Final Feasibility Report

Swan River – Bridge St (Bigfork)

STPB 9015 (126)

UPN 9020000

February, 2017

Table of Contents

TABLE OF CONTENTS

List of Tables and Figures

List of Appendices

EXECUTIVE SUMMARY

The 1912, Pratt pin-connected through truss bridge leading into downtown Bigfork, Montana originally served this community as a vital river crossing into a frontier commerce center. Over a century later, the single-lane bridge with an added sidewalk provides a secondary entry into Bigfork but also serves as an iconic symbol for the current business and tourist community located on Flathead Lake.

Figure 1: Swan River Bridge in Bigfork

Due to time, corrosion and damage to the century-old steel truss, the bridge is no longer able to carry heavier vehicles and has been limited to a maximum, three-ton load. With no remediation, the bridge is expected to be closed in the near future, when it can no longer carry the minimum, legal load of three tons. Flathead County, the bridge owner, is seeking options to preserve the river crossing, by either rehabilitating or replacing the bridge and its walkway. Flathead County requested technical and financial assistance from the Montana Department of Transportation (MDT) through its off-system bridge funding.

This Final Feasibility Report summarizes the year-long effort to define the project needs, to identify and evaluate various bridge options, and to seek input on the Bigfork community's preferences. This Final Feasibility Study will be submitted to the Flathead County Commission for their further action and to seek funding and to initiate a project through MDT to perpetuate this Swan River bridge crossing for the public and the citizens of Bigfork.

Bridge Replacement Recommendation:

The local community and a project Steering Committee (SC) identified the key project goals and emphasized the community's desire to maintain the iconic appearance. The SC worked extensively with the technical design team to consider the feasibility of seven bridge options. Based upon public input and final discussions, the SC concluded that replacing the bridge will best fit the safety, travel and maintenance needs while retaining the iconic appearance valued by the community. **Option 7 is recommended to the County Commission. Option 3 is viewed as acceptable but not preferred.**

- **Option 7, a New, Single-Lane Steel Through Truss** would be similar in appearance to the current bridge, would provide one lane and a sidewalk, would have thicker truss members and would provide an overhead structural truss (i.e., the overhead members carry the bridge loads). All parts of this bridge would be designed to provide a 75-year bridge life. The existing bridge would be completely removed and could be salvaged, sold or repurposed.

The SC recognizes that Option 3 also meets the safety and travel needs and would retain the iconic appearance by re-using overhead portions of the existing bridge. The SC concurred that the re-use of overhead portions of the existing structure introduces some unknowns into the construction and may add uncertainty for future County maintenance responsibilities. Option 3 was identified by the SC as an acceptable option but not the preferred option.

- **Option 3, a New, Single-Lane Steel Girder with Architectural Truss** would be similar in appearance to the current bridge, would provide one lane and a sidewalk, would have a deeper girder (closer to the water level) but still above floodway needs and would re-use the overhead portions of the existing truss by attaching them atop the new bridge. The re-used portions of the existing bridge would be for appearance only and are considered an architectural (not a structural) feature. The overhead truss members to be salvaged for re-use may generate a relatively small risk that costs could increase due to additional construction needed during removal, salvage and re-attachment.

Bridge Options that are Not Forwarded by the SC are:

- **Option 1, No Build**
- **Option 2, a New, Single-Lane Pony Truss Bridge**
- **Option 4, a New, Single-Lane Concrete Girder Bridge**
- **Option 5, Rehabilitation of the Existing Bridge** received significant discussion and sizable public support. Due to construction and cost uncertainties and the lesser bridge life expected (from the 104-year old steel), this option was not forwarded.
- **Option 6, a New, Two-Lane Concrete Girder Bridge with Architectural Truss** was opposed by nearly all members of the public as they prefer to retain the single-lane appearance (and traffic queues) to a standard, two-way bridge.

1 INTRODUCTION

Flathead County requested MDT assistance in reviewing the feasibility of rehabilitating or replacing the Swan River Bridge, a single-lane truss bridge constructed in 1911-12. The 119 – foot long bridge rests atop concrete abutments and has a narrow pedestrian walkway hung outside the east (upstream) truss. The bridge crosses the Swan River in Bigfork, Montana approximately 0.2 miles east of State Primary Route 35 (MT 35).

Listed on the National Register of Historic Places (NRHP) in 2015, this bridge provides one of two river crossings between the Bigfork Dam and Flathead Lake. The bridge is load-limited at the minimum, legally-allowed load of three tons (T) due to corrosion and damage to the century-old steel truss. The historic appearance of the bridge is a valued component to the business and tourist community of Bigfork, which is an unincorporated village in Flathead County. The bridge is maintained by and under the jurisdiction of Flathead County.

1.1 Project Goals

A bridge for both vehicular and pedestrian crossing of the Swan River is needed at the current location of the Swan River Bridge in Bigfork. The community strongly desires to maintain the historic appearance of the single-lane, truss structure and both Flathead County (owner) and MDT (funding agency) acknowledge that due to the historical nature and the unique features of the bridge within Bigfork, future options may not need to meet all current design standards.

