EXECUTIVE SUMMARY
Bandemer-Barton Trail & Underpass Study

Bandemer Park and Barton Nature Area

Washtenaw County, MI

Bergmann

Office:
7050 W. Saginaw Highway Suite 200
Lansing, MI 48917

Phone: 517.272.9835

Email: jhedden@bergmannpc.com
www.bergmannpc.com

OHM Advisors

Office:
34000 Plymouth Road
Livonia, MI 48150

Phone: 734.522.6711

November 13, 2020

TABLE OF CONTENTS

1.0 Executive Summary

1.1 PROJECT BACKGROUND (BY WASHTENAW COUNTY PARKS & RECREATION)

1.1.1 Project Intent

The Washtenaw County Parks & Recreation Commission (WCPARC), in cooperation with the City of Ann Arbor, commissioned this study to evaluate two components of a proposed project to expand the Border-to-Border Trail (B2B) located on the northwest side in the City of Ann Arbor, Washtenaw County, Michigan. The first component is to understand the feasibility of constructing a shared-use, non-motorized underpass of the Michigan Line railroad (owned by MDOT and operated and maintained by Amtrak) to facilitate the extension of the B2B between Bandemer Park and Barton Nature Area (Part 1 of this report). The second part of the project is to evaluate options and associated impacts for extending the B2B from the proposed underpass through Barton Nature Area, utilizing the existing non-motorized bridges over the Huron River and connecting with the existing parking area south of Barton Dam (Part 2 of this report).

1.1.2 Project Background

The B2B is the premier non-motorized trail system in Washtenaw County. Its goal is to connect people to destinations, such as parks, the Huron River, and downtown areas. The B2B is part of Michigan's Iron Belle Trail, which expands the local trail efforts to make regional connections to neighboring communities. As part of the Iron Belle Trail, Washtenaw County and the B2B will be part of more than 130 miles of interconnected regional trails spanning from the City of Jackson to Lake Erie. Within Washtenaw County, the B2B has 34 miles of completed trails with a total of 55 miles planned.

One of the largest remaining gaps in the B2B is the corridor between the City of Dexter and the City of Ann Arbor along the Huron River. In 2015, the WCPARC led an effort to develop a Master Plan (herein referred to as the 2016 Master Plan) to guide the development for the Dexter-Ann Arbor corridor of the B2B. The planning process engaged local governments, including the City of Ann Arbor, numerous stakeholders, and the public.

The plan was ultimately adopted in 2016 and since then, work has been steadily progressing to extend the popular trail segments near the City of Dexter, east to connect the Huron Clinton Metroparks. The City of Ann Arbor's sections of the B2B are among the oldest and most heavily utilized segments of trail and are integral to the non-motorized transportation network. The existing B2B near Ann Arbor extends from the northwest side of the City, in Bandemer Park, 20 miles east through the City of Ypsilanti and nearly to the county border. On its route, the trail links 14 parks along the Huron River, University of Michigan Hospital, University of Michigan's North and Central Campuses, Washtenaw Community College, St. Joseph's Hospital, Eastern Michigan University, and the downtown areas of Ypsilanti.

According to the 2016 Master Plan, Barton Nature Area and Bandemer Park is the proposed connection point for the B2B between the existing trail in Ann Arbor and the proposed trail coming from Dexter. The primary challenge associated with completing this connection is: how to extend the trail across the existing Michigan Line railroad, which carries Amtrak's Wolverine service. One side of the railroad contains Bandemer Park and the existing trail. On the opposite side of the railroad is Barton Nature Area, owned by the City of Ann Arbor, and Huron River Drive, arguably the most popular and scenic bicycling road in the county. Therefore, developing a safe connection between Bandemer Park and the Barton Nature Area is a critical link in the B2B and the regional efforts of the Iron Belle Trail.

WCPARC, in cooperation with the City of Ann Arbor, commissioned this study to evaluate two components of the proposed project. One being the feasibility of constructing a shared-use, non-motorized underpass of the Wolverine Line to facilitate the extension of the B2B between Bandemer Park and Barton Nature Area. The second part of the project is to evaluate options and associated impacts for extending the B2B from the proposed underpass through

Barton Nature Area, utilizing the existing non-motorized bridges and connecting with the existing parking area south of Barton Dam.

