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CARBON COUNTY PRELIMINARY ENGINEERING REPORT
CHANCE ROAD BRIDGE OVER THE CLARKS FORK
OF THE YELLOWSTONE RIVER
(MDT# - L05129001+05001)
(COUNTY BRIDGE #CR3)

List of Appendices

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I. Executive Summary

The Chance Road Bridge is the primary access to an area serving agricultural, residential and recreational land users. The bridge provides the most direct access to 6 full-time residences, numerous agricultural operations, a church, BLM lands, is a cut-across route to many other residences and is located on a mail route. Currently, the bridge serves an estimated combined average of 60 residential, recreational and agricultural vehicles per day. Additionally, the bridge acts as an informal fishing access to the Clarks Fork of the Yellowstone River.

The load capacity and structural condition of the existing bridge creates a serious threat to overall public safety and represents a liability to the County. The existing bridge is in poor condition, classified as Structurally Deficient with a National Bridge Inventory (NBI) Sufficiency Rating of 25.8, structure appraisal rating of 2, superstructure rating of 4, deck rating of 5, substructure rating of 5 and posted load limit of 3 tons. The superstructure, consisting of an overhead steel truss is incapable of supporting legal loading. The steel stringers and floorbeams exhibit corrosion, pack rust and deformations. The steel truss frame exhibits corrosion, pack rust and collision damage. The timber deck is in fair condition with surface decay, end checks and rotation. The timber plank wearing surface is in poor condition with decay, heavy wear and section loss. The bridge substructure, consisting of cast-in-place concrete abutments and wingwalls, is in fair condition. Substructure deficiencies include cracking, spalls and seized bearings. Recommended improvements to the Chance Road Bridge include: installation of a new superstructure, modifications to facilitate widening, substructure repairs, new bridge rail and the installation of approach rail. As the original structure requires significant work and is at the end of its useful life, it is in the best interest of the County to replace the bridge rather than conduct repairs or rehabilitation. A new structure would have a useful life of 75 to 100 years and require substantially less maintenance. The replacement structure will also allow for safe passage of two-way traffic with the capacity to convey legal loads.

Several bridge replacement alternatives were investigated during the preparation of the Preliminary Engineering Report. The prescreening selection process revealed precast, prestressed concrete bulb tee beams and steel girder bridge systems to be acceptable bridge superstructure alternatives. Bridge substructure alternatives investigated included driven piling and drilled shaft foundations. Single-span and two-span alternatives were also examined to determine the most effective superstructure-substructure configuration. The alternatives were evaluated with a comparative analysis, which examined initial cost, maintenance costs, technical feasibility and environmental impacts. The preferred alternative for the Chance Road Bridge involves replacement with a new, two-span, 225-foot long, prestressed concrete bulb tee beam superstructure on driven pile foundations resulting in a total contracted project cost of $1,643,739.

An Environmental Assessment (EA) has been prepared for this project in accordance with Montana Environmental Policy Act (MEPA) guidelines. All necessary stream permits will be obtained from relevant agencies prior to construction and any requirements will be adhered to by the contractor. The replacement structure will be located in the same general location as the existing bridge and will consist of two spans totaling 225 feet and a useable roadway width of 24 feet. The new structure will accommodate all loading requirements, increase public safety, improve waterway efficiency and conform to current County Bridge Standards. A new structure at this location will ensure residential, agricultural and recreational users will have continued access to the area for many years.

II. Problem Definition

A. Area Served by the Bridge

1. Location of Bridge

Please refer to Figures 1, 2 and 3 within Appendix I for a location map, site map and topographic map.

The Chance Road Bridge (CR3), crosses the Clarks Fork of the Yellowstone River about 9 miles south of Belfry, Montana. Chance Road is a County maintained gravel thoroughfare, classified as a rural collector. The bridge is located in Section 36, Township 9 South and Range 22 East; at latitude 45°00'42.5" north and longitude 109°03'43.6" west; and at an approximate elevation of 4,000 feet.

2. Physical Characteristics of the Area

The bridge is located on a tangent section of roadway. The roadway at the bridge has been built up through the floodplain and is located on a crest vertical curve. Adjacent property consists of privately held farmland and private residences. Vegetation in the vicinity of the bridge consists of grasses, shrubs, deciduous trees and riparian vegetation. The road provides primary access to full-time residences, ranching operations, a church and recreational users.

USDA Soil Maps indicate the parent soil material at the bridge site is classified as Tonra gravelly silty clay loam, 2 to 4 percent slopes, which primarily consists of gravelly clay loam. This material is considered to be a relatively poor subgrade material. Refer to Appendix I of this report for an area soil map. Detailed soil descriptions and properties can be found in Appendix V.

The Clarks Fork of the Yellowstone River originates in the Beartooth Mountains located in the Upper Yellowstone Central Mountain Hydrologic Region Drainage Basin and eventually flows into the Yellowstone River, about 50 miles downstream of the bridge site just east of Laurel. A preliminary hydrologic analysis was completed for the site using data from a USGS stream gage located at the bridge. The gage data specified the 2, 25, 50 and 100-year flood events. The flows are 7590, 11700, 12700 and 13600 cfs, respectively. Refer to Appendix III for supporting hydrologic information.

3. Users of the Bridge

a) Use of Structure

The existing structure primarily serves residential, agricultural and recreational users. The Chance Road Bridge is the primary County-maintained access to 6 full-time residences, numerous agricultural operations, a church, BLM lands, is a cut-across route to many other residences and is located on a mail route. Residents, farmers and ranchers typically use the bridge on a daily basis to access their properties, to navigate to local services in Belfry, Montana or Powell, Wyoming and to get to work. During the harvest and cattle shipping seasons, the Chance Road Bridge and Chance Road is a critical thoroughfare for farmers and ranchers transporting equipment and materials between non-contiguous cultivation areas and to transport cattle and crops to market and local elevators.

A church is located south of the bridge along Chance Road. Churchgoers traveling from north of the bridge likely use the Chance Road Bridge as it is the shortest route to the church.

Refer to Appendix IV for documentation from bridge users.

b) Number of Users

According to the Montana Department of Transportation (MDT) assessment form for the structure, an average daily traffic (ADT) of 100 vehicles was used in the calculation of the National Bridge Inventory (NBI) Sufficiency Rating. This is typically the value utilized by MDT if a formal ADT count has not been conducted. However, based on the number of residences and agricultural operations in the area, an average daily traffic of 60 vehicles will be used in this analysis.

c) Growth Areas and Population Trends

Carbon County Contracted Planner, Monica Plecker, notes the population of the areas north and south of the Chance Road Bridge are not expected to change significantly. The property is primarily privately held farm and ranch land as well as permanent residences and a church. Barring an unlikely subdivision, the population should remain relatively stable for the foreseeable future. The bridge is needed to help sustain access for local farmers, ranchers and residents. No major developments are expected in the area. Refer to Appendix IV of this report and the Grant Application for correspondence from Carbon County and other Agencies.

B. Evaluate Condition of Existing Bridge

1. History

Please refer to the photos of the existing bridge included in Appendix II of this report. The photos depict the existing bridge from both approaches, profile views of the structure and any relevant deficiencies.

The existing bridge is classified as a single-lane, single-span, steel through-truss bridge with a timber deck and cast-in-place concrete abutments. The bridge superstructure has a total span of 203 feet. The total bridge width is 16 feet, while the useable width is approximately 15.5 feet due to the configuration of the bridge rail. The clear opening between the lower chord of the truss and the streambed is approximately 14 feet. Discussions with the MDT indicate the bridge abutments were constructed in 1946 while the truss was originally built in the early 1900's and was part of the Huntley Bridge over the Yellowstone River before being moved to its current site. Periodic maintenance and repairs have been made including replacement of object markers, installation of load posting signs and replacement of timber deck members.

The bridge foundation consists of cast-in-place concrete abutments. The support system for the abutments is unknown and is likely either concrete footings or piles. Wingwalls are present at each bridge corner and consist of 15-inch wide cast-in-place concrete at a length of 10-feet and angled at 45 degrees to the bridge. A 12-inch wide cast-in-place concrete backwall is present behind the truss ends and extends the full bridge width.

The bridge superstructure consists of a 203-foot span camelback steel through-truss. Steel stringers support the deck and transfer the load to the truss via steel floorbeams. There are eight stringers in the bridge cross-section at 24 inches deep and 10 ½ inches wide. Additionally, steel cross bracing is present to serve as lateral support and to prevent movement. The through-truss is attached to the concrete abutments with a bearing system consisting of pinned and moveable steel bearings. The bridge deck consists of a 2-inch by 6-inch nailed-laminated timber deck installed transversely across the bridge. Untreated timber running planks provide the wearing surface. The bridge rail system consists of untreated timber rail attached to vertical and diagonal truss members and supported intermediately by steel angles attached directly to the deck fascia. No bridge approach rail is present. There are 3-ton load posting signs at each bridge approach. An object marker is present at each bridge corner.

The existing bridge is located on a tangent roadway section and is located on the crest of a vertical curve.

There are 3 other Clarks Fork of the Yellowstone River crossings in the area. One is located about 2 miles southwest of the Chance Road Bridge on Road 1Bh in Wyoming, one is located about 1.5 miles north on Chance Road and one is located on Highway 72 about 5 miles north of the existing Chance Road Bridge.

2. Condition of Bridge

a) Overall County Bridge Needs

Carbon County is 2062 square miles in size with hundreds of streams and lakes. Large portions of the Custer National Forest are located within the County, as are sizeable sections of the Beartooth Mountain Range and the Pryor Mountain Range. Carbon County is responsible for maintaining 60 bridges (16 minor and 44 major). Additionally, Carbon County maintains seventeen stream crossings with one to three 80-inch diameter steel boiler pipes. While not bridges, these boiler pipes are nearing the end of their useful life and are in many cases constricting the stream, so replacement with bridges will likely be necessary in the next 5 to 10 years.

The bridges in Carbon County defined as major bridges (clear spans over 20 feet in length) are inspected biennially by the Montana Department of Transportation (MDT). Detailed inspections of the minor bridges (clear spans less than 20 feet in length) are not conducted on a regular basis by MDT. Monitoring the condition of the bridges can be a daunting task at times, but with the County's population increasing and the number of functionally obsolete and structurally deficient bridges on the rise, the County has developed a pro-active attitude toward bridge replacements in the past ten years, replacing numerous structures.

In 2007, the County utilized TSEP matching funds to evaluate all County maintained bridges, prioritize bridge improvements and develop a plan of action. The Bridge Evaluation and Capital Improvement Plan Report was completed and adopted in April of 2008. The report assessed the condition of each bridge maintained by the County and ranked the bridges in order of greatest need for replacement or rehabilitation. Also in 2008, Carbon County submitted a TSEP grant application in order to obtain assistance with projects outside the County's bridge budget. The application was successful and allowed the County to replace 5 bridges, two with bridges and three with culverts. After seeing the results of their first TSEP Grant Application, the County submitted for additional grant applications in 2010, 2012 and 2014. The 2010, 2012 and 2014 grant applications were a success and provided funding for a total of six bridge replacements. The replacement of the Chance Road Bridge (CR3) has been identified in the 2016 Bridge Capital Improvements Plan as the top priority for replacement. In the past ten years, through a variety of funding sources, Carbon County has replaced eleven bridges and repaired numerous others. Of those eleven bridges replaced, seven were replaced with bridges and four were replaced with large culverts.

Recently, the County utilized TSEP matching funds to update its bridge inventory and bridge capital improvement plan. The Capital Improvement Plan gave the County a defensible basis upon which to make decisions regarding the allocation of financial resources, provided a mechanism to schedule capital projects with regard to financial limitations and assisted in identifying potential outside funding sources in light of overall needs and available resources. A copy of the 2016 Carbon County Bridge Evaluation and Capital Improvement Plan can be found as an Appendix to the TSEP Grant Application.

The 2016 Carbon County Bridge Evaluation and Capital Improvement Plan Report provides a ranking to determine the most critical bridges for replacement/repair. The Chance Road Bridge (CR3) is the number one ranked priority for improvements. The County's examination of the financing options led to the conclusion that this project would require outside funding sources. The County is seeking assistance from the Treasure State Endowment Program on the Chance Road Bridge. This structure was chosen based on its poor structural condition, load limiting capacity, narrowness and high level of need.

The following presents a verbal narrative summarizing the County's plan to address its bridge needs over the next five years (FY 2016 through 2016).

1. Chance Road over the Clarks Fork of the Yellowstone (CR3). The proposed improvements for this structure include removal and replacement with a new bridge at an estimated cost of $1,700,000. The proposed avenue of financing for this project is the TSEP program (2016) with matching local bridge funds. The project has been nominated and the anticipated timeframe for construction of this project is after FY 2018.

2. Aisenbrey Loop over Hunt Creek (AL1). The proposed improvements for this structure include removal and replacement with a new bridge at an estimated cost of $410,000. The proposed avenue of financing for this

project is the TSEP program (2018) with matching local bridge funds. The anticipated timeframe for construction of this project is FY 2019-2020.

3. West Pryor Road over Elbow Creek (WP1). The proposed improvements for this structure include removal and replacement with a new bridge at an estimated cost of $390,000. The proposed avenue of financing for this project is the TSEP program (2018) with matching local bridge funds. The anticipated timeframe for construction of this project is FY 2019-2020.

4. Robinson Draw Road over Interstate Ditch (RD1). The proposed improvements for this structure include removal and replacement with a new concrete box culvert at an estimated cost of $160,000. The proposed avenue of financing for this project is the TSEP program (2020) with matching county funds. The anticipated timeframe for construction of this project is after FY 2022.

5. Musegades Road over Bluewater Creek (MU1). The proposed improvements for this structure include removal and replacement with a new bridge at an estimated cost of $420,000. The proposed avenue of financing for this project is the TSEP program (2020) with matching county funds. The anticipated timeframe for construction of this project is after FY 2022.

6. Red Lodge Creek Road over Red Lodge Creek (RL3). The proposed improvements for this structure include removal of the existing rail car superstructure and replacement with a new concrete superstructure at an estimated cost of $90,000. The proposed avenue of financing for this project is the TSEP program (2022) with matching county funds. The anticipated timeframe for construction of this project is FY 2023+.

7. Fox East Bench Road over Clear Creek Ditch (FEB2). The proposed improvements for this structure include removal and replacement with a new concrete box culvert at an estimated cost of $50,000. The project would be completed with local bridge funds and the anticipated timeframe for construction of this project is 2022.

8. Luther Roscoe Road over Red Lodge Creek (LR1). The proposed improvements for this structure include removal and replacement with a new bridge at an estimated cost of $350,000. The proposed avenue of financing for this project is the TSEP program (2022) with matching county funds. The anticipated timeframe for construction of this project is after FY 2023.

9. Chance Road over Ditch (CR2). The proposed improvements for this structure include removal and replacement with a new concrete box culvert at an estimated cost of $280,000. The proposed avenue of financing for this project is the TSEP program (2024) with matching county funds. The anticipated timeframe for construction of this project is after FY 2026.

10. Prosperity Road over First Chance Ditch (PR1). The proposed improvements for this structure include removal and replacement with a new concrete box culvert at an estimated cost of $140,000. The proposed avenue of financing

for this project is the TSEP program (2024) with matching county funds. The anticipated timeframe for construction of this project is after FY 2026.

11. Clear Creek Road over Stockpass (CL1). The proposed improvements for this structure include removal and replacement with a culvert stockpass. The project will be completed using local bridge funds and the anticipated timeframe for construction of this project is FY 2024.

b) Present Condition and Capacity

Please refer to the photos of the existing bridge included in Appendix II of this report. Many of the most critical deficiencies are displayed in these photos.

The Montana Department of Transportation (MDT) typically inspects all structures with clear spans (coping to coping) over 20 feet. At a total span of 203 feet, MDT regularly inspects the Chance Road Bridge. The bridge was last inspected by MDT personnel in April of 2015. The most recent National Bridge Inventory (NBI) Rating Form for the Chance Road Bridge was obtained from the Montana Department of Transportation (MDT) and is included in Appendix II of report. The MDT Initial Assessment Form includes the NBI Sufficiency Rating, NBI Appraisal Ratings and NBI Element Condition Ratings for the structure. The MDT structure number is L05129001+05001.

