Montana Department of Transportation
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Memorandum

To: James Combs, P.E.
Highways Engineer

From: Tyrel G. Murfitt, P.E. TGM
Design Project Manager

Thru: Damian Krings, P.E. DMK
Road Design Engineer

Date: May 22, 2019

Subject: NH 49-1(25)9
Stone Creek - North
UPN 7931000
Work Type 140 - Reconstruction – without added capacity

Please Approve the Alignment and Grade Review for this project.

Approved James Combs Date 5/22/19
James Combs, P.E.
Highways Engineer

We are requesting comments from the below distribution. If no comments are received within two weeks of the release date, we will assume concurrence.

Distribution (electronic):

Jeff Ebert, Butte District Administrator
Stephanie Brandenberger, Bridge Engineer
James Combs, Highways Engineer
Roy Peterson, Traffic and Safety Engineer
Robert Stapley, Right-of-Way Bureau Chief
Lynn Zanto, Rail, Transit, & Planning Division Administrator
Kevin Christensen, Construction Engineer
Jeff Jackson, Geotechnical Bureau Chief
Jon Swartz, Maintenance Division Administrator
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cc:

Tyrel Murfitt EPS Project Manager, Butte District
Highways Master file
Damian Krings, Road Design Engineer

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Located at the end of this document

Introduction

This project has had several alignment and grade reviews since the first one in November 2014, when it was discovered that there are significant issues with subgrade and special aquatic resources north of the Beaverhead River crossing. This necessitated a reset on the AGR after considerable field investigation, groundwater monitoring, and wetland/fen delineation. The revised set of AGR plans were mailed out on June 25, 2018. The plans were distributed electronically and an AGR/LEDPA (Least Environmentally Damaging Practical Alternative) meeting was held on 8/14/2018. In attendance of the meeting was the following:

Duane Liebel, Butte Preconstruction Engineer
Joe Walsh, Butte District Projects Engineer
Justin Crow, Butte Dist. R/W Des. Super
Theresa Iwaniak, Butte Dist. R/W Super
Tyrel Murfitt, Butte Area Engineer – Road Design
Mike Degenstein, Road Design – Butte crew
Deb Wambach, Butte District Biologist
Rebecca Ridenour, Butte District Project Development Eng.
Nick Jaynes, Geotechnical Specialist
Greg Zeihen, Surfacing
J.R. Taylor, Butte Dist. Hydraulics Eng.

Scope of Work

The proposed scope of work is to reconstruct the roadway providing geometric improvements, shoulder widening, and structure replacements at Stone Creek and the Beaverhead River. The project was nominated as a Primary Rural Minor Arterial with a design speed of 55-mph and has since been upgraded to a Rural Principal Arterial (National Highway System) route with a design speed of 60-mph.

The work will include clearing, grading, drainage, structure replacement, gravel, plant mix surfacing, culverts, signing, striping, fencing and other miscellaneous items. Extensive right-of-way and utility relocation will be required.

Project Location and Limits

N-49 is in Beaverhead and Madison Counties and begins near the junction of N-89 and P-89 north of Dillon and ends near the junction of N-29 and P-29 in Twin Bridges. The project begins at RP 9.000± about 8.4 miles northeast of Dillon. The project extends northeasterly 7.322 miles to RP 16.306± and ends 10.7 miles southwest of Twin Bridges. The project stationing runs southwest to northeast. There are existing bridges over Stone Creek, RP 9.066±, and the Beaverhead River, RP 14.652±.

The length of the proposed reconstruction segment from RP 14.57± to RP 15.72± is approximately 1.14 miles, about 0.01 miles shorter than the PTW segment it would replace and is the only significant deviation from the PTW. Neither the project length nor the PTW length correlate to the difference in mileposts, which is most likely due to previous reconstruction within the project limits.

Work Zone Safety and Mobility

At this time, Level 2 construction zone impacts are anticipated for this project as defined in the Work Zone Safety and Mobility (WZSM) guidance. The plans package will include a Transportation Management Plan (TMP) consisting mainly of a Traffic Control Plan (TCP). A limited Transportation Operations (TO) component and a limited Public Information (PI) component will also be included in the plan package. These issues are discussed in more detail under the Traffic Control and Public Involvement sections.

Physical Characteristics

N-49 is functionally classified as a Rural Principle Arterial. It passes through rolling terrain transitioning to more level terrain north of the Beaverhead River. There are a moderate amount of approaches intersecting N-49 within the project limits.

Beaverhead Rock State Park is located west of N49 between RP 14.6± and RP 15.1±.

As-built plan information shows original construction with F-387(2) & (4) and F-387(5) in 1947 and 1953, respectively. F HES 49-1(5)9 improved the roadway with slope flattening, shoulder widening and guardrail in 1988. The PTW connection for the beginning of the proposed project contains the end of project STPP 49-1(7)2 which reconstructed the previous 7 miles of the corridor in 1994 to widen shoulders to 4 ft. as well as providing the subgrade for future widening to a 40 ft. top width. It should be noted that STPP 49-1(7)2 processed a change order under construction and built the additional 4 ft. per side on the provided subgrade width.

Reference Post (RP)	As-Built Stationing	Project Number	Year
6.85 to 27.59	340+47.1 to 1434+96.1	F-387(2) & (4)	1947
16.21 to 26.51	833+08.6 to 1378+00±	F-387(5)	1953
8.90 to 16.20	448+79.5 to 832+31.5	F HES 49-1(5)9	1988
1.85 to 9.02	76+41.7 to 455+00±	STPP 49-1(7)2	1994

Due to variability in original surfacing and overlays conducted after; the pavement depths vary from 0.5 ft. to 1.0 ft. and base course depths from 0.4 ft. to 2.4 ft. Base course thicknesses were less than the 0.65 ft. minimum in 8 of the 26 road borings.