Through a series of meetings, the SC developed three, specific Project Goals[1]:

- Provide a Safe Crossing of the Swan River (for both vehicles and pedestrians)
- Maintain the Historic Truss Appearance
- Ensure the Project is Constructible and Maintainable

These goals were presented to the public at the April 12, 2016 public meeting, prior to development of any options for the bridge. The attending public provided their input on these project goals via a preference survey or via public comments submitted over the next month.

1.2 Project Comparison Criteria

After concurrence on the Project Goals, the SC then developed comparison criteria for future bridge options[1]. The criteria were developed by consensus at multiple meetings to provide measurable definitions that allow a qualitative (graphic) comparison between bridge options. The SC also defined select criteria as "required", indicating a higher importance to that criteria and shown with underline below. The comparison criteria are detailed below:

[1] Project Need and Screening Criteria Memorandum, July 2016.

Need 1: Provide Safe Crossing of Swan River.

a) Increase load limit. A minimum of an H-15 loading (15 tons) is required for rehabilitation in accordance with MDT policy, with a higher loading preferred if found feasible. A standard HS-20 design loading (36 tons) is required for new construction.
b) Provide minimum of one-lane vehicular width.
c) Accommodate pedestrians. Provide walkway that is separated from vehicles. Full accessibility (Americans with Disability Act (ADA) requirements) will be required for any federal funding. Provide pedestrian rail to current design standards.
d) Provide 75-year bridge life. Standard for new bridge design is 75-years but this project could accept reduced life for rehabilitation.
e) Minimize reduction of the current vertical clearance above the river.
f) Provide design that encourages the current slow vehicular speeds (due to need to see across one-lane bridge before entering onto bridge and also tight approach radii which limit sight distance).
g) Improve other design standards (approaches, barrier rails, etc.)
h) Improve guardrail on the bridge approach.

Need 2: Maintain Historic Truss Appearance.

a) Maintain appearance of overhead truss structure.
b) Maintain NRHP-listing of bridge.
c) Keep silver paint color.
d) Replicate existing overhead truss dimensions.

Need 3: Provide a crossing that is constructible and maintainable (by standard County resources).

a) Propose an option that is fundable (federal funds and County funds).
b) Propose an option that can be permitted, through known construction permits.
c) Propose an option that can be permitted for stormwater and water quality through the Montana Department of Environmental Quality (DEQ) and Clean Water Act requirements to eliminate direct bridge deck runoff into open water (such as runoff from a wooden plank deck).
d) Provide an option that can be maintained by County for the life of the structure (reduce special maintenance needs such as substructure cleaning, etc.).
e) Remove wooden deck.
f) Reduce need for special County maintenance.
g) Reduce bridge degradation (peeling, flaking of lead-based paint and deterioration of steel) into river.
h) Avoid right-of-way acquisition.
i) Minimize utility costs.

Figure 2 shows the greater Bigfork community, at the northeastern edge of Flathead Lake. Because this study is only considering options to rehabilitate or replace the existing bridge, the study area was limited to the area immediately surrounding the bridge.

Figure 2: Vicinity Map

2 PUBLIC OUTREACH

Three types of public outreach were undertaken for the Feasibility Study:

- Creation of a project SC
- Extensive public contact via direct mailings and informational meetings
- Early coordination with resource agencies

2.1 Steering Committee

A SC comprised of local representation, owner representation (Flathead County) and funding agency staff (MDT) provided guidance and feedback to the study team. The SC was responsible for providing direction for the project, reviewing all work products, assisting with the Public Informational Meetings, and making recommendations on the study. The SC developed a consensus finding for the project goals, screening criteria, conclusions and offered insights throughout the duration of the Feasibility Study.

The SC members are:

Susan Hansen	Bigfork Citizen Representative
Walter Kuhn	Bigfork Citizen Representative
Paul Mutascio	Bigfork Representative, Citizens for a Better Bigfork (CFBB)
Jed Fisher	Flathead County Parks & Recreation
Pam Holmquist	Flathead County Commissioner
Dave Prunty	Flathead County Public Works
Vicki Crnich	MDT Planning
Chris Hardan	MDT Bridge
Shane Stack	MDT Missoula District

Seven SC meetings were held over the course of the study. Dates and primary outcomes of the meetings are summarized as follows with SC Meeting Minutes contained in Appendix 2:

- Meeting 1 – 3/10/2016 – The SC discussed bridge use and feasibility, including bridge purposes, modes of travel on the bridge, and overall purpose and need for the bridge. SC members stated that the top need for a bridge project to be feasible was that it improved safety for the traveling public. The SC discussed, in depth, the community's preference to maintain the historic, truss appearance as it is a vital component of Bigfork's identity and character.

- Meeting 2 – 4/6/2016 – The SC reviewed bridge needs statements and information to be presented at the first public input meeting.

- Meeting 3 – 5/16/2016 – Jon Axline, MDT's historian, attended and talked about the historic listing of the bridge, and how various alternatives could impact the National Register of Historic Places (NRHP) listing of the bridge. The Swan River Bridge Needs and Project Objectives were refined into comparison criteria which will be used in comparing (future) bridge options. The comparison criteria were identified as "required" or "desired" to differentiate the importance of project features. The criteria and final comparison matrices are included in Appendix 2.