Part 1 of the report investigates alternatives for a proposed grade separation of the railroad between Bandemer Park and the Barton Nature Area (see **Exhibit 1-1** for project location map). An underpass is the recommended method for separating the railroad from non-motorized traffic for the following reasons:

1. It provides the safest, most direct, and legal crossing;
2. It minimizes environmental and aesthetic impacts;
3. At-Grade crossings (traditional gates, bells, and lights), are not permitted at this location by law.

Part 2 of the report investigates alternatives for a proposed accessible trail through the Barton nature Area.

1.1.3 Project Goals

The goal of this project is to assess the feasibility of constructing a grade separation for a pedestrian underpass under the Michigan Line Railroad near Bandemer Park as well as an accessible trail connecting the new underpass to, and through, the Barton Nature area. Criteria and tools used to evaluate the feasibility are outlined below:

1. Build upon a previous study completed in 2005 (Pedestrian Tunnel Feasibility Study, Ann Arbor, Michigan, July 22, 2005) and update it to meet modern engineering standards and permitting requirements
2. Incorporate findings from the B2B Trail Master Plan: Dexter to Ann Arbor developed in 2016.
3. Trail user safety: safety, protection from trains, trail user conflicts, and perceptions of using an enclosed space
4. Limit disturbance of the natural environment (including minimizing habitat fragmentation) to the minimum necessary to complete the project
5. Avoid Oak trees (just east of the natural prairie area) wherever possible
6. Create a positive trail user (runners, bicyclists, pedestrians, etc.) experience and a structure that is aesthetically pleasing and fits into its context.
7. Public opinion and input regarding all aspects of the proposal
8. Construction methodology and costs
9. Maintenance considerations, including legacy costs
10. Incorporate existing pedestrian bridges over the Huron River
11. Coordinate with heavily used canoe launch located just downstream of the Barton Dam
12. Match existing ground topography as much as possible, minimizing grading impacts

1.1.4 Methodology and Evaluation

The project team used their professional engineering knowledge and past experience to guide the development of this report. The methodology outlined below was followed:

1. Critically analyze and evaluate existing site conditions, including: the railroad, soils and geotechnical considerations, hydrology, topography, presence of utilities, existing vegetation, and other factors
2. Analyze impacts to the quality of ecological areas
3. Identify and evaluate site constraints that may affect each alternative. Options must also be evaluated for compliance with current design standards and criteria:
    a. American Association of State Highway and Transportation Officials (AASHTO)
    b. Americans with Disabilities Act (ADA)
    c. Amtrak standards for structures under railroads
    d. Permit requirements from the appropriate agencies
4. Solicit feedback from stakeholders and advisory bodies, (MDOT Office of Rail, City of Ann Arbor Parks Advisory Commission, etc.) and incorporate into plan
5. Solicit public feedback and incorporate into plan

6. Develop a preferred alternative
7. Alignment of the trail south of Bridge 1 to the pedestrian underpass will be included in the rail underpass project once an alignment (for the underpass) is finalized
8. For Part 1: Develop alternatives to provide a separated grade crossing between a new path and the railroad. Include options that were explored in the 2005 study, potential new ideas, and lessons learned from a similar project, Allen Creek Berm: Feasibility of Flood Reduction and Pedestrian Options (City of Ann Arbor) developed in 2013 and subsequent final design plans completed in 2019.
9. For Part 2: Critically analyze the conditions of the existing pathways through the Barton Nature Area
10. For Part 2: Utilize topographic information and tree survey data results to develop various path alignments and compare each alternative