According to the TIS Roadlog the current roadway width is 32 ft. for the beginning of the project, 24 ft. for most of the project and 26 ft. for the end of the project. However, previous subgrade widening and subsequent overlay, or widening operations, are commensurate with the current roadway width of 40 ft. at the beginning of the project and 24-26 ft. for the remainder of the project. These reported widths were confirmed using survey data.

The existing horizontal alignment consists of one 1637 ft. radius curve, four 2865 ft. radii curves, one 5730 ft. radius curve and one 9047 ft. radius curve. The superelevation rates at 60-mph for those radii curves should be 8%, 6%, 3% and 2%, respectively. The 1637 ft. radius curve has an insufficient superelevation with 6%. All of the 2865 ft. radius curves have insufficient superelevations with 4%, normal crown, 5% and 2%. The 5730 ft. radius curve has an insufficient superelevation with normal crown. The 9047 ft. radius curve has an insufficient superelevation with normal crown.

The vertical alignment needs to be reconstructed to improve sight distance and lessen the grade and rolling profile. The maximum as-built grade is -6.89% at as-built station 678+00, compared to the maximum grade of 4% for a rural principle arterial in rolling terrain. The maximum grade is exceeded at as-built station 455+00 with -4.05%, as-built station 571+00 with -4.01%, as-built station 651+00 with -6.00%, as-built station 659+00 with 4.65%, and as-built station 736+50 with -5.70%, which was reconstructed at some point to -4.92%. Thirteen vertical curves along the project do not meet current design criteria for stopping sight distance.

Existing fill slopes with a fill height of less than 5 ft. are 4:1 or flatter, fill slopes between 5 ft. and 10 ft. are 3:1 and over 10 ft. are 2:1.

Exiting ditch sections have 3:1 inslopes or flatter that extend 9 ft. beyond the ETW, and a 20:1 ditch bottom 6 to 8 ft. wide. Backslopes for cuts less than 5 ft. are 3:1, cuts over 5 ft. have 2:1 backslopes.

The proposed reconstruction is intended to address these geometric design criteria deficiencies.

PvMS indices & recommended treatment for 2018:

Section	Ride	Rut	ACI	MCI	Construction	Maintenance
RP 9.01 to 16.19	77.2	71.3	95.4	97.5	Do Nothing	Do Nothing

The following bridges are within the project limits and will be replaced:

Bridge ID	RP	Feature Crossed	Width	Length	Year Constructed	Sufficiency Rating
P00049009+00571	9.066	Stone Creek	30 ft.	38 ft.	1949	66.4
P00049014+06711	14.652	Beaverhead River	31.8 ft.	150 ft.	1949	60.7

The design speed is 60-mph. The posted speed is 70-mph for daylight hours, 65-mph for nighttime hours, 60-mph for trucks during daylight hours and 55-mph for trucks during nighttime hours.

Horizontal Alignment

The proposed horizontal alignment of N-49 generally follows the existing alignment with offsets balanced to optimize traffic during construction, avoid natural and manmade features, utilities, balance earthwork, and minimize right-of-way impacts. The only significant divergence from the existing alignment is before the existing structure over the Beaverhead River to increase the radius of the curve with and identified crash cluster, align with the proposed structure and minimize impact to sensitive areas.

The proposed alignment below meets the criteria for a 60-mph design speed.

From	To	Alignment Feature (radius)	Remarks
POT 454+00.00	PC 482+77.58	2878’ tangent	Transitions centerline from PTW to 17’ right.
PC 482+77.58	PT 496+44.67	3115’ curve (5% super), Δ=25°08’44” RT	Replaces 45-mph curve with 60-mph curve. Diverges up to 23’ right of PTW.
PT 496+44.67	PC 580+19.27	8375’ tangent	Transitions centerline from 17’ right of PTW to 19’ left of PTW. Centerline and PTW coincident at about 536+00.
PC 580+19.27	PT 586+28.37	5000’ curve (4% super), Δ=6°58’47” RT	Replaces less than 30-mph curve with 60-mph curve. Transitions centerline from 19’ left to PTW.
PT 586+28.37	PC 626+39.97	4012’ tangent	Follows PTW centerline and ends with a 2’ offset to the left.
PC 626+39.97	PT 634+87.86	7070’ curve (3% super), Δ=6°52’17” LT	Replaces 40-mph curve with 60-mph curve. Transitions centerline from 2’ left to 15’ left of PTW.

