis and Clark National Forest.

H. **Attach** specific project plans (e.g. detailed sketches, plan views [showing location and type of channel modifications], example photographs), current condition photographs, and maps. **If project involves water leasing or water salvage complete and attach a supplemental questionnaire (fwp.mt.gov/habitat/futurefisheries/supplement2.doc).*

I. **Attach** letters or statements of support. This includes landowner consent, community or public support, and fish biologist support.

J The project agreement includes a 20-year maintenance commitment. Please indicate (yes or no) that you will ensure project protection for 20 years. Discuss your ability to meet this commitment.

Yes [x] No [ ]

The Helena – Lewis and Clark National Forest manages the lands where the proposed project would occur and will be responsible for inspection of the stream and habitat improvement work over time. This project is also designed to move aquatic and riparian resources towards the Desired Conditions identified in the Draft Revised Helena-Lewis and Clark National Forest Plan. The aquatics and hydrology staff will ensure the improvements are providing for appropriate stream form and function for as long as the Forest has management jurisdiction. If maintenance issues develop, we will work with our partners to address those concerns. If the project is approved, we will provide the Future Fisheries Program adequate documentation to address the maintenance commitment.

K. **Describe** or **attach** land management & maintenance plans, including changing to grazing regimes, that will ensure protection of the restored area.

The project area lies within a W-1 Management Area under the existing Helena Forest Plan (1986). This management area contains a variety of wildlife habitat ranging from important big game summer and winter range. It includes a variety of habitat for game including riparian, calving or fawning areas, and hiding cover. Wildlife habitat improvement and maintenance practices, including road management, prescribed fire and other techniques will be used to maintain and/or enhance the quality of big game habitat and non-game habitat.

The new revised draft Helena-Lewis and Clark Forest Plan (2021) prioritizes protection of unique plant communities and desired non-forested vegetation within the project area including habitat connectivity for a wide range of species. In addition, the project area lies between the Big Log and Devils Tower inventoried roadless area. The Big Log Gulch recommended wilderness area is proposed north of the project area. Under the new Forest Plan, the Missouri River-Hauser tailwaters and lower Beaver Creek are eligible Scenic Rivers given their recreation importance. Beaver Creek watershed is also a designated Conservation Watershed Network given the large recreational fishing component.

This area is not suitable for timber production and is located in a vacant range allotment.

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

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

Historically, Beaver Creek served as a primary spawning tributary for the large migratory rainbow and brown trout from the Missouri River below Hauser Dam and Holter Reservoir and are the focal species for this restoration project.

USFS has been conducting annual spawning ground surveys for rainbow trout since 1983, please refer to attachment with redd count data. Redd counts in lower Beaver (mouth of Beaver Creek to Nelson), capture patterns of spatial and temporal distribution of spawning rainbow trout and provide an indicator of the magnitude of wild fish recruitment to sections of the Missouri River and Holter Reservoir. Spawning returns in years 2014-2018 repeat a pattern observed since early 2000 when the number and extent of adfluvial rainbow trout redds experienced severe declines. Factors contributing to the declines in rainbow trout returns include prolonged drought, increased fishing pressure, habitat degradation, whirling disease and predation.

There is not consistency or the longevity in brown trout spawning redd count data but, brown trout would benefit from this project. Fall surveys noted intermittent flow conditions in the lower one-quarter mile of Beaver Creek, restricted spawning migration by most brown trout. The project area was identified as a priority for restoration because it is one of the more degraded sections of Beaver Creek due to past agricultural practices but provides the most potential for future spawning and rearing habitat by reconnecting the large valley floodplain, improving flow patterns and returning it to a dynamic system.

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

The presence of well-defined terraces within the project area and LiDAR imagery indicate that Beaver Creek once occupied surfaces that were abandoned when the channel was straightened and subsequently down-cut. These former surfaces above the existing channel base elevation, would be reconnected by constructing a new, lower gradient stream type representing the historic stream morphology of Beaver Creek.

The construction of a design channel with increased sinuosity and stream length, reduction in stream slope, and pool-riffle sequences within a C4 stream type with the addition of complex large wood structures would provide quality habitat for fish, provide additional habitat through additional stream length, and allow for more hydrologic function that would maintain these features in the future. Improved hydrologic function and streambank treatments composed of wood, alluvium native rock and vegetation, would increase bank resistance and provide for streambed and bank stability improving water quality and reducing substrate embeddedness.

The existing channel would be converted to off-channel emergent wetlands and alcove habitat (2.0 acres). Fish, especially juvenile salmonids, enter these shallow, well vegetated, low-velocity alcove areas during high flows, where they can seek refuge from fast, turbid waters. Other complex features associated with the main channel not only moderate high flows but can also offer alternate food sources.

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

Beaver Creek and the Missouri River (Hauser tailrace) provide the majority of spawning habitat for the large adfluvial rainbow and brown trout that migrate from Holter reservoir. The rainbow trout fishery in the Holter Lake system is hatchery supplemented with a high of around 461,351 fish stocked in 2001 and due to recent budget constraints, a low of 128,588 fish that were stocked in 2018. Stocking regiments have averaged 246,117 fish per year (2003-2020). Since 2011, MTFWP has observed a marked decline in wild fish production when examining Hauser trailrace estimates for rainbow trout (percent hatchery origin/detection). For example, the 2017 survey detected 79% hatchery origin compared to the 2003 estimate of only18.0% hatchery detection rate. This decline in wild fish production is likely fueled by ongoing habitat degradation (lack of spawning and rearing habitat), a decreased rate in spawning returns, angling pressure, and an increased rate in predation.

Restoring Beaver Creek's natural stream morphology and hydrologic processes will "reset" the system to provide a dynamic and complex aquatic environment that meets the habitat requirements for all life stages and production of wild trout and other native aquatic species. This is expected to improve wild fish populations as well as fishing opportunity.

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

As mentioned above, restoration efforts would focus on restoring hydrologic processes and improving aquatic habitat complexity. Treatments would include constructing a channel that reconnects historic channel oxbows to increase stream length and constructing a riffle-pool C4 stream type to increase spawning habitat and wild trout production. Streambank treatments, placement of large wood structures, increased pool frequency and development of connected alcoves would improve rearing habitat for both the focal species.

Recent creel surveys for the Hauser tailrace (dam to the confluence of Beaver Creek) reported an average of 5,521 fishing hours for rainbow trout and 126 fishing hours for brown trout per year (2016-2018). This project may be even more valuable if MT FWP were to expect a continued decline in stocking rates for rainbow trout with increased angling pressure. Within the project area itself, improved habitat will provide an increase in fishing opportunities over the existing degraded habitat conditions.

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

Beaver Creek is a highly impaired system from past agricultural, grazing practices, and rip-rap stabilization that resulted in stream channelization, removal of riparian vegetation and likely the displacement of beaver, refer to attached pictures. These impacts have led to degradation of channel form, bank stability and eventual channel incision and reduced floodplain connectivity. Due to channel incision and lack of floodplain connectivity, there is a lack of aquatic habitat diversity. Stream reaches in the project area are primarily dominated by long homogenous riffles with highly embedded substrate and infrequent pools with limited depth. Floodplain surfaces within the project area are limited to narrow riparian areas directly adjacent to the channel. In 1974, the USFS purchased the 3,355 acre parcel from private ownership in lower Beaver Creek and it has not been grazed/farmed since, and the project area is not in a designated allotment. Currently, recreational impacts are limited to three dispersed campsites in the project area, however, FS road 138 and the trailhead at the confluence of Beaver Creek and the Missouri are well utilized by hikers and anglers alike. Beaver Creek is currently listed for sediment impairments and alteration of stream-side vegetative cover; there is not an approved TMDL associated with this waterbody.

This project seeks to restore a total of 1.2 miles of lower Beaver Creek, to improve water quality, restore hydrologic processes, reconstruct the stream channel and floodplain to more natural conditions, and increase aquatic habitat complexity to provide spawning and rearing habitat for rainbow and brown trout. Beaver are active throughout the watershed and would have historically been one of the greatest influences on aquatic habitat and riparian communities within the project area. Proposed restoration activities will likely be influenced by ongoing beaver activity and restoring vegetation communities will likely further the influence and presence of beaver within the project area.

Phase II would increase length and sinuosity for additional spawning and rearing habitat, restore 2.0 acres of additional wetland and alcove habitat, and 6 acres of additional floodplain area. This project would also address non-managed recreational use that has resulted in removal of riparian vegetation, bank erosion, and direct manipulation of the stream channel.

F. What public benefits will be realized from this project?

Beaver Creek is a primary spawning tributary to the Missouri River within the Holter Lake system and supports a very popular recreational fishery for both rainbow and brown trout. Holter Lake ranked 6th in the state for fishing pressure observed approximately 96,103 angler days from March 2017-February 2018. The Missouri River just above and below Beaver Creek observed over 31,033 angler days during this time frame (MT FWP) and is ranked 22nd statewide and 5th regionally. Holter Reservoir and the Hauser tailwaters generate approximately $18.9 million dollars in state revenue (Strainer, MT FWP), benefitting local economies within the area, see attached. This expenditure report includes, non-resident transportation, food, beverages and lodging, equipment purchases and guide fees. This report does not include license fees and any durable goods.

The Beaver Creek Restoration project will not only improve a popular recreational trout fishery but restoration efforts will restore floodplain and hydrologic processes, returning the stream to more natural conditions, benefitting riparian habitat, wildlife and native and non-native fish species alike.

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

No water or property rights of other landowners would be affected by this project. The proposed work is on and surrounded by Forest Service lands, please refer to attached map.

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

No, this project supports public access and recreational fishing on Beaver Creek.

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

No, this project is not associated with mine reclamation or past mining activity.

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

IV. AUTHORIZING STATEMENT

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

Applicant Signature: J Hastings Date: 5/19/21

Sponsor (if applicable): _____

Submittal: **Applications must be *signed and received before* December 1 and June 1 of each year 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

Applications may be rejected if this form is modified.

Revised July 2020

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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: Kelly Boshell Date: 5-19-21

Sponsor (if applicable): _____

Submittal: **Applications must be *signed and received before* December 1 and June 1 of each year 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

Applications may be rejected if this form is modified.

Revised July 2020

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***								
GPS Site Calibration , Construction Management	1	lump sum	$62,367.96	$ 62,367.96		62,367.96		$ 62,367.96
Engineering Re-Design	1	lump sum	$7,600.00	$ 7,600.00		7,600.00		$ 7,600.00
Range Technician	8	cost/day	$142.80	$ 1,142.40			1,142.40	$ 1,142.40
				$ -				$ -
				$ -				$ -
				$ -				$ -
			Sub-Total	$ 71,110.36	$ -	$ 69,967.96	$ 1,142.40	$ 71,110.36
Travel								
Vehicle	8	0.29/mi	$17.90	$ 143.20			143.20	$ 143.20
Per diem	1	Lump sum	$9,000.00	$ 9,000.00		9,000.00		$ 9,000.00
			Sub-Total	$ 9,143.20	$ -	$ 9,000.00	$ 143.20	$ 9,143.20
Construction Materials****								
Furnish Willow Clippings	34,300	each	$0.88	$ 30,184.00		30,184.00		$ 30,184.00
Riparian and Upland Broadcast seeding	1	LS	$5,000.00	$ 5,000.00		5,000.00		$ 5,000.00
Furnish Wood	1	LS	$40,000.00	$ 40,000.00		40,000.00		$ 40,000.00
Furnish Streambed and streambank fill	1,700	CY	$22.00	$ 37,400.00		37,400.00		$ 37,400.00
Riparian Plants	7	acres	$1,431.00	$ 10,017.00			10,017.00	$ 10,017.00
				$ -				
				$ -				
				$ -				
				$ -				
				$ -				
				$ -				
				$ -				
				$ -				

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

				$ -					$ -
				$ -					$ -
				$ -					$ -
				$ -					$ -
				$ -					$ -
			Sub-Total	$ 122,601.00	$ -	$ 112,584.00	$ 10,017.00	$	122,601.00
Equipment, Labor, and Mobilization									
Mobilization	1	Lump sum	$20,000.00	$ 20,000.00		20,000.00		$	20,000.00
GPS Equipment	1	Lump sum	$11,000.00	$ 11,000.00		11,000.00		$	11,000.00
UTV	4	days	$125.00	$ 500.00			500.00	$	500.00
milestone	20	acres	$5.34	$ 106.80			106.80	$	106.80
Dicamba/2,4d	20	acres	$17.43	$ 348.60			348.60	$	348.60
Non-ionic surfactant	20	acres	$0.72	$ 14.40			14.40	$	14.40
Clear and Grub Site	1	Lump Sum	$5,000.00	$ 5,000.00		5,000.00		$	5,000.00
Salvage, Preserve and transplant existing vegetation	1	Lump sum	$11,000.00	$ 11,000.00		11,000.00		$	11,000.00
Construct/decommission diversion	4	Lump sum	$1,000.00	$ 4,000.00		4,000.00		$	4,000.00
Install Floodplain roughness and wetlands	5.9	Acres	$1,650.00	$ 9,735.00		9,735.00		$	9,735.00
Excavate, haul, place floodplain backfill	9,765	CY	$3.50	$ 34,177.50		34,177.50		$	34,177.50
Excavate, haul, place fill in repository	3,550	CY	$3.50	$ 12,425.00		12,425.00		$	12,425.00
Construct channel streambed	2,590	LF	$20.00	$ 51,800.00	50,000.00	1,800.00		$	51,800.00
Construct Improve roads/staging areas	1	Lump sum	$5,500.00	$ 5,500.00		5,500.00		$	5,500.00
Construct Log step pool	9	each	$1,200.00	$ 10,800.00		10,800.00		$	10,800.00

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Construct Vegetated Wood Matrix Type 1	837	LF	$13.20	$ 11,048.40		11,048.40		$ 11,048.40
Construct Vegetated Wood Matrix Type 2	3,210	LF	$19.80	$ 63,558.00		63,558.00		$ 63,558.00
Construct Vegetated Wood Matrix Type 3	1,645	LF	$4.50	$ 7,402.50		7,402.50		$ 7,402.50
Install Wildlife Snag Pods	4	each	$1,485.00	$ 5,940.00		5,940.00		$ 5,940.00
Construct Large Wood Structures	31	each	$1,000.00	$ 31,000.00		31,000.00		$ 31,000.00
				$ -				$ -
			Sub-Total	$ 295,356.20	$ 50,000.00	$ 244,386.40	$ 969.80	$ 295,356.20
			TOTALS	$ 498,210.76	$ 50,000.00	$ 435,938.36	$ 12,272.40	$ 498,210.76

OTHER REQUIREMENTS:

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

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

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

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

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

Additional details: DNRC -RRGL funding as other contributions only accounts for 1 year of revegetation efforts.

APPLICATION MATCHING CONTRIBUTIONS

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

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
NorthWestern Energy	$ -	$ 350,000.00	$ 350,000.00	Y
Pat Barnes Trout Unlimited	$ 6,417.60	$ -	$ 6,417.60	Y
Forest Service		$ 15,754.36	$ 15,754.36	Y
Lewis and Clark CD-DNRC RRGL Program		$ 63,766.40	$ 63,766.40	N
	$ -	$ -	$ -	
	$ -	$ -	$ -	

	$ -	$ -	$ -	
	$ -	$ -	$ -	
TOTALS	$ 6,417.60	$ 429,520.76	$ 435,938.36	

OTHER CONTRIBUTIONS

(contributions not associated with the application)

CONTRIBUTOR	IN-KIND	CASH	TOTAL	Secured? (Y/N)
USFS	$ -	$ 2,255.40	$ 2,255.40	Y
Lewis and Clark CD-DNRC RRGL Program	$ -	$ 10,017.00	$ 10,017.00	N
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
	$ -	$ -	$ -	
TOTALS	$ -	$ 12,272.40	$ 12,272.40	

FWP.MT.GOV

THE **OUTSIDE** IS IN US ALL.

May 12, 2021

Michelle McGree
Future Fisheries Improvement Program
Fish Management Bureau
Montana Fish, Wildlife & Parks
PO Box 200701
Helena, MT 59620-0701

Dear Ms. McGree,

I am writing to support Phase II of the Beaver Creek Restoration Project Area application to fund riparian corridor restoration efforts on Beaver Creek near Helena, MT.

In the past Montana Fish, Wildlife & Parks (FWP) has worked with the USFS, Northwestern Energy, and the local Conservation District to identify significant resource issues associated with stream and riparian degradation on Beaver Creek upstream from its confluence with the Missouri River. Rehabilitation of the riparian corridor throughout the proposed project area provides another opportunity to enhance public recreational resources for the community.

This reach of Beaver Creek contains sustainable populations of resident Eastern brook trout and both resident and migratory (adfluvial Missouri River fish) rainbow and brown trout. However, the fishery remains substantially impacted by habitat degradation and a lack seasonal connectivity to the Missouri River. The proposed contemporary restoration efforts on this project are expected to positively benefit the fishery through moderated stream temperatures, reduced rate of bank erosion, improved floodplain connectivity and aquatic habitat, fish passage, and improvements to overall water quality. The proximity of the stream reach to Helena also provides additional fishing opportunity to the community.

Ultimately, Phase II of the Beaver Creek Restoration Project will benefit the fishery, riparian corridor and community in perpetuity and the proposed restoration effort aligns with FWP's mission and core values. FWP looks forward to continuing our relationship with the Lewis & Clark Conservation District and other cooperators on this and future projects.

Thank you for considering our comments.

Sincerely,

Adam Strainer
Helena Area Fish Biologist
Montana Fish, Wildlife and Park
PO Box 200701 or 930 Custer Ave W
Helena, MT 59620

5

May 18, 2021

Michelle McGree
Future Fisheries Improvement Program
Fish Management Bureau
Montana Fish, Wildlife & Parks PO Box 200701
Helena, MT 59620-0701

Dear Ms. McGree;

I am writing today, on behalf of the Lewis and Clark Conservation District, in support of Phase 2 of the Beaver Creek Restoration Project Area Application to fund riparian corridor restoration efforts on Beaver Creek near Helena Montana.

The Conservation District has been working with the USFS to obtain funding through the DNRC RRGL grant program at this last legislative session for part of this project, and we should be hearing soon from DNRC about that award. The Conservation District is very supportive of these efforts, and we have spent many hours in the drainage doing stream permit inspections with Yellowstone Pipeline, among others.

The planned work is expected to benefit the fishery and the riparian corridor health in the drainage with added habitat for the fish, as well as other wildlife, and will promote stream stability, improve the floodplain connectivity and overall water quality. We look forward to the further collaboration with the Montana Department of Fish, Wildlife and Parks, and the USFS in this area.

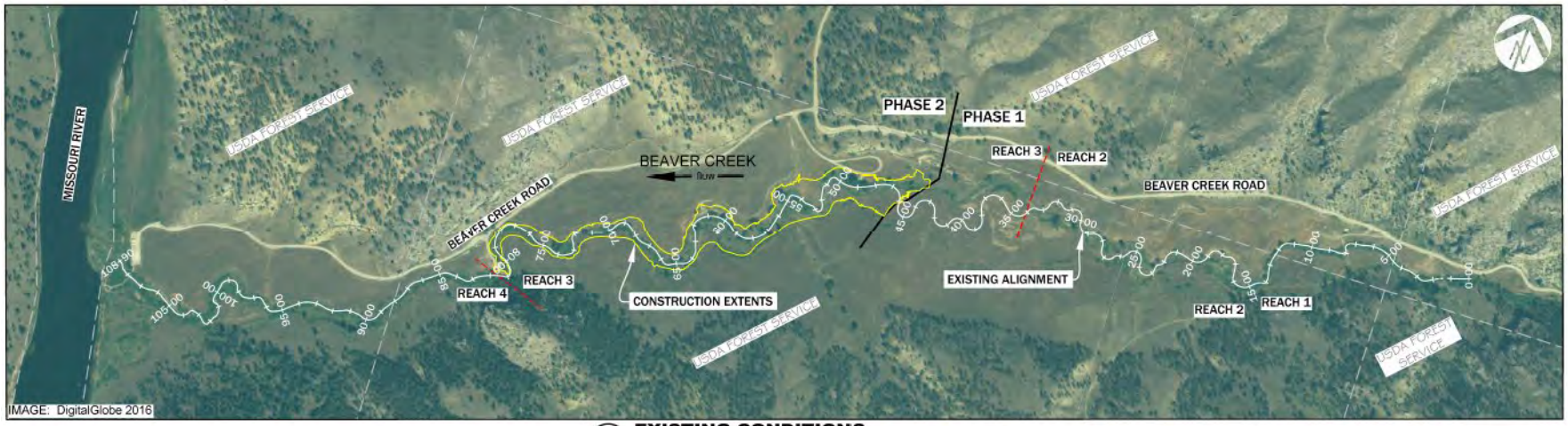
If you have further questions, please contact me at 406-449-5000 ext. 3884 or via email at chris@lewisandclarkcd.org.

Sincerely,

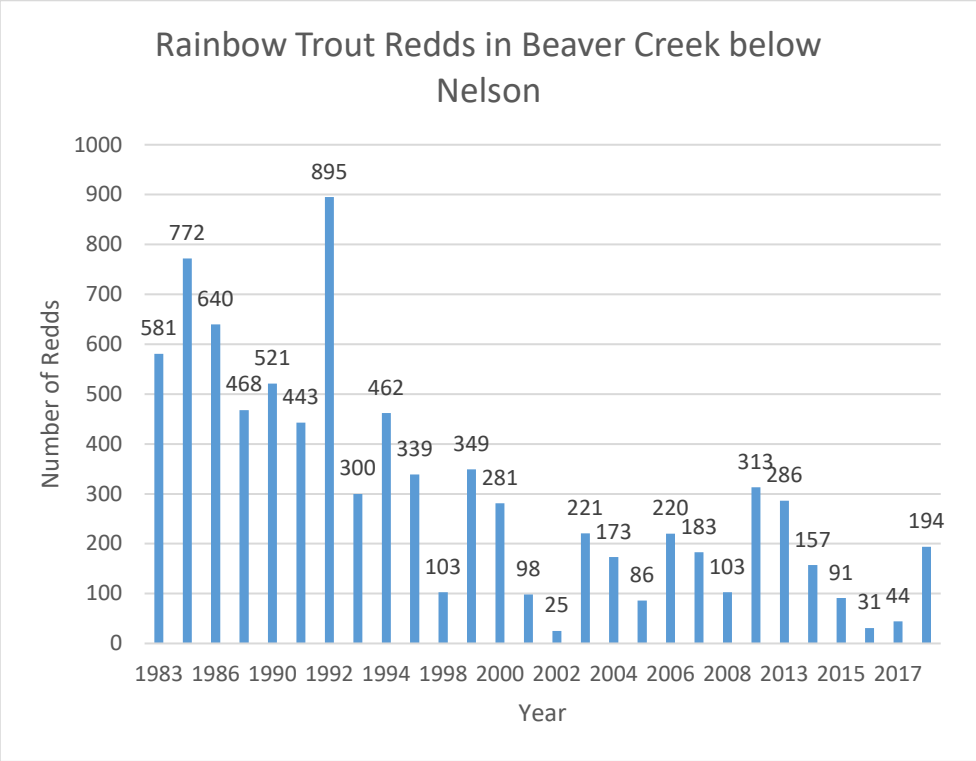
LEWIS AND CLARK CONSERVATION DISTRICT

Chris Evans
District Administrator

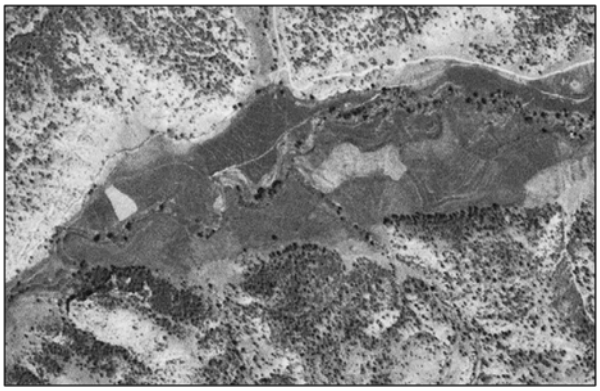
Beaver Creek Phase 2 Restoration Project-FFIP Supplemental
5/20/2021



1 EXISTING CONDITIONS
1" = 600'


Rainbow Trout Redds in Beaver Creek below Nelson
Number of Redds
Year
1000
900
800
700
600
500
400
300
200
100
0
581
772
640
468
521
443
895
300
462
339
103
349
281
98
25
221
173
86
220
183
103
313
286
157
91
31
44
194
1983 1986 1990 1992 1994 1998 2000 2002 2004 2006 2008 2013 2015 2017

Beaver Creek currently lacks floodplain connectivity, habitat complexity and a functioning riparian area due to decades of historic land use: agricultural impacts/overgrazing, rip-rap stabilization and channelization.



Pictured above, a 1948 aerial photo of lower Beaver Creek, same location May 2021. The Cochran Ranch was purchased by the USFS in 1974.

Hardened streambanks with rip-rap to preserve hay fields and “stabilize the channel”. Placed rip-rap, grazing and agricultural practices have artificially straightened the channel causing further incision and lowering the water table.

Bottom of the project area looking upstream.

Dispersed camping along lower Beaver Creek (bottom of the project area) has also caused channel modifications and bank instability. Beaver Creek is 303d listed for sediment impacts.