- Meeting 4 – 7/27/2016 – Six bridge options were presented to the SC. A seventh option showing a new, one lane, through truss was added. The SC provided a preliminary rating of each bridge option based on screening criteria developed for each of the three identified bridge needs.

- Meeting 5 – 10/12/2016 – The SC reviewed results from the second public meeting. The SC determined that the ratings (screening criteria rankings) should remain as is-and not be changed based on the written and verbal public comments.

- Meeting 6 – 11/16/2016 – The SC reviewed Bridge Memo #2 which provided a planning-level risk analysis and cost estimate for each bridge option. The SC also provided comments on a draft of the Final Report. The SC ranked the bridge options and discussed information that should be presented to the County Commission at the completion of this feasibility study.

- Meeting 7 – 1/25/2017 – The SC reviewed results from the third public meeting and minor revisions to the conceptual costs. Based upon these reviews, the SC determined that the qualitative costs rankings and the prioritization of bridge options had not changed from the previous work. The SC reached a consensus that Option 7 is the recommended option but noted that Option 3 is acceptable.

2.2 Public Outreach

Due to the community's strong attachment to the historic bridge and its value to the community of Bigfork, public outreach was emphasized from the earliest stage of the Feasibility Study. The public has played a major role in responding to the validity and acceptability of study alternatives. The first public meeting emphasized that no options were developed until after seeking input from the local community. The SC also served as a communication link to the community and decision makers and was encouraged to share information.

Three public informational meetings were held during the study process with summaries and comments received from the public included in Appendix 3. The meetings were advertised through local papers (Kalispell Daily Interlake and Flathead Beacon), news releases, letters to the local community and MDT's website.

A project website, http://www.mdt.mt.gov/pubinvolve/bigforkbridge/documents.shtml, was maintained on MDT's website. A link to the project website was provided in public meeting letter invitations, advertisements, and materials. The website provided a project overview, contact information, meeting announcements and links to study documents, videos, frequently asked questions, and the project schedule. There was also a link for people to submit their comments.

Prior to each public informational meeting, a letter was mailed to approximately 400 addresses from the Bigfork Water and Sanitary District. Each letter provided meeting notification and encouraged attendance or comment and provided contact information and a link to the website.

Informational Meetings

- Informational Meeting 1 – 4/12/2016 – Fifty-two members of the public attended the meeting. The purpose of the meeting was to introduce the Feasibility Study and seek public input on the needs and issues for the historic bridge. Three stations were available giving attendees the opportunity to review and discuss existing bridge conditions, needs, and to provide comments. Following a short presentation that summarized the purpose, need and schedule for the study,

attendees overwhelmingly chose maintaining the historic appearance and maintaining the one-lane configuration of the bridge as the top needs for the project.

- Informational Meeting 2 – 8/16/2016 – Sixty-one members of the public attended the meeting. The purpose of the meeting was to present bridge options and screening criteria ratings. Three meeting stations were available to the public, which covered bridge options, screening criteria and opportunities to provide written comments. Following a presentation of seven bridge options, a session was held to receive and respond to questions from the public. The consensus of the meeting and subsequent public comments was:

  - None of the public responses supported Options 1, 2, 4 or 6.

  - 78% (30 of 38) responses indicated a preference for Options 3, 5 or 7. (Some indicated two preferences).

- Informational Meeting 3 – 12/1/2016 – Twenty members of the public attended the meeting. The purpose of this final public meeting was to relay the SC support of two bridge replacement options and seek public comments. Following a brief presentation of the study status and SC conclusions, a session was held to receive and respond to questions. A total of 15 comments were received from the public. The consensus of the meeting and subsequent public comments was:

  - Attendees expressed appreciation to MDT and Flathead County for the outreach and study efforts.
  - 14 of the 15 comments supported replacing the bridge with a one-lane, truss type structure. The remaining comment supported the cheapest replacement option possible.
    - 40% (6 of 15) supported Option 7
    - 40% (6 of 15) did not indicate support for a numbered option but did support a single lane replacement with overhead truss appearance.

2.3 Resource Agency Meeting

A Resource Agency meeting was held with environmental agency representatives on October 6, 2016 to provide an overview of the Feasibility Study and its Environmental Scan Report (E-scan), and to confirm if potential environmental issues have been addressed. Meeting minutes are contained in Appendix 4. The E-Scan Report identified most potential project issues with the following issues reinforced with meeting discussions:

- The proposed project site adjoins a superfund site and would require coordination with state and federal agencies and PacifiCorp, the site owner. If a project moves forward, pre-construction sampling would need to occur near the abutments and on the south side of the existing bridge. An Environmental Assessment is presently being prepared by PacifiCorp for the superfund site but was not available at the time of this writing.

- Special provisions would be needed to address any lead-based paint on the current bridge.

The Resource Agency meeting identified the following additional issue:

- The bridge is in a unique stretch of Swan River as fish move in and out from Flathead Lake within the proximity of the bridge which may affect bull trout and western slope cutthroat trout. The bridge area is not part of a migratory corridor or a spawning or rearing habitat however, some seasonal use is anticipated.

3 EXISTING AND FUTURE CONDITIONS

3.1 Existing Conditions

An Existing and Projected Conditions Report[2] analyzed the current and future conditions of the bridge.