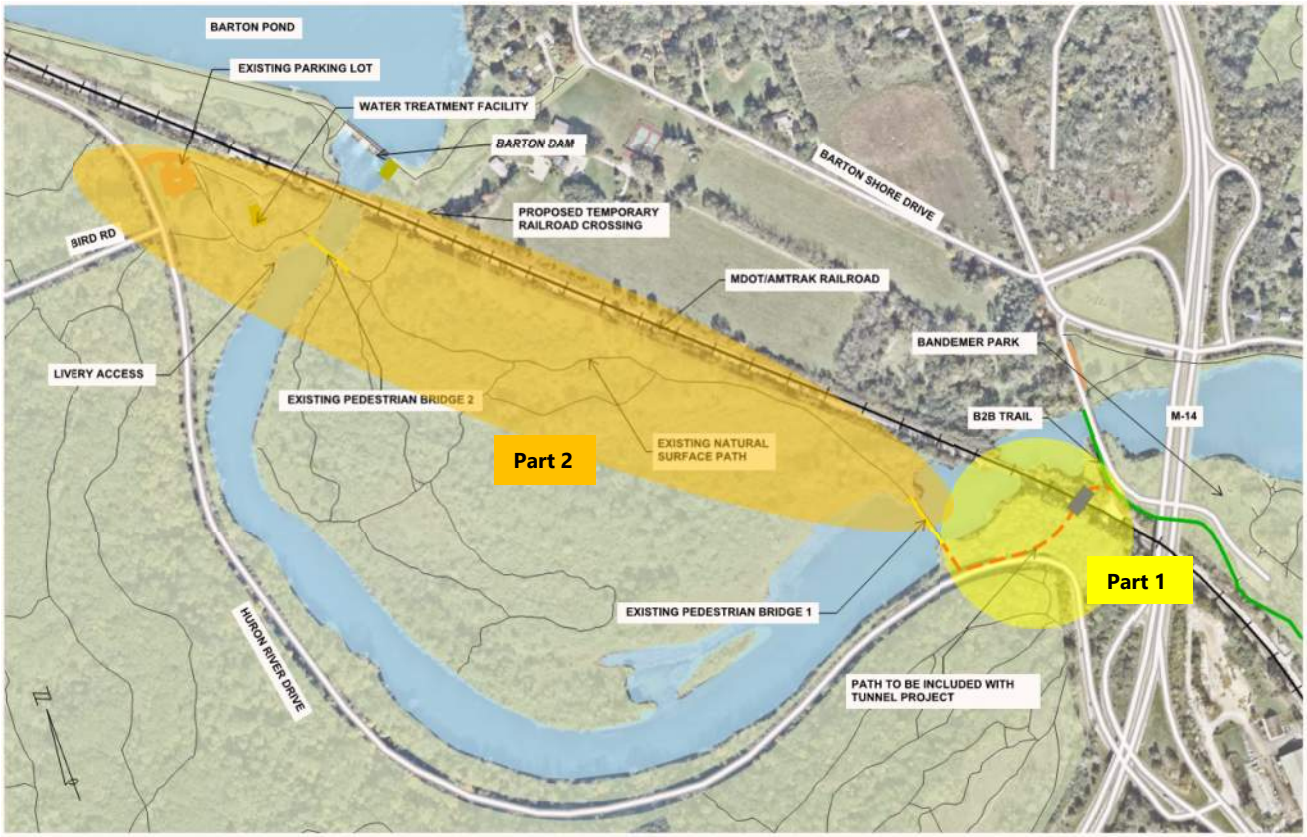


Exhibit 1-1: Area Map

1.1.5 Summary of Part 1 Findings – New Pedestrian Underpass

Eight alternatives were considered during the 2005 study and this report evaluated, refined, and developed those options into 3 alignment alternatives (PA-1, PA-2, and PA-3) utilizing one of 3 structure types (ST-1, ST-2, and ST-3). The general location of the proposed underpass presented in the 2005 study was confirmed and is located just south of the Bandemer Park entrance road (west of US-23 BR/M-14). This location currently sees the most pedestrian and bicycle trespassers as evidenced by a well-worn footpath through the woods. A public meeting was held to discuss the proposed grade separated trail crossing on February 26, 2019 where concepts from this study were presented. The feedback from the public, which was generally in support of the project, was reviewed and incorporated into this study.

The project team recommends advancing PA-3 and ST-1 into preliminary design. The recommended path alignment (PA-3) places the underpass furthest from the Huron River while providing the shortest underpass length. The recommended structure type (ST-1) is a box culvert structure constructed during a short-term track outage (less than 24-hours). The box culvert provides ample room, is the most cost effective to construct and maintain, and can be lengthened in the future relatively easy. The recommended opening is 16-feet wide by 10-feet high.

For complete details on alternatives and the recommended option, please refer to Part 1 of this report. The findings of this study are considered conceptual and not final. Advancing specific alternative recommendations will require additional input from the community and governmental agencies (City, County, State, etc.). Additional environmental study and appropriate environmental clearance may also be required.

1.1.6 Summary of Part 2 Findings – Pathway through Barton Nature Area

Three (3) alternatives were assessed for the pathway. Safety, impact to the environment, cost, as well as overall experience were considered. After various iterations and some preliminary design steps to refine the critical features discussed in the early field meetings and concept evaluations, **Alternative 2 is the recommended pathway alignment.** During the iterative preliminary design, the team developed costs considering impactful elements such as constructability. One outcome included building a cross section that will not only support typical pathway traffic but also construction traffic which is critical due to the unique location and restricted access. It will be difficult to mobilize in the future to perform standard rehabilitation measures therefore, a more robust cross-section was assumed which should require less major future maintenance projects. Alternative 2 provides pedestrians and bicyclists with a safe and aesthetic route through the Barton Nature Area. The Natural Area Preservation (NAP) unit of Ann Arbor Parks & Recreation was consulted regarding level of impact and are generally supportive of this approach. Furthermore, preliminary cost estimates were compared for the three alternatives and no significant cost savings was found among them.