Holter Reservoir (HO)								
	Resident	Non-Resident	Total	Resident	Non-res	State	Regional	Total
Year	Value ($)	Value ($)	Angler Days	Angler Days	Angler Days	Rank	Rank	Economic Value
2013	$87.35	$379.33	60,939	53,252	7,687	7	3	**$7,567,471.91**
2015	$87.45	$379.33	90,470	85,838	4,632	6	3	**$9,263,589.66**
2017	$90.32	$392.23	96,103	85,512	9,591	6	3	**$11,485,321.77**

Missouri River - Hauser tailwater (HA TW) sec 10A								
	Resident	Non-Resident	Total	Resident	Non-res	State	Regional	Total
Year	Value ($)	Value ($)	Angler Days	Angler Days	Angler Days	Rank	Rank	Economic Value
2013	$83.40	$646.23	39,987	30,001	9,986	19	5	**$8,955,336.18**
2015	$84.12	$651.80	40,129	29,405	10,725	19	5	**$9,464,103.60**
2017	$86.24	$668.20	31,033	22,834	8,199	22	5	**$7,447,775.96**

Beaver Creek is the primary spawning tributary for migratory rainbow trout and supports a large recreational fishery on Holter Reservoir and Hauser tailwater sec 10A that benefits the local Helena area and economy (Strainer, FWP).

BEAVER CREEK RESTORATION PROJECT
PHASE 2 - FINAL DESIGN PLAN SET

PROJECT PARTNERS

Montana Fish, Wildlife & Parks
MONTANA FISH WILDLIFE AND PARKS
1420 E 6TH AVENUE
HELENA, MONTANA 59620

HELENA- LEWIS AND CLARK NATIONAL FOREST
2880 SKYWAY DRIVE
HELENA, MONTANA 59602

NORTHWESTERN ENERGY
6700 RAINBOW DAM ROAD
GREAT FALLS, MONTANA 59404

BEAVER CREEK VICINITY MAP

LEGAL DESCRIPTION: S16, S17, S20, T12N R2W, P.M., M
LEWIS AND CLARK COUNTY, MONTANA

DRAWING INDEX

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 INCLUDING THE 100-YEAR FLOW.

REUSE OF DRAWINGS

PROJECT DESCRIPTION

THE BEAVER CREEK WATERSHED IS LOCATED IN THE MISSOURI RIVER WATERSHED APPROXIMATELY 14 MILES NORTHEAST OF HELENA, MONTANA. WITH A CONTRIBUTING AREA OF 73.3 SQUARE MILES, THE WATERSHED ORIGINATES ALMOST ENTIRELY ON HELENA NATIONAL FOREST, U.S. FOREST SERVICE (USFS) LAND AND FLOWS 18.6 MILES TO THE CONFLUENCE OF THE MISSOURI RIVER UPSTREAM FROM HOLTER DAM. BEAVER CREEK IS AN IMPORTANT TRIBUTARY TO THE MISSOURI RIVER AND HISTORICALLY SUPPORTED HEALTHY RUNS OF ADFLUVIAL RAINBOW TROUT. IN 1974, THE U.S. FOREST SERVICE PURCHASED A 3,355-ACRE PARCEL OF LAND HELD IN PRIVATE OWNERSHIP. THE PURCHASE ENCOMPASSED LANDS ALONG FIVE MILES OF LOWER BEAVER CREEK, INCLUDING THE 1.8 MILES OF BEAVER CREEK UPSTREAM OF THE CONFLUENCE WITH THE MISSOURI RIVER (PROJECT AREA). PAST STUDIES HAVE IDENTIFIED LOWER BEAVER CREEK AS IMPAIRED DUE TO DECADES OF ARTIFICIAL MANIPULATION AND DISTURBANCE OF THE CHANNEL AND ITS FLOODPLAIN (PORTAGE ENVIRONMENTAL 2006). APPROXIMATELY 1.2 MILES OF BEAVER CREEK WERE ASSESSED AS NONFUNCTIONING AND 0.5 MILES AS FUNCTIONING-AT-RISK. THE STUDY RECOGNIZED THAT DECADES OF HISTORICAL LAND USE PRACTICES INCLUDING GRAZING, RIP-RAP BANK STABILIZATION, CHANNELIZATION, OVERGRAZING, AND REMOVAL OF RIPARIAN VEGETATION HAD SIGNIFICANTLY ALTERED THE MORPHOLOGY OF LOWER BEAVER CREEK, AND ACTIVE INTERVENTION WAS NEEDED TO RESTORE PROPER CHANNEL, FLOODPLAIN, AND AQUATIC HABITAT CONDITIONS.

NORTHWESTERN ENERGY (NWE) IN PARTNERSHIP WITH USFS, COMMISSIONED RIVER DESIGN GROUP TO DEVELOP A FINAL RESTORATION PLAN FOR LOWER BEAVER CREEK. THIS PLAN SET PRESENTS A PREFERRED RESTORATION SCENARIO WITHIN THE LOWER 0.7 MILES OF BEAVER CREEK. THIS DESIGN ADDRESSES THE GOALS ESTABLISHED FOR THE STREAM AND DRAINAGE FOR REACH 3 AS PHASE 2 OF RESTORATION. SPECIFICALLY ABOUT 3,700 LINEAR FEET OF BEAVER CREEK WILL BE RESTORED WITH A VARIETY OF TREATMENTS AND STRATEGIES TO BEST MEET THE PROJECT GOALS.

THE FOLLOWING RESTORATION GOALS WERE DEVELOPED BY THE PROJECT STAKEHOLDERS AND USED TO DEVELOP THE RANGE OF TECHNIQUES, AND STRATEGIES:

- RESTORE FLOODPLAIN AND HYDROLOGIC PROCESSES;
- RECONSTRUCT THE STREAM CHANNEL AND FLOODPLAIN TO MORE NATURAL CONDITIONS THAT EMULATE THE HISTORICAL STREAM SINUOSITY AND MORPHOLOGY, GIVEN THE EXISTING CONSTRAINTS;
- INCREASE CHANNEL COMPLEXITY TO PROVIDE SPAWNING AND REARING HABITAT FOR NATIVE AND NON-NATIVE FISH SPECIES; AND
- RESTORE RIPARIAN AREAS.

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. SURVEY DATA WAS COLLECTED UTILIZING SURVEY GRADE GPS IN MAY, 2017. THE COMPILED BATHYMETRIC SURFACE WAS MERGED INTO LIDAR DATA COLLECTED IN OCTOBER, 2016 TO COMPLETE THE EXISTING GROUND SURFACE. ALL SURVEY 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. AT LEAST ONE EXCAVATOR SHALL BE EQUIPPED WITH MACHINE GRADE GPS ((L1/L2/GLONASS)). CONSTRUCTION AREAS WILL BE STAKED OUT PRIOR TO CONSTRUCTION USING SURVEY GRADE GPS (L1/L2/GLONASS).
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.

RDG RIVER DESIGN GROUP
235 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

COVER PAGE AND NOTES
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

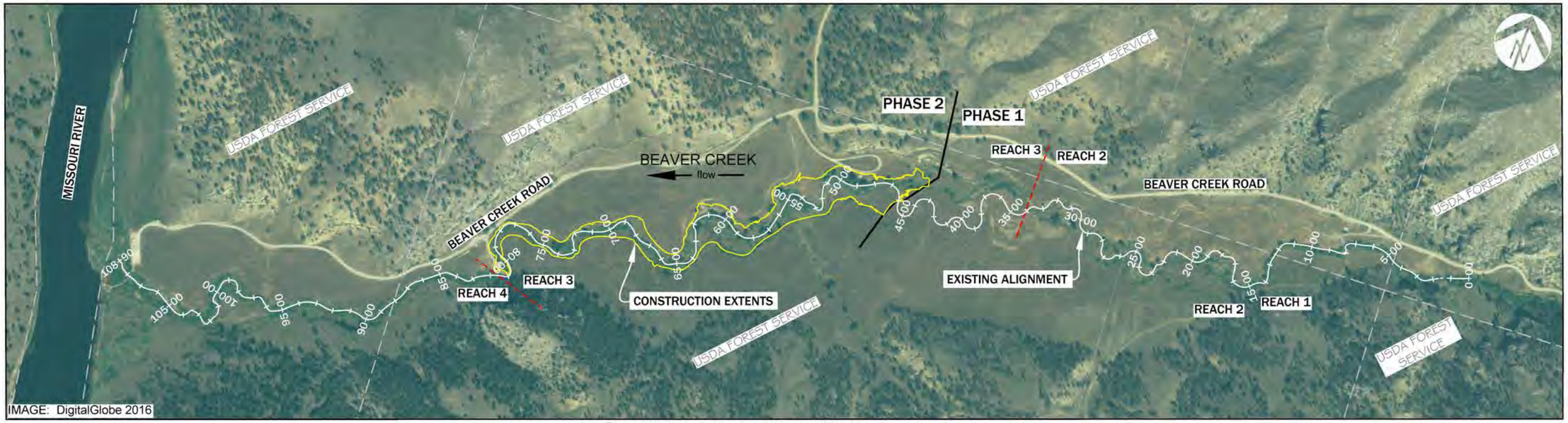
NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
1.0

Drawing 1 of 30

M:\Projects\2021\RDG-21-006 Beaver Creek Phase 2\CAD\21-01-22 Beaver Creek Phase 2 Working.dwg



1 **EXISTING CONDITIONS**

1" = 600'

EXISTING CONDITIONS

BEAVER CREEK IS A HIGHLY-IMPAIRED SYSTEM FROM ANTHROPOGENIC IMPACTS INCLUDING GRAZING, CHANNELIZATION, IRRIGATION AND REMOVAL OF RIPARIAN VEGETATION. THESE IMPACTS HAVE LED TO A DEGRADATION OF CHANNEL FORM AND GEOMETRY, INCLUDING REDUCED BANK STABILITY AND CHANNEL INCISION. FOUR STREAM REACHES WERE DELINEATED IN THE PROJECT AREA. THIS DESIGN PACKAGE FOCUSES ON REACH 3.

REACH 3 INCLUDES 0.7 MILES (3,700 FEET) OF BEAVER CREEK. ALLUVIAL TERRACES AND FLOODPLAINS ARE THE PREDOMINANT LANDFORMS IN REACH 3. BEAVER CREEK CLASSIFIES AS A MODERATELY TO SLIGHTLY ENTRENCHED, C4 STREAM TYPE WITH A MEANDERING CHANNEL AND RIFFLE-POOL BEDFORMS. FLOODPLAIN CONNECTIVITY IS THE HIGHEST OF THE FOUR REACHES ANALYZED, PARTICULARLY IN THE UPPER PORTION OF THE REACH. HIGH FLOODPLAIN CONNECTIVITY IS A FUNCTION OF LOW BANK HEIGHTS AND THE PRESENCE OF CHANNEL-SPANNING BEAVER COMPLEXES THAT INCREASE WATER SURFACE ELEVATIONS AND FORCE OVERBANK FLOODING EVEN DURING LOW TO MODERATE DISCHARGES. PAST LAND MANAGEMENT PRACTICES INCLUDED PLACEMENT OF RIPRAP ALONG MEANDER BENDS IN THE LOWER PORTION OF REACH 3 TO REDUCE BANK EROSION AND PROPERTY LOSS. RIPRAP PLACEMENT CONTRIBUTED TO CHANNEL INSTABILITY, AND COMBINED WITH CHANNEL STRAIGHTENING, RESULTED IN INCISION, LOSS OF FLOODPLAIN CONNECTION, AND SIMPLIFIED AQUATIC HABITAT. THE LOWER PORTION OF REACH 3 TRANSITIONS TO MODERATELY TO HIGHLY ENTRENCHED, B AND F STREAM TYPES AND FLOODPLAIN CONNECTION IS LIMITED. AQUATIC HABITAT IS DOMINATED BY RIFFLES WITH INFREQUENT SCOUR POOLS ASSOCIATED WITH BEDROCK.

REGIONAL CURVES AND HYDRAULIC COMPUTATIONS OF CHANNEL CROSS SECTIONS WERE USED TO DETERMINE BANKFULL DISCHARGE. BANKFULL DISCHARGE WAS ESTIMATED TO BE IN THE 55-65 CFS RANGE BASED PRIMARILY ON CHANNEL CROSS SECTION ANALYSIS.

BEAVER CREEK IS AN IMPORTANT TRIBUTARY TO THE MISSOURI RIVER, AND HISTORICALLY SUPPORTED HEALTHY RUNS OF ADFLUVIAL RAINBOW TROUT, THE FOCAL SPECIES OF THE BEAVER CREEK RESTORATION PROJECT. CURRENTLY, LACK OF STREAM-FLOODPLAIN CONNECTION AND INCISED CHANNEL MORPHOLOGY HAVE RESULTED IN DEGRADED FISH HABITAT, INTERMITTENT FLOW, AND LACK OF DIVERSE, MATURE RIPARIAN VEGETATION ON STREAMBANK AND FLOODPLAIN SURFACES. PAST SURVEYS HAVE NOTED INTERMITTENT FLOW CONDITIONS IN THE LOWER ONE-QUARTER MILE OF BEAVER CREEK BEFORE THE SPRING FRESHET, AND DURING LOW FLOW PERIODS DURING THE FALL. FLOW INTERMITTENCY AFFECTS BOTH ADFLUVIAL RAINBOW TROUT AND BROWN TROUT RETURNS (USFS, PERSONAL COMMUNICATION, AUGUST 2016). SPAWNING RETURNS IN YEARS 2014 THROUGH 2016 REPEAT A PATTERN OBSERVED SINCE 1998 WHEN THE NUMBERS AND EXTENT OF ADFLUVIAL RAINBOW TROUT REDDS IN THE INDEX REACH FROM THE MOUTH OF BEAVER CREEK TO NELSON EXPERIENCED DECLINES. FACTORS LIKELY CONTRIBUTING TO THE OBSERVED DECLINE IN RAINBOW TROUT RETURNS TO THE LOWER THREE MILES OF BEAVER CREEK ARE PROLONGED DROUGHT CONDITIONS, INCREASED FISHING PRESSURE, HABITAT DEGRADATION, AND WHIRLING DISEASE.

LIMITING FACTORS

AQUATIC LIMITING FACTORS INCLUDE LACK OF HIGH QUALITY POOLS DUE TO THE STRAIGHTENED, ENTRENCHED CHANNEL AND LACK OF HIGH QUALITY RIPARIAN HABITAT. ADDITIONALLY, LACK OF DIVERSITY DUE TO ALTERED STREAM MORPHOLOGY LIMITS COVER AND COMPLEXITY OF HABITAT. MUCH OF THE HABITAT CONSISTS OF RIFFLES AND RUNS WITHOUT COMPLEXITY PREFERRED BY THE FOCAL SPECIES. SUITABLE SPAWNING AND JUVENILE REARING HABITATS ARE LACKING DUE TO THE SIMPLIFIED HABITAT.

MORPHOLOGICAL LIMITING FACTORS INCLUDE CHANNEL ENTRENCHMENT, WHICH LIMITS FLOODPLAIN CONNECTION, FLOOD DISSIPATION, AND RIPARIAN VEGETATION. INCREASED ENERGY ALSO INCREASES BANK EROSION AND LIMITS SEDIMENT DEPOSITION AND SORTING. THE CHANNEL PATTERN IS STRAIGHTER THAN TYPICAL FOR THIS GEOMORPHIC SETTING AND BED MATERIAL IS COARSER AND MORE HOMOGENOUS. POOL DEVELOPMENT IS LIMTED DUE TO STRAIGHTENED CHANNEL AND LACK OF POOL FORMING STRUCTURE SUCH AS LARGE WOOD. WITH HIGHLY LIMITED FLOODPLAIN ACCESS, WATER STORAGE DURING HIGH FLOWS AND RELEASE DURING LOW FLOW PERIODS IS LIMITED. THE WATER TABLE IS LOWER THAN HISTORICAL CONDITIONS WITH THE ENTRENCHED CHANNEL.

VEGETATION CLEARING AND AGRICULTURAL LAND USES ADJACENT TO BEAVER CREEK DISPLACED NATIVE RIPARIAN AND UPLAND VEGETATION. SHADING OF THE STREAM, BIOMASS AND LACK OF BANK STABILITY ARE ALL LIMITING FACTORS BY THE EXISTING CONDITIONS.

BEAVER ARE ACTIVE THROUGHOUT LOWER BEAVER CREEK AND WOULD HAVE HISTORICALLY BEEN ONE OF THE GREATEST INFLUENCES ON CHANNEL FORM, AQUATIC HABITAT AND RIPARIAN VEGETATION COMMUNITY STRUCTURE AND DISTRIBUTION.

RDG RIVER DESIGN GROUP
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311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

EXISTING CONDITIONS
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
2.0

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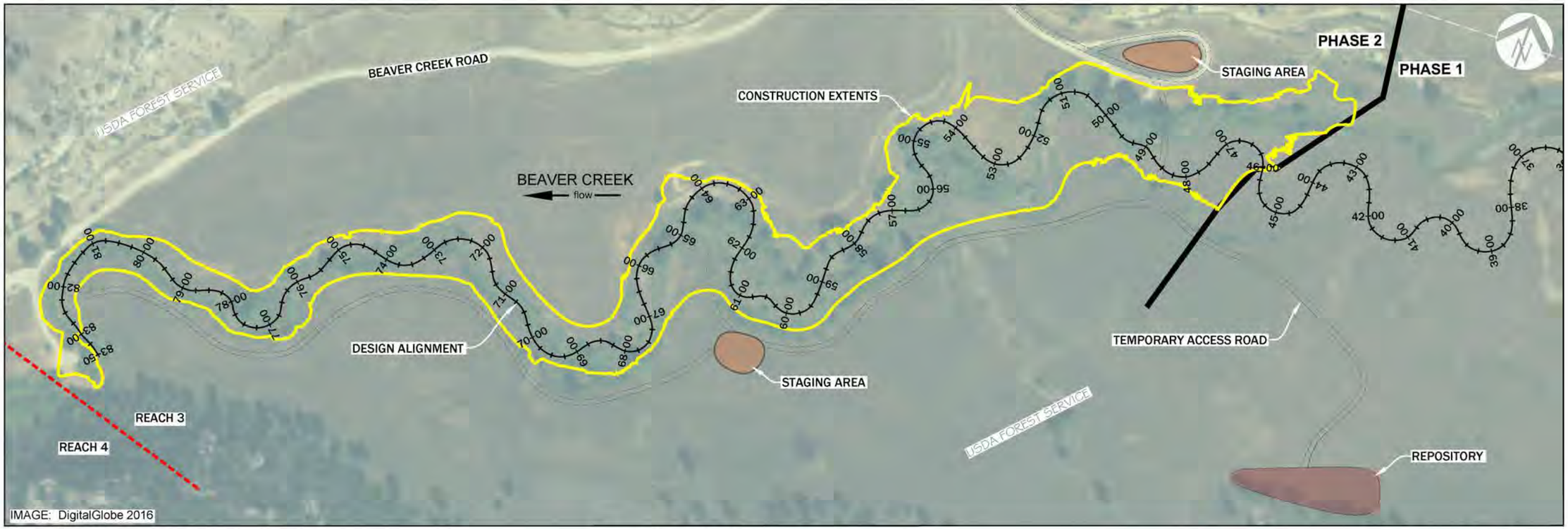

1 **SITE PLAN**

1" = 200'

RESTORATION ALTERNATIVES

RESTORATION ALTERNATIVES FOR THE BEAVER CREEK RESTORATION PROJECT AREA WERE DEVELOPED BY A MULTL-DISCIPLINARY TEAM CONSISTING OF RESOURCE PROFESSIONALS FROM NORTHWESTERN ENERGY, THE US FOREST SERVICE, MONTANA FISH WILDLIFE AND PARKS AND RIVER DESIGN GROUP, INC. ALTERNATIVES RANGED FROM:

1. RESTORING THE CHANNEL AND FLOODPLAIN AT HISTORICAL FLOODPLAIN ELEVATIONS;
2. RESTORING THE CHANNEL AT ITS PRESENT ELEVATION AND LOCATION WHILE EXPANDING THE FLOODPLAIN WHERE POSSIBLE.

A PREFERRED RESTORATION SCENARIO WAS DEVELOPED FOR THE PROJECT AREA BY ASSIGNING THE ALTERNATIVES TO EACH REACH BASED ON REACH-SPECIFIC LIMITING FACTORS, CONSTRAINTS, AND RESTORATION FEASIBILITY. THE SELECTED RESTORATION STRATEGY WAS A COMBINATION OF THE TWO ALTERNATIVE STRATEGIES, SPECIFICALLY:

1. ALTERNATIVE 2 FOR REACHES 1 AND 4 DUE TO THE LIMITED OPPORTUNITY TO RESTORE THE CHANNEL AND FLOODPLAIN AT ITS HISTORICAL ELEVATION AND THE EXISTING SPAWNING IN THE LOWER REACH 4;
2. ALTERNATIVE 1 FOR REACHES 2 AND 3 BECAUSE THERE WAS AMPLE OPPORTUNITY TO RAISE THE GRADE OF THE CHANNEL AND RE-ACTIVATE THE HISTORICAL FLOODPLAIN.

THIS RESTORATION DESIGN WILL BE DIVIDED INTO TWO PHASES. THE FIRST PHASE OF THIS DESIGN FOCUSED ON REACH 2 AND WAS COMPLETED IN 2020. THE SECOND PHASE IS OUTLINED IN THIS DESIGN AND WILL ADDRESS REACH 3. PHASE 3 WILL INCLUDE REACHES 1 AND 4 AND WILL BE ADDRESSED WITH FUTURE ACTIONS.

RESTORATION OBJECTIVES

THE BEAVER CREEK RESTORATION PLAN ADDRESSES LIMITING FACTORS IDENTIFIED BY PROJECT STAKEHOLDERS BASED ON PREVIOUS STUDIES AND FIELD INVESTIGATIONS. THE PRIMARY GOAL OF THE PROJECT IS TO RESTORE CHANNEL AND FLOODPLAIN CONDITIONS THAT SUPPORT HIGH QUALITY AQUATIC HABITAT CONDITIONS, PROMOTE THE ESTABLISHMENT OF EMERGENT AND SCRUB SHRUB WETLANDS FOR THE BENEFIT OF RIPARIAN DEPENDENT WILDLIFE SPECIES, AND HIGH WATER QUALITY.

SPECIFIC OBJECTIVES FOR PHASE 2 INCLUDE:

- RAISING THE ELEVATION OF BEAVER CREEK TO RECONNECT FORMER FLOODPLAIN SURFACES;
- RECONNECTING ABANDONED OXBOW CHANNELS, WHERE PRESENT, TO INCREASE STREAM LENGTH AND REDUCE CHANNEL SLOPE;
- CONSTRUCTING A NEW SLIGHTLY ENTRENCHED, RIFFLE-POOL, C4 STREAM TYPE WITHIN A TERRACED VALLEY, WITH A BROAD, CONNECTED BANKFULL FLOODPLAIN;
- TRANSITIONING TO REACHES 1 AND 4 WITH A MODERATELY ENTRENCHED B4 STREAM TYPE BY INCREASING FLOODPLAIN WIDTH AND INCORPORATING MORE SINUOSITY;
- CONVERTING THE EXISTING CHANNEL TO OFF-CHANNEL WETLANDS AND/OR SIDE CHANNEL HABITAT; AND
- IMPLEMENTING STREAMBANK, BANKFULL FLOODPLAIN, AND RIPARIAN UPLAND REVEGETATION PRESCRIPTIONS TO INCREASE THE COVER OF WOODY RIPARIAN SHRUBS AND TREES.

RESTORATION TREATMENTS

PHASE 1 OF RESTORATION WORK BEGAN IN 2020 AND ADDRESSED APPROXIMATELY 3,075 FEET OF CHANNEL (0.6 MILES). RESTORATION WORK IN PHASE 2 WILL ADDRESS APPROXIMATELY 3700 FEET OF CHANNEL AND WILL BE COMPLETED MOSTLY IN THE DRY DURING FALL OF 2021. THIS PROJECT WILL BE CLOSELY INTEGRATED WITH THE HELENA NATIONAL FOREST, NORTHWESTERN ENERGY, AND PERMITTING AGENCIES. FOR THOSE SHORT REACHES THAT MUST BE CONSTRUCTED IN THE WET, BMP'S WILL BE IMPLEMENTED TO ROUTE OR PUMP WATER AROUND THE CONSTRUCTION TO MINIMIZE TURBIDITY. THE EXISTING CHANNEL AND FLOODPLAIN MORPHOLOGY WILL BE MODIFIED TO INCLUDE RIFFLE AND POOL STREAM TYPES DEVELOPED WITHIN A BROAD, WELL VEGETATED RIPARIAN FLOODPLAIN CORRIDOR. IN LOCATIONS, THE CHANNEL BED WILL BE RAISED TO RECONNECT HISTORICAL VEGETATED TERRACE SURFACES. A VARIETY OF STREAMBED, STREAMBANK, FLOODPLAIN, AND REVEGETATION TREATMENTS WILL BE IMPLEMENTED TO SUPPORT THE RESTORATION OBJECTIVES AND DESIRED OUTCOMES. TREATMENTS WILL BE NATIVE MATERIALS BASED AND DESIGNED TO MIMIC NATURALLY OCCURRING COMPONENTS OF A HEALTHY, FUNCTIONING STREAM CHANNEL AND FLOODPLAIN ECOSYSTEM. STREAMBED TREATMENTS WILL CONSIST OF COMPLEX AQUATIC HABITAT COMPONENTS INCLUDING, RIFFLE, RUN, POOL AND GLIDE FEATURES. STREAMBANK TREATMENTS WILL BE COMPOSED OF WOOD, ALLUVIUM, NATIVE ROCK AND VEGETATION, AND WILL INCREASE BANK RESISTANCE TO EROSION. PROVIDING SHORT-TERM STREAMBED AND STREAMBANK STABILITY IS REQUIRED TO SUPPORT THE VEGETATION DESIGN WHICH EMPHASIZES CREATING A SELF-SUSTAINING MOSAIC OF RIPARIAN AND WETLAND COMMUNITIES ON A FLOODPLAIN SURFACE THAT IS HYDROLOGICALLY CONNECTED TO THE CHANNEL. FLOODPLAIN TREATMENTS INCLUDE A VARIETY OF VEGETATION COVER TYPES THAT INTEGRATE PLANT SPECIES COMPOSITION WITH GEOMORPHOLOGY AND HYDROLOGY, AND ACCOUNT FOR ECOLOGICAL PROCESSES THAT SUPPORT PLANT COMMUNITY DEVELOPMENT OVER TIME. FLOODPLAIN TREATMENTS WILL INCLUDE THE USE OF SWALES, SIDE CHANNELS, OFF-CHANNEL WETLANDS, MICROTOPOGRAPHY, COARSE WOOD, PLANTINGS, SEEDING, SALVAGING EXISTING VEGETATION AND TREATING INVASIVE PLANTS.