PT 634+87.86	PC 658+37.64	2350' tangent	Transitions centerline from 15' left to 36' left of PTW.
PC 658+37.64	PT 661+63.80	15000' curve (normal crown), Δ=1°14'45" RT	Continues 36' offset left of PTW.
PT 661+63.80	PC 709+29.48	4766' tangent	Transitions centerline from 36' left to 27' right of centerline. Centerline and PTW coincident at about 689+00.
PC 709+29.48	PT 710+70.86	15000' curve (normal crown), Δ0°32'24" LT	Continues 27' offset right of PTW.
PT 710+70.86	PC 733+78.28	2307' tangent	Transitions centerline from 27' right to 36' right of PTW.
PC 733+78.28	PT 749+23.12	2515' curve (6% super), Δ=35°11'38" LT	Replaces 45-mph curve with 60-mph curve. Transitions from 36' right of centerline to a maximum divergence left of 28' and ends 8' right of centerline. Centerline and PTW are coincident at about 738+50 and 748+50.
PT 749+23.12	PC 802+49.33	5326' tangent	Replaces 50-mph curve. Transitions centerline from 8' right to 69' right of PTW. Diverges up to 356' right of PTW.
PC 802+49.33	PT 809+95.59	4000' curve (4% super), Δ=10°41'22" RT	Transitions centerline from 69' right back onto PTW.
PT 809+95.59	PC 818+53.96	858' tangent	Follows PTW centerline.
PC 818+53.96	PT 822+99.06	3175' curve (5% super), Δ=8°01'56"	Replaces 55-mph curve with 60-mph curve. Transitions centerline from PTW to 8' right.
PT 822+99.06	PC 826+36.87	338' tangent	Transitions centerline from 8' right to 9' right of PTW.
PC 826+36.87	PT 833+63.91	3620' curve (5% super), Δ=11°30'26"	Replaces 30-mph curve with 60-mph curve. Transitions from 9' right back to PTW centerline.
PT 833+63.91	POT 840+57.93	694' tangent	Follows PTW centerline.

Vertical Alignment

The vertical alignment described below meets the criteria for a 60-mph design speed. The grades range from 0.170% to -4.000%.

BOP 454+00.00	VPC 466+11.20	Two grades: -3.755% and -0.306% connected by a 550' sag curve.	The profile is raised above the PTW. A -4.050% grade and a 50-mph sag curve are replaced with a -3.755% grade and a 60-mph sag curve.
VPC 466+11.20	VPC 484+89.37	Two grades: -0.306% and 1.240% connected by an 1800' sag curve.	The profile ranges from above the PTW, is coincident with the PTW at about 480+00 and ends below the PTW.
VPC 484+89.37	VPC 503+21.92	Two grades: 1.240% and -0.200%	The profile ranges from below the PTW to above the PTW and is coincident

		connected by an 850' crest curve.	near the approach at 488+50. A nearly flat grade and a 75-mph crest curve are replaced by a -0.200% grade and an 80-mph crest curve.
VPC 503+21.92	VPC 514+23.68	Two grades: -0.200% and -2.000% connected by a 1000' crest curve.	The profile is below the PTW. A -3.740% grade and 55 mph crest curve are replaced by a 2.000% grade and an 80-mph crest curve.
VPC 514+23.68	VPC 526+56.28	Two grades: -2.000% and 1.940 % connected by a 1000' sag curve.	The profile ranges from above the PTW to below the PTW and is coincident at 516+00 and 521+75. A 50-mph sag curve is replaced by an 80-mph sag curve.
VPC 526+56.28	VPC 545+31.68	Two grades: 1.940% and 0.800% connected by a 1050' crest curve.	The profile ranges from below the PTW to above the PTW and is coincident at 531+50 and 545+00. A 55-mph crest curve is replaced by an 80-mph crest curve.
VPC 545+31.68	VPC 563+30.38	Two grades 0.800% and -0.400% connected by a 1000' vertical curve.	The profile starts and ends near the PTW and is coincident at 552+00 and 561+00. A flat grade and 55 mph crest curve are replaced by a -0.400% grade and 80 mph crest curve.
VPC 563+30.38	VPC 571+13.03	Two grades: -0.400% and -4.000% connected by a 695' crest vertical curve.	The profile starts and ends below the PTW. A 55-mph crest curve is replaced by a 65-mph crest curve.
VPC 571+13.03	VPC 583+99.87	Two grades: -4.000% and 1.000% connected by an 860' sag curve.	The profile begins and ends below the PTW. A 50-mph sag curve is replaced by a 60-mph sag curve.
VPC 583+99.87	VPC 606+32.66	Two grades: 1.000% and -1.000% connected by a 2000' crest curve.	The profile begins below the PTW and ends above the PTW and is coincident at 588+75.
VPC 606+32.66	VPC 610+02.28	Two grades: -1.000% and 0.940% connected by a 300' sag curve.	The profile begins and ends above the PTW. A 40-mph curve is replaced by a 65-mph sag curve.
VPC 610+02.28	VPC 634+67.94	Two grades: 0.940% and -0.200% connected by a 700' crest curve.	The profile begins above and ends below the PTW. They are coincident at 620+00. A 75-mph crest curve is replaced be an 80-mph crest curve.
VPC 634+67.94	VPC 653+01.96	Two grades: -0.200% and -3.050% connected by a 1200' crest curve.	The profile begins below and ends above the PTW. They are coincident at 652+00. A -6.000% grade is replaced by a -3.050% grade. A 60-mph crest curve is replaced by an 80-mph crest curve.
VPC 653+01.96	VPC 663+58.88	Two grades: -3.050% and 3.100% connected by a 1030' sag curve.	The profile begins above and ends below the PTW. It is coincident at 659+00. A -6.150% grade and a 30-mph sag curve are replaced by a -3.050% grade and a 65-mph sag curve.