Additional detail will be developed during the design process. It should be noted that additional items such as the impact to the canoe livery / launch area as well as some complicated slope areas identified in this study will need to be further explored. These areas are outlined in more detail in the Part 2 report.

The critical next step is to obtain Parks Advisory Commission (PAC) approval to pave within the nature area. This decision will rest solely on PAC. After that, it will be important to obtain soil borings to validate cross section and identify potential soils issues. Coordination with the canoe livery and additional design at the west end will need to be developed to provide river access for both the livery and the public while maintaining a safe path through the construction area. In addition, continued coordination with MDOT, Amtrak, and the Water Treatment Plant for the temporary railroad crossing will need to be finalized as this has the largest impact to construction cost, timing, and schedule.

PART 1

Bandemer-Barton RR Underpass Study

Bandemer Park and Barton Nature Area

Washtenaw County, MI

Bergmann

Office:
7050 W. Saginaw Highway Suite 200
Lansing, MI 48917

Phone: 517.272.9835

Email: jhedden@bergmannpc.com
www.bergmannpc.com

OHM Advisors

Office:
34000 Plymouth Road
Livonia, MI 48150

Phone: 734.522.6711

November 13, 2020

TABLE OF CONTENTS – PART 1 (UNDERPASS)

Attachments

1.0 Part 1 – Pathway – Railroad Grade Separation

1.1 PROJECT BACKGROUND

This portion of the report investigates alternatives for the proposed underpass of the railroad between Bandemer Park and the Barton Nature Area located in the City of Ann Arbor, Washtenaw County, Michigan (see **Exhibit 1-1: Area Map**). The heavily utilized Border-to-Border (B2B) trail is located north of the railroad tracks while the Barton Nature Area and continuance of the B2B trail is located south of the tracks. A grade separated crossing is required to provide safe passage of trail users and trains alike. An underpass is the recommended method for crossing the railroad for the following reasons:

1. It provides a safe, direct, and legal crossing
2. It minimizes environmental and aesthetic impacts
3. At-Grade crossings (traditional gates, bells, and lights) are not permitted at this location by law