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SITE PLAN

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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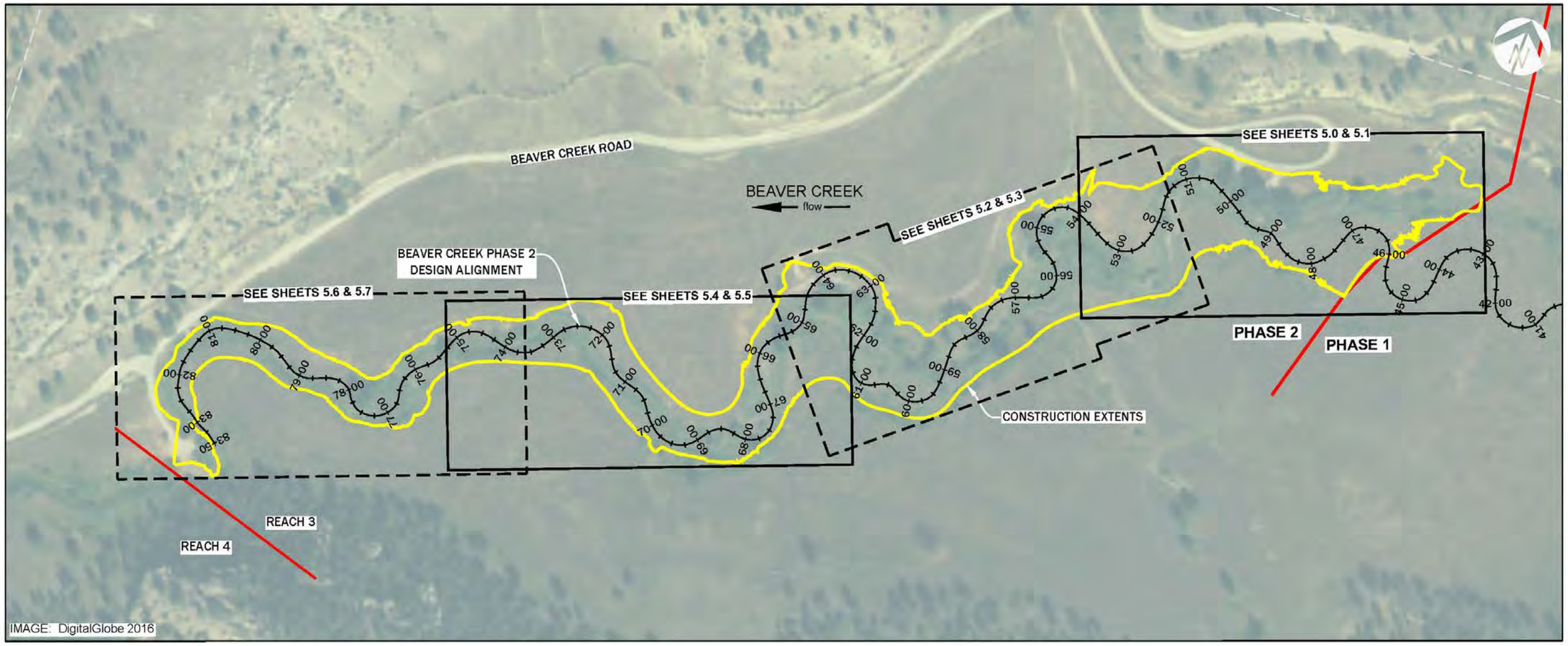
DRAWING NUMBER
3.0

Drawing 3 of 30

M:\Projects\2021\RDG-21-006 Beaver Creek Phase 2\CAD\21-01-22 Beaver Creek Phase 2 Working.dwg



1 **PLAN VIEW INDEX**

1" = 200'

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236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
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PLAN VIEW INDEX

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
3.1

1 ACCESS AND STAGING PLAN VIEW

1" = 200'

ACCESS AND STAGING

1. DIRECTIONS TO THE SITE - BEGIN AT THE SMALL TOWN OF YORK, MT. FROM YORK HEAD NORTH ON NELSON ROAD FOR APPROXIMATELY 7.9 MILES. TURN LEFT AND HEAD WEST ON BEAVER CREEK ROAD. AFTER 4.5 MILES TURN LEFT INTO AN EXISTING RIVER ACCESS LOOP. THIS LOCATION WILL SERVE AS THE NORTH SIDE ACCESS AND STAGING SITE.

2. A TEMPORARY HAUL ROAD WILL BE CONSTRUCTED ALONG THE SOUTH SIDE OF THE RIVER. ACCESS WILL BE FROM AN TEMPORARY CROSSING AT STATION 48+50. SOUTH SIDE STAGING WILL OCCUR AT THE SITE(S) DESIGNATED ON THE PLAN VIEW.

LEGEND

TEMPORARY HAUL ROAD

STAGING AREA

REPOSITORY

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

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

ACCESS AND STAGING PLAN

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
3.2

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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.

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. USFS SHALL BE NOTIFIED AT LEAST 72 HOURS PRIOR TO ACTIVATION OR DEACTIVATION OF ALL TEMPORARY BYPASS CHANNELS. THE PHONE NUMBER FOR THE USFS OFFICE IS 406-495-3923. USFS SHALL DETERMINE IF IT IS NECESSARY TO CONDUCT A FISH RESCUE.

2. TEMPORARY DIVERSIONS SHALL BE ACTIVATED OR DEACTIVATED INCREMENTALLY IN TWO STAGES TO ALLOW RESIDENT AQUATIC LIFE TO EXIT THE DEWATERED AREA.

3. A PERIOD OF APPROXIMATELY ONE HOUR SHALL BE ALLOWED BETWEEN THE TWO STAGES.

4. FWP AND USFS SHALL CONDUCT FISH RESCUES DURING THE ONE HOUR PERIOD.

5. 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.

6. EFFORTS SHALL BE MADE TO LIMIT DISTURBANCE TO VEGETATION.

7. EFFORTS SHALL BE MADE TO AVOID FATALITIES OF AQUATIC LIFE.

MATERIALS SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL MATERIALS NECESSARY TO CONSTRUCT THE PROJECT (ALL MATERIALS WILL BE SOURCED OFF-SITE). 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 - ONE (1) 14.5 CY ARTICULATED DUMP TRUCK.

BULL DOZER - ONE (1) BULL DOZER IS RECOMMENDED FOR THIS PROJECT. THE EQUIPMENT SHALL BE A MINIMUM OF CAT D6 OR EQUIVALENT.

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. 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 KEPT WATERED IN ORDER TO BE 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 TO AN ON-SITE REPOSITORY DESIGNATED BY THE CONSTRUCTION MANAGER. 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.

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SPECIFICATIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
3.3

TOTAL WOOD QUANTITIES

ITEM	QUANTITY	DIAMETER	LENGTH	ROOTWAD
CATEGORY 1 WOOD	120	10 -12 IN	25 FT	YES
CATEGORY 2 WOOD	3,090	3 - 6 IN	20 FT	OPTIONAL
CATEGORY 3 WOOD	12,400 (~5,500 CY)	< 3 IN	10 - 12 FT	OPTIONAL
WILLOW CUTTINGS	34,300	0.25 - 1.0 IN	8 FT	NO

NOTE: WOOD LENGTHS SHOWN WILL PRODUCE THE PROPER AMOUNT MATERIAL FOR STRUCTURES WHEN SPLIT INTO APPROPRIATE SIZES DURING CONSTRUCTION. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
NOTE: CATEGORY 3 WOOD (BRUSH) VOLUME IS BASED ON 90 PIECES PER 10 CY TRUCK LOAD (9 PIECES/CY). ACTUAL VOLUME PER CUBIC YARD WILL VARY BASED ON WOOD SPECIES, LOADING TECHNIQUE, DENSITY OF BOUGHS.

TOTAL ROCK QUANTITIES

ITEM	QUANTITY	DIAMETER
CATEGORY 1 ROCK	2,110 EA (~80 CY)	10 - 12 IN

ITEM	QUANTITY	GRADATION		
		SIZE (IN)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
STREAMBED/STREAMBANK FILL	3,485 CY	6	95	D100
		5	90-95	D95
		4	85-90	D84
		3	65-85	D65
		2	50-65	D50
		1	30-50	D35
		0.5	20-30	D15
		0.08	20	

EARTHWORK QUANTITIES

ITEM	QUANTITY (CY)
CUT	13,315
BACKFILL	9,765
NET CUT	3,550

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

LARGE WOOD STRUCTURE QUANTITIES

ITEM	QUANTITY
LARGE WOOD STRUCTURES	**31**
CATEGORY 1 WOOD	64
CATEGORY 2 WOOD	62
CATEGORY 3 WOOD	155
WILLOW CUTTINGS	3,100

LOG STEP POOL QUANTITIES

ITEM	QUANTITY
LOG STEP STRUCTURES	**.**
CATEGORY 1 WOOD	**36**
CATEGORY 2 WOOD	**14**
CATEGORY 1 ROCK	**36**
FILTER FABRIC	**150 SF**
RING SHANK NAILS	**180**

VEGETATED WOOD MATRIX QUANTITIES

ITEM	QUANTITY
VEGETATED WOOD MATRIX TYPE 1	**837**
VEGETATED WOOD MATRIX TYPE 2	**3,210**
VEGETATED WOOD MATRIX TYPE 3	**1,645**
CATEGORY 2 WOOD	2,600
CATEGORY 3 WOOD	10,750
WILLOW CUTTINGS	28,250
STREAMBANK FILL	2,450

WILDLIFE SNAG QUANTITIES

ITEM	QUANTITY
WILDLIFE SNAG PODS	**6**
CATEGORY 1 WOOD	**25**

CONSTRUCTED CHANNEL STREAMBED QUANTITIES

ITEM	QUANTITY
CONSTRUCTED RIFFLE	**2,590**
CATEGORY 1 ROCK	2,075
STREAMBED FILL	1,035
CATEGORY 2 WOOD	207

FLOODPLAIN TREATMENT

ITEM	QUANTITY
ACRES OF FLOODPLAIN	**5.9**
CATEGORY 2 WOOD	207
CATEGORY 3 WOOD	1,485
WILLOW CUTTINGS	2,950

NOTE: WOOD QUANTITIES SHOWN WILL PRODUCE THE PROPER AMOUNT OF 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.

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MATERIALS AND QUANTITES

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

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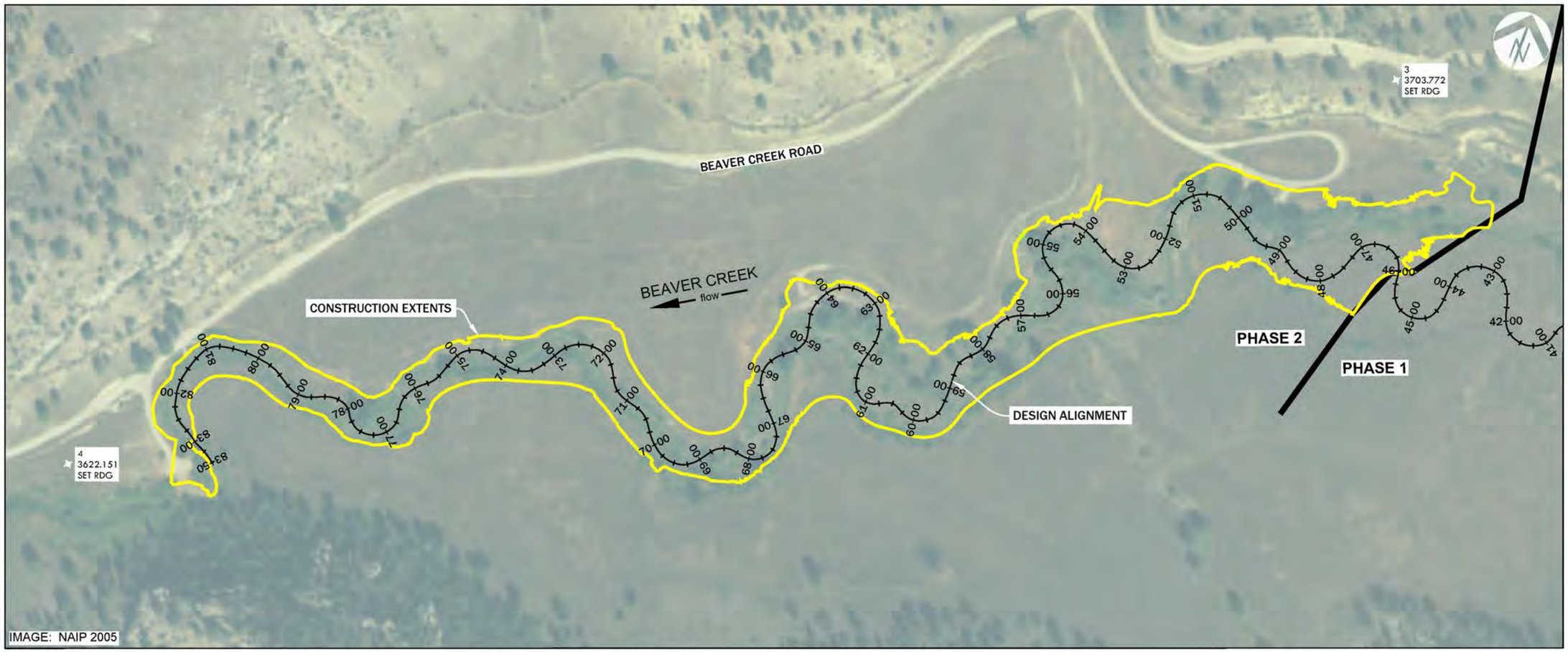
PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
3.4



1 SURVEY CONTROL PLAN

1" = 200'

PROJECT DATUM

THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:	
HORIZONTAL PROJECTION:	MONTANA STATE PLANE
HORIZONTAL DATUM:	NAD83 (CORS96 2002.00)
UNITS:	US SURVEY FEET
VERTICAL DATUM:	NAVD88 (GEOID 9)

CONTROL POINTS

POINT NUMBER	EASTING	NORTHING	POINT ELEVATION	RAW DESCRIPTION
3	1371400.5140'	935462.5460'	3703.772'	5/8" REBAR WITH A 2" ALUMINUM CAP MARKED "RDG"
4	1369241.2480'	934121.9760'	3622.151'	5/8" REBAR WITH A 2" ALUMINUM CAP MARKED "RDG"

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SURVEY CONTROL PLAN

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

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RDG-21-006

DRAWING NUMBER
4.0

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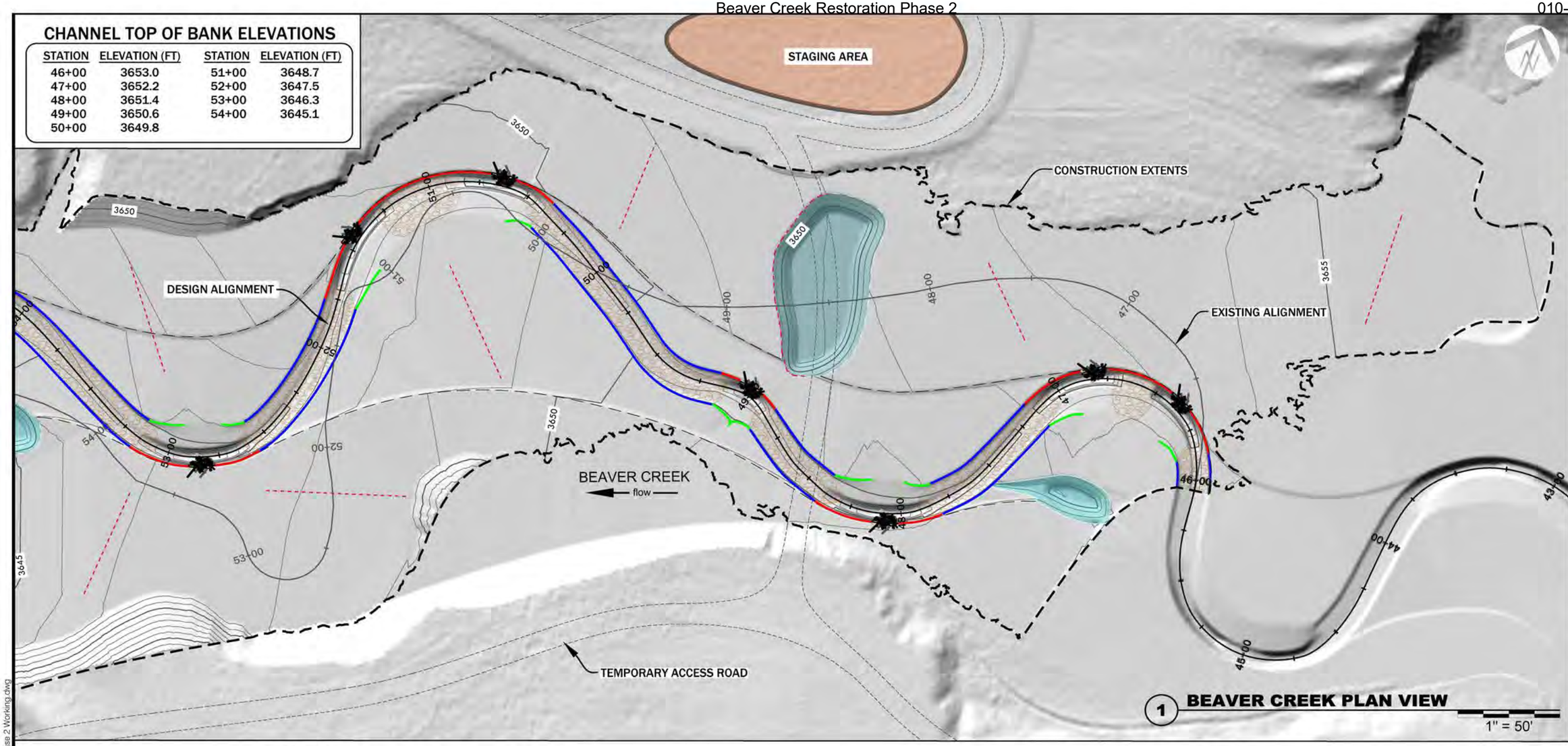
CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)	STATION	ELEVATION (FT)
46+00	3653.0	51+00	3648.7
47+00	3652.2	52+00	3647.5
48+00	3651.4	53+00	3646.3
49+00	3650.6	54+00	3645.1
50+00	3649.8		



1 BEAVER CREEK PLAN VIEW
1" = 50'

LEGEND

	DETAIL SHEET #
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 RIFFLE (CR)	8.2
FLOODPLAIN FEATURES	
OFF-CHANNEL EMERGENT WETLAND	
ALCOVE	
VEGETATED BRUSH TRENCH	8.4

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
45+61	46+21	C	CR	47+16	47+83	R	VWM 2	49+05	49+16	L	VWM 3	51+77	52+56	L	VWM 2
45+61	46+12	L	VWM 2	47+83	47+99	R	VWM 1	49+05	49+16	R	VWM 3	51+77	52+56	R	VWM 2
45+61	46+12	R	VWM 2	47+83	48+02	L	VWM 3	49+08	50+48	C	CR	52+12	51+77	R	VWM 3
46+12	46+30	L	VWM 1	48+02	48+12	L	LWS	49+16	50+39	L	VWM 2	52+56	52+74	R	VWM 1
46+12	46+33	R	VWM 3	48+12	48+40	L	VWM 3	49+16	50+39	R	VWM 2	52+56	52+78	L	VWM 3
46+33	46+43	R	LWS	48+15	48+40	R	VWM 1	50+39	50+56	L	VWM 1	52+78	52+88	L	LWS
46+43	46+77	R	VWM 3	48+28	48+94	C	CR	50+39	50+59	R	VWM 3	52+88	53+17	L	VWM 3
46+49	46+70	C	CR	48+40	48+87	L	VWM 2	50+59	50+69	R	LWS	52+91	53+17	R	VWM 1
46+77	46+87	R	LWS	48+40	48+87	R	VWM 2	50+69	51+39	R	VWM 3	53+04	54+19	C	CR
46+90	47+16	L	VWM 1	48+87	48+95	L	VWM 3	50+85	51+27	C	CR	53+17	54+10	L	VWM 2
46+98	47+16	R	VWM 3	48+87	48+95	R	VWM 3	51+39	51+49	R	LWS	53+17	54+10	R	VWM 2
47+03	47+91	C	CR	48+95	49+05	L	LWS	51+53	51+77	L	VWM 1				
47+16	47+83	L	VWM 2	48+95	49+05	R	LWS	51+65	52+65	C	CR				

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PLAN VIEW AND STRUCTURE LAYOUT

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.0

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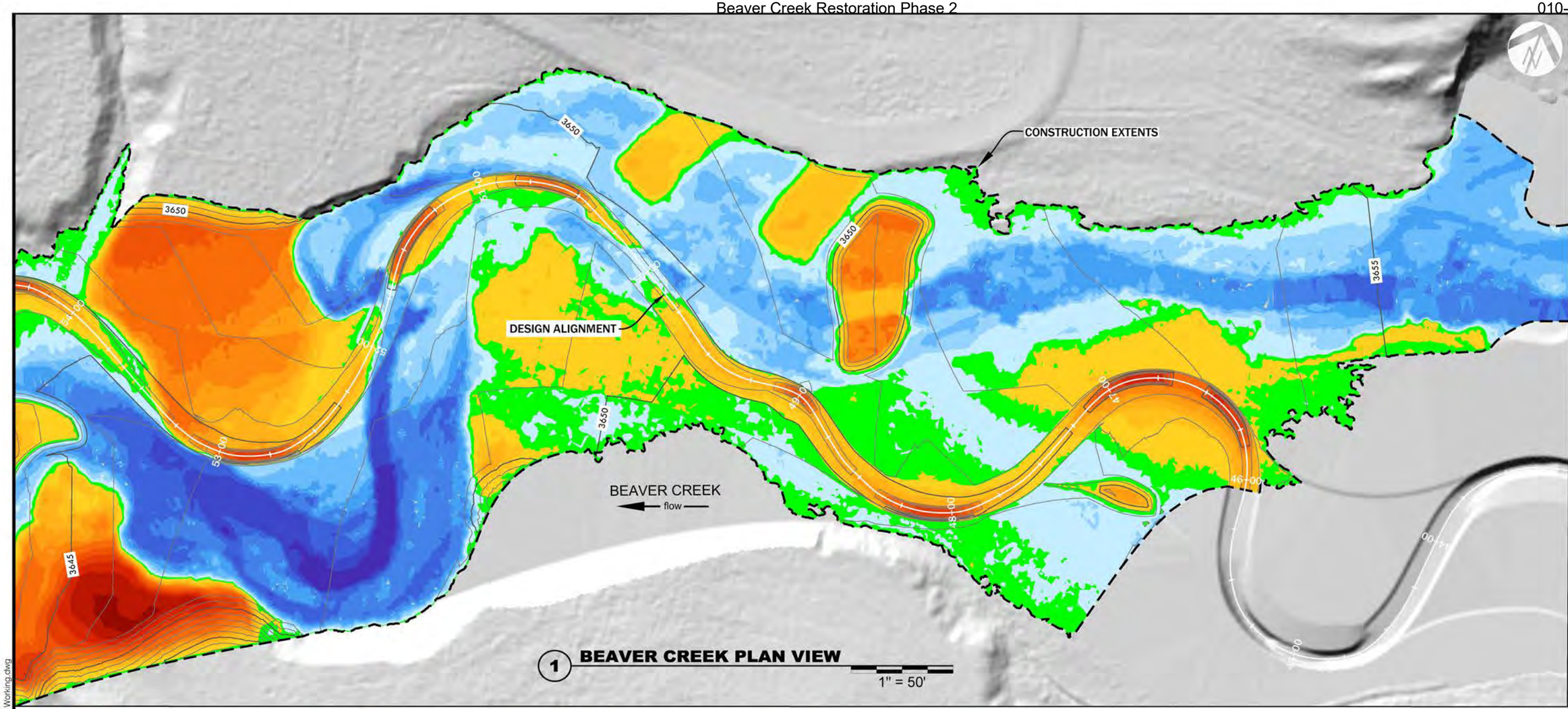
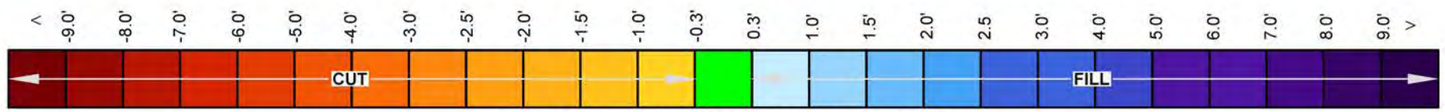
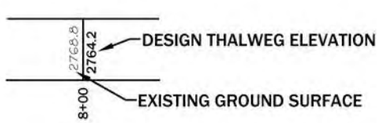