VPC 663+58.88	VPC 675+39.34	Two grades: 3.100% and -3.800% connected by a 1085' crest curve.	The profile begins and ends below the PTW. A 4.410% grade and 60-mph crest curve are replaced by a 3.100% grade and a 65-mph crest curve.
VPC 675+39.34	VPC 705+59.20	Two grades: -3.800% and -0.600% connected by a 1700' sag curve.	The profile begins below and ends above the PTW. It is coincident at 678+00, 684+50 and 695+50. A 7.180% grade, 30-mph sag curve, 65-mph crest curve and 55-mph sag curve are replaced by a -3.800% grade and an 80-mph crest curve.
VPC 705+59.20	VPC 723+77.34	Two grades: -0.600% and 0.400% connected by a 900' sag curve.	The profile begins and ends above the PTW. It is coincident at 706+00 and 714+00. A 60-mph crest curve and 60-mph sag curve are replaced by an 80-mph sag curve.
VPC 723+77.34	VPC 738+65.93	Two grades: 0.400% and -3.150% connected by an 1100' crest curve.	The profile begins and ends above the PTW. A 60-mph crest curve is replaced by an 80-mph crest curve.
VPC 738+65.93	VPC 778+26.78	Two grades: -3.150% and -0.395% connected by a 750' sag curve.	The profile begins and ends above the PTW. A -4.850% grade and a 40-mph sag curve are replaced by a -3.150% grade and an 80-mph sag curve.
VPC 778+26.78	VPC 784+54.05	Two grades: -0.395% and 0.170% connected by a 500' sag curve.	The profile begins and ends below the PTW.
VPC 784+54.05	VPC 796+73.74	Two grades: 0.170% and -0.640% connected by a 1150' crest curve.	The profile begins and ends below the PTW.
VPC 796+73.74	VPC 800+93.34	Two grades: -0.640% and 0.710% connected by a 350' sag curve.	The profile begins below and ends above the PTW.
VPC 800+93.34	VPC 811+79.13	Two grades: 0.710% and -0.737% connected by a 1000' crest curve.	The profile begins and ends above the PTW.
VPC 811+79.13	VPC 829+92.59	Two grades: -0.737% and 0.200% connected by a 1750' sag curve.	The profile begins and ends above the PTW.
VPC 829+92.59	VPC 837+69.02	Two grades: 0.200% and -1.350% connected by a 700' crest curve.	The profile begins and ends above the PTW.
VPC 837+69.02	EOP 840+80.27	Two grades: -1.350% and -0.650% connected by a 300' sag curve	The profile starts above and ends at the PTW.

Surfacing and Typical Section

Surfacing Design's recommendation for a 20-year design life is 0.35' plant mix surfacing and 1.10' crushed aggregate course for reconstruction from the beginning of the project to approximately RP 13.5; 0.35' plant mix surfacing and 1.50' crushed aggregate course for reconstruction from approximately RP 13.5 to the end of the project; and 0.35' plant mix surfacing, 0.80' crushed aggregate course and 2.00' special borrow for new alignment or sub-excavation. Forthcoming Geotechnical recommendations for constructability and long-term settlement mitigation are likely to change the design R-Value for the reconstruction typical. The subgrade is expected to be constructed with special borrow increasing the R-Value to 30. Final surfacing recommendations are to be provided after the Geotechnical Alignment report is completed.

Two alternative recommendations were also made for the thickest recommended section from RP 13.5 to the end of the project, 0.35' plant mix surfacing and 1.05' cement treated base or 0.35' plant mix surfacing and 1.05' crushed aggregate course with geogrid and geotextile.

A seal coat with type 1 cover material and CRS-2P seal oil will be placed full width atop the pavement.

We propose a top width of 40 feet, which will accommodate two 12-ft. travel lanes and 8-ft. shoulders. This is consistent with the route segment plan and NHS standards.

Standard 6:1 surfacing inslopes are proposed from the beginning of the project, sta. 454+00, to sta. 757+00 where they transition to 4:1 and remain to the end of the project, sta. 840+57.93. The surfacing shoulder will extend 9.9' beyond the edge of the plant mix shoulder for a crushed aggregate thickness of 1.10' and an inslope of 6:1, 12.6' beyond the shoulder for a CAC thickness of 1.50' and an inslope of 6:1, 8.0' beyond the shoulder for a CAC thickness of 1.50' and an inslope of 4:1 and 5.0' beyond the shoulder for a CAC thickness of 0.80' and an inslope of 4:1.

Standard ditch sections with a 10-ft. 6:1 foreslope, 10-ft. 20:1 flat bottom ditch and standard backslopes, excluding 1:5:1, are proposed.

Standard fill slopes are proposed through sta. 747+00 where they will be steepened to 2:1 to avoid the river channel through sta. 756+00. The standard fill slopes will be steepened from that point on to 4:1 avoid/minimize impacts to sensitive wetland areas, hydrothermal features, existing irrigation and right-of-way.

Grading

The greatest impact on the grading will be the embankment beginning when dropping into the Beaverhead valley which extends through the proposed structure and wetland WL-19. There are also significant embankments around sta. 540+00, sta. 606+00, sta. 655+00, sta. 681+00, sta. 700+00 and sta. 719+00. There are significant excavations around sta. 510+00, sta. 570+00, sta. 645+00, sta. 669+00, sta. 690+00, sta. 709+00 and sta. 730+00.

Balance points do not account for approach grading at this time and are at sta. 456+85, sta. 506+57, sta. 542+97, sta. 546+30, sta. 557+93, sta. 564+97, sta. 608+63 and sta. 631+25.

The preliminary quantities show 560,000 yards excavation and 622,000 yards of adjusted embankment, shrink factor 25%, resulting in 62,000 yards of borrow. The AGR earthwork indicates a balanced project. Grading will change as forthcoming Geotechnical recommendations for constructability and long-term settlement mitigation will likely replace a significant amount of embankment material with special borrow, embankment foundation treatment, and/or rock fill.