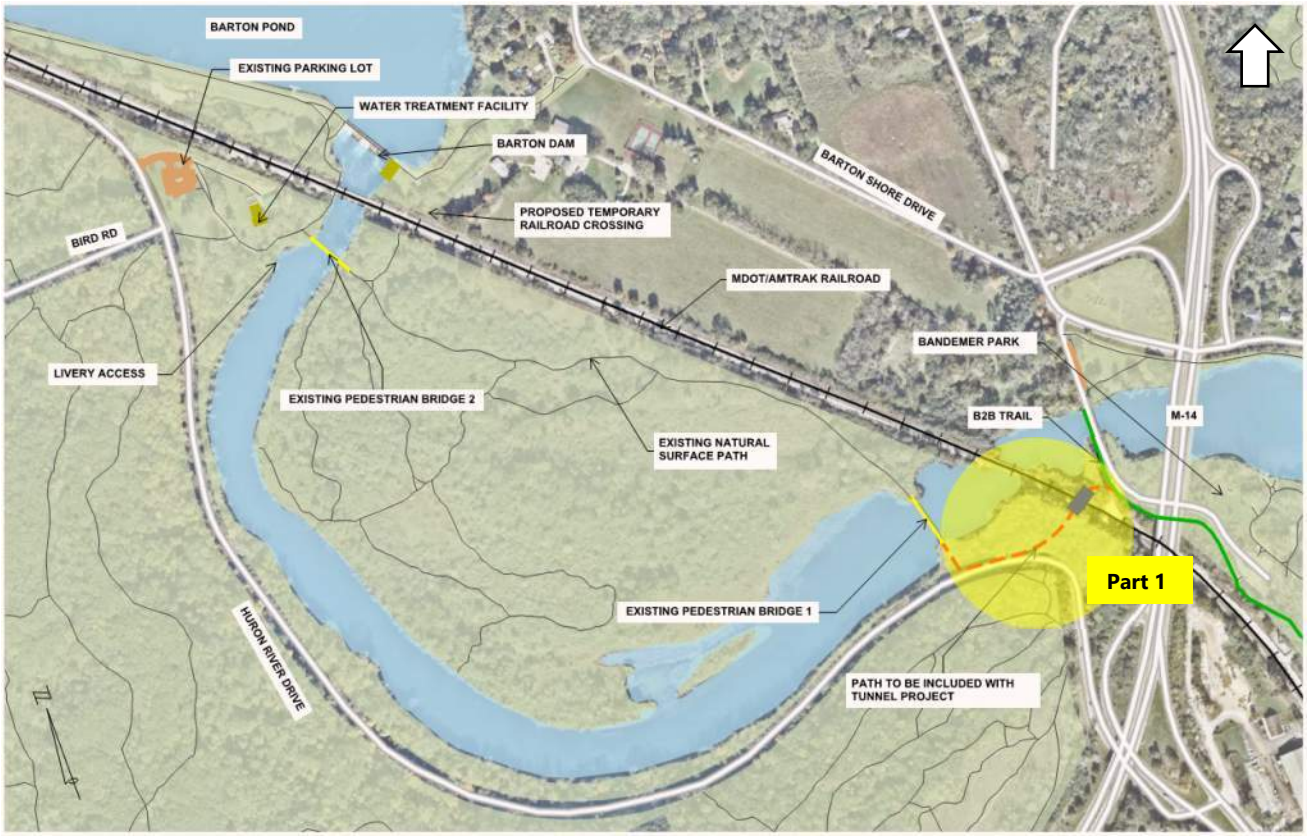


Exhibit 1-1: Area Map

1.2 PROJECT GOALS

The goal of this portion of the project is to assess the feasibility of constructing the proposed underpass. Criteria and tools used to evaluate the feasibility are outlined below:

1. Build upon a previous study completed in 2005 (*Pedestrian Tunnel Feasibility Study, Ann Arbor, Michigan, July 22, 2005*) and update it to meet modern engineering standards and permitting requirements
2. Incorporate findings from the B2B Trail Master Plan: Dexter to Ann Arbor developed in 2016

3. Trail user safety: protection from trains, trail user conflicts, and perceptions of using an enclosed space
4. Limit disturbance of the natural environment to the minimum necessary to complete the project
5. Create a positive trail user experience and a structure that is aesthetically pleasing and fits into its context
6. Solicit public opinion and input regarding all aspects of the proposal
7. Construction methodology and costs
8. Maintenance considerations, including legacy costs

1.3 METHODOLOGY AND EVALUATION

The following methodology was utilized during the development of this study and additional discussion is presented for each of the topics below:

1. Evaluate existing site conditions to update and re-evaluate feasible pedestrian railroad underpass options developed in a previous 2005 study.
2. Identify and evaluate site constraints that may affect each alternative. These constraints include the following:
    a. Michigan Line Railroad
    b. Adjacent Roadways and Pedestrian Pathways
    c. Critical Utilities (Gas, Water, and Fiber Optics)
    d. Geotechnical Conditions
    e. Huron River and Associated Floodplain/Floodway
    f. Stormwater
    g. Section 4(f) Properties
    h. Historical Sites
    i. Wetlands and Trees
    j. Endangered Species Habitat & Ecological Resources
3. Review of the Allen Creek Berm: Feasibility of Flood Reduction and Pedestrian Options (City of Ann Arbor) developed in 2013 and subsequent final design plans completed in 2019.
4. Review of the B2B Trail Master Plan: Dexter to Ann Arbor developed in 2016.
5. Consideration of current design standards and criteria:
    a. American Association of State Highway and Transportation Officials (AASHTO)
        i. Provide minimum 14-feet wide by 10-feet tall opening
    b. Americans with Disabilities Act (ADA)
    c. Amtrak standards for structures under railroads

1.4 PUBLIC ENGAGEMENT

A public meeting was held on February 26, 2019 at 6:30pm at Forsythe Middle School to seek initial public feedback to the City of Ann Arbor and Washtenaw County Parks and Recreation Commission (WCPARC) regarding the Border-to-Border Trail (B2B) Barton-Bandemer Connection Project. Sixty members of the public signed in at the meeting, which consisted of a brief presentation by City and County staff, followed by open discussion/questions, then an open-house format with more detailed maps and staff/consultants at each station to discuss the project with interested parties.