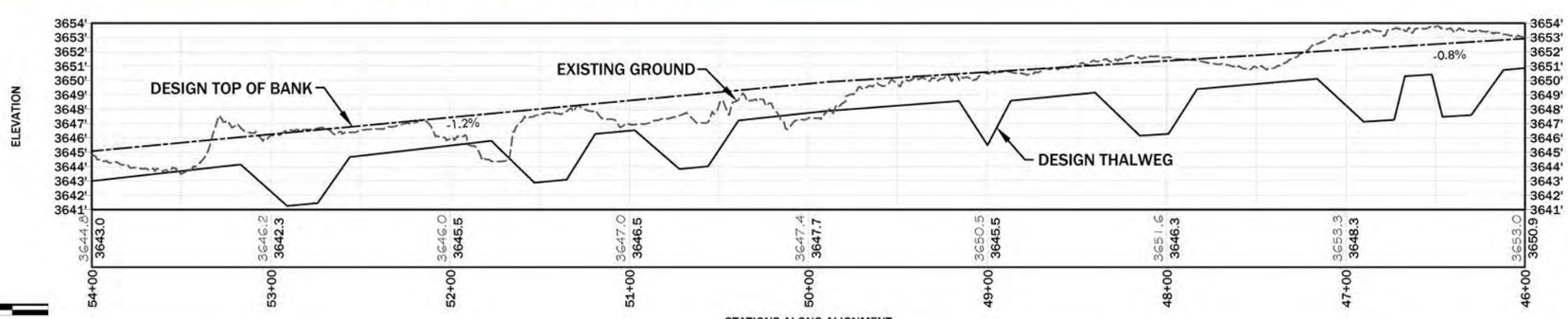
1 **BEAVER CREEK PLAN VIEW**

1" = 50'



EXISTING GROUND COMPARED TO RDG DESIGN SURFACE





1 **BEAVER CREEK PROFILE**

1" = 80'

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GRADING PLAN AND PROFILE

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	2/19/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.1

Drawing 10 of 29

LEGEND

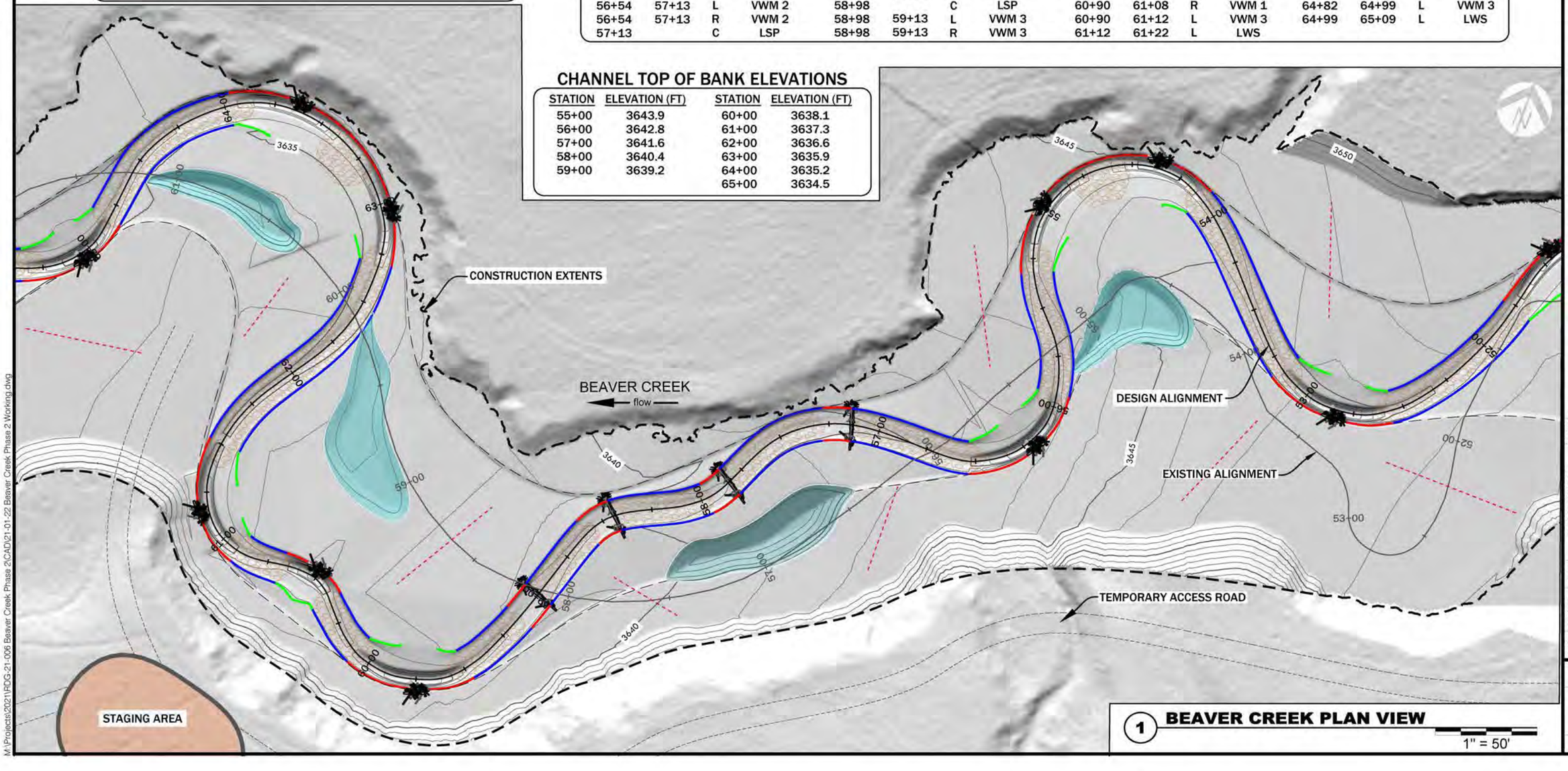
	DETAIL SHEET #
BANK STRUCTURES	
LARGE WOOD STRUCTURE (LWS)	8.0
VEGETATED WOOD MATRIX TYPE 1 (VWM 1)	8.1
VEGETATED WOOD MATRIX TYPE 2 (VWM 2)	8.1
VEGETATED WOOD MATRIX TYPE 3 (VWM 3)	8.1
CHANNEL STRUCTURES	
CONSTRUCTED RIFFLE (CR)	8.2
LOG STEP POOL (LSP)	8.3
FLOODPLAIN FEATURES	
OFF-CHANNEL EMERGENT WETLAND	
ALCOVE	
VEGETATED BRUSH TRENCH	8.4

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
54+10	54+27	L	VWM 1
54+10	54+31	R	VWM 3
54+31	54+41	R	LWS
54+41	54+93	R	VWM 3
54+53	54+81	C	CR
54+93	55+03	R	LWS
55+07	55+32	L	VWM 1
55+15	55+32	R	VWM 3
55+20	56+03	C	CR
55+32	55+94	L	VWM 2
55+32	55+94	R	VWM 2
55+94	56+11	R	VWM 1
55+94	56+15	L	VWM 3
56+15	56+25	L	LWS
56+25	56+54	L	VWM 3
56+28	56+54	R	VWM 1
56+41	57+13	C	CR
56+54	57+13	L	VWM 2
56+54	57+13	R	VWM 2
57+13		C	LSP
57+13	57+28	L	VWM 3
57+13	57+28	R	VWM 3
57+25	57+83	C	CR
57+28	57+83	L	VWM 2
57+28	57+83	R	VWM 2
57+83		C	LSP
57+83	57+98	L	VWM 3
57+83	57+98	R	VWM 3
57+95	58+44	C	CR
57+98	58+44	L	VWM 2
57+98	58+44	R	VWM 2
58+44		C	LSP
58+44	58+59	L	VWM 3
58+44	58+59	R	VWM 3
58+55	58+98	C	CR
58+59	58+98	L	VWM 2
58+59	58+98	R	VWM 2
58+98		C	LSP
58+98	59+13	L	VWM 3
58+98	59+13	R	VWM 3
59+09	59+58	C	CR
59+13	59+49	L	VWM 2
59+13	59+49	R	VWM 2
59+49	59+66	R	VWM 1
59+49	59+70	L	VWM 3
59+70	59+80	L	LWS
59+80	60+09	L	VWM 3
59+96	60+45	C	CR
60+09	60+38	L	VWM 2
60+09	60+38	R	VWM 2
60+38	60+68	L	VWM 1
60+38	60+47	R	VWM 3
60+47	60+57	R	LWS
60+57	60+68	R	VWM 3
60+60	60+99	C	CR
60+68	60+90	L	VWM 2
60+68	60+90	R	VWM 2
60+90	61+08	R	VWM 1
60+90	61+12	L	VWM 3
61+12	61+22	L	LWS
61+22	61+50	L	VWM 3
61+25	61+50	R	VWM 1
61+38	62+79	C	CR
61+50	62+70	L	VWM 2
61+50	62+70	R	VWM 2
62+70	62+87	L	VWM 1
62+70	62+91	R	VWM 3
62+91	63+01	R	LWS
63+01	63+59	R	VWM 3
63+13	63+46	C	CR
63+59	63+69	R	LWS
63+72	63+96	L	VWM 1
63+79	63+96	R	VWM 3
63+84	64+91	C	CR
63+96	64+82	L	VWM 2
63+96	64+82	R	VWM 2
64+82	64+99	R	VWM 1
64+82	64+99	L	VWM 3
64+99	65+09	L	LWS

CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)	STATION	ELEVATION (FT)
55+00	3643.9	60+00	3638.1
56+00	3642.8	61+00	3637.3
57+00	3641.6	62+00	3636.6
58+00	3640.4	63+00	3635.9
59+00	3639.2	64+00	3635.2
		65+00	3634.5



1 **BEAVER CREEK PLAN VIEW** 1" = 50'

RDG RIVER DESIGN GROUP
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927

PLAN VIEW AND STRUCTURE LAYOUT

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER RDG-21-006

DRAWING NUMBER 5.2

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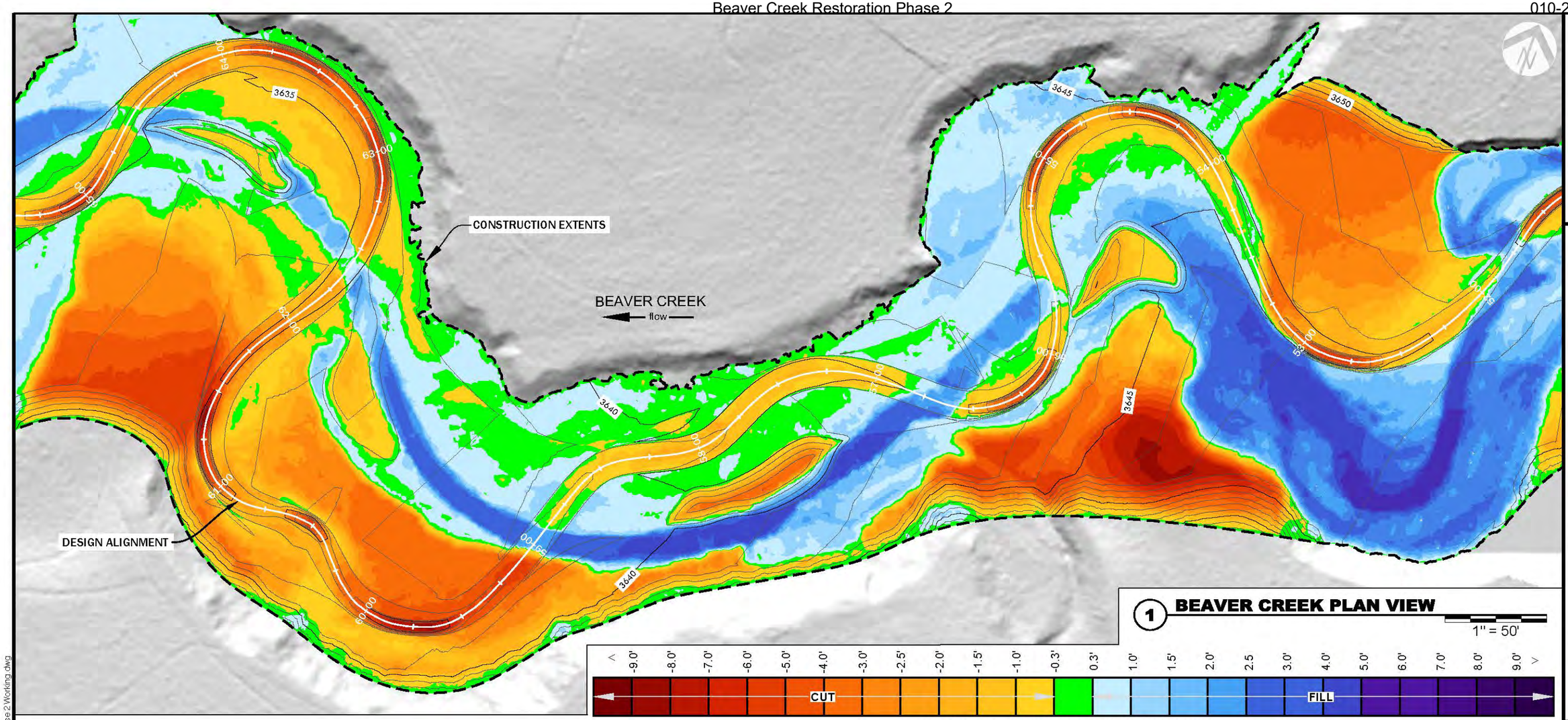
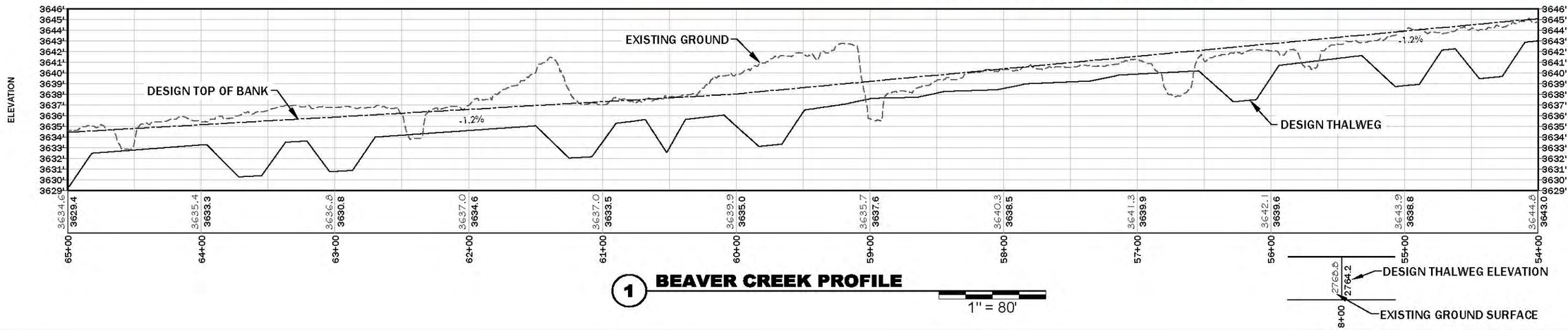


1 **BEAVER CREEK PLAN VIEW** 1" = 50'

< -9.0' -8.0' -7.0' -6.0' -5.0' -4.0' -3.0' -2.5' -2.0' -1.5' -1.0' -0.3' 0.3' 1.0' 1.5' 2.0' 2.5 3.0' 4.0' 5.0' 6.0' 7.0' 8.0' 9.0' >

CUT FILL

EXISTING GROUND COMPARED TO RDG DESIGN SURFACE



1 **BEAVER CREEK PROFILE** 1" = 80'

RDG RIVER DESIGN GROUP

236 Wisconsin Avenue, Whitefish, MT 59937, 406.862.4927

311 SW Jefferson Avenue, Corvallis, OR 97333, 541.738.2920

GRADING PLAN AND PROFILE

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	2/19/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.3

Drawing 12 of 29

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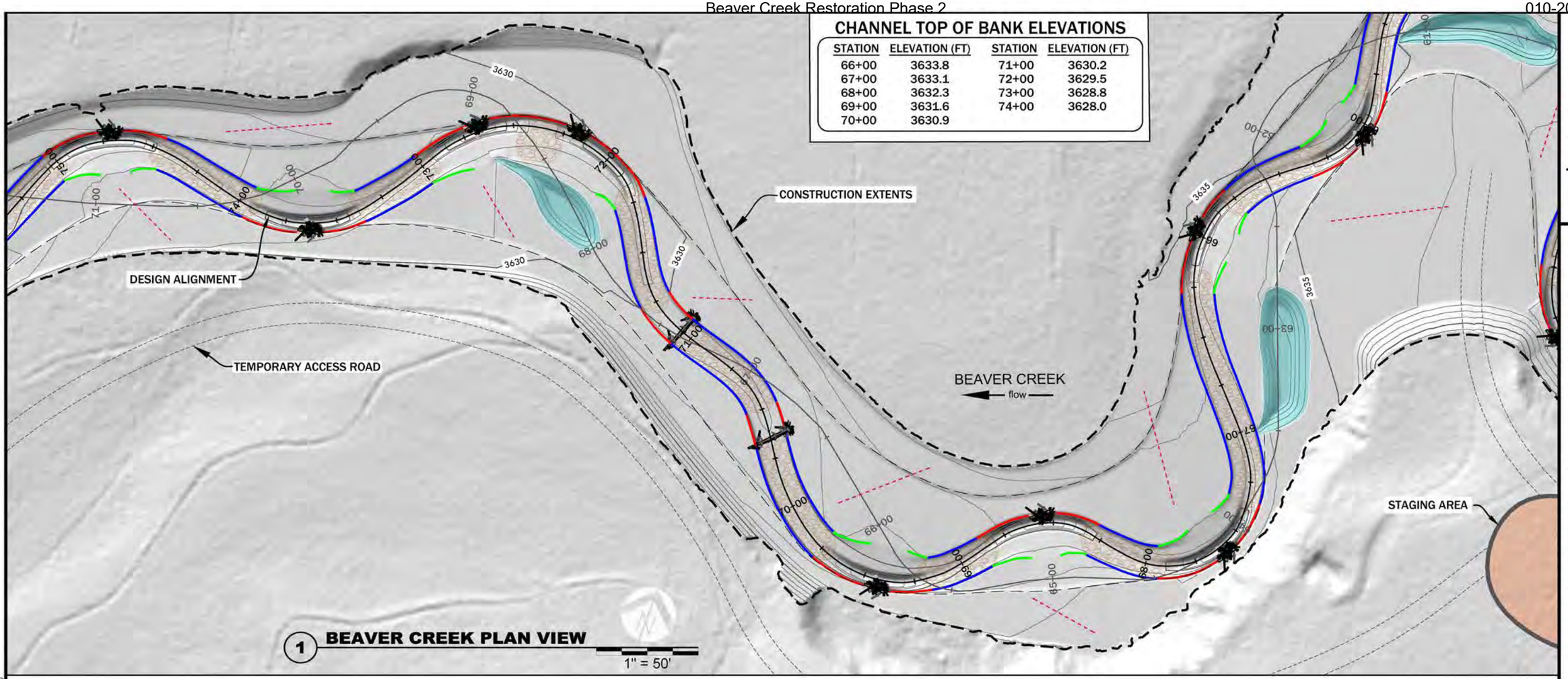
CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)	STATION	ELEVATION (FT)
66+00	3633.8	71+00	3630.2
67+00	3633.1	72+00	3629.5
68+00	3632.3	73+00	3628.8
69+00	3631.6	74+00	3628.0
70+00	3630.9		



1 **BEAVER CREEK PLAN VIEW**
1" = 50'

LEGEND

	DETAIL SHEET #
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 RIFFLE (CR)	8.2
LOG STEP POOL (LSP)	8.3
FLOODPLAIN FEATURES	
ALCOVE	
VEGETATED BRUSH TRENCH	8.4

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
65+09	65+35	R	VWM 1	67+65	67+94	L	VWM 3	69+47	69+75	L	VWM 3	71+20	71+75	R	VWM 2
65+09	65+35	L	VWM 3	67+68	67+94	R	VWM 1	69+50	69+75	R	VWM 1	71+75	71+93	L	VWM 1
65+22	65+84	C	CR	67+81	68+37	C	CR	69+63	70+35	C	CR	71+75	71+96	R	VWM 3
65+35	65+75	L	VWM 2	67+94	68+28	L	VWM 2	69+75	70+35	L	VWM 2	71+96	72+06	R	LWS
65+35	65+75	R	VWM 2	67+94	68+28	R	VWM 2	69+75	70+35	R	VWM 2	72+06	72+63	R	VWM 3
65+75	65+93	L	VWM 1	68+28	68+45	L	VWM 1	70+35		C	LSP	72+20	72+51	C	CR
65+75	65+93	R	VWM 3	68+28	68+49	R	VWM 3	70+35	70+50	L	VWM 3	72+63	72+73	R	LWS
65+93	66+03	R	LWS	68+49	68+59	R	LWS	70+35	70+50	R	VWM 3	72+76	73+00	L	VWM 1
66+03	66+28	L	VWM 1	68+59	68+87	R	VWM 3	70+46	71+05	C	CR	72+83	73+00	R	VWM 3
66+03	66+28	R	VWM 3	68+63	68+87	L	VWM 1	70+50	71+05	L	VWM 2	72+88	73+45	C	CR
66+16	67+43	C	CR	68+75	69+26	C	CR	70+50	71+05	R	VWM 2	73+00	73+36	L	VWM 2
66+28	67+35	L	VWM 2	68+87	69+17	L	VWM 2	71+05		C	LSP	73+00	73+36	R	VWM 2
66+28	67+35	R	VWM 2	68+87	69+17	R	VWM 2	71+05	71+20	L	VWM 3	73+36	73+53	R	VWM 1
67+35	67+51	R	VWM 1	69+17	69+34	R	VWM 1	71+05	71+20	R	VWM 3	73+36	73+57	L	VWM 3
67+35	67+55	L	VWM 3	69+17	69+37	L	VWM 3	71+16	71+84	C	CR	73+57	73+67	L	LWS
67+55	67+65	L	LWS	69+37	69+47	L	LWS	71+20	71+75	L	VWM 2	73+67	73+95	L	VWM 3
												73+70	73+95	R	VWM 1

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue 311 SW Jefferson Avenue
Whitefish, MT 59937 Corvallis, OR 97333
406.862.4927 541.738.2920