Geotechnical Considerations

The subsurface investigation has been completed for this project. Results and alignment recommendations have been provided for the southern portion of the project (BOP to and including the bridge over the Beaverhead River). Subsurface investigation results and recommendations for the proposed box culverts at Stone Creek and Warm Springs Ditch (approximate sta. 798+00), the proposed structure at the Beaverhead River and the alignment of the northern portion of the project (north of the Beaverhead River to the EOP) are forthcoming.

New embankments and the bridge approach north of the Beaverhead River will be constructed on top of poor subgrade soils and in areas of elevated groundwater. Subgrade shear failure is possible during embankment construction, especially with repeated movement of heavy construction equipment. Two alternatives for embankment foundation treatment will be recommended in this portion of the project, depending on whether subexcavation and salvaging of organic topsoil is needed for wetland mitigation or not. Staged construction of the bridge approach and embankments will be recommended to allow complete settlement of the subgrade soils and dissipation of excess pore water pressures.

A long-term groundwater monitoring program is being performed by a consultant north of the Beaverhead River. The program will be continued through construction and likely for a period of time after major construction is complete.

For general stability, all embankment and bridge approach slopes should be shown at 3H:1V or flatter and all cut slopes should be shown at 2H:1V or flatter.

Hydraulics

The major drainages that affect the roadway alignment are Stone Creek and the Beaverhead River at sta. 457+56 and sta. 753+73, respectively. A preliminary recommendation from hydraulics was to replace the timber structure over Stone Creek with a box culvert(s). A 12’ span x 8’ rise RCB will handle most of the streamflow with a 10’ span x 10’ rise RCB for stock passage set up high enough so water will not flow except during larger storm events. A re-evaluation of the box with respect to site conditions and constructability prompted the recommendation of a double cell box culvert with a 10’ rise. One side will have a 12’ span for streamflow and the other a 10’ span with material filled in to provide a grade separation to be used as stock passage and overflow for larger storm events. The profile grade raise will allow sufficient cover and the offset horizontal alignment should allow for a detour if necessary. The placement of the structure over the Beaverhead River balanced many considerations, including sight distance from East Bench Road, minimum grade, flattening of the horizontal curve into the bridge, hydraulic opening requirements, river channel migration, distance from the existing bridge so the existing can be used as a detour and the location of the work bridge.

There are six minor unnamed drainages that cross the roadway at stations 518+18, 574+72, 606+61, 654+76, 680+35, and 734+68. All are conveyed through 36” RCP’s except for a 48” RCP at sta. 680+35 and a 90” stock pass at 654+76. There is also a 90” stock pass at sta. 577+73 that is not associated with a drainage. The preliminary flows appear to be high compared to existing culvert size though there have been no known overtopping events or drainage structure flood summary reports found.

Some minor channel modification may be required to improve channel stability at the highway crossings, notably Stone Creek due to the box culvert and large embankment.

Culvert condition and depth of fill, as well as proposed ditch configuration and grade, will determine whether culverts are removed and replaced, abandoned and relocated, or extended.

The project runs through irrigated cropland and coordination with local irrigation districts will be conducted by right-of-way. Several small irrigation structures cross the highway beginning at sta. 734+68 and ending at sta. 819+14. Two 54" equivalent pipe arches are located at sta. 786+90 approach LT. An existing irrigation ditch is located on the west side of the roadway from 782+62 to 798+50. An existing irrigation ditch is located on the east side of the roadway from 784+80 to 850+00, warm springs ditch. The impact to this ditch will be minimized when transitioning the alignment back to the PTW. This transition will take place before the maximum travel of a large irrigation pivot centered about 1400' east of warm springs ditch minimizing impact to an area of a hayfield that appears to be flood irrigated.

Currently there are no FEMA flood plain maps within the project area and it is anticipated that a flood plain permit will not be required for this project.

Permanent Erosion and Sediment Control (PESC) Features

Riprap armoring of the bridge in-slopes at station 753+73 will use PESC features, as well as the inlet and outlet ends of the culvert over stone creek at station 457+56. It is likely that riprap chutes will be necessary to convey drainage down some of the steeper fill slopes. As the plans are developed locations for these PESC features and others will be identified and documented in subsequent reports.

Bridges

The bridges within the project limits have been inspected and the following work will be performed:

Bridge ID	Drainage	Location	Work Proposed
P00049009+00571	Stone Creek	9 miles NE Dillon	Bridge Replacement with RCB
P00049014+06711	Beaverhead River	12 miles SW Twin Bridges	Bridge Replacement

The proposed box culvert at Stone Creek, a double cell with 10' rise, will offset the horizontal alignment slightly to assist in constructability and traffic control. The existing timber structure is currently in a sag curve with insufficient stopping sight distance and is adjacent to a grade exceeding the maximum. Raising the grade to flatten the curve and adjacent grade as well as balancing culvert cover and clear zone considerations control the vertical alignment.

The proposed structure at the Beaverhead River (40' x 181' two-span concrete) is located along the divergence of the horizontal alignment from the PTW and is on a horizontal and vertical tangent. The existing structure is adjacent to a horizontal curve with insufficient radius, a vertical curve with insufficient stopping sight distance, a grade exceeding maximum and insufficient intersection sight distance from the approach at East Bench Rd. The position and elevation of the proposed structure will allow all the alignment criteria to meet current design standards. The existing structure will be used as the detour route while the new bridge is being built off the PTW. The proposed design of the new structure will incorporate unequal spans to keep the pier(s) out of the active channel of the Beaverhead River.