The following is a summary of the NBI Rating Report for the Chance Road Bridge over the Clarks Fork of the Yellowstone River (County Bridge #CR3).

Sufficiency Rating:	25.8
Structure Status:	Structurally Deficient
Inventory Load Rating (HS-20):	N/A
Operating Load Rating (HS-20):	3 tons
Existing Posting:	3 tons
<u>Appraisal Ratings (Item #)</u>	
Structure Rating (67):	2
Deck Geometry (68):	6
Approach Roadway Alignment (72):	6
Waterway Adequacy (71):	9
<u>Element Condition Ratings</u>	
Bridge Deck (58):	5
Superstructure (59):	4
Substructure (60):	5
<u>Bridge Safety Features</u>	
Bridge Railings (36A):	0
Transition Railings (36B):	N
Approach Guardrail (36C):	N
Approach Guardrail Ends (36D):	0

The Appraisal Ratings and Element Condition Ratings are assigned on a scale of 0 to 9; with 9 points assigned to the best possible condition. A bridge is considered structurally deficient if it has a rating of four or less on the deck (Item 58), superstructure (Item 59) or substructure (Item 60) or an appraisal of two or less on waterway adequacy (Item 70) or structural evaluation (Item 67). In order to be classified as functionally obsolete, a bridge must receive an appraisal rating of 3 or less on deck geometry (Item 68), under-clearance (Item 69), approach roadway alignment (Item 72), structural evaluation (Item 67) or waterway adequacy (Item 71). Any bridge that is classified as structurally deficient is excluded from the functionally obsolete category.

The Sufficiency Rating (SR) is a measure of the overall integrity of the structure and is based upon a scale of 0 to 100 with 100 being the best rating. The Montana Department of Transportation recommends that a bridge be replaced when the SR is 50 or less, rehabilitated or replaced for an SR between 50 and 80 and that no/minor improvements need be made for an SR above 80.
A supplementary field inspection of the Chance Road Bridge was performed by Great West Engineering personnel in January of 2016. The inspector concluded that the deteriorating superstructure and material components, have led to its current load limited and structurally deficient condition. Refer to the structure photos in Appendix II of this report. The following is a summary of the most serious deficiencies of the bridge.

According to MDT documentation, the bridge abutments were originally constructed in 1946 and the steel overhead truss was salvaged from a structure constructed in the early 1900's. This would mean the truss was likely made of mild steel. Mild steel was widely popular prior to the early 1900's, but is undesirable today due to low values of tensile strength and yield strength. As a result of the steel's strength and truss member sizes, the Type 3 inventory rating was determined to be only 3 tons. The reduction of the steel structure's strength due to mild steel is compounded by the paint failure on the steel truss members, which is causing surface rust, pack rust, pitting and corrosion on all primary steel elements of the superstructure (truss, stringers, and floor beams). The steel stringers, floorbeams and truss frame exhibits deformations and areas of collision damage. The bridge bearings are in poor condition with corrosion, pack rust and appear to be seized. The truss superstructure is considered to be a fracture critical structure as there is no load path redundancy. Load path redundancy means that if one critical member of the truss were to fail, whether from collision or overloading, the entire structure is rendered susceptible to failure.

The substructure consists of cast-in-place concrete abutments and is in fair condition. The footing configuration/ construction is unknown due to lack of as-built drawings and absence of visual clues during inspection. It is likely that the abutment is either supported by timber piles or concrete footings. In general, most exposed concrete surfaces of the abutments and wingwalls exhibit cracks, spalls and rock pockets. Minor erosion is also present along the back face of the wingwalls, as these wingwalls are insufficient in retaining the current fill slopes due to their size and length.

The timber deck is in fair condition with areas of surface decay, end checks and member rotation. The timber running planks are in poor condition with decay, heavy wear and section loss.

The channel configuration and channel composition in the vicinity of the bridge is fair. The existing bridge is not skewed, while the channel is skewed approximately 30 degrees to the bridge. No riprap is present at the project site. The channel at the bridge consists of a broad, wide riffle section on a straight reach of stream. Overall, vegetation coverage is fair, with mostly native grasses and deciduous trees present. Some minor bank erosion is present upstream and downstream of the bridge. The new bridge should be designed with a 30-degree skew to better match the existing stream channel.

Overall, the condition of the existing bridge is poor. There are serious structural issues with the condition and load-limited capacity of the steel truss, which have led to the current posting of 3 tons. Repairs to the Chance Road Bridge include installation of a new superstructure, modifications to the concrete abutments to facilitate bridge widening, new bridge rail and installation of approach guardrail and terminal end sections. As the original structure requires significant work on the superstructure and significant repair work, it is in the best interest of the County to replace the entire bridge rather than conducting repairs. A new structure would have a useful life of 75 years and require substantially less maintenance. The replacement structure will also allow for two-way traffic with the capacity to convey legal loads.

C. Need for Project and Problems to be Solved

1. Current and Future Bridge Standards

The Chance Road Bridge is currently posted at a 3-ton weight limit restriction for all vehicle types. This weight limit currently restricts County road maintenance vehicles, concrete trucks, agricultural equipment, fire trucks and other heavy vehicles from crossing the bridge safely. Additionally, the bridge is narrow, with a useable width of 15.5 feet limiting traffic to a single-lane. Due to the existing bridge condition, public traffic over 3 tons must be detoured to Montana Highway 72, which avoids crossing the Clarks Fork of the Yellowstone River in the vicinity of the Chance Road Bridge.

The Carbon County Commission adopted Bridge Standards in March of 2008. The Carbon County Bridge Standards utilize AASHTO and MDT guidelines for bridge construction and specify accepted methods for the hydraulic design of the waterways associated with bridges and culverts. The primary purpose of the Bridge Standards is to lend a measure of uniformity to future bridge projects within the County by specifying minimum road approach widths, bridge widths, design floods, freeboard, design loads, minimum freeboard, etc. The document also outlines the County's policy on whether an existing structure should be replaced with a culvert or a bridge.

In accordance with the Carbon County Bridge Standards, all new bridges shall be constructed as two-lane structures capable of handling AASHTO HS20-44 live loads and have the ability to pass the 50-year storm event with 2-feet of freeboard (at a minimum) and the 100-year event with 2-feet of freeboard, if possible. The freeboard is required to allow a large tree or ice chunk to safely pass under the structure. The minimum usable bridge width shall be 24 feet, with the typical overall bridge width of 26'-4", to account for 1'-2" of rail on each side of the bridge. The existing Chance Road Bridge does not meet current bridge standards. A copy of the Carbon County Bridge Standards is included as an Appendix to the TSEP Grant Application.

2. Safety Considerations

The existing bridge is incapable of carrying heavy truck traffic due to the load limiting superstructure. If the bridge is not replaced, the superstructure deterioration will create a greater safety concern and liability for the County. The bridge is already posted at the lowest allowable capacity and any further measurable deterioration that affects the load capacity will result in the closure of the bridge. The replacement structure should be constructed to handle HS 20-44 or, if possible, the more current HL-93 loading requirements.

With a current useable width of 15.5 feet, the current Chance Road Bridge is too narrow to facilitate two-way travel. Carbon County has decided to utilize a 24-foot wide bridge width primarily for safe passage of two-way traffic. As the current roadway width of Chance Road is around 22 feet, a 24-foot useable width structure will accommodate future road widening along Chance Road.

The current bridge rail configuration is substandard untreated timber rail attached directly to truss members via bolted attachments and supported at intermediate locations by steel angle posts attached to the deck. The timber rail is in fair condition with heavy weathering and checking. As such, new bridge rail and approach rail sections as required by MDT, AASHTO and the County Bridge Standards should be installed to increase overall safety.

Because of the narrow width, vehicle accidents are more prone to occur. The MDT Safety Engineer was contacted in regards to crash data at the bridge site and reported that no documented vehicular crashes have occurred at the bridge site in the past 10 years. However, it is also possible that unreported accidents have occurred at the bridge site.

Refer to Appendix IV for letters of support and letters from emergency and service organizations detailing safety issues.

3. Alternative Routing Options

Chance Road serves as a north-south connection route in the area south of Belfry, Montana and north of Powell, Wyoming to properties along the Clarks Fork of the Yellowstone River. The local community uses Chance Road to access residences, agricultural operations and public land. During construction, traffic comprised of local residents, agricultural operations, recreational users and emergency service vehicles will be forced to use existing alternate routes to detour around the bridge to the east. Montana Highway 72 runs north-south adjacent to Chance Road and provides access to both ends of the bridge. The identified detour route will consist of the nearest bridge end to bridge end route capable of handling legal loads. From the north approach, this consists of traveling north from the bridge for 1.4 miles on Chance Road, then 2.9 miles south on Highway 72 which becomes Highway 120 at the Wyoming state line, then 0.6 miles west on Road 8Ve, then 0.9 miles north on Road 1Bi, then 1.1 miles on Chance Road to the bridge end. The total detour from the one end of the bridge to the other end of the bridge is approximately 6.8 miles. Refer to Appendix I of this report for the detour route figure.

4. Impact on Public and Emergency Services

It has been estimated that closure of Chance Road Bridge would inconvenience approximately 60 vehicles per day in addition to seasonal and recreational use. Medical, fire and law enforcement personnel would also be directly impacted from accessing those served by the Chance Road Bridge. As noted, the Chance Road Bridge is the primary County maintained access to six existing residences, numerous agricultural properties and a church. Public and emergency services, including firefighting crews, would have to travel up to 7 additional miles if the current bridge were to close. Thomas Kohley of the Carbon County Disaster and Emergency Services (DES) states, *"Construction of a new bridge at this location is needed to support heavy fire apparatus that may need to respond to lower Chance Road. Currently there are six structures that are located below the* *bridge. If any of these structures were to ignite or if there was a wildland fire in this vicinity, responding engines and tenders may not be able to respond due to weight limits or condition of the existing bridge. It is critical that a new bridge be constructed to support heavy equipment that may be needed in an emergency."*

Chance Road is utilized as a rural mail route. If the bridge were to close, government services such as the United States Postal Service would be forced to detour to different roads in order to deliver mail to homeowners and ranching operations.

Please refer to correspondence letters in Appendix IV of this report for support of the above statements.

5. Utilities Location or Relocation

A site visit identified overhead power lines located approximately 20 feet upstream of the bridge, with one power pole located 25 feet northwest of the existing north bridge end and the other, 50 feet southwest of the existing south bridge end. One conduit (unknown contents) is attached to the downstream truss.

Prior to construction, a detailed inspection will be undertaken by contacting a utility location service. If underground utilities are located within the affected area, they will be relocated. Typically, such relocations are completed by the utility company at no cost to the County. Due to the proximity of the project to the adjacent overhead power line, close coordination with the power utility will be critical. At this stage, no impact to the line is anticipated. A work bridge to facilitate construction of the new bridge is anticipated to be located on the downstream side of the structure.

6. Floodway

The bridge is located in a Federal Emergency Management Agency (FEMA) mapped Zone A floodplain (FIRM Panel 30009C1125D). As such, replacement of the existing bridge will require a local floodplain development permit. Based on information gathered from preliminary hydraulic calculations the current hydraulic capacity of the existing structure is sufficient.

The design flows for the Clarks Fork of the Yellowstone River at the bridge location are displayed in the table below.

Storm Event	Design Flow (CFS)
Q2	7,590
Q25	11,700
Q50	12,700
Q100	13,600

Refer to Appendix III for preliminary hydrologic and hydraulic calculations. A detailed hydraulic analysis will be performed prior to final design in order to more accurately verify the required dimensions of the structure opening.

D. Environmental Considerations

The Montana Environmental Policy Act (MEPA) requires state government to coordinate state plans, functions and resources to achieve various environmental, economic and social goals through the use of a systematic, interdisciplinary analysis of state actions that have an impact on the human environment. This is accomplished through the use of a deliberative, written environmental review. For this type of project, an Environmental Assessment (EA) is initiated to determine the potential significance of impacts to the human environment. If the EA determines the proposed action will have significant impacts, then either an Environmental Impact Statement (EIS) must be prepared or the effects of the proposed action must be mitigated below the level of significance and documented in a mitigated EA.

An EA must document the purpose and need for the proposed action, the affected environment, an analysis of alternatives including a No-Action alternative and analysis of the impacts to the human environment of the different alternatives, including an evaluation of appropriate mitigation measures. An EA has been prepared for this project in accordance with MEPA guidelines. In addition, this report serves as a supplement to the EA. Please refer to Appendix V for the attached Environmental Assessment and letters from environmental agencies for supporting documentation of the information presented below.

In order to complete a systematic, interdisciplinary analysis of the project, letters were written to various governmental agencies soliciting comment on any potential environmental impacts, whether beneficial or adverse, which would result from the proposed project. The agencies that were contacted are listed below. See Appendix V for a copy of the EA and comments from the agencies describing the project and any possible environmental impacts.
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- Montana Department of Fish, Wildlife and Parks
- Montana Department of Natural Resources and Conservation
- Montana Department of Environmental Quality
- Montana Department of Transportation
- State Historical Preservation Office
- Carbon County Floodplain Administrator
- Carbon County Planning Office
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers

MEPA also requires public involvement to allow interested and affected individuals organizations and agencies to be included in the decision-making process. In order to give members of the public the opportunity to be involved in the environmental review, a public meeting was held at:

- Belfry Elementary School Multipurpose Room, Belfry, MT, March 31, 2016 at 6:00 p.m.

In addition, as part of the grant application submittal, a public hearing was conducted at:

- Office of the Carbon County Commission, Red Lodge, MT, April 28, 2016 at 10:00 a.m.

Public notice for these meetings/hearings, which included invitations for written comments, were published in the Carbon County News, the newspaper of record for Carbon County. The meetings/hearings detailed the inventory process, sought comment on the Environmental Assessment, presented the Preliminary Engineering Report (in draft format) and allowed a venue for public comment. Written comments (and comments received at the public meetings) were documented and added to the EA. Responses to each comment were also documented and added to the EA. According to MEPA, agencies must consider substantive comments to EAs prior to making final decisions about the adequacy of the analysis in the EA, modifications to the proposed action and the necessity of preparing an EIS.

1. Land Use/Important Farm Land/Formally Classified Lands

Affected Environment:

The Chance Road Bridge over the Clarks Fork of the Yellowstone River is located in a rural area with primarily undeveloped adjacent properties. Preliminary investigations indicate that the surrounding lands are designated as Farmland of Local Importance (NRCS Soils Map). Existing farmlands are not located in the direct vicinity of the bridge and at their nearest occur 250 feet to the northwest of the bridge. The predominant crops in this area are dryland grass and flood irrigated alfalfa. As the structure replacement will likely be located within the 60-foot County easement and is not tillable land, no negative impact is anticipated.

A section of state land and a large area of federal BLM land is located to the northwest of the bridge. No forest lands exist within one mile of the project. If the bridge is not improved and becomes closed, agricultural operations would be forced to detour to different roadways in order to access their agricultural interests. A new structure will ensure access to the area for another 75 years.

Environmental Consequences:

The alternatives may result in temporary dust, silt and erosion problems during construction. No long term effects are anticipated.

Mitigation:

The Contractor will be required to erect silt fence along the banks to prevent silt and construction debris from entering the stream. The disturbed areas will be seeded to promote re-vegetation. In order to minimize silt and erosion problems typically associated with bridge construction, construction will likely take place in late summer/early fall, at a period of low water to reduce impacts on spawning trout, reduce turbidity constraints and minimize effects on any native fish and aquatic organism species.

The necessary stream permits will be obtained prior to construction and the Contractor will be required to adhere to all guidelines set forth by these documents. The Contractor will also be required to water the construction site as necessary throughout the project in order to mitigate any temporary dust problems.

2. Floodplains

Affected Environment:

The bridge is located in a mapped Zone A- Federal Emergency Management Agency (FEMA) floodplain. As the proposed bridge replacement is located within a designated floodplain, a County Floodplain Development Permit will be required.