PLAN VIEW AND STRUCTURE LAYOUT

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.4

Drawing 13 of 30

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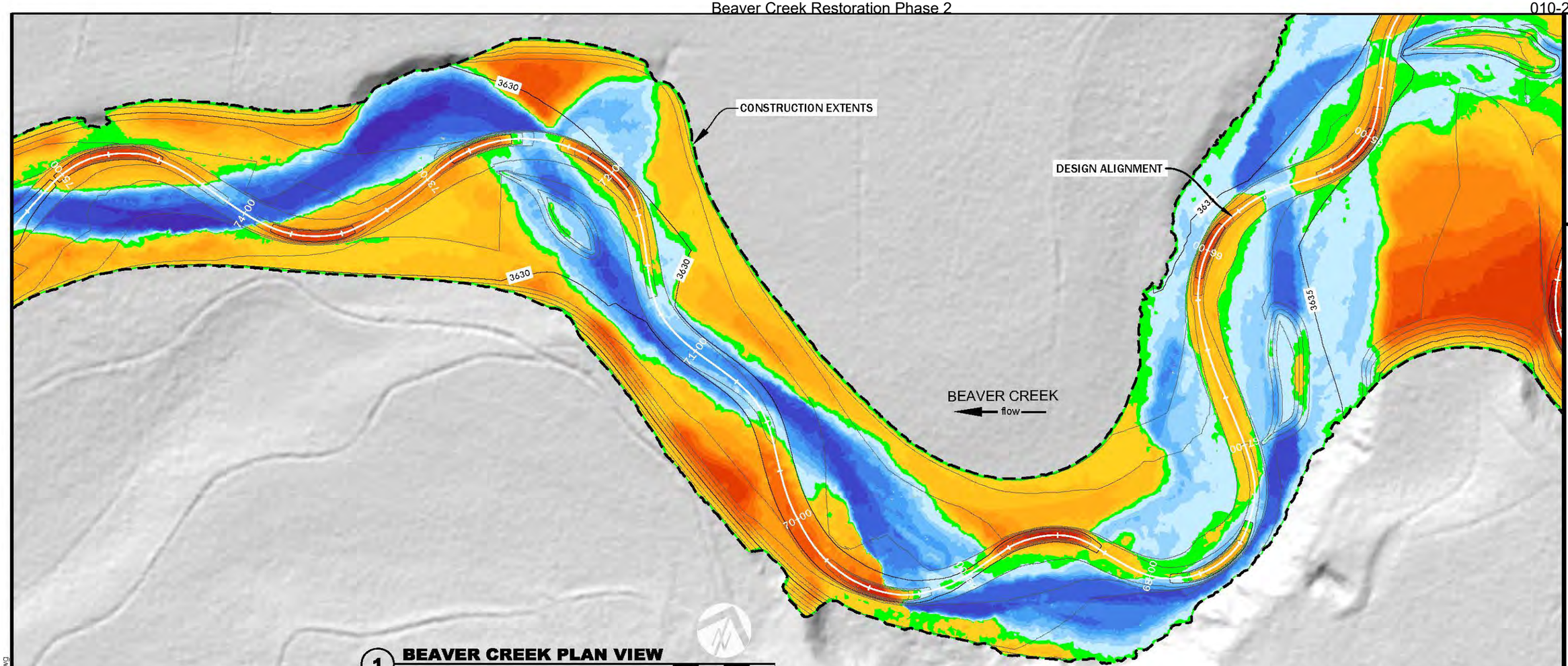
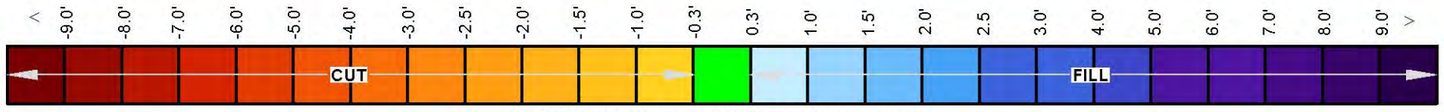
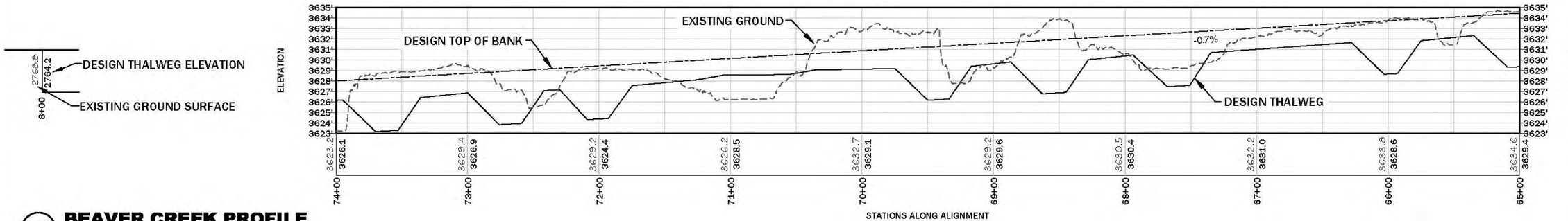


1 **BEAVER CREEK PLAN VIEW**
1" = 50'



EXISTING GROUND COMPARED TO RDG DESIGN SURFACE



1 **BEAVER CREEK PROFILE**
1" = 80'

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

GRADING PLAN AND PROFILE

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

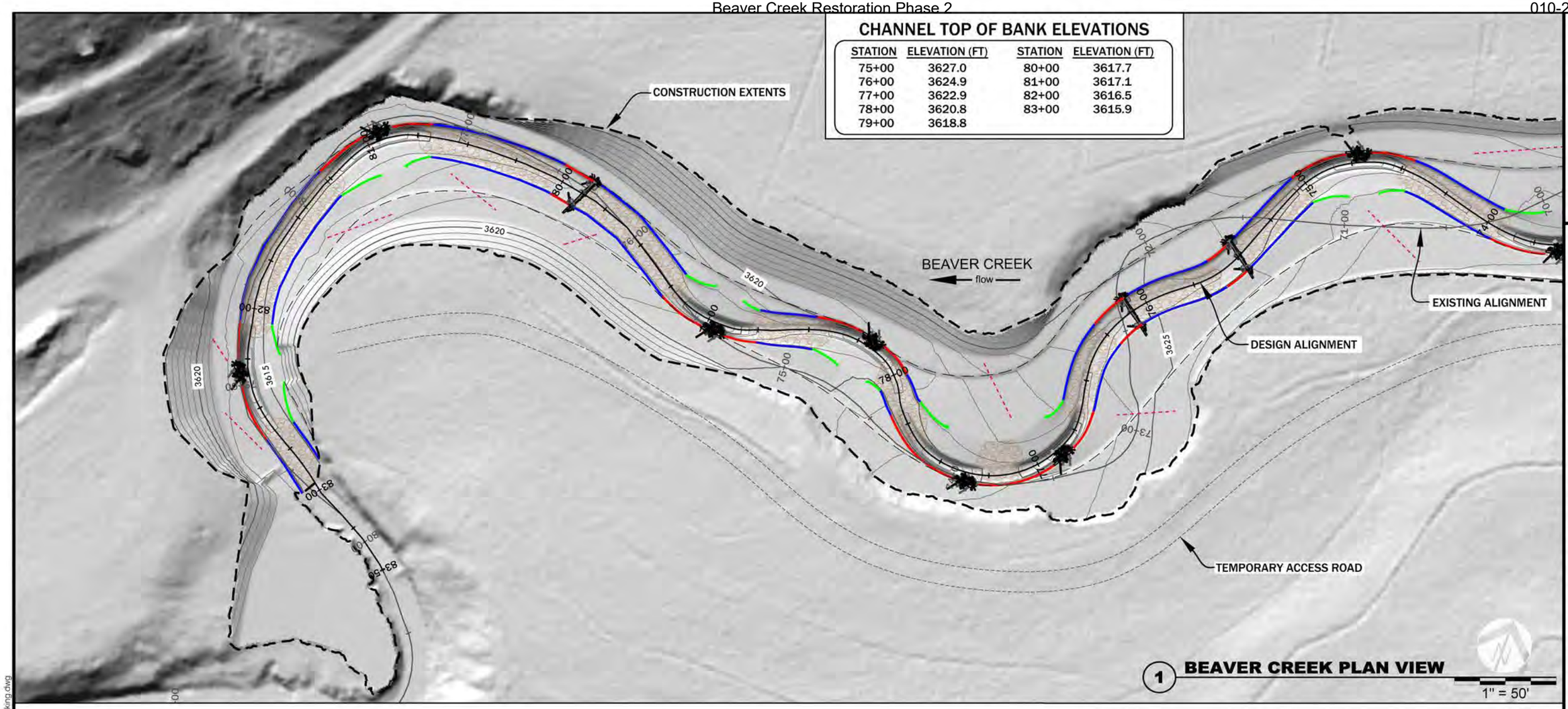
NO.	DATE	BY	DESCRIPTION	CHK
1	2/19/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.5

CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)	STATION	ELEVATION (FT)
75+00	3627.0	80+00	3617.7
76+00	3624.9	81+00	3617.1
77+00	3622.9	82+00	3616.5
78+00	3620.8	83+00	3615.9
79+00	3618.8		



1 BEAVER CREEK PLAN VIEW

1" = 50'

LEGEND

	DETAIL SHEET #
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 RIFFLE (CR)	8.2
LOG STEP POOL (LSP)	8.3
FLOODPLAIN FEATURES	
ALCOVE	
VEGETATED BRUSH TRENCH	8.4

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
73+83	74+54	C	CR	76+08		C	LSP	77+97	78+10	L	VWM 1	79+88	80+03	R	VWM 3
73+95	74+45	L	VWM 2	76+08	76+23	L	VWM 3	77+97	78+14	R	VWM 3	79+99	80+77	C	CR
73+95	74+45	R	VWM 2	76+08	76+23	R	VWM 3	78+14	78+24	R	LWS	80+03	80+68	L	VWM 2
74+45	74+62	L	VWM 1	76+19	76+72	C	CR	78+24	78+47	R	VWM 3	80+03	80+68	R	VWM 2
74+45	74+65	R	VWM 3	76+23	76+63	L	VWM 2	78+27	78+47	L	VWM 1	80+68	80+85	L	VWM 1
74+65	74+75	R	LWS	76+23	76+63	R	VWM 2	78+37	78+81	C	CR	80+68	80+89	R	VWM 3
74+75	75+04	R	VWM 3	76+63	76+82	L	VWM 3	78+47	78+75	L	VWM 2	80+89	80+99	R	LWS
74+78	75+04	L	VWM 1	76+63	76+80	R	VWM 3	78+47	78+75	R	VWM 2	80+99	82+27	R	VWM 3
74+91	75+48	C	CR	76+82	76+92	L	LWS	78+75	78+87	R	VWM 1	81+02	81+27	L	VWM 1
75+04	75+04	L	VWM 2	76+92	77+14	L	VWM 3	78+75	78+91	L	VWM 3	81+15	82+15	C	CR
75+04	75+48	R	VWM 2	77+04	77+36	C	CR	78+87	79+88	R	VWM 2	81+27	82+95	L	VWM 2
75+04	75+19	L	VWM 3	77+46	77+56	L	LWS	78+91	79+01	L	LWS	82+27	82+37	R	LWS
75+19	76+08	L	VWM 2	77+56	77+83	L	VWM 3	79+01	79+24	L	VWM 3	82+48	82+65	R	VWM 3
75+48		C	LSP	77+57	77+83	R	VWM 1	79+14	79+88	C	CR	82+53	82+89	C	CR
75+48	75+63	R	VWM 3	77+70	78+04	C	CR	79+24	79+88	L	VWM 2	82+65	82+95	R	VWM 2
75+59	76+08	C	CR	77+83	77+97	L	VWM 2	79+88		C	LSP				
75+63	76+08	R	VWM 2	77+83	77+97	R	VWM 2	79+88	80+03	L	VWM 3				

RDG RIVER DESIGN GROUP
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311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

PLAN VIEW AND STRUCTURE LAYOUT

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM
2	4/04/21	NW	REVISION	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.6

Drawing 15 of 30

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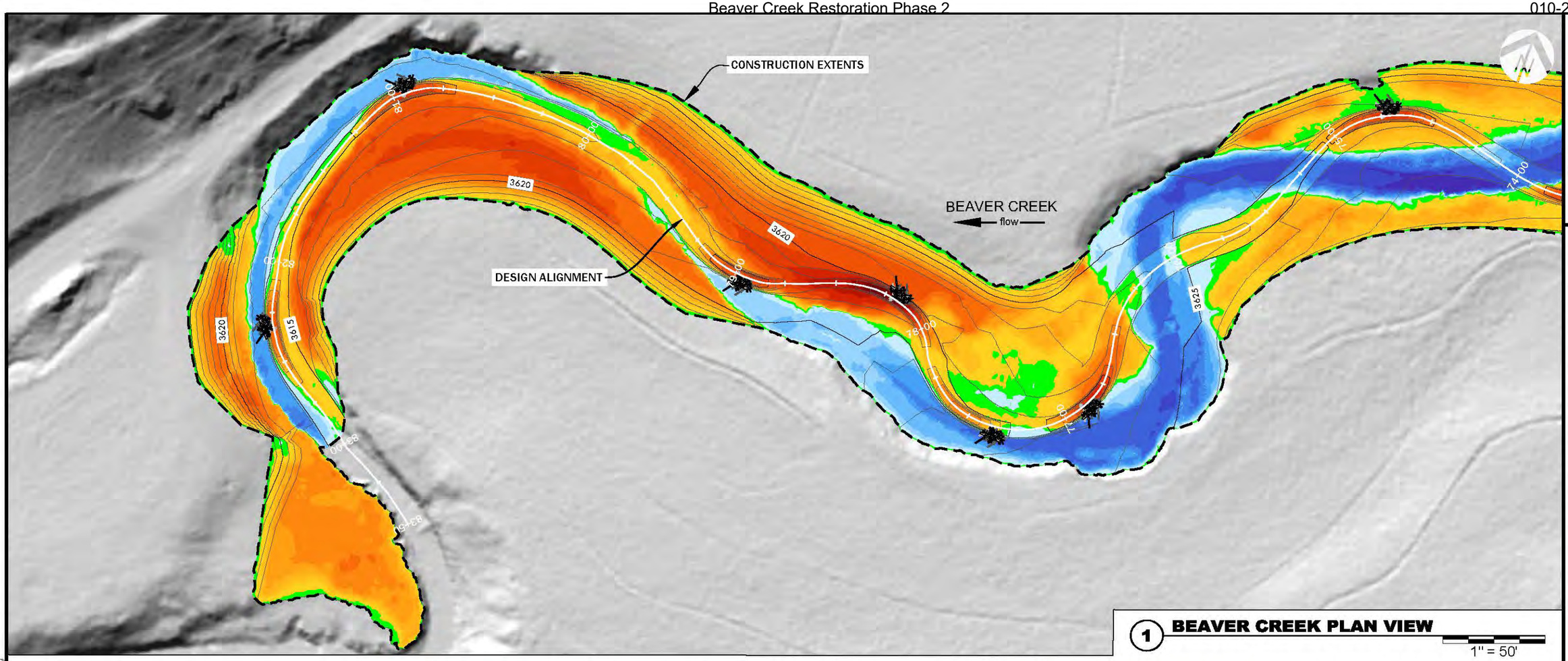
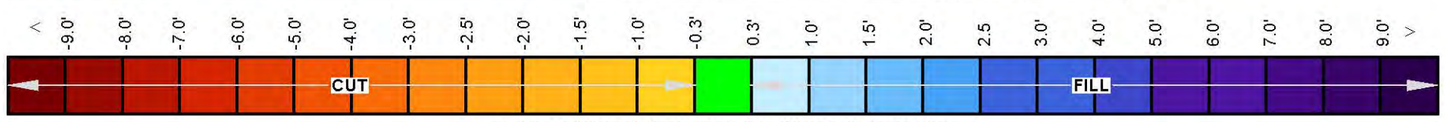
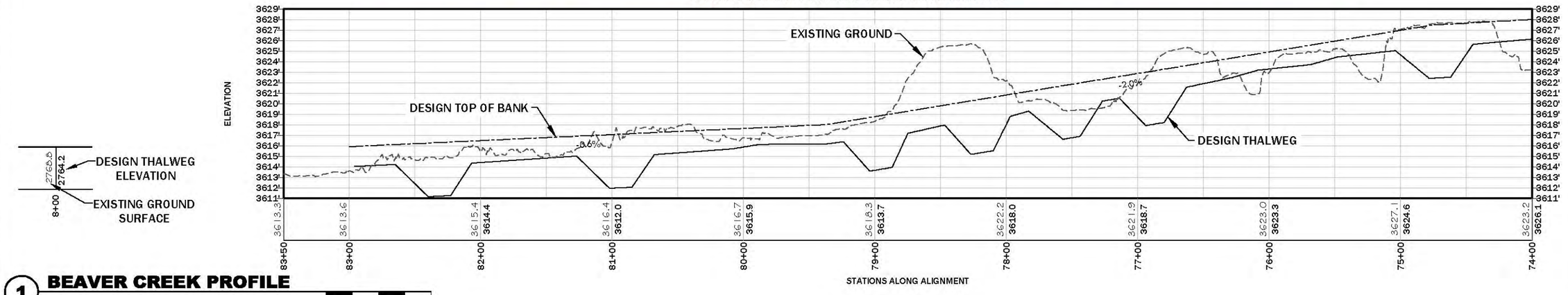


1 **BEAVER CREEK PLAN VIEW**
1" = 50'



EXISTING GROUND COMPARED TO RDG DESIGN SURFACE



1 **BEAVER CREEK PROFILE**
1" = 80'

RDG RIVER DESIGN GROUP
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927

GRADING PLAN AND PROFILE

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	2/19/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
5.7

Drawing 16 of 29

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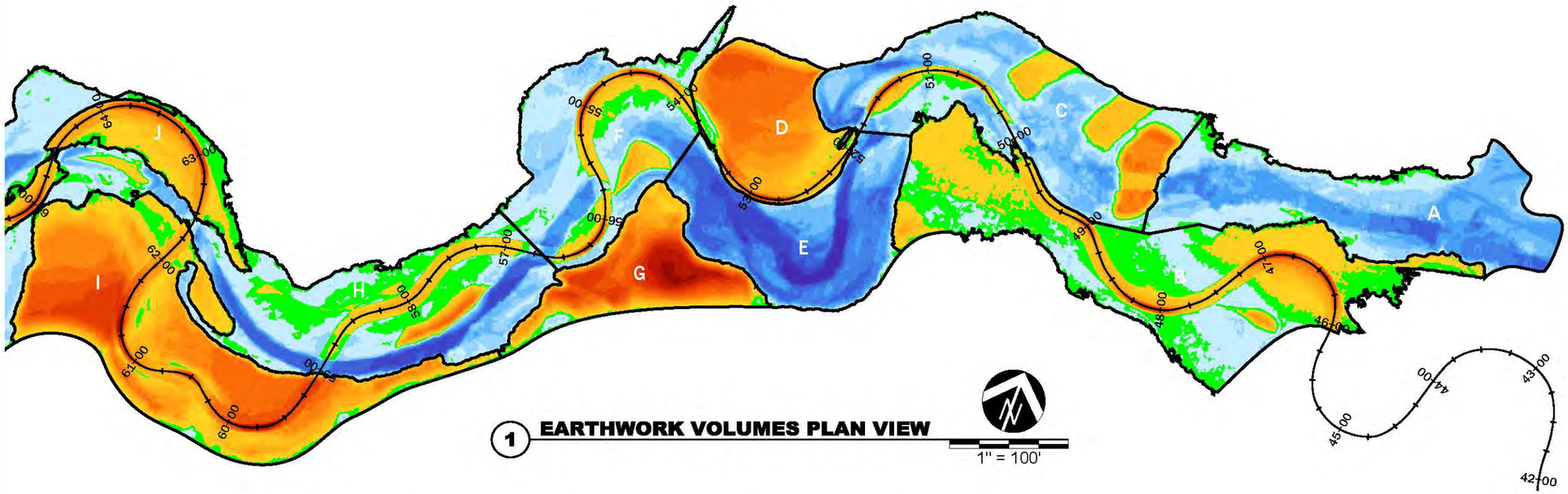
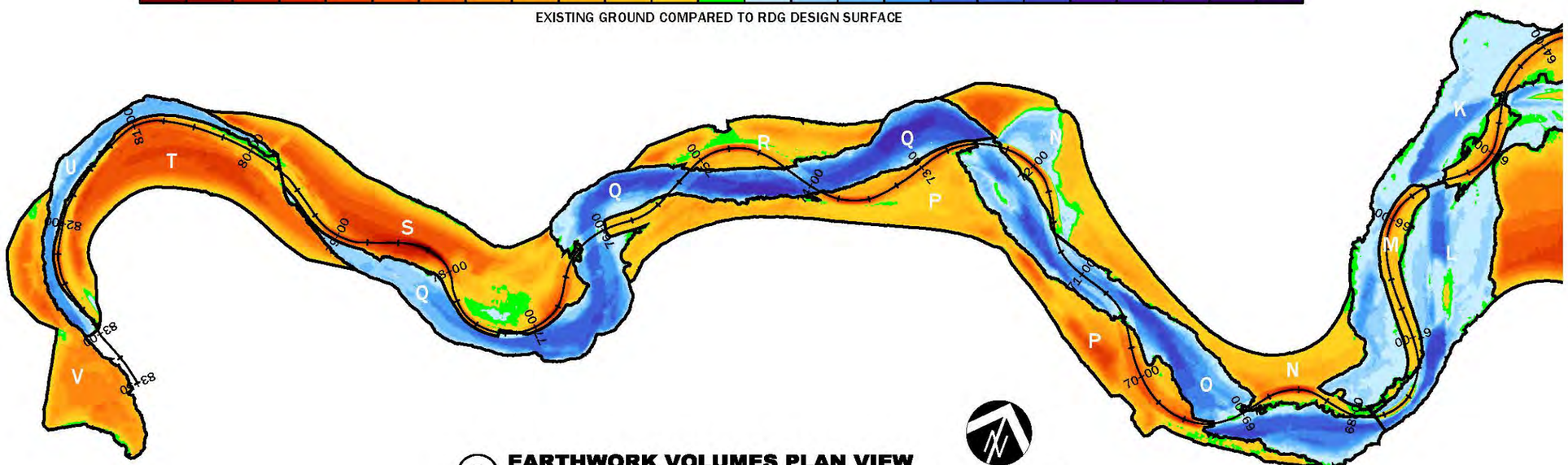


1 EARTHWORK VOLUMES PLAN VIEW

1" = 100'

EXISTING GROUND COMPARED TO RDG DESIGN SURFACE



2 EARTHWORK VOLUMES PLAN VIEW

1" = 100'

EARTHWORK VOLUMES

AREA	CUT (CY)	FILL (CY)
A	0	1,320
B	730	180
C	415	875
D	1,150	0
E	0	1,850
F	253	550
G	1,460	0
H	220	1,000
I	2,870	0
J	490	0
K	0	460
L	0	435
M	120	0
N	700	75
O	0	1,070
P	1,110	0
Q	0	1,750
R	300	0
S	1,500	0
T	1,415	0
U	0	200
V	580	0
	13,313 CY	9,765 CY

3,548 CY EXCESS MATERIAL TO BE PLACED INTO A REPOSITORY

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

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue 311 SW Jefferson Avenue
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EARTHWORK VOLUMES

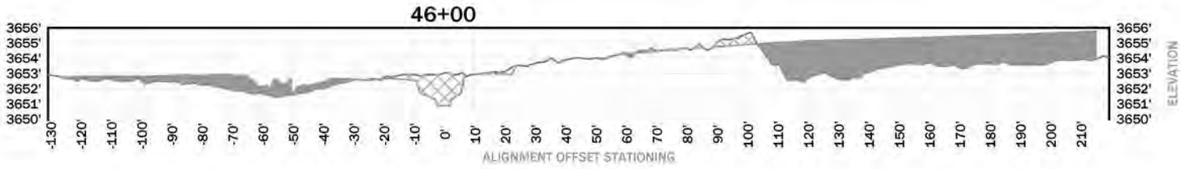
BEAVER CREEK RESTORATION PROJECT

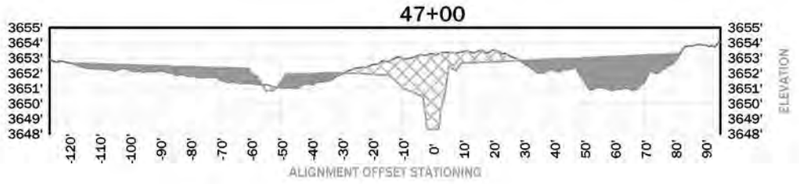
NEAR YORK, MONTANA

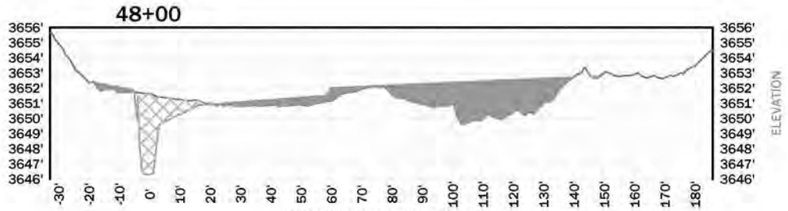
NO.	DATE	BY	DESCRIPTION	CHK
1	2/19/21	NW	FINAL DESIGN	JM