Traffic

Access to existing public road approaches will be perpetuated with 75' landings. Private and farm field approached will receive 25' landings. Due to existing terrain and proposed improvements to the vertical profile some approaches may require grades as steep as 10%.

Crash clusters have been identified on sections on both sides of the bridge. In 2004, 2008, and 2010 the section between RP 15.4 and RP 16.1 was identified. No recommendations were made as there was no feasible countermeasure identified to address any specific crash trend. The proposed design eliminates a 50-mph curve with a tangent and replaces a 55-mph curve with a 60-mph curve as well as widening the shoulder to 8'. In 2003, 2007, and 2009 the section between RP 14.1 and RP 14.9 was identified as a crash cluster. As a result, curve warning signs and delineation were installed by MDT maintenance in fall of 2005. The crash cluster persisted prompting safety project HSIP 49-2(11)14, UPN 7526 was nominated to reconstruct the curve but ended being scoped as just a signing upgrade with flashing chevrons. The crash rate is lower than the statewide average for rural state primary routes while the severity index and rate are higher than the statewide average for primary routes. Traffic recommends reconstruction to current design standards. The proposed design replaces a 45-mph curve with a 60-mph curve and widens the shoulders to 8'.

Intelligent Transportation Systems (ITS) Features
No, ITS feature is currently proposed, existing flashing chevrons may be re-evaluated.

Miscellaneous
Mailboxes exist on numerous approaches along the project, turnouts will not be provided as 8-foot shoulders are planned. It is unlikely that mailboxes can be clustered based on the rural location of the project and the sparse housing. It is anticipated that all mailboxes will be single installations.

There are three well-used turnouts within the project limits. The first begins at about sta. 666+64 and is about 50' wide and 225' long. This turnout is atop a crest curve adjacent to the steepest existing grade within the project limits. The proposed design shifts the alignment west over the pullout and lowers the grade increasing sight distance and decreasing the existing adjacent grade but also puts the section in a cut condition and may require a long drain, shortening of the ditch section or steepening of the back slope. The proposed construction limits through this section would already require right-of-way acquisition. This turnout has not been designed at this time and will most likely be relocated and paved.

The second turnout is the snow plow turnaround at the county line which starts at about sta. 701+47 and is 75' wide by 145' long. The proposed design is reconstructed and repaved in the same location, but the horizontal alignment shifts east, and the grade raise reduce the width to 50' if catching the existing edge of pavement and fill slope. The approach radii have been increased to help alleviate turning movements in a narrower turnout, but additional widening would most likely require right-of-way acquisition or at least a construction permit if daylighting slopes.

The last pullout is a viewing area with visitor information signs about Lewis & Clark and the Beaverhead River Valley. It starts at about sta. 710+70 and is 125' wide by 140' long. Although the alignment is shifted significantly to the west the lowered grade through this section requires the approach grade to be chased back onto the pullout. The proposed design has the approaches tying into the existing pullout. Full reconstruction and pavement of the turnout will be included.

New metal guardrail meeting current MASH requirements is proposed where warranted at various locations throughout the project to shield obstacles or slopes.

Design Exceptions

No design exceptions are currently anticipated for the horizontal and vertical alignment. Design exceptions pursued and documented are steepened inslope and fill slope ratios. The AGR plans currently have the following incorporated into the plans. A minimum inslope/fill slope ratio of 4:1 from sta. 747+00 to the EOP and steeper fill slopes, 2:1 on the bridge approach sections for the proposed bridge over the Beaverhead River, sta. 747+00 to sta. 755+00. For additional information reference the design exception report dated August 4, 2017 stored in DMS (7931000RDDER001.pdf).

Right-of-Way

Existing right-of-way widths are typically 60-230 feet left of and 80-300 feet right of the PTW throughout the project. In certain areas the proposed construction limits extend past the existing right-of-way from 10’ to 130’ for embankments project right, 10’ to 55’ for excavations project right, 15’ to 65’ for embankments project left and 10’ to 40’ for excavations project left. The construction limits were extended in excavations where standard backslopes that were 1.5:1 were flattened to 2:1 per geotechnical recommendations. The construction limits were narrowed where standard 6:1 fill slopes were steepened to 4:1 for avoidance and minimization of impacts. A few of the steeper embankments appearing to impact the existing right-of-way in the alignment and grade plans have slopes that will most likely warrant guardrail which may steepen slopes and eliminate impacts.

We anticipate we will need to acquire approximately 50 acres to accommodate our proposed design. The proposed alignment diverges from the PTW around sta. 749+00 and the tangent north of the river will require most of the right-of-way acquisition on the project. The grade reductions as well as the vertical curve flattening result in significant grade separations for many of the approaches. Many of the approaches due to landing lengths and approach grades will require construction permits to tie into the existing approach.

It is anticipated that the project will not require a modification (addition or reduction) to the current federal aid agreement for R/W. Additional review will be conducted during future milestone reports.

Utilities/Railroads

Utilities will be impacted throughout the project. Overhead power and underground communications run along the right-of-way fence most of the project length. Several power poles will likely be impacted due to horizontal alignment shifts and underground utilities will likely be impacted due to excavations out to the right-of-way limit from lowering the grade.

There are no railroad facilities in the area and no railroad involvement is anticipated.

Environmental Considerations

The environmental review of this project is anticipated to fall under a listed categorical exclusion (CE).