3.1.1 Existing Bridge Conditions

The existing 119-foot, steel truss is a pin connected Pratt through truss with the configuration shown in Figure 3. The bridge sits on concrete abutments with unknown foundations. The south abutment appears to rest on bedrock while the north abutment is believed to rest on native soil. A pedestrian walkway was attached onto the bridge at an unknown date after the original construction. Wooden planks serve as both the driving and walking surfaces.

Figure 3: Existing Bridge Profile

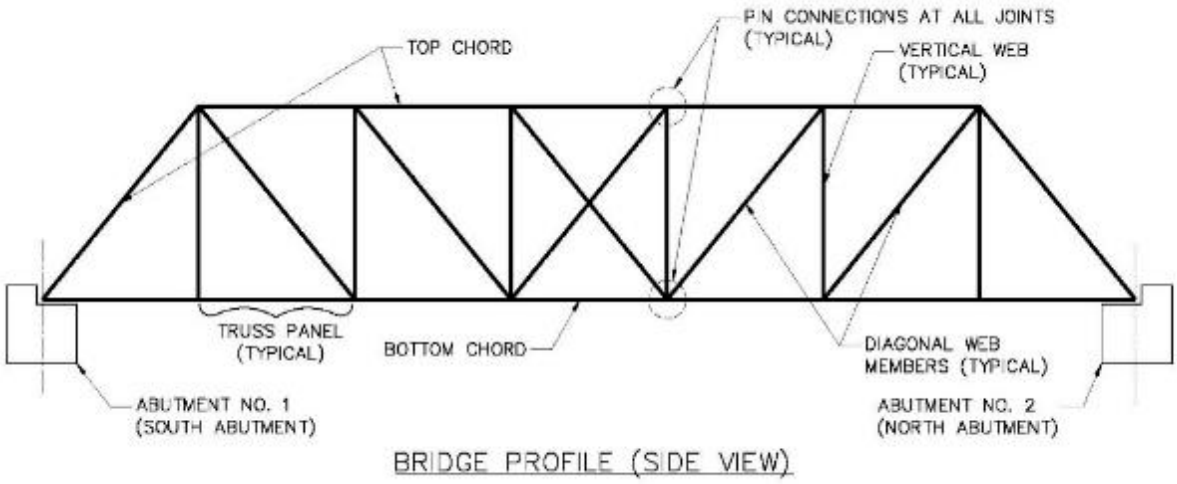
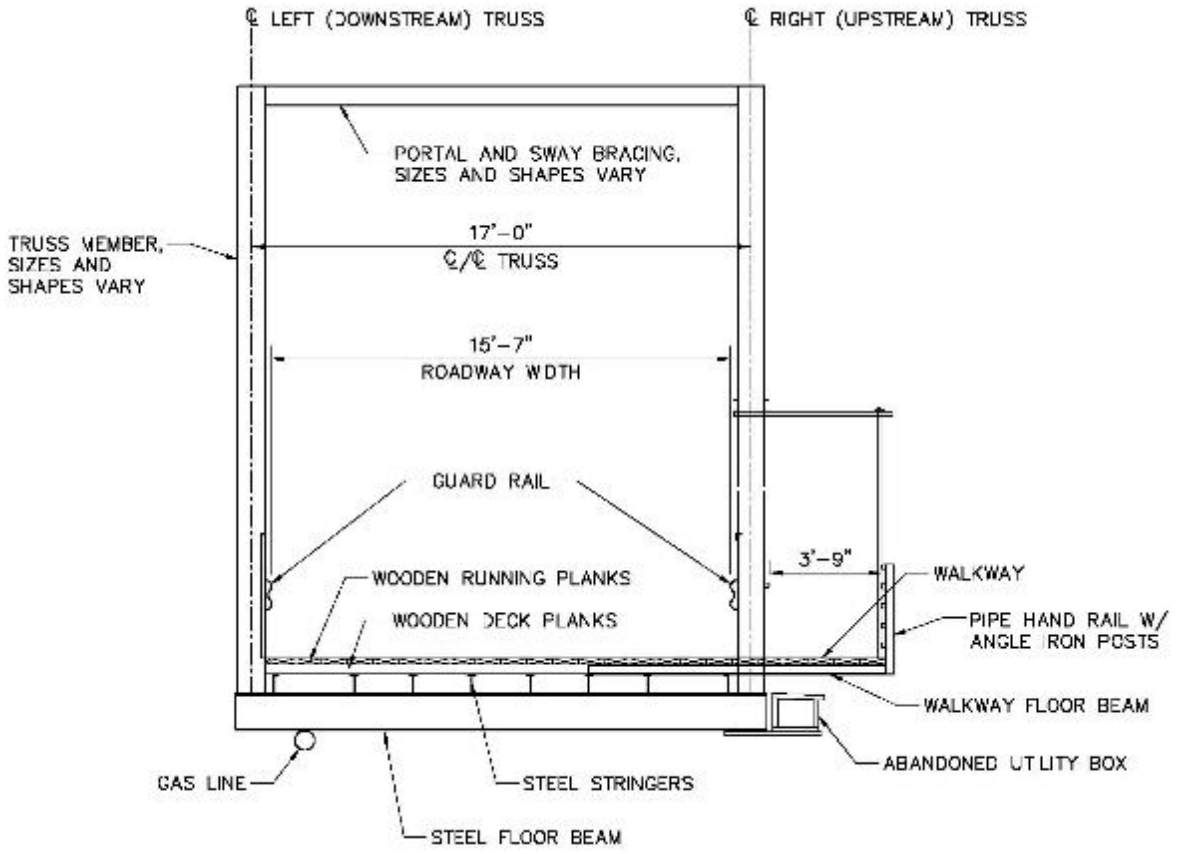