Environmental Consequences:

No environmental issues associated with floodplains have been identified at this time.

Mitigation:

The replacement of the Chance Road Bridge will require the acquisition of a County Floodplain Permit. The purpose of the floodplain permit, administered by the County Floodplain Administrator with assistance from the Montana DNRC, is to prevent new construction from adversely affecting the 100 and 500-year floodplains in the County. The permit states that the replacement structure may not raise or lower the 100-year floodplain elevation more than six inches upstream or downstream of the bridge. Thus, the acquisition of a Floodplain Development Permit serves as mitigation for this issue.

3. Wetlands

<u>Affected Environment:</u>
Based on information from the USFWS Survey National Wetlands Inventory, there appear to be riparian lotic forested wetlands in the vicinity, located to the northwest and southeast of the bridge.

A wetland delineation will be performed to document any jurisdictional wetlands at the site vicinity during the design phase of the project. The entire footprint of the proposed construction disturbance will be evaluated for the presence of wetlands and those wetlands will be delineated and mapped in accordance with the Corps 1987 Delineation Manual (and applicable Regional Supplement). Wetlands boundaries will be flagged in the field and numbered. Flag numbers and locations will be surveyed using a sub-meter GPS and depicted on the delineation map.

The Contractor will be required, to the extent feasible, to avoid wetlands in and around the project site that may be affected by construction activities. The Contract will require the Contractor to minimize wetland disturbance wherever possible and implement BMPs to avoid impacts such as material inputs and sedimentation to wetlands or the Clarks Fork of the Yellowstone River. At this time and based upon the preliminary information available, it is anticipated that less than one-tenth of an acre of wetlands will be disturbed as a result of the proposed project. However, the potential for wetland disturbance will be evaluated in more detail during the design phase in order to determine if compensatory mitigation is required as a result of the project.

<u>Environmental Consequences:</u>
Only a minor impact to potential wetlands is anticipated as a result of the proposed construction alternatives.

<u>Mitigation:</u>
The Contractor will be required to erect silt fence along the stream banks to prevent silt and construction debris from entering the stream. Disturbed areas will be seeded to promote re-vegetation. In order to minimize silt and erosion problems typically associated with bridge construction, construction will be scheduled during the summer or early fall when flows are minimal. A detailed wetland survey will occur during the survey phase to identify any potential impacts. All necessary stream permits will be acquired prior to construction of the new bridge.

4. Cultural Resources

<u>Affected Environment:</u>
As a general rule, all bridges that are 50 years or older are considered eligible for listing on the National Register of Historic Places. The Chance Road Bridge is a single-span

steel through truss bridge with a timber deck and concrete abutments. According to Damon Murdo from SHPO, the bridge has been previously recorded, however, no formal determination of eligibility has been made. Furthermore, MDT Historian, Jon Axline adds, "*It was originally one of the spans of the Huntley Bridge over the Yellowstone River and was moved to its existing site in the late 1940s...the steel through truss is eligible for the National Register.*"

Environmental Consequences:
No environmental consequences have been identified at this time.

Mitigation:
As the existing bridge meets criteria for the National Register of Historic Places, prior to any construction, historical mitigation efforts will record the bridge description, history and photographs to be submitted to the National Register.

Other historic sites (irrigation system and bridge) have been located in the vicinity of the bridge but are outside of the proposed work area and will require no mitigation.

5. Biological Resources

Affected Environment:
The Clarks Fork of the Yellowstone River supports aquatic wildlife populations; therefore, careful consideration to the stream habitat and effects that the proposed bridge will have on the stream will be considered.

A database search conducted using the Montana Natural Heritage Program website and by the USFWS found sixteen possible species of special concern in the area: Canada Lynx, Grizzly Bear, Black-footed Ferret, White-Tailed Prairie Dogs, Merriam's Shrew, Golden Eagle, Pinyon Jay, Loggerhead Shrike, Sage Thrasher, Brewer's Sparrow, Sprague's Pipit, Greater Sage Grouse, Western Milksnake, Greater Short-horned Lizard, Whitebark Pine and Dwarf Mentzelia.

Jodi Bush of the United States Fish and Wildlife Service does note that "*there could be potential effects to migratory birds*" but also that her comments were "*prepared under the authority of and in accordance with, the provisions of the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250) and the Endangered Species Act (16 U.S.C. 1531 et. seq.). [My] comments do not address the overall environmental acceptability of the proposed action.*" In regard to the provided list of Threatened and Endangered Species occurring in Carbon County, she goes on to say that "*it is unlikely all of these will occur within your project areas.*"

Based on a review of the Montana Sage Grouse Habitat Conservation Program (MSGHCP) Mapper (https://sagegrouse.mt.gov/projects), the proposed project is mapped as being in an area of General Sage Grouse Habitat. Following the award of TSEP grant funds and within 12 months of the proposed construction date, the County will consult with the MSGHCP regarding the work. As necessary, a permit application will be submitted for MSGHCP review. Depending on the outcome of the permit application, some form of mitigation may be required in order to implement the project. According to the Montana Field Guide, the Greater Sage Grouse's Courtship season starts in early March and persists into May. Typically, sage hens prefer to nest on sagebrush covered benches from June to July. When forbs on bench habitats begin to dry, Sage Grouse tend to migrate to alfalfa fields or greasewood bottoms.

Environmental Consequences:
The proposed project is not expected to have any significant permanent adverse effects on vegetation and wildlife. No significant migratory bird nesting areas are anticipated to be affected by the proposed project. Any temporary construction effects on plant species will be re-seeded to promote re-vegetation and reduce erosion.

Silt and debris in the river could adversely affect fish habitat; therefore, a bridge replacement alternative that impacts the streambed and banks as little as possible is desirable. Some bridge designs can constrict the natural channel flow of the river, increase erosion and affect bedload movement both upstream and downstream of the structure. Therefore, single-span bridges with natural stream bottoms are desirable for waterways such as the Clarks Fork of the Yellowstone River. However, in order to minimize impacts to the adjacent floodplain and adjacent farmland, the preferred structure alternative may be a two-span structure that limits raising the road to only 1 foot versus 5 feet with a single-span girder, due to the shallower girder section.

Mitigation:
Where feasible, construction activities will be coordinated such that disruptive and/or destructive impacts to Sage Grouse can be avoided. Where avoidance is not feasible, best management practices will be implemented in order to minimize impacts and reasonable efforts will be made to restore damages. As such, Sage Grouse are not anticipated to be adversely affected by this work.

Jodi Bush of the United States Fish and Wildlife Service notes that special considerations are needed as the project is located in known Grizzly Bear habitat. The USFWS recommends several steps to prevent conflicts with Endangered Grizzly Bears.

1. Promptly clean up any project related spills, litter, garbage and debris.
2. Camping allowed in designated campgrounds only.
3. Store all food, food related items, petroleum products, antifreeze, garbage and personal hygiene items inside a closed, hard-sided vehicle or commercially manufactured bear resistant container.
4. Notify the project manager of any animal carcasses found in the area.
5. Notify the project manager of any bears observed in the vicinity of the project.

Jason Rhoten, Montana FWP, notes that the primary gamefish in the area of the bridge are rainbow trout, brown trout and mountain whitefish. Based on the presence of brown trout, construction of the project will likely occur in the late summer/early fall at a period of low water to reduce impacts on spawning trout and reduce turbidity constraints. All necessary stream permits will be acquired prior to construction and the Contractor will be required to adhere to the permit documents, including guidance on protection or mitigation measures that the USACE feels are reasonable and prudent.

6. Access to and Quality of, Recreational and Wilderness Activities, Public Lands, Waterways and Public Open Space

Affected Environment:
The Chance Road Bridge serves less than 100 vehicles per day including access to private homes, agricultural properties, State Trust Lands and Federal lands. Closure of the bridge would impact access to (and quality of experience of) recreational activities, public lands and waterways and public open space for local residents, fisherman and hunters.

Environmental Consequences:
As long as the bridge remains open, no environmental consequences have been identified.

Mitigation:
The replacement of the Chance Road Bridge serves as the primary form of mitigation for this issue. A new structure will ensure access to the area for 75 years.

7. Socio-Economic/Environmental Justice Issues

Affected Environment:
The Chance Road Bridge provides primary access to numerous residences and agricultural operations. The proposed project will allow residents and business owners (including ranchers and farmers) to continue to have the most direct access to their properties. If the bridge is not improved and becomes closed, residents would be forced to detour to different roads for access.

Environmental Consequences:
No adverse environmental consequences have been identified at this time.

Mitigation:
Replacement of the Chance Road Bridge would serve as the primary form of mitigation for this issue. Proposed improvements will ensure access to the area for the next 75 years.

8. Lead Based Paint and/or Asbestos

Affected Environment:
There is no known lead based paint or asbestos at this site.

Environmental Consequences:
No adverse environmental consequences have been identified at this time.

Mitigation:
Recent requirements from Montana DEQ require an inspection for asbestos (performed by an accredited inspector) prior to any demolition taking place. This inspection may be waived depending on the type of bridge structure and its components.

E. General Design Requirements

The replacement structure is required to safely allow two-way travel, allow legal loads, add necessary bridge and approach rail, ensure adequate hydraulic capacity and conform to the County's Bridge Standards. The standards require the new structure to handle HS 20-44 live loads and have a minimum useable width of 24 feet. A wider, two-lane structure will accommodate future road improvements and allow oversized vehicles or two-way travel for passenger vehicles to safely navigate the bridge at the same time. The bridge edges should be protected with T101 Bridge rail, conforming to County standards in order to provide adequate structural support in the event of a collision. Approach guardrail with end sections, as required by MDT and AASHTO design standards, should be installed.

A preliminary hydraulic analysis for this report has been performed to ensure the structure will adequately pass the 50-year flood event at a minimum with two feet of freeboard. If costs are not significantly increased, the structure should pass the 100-year flood event. The preliminary hydraulic analysis for this report will use HY-8 hydraulic modeling software to estimate the flood elevations at the crossing. This information will be useful in determining the preliminary span for the proposed alternative.

Additionally, the replacement structure must not adversely impact the natural passage of aquatic species in the Clarks Fork of the Yellowstone River. FWP, USACE and the USFWS has recommended that new bridges and culverts be wide enough to provide stream simulation design, pass the 100-year event with minimal backwater, be properly aligned with the stream channel and generally avoid fish spawning periods.

III. Mitigation Options: Present Concerns & Existing Bridge Deficiencies

A. No Action

Deferring maintenance (or other corrective actions) for the existing crossing would lead to further deterioration of the through-truss superstructure and substructure. Any additional measurable deterioration of the through-truss would likely reduce the load rating of the bridge. As the bridge is already posted at the minimum allowable posting of 3 tons, posting the bridge at a lower posted capacity is not an option and would necessitate closing the bridge to all traffic. Closing the bridge permanently is not a favorable or beneficial option as it serves numerous residents and agricultural operations, which would be harmed by the inconvenience of losing the most efficient transportation route to and from their properties. The bridge is also at the end of its useful life and necessitates replacement. As such, this ‘do nothing’ option will not be considered further.

B. Structure Rehabilitation

Rehabilitation efforts generally include work to augment the load capacity, hydraulic conveyance, safety and/or reliability of an existing bridge crossing without the potentially higher costs of a full structure replacement. Rehabilitation would include widening the existing bridge abutments to accommodate a wider superstructure; retrofitting the existing truss to widen the useable width and increase the load capacity; and adding safety features such as standard bridge and approach rail. However, retrofitting a truss at the end of its useful life is not cost-effective and may not be technically feasible. Therefore, retrofitting the existing truss will not be considered a viable rehabilitation option. Without the potential cost savings of reusing the existing truss, rehabilitation largely becomes a full structure replacement alternative with only minor savings that may be realized in substructure construction costs. Because rehabilitation and full structure replacement are very similar and both require substantial construction efforts, rehabilitation will not be examined further.

C. Full Structure Replacement

Full structure replacement involves complete demolition of the existing bridge foundations as well as removal and disposal of the existing superstructure and deck components. This option is usually advantageous when upgrading or retrofitting an existing bridge/culvert is not economically viable or technically feasible. For example, full replacement might be more advantageous than structure rehabilitation in a situation where the existing bridge configuration does not pair well with the site hydraulics or where design requirements imposed by the stream channel and/or the roadway approach configuration limit the potential benefits, which might be realized by retrofitting/rehabilitating the existing crossing.

Structure replacement alternatives can typically be designed and configured to optimize economics, stream channel hydraulics and roadway geometry while meeting (at a minimum) the County Bridge Standards for floodway passage, minimum freeboard and useable bridge width. Full structure replacement alternatives allow for the consideration of safety upgrades, provide additional width for conveyance of two-way traffic and offer upgraded superstructure capacity to support legal loads. New crossings would provide useful lives of 75 to 100 years and require substantially less maintenance. As such, alternatives (and components) for full replacement of the existing structure (as well as present and future repair cost comparisons) will be analyzed in greater detail in the subsequent discussions.

IV. Prescreening of Alternatives for Replacement

A. Superstructure Alternatives

Introduction

The structural and geometric complexities of the superstructure make it one of the most challenging portions of a bridge to design. In order to simplify the screening process, two basic components of the superstructure will be examined; the deck and beams; as well as single vs. multiple span configurations. Although there are many combinations possible, past experience along with site characteristics have narrowed the suitable field to the following alternatives. Each will be examined in detail to more accurately compare them with the other alternatives.

1. Beams

a) Steel

This alternative utilizes steel I-beams or steel plate girders. The traditional steel girder and deck system does not provide for the ease of installation associated with precast concrete members, though, many companies now supply a modular steel bridge system with preassembled bridge sections for spans from 20 to 120 feet. The modular bridge systems come preassembled in sections and offer the advantage of a quick installation compared to typical steel stringers. However, in long spans that exceed 120 feet, the traditional steel girder system and deck system are preferable to modular steel bridge systems with preassembled bridge sections. Steel beam systems are typically lighter than concrete beams sized for equivalent spans, sometimes allowing for the use of excavators rather than cranes for installation. Therefore installation costs may be reduced. Steel modular systems have a projected service life of 50 to 100 years if a hard surfacing (asphalt or concrete) is placed over the modular structure and if maintained properly. Service life will be diminished and maintenance costs increase for steel modular superstructures with a gravel wearing course. Traditional steel bridge systems with a cast-in-place concrete deck have a projected service life of 75-100 years.

b) Composite Concrete Trideck or Bulb Tee Beam

This alternative involves the use of precast, prestressed concrete beams. Two types of precast beams are typically utilized for County bridge applications. Trideck beams are desirable for spans of 20 to 62 feet due to their relatively shallow depth of 1'-4" to 2'-3." Bulb Tee beams with depths of 2'-11" to 5'-5" are utilized for larger spans of 62 to 165 feet. Beams are typically placed with a crane, then welded together at intervals recommended by the supplier. A preformed channel between the beams is filled with non-shrink grout. A concrete backwall is later poured on-site and, if necessary, intermediate steel diaphragm members are installed. The main advantage realized with this system is the convenience of a concrete deck that is integral with the beams. Depending on the bridge span and loading requirements, precast beams can be set on driven pile, drilled shaft, grade beam or spread footing foundations. The projected service life for this alternative is 75 to 100 years if maintained properly.

c) Prestressed Concrete I-Beams

This alternative involves the use of Type 1, MT28, Type A, Type IV and Type M72 precast, prestressed concrete I-beams. Each of these types are standard AASHTO shapes for various span lengths and loading requirements. Type 1 beams are used for spans up to 60 feet, Type MT28 for spans up to 70 feet, Type A for 60-95 feet, Type 4 for 95-120 feet and Type M72 for 120-150 feet. Each type is available for HS-20 loading meeting County Bridge Standards. Concrete I-Beams do not lend themselves to a rapid bridge installation because a cast-in-place deck must be formed and poured separately. Precast concrete or steel stay-in-place deck forms can be utilized rather than precursor wood forms to speed up the construction process. The projected service life for this alternative is 75 to 100 years if maintained properly.

d) Precast, Prestressed Concrete Slab

This alternative utilizes precast, prestressed concrete slabs that are normally cast at concrete plants where the environment and curing process can be controlled and prestressing tension can be applied to the prestressing cables. Slabs are cast in a variety of lengths. Solid slabs come in depths of 10 to 16 inches and widths of up to 6 feet. They are fastened together with welded plates and a grouted shear key. Precast slabs are fastened to abutments with reinforcing dowels or blockouts. Precast slabs are ideal for relatively short spans of 30 feet or less where superstructure depth must be minimized for hydraulic reasons. Precast concrete slabs are not used for spans greater than 35 feet due to the increased depth needed which results in an uneconomical shipping weight. For larger spans the use of Trideck or Bulb Tee precast beams is recommended. The projected service life for this alternative is 75 to 100 years if maintained properly.

e) Treated Timber Stringer

This alternative involves sawn and treated timber stringers. Timber bridges typically may be constructed without erection equipment or specialized skilled workers. Spans of under 30 feet are generally preferred on timber bridges due to strength limitations. Treated timber bridges typically have a service life of 30 to 50 years. Therefore, they have longevity concerns and require maintenance costs not associated with steel or concrete structures.

f) Glued-Laminated Timber Stringer

This alternative utilizes glued-laminated timber stringers. Glued-laminated stringers are manufactured in a variety of sizes that are not governed by the size or defects of the tree. Glued-laminated stringers are typically used for spans less than 60 feet due to the large deflections experienced. The main disadvantage with glued-laminated stringers is they require more maintenance than the steel or concrete alternatives and have a limited useful life. A bituminous surface course should be placed on all structures with glued-laminated stringers in order to prevent frequent contact and weathering associated with water exposure. Glued-laminated stringer bridges typically have a service life of 30 to 40 years. Therefore, they have durability issues and require maintenance costs not present with steel or concrete structures.