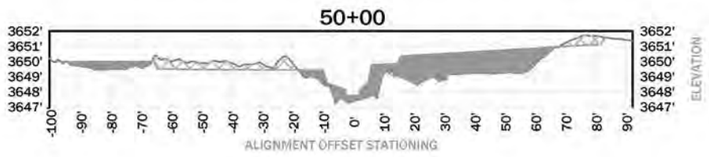
PROJECT NUMBER
RDG-21-006

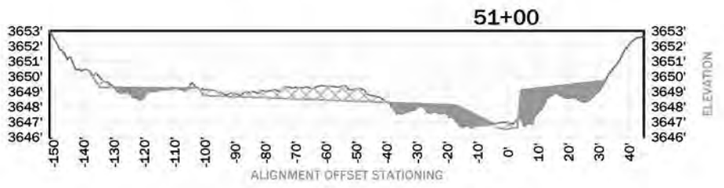
DRAWING NUMBER
5.8

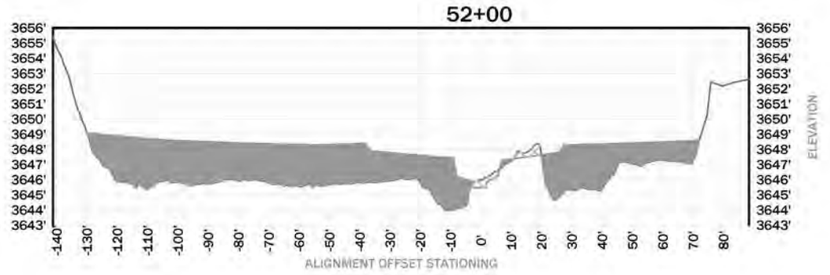


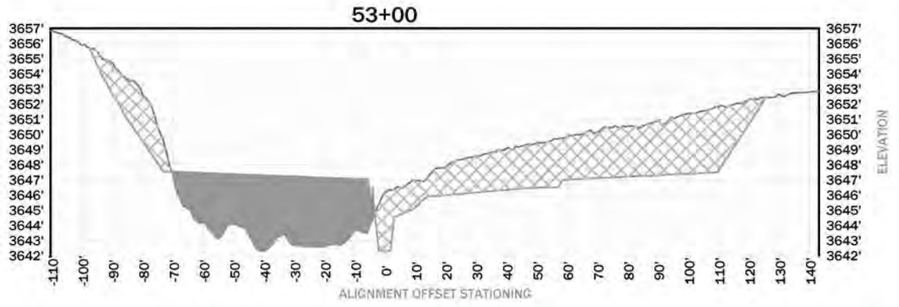


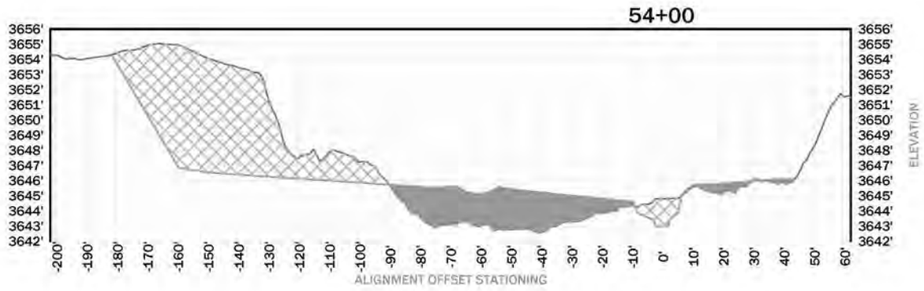


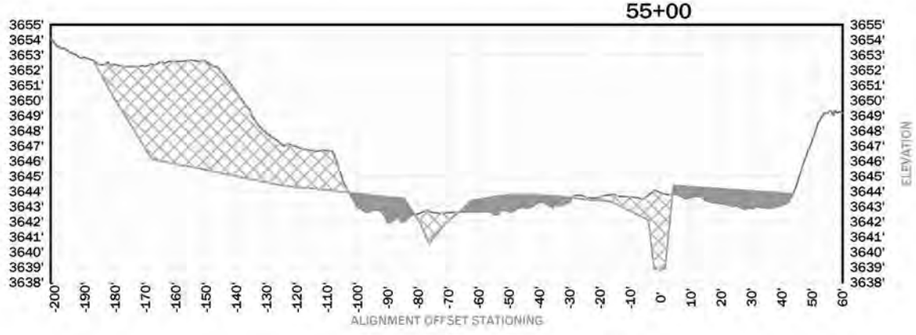












LEGEND

EXISTING GROUND ELEVATION	CUT
FINISHED GRADE	FILL

\\rdgjwf\Projects\2021\RDG-21-006 Beaver Creek Phase 2\CAD\21-01-22 Beaver Creek Phase 2 Working.dwg

RDG RIVER DESIGN GROUP
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311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

CROSS SECTIONS

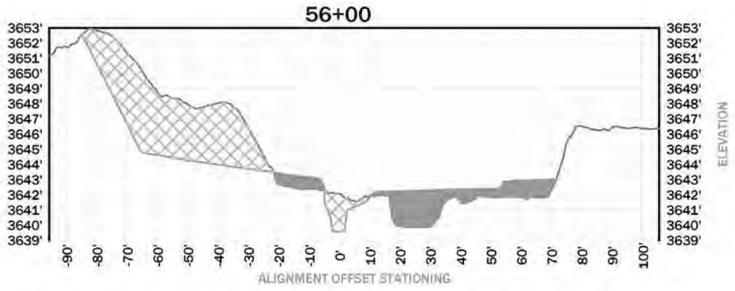
BEAVER CREEK RESTORATION PROJECT

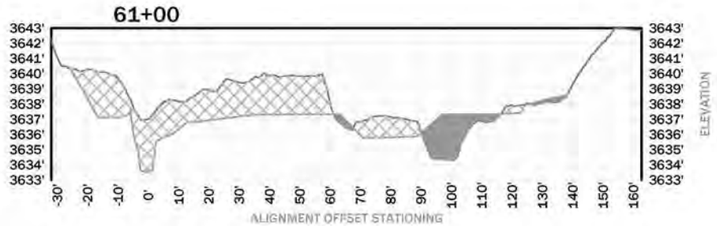
NEAR YORK, MONTANA

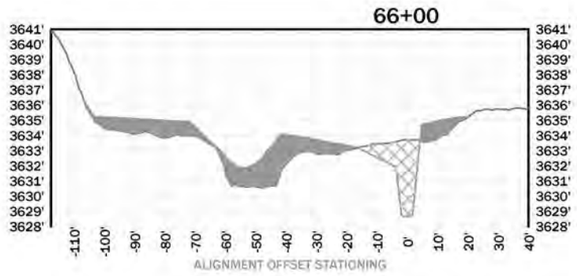
NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

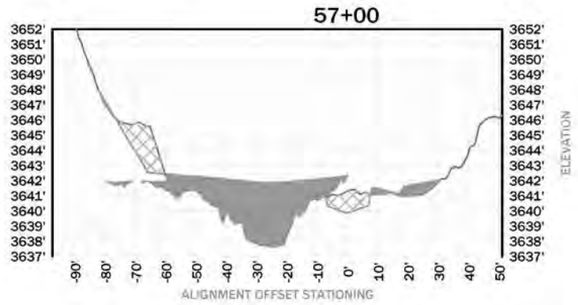
PROJECT NUMBER
RDG-21-006

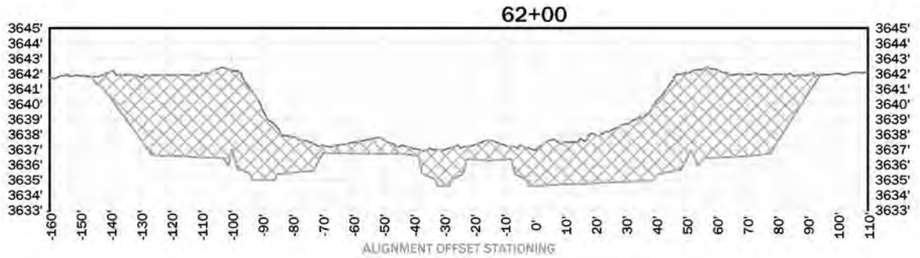
DRAWING NUMBER
6.0

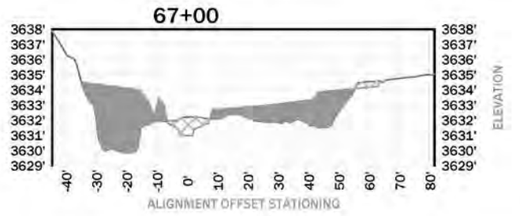


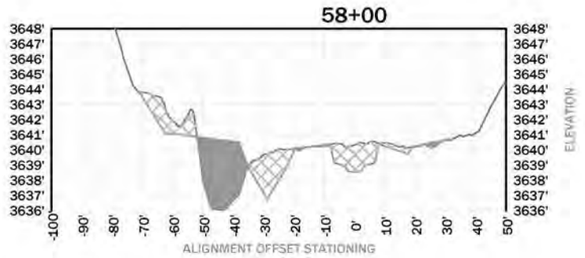


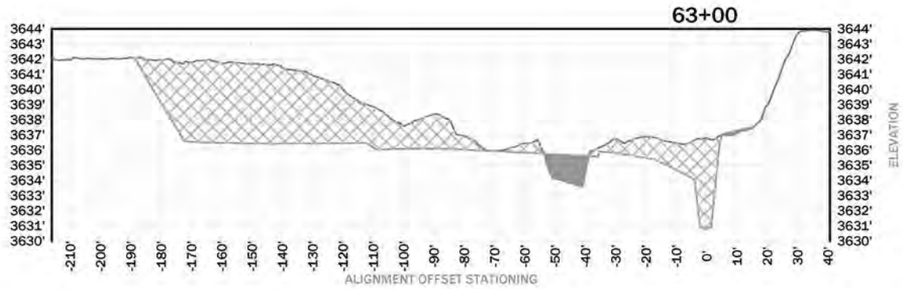


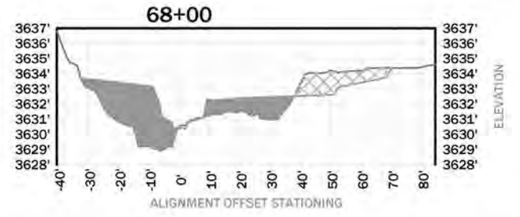


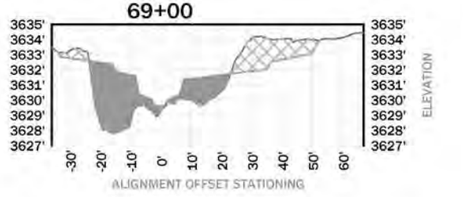


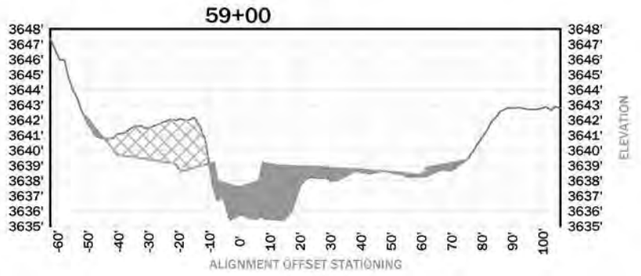


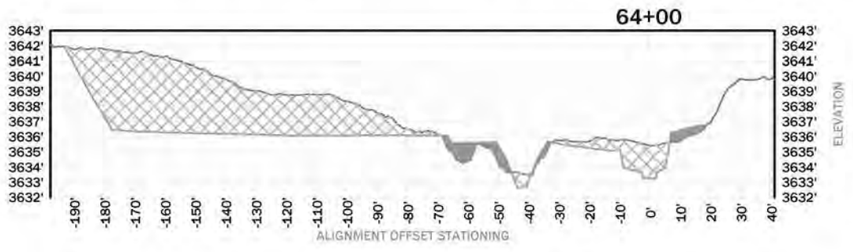


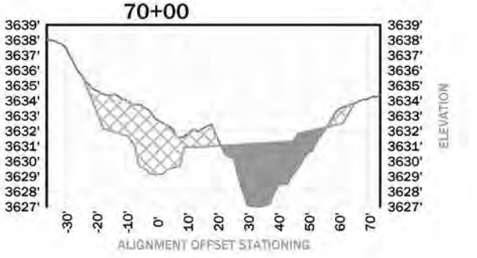


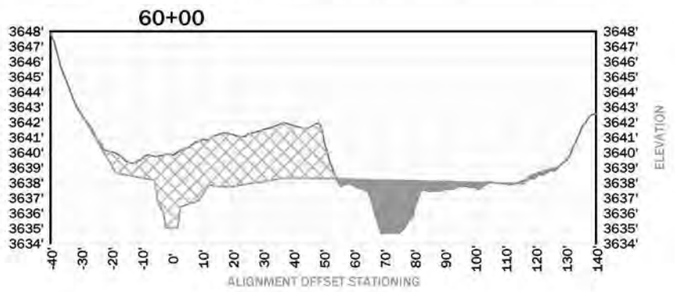


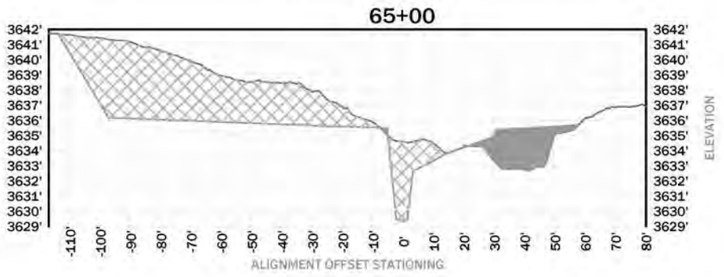












LEGEND

EXISTING GROUND ELEVATION — CUT

FINISHED GRADE — FILL

CROSS SECTIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

RDG RIVER DESIGN GROUP
311 SW Jefferson Avenue
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236 Wisconsin Avenue
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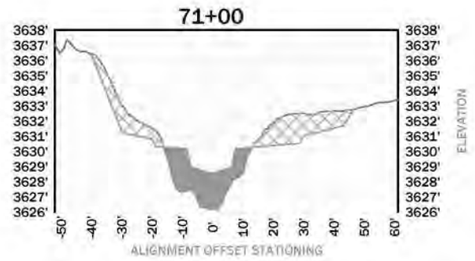
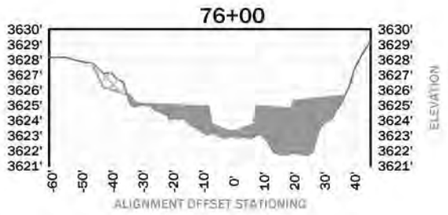
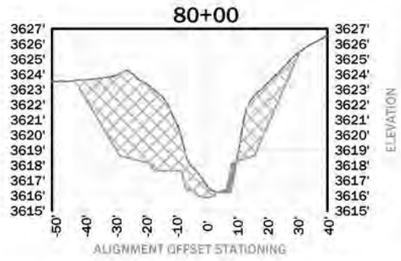
NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

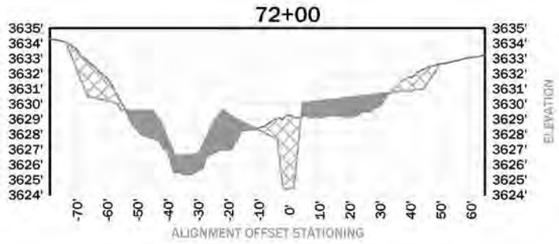
PROJECT NUMBER
RDG-21-006

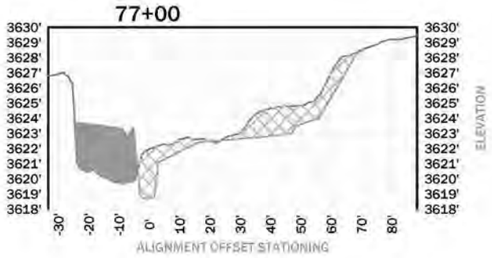
DRAWING NUMBER
6.1

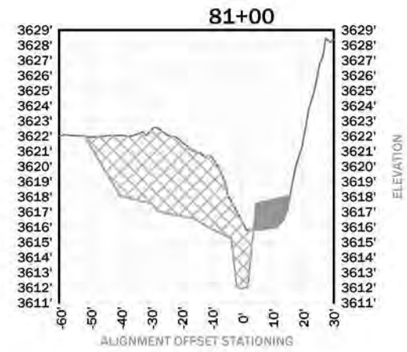


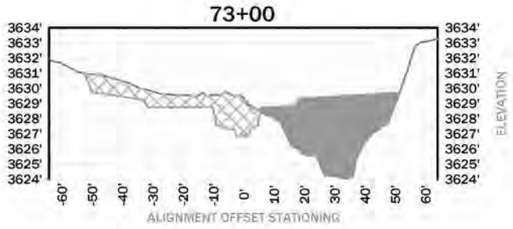


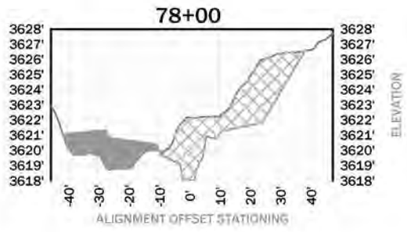


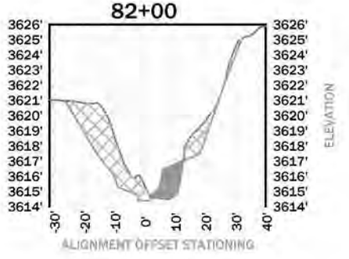


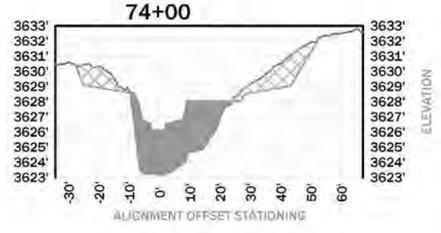


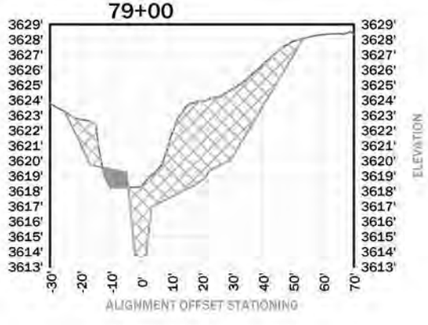


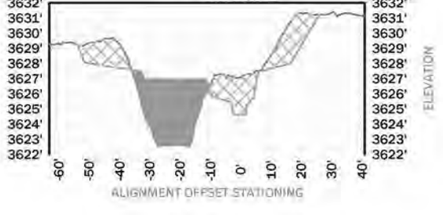












LEGEND

EXISTING GROUND ELEVATION — CUT

FINISHED GRADE — FILL

RDG RIVER DESIGN GROUP
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CROSS SECTIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
6.2

Drawing 20 of 30

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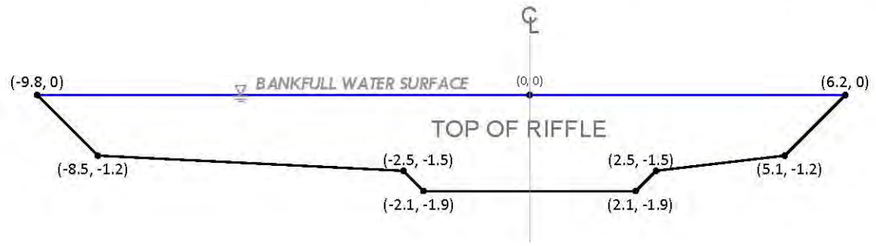
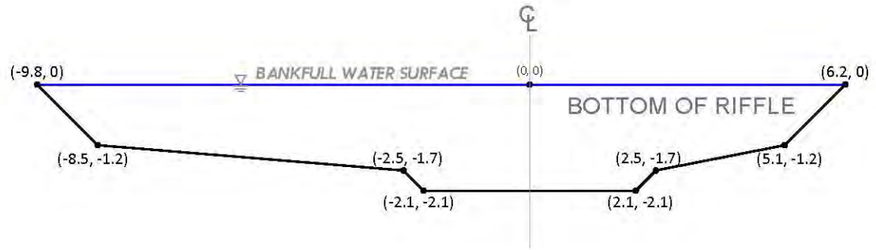
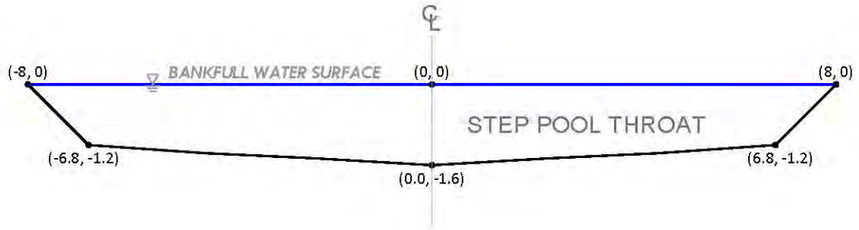
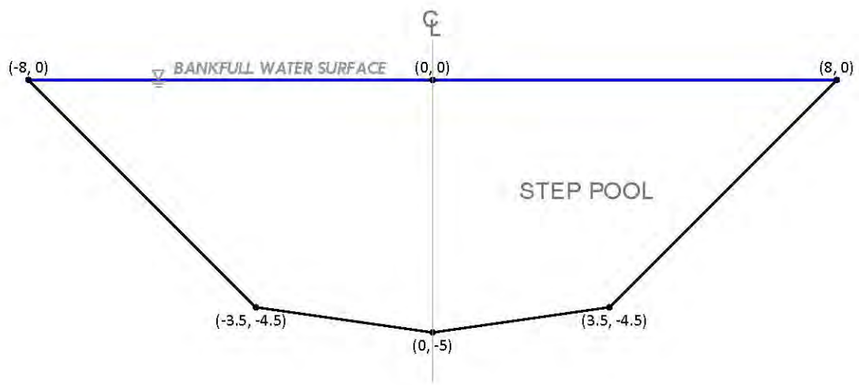
BANKFULL CROSS SECTION DESIGN CRITERIA				
	Riffle	Run	Pool	Glide
	Value (ft)	Value (ft)	Value (ft)	Value (ft)
Area	19	20	24	23
Range (Low)	17	19	21	21
Range (High)	21	23	27	25
Width/Depth Ratio	14	10	-	16
Range (Low)	12	8	-	14
Range (High)	16	13	-	20
Width				
Average	16	14	21	19
Range (Low)	15	13	19	18
Range (High)	17	16	22	21
Avg. Depth				
Average	1.2	1.4	1.1	1.2
Range (Low)	1.1	1.2	1.1	1.1
Range (High)	1.3	1.5	1.2	1.3
Max.Depth				
Average	1.8	2.4	4.2	1.7
Range (Low)	1.5	2.0	3.6	1.4
Range (High)	2.0	2.7	4.8	1.9
Scour Depth	2.4	3.0	5.0	2.4

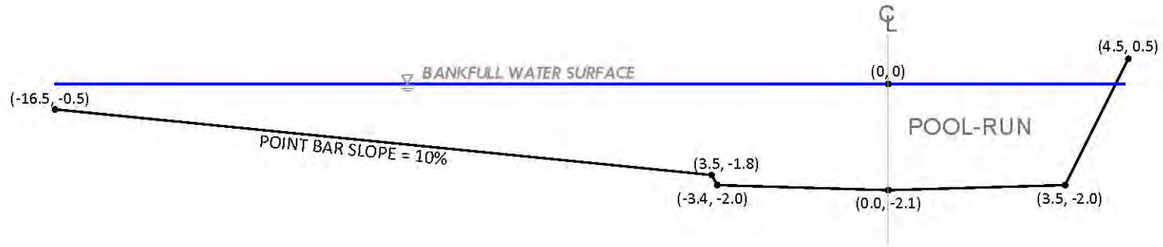
NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK THALWEG

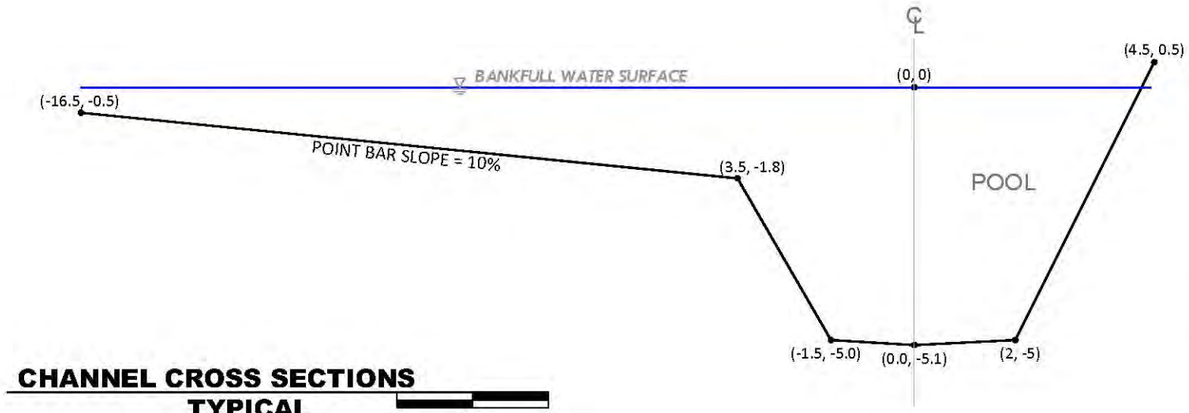












CHANNEL CROSS SECTIONS
TYPICAL

0' 1.5' 3'

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CHANNEL CROSS SECTION DIMENSIONS
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

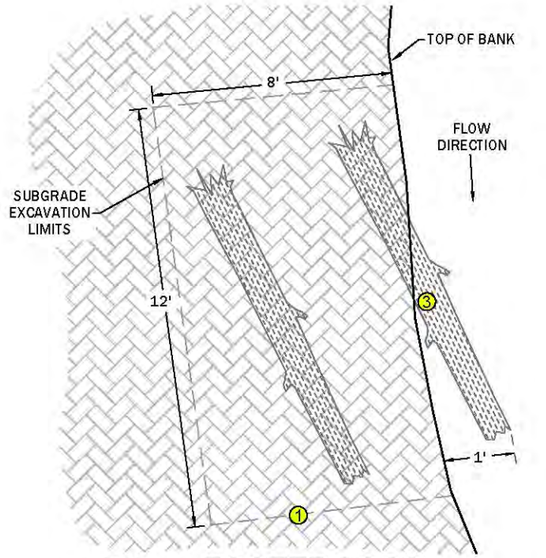
DRAWING NUMBER
7.0

GENERAL NOTES

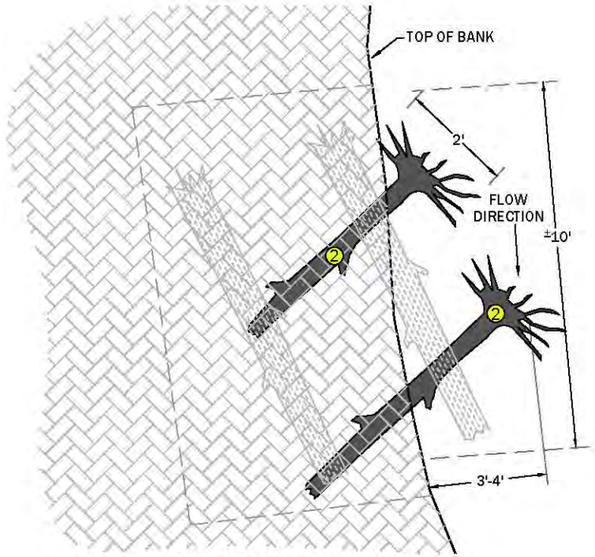
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR AFTER THE STREAMBANK SUBGRADE AND CHANNEL STREAMBED SUBGRADE IS ESTABLISHED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION

CONSTRUCTION NOTES

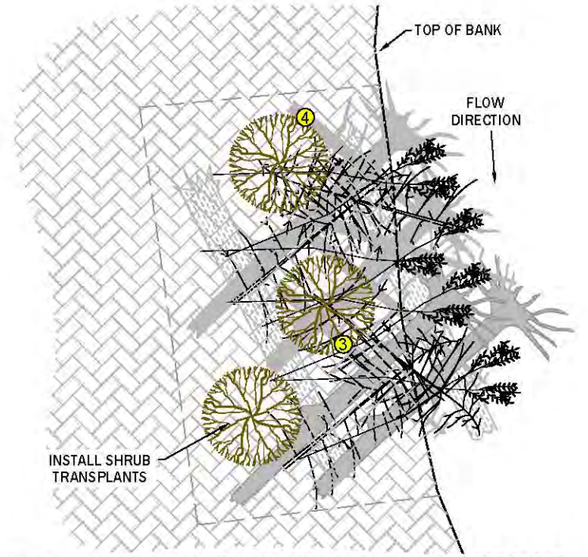
1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 FT. BEYOND 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 TWO ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE.
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS (CATEGORY 2 WOOD). BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL A SECOND TIER OF TWO FOOTER LOG (CATEGORY 2 WOOD) FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 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.
6. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE.
7. INSTALL ONE TO TWO ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING THE LOWER TIER OF ROOTWADS AT THE ORIENTATION NOTED IN PLAN VIEW. THE ROOTWADS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISHED BANK LINE.
8. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AND WILLOW CUTTINGS INTERWOMEN INTO WOOD MATRIX UP TO FINISHED GRADE. BRUSH, LIMBS, AND WILLOW CUTTINGS SHALL PROJECT NO GREATER THAN 4 FT. BEYOND THE FINISHED BANK LINE.
9. BACKFILL WOOD MATRIX WITH STREAMBED FILL UP TO FINISHED GRADE WITH STOCKPILED NATIVE MATERIAL. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.
10. INSTALL DEFLECTOR LOGS (CATEGORY 2 WOOD)) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL BE HALF EMBEDDED IN THE FLOODPLAIN AND PROJECT NO GREATER THAN 4 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.