Figure 4 shows the existing bridge cross-section which provides a single 15'-7" vehicle lane with a 16'-2" vertical clearance to the overhead truss and an 8'-6" clearance to a rub-bar installed by the County. The pedestrian walkway provides a 3'-9" width for travel on the upstream side of the bridge. Guardrail (steel W-beam) is installed on both trusses to channel errant vehicles and provides modest protection for the truss members.

[2] Existing and Projected Conditions Report, July 2016.

Figure 4: Existing Bridge Cross Section



The pedestrian walkway is narrow and does not meet ADA requirements for accessibility. The wooden surface and the pipe hand rail also do not meet current design standards.

Given the current rate of corrosion and the high levels of existing deterioration of the steel components, the Swan River Bridge is expected to fall below the minimum-allowable three-ton limit which would require closure to vehicular traffic in the relatively near term. A finite time is not projected but pending closure would be based upon regular inspections and analysis.

This bridge will not be in continued service with only the current maintenance plan and with no rehabilitation. To reach a reasonable expectancy of continued service, rehabilitation or replacement will need to occur.

3.1.2 Traffic Conditions

The Swan River Bridge carries approximately 1,000 vehicles per day (vpd) on an average day of the year, with peak summer days carrying nearly 3,000 vpd. The peak hour for traffic in May 2016 occurred during the hour between 4-5 pm, with counts ranging from 97 to 117 vehicles per hour (vph), an average of less than two vehicles per minute. Vehicle queues to enter the single lane bridge did not extend more than three vehicles during the 2016 counts which appear to be representative of off-season traffic. Due to the one-lane bridge and the nature of Bigfork, population and business growth is not anticipated in the vicinity of the bridge that would result in a notable increase in traffic. The project needs are geared toward maintaining a river crossing – not toward increasing vehicle capacity. Therefore, no traffic projections were prepared as part of this report. Furthermore, the single-lane layout of the bridge, if maintained, will continue to deter non-local traffic from using Bridge Street as a travel route of choice.

Pedestrian counts in spring 2016 indicate 133 pedestrians use the bridge walkway during the non-peak season on an average day. The walkway provides a main crossing for pedestrians across the Swan River leading to both Sliter Park and to downtown Bigfork. The peak day for pedestrians occurred on Saturday with the highest hourly period of nearly 50 pedestrians occurring between the hours of 2-3 pm.

No crashes were reported on the one-lane bridge operations in the past ten years. It is noted that the one-lane operations appear to work acceptably for this area and is a strongly-desired condition based upon local comments. Local opinion indicates that the single-lane bridge dictates slower travel speeds, which are beneficial to the tight road curvature approaching the bridge and the narrow downtown streets.

Level of Service (LOS) is used to measure the operational function of a roadway segment. LOS is measured on a scale from A (optimal) to F (worst) correlating to the amount of time delay in seconds. LOS for Swan River Bridge was not analyzed due to the community's desire (and MDT's concurrence) to maintain a single-lane bridge. Peak hour factors were also not developed due to the unique approach to this project.

3.1.3 Other Existing Conditions

The Bridge Street approaches to the single-lane bridge begin as two-lane, paved roads with intermittent sidewalk and curb facilities which narrow onto the single-lane bridge.

No public transit services exist in the local area. Bigfork Schools provide school bussing but do not utilize the Swan River Bridge as a route. The Bigfork Fire Department does not utilize the Swan River Bridge as an emergency response route. Alternate routes from MT 35 better serve the school and emergency vehicles by avoiding both the narrow downtown streets and the narrow, one-lane Swan River Bridge.

Bridge Street, approaching the Swan River Bridge, is within a 60-foot wide public right-of-way (R/W) and the bridge is located in the center of the Bridge Street R/W. South of the Swan River, the R/W was created by a county road petition in 1904 and is a public easement and no ownership issues are anticipated around the bridge. North of the Swan River, the R/W was created by the Plat of Bigfork in 1901 and ownership details are inconsistent. Any acquisition or construction permits outside the 60-foot easement are expected to require extra effort to confirm the ownership due to its complex legal ownership.

An 8" natural gas line currently hangs under the Swan River Bridge and is expected to be replaced in the same location with any bridge change. Overhead utility lines run along the east (upstream) side of Swan River Bridge which will require minimal replacement for any bridge change, due to their proximity to the overhead truss. The Bigfork area recently completed storm sewer improvements which discharge into underground concrete vaults (manholes) on both sides of the bridge. The curb, underground pipes and concrete vaults represent a significant investment by the community and any bridge change will need to consider these infrastructure improvements.