An initial site assessment was completed to identify any potentially hazardous materials/wastes, traffic noise and air quality issues. Based on the results of the ISA, an asbestos inspection was completed on bridge ID P00049009+00571 crossing Stone Creek and bridge ID P00049014+06711 crossing the Beaverhead River. The asbestos inspection did not detect any asbestos containing materials. Lead concentrations were detected in the paint on the Beaverhead Bridge (P0049009+00571). Precautionary measures should be taken by any worker(s) who may remove or encounter the removed paint or the fumes from cutting paint covered metals. Precautionary measures will also be necessary to prevent any paint from

escaping into the environment. The bridge over Stone Creek (P00049014+06711) has treated timbers that will need to be property disposed of in a Class II landfill. The proposed alignment shifts did not warrant a detailed noise analysis.

A cultural resource survey was conducted and the two bridges on this project (Stone Creek and Beaverhead River crossings) are historic but will be handled under MDT's programmatic agreement for Historic Roads and Bridges. Within the project boundaries, historic features are the Mailey Ditch (near RP 14.3± and the East Bench Road) and the Washington Nyhart Ranch (near RP 16.3± on the west side of HWY 41).

The project includes structure replacements and roadway impacts to Stone Creek, the Beaverhead River, intermittent drainages and irrigation ditches, which will require CWA 404 and SPA 124 permitting. A wetland fringe is associated with Stone Creek. The box culvert will extend past the clear zone, eliminating the need for guardrail. Passage under the existing structure has been blocked off by the property owner.

A thermal spring exists outside the project limits near RP 15.2±. The proposed project design has avoided direct impacts to the thermal spring feature. A wetland complex with fens has been delineated around the Beaverhead River crossing and the area to the north of the structure. Wetland and fen impacts are anticipated in association with structure replacements and roadway realignment. Design considerations that minimize impacts to affected drainages, irrigation ditches, and wetland/fen areas will be documented during project development. The siting and design of the Beaverhead River Bridge has considered the meander pattern and profile of the river at the road crossing. Measures are proposed to stabilize the river banks near the new bridge to prevent future erosion damage or potential loss of the new structure. Measures in the design may include placement of fill, including riprap, within the ordinary high-water mark of the river; impacts will be minimized to the greatest extent possible, and the decision process will be documented to assist with environmental document preparation. Incorporation of bioengineered bank treatments and revegetation in association with the riprap bank stabilization will be considered and balanced with wildlife and pedestrian passage under the structure. Slopes will be steepened from the Beaverhead River bridge approach to the end of the project to minimize and avoid impacts to sensitive environmental features.

An individual Clean Water Act 404 permit is anticipated for this project due to the proposed impacts to fens and the acreage of proposed total wetland impact. As required for an individual 404 permit application, a Least Environmentally Damaging Practicable Alternative (LEDPA) analysis will be prepared and included with the application. The LEDPA would document the evaluation of potential alignments (including the no-build option and the preferred alignment), proposed avoidance and minimization measures, and provide rationale for unavoidable impacts encountered during the design process. Compensatory mitigation requirements for unavoidable impacts to wetlands and fen will be coordinated with the USACE. Mitigation may require some on-site and in-kind reclamation/restoration.

Agricultural and livestock operations are the predominant land use adjacent to the roadway. All existing right-of-way fencing will be replaced with the agreed upon type of fencing in the Right-of-way agreement. Due to the high level of use of the project area by wildlife, especially deer, wildlife friendly fencing is recommended, where landowners are agreeable. The following station locations will be evaluated for possible wildlife underpasses: 519+00 (RP 10.2), 575+00 (RP 11.2), 607+00 (RP 11.8), 655+00 (RP 12.8), 680+00 (RP 13.4), 702+00 (RP 13.8), and at the Beaverhead River bridge crossing. Crossing locations will be evaluated to ensure compatible land use on both sides of the crossing, landowner willingness to keep the crossing open on both sides and topographic and roadway design compatibility. Underpasses would be installed and connected by wildlife barrier fencing to help guide the wildlife to the structures. Fence end

treatments will be considered to close the fencing in areas it cannot be terminated at logical topographical features. Crossings will likely be placed mid-slope in areas of high fill, rather than in the bottom of the ditch line. This will help provide a shorter crossing length, which reduces cost and makes the crossing more attractive to the target species.

Experimental Features

At this time no experimental features have been identified for inclusion in the project.

Traffic Control

A Transportation Management Plan (TMP) consisting of a Traffic Control Plan (TCP), a limited Transportation Operations (TO) component and a Public Information (PI) component is appropriate for this project.

Traffic issues that will require special consideration are as follows:

- Part-width construction of the RCB(s) will be used to eliminate the need for a detour for the Stone Creek Bridge replacement, and any included wildlife crossing underpasses.
- The existing Beaverhead River Structure will be used as the detour route while the new structure is constructed off alignment.
- Normal rural reconstruction traffic issues during heavy grading operations will be encountered and the contractor will need to alternate traffic as grades are changed. As a result, traffic gravel will be required on the project.
- Embankment settlement periods and the necessary sequencing prior to final paving.

Public Involvement

The project Level of Impact (LOI) has been determined to be Moderate, and level of public involvement C, as defined by MDT's Public Involvement Plan.

Some of the strategies already employed and planned for future use include:

- News release explaining the project and including a department point of contact. (completed)
- Public meeting informing the public of the project and getting their input (ongoing)
- Personal contacts with local government officials, and interest groups.
- Personal contacts with adjacent landowners explaining final design.
- Hiring a PI firm for the Right of Way and Construction phase. A tentative scope includes:
    a. Open House meetings
    b. Flyers
    c. Project website
    d. Radio/News updates
    e. Email and Social Media information distribution
    f. Construction coordination and notification

A Public Involvement firm will be hired for this project. However, based on the projects timeline and ready date hiring of the firm may need to be phased or even separate contracts/assignments as this project is beyond the current TCP.