2. Decks

a) Cast-in-Place Concrete Deck Slab

This alternative involves the use of a cast-in-place reinforced concrete slab functioning as the entire superstructure. Cast-in-place deck slabs are utilized for short spans without the use of steel or concrete stringers. Cast-in-place deck slabs are typically utilized when the depth of the structure must be kept to a minimum. This alternative can be uneconomical as the efforts of shoring, building forms and reinforcing steel are expensive and labor intensive activities. Cast-in-place deck slabs are designed to provide all the structural support and therefore do not require stringers. Cast-in-place deck slabs are generally utilized on high volume and high-speed roads that necessitate heavy live loads and smooth riding surfaces. Past experience has shown that cast-in-place deck slabs tend to be uneconomical for bridges on low traffic, rural, county roads. The projected service life for this alternative is 75 to 100 years if maintained properly.

b) Cast-in-Place Composite Concrete Slab

This alternative involves a concrete slab rigidly interlocked to supporting stringers so that the combination functions as a single unit. Steel shear studs or hoops assist the composite action. Concrete slabs can be cast on steel or concrete beams. The cost of in-place concrete casting can be uneconomical for small structures but is generally cost-effective for bridges spanning over 100 feet. The projected service life for this alternative is 75 to 100 years if maintained properly.

c) Precast, Prestressed Concrete Slab

This alternative utilizes precast, prestressed concrete slabs that are normally cast at concrete plants where the environment and curing process can be controlled and prestressing tension can be applied to the prestressing cables. Slabs are cast in a variety of lengths. Solid slabs come in depths of 10 to 16 inches and widths of up to 6 feet. They are fastened together with welded plates and a grouted shear key. Precast slabs are typically attached to abutments with reinforcing dowels. Precast slabs are ideal for relatively short spans of 35 feet or less where superstructure depth must be minimized for hydraulic reasons. Precast concrete slabs are not used for spans greater than 35 feet due to the increased depth needed which results in an uneconomical shipping weight. For larger spans the use of Trideck or Bulb Tee precast beams is recommended. The projected service life for this alternative is 75 to 100 years if maintained properly.

d) Treated Timber Glued-Laminated Panels

This alternative involves the use of treated timber glued-laminated panels. The treated timber glued-laminated deck panels are usually 5-8 inches thick and 3-5 feet wide. The panels are typically utilized in combination with either steel girders or timber/glued-laminated stringers. They must either be bolted through the beam flange or attached with clips extending under the flange. Both methods are extremely labor intensive and require a significant amount of time and hardware. Glued-laminated panels can be used with or without a wearing surface. However, without a wearing surface glued-laminated panel decks offer poor skid resistance. This alternative requires a relatively minor amount of maintenance primarily consisting of replacing the wearing surface. The projected service life for glued-laminated panels is 40-50 years if a wearing surface is installed and maintained.

e) Treated Timber Planks

Treated timber planks are the oldest and simplest type of timber deck. They are often utilized on short spans. The planks must either be bolted through the beam flange or attached with clips extending under the flange. Treated timber planks are not as strong as other deck types and thus require narrower beam spacing. Depending on treatment type and wood grade, projected service life for treated timber planks is 30 to 50 years.

f) Untreated Timber Planks

This alternative involves the use of 3 to 6-inch thick and 10 to 12-inch wide untreated timber planking. The planks are generally placed flat, laid in the transverse direction and spiked to supporting beams. Untreated timber planks are not watertight and give little protection to supporting beams from the effects of weathering. They are not practical with asphalt surfaces because large deck deflections will cause deteriorated and cracked asphalt. This deck alternative will not be examined further due to its low service life and high maintenance costs.

g) Corrugated Steel Deck Panels

This alternative utilizes steel corrugated deck panels. Corrugated steel planks are advantageous because of their light weight and high strength. Steel deck planks are available in a variety of sizes and gauges in order to meet span requirements. The corrugations should be filled with asphalt or concrete, which may not be feasible in remote areas. Deck panels surfaced with asphalt and concrete can generally be expected to have service lives ranging between 50 and 100 years. This range depends on environmental and traffic conditions as well as the gauge of steel. Past experience with corrugated steel decks indicates that they do not perform well on bridges that experience large beam deflections, which tend to cause the asphalt or concrete to pop-out.

For structures located on low speed and low volume county roads, it is also possible to fill steel deck corrugations with sand and gravel. Surfacing a metal deck with a gravel wearing course often represents an initial capital construction cost savings. However, soil moisture contact and gravel point loading on the deck increase future maintenance costs and the frequency of repair work required. Galvanized panels are typically recommended in soil-contact applications such as this. Research conducted by the American Galvanizers Association (AGA) provides guidelines to approximate the service life of galvanized steel protection in soil-contact environments. Based on past experience; typical thicknesses of galvanizing (zinc coating in mils) available on industry standard steel bridge decking; and taking into account the variability of soil moisture and acidity levels; an estimated deck service life of 30 to 40 years is used in this analysis for soil-surfaced corrugated steel deck panels. Refer to the AGA's *Service life of Galvanized Steel Articles in Soil Applications* (2011, www.galvanizeit.org) for further information on galvanization and estimates for the estimated longevity of zinc-coated metal in contact with soil.

3. Single-Span vs. Multi-Span Superstructures

a) Single-Spans

In locations where crossings are less than 120 feet in span, single-span installations are generally more economical than multi-span structures. These superstructures can usually be installed with commonly-available construction equipment and universal construction methodologies. If sequenced properly, construction progresses quickly and a new bridge can be completed in as little as two to three weeks. Aside from the potential for shortened construction durations, the main advantage of a single-span bridge is that streambed disturbances and dewatering efforts are minimized. Single-span structures lend themselves well to bridge crossings with environmental issues such as sensitive aquatic habitats or wetlands. Most permitting agencies (MFWP, USFWS, Army Corps) prefer single-span alternatives (where possible and cost-effective).

Although certain manufacturers produce concrete beams and steel girder systems in spans up to—and exceeding—160 feet, single-span bridge crossings over 140 feet in length are not cost effective for County bridge replacements. For these longer crossings, generally multi-span structures are typically more appropriate.

b) Multiple-Spans

A cost savings may be realized by utilizing multiple spans for crossings of 120 feet or more. One advantage of a multi-span bridge is a shallower girder depth and shorter girders that are more easily transported to the site and maneuvered into place. The added expense of additional bents due to additional excavation, shoring, formwork, driven piles, drilled shafts and reinforcing steel, typically overshadows any savings in superstructure costs realized by utilizing shorter superstructure spans. Past experience has shown multi-span alternatives to be less economical than comparable single-span bridges for total lengths of less than 120 feet. Typically, multi-span structures are used for crossing lengths where vertical floodway clearance(s) and roadway approach heights are a design consideration. In shorter span superstructures, stringer/girder webbing depths can be minimized in order to maximize hydraulic capacity.

Superstructure Summary

Steel and precast concrete superstructures each have the advantages of rapid construction, durability and reduced environmental concerns. Future maintenance costs for these superstructure alternatives are expected to be on the lower end of the spectrum. Although timber structures are aesthetically pleasing, they have span limitations and are not as durable as steel or concrete. Solid sawn timber and glued-laminated superstructures will not be examined further due to durability constraints, additional maintenance costs and span limitations. A full replacement option would require the new bridge superstructure to span approximately 225 feet over the Clarks Fork of the Yellowstone River and provide a floodway equivalent to the natural conditions. Due to the long span required at the crossing, single-span alternatives are not technically feasible without significantly disrupting the floodplain due to the excessive amount of roadwork necessary to accommodate the deep girder. However, two-span structures require an intermediate pier which are a floodway obstruction and have environmental consequences resulting from construction taking place in the active channel. Superstructure alternatives that will be examined further include single-span and two-span variations of Precast, Prestressed Concrete Bulb Tee Beams and Steel Girder Bridge with Concrete Decks.

B. Substructure Alternatives

Introduction

A bridge substructure consists of two primary components: abutments and bearings. Determining the type of substructure is largely based on a geotechnical analysis. A detailed geotechnical analysis will be completed during the final design to determine the best substructure system for this site and structure. Silts and clays typically require the use of pile supported substructures due to the relatively low bearing pressure support, whereas shallow bedrock may necessitate spread footings because piles will not penetrate the dense rock. Gravels are normally suitable soils for both pile supported or spread footing foundations. In scour-critical locations, piles are recommended for foundation support.

1. Driven Pile Foundation

This alternative utilizes steel H-piles, steel pipe piles, micro-piles or round timber piles. Piles are used when the soil under a concrete footing cannot adequately support the substructure and in areas that may be prone to high stream velocity and have scour concerns.

Timber piles are typically less expensive than steel piles. However, timber piles are usually used on small bridge projects where the load carried by the piles is relatively small. Timber piles are also utilized when soils lacking solid end bearing are present. Bearing is attained by friction along the piling perimeter resulting from soil displacement. One significant disadvantage of timber piles is their ability to deteriorate and decay when constantly exposed to a wet environment. Another disadvantage is the impracticality of splicing piles if bearing is not attained in the supplied length. Timber piles can also be problematic during installation due to the soil displacements they cause.

Steel piling is typically the preferred pile alternative. Steel pipe piles (open-ended) and H-piles generally have smaller end-contact areas and are easier to drive. Steel H-piles are desirable when harder soils or soft bedrock is present, as they tend to penetrate better than pipe pile. Steel pipe piles are typically fitted with driving cones that displace larger amounts of soil. Because of their strength and soil displacement, steel round piles may be used for either end bearing on bedrock or alluvial gravels or friction bearing in silts or clays.

The use of diesel hammers or drop hammers is required for driving piles. Drop hammers are seldom used, primarily because they apply high impact stresses on piling and exert low levels of energy. This results in piles being driven more slowly—and with more pile damage—as compared to diesel pile hammers. Diesel hammers are entirely self-contained and use the combustion of diesel to drive piles. The choice of driving methods is normally determined by the contractor's availability of equipment.

2. Spread Footing Foundation

This alternative utilizes cast-in-place reinforced concrete footings and abutments. Spread footings are used when geotechnical conditions, such as shallow bedrock, exist that do not allow for sufficient pile lengths to be driven, typically a minimum of 10 feet. When footings are poured on soil that has poor load bearing characteristics, undesirable vertical settlement may occur. Countermeasures such as riprap are required to protect abutments when they are at risk from scour. The actual construction of spread footing foundations can be expensive as placing formwork is a labor-intensive process and costly. Cribbing, shoring and dewatering are typically required. Due to excessive environmental impacts and site constraints, a spread footing foundation is not appropriate for this bridge replacement and will not be examined further.

3. Concrete Grade Beam

This alternative utilizes cast-in-place or precast concrete grade beams which are typically placed on geocell earth stabilizing material. The geocell material is placed on prepared subgrade and filled with course granular material. The concrete grade beams are typically three feet wide and three feet deep, depending on local soils and the weight of the superstructure. A heavy superstructure or loading configuration may result in excessive settlement with the grade beam foundation.

Since this foundation system does not involve the use of a deep foundation, the key for proper functionality is to increase the bridge span and add riprap to protect the abutments from scour. This system also necessitates quality subgrade material to ensure suitable bearing pressures. Grade beam foundations are typically not well suited for low vertical clearance sites that typically require the grade beams to be located at or below the groundwater elevation, which would require significant dewatering. This alternative will not be examined further due to high scour potential and the excessive dead loads resulting from the long span of a replacement bridge that would surpass the capacity of a grade beam foundation.

4. Drilled Shaft Foundation

This alternative involves the use of a cylindrical structural column that transmits loads directly to soil or rock. A casing is typically set in place with the interior material bored and then the casing is filled with reinforced concrete. Shaft foundations are typically considered when spread footings cannot be placed on suitable soil or rock strata within a reasonable depth or obstructions are present preventing driven piling. Drilled shaft foundation construction is typically more expensive than piling installation due to the specialized equipment, additional construction timeframe and construction expertise that are required.

5. Geosynthetic Reinforced Soil – Integrated Bridge System (GRS-IBS)

This alternative utilizes an integrated abutment/wingwall/roadway approach system as the foundation bearing support for prefabricated or modular bridge superstructures. The GRS-IBS system can also be utilized to construct roadway approaches, headwalls and wingwalls for culvert structures. Generally, this substructure system consists of layers of geotextile fabric, which are sandwiched between multiple layers of 8”-minus (freedraining) backfill. Rows of CMU blocks are installed at the face(s) of the abutment/wingwalls to support the backfill and minimize scour.

This substructure system can be especially advantageous in dry crossing applications. Based on experience, the GRS-IBS system is best suited for situations where the site and stream drainage do not have a history of high-velocity flood flows and/or scour problems. The GRS-IBS system can also be beneficial in locations (and for projects) in which a concrete spread footing and stemwall substructure systems are being considered. Additionally, the GRS-IBS system can also be utilized in conjunction with concrete grade beam foundations.

Since this foundation system does not involve the use of a deep foundation, the key for proper function is to increase the bridge span and add riprap to protect from scour. This alternative will only be examined further if site characteristics are suited, minor differential settlements (+/- 2") are tolerable and scour is not an issue at the proposed site. As the design flood event is estimated to exceed 8077 cfs and lateral stream migration and scour are potential issues at the site, GRS-IBS foundations will not be considered in further detail.

Substructure Summary

The soil and stream characteristics in the project area typically determine the most suitable substructure alternative(s). Prior to final design, a geotechnical evaluation will be performed at the site to determine the most efficient foundation system. Generally, timber piles are used for friction bearing, steel H piles are used for end bearing, round steel pipe piles are used for end bearing or friction bearing and shallow bedrock requires spread footings. Due to site, geologic, stream channel and environmental constraints, this alternative analysis will continue to examine only pile supported and drilled shaft foundations. The cost difference between steel pile types is reasonably similar and therefore steel H piles will be examined based on suspected soils at the site. A spread footing foundation will not be examined further due to concerns regarding the stream impacts and high costs associated with the spread footing alternative. Due to the potential scour issues at the proposed project site, likely inadequate soils and based on the Engineer's experience a GRS-IBS foundation is not well suited for these conditions and will not be examined further.