3.2 Environmental Scan (E-Scan)

A separate E-Scan Report[3] completed a planning-level study to identify potential environmental concerns. The E-scan provided a summary of the physical, biological, social, and cultural resources within the study area to help identify constraints and opportunities within the study area.

Any improvement options forwarded from this Feasibility Study would need to comply with all applicable federal, state and local rules and regulations and would analyze potential impacts to determine appropriate prevention measures and necessary permits. Table 1 summarizes potential impacts for the physical, biological, social, and cultural resource areas for the Swan River Bridge (only).

Table 1: Summary of Potential Environmental Issues

Resource	Description
Hazardous Materials	• Due to its age, lead-based paint should be assumed to exist on the bridge. • The PacifiCorp transformer yard Superfund site is located within the study area, south of the bridge. • Underground contamination should be anticipated in the area. • Future coordination with DEQ and others is advised to monitor the underground contamination status.
Surface Waters, Wetlands and Floodplains	• The Swan River is a "Water of the US" and is considered a Montana navigable water way. • Wetlands and the Swan River 100-year floodplain exist surrounding the bridge.
Threatened and Endangered Species	• Bull trout and grizzly bear (threatened species) may be encountered within the study area. • The Spalding's catchfly and Yellow-billed cuckoo (also threatened species) have the potential to be encountered within the study area; however, habitat for these species are limited. • No species of concern have been identified within the study area. • The study area is used by migratory birds.
Noxious Weeds	• 13 noxious weed species are identified within the study area.
Cultural Resources	• Swan River Bridge is listed on the National Register of Historic Places (NRHP) under both Criterion A and Criterion C and is subject to Section 4(f) regulations. • Changes to the bridge overhead truss portions are expected to affect the listing.
Recreational and Visual Resources	• Recreational resources exist at Sliter Park and on the Swan River. • Section 4(f) or Section 6(f) impacts are not currently anticipated at Sliter Park. • Visual impacts for the bridge, from Sliter Park, the historic fishing hole and adjacent properties should be assessed if improvements are forwarded.

[3] E-Scan, November 2016.

4 BRIDGE ANALYSIS

4.1 Bridge Design Standards and Load Ratings[4]

The Swan River Bridge was designed and built prior to the adoption or enforcement of design standards, prior even to creation of Montana's Highway Commission or Department. For the purposes of this study, MDT and Flathead County have recognized that, due to the historical nature and the unique features of the bridge within Bigfork, future options may not need to meet all current design standards. MDT recognizes the unique nature of the state's historic and truss bridges and provides the following special consideration for these unique structures:

- Provide capacity for HS-15 loading (less than new bridge)
- Provide a minimum 14-foot vertical clearance
- Provide a 16-foot roadway width (for one-lane bridge)

The minimum allowable load limit for a bridge prior to closure is three tons which is the current rating on this bridge. The 2014 load rating factor of the bridge is 0.05 with a posted load limit restricted to three tons, in accordance with the American Association of State Highway and Transportation Officials (AASHTO) and MDT requirements.

4.2 Bridge Options

Bridge Memorandum #1[5] provided a planning level analysis to identify the most feasible options for the rehabilitation or replacement of the historic Swan River Bridge. The memo summarized the procedure used in selecting the most feasible options, described the options considered, and evaluated how the options satisfied the screening criteria.

A full array of potential bridge options was considered and narrowed to seven feasible bridge options, based on consideration of engineering constraints, public input, cost, and structure type. The options forwarded for the Feasibility Study are described below. All options provide one travel lane, a separated walkway and generally match the current location and elevation. The bridge deck material is not finalized at this level of review but the existing wooden deck is not a critical feature to the public and is discouraged by the County and MDT due to maintenance needs and wear issues.

Option 1 – No Build

Option 1 would retain the existing bridge as is. This option has no project cost and would retain its iconic appearance. Inspection and analysis indicate continuing deterioration will result in closure of the bridge when it cannot carry minimum legal loads.

[4] Existing and Projected Conditions Report, July 2016.
[5] Bridge Memorandum #1, Bridge Options, September, 2016.

Option 2 – New 1-Lane Steel Pony Truss Bridge

A new, prefabricated, steel pony truss superstructure with integral walkway would replace the existing truss bridge. The truss member connections would be bolted or welded gusset plates rather than antiquated pinned connections. This option would likely require replacement of the existing abutments.

Option 3 – New 1-Lane Steel Girder Bridge with Architectural Trusses

A new, steel girder superstructure with integral walkway would replace the existing truss bridge. The existing trusses would be attached to the new girder bridge as architectural features that imitate the existing truss appearance. This option would likely require replacement of the existing abutments.

Option 4 – New 1-Lane Concrete Girder Bridge

A new, pre-stressed concrete girder superstructure with a concrete deck and integral walkway would replace the existing truss. This option would likely require replacement of the existing abutments.

Option 5 –Rehabilitation of the Existing Bridge

The existing steel truss and attached walkway would undergo major rehabilitation efforts. This option would rehabilitate the structure to support full HS-20 load. Rehabilitation efforts would include the remediation of the lead-based paint on the structure. Bridge components that are known to be damaged and/or corroded would require replacement, as well as undersized components. Approximately 75% of the truss members are expected to require repair or replacement and 100% of stringers and floor beams are expected to be replaced. The existing walkway on the upstream side of the bridge would be widened for ADA compliance and modified to safely carry the pedestrian load.