Preliminary Construction Cost Estimate	Estimated cost	Inflation (INF) (from PPMS)	TOTAL costs w/INF + IDC (from PPMS)
(IM, NH STPP, etc.) CN	**$13,400,000**	**$2,000,000**	**$ 17,100,000**
G-Match CN	**$130,000**	**$20,000**	**$167,000**
TOTAL CN	**$13,530,000**	**$2,020,000**	**$17,267,000**
CE (10%)	**$1,400,000**	**$217,000**	**$170,000**
Project TOTAL CN+CE	**$14,930,000**	**$2,237,000**	**$17,437,000**

The estimate above includes $*425,000* for traffic control, 30% allowance for contingency, and 10% for mobilization. The pro-rata estimates are applied to the sum total of all bid items and included in the non-G-match CN line. Traffic control, contingency, and mobilization are not applied to G-match bid items during project development. The Engineering Construction Contracting Bureau will apply traffic control and mobilization pro-rata (as appropriate) when preparing the Engineer's Estimate for programming CN and advertising for bids.

Note: Inflation is calculated in PPMS to the letting date. If there is no letting date, the project is assumed to be inside the current TCP and is given a maximum of 5 years until letting. IDC is calculated at 10.46% for FY 2019.

Preliminary Engineering

The percent PE expended is 71%. A review of the expended preliminary engineering and hours used compared to the anticipated amounts required for completing the project design indicates that a modification is needed.

- A revision to the preliminary engineering cost estimate is potentially necessary based on the design requirements identified during the project design, development of the scope of work, and hours needed to finalize project requirements. There has been significant and necessary preliminary engineering field work. The project has required additional expenditures from Survey, Geotechnical, Road Design, Right-of-Way, Hydraulics, and Environmental personnel using both in-house and term Consultants. Due to the unique subsurface conditions, and adjacent aquatic resources experts in the Geotechnical, Hydrological, and Biological fields were contracted to help MDT investigate, quantify, and develop information for project development. This work required additional survey to support. Therefore, these expenditures have been higher than originally estimated from project nomination. Currently the remaining PE budget is $686,000, a PE modification is likely needed but not at this time, the budget will be monitored, and a modification will be made either at the SOW or PIH milestone.

Ready Date

The ready date is shown as August 2022, in EPS. As of this time the project is beyond the TCP and does not have a letting date. Currently the project is behind schedule with -33 days of float, but the design team is continuing work (as resources allow) to complete the design phase and are preparing project information and documentation for the USACE LEDPA analysis. To allow for additional ROW acquisition time, based on preliminary discussions with local landowner(s).

A recent PE end date modification was requested, and the new PE End Date is Oct. 2024. *The report can be found at Index of /pub-reports/prod/bv/pe_obl_and_exp. Select the most recent report.*] This request was based on a review of the remaining EPS schedule, critical path activities, and ready date.

e-copies

Dustin Rouse, Preconstruction Engineer
Bill Squires, Acting Highways Design Engineer
James Combs, Highways Design Engineer
Dave Hedstrom, Hydraulics Engineer
Bill Weber, Acting Supervisor, Photo & Survey
Stan Brelin, Traffic Operations Engineer
Ivan Ulberg, Traffic Design Engineer
Patricia Burke, Safety Engineer
Chad Richards, Engineering Cost Analyst
John Pirre, Engineering Information Services
Vacant, Public Involvement Officer
Sue Sillick, Research Section Supervisor
Lisa Hurley, Fiscal Programming Section
David Phillips, Engineering Division
Jeff Nehring, Engineering Division
Sheila Ludlow, Bicycle/Pedestrian Coordinator
Nathan Haddick, Bridge Design Engineer
Joe Radonich, Remediation and Assessment
Walt Ludlow, Reclamation Specialist
Gabe Priebe, Utilities Engineering Manager
David Hoerning, Lands Section Supervisor
Jerilee Weibel, Acquisition Section Supervisor
Joe Zody, R/W Access Management Section Manager
Jim Davies, Testing Bureau Chief
Darin Reynolds, VA Engineer
Paul Johnson, Project Analysis Bureau
Jean Riley, Planner
Dawn Stratton, Fiscal Programming Section
Tom Gocksch, ESB, Engineering Section Supervisor
Amanda Jackson, Eng. Manager, Bridge Manag. System
Damian Krings, Road Design Engineer
Becky Duke, Traffic Data Collection Section Sup. (WIM)
Doug McBroom, Maintenance Division Ops Mgr (RWIS)
Tom Martin, Environmental Services Bureau Chief
Jon Axline, Historian
Miles Yerger, Surfacing Design Supervisor

Butte:

Duane Liebel, Preconstruction Engineer
Mike Walsh, Materials Lab
Therese Iwaniak, Right of Way Supervisor
Bill Fogarty, Construction Engineer
JR Taylor, Hydraulics Engineer
Mike Grover, Traffic Project Engineer
Deborah Wambach, Biologist
Joe Walsh, Projects Engineer
Vacant, District Utility Agent
Kam Wrigg, Maintenance Chief
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Geno Liva, Construction Ops Engineer
Tyler Steffan, Bridge Area Engineer
Pat McCann, Geotechnical Manager
Rebecca Ridenour, Project Development Engineer
Mike Poole, District MCS Captain
Greg Zeihen, Surfacing Design
Janet Black, District Utility Agent
John MacMillan, Constructability Reviewer