C. Culvert Alternatives

Introduction

In many cases, a culvert rather than a new bridge may best accomplish the replacement of an existing structure. Culvert alternatives are often desirable due to short installation times, simple construction required and straightforward engineering. Additionally ordinary guardrails can be utilized instead of costly and labor-intensive bridge rail. However, culverts tend to experience problems associated with debris collection, fish passage and scour from high velocity flows and should be designed using a detailed hydraulic analysis. Several types of culverts are typically considered when replacing bridges in Carbon County.

1. Corrugated Metal Culvert

This alternative involves the use of round or arch corrugated metal pipe (CMP) culverts. Corrugated metal pipes are used to replace bridges where hydraulic flows are insignificant and no environmental concerns are present. Montana FWP and Army Corps of Engineers personnel tend to discourage these in areas where any disturbance to the streambed may adversely affect aquatic life.

2. Structural Plate Steel Pipe Arch Culvert

Structural plate or multi-plate pipe arch culverts are constructed of corrugated structural steel, which is shaped with an internal arching machine. Multi-plates are available in spans of up to 20 feet and heights of 14 feet. Super Spans up to 50 feet are available from other manufacturers; however, they require a reinforced concrete thrust block cast along the top of each side of the structure. Multi-plates are manufactured in 4 to 5 feet sections and fastened with coupling bands. Seams are lapped so the overlap is pointing downstream. Installation is performed in place, roughly 1 to 2 feet below the streambed elevation. The arch or squashed design is desirable over conventional round pipes due to its minimized height, which results in increased hydraulic capacity. The disadvantages associated with multi-plate culverts are aesthetics, streambed impact and labor intensive installation. Montana FWP personnel tend to discourage these in areas where any disturbance to the streambed may affect aquatic life and therefore multi plate pipe arch culverts are typically only utilized on irrigation canals or over intermittent or dry drainages.

3. Structural Plate Steel Arch Culvert

This alternative employs the use of bottomless structural plate or multi-plate steel arch culvert. Steel arch culverts are manufactured in spans from 6 feet to 30 feet at various heights. These culverts do not have the low vertical clearance properties seen with aluminum box culverts but they are more cost effective. Thus, they are only used at sites that have sufficient vertical clearances. Steel arch culverts typically require 1 to 3 feet of fill over the top in order to spread the load and maintain structural stability. At hydraulically insufficient sites, this option may not be feasible. The culverts are used with steel or concrete footing pads that are buried 2 to 3 feet below grade and therefore are utilized on streams that require minimal disturbance to the streambed or aquatic life.

4. Aluminum Box Culvert

This alternative employs the use of bottomless structural plate aluminum box culverts. Aluminum box culverts are manufactured in spans from 9 feet to 26 feet at various heights. Box culverts have a high width-to-height ratio, which allow large volumes of water to pass through a low profile section. They typically require at least 1.4 feet of fill over the top of the culvert in order to spread the load and maintain structural stability. This may rule out design of the culvert at hydraulically insufficient sites. Aluminum box culverts are available with aluminum or concrete footing pads that are buried 2 to 3 feet below grade and therefore are utilized on streams that require minimal disturbance to the streambed or aquatic life. Construction time is minimal with aluminum box culverts as the entire unit can be preassembled then transported to the site and placed with most lifting equipment.

5. Concrete Box Culvert

This alternative involves single or multiple concrete box culverts. Concrete box culverts may be buried just below the stream invert and require significant streambed disturbance. If culverts are not buried below the streambed, scour problems may result. Montana FWP personnel tend to discourage concrete box culverts in areas where any disturbance to the streambed may affect aquatic life. Therefore, concrete box culverts are typically only utilized on irrigation canals or over intermittent or dry drainages unless baffles are added to the floor. Multiple cell culverts tend to catch debris and should be used for specific cases where flows are low and debris in the area is minimal.

Culvert Summary

Typically, bottomless arch culverts will be used on streams that contain important aquatic life as they offer less streambed impact. Conventional round or arch pipe culverts will be utilized on irrigation canals and dry drainages as they do not require footing pads and are more economical. Height limitations may require pipe arches to be used instead of round culverts. Concrete box culverts will be used for crossings that require additional structural support.

Due to the hydraulic and site requirements, culvert alternatives will not be examined further. The culvert alternatives described above simply cannot handle the high flows of the Clarks Fork of the Yellowstone River while allowing for a naturally-functioning stream.

Replacement Prescreening Analysis Summary

Most culvert alternatives are significantly more economical than bridge replacement alternatives. However, culverts must meet hydraulic requirements and site characteristics. Preliminary sizing has determined that culvert alternatives are not appropriate for this site. Bridge replacement alternatives that will be examined further include a **Single-Span Steel Girder Bridge System with Cast-in-Place Concrete Deck** and **Two-Span** configurations of **Precast, Prestressed Concrete Bulb Tee Beams** and **Steel Girder Bridge Systems with Cast-in-Place Concrete Deck** superstructures and the **Driven Pile** or **Drilled Shaft** substructure alternatives. Each of these superstructure types is able to span the required length and meet design standard requirements.

V. Analysis of Technically Feasible Alternatives

A. Hydraulic & Hydrologic Design Recommendations

Preliminary sizing of the bridge options was done in accordance with the County Bridge Standards. The use of the structure by heavy trucks requires the replacement structure to handle HS 20-44 loading and have a useable width of 24 feet. Full hydrologic and hydraulic analysis will be performed during final design.

The proposed bridge will be designed for the County Bridge Standard requirement of the 50-year event of 12,700 cfs with two feet of freeboard. In addition, the new structure will accommodate the normal width of the stream in order to minimize the occurrence of downstream erosion. A spill-through channel configuration is best-suited for this application and consists of matching the channel base width and utilizing riprap at a 2:1 slope tying into the abutment. A preliminary hydraulic analysis using HY-8 was performed and used to size the replacement structure opening configuration. It is difficult to eliminate uncertainty during hydraulic sizing calculations without the aid of field survey information and detailed stream modeling. A stream gage located at the bridge was used to determine stream flows for various recurrence intervals for the hydraulic calculations to size the new structure. The estimated stream slope of 0.25% was determined from topographic maps of the Clarks Fork of the Yellowstone River for these initial design calculations. Site characteristics show that the existing channel base width is approximately 100 feet in the vicinity of the bridge.

The current road and bridge deck elevations pass up to the 100-year storm event with about 1.5 feet of freeboard. Preliminary hydraulic calculations have indicated that a channel bottom width of 100 feet with 2:1 riprapped slopes and a 30 degree skewed structure results in a total structure span length of 225 feet and produces the following freeboard:

Storm Event	Flow	Freeboard
25-year	11,700 cfs	2.54 ft
50-year	12,700 cfs	2.00 ft
100-year	13,600 cfs	1.55 ft

The recommended bridge structure spans (225-feet) and exceeds the minimum 50-year event design criteria set forth in the Carbon County Bridge Standards. The final design stage will involve a complete hydraulic analysis using survey information and a more detailed HEC-RAS hydraulic model. Refer to Appendix III for supplementary information on hydraulics.

B. Structural Design Components

The subsequent discussions consider the bridge as being composed of two distinct elements: 1) the superstructure consisting of the stringers, deck, bridge rail, etc. and 2) the substructure composed of either a pile supported or spread footing foundation, wingwalls, riprap, etc. To simplify the alternative analysis and stay conservative at this planning stage, each substructure option was determined to be interchangeable with each superstructure option. Thus; they will be discussed separately during the alternatives analysis. During the final design stage, the proposed alternative components will be reanalyzed to ensure that the selected mitigation plan for the crossing is still viable and in the best interests of the County, project stakeholders and the environment.

Please refer to the figures in Appendix I for plan and profile views of the proposed replacement and rehabilitation configurations.

C. Superstructure Alternatives

Each superstructure alternative presented herein has been assigned a number designator.

1. Single-Span Steel Plate Girder with Concrete Deck – Alternative 1

This alternative would utilize a single-span steel plate girder bridge with a cast-in-place concrete deck. Preliminary design indicates a cast-in-place concrete deck as the preferred deck type for a steel girder superstructure of this length due to structural constraints and cost savings that result when dealing with larger deck areas. The decking system will be compositely tied to the steel girders resulting in a stronger and more efficient structure design. The steel girder superstructure would need to be approximately 9 feet deep to span 225 feet. Installation of the concrete deck is fairly labor intensive and time consuming since the deck must be formed in-place once the steel girders are installed. County standard bridge barrier rail would be integrated into the overall design of the deck and would accommodate a useable width of 24 feet.

This alternative would require a relatively minor amount of maintenance. The steel stringers would be constructed with A588 weathering steel which would not require periodic painting. The projected service life for this alternative is 75 to 100 years if maintained properly.

2. Two-Span Precast, Prestressed Concrete Bulb Tee Beams – Alternative 2

This alternative would utilize precast, prestressed concrete Bulb Tee beams to form the superstructure system of the bridge. The deck is cast as an integral part of the beam, alleviating the need to cast a deck in the field. The bridge cross-section would consist of four beams, each with a width of 6'-7", resulting in a total deck width of 26’-4” and a useable width of 24’-0”. The bulb tee beams would be 4'-8" deep to span 225 feet with a center pier (approximately 110 feet each span).

This beam system simply involves setting the beams in place, welding them together and grouting the seams between adjacent beams. The final step involves casting concrete end diaphragms and installing steel intermediate diaphragms.

The main benefit of this alternative is the use of a shallower beam section which results in significant savings in the supply cost for the beams. Another significant benefit with the shallower beam section is the reduction in the amount the existing road must be built up to the new bridge deck elevation which reduces earthwork costs and potential right-of-way acquisition due to the wider road fills. The use of a prestressed, precast concrete deck system allows for the quick and efficient installation of the superstructure. The quality control of this alternative can also be closely monitored as the beams are cast and cured in a controlled environment.

Construction of the two-span bulb tee superstructure including placement and installation can be completed in 4-6 weeks. This alternative is essentially maintenance free and has a projected service life of 75 to 100 years.

3. Two-Span Steel Plate Girder with Concrete Deck– Alternative 3

This alternative would utilize a steel plate girder bridge system with a cast-in-place concrete deck. Preliminary design indicates a cast-in-place concrete deck as the preferred deck type for a steel girder superstructure of this length due to structural constraints and cost savings that result when dealing with larger deck areas. The decking system will be compositely tied to the steel girders resulting in a stronger and more efficient structure design. The steel girder superstructure would need to be approximately 5'-6" deep to span 225 feet with a center pier. Installation of the concrete deck is fairly labor intensive and time consuming since the deck must be formed in-place once the steel girders are installed. County standard bridge barrier rail would be integrated into the overall design of the deck and would accommodate a useable width of 24 feet.

The main benefit of this alternative is the use of a shallower beam section which results in significant savings in the supply cost for the beams. Another significant benefit with the shallower beam section is the reduction in the amount the existing road must be built up to the new bridge deck elevation which reduces earthwork costs and potential right of way acquisition due to the wider road fills.

This alternative would require a relatively minor amount of maintenance. The steel stringers would be constructed with A588 weathering steel which would not require periodic painting. The projected service life for this alternative is 75 to 100 years if maintained properly.

D. Substructure Alternatives

A complete geotechnical analysis will be performed during the final design process to delineate the most efficient and cost effective alternative. Each substructure alternative is designated by a letter (e.g. Alternative A).

1. Single-Span, Driven Pile Abutments with Concrete Caps and Wingwalls – Alternative A

Information gathered from site visits and from USDA soil maps indicate soils in the area primarily consist of very gravelly loam (depending on depth and location). Nearby soil borings and the engineer's experience in the project area suggest steel H-piles are best suited for these conditions. Based on anticipated loading, four piles per abutment at an average driven depth of 43.5 feet will be assumed.

Installation of steel piles is a fast and efficient process that typically takes one to two days per abutment. Following installation of the piles, a cast-in-place concrete cap will be constructed to provide bearing for the superstructure. Once the superstructure is in place, the cast-in-place concrete wingwalls can be installed. It is estimated that each wingwall will be supported by a driven pile and will be around 22 feet long and 12 feet tall.

Riprap will be placed against each abutment and wingwalls in order to protect against scour. This alternative will require little maintenance and has a projected service life of 75 to 100 years.

2. Single-Span, Drilled Shaft Abutments with Concrete Caps and Wingwalls – Alternative B

Information gathered from site visits and from USDA soil maps indicate soils in the area primarily consist of very gravelly loam (depending on depth and location). Based on anticipated loading, six-foot diameter, drilled shafts will likely need to be constructed to a depth of 40 feet.

Installation time of drilled shaft abutments is more prolonged than driven pile abutments. First, a steel casing is driven into place and the encapsulated soil is removed. A steel reinforcing cage is placed in the steel casing and concrete is poured to fill the steel casing. Following installation of the drilled shaft, a cast-in-place concrete cap is formed and poured to provide bearing for the superstructure. Once the superstructure is in place, the cast-in-place concrete wingwalls can be installed. It is estimated that each wingwall will be around 22 feet long and 12 feet tall and will be supported by a concrete spread footing.

Riprap will be placed against each abutment and wingwalls in order to protect against scour. This alternative will require little maintenance and has a projected service life of 75 to 100 years.

3. Two-Span, Driven Pile Abutments with Concrete Caps and Wingwalls and Driven Pile Pier with Concrete Cap – Alternative C

This three-span substructure alternative incorporates the design features of the single-span alternative (Alternative A) and adds one additional intermediate driven pile pier with a cast-in-place concrete pile cap. The installation and construction of an intermediate bent or pier with a pile cap usually takes longer than a comparable end abutment because it is installed over the river channel but follows the same process described above. Constructing an intermediate pier typically requires staging materials and equipment from an adjacent work structure or bridge. Based on anticipated loading, 6 piles at the intermediate pier would be driven to a depth of 58.5 feet with an additional 10 feet of exposed pile above the ground to reach the height necessary to support the superstructure.

4. Two-Span, Driven Pile Abutments with Concrete Caps and Wingwalls and Drilled Shaft Pier with Concrete Cap – Alternative D

This three-span substructure alternative incorporates the design features of the single-span alternative (Alternative A) and adds one additional intermediate drilled shaft pier with a cast-in-place concrete pile cap. The installation and construction of an intermediate bent or pier with a pile cap usually takes longer than a comparable end abutment because it is installed over the river channel but follows the same process described above. Constructing an intermediate pier typically requires staging materials and equipment from an adjacent work structure or bridge. Based on anticipated loading, a six-foot diameter, shaft will likely need to be constructed to a depth of 40 feet with an additional 10 feet of exposed shaft above the ground to reach the height necessary to support the superstructure.

5. Two-Span, Drilled Shaft Abutments with Concrete Caps and Wingwalls and Drilled Shaft Pier with Concrete Cap – Alternative E

This two-span substructure alternative incorporates the design features of the single-span alternative (Alternative B) and adds one additional intermediate drilled shaft pier with a cast-in-place concrete pile cap. The installation and construction of an intermediate bent or pier with a pile cap usually takes longer than a comparable end abutment because it is installed over the river channel but follows the same process described above. Constructing an intermediate pier typically requires staging materials and equipment from an adjacent work structure or bridge. Based on anticipated loading, a six-foot diameter, shaft will likely need to be constructed to a depth of 40 feet with an additional 10 feet of exposed shaft above the ground to reach the height necessary to support the superstructure.

E. Schematic Layout

Schematic drawings of Replacement Alternatives 1 through 3 are provided as Figures 6 through 8 in the Appendices. Each of these figures depicts a replacement superstructure alternative along with possible driven pile or drilled shaft substructure alternatives. The remaining alternatives discussed in the screening process were not deemed to be viable (or economically feasible) replacement options. All figures are included in Appendix I of this report.

F. Regulatory Compliance and Permits

Regardless of the selected alternative, the proposed improvements for the Chance Road Bridge will be designed in accordance with the Carbon County Bridge Standards and applicable AASHTO and MDT design guidelines. The Engineer will work closely with the County during the design process and the final design will be presented to Carbon County and the Treasure State Endowment Program for approval prior to soliciting bids.