Option 6 - New 2-Lane Concrete Girder Bridge with Architectural Trusses

This option proposes a new, two-lane, pre-stressed concrete girder superstructure with integral walkway which meets current road and bridge design standards (including two travel lanes) to replace the existing truss bridge. The existing trusses would be attached to the bridge as architectural features to imitate the look of the existing truss bridge. New cast-in-place concrete deck and abutments are expected in this option. The two-lane bridge would require roadway realignments and the acquisition of additional right of way.

Option 7 – New 1-Lane Steel Through Truss

A new, prefabricated, steel through truss superstructure with integral walkway would replace the existing truss bridge. The new truss could be designed to somewhat resemble the existing truss, with overhead truss bracing and similar truss height. However, the new bridge would utilize the modern construction practice of bolted or welded gusset plate connections rather than antiquated pinned connections. This option would likely require replacement of the existing abutments.

4.2.1 Structural Screening Criteria

Bridge Memorandum #1 focused on the structural screening criteria that pertain to providing a safe crossing of the Swan River which are described below:

- Design Standards: The highest ratings were assigned to options that meet all requirements of current bridge design standards such as seismic and wind resistance. A one-lane bridge is not typically provided in modern times; so this criterion also reflects if the one or two lane option is provided.
- Load Ratings: The highest ratings were given to options that can support at least an HS-20 truck loading, the standard design load for highway bridges.
- Lifespan: Highest ratings were given to options that provide a 75-year lifespan, the current standard for highway bridges.
- Ability to maintain the existing vertical clearance above the river: Floodway and floodplain impacts will be determined in the future but are not expected to be a governing design factor due to the large existing vertical clearance.

These structural criteria were ranked by the Design Team. Other criteria were ranked by the SC.

4.3 Screening Criteria

The SC, with support from the design team, developed qualitative screening criteria to reflect each of the three project goals. The Committee spent multiple meetings developing qualitative ratings (or comparisons) for all seven bridge options for each of the screening criteria (shown in Appendix 1). The bridge options and the Committee's rankings were presented to the public in August 2016. The public did not offer comments or changes to the SC rankings. The SC reviewed the ranking after the August public meeting and reaffirmed with no changes.

4.4 Risk Assessment and Conceptual Costs

Bridge Memorandum #2[6] provided a planning level analysis to develop conceptual costs and to identify the level of risk or uncertainty for each of the bridge options. MDT's Risk Management process was applied to the seven bridge options to determine which options might contain a higher project risk or uncertainty, resulting in higher project costs. Higher risks for individual bridge options were subsequently incorporated into the cost estimates, reflecting that certain bridge options (Options 5 and 6) have potential to have higher costs. Table 2 presents the conceptual bridge cost estimates.

Table 2: Planning-Level Cost Estimates

#	Description	Project Risk Probability	Cost Ranges (in millions of 2016 dollars)	Qualitative Cost Comparison
2	New, 1-Lane, Pony Truss	Standard	$ 1.0 to 1.8	$$
3	New, 1-Lane, Steel Girder w/ Arch Truss	Standard	$ 1.1 to 2.1	$$
4	New, 1-Lane, Concrete Girder	Standard	$ 0.9 to 1.6	$
5	Rehab, w/ Integral Walkway	Increased Risk due to unknown steel integrity, design and construction services	$ 1.7 to 2.9	$$$
6	New, 2-Lane, Concrete Girder w/ Arch Truss	High cost risk due to widening roadway	$ 1.9 to 3.4	$$$$
7	New, 1-Lane, Through Truss	Standard	$ 1.6 to 2.3	$$

[6] Bridge Memorandum #2, Planning-Level Risk Assessment and Cost Development, November 2016.

5 CONCLUSIONS

The project SC and the interested citizens from the Bigfork community provided a crucial role in emphasizing the community's desire to retain the iconic appearance of the 1912 steel truss bridge and a strong desire to perpetuate the single-lane configuration. Both the County (the bridge owner) and the MDT (technical expert and primary funding source) indicated that a single-lane bridge, although not a current standard, could be considered for this unique and historic location. The SC, with the support of the study team, invested significant effort in selecting feasible options for bridge replacement or rehabilitation. The SC also expended considerable effort becoming familiar with issues associated with the challenge of rehabilitating or replacing all or part of the bridge, and listening to the public input.

The SC developed screening criteria to compare bridge options and then rated each of the bridge options (See Appendix 2). At its November 2016 meeting, the SC unanimously determined that **the following bridge options should not move forward** (listed in order of the least desirable option):

- **Option 1, No Build** does not meet the minimum safety requirement as bridge deterioration is expected to continue and result in future closure. The existing bridge will be closed when it no longer can carry minimal weight (three-ton load limit). This option received no public support.

- **Option 4, a New, Single-Lane Concrete Girder Bridge,** although the least expensive option, does not replicate the current bridge appearance (overhead truss) which was deemed vital by the local citizens. This option received no public support.