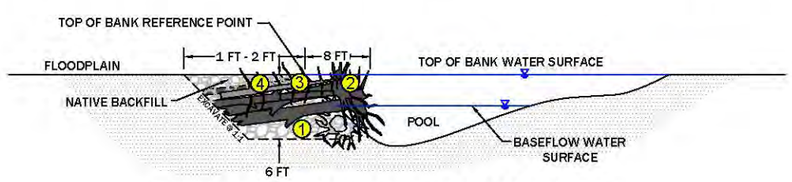
1 FOOTER LOGS PLAN VIEW 1" = 5'



2 ROOTWAD LOGS PLAN VIEW 1" = 5'



3 DEFLECTOR AND BRUSH WOOD PLAN VIEW 1" = 5'



4 LARGE WOOD STRUCTURE SECTION VIEW 1" = 5'

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	QUANTITY	DIA. (IN)	LENGTH (FT)	ROOTWAD (Y/N)
1	CY OF SUBGRADE EXCAVATION	5			
2	CATEGORY 1 WOOD	2	10-12	12-15	YES - 18 IN DIA. MIN.
3	CATEGORY 2 WOOD	4	3-10	10-15	NO
4	CATEGORY 3 WOOD	10	1-3	10-12	OPTIONAL 1-2 FT

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LARGE WOOD STRUCTURE DETAIL

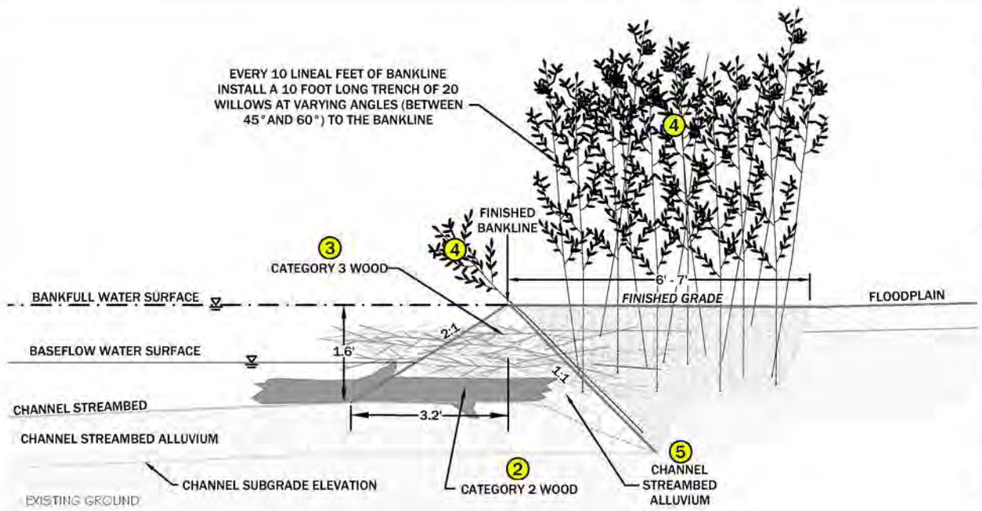
BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

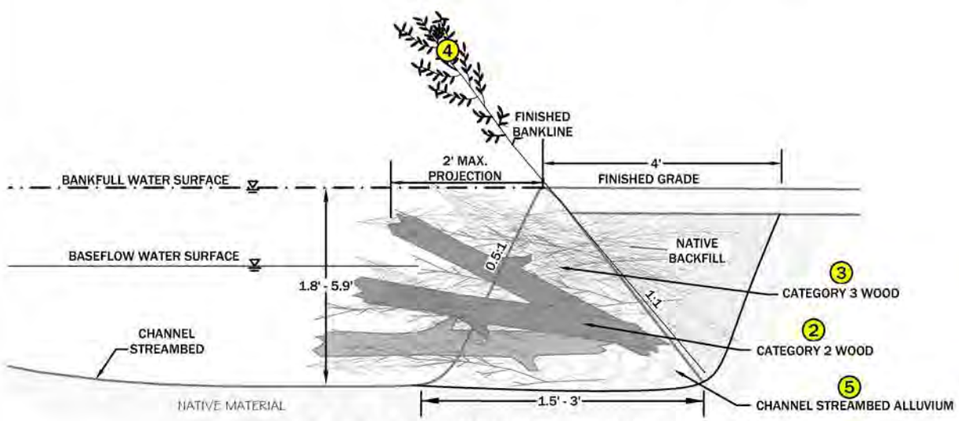
NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER RDG-21-006

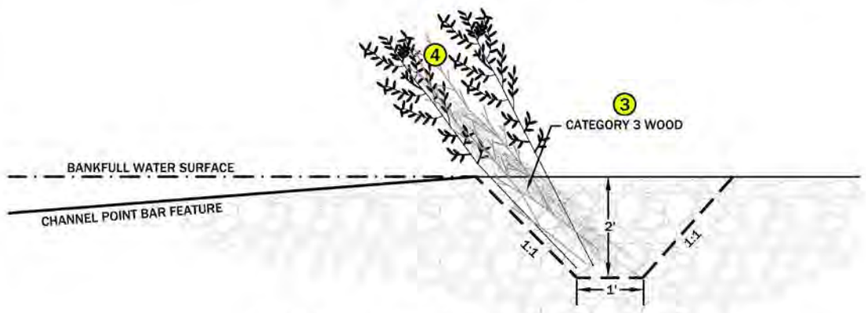
DRAWING NUMBER 8.0



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



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



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

GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER THE CHANNEL AND FLOODPLAIN BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED. INSTALLATION OF FLOODPLAIN TREATMENT SHALL BE COMPLETED AFTER VEGETATED WOOD 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.

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

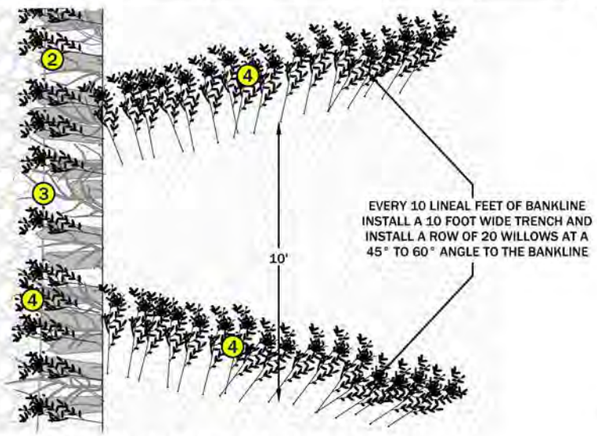
1. EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. PREPARE THE BENCH OF THE STRUCTURE BY PLACING CHANNEL STREAMBED ALLUVIUM FROM THE BASE OF THE EXCAVATION DEPTH/BOTTOM OF EXCAVATION TO WITHIN 1.0-FT. OF FINISHED GRADE.
3. CATEGORY 2 AND CATEGORY 3 WOOD, AND CHANNEL STREAMBED ALLUVIUM SHALL BE PLACED IN ALTERNATING LAYERS AND BUCKET COMPACTED UP TO THE TOP OF BANK ELEVATION AS SHOWN BELOW IN THE INSTALLATION SEQUENCE. PLACE SIX (6) FT TO EIGHT (8) FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER 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.
4. THE UPSTREAM AND DOWNSTREAM ENDS OF THE STRUCTURE SHALL TRANSITION SMOOTHLY INTO ADJACENT STREAMBANK STRUCTURES TO MINIMIZE EROSION, FLANKING, AND BANK FAILURE. STRUCTURE ENDS MAY BE STABILIZED WITH ADDITIONAL CATEGORY 1 ROCK AS APPROVED BY ENGINEER.
5. AFTER INSTALLATION OF THE VEGETATED WOOD MATRIX, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE, AND BUCKET COMPACT. INSTALL WILLOW TRENCHES AT A RATE OF 2 PER LINEAR FOOT (OR 20 PER TRENCH) AS SHOWN. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

STREAMBANK FILL GRADATION

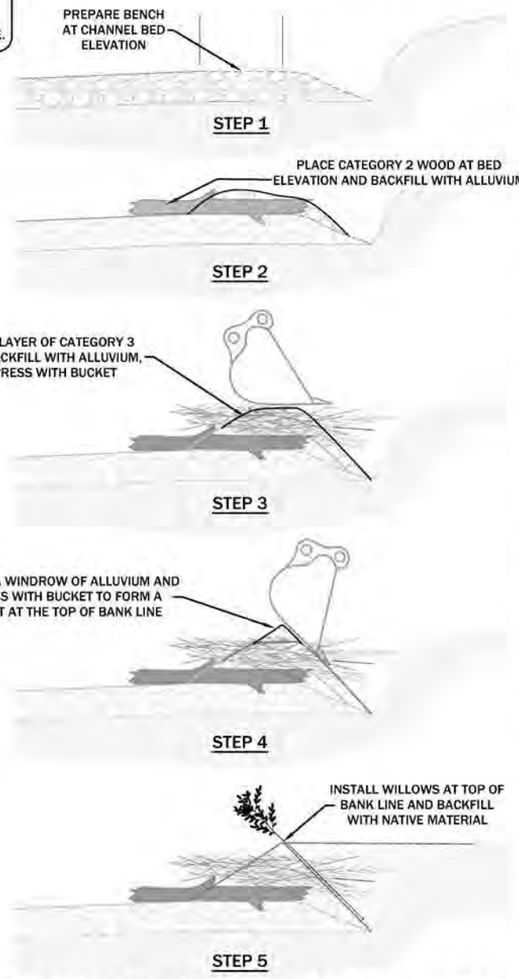
SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
5	90-95	D95
4	85-90	D84
3	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA.	QUANTITY TYPE 1	TYPE 2	TYPE 3
2	CATEGORY 2 WOOD	3" - 6"	0.25	2	-
3	CATEGORY 3 WOOD	< 3"	2	5	0.5
4	WILLOW CUTTINGS	0.25" - 1"	5	5	3
5	STREAMBANK ALLUVIUM	6" MINUS	0.2 CY	0.6 CY	-



4 WILLOW TRENCH DETAIL PLAN VIEW 1" = 2'



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

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VEGETATED WOOD MATRIX DETAIL

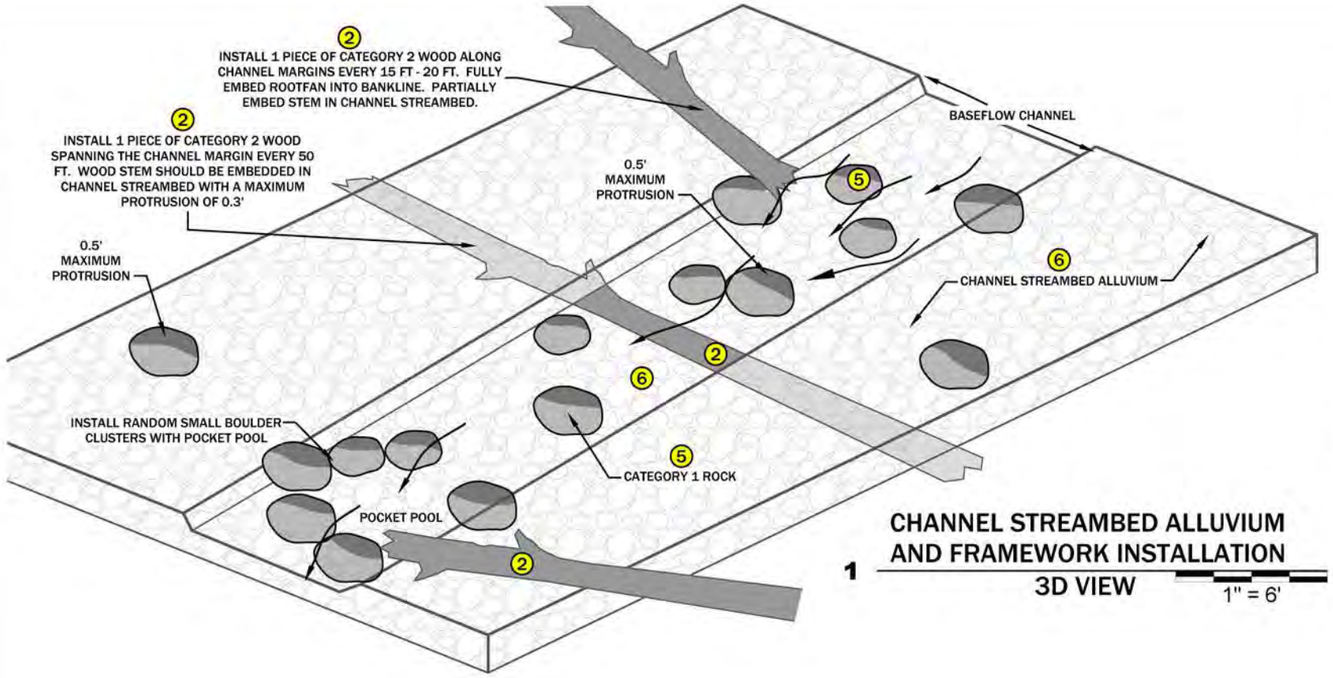
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

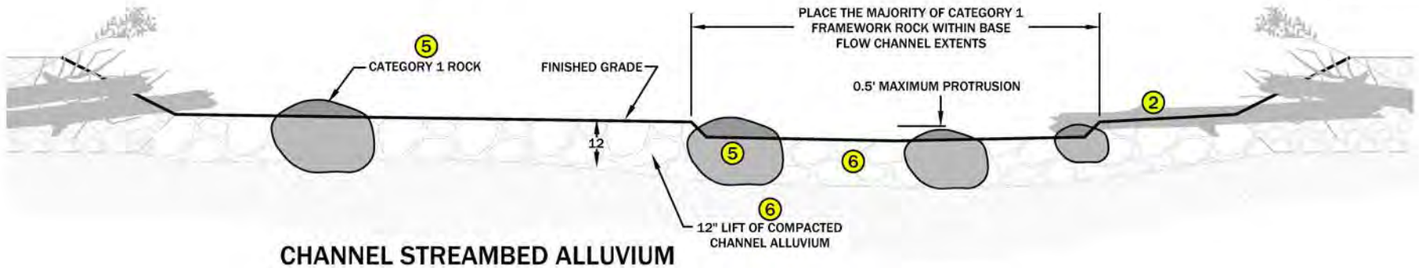
PROJECT NUMBER RDG-21-006

DRAWING NUMBER 8.1

Drawing 23 of 30



1 CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION
3D VIEW 1" = 6'



2 CHANNEL STREAMBED ALLUVIUM AND FRAMEWORK INSTALLATION
SECTION VIEW 1" = 4'

TYPICAL CONSTRUCTED STREAMBED THROUGH A RIFFLE FEATURE

TYPICAL CONSTRUCTED STREAMBED THROUGH A RUN FEATURE

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL STREAMBED WILL OCCUR AFTER THE CHANNEL SUBGRADE IS PREPARED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE CONSTRUCTION MANAGER.
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.

NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION

1. PRIOR TO CONSTRUCTION OF THE CHANNEL STREAMBED, CONSTRUCTION MANAGER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.
3. PREPARE THE FRAMEWORK. CONTRACTOR SHALL PLACE 12-INCH TO 18-INCH BOULDERS (CATEGORY 1 ROCK) ON THE SURFACE OF THE CHANNEL SUBGRADE PRIMARILY WITHIN THE LOW FLOW CHANNEL 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 0.5-FT.
4. CONTRACTOR MAY INSTALL 12-INCH TO 18-INCH BOULDERS (CATEGORY 1 ROCK) IN CLUSTERS, AS DIRECTED BY THE CONSTRUCTION MANAGER, 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 0.5-FT.
5. CONTRACTOR SHALL INSTALL CHANNEL SPANNING WOOD (CATEGORY 2 WOOD) AND CHANNEL MARGIN WOOD (CATEGORY 2 WOOD) TO PROVIDE AQUATIC HABITAT COMPLEXITY AND ROUGHNESS. CHANNEL SPANNING WOOD SHALL BE INSTALLED INTO THE BED PERPENDICULAR TO FLOW WITH A MAXIMUM PROJECTION OF 0.3'. CHANNEL MARGIN WOOD SHALL PROJECT NO GREATER THAN 8 FEET INTO THE CONSTRUCTED STREAMBED IN VARIOUS ORIENTATIONS TO FLOW, AS DIRECTED BY CONSTRUCTION MANAGER. CHANNEL MARGIN WOOD SHALL BE EMBEDDED INTO THE CHANNEL STREAMBED A MINIMUM OF ONE-HALF THE LOG DIAMETER, AS SHOWN ON THE DRAWINGS.
6. PREPARE THE MATRIX. AFTER THE FRAMEWORK, WOOD, BOULDER CLUSTERS, AND SMALL BOULDER RIBS ARE INSTALLED AND INSPECTED BY CONSTRUCTION MANAGER, PLACE APPROPRIATE CHANNEL STREAMBED ALLUVIUM GRADATION AND WASH FINES INTO STREAMBED. CHANNEL STREAMED ALLUVIUM SHALL BE PLACED TO THE FULL COURSE THICKNESS OF 12-INCHES TO FINISHED GRADE.

STREAMBED ALLUVIUM GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
5	90-95	D95
4	85-90	D84
3	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA.	QUANTITY
5	CATEGORY 1 ROCK	12" - 18"	0.8 EA
6	CHANNEL STREAMBED ALLUVIUM	8" MINUS	0.4 CY
2	CATEGORY 2 WOOD	3" - 6"	0.08 EA

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CONSTRUCTED CHANNEL STREAMBED DETAIL

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER RDG-21-006

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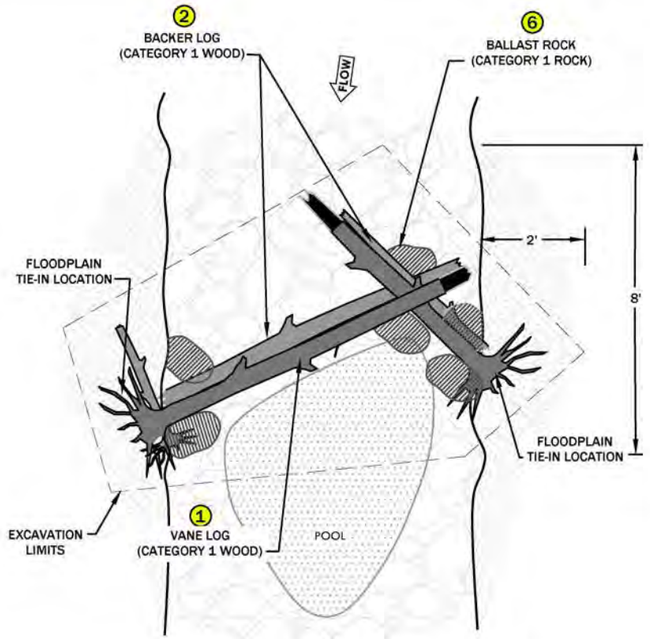
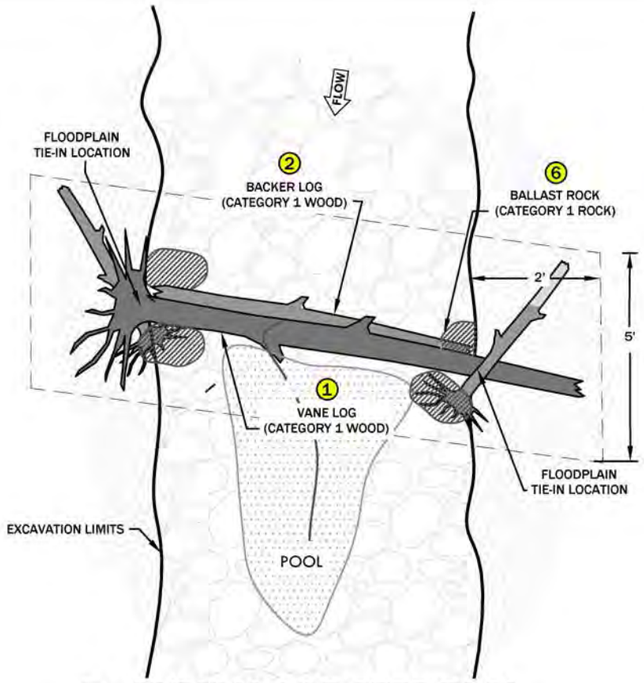
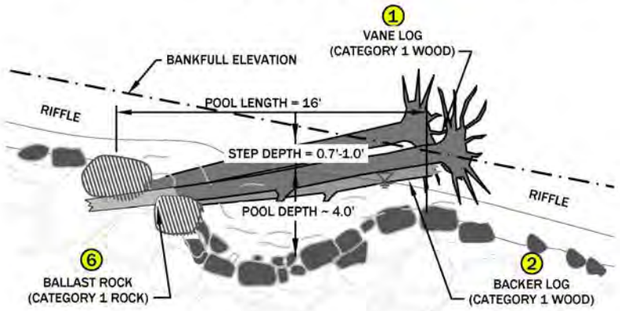


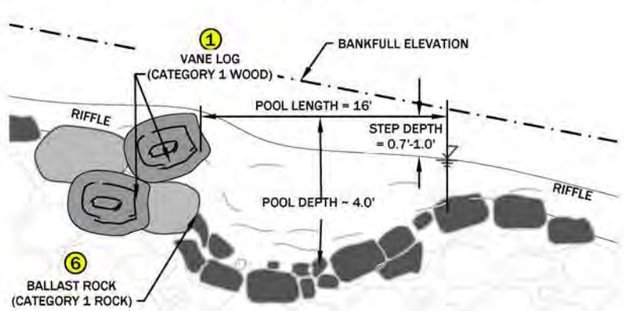
1 **TYPICAL LOG STEP POOL PLAN VIEW** NTS



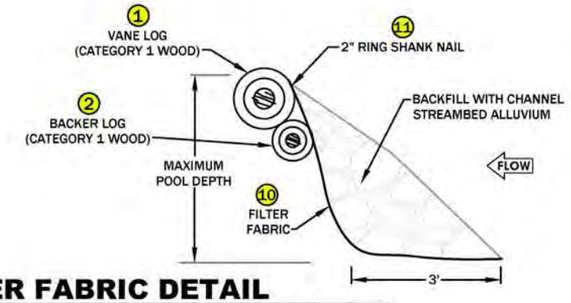
3 **TYPICAL LOG STEP POOL PLAN VIEW** NTS



2 **TYPICAL LOG STEP POOL PROFILE VIEW** NTS



4 **TYPICAL LOG STEP POOL PROFILE VIEW** NTS



5 **FILTER FABRIC DETAIL SECTION VIEW** NTS

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	QUANTITY
1	CATEGORY 1 WOOD	4
2	CATEGORY 2 WOOD	3
6	CATEGORY 1 ROCK	4
10	LF OF FILTER FABRIC	17
11	2" RING SHANK NAILS	20

GENERAL NOTES

1. CONSTRUCTION OF THE CHANNEL LOG STEP POOL WILL OCCUR PRIOR TO THE CONSTRUCTED CHANNEL.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
3. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY ENGINEER.
4. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE FLOODPLAIN AND CHANNEL STREAMBED TIE-IN LOCATIONS.