Regardless of the preferred alternative, the project will be constructed in accordance with state and federal stream permitting guidelines. The construction of the new structure will require permits from the Montana Department of Fish, Wildlife and Parks (124 Permit), The Montana Department of Environmental Quality (318 Permit), U.S. Army Corps of Engineers (404 Permit) and a local County Floodplain Permit.

The bridge is located in a mapped floodplain (Panel No.: 30009C1125D). The work will require a County floodplain permit. The Clarks Fork of the Yellowstone River is not considered a navigable water body; therefore, a State Land Use Easement or License will not be required. A stormwater discharge permit from the DEQ will not be needed as construction activities are not anticipated to disturb more than 1 acre.

In the interest of public health and safety, a traffic control plan outlining the proposed signage and barricades will be required of the Contractor prior to the commencement of construction.

G. Land Requirements

Regardless of the selected alternative, the project will be constructed in essentially the same location as the existing bridge. The new structure will be located within the existing 60-foot section of County road easement. If temporary easement or right-of-ways are required to construct improvements, the County will work with the adjacent landowner(s) to procure access during the design phase. A work bridge, likely constructed outside the existing right of way will be necessary for construction crews to access the center pier and convey equipment across the waterway. Since it will be constructed outside the existing right-of-way, the work bridge will most likely require a temporary easement with the adjacent landowner.

H. Environmental Considerations

Bridge construction projects typically cause silt and construction debris to enter the waterway beneath the structure. However, steps can be taken to minimize the amounts of silt, sediments and construction debris that enter the Clarks Fork of the Yellowstone River. One of the most important environmental considerations for this project includes minimizing the effects of sedimentation in the river from construction. Jason Rhoten, local FWP Fisheries Biologist, has indicated that the river supports native fish populations. Unfortunately, temporary adverse effects to water quality cannot be completely avoided. However, in a project such as this, additional steps will be taken to keep silt and sedimentation in the river to a minimum. The contractor will be required to place silt fence along the stream banks. No in-stream work window has been established by FWP but work will likely take place in late summer or early fall when stream flows are at their lowest point. The type of structure and duration of the project schedule should be considered in order to reduce environmental impacts.

The USFWS, Montana FWP and the U.S. Army Corps of Engineers have suggested a strong preference toward the use of single-span bridges to minimize the environmental impacts of the replacement. In the case of this bridge replacement, a single-span structure would allow more natural flow of the river as it approaches the bridge; thus, reducing erosion and scour and allowing natural material bed load movements upstream and downstream of the bridge. However, single-span alternatives require significantly deeper girder sections than multi-span alternatives and consequently the roadway approaches must be raised more which results in a greater detriment to the floodplain upstream of the structure. Typically, pile and drilled shaft foundations are considered to be less of an impact to the streambed than other foundation types because of the minimal amount of excavation required. Alternatives will be comparatively evaluated based on environmental impacts; which will play an important role in selecting the preferred alternative for this bridge replacement.

All necessary stream permits will be acquired prior to construction and the contractor will be required to abide by the conditions set forth by these permits (e.g. silt fence). All disturbed areas will be re-seeded at the end of the project to promote re-vegetation and reduce erosion.

I. Construction Problems

The Chance Road Bridge is located approximately 9 miles south of Belfy, Montana in a relatively remote site. It is anticipated that due to the distance from Billings, Zone 3 Montana Prevailing wages will be required. This means that an additional increase over the base salary rate for employees will be required. The concrete prices may be slightly above average as the nearest concrete batch plant is located in Powell, Wyoming, approximately 35 miles from the project site. The distance of the bridge site from common construction supply centers will increase the delivery cost of materials as well.

A geotechnical investigation will be required which may have an effect on the cost of the bridge replacement project. The design and construction price may increase should the geotechnical analysis determine that a standard foundation design is not feasible. For instance, a geotechnical study may determine that the soils in the area of a particular bridge are extremely poor and necessitate a specialized design for foundation support.

J. Cost Estimates

1. Project Costs

Cost estimates have been prepared for each superstructure and substructure alternative. The estimates include costs associated with engineering, administration, legal and construction activities. Cost estimates are based on past bid tabs on similar projects and quotes received from suppliers. A contingency item has been included as well to account for any unforeseen expenses.

In an effort to standardize the cost estimates for each bridge alternative, the superstructure estimate was assumed to include all roadwork necessary to transition between the existing road and new bridge superstructure, right-of-way acquisition, structural backfill, providing and installing the girders and deck, providing and installing the bridge rail and guardrail terminal end sections and installation of backwalls. Superstructure Alternative Costs are outlined in variants of Table 1, shown below. As discussed previously, each superstructure is designated by a number. For example, Alternative 1 consists of single-span steel plate girders with concrete deck. Table 1-1 describes the opinion of probable cost for Superstructure Alternative 1. Likewise, Table 1-2 describes the estimated cost of Superstructure Alternative 2.

Analogous to the numbers designating each superstructure, Substructure Alternatives are each assigned a letter (e.g. Substructure Alternative B). All costs associated with structure excavation is included in the prices of the substructure alternatives. The substructure estimates include costs for cast-in-place concrete for abutment walls, wingwalls, etc. The substructure costs for Alternatives A, B, C, D and E are outlined in Tables 2-A, 2-B, 2-C, 2-D and 2-E of this section, respectively. Separating the superstructure and substructure cost estimates along these lines will allow the various alternatives to be interchanged and compared on a fair basis.

The costs common to the project (removal of existing bridge; temporary work bridge; riprap installation; historic bridge mitigation; utility mitigation; wetland delineation; object marker installation; seeding; geotechnical investigation; etc.) are compiled separately in Table 3, as these items are unrelated to the selection of the bridge superstructure and bridge substructure alternatives.

A contractor's mobilization fee, construction contingency set-aside, engineering design and construction management fees and an administrative fee has been added to all cost estimates. The mobilization fee accounts for bonding, insurance, transportation of labor and equipment and other costs that are typically not included in the other bid items. While 10% (approximate) may seem slightly elevated, several years of bid tabulations indicate that this number accurately reflects the rates commonly utilized by contractors for bridge projects of this nature. The contingency (roughly 10%) allows for inflation of costs between the writing of this report and construction in a couple of years as well as any unforeseen subsurface characteristics evidenced as result of geotechnical investigation, which might elevate contracted costs. The estimated engineering fee accounts for all preliminary design, final design, field surveying, construction documents and permitting. The administrative fee accounts for all clerical, secretarial and legal costs.

2. Present Worth Analysis

Following each cost estimate is a present worth analysis which details costs over the life of the structure. The analysis is completed for each of the alternatives proposed for replacement of the existing bridge. Each bridge alternative will be designed for a useful life of 75 years, which conforms to standards set by AASHTO and followed by MDT. All costs used in the Operation and Maintenance (O&M) assumptions are in today's dollars, as this category is broken out over a 75-year period and inflation over that period cannot be projected.

TABLE 1 - 1
OPINION OF PROBABLE COST
Superstructure Alternative 1 - Single-Span - Steel Plate Girders with a Concrete Deck

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$103,800	$103,800
2	Steel Plate Girders w/CIP Deck (9' Deep) (225 ' Span)	SF	5,925	$120	$711,000
3	Cast-In-Place Concrete End Diaphragms	CY	23	$925	$21,275
4	Steel Bridge Barrier Rail	LF	458	$115	$52,670
5	Approach Guardrail	EA	4	$3,500	$14,000
6	Structural Backfill	CY	450	$40	$18,000
7	Unclassified Excavation & Embankment (Includes Roadway Widening)	CY	3,600	$20	$72,000
8	Crushed Gravel Surfacing	CY	140	$40	$5,600
9	Crushed Base Course	CY	400	$35	$14,000
10	Additional Right-of-Way Acquisition	LS	1	$25,000	$25,000
	SUBTOTAL				**$1,037,345**
	Construction Contingency				**$103,735**
	Engineering				**$207,469**
	Administration/Legal				**$51,867**
	TOTAL				**$1,400,416**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Repair of Concrete Deck	25	$6,000	$12,000
Maintenance and Repair of Bridge Rail	25	$5,000	$10,000
Maintenance and Repair of Approach Guardrail	25	$1,500	$3,000
Useful Life (years)	75		
Superstructure O & M			$25,000
CAPITAL COSTS			$1,400,416
TOTAL (75 YEAR COST)			**$1,425,416**

TABLE 1 - 2 OPINION OF PROBABLE COST Superstructure Alternative 2 - Two-Span - Precast, Prestressed Concrete Bulb Tee Beams					
Item No.	**Description**	**Unit**	**Quantity**	**Price**	**Amount**
1	Mobilization	LS	1	$69,000	$69,000
2	Precast, Prestressed Concrete Bulb Tee Beams (4'-8" Deep) (2 - 110' Spans)	SF	5,795	$85	$492,575
3	Cast-In-Place Concrete Diaphragms (End & Center)	CY	25	$925	$22,663
4	Steel Bridge Barrier Rail	LF	458	$115	$52,670
5	Approach Guardrail	EA	4	$3,500	$14,000
6	Structural Backfill	CY	215	$40	$8,600
7	Unclassified Excavation & Embankment (Includes Roadway Widening)	CY	1,000	$20	$20,000
8	Crushed Gravel Surfacing	CY	70	$40	$2,800
9	Crushed Base Course	CY	200	$35	$7,000
	SUBTOTAL				**$689,308**
	Construction Contingency				**$68,931**
	Engineering				**$137,862**
	Administration/Legal				**$34,465**
	TOTAL				**$930,565**

PRESENT WORTH ANALYSIS			
Maintenance Description	**Frequency (years)**	**Cost per Repair**	**Total Cost**
Patching and Repair of Beam Joints	25	$4,000	$8,000
Maintenance and Repair of Bridge Rail	25	$3,500	$7,000
Maintenance and Repair of Approach Guardrail	25	$1,500	$3,000
Useful Life (years)	75		
Superstructure O & M			$18,000
CAPITAL COSTS			$930,565
TOTAL (75 YEAR COST)			**$948,565**

TABLE 1 - 3
OPINION OF PROBABLE COST
Superstructure Alternative 3 -
Two Span - Steel Plate Girders with a Concrete Deck

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$92,200	$92,200
2	Steel Plate Girders w/CIP Deck (5'-6" Deep) (2-110' Spans)	SF	5,795	$120	$695,400
3	Cast-In-Place Concrete Diaphragms (End & Center)	CY	28	$925	$25,900
4	Steel Bridge Barrier Rail	LF	458	$115	$52,670
5	Approach Guardrail	EA	4	$3,500	$14,000
6	Structural Backfill	CY	240	$40	$9,600
7	Unclassified Excavation & Embankment (Includes Roadway Widening)	CY	1,100	$20	$22,000
8	Crushed Gravel Surfacing	CY	70	$40	$2,800
9	Crushed Base Course	CY	200	$35	$7,000
	SUBTOTAL				**$921,570**
	Construction Contingency				**$92,157**
	Engineering				**$184,314**
	Administration/Legal				**$46,079**
	TOTAL				**$1,244,120**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Repair and Renovation of Concrete Deck	25	$6,000	$12,000
Maintenance and Repair of Bridge Rail	25	$5,000	$10,000
Maintenance and Repair of Approach Guardrail	25	$1,500	$3,000
Useful Life (years)	75		
Superstructure O & M			$25,000
CAPITAL COSTS			$1,244,120
TOTAL (75 YEAR COST)			**$1,269,120**

TABLE 2 - A

OPINION OF PROBABLE COST

Substructure Alternative A -
Single-Span - Driven Pile Abutments with Concrete Caps & Wingwalls

Item No.	Description		Unit	Quantity	Price	Amount
1	Mobilization		LS	1	$17,400	$17,400
2	Structure Excavation		CY	440	$15	$6,600
3	Cast-in-Place Concrete		CY	75	$925	$69,375
4	Furnish Steel H Piles	(18 @ 45')	LF	810	$75	$60,750
5	Drive Steel H Piles	(18 @ 43.5')	LF	783	$25	$19,575
	SUBTOTAL					**$173,700**
	Construction Contingency					**$17,370**
	Engineering					**$34,740**
	Administration/Legal					**$8,685**
	TOTAL					**$234,495**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Renovating Concrete	25	$5,000	$10,000
Useful Life (years)	75		
Substructure O & M			$10,000
CAPITAL COSTS			$234,495
TOTAL (75 YEAR COST)			**$244,495**

TABLE 2 - B

OPINION OF PROBABLE COST

Substructure Alternative B -
Single-Span - Drilled Shaft Abutments with Concrete Caps & Wingwalls

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$29,900	$29,900
2	Structure Excavation	CY	440	$15	$6,600
3	Cast-in-Place Concrete	CY	110	$925	$101,750
4	Drilled Shaft (6' Diameter)	LF	80	$2,000	$160,000
	SUBTOTAL				**$298,250**
	Construction Contingency				**$29,825**
	Engineering				**$59,650**
	Administration/Legal				**$14,913**
	TOTAL				**$402,638**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Renovating Concrete	25	$7,500	$15,000
Useful Life (years)	75		
Substructure O & M			$15,000
CAPITAL COSTS			$402,638
TOTAL (75 YEAR COST)			**$417,638**

TABLE 2 - C

OPINION OF PROBABLE COST

Substructure Alternative C -
Two-Span- Driven Pile Abutments and Pier with Concrete Caps & Wingwalls

Item No.	Description		Unit	Quantity	Price	Amount
1	Mobilization		LS	1	$18,500	$18,500
2	Structure Excavation		CY	440	$15	$6,600
3	Cast-in-Place Concrete		CY	62	$925	$57,350
4	Furnish Steel H Piles	(12 @ 45') (6 @ 70')	LF	960	$75	$72,000
5	Drive Steel H Piles	(12 @ 43.5') (6 @ 68.5')	LF	1,151	$25	$28,775
	SUBTOTAL					**$183,225**
	Construction Contingency					**$18,323**
	Engineering					**$36,645**
	Administration/Legal					**$9,161**
	TOTAL					**$247,354**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Renovating Concrete	25	$4,500	$9,000
Useful Life (years)	75		
Substructure O & M			$9,000
CAPITAL COSTS			$247,354
TOTAL (75 YEAR COST)			**$256,354**

TABLE 2 - D

OPINION OF PROBABLE COST

Substructure Alternative D -
Two-Span - Driven Pile Abutments and Pier with Concrete Caps and Wingwalls

Item No.	Description		Unit	Quantity	Price	Amount
1	Mobilization		LS	1	$26,000	$26,000
2	Structure Excavation		CY	440	$15	$6,600
3	Cast-in-Place Concrete		CY	75	$925	$69,375
4	Furnish Steel H Piles	(12 @ 45')	LF	540	$75	$40,500
5	Drive Steel H Piles	(12 @ 43.5')	LF	522	$25	$13,050
6	Drilled Shaft (6' Diameter)		LF	50	$2,000	$100,000
	SUBTOTAL					**$255,525**
	Construction Contingency					**$25,553**
	Engineering					**$51,105**
	Administration/Legal					**$12,776**
	TOTAL					**$344,959**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Renovating Concrete	25	$5,000	$10,000
Useful Life (years)	75		
Substructure O & M			$10,000
CAPITAL COSTS			$344,959
TOTAL (75 YEAR COST)			**$354,959**

TABLE 2 - E

OPINION OF PROBABLE COST

Substructure Alternative E -
Two-Span - Drilled Shaft Abutments and Pier with Concrete Caps and Wingwalls

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$38,400	$38,400
2	Structure Excavation	CY	440	$15	$6,600
3	Cast-in-Place Concrete	CY	85	$925	$78,625
4	Drilled Shaft (6' Diameter)	LF	130	$2,000	$260,000
	SUBTOTAL				**$383,625**
	Construction Contingency				**$38,363**
	Engineering				**$76,725**
	Administration/Legal				**$19,181**
	TOTAL				**$517,894**

PRESENT WORTH ANALYSIS

Maintenance Description	Frequency (years)	Cost per Repair	Total Cost
Patching and Renovating Concrete	25	$5,500	$11,000
Useful Life (years)	75		
Substructure O & M			$11,000
CAPITAL COSTS			$517,894
TOTAL (75 YEAR COST)			**$528,894**

TABLE 3

OPINION OF PROBABLE COST

Common Costs

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$34,600	$34,600
2	Removal and Disposal of Existing Bridge	LS	1	$70,000	$70,000
3	Temporary Work Bridge	LS	1	$150,000	$150,000
4	Random Riprap	CY	560	$90	$50,400
5	Object Markers & Steel Posts	EA	4	$200	$800
6	Seeding/Erosion Control/Revegetation	LS	1	$3,500	$3,500
7	Geotechnical Investigation	LS	1	$20,000	$20,000
8	Historic Bridge Mitigation	LS	1	$2,000	$2,000
9	Wetland Delineation	LS	1	$5,000	$5,000
10	Asbestos Investigation	LS	1	$750	$750
11	Utility Mitigation	LS	1	$8,000	$8,000
	SUBTOTAL				**$345,050**
	Construction Contingency				**$34,505**
	Engineering				**$69,010**
	Administration/Legal				**$17,253**
	TOTAL				**$465,818**

K. Basis for Selection of the Preferred Alternative

Table 4, below, presents a ranking of each alternative based on a comparative evaluation. Refer to the table for a summarization of the selection process.