- **Option 6, a New, Two-Lane Concrete Girder Bridge with Architectural Truss** meets current standards and expectations for bridges on public roads but would create new, and costly, impacts to adjoining properties and would not meet the strong preference voiced by local citizens to retain the single-lane nature of the bridge. Due to low traffic volumes (both existing and future) and the acknowledgement that this single-lane situation operates acceptably at this location; this option was deemed in opposition to the strongly-stated desires of the community. This option received minimal public support and much public opposition.

- **Option 2, a New, Single-Lane Pony Truss** does not replicate the current bridge appearance which was deemed vital by local citizens. This option received no public support.

- **Option 5, Rehabilitation of the Existing Bridge** received significant discussion and sizable public support. Current conditions indicate over 75% of the bridge members require replacement due to the increased weights (loads) of modern-day vehicles and a century of corrosion and use. Replicating and installing these bridge members presents numerous design and construction challenges which reflect a higher cost with limited public dollars. Additionally, the County has noted that this type of bridge requires special maintenance which may lead to higher maintenance costs for the County. This option has a large cost range due to the unknown nature of determining the level of replacement versus rehabilitation. After extensive SC discussions concerning the challenge of design and construction, the need to increase the load-carrying capacity of the century-old design, the risks associated with rehabilitation of century-old steel, the potential that unknown issues could arise, and the potential that century-old steel will have a shorter life than new steel; the SC determined that the benefits to rehabilitating the bridge do not outweigh the risks, and therefore concluded not to move this option forward.

At the November 2016 and January 2017 meetings, the SC further considered the remaining bridge options 3 and 7. The SC concluded that these replacement options are preferred due to the following reasons:

- Meet the overarching safety needs for a public bridge and extend the bridge's life
- Replicate the appearance of the current bridge which is strongly desired by the local community
- Maintain the single-lane configuration, which is strongly desired by the local community and is acceptable to the County and to MDT, while minimizing impacts to adjoining properties

The bridge options are summarized as:

- **Option 3, a New, Single-Lane Steel Girder with Architectural Truss** would meet the community's desires and provide a new bridge. This option would replace the existing bridge with a steel girder bridge that carries full highway loading and provides a separated walkway. The bridge itself would be designed for a 75-year bridge life but the reused, overhead truss may not have similar longevity. The overhead portions of the existing bridge would be removed from the historic structure and placed on the new bridge to replicate the existing appearance. The overhead trusses would not support the bridge but would re-purpose the century-old steel to provide a visual (or architectural) feature only. Care would be needed when removing the existing bridge to salvage the upper portions of the truss to successfully re-purpose the steel truss.

- **Option 7, a New, Single-Lane Steel Through Truss** would meet the community's desires and provide a new bridge. This option would replace the existing bridge with a new steel truss bridge that carries full highway loading and provides a separated walkway. The overhead truss would be an integral part of the bridge and serve a structural function. All parts of this bridge would be designed to provide a 75-year bridge life. County Maintenance has indicated a preference for this option, which provides new steel of the same age and characteristics.

At the January 2017 meeting, the SC unanimously concluded that **the bridge option #7 is recommended as it would:**

- Provide uniformly new materials of known characteristics that are of the same age and strength. This uniformity is expected to minimize maintenance needs and prolong the lifespan of the structure.
- Provide a replacement with a 75-year design life that does not utilize century-old steel (such as Option 3 which would reuse existing, overhead truss members).
- Replicates the overhead truss structure including the functionality of the truss.
- Reduces the construction risks that may be incurred with the reuse of portions of the existing overhead truss.

The SC also agreed that Option 3 is acceptable, but not preferred, as it introduces risks into the construction and future maintenance due to uncertainties of repurposing the century-old steel portions of the bridge.

6 ACKNOWLEDGEMENTS

The Swan River Bridge Feasibility Study was developed under the guidance of a project SC who invested many hours into understanding the project needs and the differences between bridge options. SC and design team members are identified below. A special thanks to the SC for providing insights on the study, engaging in study updates, attending the public meetings and for their instrumental involvement throughout the Swan River Bridge feasibility study.

Steering Committee Members

Sue Hanson – Bigfork (Community Member)
Walter Kuhn – Bigfork (Community Member)
Paul Mutascio – Bigfork (Community Member) CFBB
Jed Fisher – Flathead County Parks & Recreation and Maintenance Director
Dave Prunty – Flathead County Public Works Director
Pam Holmquist – Flathead County Commissioner
Vicki Crnich – MDT Planning Division
Chris Hardan – MDT Missoula District Bridge Area Engineer
Shane Stack – MDT Missoula District Preconstruction Engineer

MDT and Design Team

MDT:
Wade Salyards, PE – MDT Project Manager
Jon Axline – MDT Historian
Kent Barnes, PE – MDT Bridge Engineer
James Freyholtz, PE – MDT Missoula Traffic Engineer
Jan Nesset – MDT Public Relations
Bob Vosen, PE – MDT Missoula District Construction Engineer
Ed Toavs, PE – MDT Missoula District Administrator

KLJ:
Kathy Harris, PE –Project Manager
Jennifer Davis, EI – Environmental Analyst
Chad Fisher – Project Analyst/Designer
Steve Grabill, PE – Public Involvement
Brady Lassila, PE – Project Engineer
Russ Lay, PE – Project Engineer

A final thank you to the public that provided comments, suggestions, or their valuable time during the planning process.