NOTES ON CONSTRUCTED CHANNEL LOG STEP POOL INSTALLATION

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

EXAMPLE OF A CONSTRUCTED LOG STEP POOL

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LOG STEP POOL DETAIL

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
8.3

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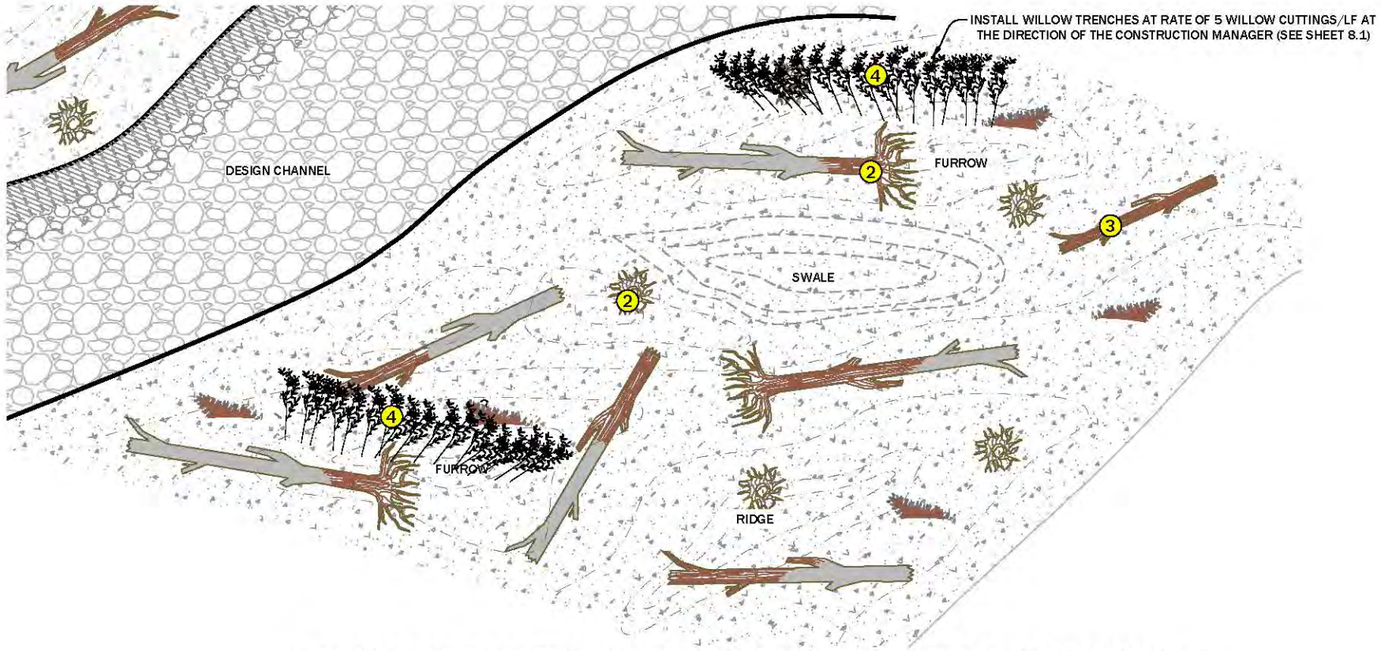


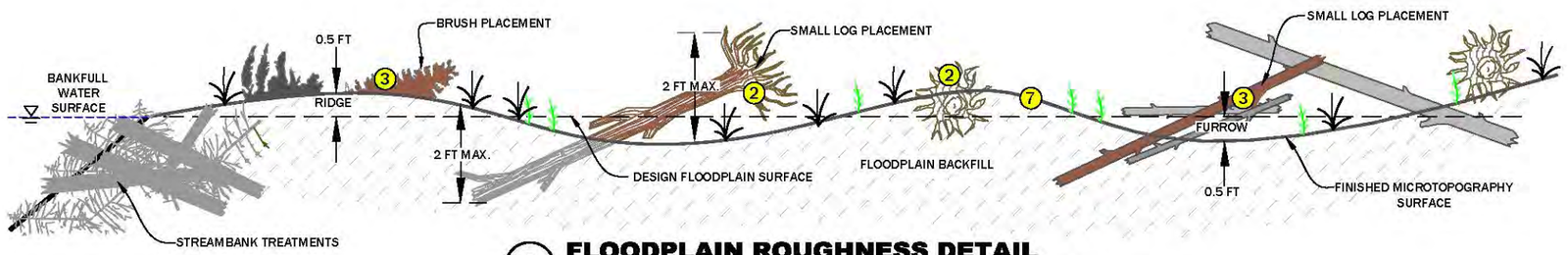
1 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
3D VIEW
NTS

GENERAL NOTES

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

NOTES ON FLOODPLAIN ROUGHNESS INSTALLATION

1. CONTRACTOR SHALL DEVELOP MICROTOPOGRAPHY AND PLACE WOODY MATERIAL IN THE CONSTRUCTED FLOODPLAIN.
2. INSTALL WILLOW TRENCHES ACROSS THE FLOODPLAIN PER THE DIRECTION OF THE PROJECT MANAGER. CONTRACTOR TO DIG A 2' DEEP TRENCH AND LAY WILLOW CUTTINGS AT A RATE OF 5/LINEAR FOOT. BACKFILL TRENCH TO FLOODPLAIN GRADE AND COMPACT TO REMOVE ANY AIR VOIDS.
3. TRANSPORT CATEGORY 2, AND CATEGORY 3 WOOD FROM FROM DESIGNATED STOCKPILE AREAS. 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.



2 FLOODPLAIN ROUGHNESS DETAIL
TYPICAL CROSS SECTION
NTS

MATERIAL SCHEDULE (PER ACRE)

	ITEM	DIA.	LENGTH	QUANTITY	UNIT
2	CATEGORY 2 WOOD	3" - 6"	10' - 12'	35	EA
3	CATEGORY 3 WOOD	<3"	10' - 12'	25	% COVER*
4	WILLOW TRENCH	0.25" - 1"	8'	5/LF	

*APPROXIMATELY 250 PIECES/ACRE

EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS


EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS


EXAMPLE OF CONSTRUCTED FLOODPLAIN SWALE

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FLOODPLAIN ROUGHNESS DETAIL

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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PROJECT NUMBER
RDG-21-006

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8.4

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GENERAL NOTES

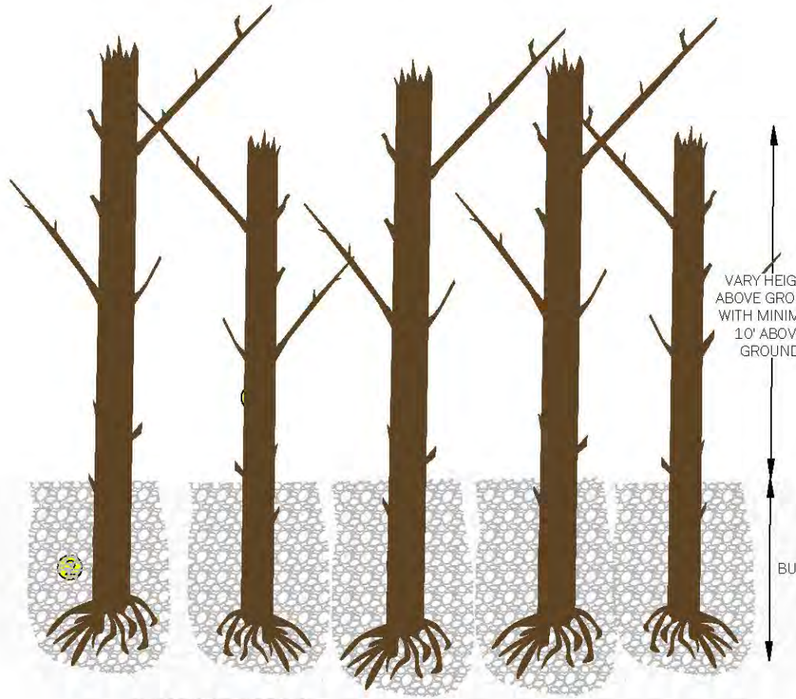
1. CONSTRUCTION OF THE WILDLIFE SNAGS WILL OCCUR AFTER THE SIDE CHANNEL AND FLOODPLAIN SUBGRADE BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR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

NOTES ON WILDLIFE SNAG INSTALLATION

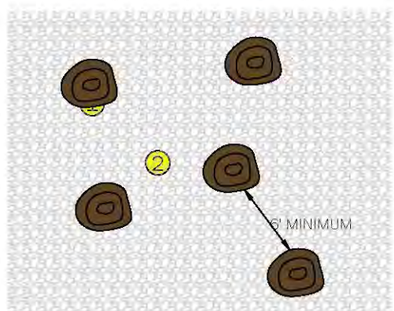
1. TRANSPORT SNAG TREES FROM DESIGNATED STOCKPILE AREAS TO THE TREATMENT SITES DESIGNATED BY CONSTRUCTION MANAGER.
2. INSTALL WILDLIFE SNAGS IN THE FLOODPLAIN SO THEY STAND VERTICALLY WITH NO LEAN AND WILL STAY STANDING AS THEY DECAY OVER TIME. DIG A HOLE A MINIMUM OF 4 FT DEEP AND LARGE ENOUGH FOR THE 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.

EXAMPLE OF AN INSTALLED WILDLIFE SNAG

EXAMPLE OF AN INSTALLED WILDLIFE SNAG POD



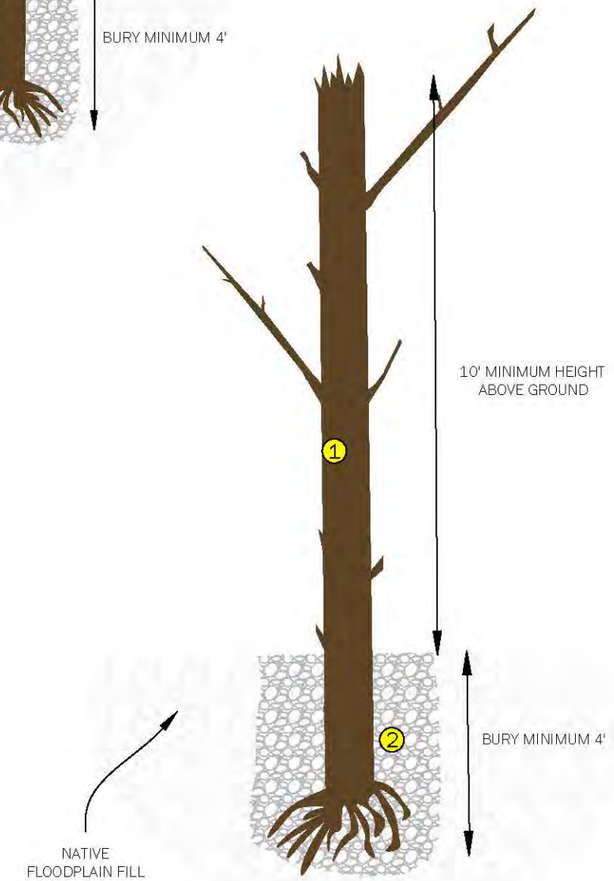
WILDLIFE SNAG POD
PROFILE VIEW



WILDLIFE SNAG POD
PLAN VIEW

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



SINGLE WILDLIFE SNAG
PROFILE VIEW

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236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927

WILDLIFE SNAG DETAILS

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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RDG-21-006

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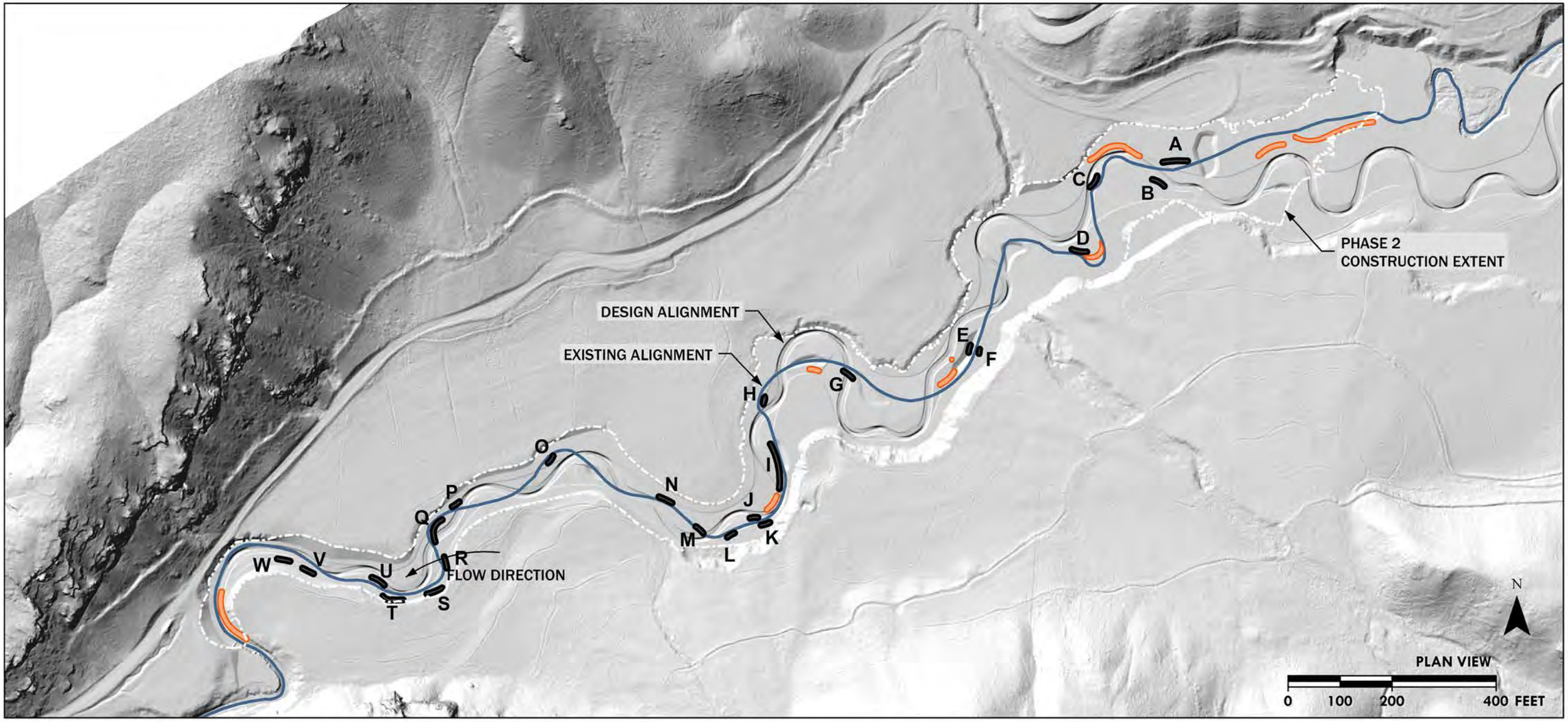
8.5



SHRUBS AND TREES TO SALVAGE AND TRANSPLANT TO CONSTRUCTED FLOODPLAIN

ID	SPECIES	NUMBER
A	SANDBAR WILLOW, COTTONWOOD SAPLINGS	12
B	COTTONWOOD	5
C	YELLOW WILLOW	4
D	SANDBAR WILLOW	5
E	COTTONWOOD	2
F	DOGWOOD	1
G	COTTONWOOD	5
H	COTTONWOOD	10
I	SANDBAR WILLOW, COTTONWOOD	15
J	COTTONWOOD	2
K	COTTONWOOD	1

ID	SPECIES	NUMBER
L	DOGWOOD	1
M	COTTONWOOD	10
N	SANDBAR WILLOW	4
O	YELLOW WILLOW	2
P	COTTONWOOD, ALDER	3
Q	COTTONWOOD, YELLOW WILLOW	9
R	YELLOW WILLOW, ALDER	3
S	YELLOW WILLOW, COTTONWOOD, ALDER	3
T	YELLOW WILLOW, COTTONWOOD	10
U	COTTONWOOD	10
V	ALDER	2
W	COTTONWOOD	2

TOTAL

SPECIES	NUMBER
SANDBAR WILLOW	22
YELLOW WILLOW	18
COTTONWOOD	74
ALDER	6
DOGWOOD	1
TOTAL	**121**

FEATURES

- SHRUB AND TREE SALVAGE
- VEGETATION PRESERVATION AREA

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VEGETATION SALVAGE PLAN

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

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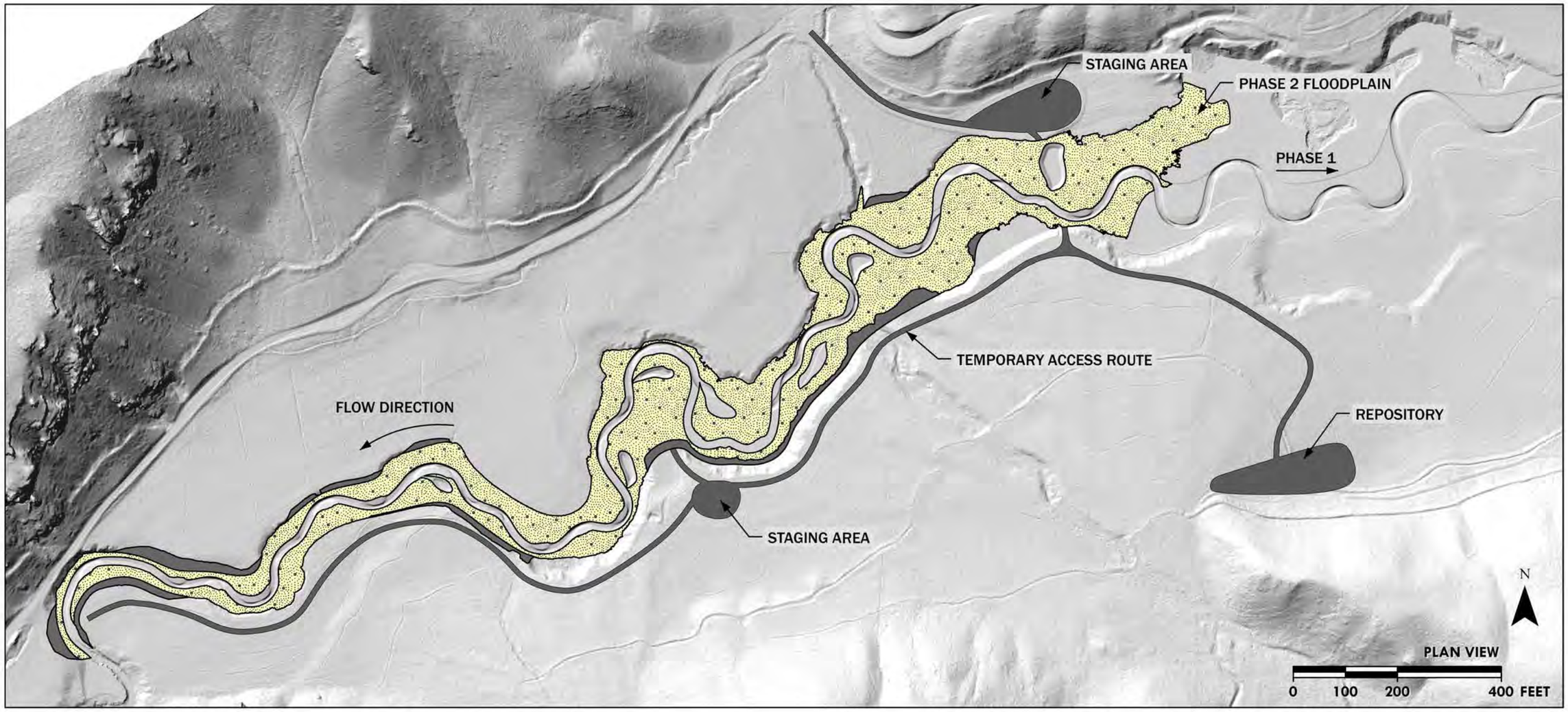
DRAWING NUMBER
9.0



LOCATION	SPECIES		PLS/ACRE	TOTAL PLS LBS
FLOODPLAIN 5.85 ACRES	BLUEJOINT REEDGRASS	*CALAMAGROSTIS CANADENSIS*	0.57	3.34
	BLUEBUNCH WHEATGRASS	*PSEUDOROEGNERIA SPICATA*	5.14	30.09
	THICKSPIKE WHEATGRASS	*ELYMUS MACROURUS*	5.14	30.09
	SLENDER WHEATGRASS	*ELYMUS TRACHYCAULUS*	3.57	20.89
	WESTERN WHEATGRASS	*PASCOPYRUM SMITHII*	9.14	53.49
	PRAIRIE FLAX	*LINUM LEWISII*	0.14	0.84
			TOTAL	138.73

LOCATION	SPECIES		PLS/ACRE	TOTAL PLS LBS
UPLAND 2.40 ACRES	IDAHO FESCUE	*FESTUCA IDAHOENSIS*	2.61	6.27
	BLUEBUNCH WHEATGRASS	*PSEUDOROEGNERIA SPICATA*	5.88	14.11
	STREAMBANK WHEATGRASS	*ELYMUS LANCEOLATUS*	5.88	14.11
	WESTERN WHEATGRASS	*PASCOPYRUM SMITHII*	10.45	25.08
	COMMON YARROW	*ACHILLEA MILLEFOLIUM*	0.04	0.10
			TOTAL	59.66

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SEEDING PLAN AND SCHEDULE

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER RDG-21-006

DRAWING NUMBER 9.1

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WOODY VEGETATION SALVAGE

YOUNG WILLOW, COTTONWOOD, ALDER, AND DOGWOOD SHRUBS/TREES SHALL BE SALVAGED AS SPECIFIED ON SHEET 9.0 (VEGETATION SALVAGE PLAN) TO THE GREATEST EXTENT POSSIBLE AND PLANTED IN LOCATIONS ON THE CONSTRUCTED FLOODPLAIN, SPECIFIED ON-SITE BY THE CONSTRUCTION MANAGER. HARVEST SHALL OCCUR SUCH THAT AN INTACT ROOT BALL REMAINS. SHRUBS AND TREE SHALL BE YOUNG AND BETWEEN 3 AND 10 FEET TALL, AND THE ROOTBALL (ROOTS AND SOIL MASS) SHALL BE THE DEPTH OF THE EXCAVATOR BUCKET. THE ROOTBALL SHALL BE WRAPPED IN BIODEGRADABLE BURLAP AND TWINE TO HOLD IT IN PLACE DURING TRANSPORT, AND SHALL BE LEFT UNDER THE TRANSPLANT DURING PLANTING, TAKING CARE TO NOT EXPOSE BURLAP ABOVE THE SOIL LINE. A SUITABLE STOCKPILE LOCATION SHALL BE IDENTIFIED BY THE CONSTRUCTION MANAGER FOR STAGING THE TREES/SHRUBS BEFORE THEY CAN BE PLANTED IN APPROPRIATE LOCATIONS. PLANTING HOLES SHALL BE PRE-DUG IN LOCATIONS SPECIFIED BY THE CONSTRUCTION MANAGER. THE HOLES SHALL BE BACKFILLED WITH SOIL AND WATER AFTER PLANTING. FILL SHALL BE ADEQUATELY COMPACTED TO MINIMIZE AIR POCKETS, BY LIGHLY TAMPING THE SOIL WITH THE EXCAVATOR BUCKET. TRANSPLANTS SHALL BE THOROUGHLY WATERED IMMEDIATELY FOLLOWING INSTALLATION. TRANSPLANTS SHALL BE PRUNED BACK FOLLOWING PLANTING, CUTTING OFF ONE-THIRD TO ONE-HALF OF THE ABOVE-GROUND BIOMASS.

BROADCAST SEEDING

BROADCAST SEEDING SHALL OCCUR IN ALL DISTURBED AREAS OUTSIDE OF THE CHANNEL AND POINT BAR AREAS. COMMERCIAL SEED MIXES AND BROADCAST RATES ARE PROVIDED ON SHEET 9.3 (SEEDING SCHEDULE). IN ADDITION TO BROADCAST SEEDING OF FLOODPLAINS, SLOPE AREAS, AND DITCH RECLAMATION AREAS, SEEDING SHALL OCCUR ON ALL DISTURBED UPLAND SITES (MATERIALS STAGING AREAS, ACCESS ROUTES) AND SHALL CONSIST OF THE UPLAND SPECIES MIX AND SEEDING RATE (LBS/ACRE). SEED BROADCAST AREAS ARE DEFINED ON SHEET 9.1 (SEEDING PLAN). THE BROADCAST METHOD SHALL BE USED, WHEREBY SEED IS SCATTERED ON THE SURFACE OF THE GROUND INSTEAD OF PLANTED IN THE GROUND. FLOODPLAIN AREAS WITH MICROTOPOGRAPHY TREATMENT SHALL BE BROADCAST SEEDED AND DRAGGED. SEEDBEDS IN ALL OTHER AREAS SHALL BE PREPARED BY ROUGHENING THE SOIL SURFACE PRIOR TO SEED BROADCAST, THEN SEEEDED AND HARROWED. FLOODPLAIN AND UPLAND BROADCAST SEEDING SHALL OCCUR IN LATE FALL OR EARLY SPRING DEPENDING ON THE CONSTRUCTION TIMELINE.

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REVEGETATION SPECIFICATIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	3/03/21	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-21-006

DRAWING NUMBER
9.2

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