Superstructure alternatives explored in the cost analysis included precast, prestressed concrete bulb tee beams and steel girder systems in single-span and two-span variations. The single-span alternatives examined steel girders capable of spanning 225 feet. The two-span alternatives examined concrete and steel girders capable of spanning 110 feet. Alternative 2, two-span bulb tee beam superstructure has a present worth savings of approximately $320,000 over Alternative 3, two-span steel girder system and a savings of $477,000 over Alternative 1, single-span steel plate girder. Therefore, both the single-span and two-span steel girder system alternatives are significantly more expensive than the two-span precast, prestressed concrete girder alternatives.

Substructure alternatives explored included driven pile and drilled shaft with variations to accommodate single-span or two-span structures. Generally, driven pile alternatives were less costly than drilled shaft alternatives and single-span substructure alternatives were less costly than two-span substructure alternatives. The results of the present worth cost comparison showed Alternative A, single-span driven pile abutments, to be about $125,000 less expensive than Alternative B, single-span drilled shaft abutments. The results of the present worth cost comparison also revealed Alternative C, driven pile abutments with a driven pile pier to be about $270,000 less expensive than Alternative E, drilled shaft abutments with a drilled shaft pier but only about $100,000 less expensive than Alternative D, driven pile abutments with a drilled shaft pier. Therefore, both the single-span and two-span drilled shaft substructure alternatives are significantly more expensive than the corresponding driven pile substructure alternatives.

To fully compare costs of single-span and two-span superstructure and substructure alternatives, the superstructure and substructure costs associated with each configuration must be combined into a single superstructure-substructure cost. Since common costs are applicable to all alternatives, they are included in the total initial costs but have no bearing on comparative analysis. Alternatives 1A and 1B, single-span variations of the steel plate girder superstructure are generally, considerably more expensive than the two-span variations of the steel plate girder. Alternative 2C, a two-span precast, prestressed concrete bulb tee beam superstructure with driven pile abutments and a driven pile pier has a total initial cost of $1,643,739 and was identified as the most cost effective alternative. The two-span configuration allows for the use of a precast concrete girder with composite concrete deck that is not possible in a single-span alternative. The two-span precast, prestressed concrete bulb tee beam superstructure with driven pile abutments and a driven pile pier allows for the use of a shallower, girder section versus a comparatively deep steel girder section that would be necessary in a single-span alternative. This alleviates the amount of roadwork that must completed to raise the road to the new deck elevation and results in reduced impacts to the floodplain and makes it less likely that additional right of way would need to be acquired for the project.

Thus, largely based on long term viability, cost and reduced impacts to the floodplain and adjacent landowners, the preferred alternative for mitigation of the present concerns and existing bridge deficiencies consists of replacing the existing Chance Road Bridge with a **Two-Span Precast, Prestressed Bulb Tee Beam Superstructure** supported on **Driven Pile Abutments and a Driven Pile Pier.**

TABLE 4

Basis For Selection

	Superstructure Alternatives (Refer to Tables 1-1 to 1-3)			Substructure Alternatives (Refer to Tables 2A-2E)					(Refer to Table 3)
	1	2	3	A	B	C	D	E	
	Single-Span (225')	Two-Span (2-110' Spans)		Single-Span		Two-Span			
	Steel Plate Girders w/Concrete Deck	Precast, Prestressed Concrete Bulb Tee Beams	Steel Plate Girders w/Concrete Deck	Driven Pile	Drilled Shafts	Driven Pile Abutments & Piers	Driven Pile Abutments & Drilled Shaft Pier	Drilled Shaft Abutments & Pier	Common Costs
Construction Cost	$1,037,345	$689,308	$921,570	$173,700	$298,250	$183,225	$255,525	$383,625	$345,050
Total Initial Cost w/ contingency, engineering, & administration	$1,400,416	$930,565	$1,244,120	$234,495	$402,638	$247,354	$344,959	$517,894	$465,818
O & M Costs	$25,000	$18,000	$25,000	$10,000	$15,000	$9,000	$10,000	$11,000	-
Useful Life	75 years	75 years	75 years	75 years	75 years	75 years	75 years	75 years	75 years
75 Year Present Worth	$1,425,416	$948,565	$1,269,120	$244,495	$417,638	$256,354	$354,959	$528,894	$465,818
Cost Effectiveness	0	+1	0	+1	0	+1	0	0	-
Technical Feasibility	0	+1	+1	+1	0	0	+1	0	-
Environmental Impacts	+1	0	0	+1	+1	0	+1	0	-
Construction Time	+1	+1	0	+1	0	+1	0	0	-
Total	+2	+3	+1	+4	+1	+2	+2	0	-

Replacement Alternative		Total Initial Cost (including common)	75-YEAR PW
1-A	Single-Span Steel Plate Girders & Concrete Deck w/Driven Pile Foundation	$2,100,728	$2,135,728
1-B	Single-Span Steel Plate Girders & Concrete Deck w/Drilled Shaft Foundation	$2,268,871	$2,308,871
2-C	Two-Span Precast, Prestressed Concrete Bulb Tee Beams w/Driven Pile Abutments & Piers	$1,643,739	$1,670,736
2-D	Two-Span Precast, Prestressed Concrete Bulb Tee Beams w/Driven Pile Abutments & Drilled Shaft Pier	$1,741,341	$1,769,341
2-E	Two-Span Precast, Prestressed Concrete Bulb Tee Beams w/Drilled Shaft Abutments & Pier	$1,914,276	$1,943,276
3-C	Two-Span Steel Plate Girders & Concrete Deck w/Driven Pile Abutments & Piers	$1,957,291	$1,991,291
3-D	Two-Span Steel Plate Girders & Concrete Deck w/Driven Pile Abutments & Drilled Shaft Pier	$2,054,896	$2,089,896
3-E	Two-Span Steel Plate Girders & Concrete Deck w/Drilled Shaft Abutments & Pier	$2,227,831	$2,263,831

Recommended Alternative: Two-Span Prestressed Concrete Bulb Tee Beams with Driven Pile Abutments & Piers

Total Initial Project Cost (TABLES 1-2 *(+)* 2-C *(+)* 3) **$1,643,739**

VI. Detailed Description of the Preferred Alternative

A. Site Location and Characteristics

Refer to Appendix I, which includes Figures 9 and 10 (preliminary schematic and preliminary site plan) for the preferred alternative.

The replacement structure will be located in essentially the same location as the existing bridge. The useable bridge width will be increased to 24 feet, the overall length increased to 225 feet and skewed 30 degrees for better alignment to the channel. The increased width will allow for two-way travel and the increased span will allow for a two-span structure while allowing for the proper placement of riprap and environmentally friendly spill-through channel configuration. All bridge work will be completed with only minimal interference to the stream. Work in the streambed vicinity is anticipated to include removing the existing concrete abutments, installing the intermediate pier and keying in new riprap.

The roadway approaches will be vertically aligned to provide a smooth transition to the new bridge deck elevation and will require roadwork over approximately 260 feet (160 feet from the north bridge end and 100 feet from the south bridge end). It is anticipated that the roadway in the bridge vicinity will be raised approximately 1.5 feet from the existing crossing in order to meet the County freeboard requirements. The roadway width at the bridge will be increased to 24 feet with a 3% crown to provide adequate drainage. The new roadway improvements are anticipated to be located within the County right-of-way.

During construction, the roadway at the bridge will be closed and traffic will be redirected to alternate routes around the project. A temporary work bridge will be constructed adjacent to the existing bridge to convey construction equipment across the channel and to access the center pier. The temporary work bridge will be closed to public traffic. The temporary work bridge will be located on private property, downstream of the bridge. The construction of the bridge is anticipated to occur over a period of 90-120 days.

B. Design Criteria

Refer to Appendix I, which includes a schematic drawing (Figure 9) for the selected alternative.

The replacement structure will provide sufficient roadway width at the bridge to ensure two-way travel, remedy existing structural concerns, adequately handle proposed loading requirements, provide structurally adequate bridge rail and approach end sections and conform to applicable MDT, AASHTO and County Bridge Standard requirements. The preferred alternative will be constructed with a two-span precast, prestressed concrete bulb tee beam superstructure with driven pile abutments and a driven pile pier.

The two-span precast, prestressed concrete bulb tee beam bridge will be 225 feet long. The new bridge will be 26 feet and 4 inches wide. Bridge barrier rails on each side will allow for a useable width of 24 feet. The replacement structure will handle the 50-year flood event with approximately 2 feet of freeboard. The 100-year flood event passes through the structure with approximately 1.5 feet of freeboard. Six steel piles per abutment will be driven to an estimated depth of 43.5 feet and six steel piles at the intermediate pier will be driven to 68.5 feet for proper foundation stability. Cast-in-place concrete pile caps will be installed on the piles with a bearing system placed on top of the caps to provide an adequate bearing configuration and remain functional in extreme temperature fluctuations. A cast-in-place end wall will be installed at the bridge ends. The precast bulb tee beams will allow for HS-20-44 live loading. The proposed bridge will be designed for a 75-year useful life, but with an anticipated life closer to 100 years.

Steel W-beam T-101 Bridge Rail and guardrail end sections as required by the County Bridge Standards will be integrated into the design and construction of the preferred alternative. At a minimum, bridge rail will meet AASHTO LRFD TL-2 crash testing criteria. The PER and cost estimate provides sufficient funding for County Standard 37.5’ flared end approach rail sections.

C. Environmental Considerations

The Montana Environmental Policy Act (MEPA) requires state government to coordinate state plans, functions and resources to achieve various environmental, economic and social goals through the use of a systematic, interdisciplinary analysis of state actions that have an impact on the human environment. This is accomplished through the use of a deliberative, written environmental review. For this type of project, an Environmental Assessment (EA) is initiated to determine the potential significance of impacts to the human environment. If the EA determines the proposed action will have significant impacts, then either an Environmental Impact Statement (EIS) must be prepared or the effects of the proposed action must be mitigated below the level of significance and documented in a mitigated EA.

An EA must document the purpose and need for the proposed action, the affected environment, an analysis of alternatives including a No-Action alternative and analysis of the impacts to the human environment of the different alternatives, including an evaluation of appropriate mitigation measures. An EA has been prepared for this project in accordance with MEPA guidelines. In addition, this report serves as a supplement to the EA. Please refer to Appendix V for the attached Environmental Assessment and letters from environmental agencies for supporting documentation of the information presented below.

In order to complete a systematic, interdisciplinary analysis of the project, letters were written to various governmental agencies soliciting comment on any potential environmental impacts, whether beneficial or adverse, which would result from the proposed project. The agencies that were contacted are listed below. See Appendix V for a copy of the EA and comments from the agencies describing the project and any possible environmental impacts.
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- Montana Department of Fish, Wildlife and Parks
- Montana Department of Natural Resources and Conservation
- Montana Department of Environmental Quality
- Montana Department of Transportation
- State Historical Preservation Office
- Carbon County Floodplain Administrator
- Carbon County Planning Office
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers

MEPA also requires public involvement to allow interested and affected individuals organizations and agencies to be included in the decision-making process. In order to give members of the public the opportunity to be involved in the environmental review, a public meeting was held at:

- Belfry Elementary School Multipurpose Room, Belfry, MT, March 31, 2016 at 6:00 p.m.

In addition, as part of the grant application submittal, a public hearing was conducted at:

- Office of the Carbon County Commission, Red Lodge, MT, April 28, 2016 at 10:00 a.m.

Public notice for these meetings/hearings, which included invitations for written comments, were published in the Carbon County News, the newspaper of record for Carbon County. The meetings/hearings detailed the inventory process, sought comment on the Environmental Assessment, presented the Preliminary Engineering Report (in draft format) and allowed a venue for public comment. Written comments (and comments received at the public meetings) were documented and added to the EA. Responses to each comment were also documented and added to the EA. According to MEPA, agencies must consider substantive comments to EAs prior to making final decisions about the adequacy of the analysis in the EA, modifications to the proposed action and the necessity of preparing an EIS.

1. Land Use/Important Farm Land/Formally Classified Lands

Affected Environment:

The Chance Road Bridge over the Clarks Fork of the Yellowstone River is located in a rural area with primarily undeveloped adjacent properties. Preliminary investigations indicate that the surrounding lands are designated as Farmland of Local Importance (NRCS Soils Map). Existing farmlands are not located in the direct vicinity of the bridge and at their nearest occur 250 feet to the northwest of the bridge. The predominant crops in this area are dryland grass and flood irrigated alfalfa. As the structure replacement will likely be located within the 60-foot County easement and is not tillable land, no negative impact is anticipated.

A section of state land and a large area of federal BLM land is located to the northwest of the bridge. No forest lands exist within one mile of the project. If the bridge is not improved and becomes closed, agricultural operations would be forced to detour to different roadways in order to access their agricultural interests. A new structure will ensure access to the area for another 75 years.

Environmental Consequences:

The alternatives may result in temporary dust, silt and erosion problems during construction. No long term effects are anticipated.

Mitigation:

The Contractor will be required to erect silt fence along the banks to prevent silt and construction debris from entering the stream. The disturbed areas will be seeded to promote re-vegetation. In order to minimize silt and erosion problems typically associated with bridge construction, construction will likely take place in late summer/early fall, at a period of low water to reduce impacts on spawning trout, reduce turbidity constraints and minimize effects on any native fish and aquatic organism species.

The necessary stream permits will be obtained prior to construction and the Contractor will be required to adhere to all guidelines set forth by these documents. The Contractor will also be required to water the construction site as necessary throughout the project in order to mitigate any temporary dust problems.

2. Floodplains

Affected Environment:
The bridge is located in a mapped Zone A- Federal Emergency Management Agency (FEMA) floodplain. As the proposed bridge replacement is located within a designated floodplain, a County Floodplain Development Permit will be required.

Environmental Consequences:
No environmental issues associated with floodplains have been identified at this time.

Mitigation:
The replacement of the Chance Road Bridge will require the acquisition of a County Floodplain Permit. The purpose of the floodplain permit, administered by the County Floodplain Administrator with assistance from the Montana DNRC, is to prevent new construction from adversely affecting the 100 and 500-year floodplains in the County. The permit states that the replacement structure may not raise or lower the 100-year floodplain elevation more than six inches upstream or downstream of the bridge. Thus, the acquisition of a Floodplain Development Permit serves as mitigation for this issue.

3. Wetlands

Affected Environment:
Based on information from the USFWS Survey National Wetlands Inventory, there appear to be riparian lotic forested wetlands in the vicinity, located to the northwest and southeast of the bridge.

A wetland delineation will be performed to document any jurisdictional wetlands at the site vicinity during the design phase of the project. The entire footprint of the proposed construction disturbance will be evaluated for the presence of wetlands and those wetlands will be delineated and mapped in accordance with the Corps 1987 Delineation Manual (and applicable Regional Supplement). Wetlands boundaries will be flagged in the field and numbered. Flag numbers and locations will be surveyed using a sub-meter GPS and depicted on the delineation map.

The Contractor will be required, to the extent feasible, to avoid wetlands in and around the project site that may be affected by construction activities. The Contract will require the Contractor to minimize wetland disturbance wherever possible and implement BMPs to avoid impacts such as material inputs and sedimentation to wetlands or the Clarks Fork of the Yellowstone River. At this time and based upon the preliminary information available, it is anticipated that less than one-tenth of an acre of wetlands will be disturbed as a result of the proposed project. However, the potential for wetland disturbance will be evaluated in more detail during the design phase in order to determine if compensatory mitigation is required as a result of the project.

Environmental Consequences:
Only a minor impact to potential wetlands is anticipated as a result of the proposed construction alternatives.

Mitigation:
The Contractor will be required to erect silt fence along the stream banks to prevent silt and construction debris from entering the stream. Disturbed areas will be seeded to

promote re-vegetation. In order to minimize silt and erosion problems typically associated with bridge construction, construction will be scheduled during the summer or early fall when flows are minimal. A detailed wetland survey will occur during the survey phase to identify any potential impacts. All necessary stream permits will be acquired prior to construction of the new bridge.

4. Cultural Resources

Affected Environment:
As a general rule, all bridges that are 50 years or older are considered eligible for listing on the National Register of Historic Places. The Chance Road Bridge is a single-span steel through truss bridge with a timber deck and concrete abutments. According to Damon Murdo from SHPO, the bridge has been previously recorded, however, no formal determination of eligibility has been made. Furthermore, MDT Historian, Jon Axline adds, "*It was originally one of the spans of the Huntley Bridge over the Yellowstone River and was moved to its existing site in the late 1940s...the steel through truss is eligible for the National Register.*"

Environmental Consequences:
No environmental consequences have been identified at this time.

Mitigation:
As the existing bridge meets criteria for the National Register of Historic Places, prior to any construction, historical mitigation efforts will record the bridge description, history and photographs to be submitted to the National Register.

Other historic sites (irrigation system and bridge) have been located in the vicinity of the bridge but are outside of the proposed work area and will require no mitigation.

5. Biological Resources

Affected Environment:
The Clarks Fork of the Yellowstone River supports aquatic wildlife populations; therefore, careful consideration to the stream habitat and effects that the proposed bridge will have on the stream will be considered.

A database search conducted using the Montana Natural Heritage Program website and by the USFWS found sixteen possible species of special concern in the area: Canada Lynx, Grizzly Bear, Black-footed Ferret, White-Tailed Prairie Dogs, Merriam's Shrew, Golden Eagle, Pinyon Jay, Loggerhead Shrike, Sage Thrasher, Brewer's Sparrow, Sprague's Pipit, Greater Sage Grouse, Western Milksnake, Greater Short-horned Lizard, Whitebark Pine and Dwarf Mentzelia.

Jodi Bush of the United States Fish and Wildlife Service does note that "*there could be potential effects to migratory birds*" but also that her comments were "*prepared under the authority of and in accordance with, the provisions of the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, 54 Stat. 250) and the Endangered Species Act (16 U.S.C. 1531 et. seq.). [My] comments do not address the overall environmental acceptability of the proposed action.*" In regard to the provided list of Threatened and Endangered Species occurring in Carbon County, she goes on to say that "*it is unlikely all of these will occur within your project areas.*"

Based on a review of the Montana Sage Grouse Habitat Conservation Program (MSGHCP) Mapper (https://sagegrouse.mt.gov/projects), the proposed project is mapped as being in an area of General Sage Grouse Habitat. Following the award of TSEP grant funds and within 12 months of the proposed construction date, the County will consult with the MSGHCP regarding the work. As necessary, a permit application will be submitted for MSGHCP review. Depending on the outcome of the permit application, some form of mitigation may be required in order to implement the project. According to the Montana Field Guide, the Greater Sage Grouse's Courtship season starts in early March and persists into May. Typically, sage hens prefer to nest on sagebrush covered benches from June to July. When forbs on bench habitats begin to dry, Sage Grouse tend to migrate to alfalfa fields or greasewood bottoms.

Environmental Consequences:
The proposed project is not expected to have any significant permanent adverse effects on vegetation and wildlife. No significant migratory bird nesting areas are anticipated to be affected by the proposed project. Any temporary construction effects on plant species will be re-seeded to promote re-vegetation and reduce erosion.

Silt and debris in the river could adversely affect fish habitat; therefore, a bridge replacement alternative that impacts the streambed and banks as little as possible is desirable. Some bridge designs can constrict the natural channel flow of the river, increase erosion and affect bedload movement both upstream and downstream of the structure. Therefore, single-span bridges with natural stream bottoms are desirable for waterways such as the Clarks Fork of the Yellowstone River. However, in order to minimize impacts to the adjacent floodplain and adjacent farmland, the preferred structure alternative may be a two-span structure that limits raising the road to only 1 foot versus 5 feet with a single-span girder, due to the shallower girder section.

Mitigation:
Where feasible, construction activities will be coordinated such that disruptive and/or destructive impacts to Sage Grouse can be avoided. Where avoidance is not feasible, best management practices will be implemented in order to minimize impacts and reasonable efforts will be made to restore damages. As such, Sage Grouse are not anticipated to be adversely affected by this work.

Jodi Bush of the United States Fish and Wildlife Service notes that special considerations are needed as the project is located in known Grizzly Bear habitat. The USFWS recommends several steps to prevent conflicts with Endangered Grizzly Bears.

1. Promptly clean up any project related spills, litter, garbage and debris.
2. Camping allowed in designated campgrounds only.
3. Store all food, food related items, petroleum products, antifreeze, garbage and personal hygiene items inside a closed, hard-sided vehicle or commercially manufactured bear resistant container.
4. Notify the project manager of any animal carcasses found in the area.
5. Notify the project manager of any bears observed in the vicinity of the project.

Jason Rhoten, Montana FWP, notes that the primary gamefish in the area of the bridge are rainbow trout, brown trout and mountain whitefish. Based on the presence of brown trout, construction of the project will likely occur in the late summer/early fall at a period of low water to reduce impacts on spawning trout and reduce turbidity constraints. All necessary stream permits will be acquired prior to construction and the Contractor will be required to adhere to the permit documents, including guidance on protection or mitigation measures that the USACE feels are reasonable and prudent.

6. Access to and Quality of, Recreational and Wilderness Activities, Public Lands, Waterways and Public Open Space

Affected Environment:
The Chance Road Bridge serves less than 100 vehicles per day including access to private homes, agricultural properties, State Trust Lands and Federal lands. Closure of the bridge would impact access to (and quality of experience of) recreational activities, public lands and waterways and public open space for local residents, fisherman and hunters.

Environmental Consequences:
As long as the bridge remains open, no environmental consequences have been identified.

Mitigation:
The replacement of the Chance Road Bridge serves as the primary form of mitigation for this issue. A new structure will ensure access to the area for 75 years.

7. Socio-Economic/Environmental Justice Issues

Affected Environment:
The Chance Road Bridge provides primary access to numerous residences and agricultural operations. The proposed project will allow residents and business owners (including ranchers and farmers) to continue to have the most direct access to their properties. If the bridge is not improved and becomes closed, residents would be forced to detour to different roads for access.

Environmental Consequences:
No adverse environmental consequences have been identified at this time.

Mitigation:
Replacement of the Chance Road Bridge would serve as the primary form of mitigation for this issue. Proposed improvements will ensure access to the area for the next 75 years.

8. Lead Based Paint and/or Asbestos

Affected Environment:
There is no known lead based paint or asbestos at this site.

Environmental Consequences:
No adverse environmental consequences have been identified at this time.

Mitigation:
Recent requirements from Montana DEQ require an inspection for asbestos (performed by an accredited inspector) prior to any demolition taking place. This inspection may be waived depending on the type of bridge structure and its components.

D. Cost Summary of Selected Alternative

The following table itemizes the Engineers opinion of probable contracted cost for the preferred alternative. This assumes all work items are contracted to a contractor. All costs are in today's dollars.

TABLE 5

OPINION OF PROBABLE COST

Total Contracted Project Costs

Item No.	Description	Unit	Quantity	Price	Amount
1	Mobilization	LS	1	$122,100	$122,100
2	Precast, Prestressed Concrete Bulb Tee Beams (4'-8" Deep) (2 - 110' Spans)	SF	5,795	$85	$492,575
3	Cast-In-Place Concrete Diaphragms (End & Center)	CY	25	$925	$22,663
4	Steel Bridge Barrier Rail	LF	458	$115	$52,670
5	Approach Guardrail	EA	4	$3,500	$14,000
6	Structural Backfill	CY	215	$40	$8,600
7	Unclassified Excavation & Embankment (Includes Roadway Widening)	CY	1,000	$20	$20,000
8	Crushed Gravel Surfacing	CY	70	$40	$2,800
9	Crushed Base Course	CY	200	$35	$7,000
10	Structure Excavation	CY	440	$15	$6,600
11	Cast-in-Place Concrete	CY	62	$925	$57,350
12	Furnish Steel H Piles	LF	960	$75	$72,000
13	Drive Steel H Piles	LF	1,151	$25	$28,775
14	Removal and Disposal of Existing Bridge	LS	1	$70,000	$70,000
15	Temporary Work Bridge	LS	1	$150,000	$150,000
16	Random Riprap	CY	560	$90	$50,400
17	Object Markers & Steel Posts	EA	4	$200	$800
18	Seeding/Erosion Control/Revegetation	LS	1	$3,500	$3,500
19	Geotechnical Investigation	LS	1	$20,000	$20,000
20	Historic Bridge Mitigation	LS	1	$2,000	$2,000
21	Wetland Delineation	LS	1	$5,000	$5,000
22	Asbestos Investigation	LS	1	$750	$750
23	Utility Mitigation	LS	1	$8,000	$8,000
	SUBTOTAL				**$1,217,583**
	Construction Contingency				**$121,759**
	Engineering				**$243,517**
	Administration/Legal				**$60,880**
	TOTAL				**$1,643,739**

The following table itemizes the Engineers opinion of probable cost for the Chance Road Bridge (CR3) Replacement.

TABLE 6

OPINION OF PROBABLE COST

Total Project Costs

Administrative Line Items	TSEP Cost	County Cash
Personnel	$0	$3,000
Office Costs	$0	$500
Professional Services	$600	$25,440
Legal Costs	$500	$500
Audit Fees	$0	$1,000
Travel and Training	$500	$500
Loan Fees	$0	$0
Load Reserves	$0	$0
Interim Interest	$0	$0
Bond Counsel and Related Costs	$0	$0
SUBTOTAL	**$30,440**	**$30,440**
Construction Line Items	**Cost**	**County Cash**
Land Purchase Costs	$0	$0
Preliminary Engineering	$0	$15,000
Engineering Design Services	$80,555	$65,555
Construction Management	$48,703	$48,703
Construction Costs	$529,422	$688,161
Contingency	$60,880	$60,880
SUBTOTAL	**$719,560**	**$878,299**
TOTAL	**$750,000**	**$908,739**
TOTAL	**$1,658,739**	

VII. Recommendations and Implementation

A. Funding Strategy

Carbon County has in the past and continues to demonstrate serious efforts to seek out, analyze and secure the firm commitment of all known sources of alternative funding for bridge improvements. However, sources of funding for bridge projects within the State of Montana are extremely limited. The vast majority of all bridge replacements are funded by bridge mills assessed through local property taxes. The following is a list of sources that were identified in the Bridge Evaluation and Capital Improvement Plan as potential funding sources for bridges.

- Levy the maximum amount of bridge mills allowed by state law.
- Bridge Depreciation Reserve Fund.
- County CIP Fund.
- PILT Payments and Timber Receipts.
- Optional Motor Vehicle Tax.
- Local Option Motor Fuel Excise Tax.
- Oil and Gas Lease Funds.
- Rural Improvement Districts.
- General Obligation Bonds.
- Revenue Bonds.
- Impact Fees.
- MDT Secondary Road Program.
- MDT Bridge Replacement and Rehabilitation Program (HBRRP Off-System).
- Federal Lands Access Program (FLAP).
- Federal Hazard Elimination Program (STPHS).
- Treasure State Endowment Program (TSEP).
- Montana Board of Investments Intercap Program.
- Federal Emergency Management Agency (FEMA).
- Secure Rural Schools Program - Resource Advisory Committee (RAC).

In reviewing the aforementioned list, the County has determined that most of these funding sources are simply not feasible. However, some have been looked as potential funding sources. Carbon County has considered contacting the Montana Fish, Wildlife and Parks and the DNRC for funding assistance, but while they are typically are in support of bridge replacement projects, they rarely contribute to County bridge replacement projects.

The Montana Department of Transportation allocates monies to Counties through the off-system bridge program (MDT HBRRP). The only bridge nominated for the HBBRP program by Carbon County is the Homestead Road Bridge (L05312000+08001). It has been programmed with an estimated construction in 2020.

The County has also considered bridge rural improvement districts. However, identifying the users that benefit by a specific structure is difficult as most bridges benefit the infrastructure needs of the entire County.

It is the opinion of Carbon County that, with the exception of the Treasure State Endowment Program, there are no other viable sources of funding available for the replacement of Chance Road Bridge outside of the County bridge budget. The County proposes to fund half of the Chance Road Bridge replacement through grant monies received from the Treasure State

Endowment Program. The remaining half of the estimated project cost would be funded through the Carbon County Bridge Budget.

B. Implementation

This project will be scheduled to begin in the late summer or early fall of 2018 and is anticipated to occur in a contract period of 90 to 120 days. Constructing the bridge at this time of year will allow construction to occur when flows in the Clarks Fork of the Yellowstone River are minimal and spawning fish are not affected. The County intends to contract out all work. Funding tables identifying detailed County contributions toward this project are shown in Table 6 above. The project schedule is included following the Public Participation section of this preliminary engineering report.

C. Public Participation

The public has been involved and supportive throughout the entire process. Letters were mailed to several emergency, construction and service businesses as well as area residents. Concerned citizens responded with solid support. Please refer to Appendix IV for letters of support. A public meeting was held in Belfry on March 31st, 2016 for the Draft Environmental Assessment and a public hearing was held in Red Lodge on April 28th, 2016 for the PER and TSEP Grant. The public meeting and hearing were advertised in the local newspaper to ensure maximum exposure. No objections were expressed at the public events, which had moderate turnout. Minutes from the meeting and hearing well as the public notices published in the Carbon County News regarding the meeting and hearing agendas are included as an Appendix of the TSEP Grant Application.

CARBON COUNTY – SPRING RIVER BRIDGE (CR3)
QUARTERLY PROJECT IMPLEMENTATION SCHEDULE

TASK	QUARTERS, 2017				QUARTERS, 2018			
	1st J F M	2nd A M J	3rd J A S	4th O N D	1st J F M	2nd A M J	3rd J A S	4th O N D
PROJECT START UP								
Sign TSEP Contract			X					
Prepare Management Plan			X					
Establish Project Files			X					
Submit Signature & Depository Forms			X					
Submit Budgetary Resolution			X					
PROJECT DESIGN								
Advertise for & Select Engineer		COMPLETED						
Commence Final Design			X					
Complete Project Design				X X				
Submit Plans to TSEP				X				
Prepare Bid Documents					X X			
Finalize Acquisition (N/A)	N/A							
ADVERTISEMENT FOR CONST. BID								
Review Contract Requirements						X		
Public Bid Advertisement						X X		
Open Bids & Examine Proposals						X		
Request Contr. Debarment Review						X		
Select Contractor & Award Bid						X		
Conduct Pre-Const. Conference						X		
Issue Notice to Proceed to Contractor						X		
PROJECT CONSTRUCTION								
Begin Construction							X	
Monitor Engineer & Contractor							X X X	X
Conduct Labor Compliance Reviews							X X	X
Hold Const. Progress Meetings							X X	X
Final Inspection								X
PROJECT CLOSE OUT								
Submit Final Drawdown								X
Determine Audit Requirements								X
Project Completion Report								X
Submit Conditional Certification								X
Submit Final Certification								X