In total, 60 written comments were received (as of March 12, 2019), 19 of which were written comments collected at the public meeting, 13 were in the form of emails to County and City staff, and 28 were received through on-line form submissions during the two weeks afterwards. The presentation and displays were posted on the same website as the comment sheets to provide as much information as possible to the public who were unable to attend the

meeting. Per the request of some members of the public, the comment period has been re-opened and left open-ended.

Common themes expressed in support of the project include (not representative of quantity of expression):

- The underpass is essential for the future success of the B2B for bike and pedestrian traffic to move in to, and out of, the city in the N. Main St./Huron River Drive area
- Support for the underpass portion of the project because of a clear desire for the pedestrian connection and a desire by the rail to prevent crossing the tracks
- Support for the underpass because it also connects the hiking and biking trails of the adjacent nature areas to parking areas and the B2B in Bandemer Park
- Support for the overall project to provide a safe bike route along N. Main St. at the M-14 interchange.
- Overall project would be a benefit to the community
- Support or no concern for paving the main (existing woodchip) trail through Barton Nature Area as long as it is part of a regional system
- Support of paving in the nature area if disturbance and path width is kept to a minimum to keep as much existing vegetation and feel as possible
- Support of improving ADA connections and improving safety
- Current woodchip trail is often muddy and difficult to use, paving would solve this

Common themes expressed with concerns for the project include (not representative of quantity of expression):

- Concern that the project will take too long to implement and a desire to implement the project quickly
- Concern for how the trail and underpass will change demand for the current parking lot near Barton Dam and the use of any of the nature trails in Bird Hills and surrounding nature areas
- Request of the team to make the underpass feel safe through use of sight lines, lighting, and other measures
- Concern for overall project costs and how to pay for it
- Need an explanation for why a gated crossing (much cheaper) could not be used instead of an underpass
- Build the underpass but don't touch the nature area because it is nice as-is
- Concern for stormwater runoff from a paved trail in the nature area
- Would like to add a limestone or dirt path next to the paved path for runners
- Consider alternate materials to asphalt for the trail in the nature area such as porous paving or limestone
- Oppose paving the wood chip trail in the nature area
- Need to ensure all of the alternatives to paving the trail been explored
- Concern for increased incursion into natural areas

Exhibit 1-2: Public Meeting Held on February 26th, 2019

1.5 REVIEW AND UPDATE TO THE 2005 STUDY

The previous 2005 study considered 8 different structure types for separating the grades between the trail and existing tracks. All of the options considered a trail under the tracks except for one which was to utilize ADA accessible ramps to cross over the tracks. Each structure type was evaluated using 15 different rating categories in order to determine the best fit for each of the structure types for this site. A review of the structure types considered resulted in confirmation of the top two rated alternatives despite several major changes that have occurred over the last 14-years. Changes include:

1. Freight traffic does not currently utilize tracks in this area (but does have trackage rights)
2. The Michigan Department of Transportation (MDOT) now owns the railroad right-of-way after purchasing it from Norfolk Southern Railway in 2013
3. Amtrak now operates and maintains the railroad through an agreement with MDOT
4. Railroad is now designated as a High Speed Rail Corridor
5. Washtenaw County and the City of Ann Arbor plan to pave and improve the trail within the Barton Nature Area
6. Minimum vertical clearance to be 10-feet and path width to be 14-feet to meet current AASHTO criteria

The 2005 study did not consider an at-grade legal crossing. However, new permanent at-grade crossings are not permitted per Michigan's Railroad Code of 1993 (Act 354 of 1993, Subsection 462.307(3). A new pedestrian crossing at this location would not be considered part of a consolidation which the statute allows as an exception if approved by the Department because there is not an existing crossing at this location.

The 2005 study concluded that a trestle (short span rail bridge), box culvert, and Tunnel Liner (described in Section 1.9.3) could be considered for a new underpass to convey trail traffic. This study confirms these three options with a serious concern of whether a Tunnel Liner structure could be constructed (see further discussion below).

The general location of the proposed grade separation presented in the 2005 study was confirmed and is located just south of the Bandemer Park entrance road (west of US-23 BR/M-14). This site currently sees the most pedestrian and bicycle trespassers as evidenced by Google Maps, which incorrectly indicates there is a trail over the tracks. The underpass orientation and specific location was studied and is summarized in this report. The 2005 study considered a boardwalk beneath the existing rail bridge over the Huron River (just west of the proposed underpass location), but was dismissed due to inadequate vertical clearance between the river and bottom of the rail bridge (see further discussion below). Another location option that was considered was to extend the trail along the north side of the railroad from Bandemer Park and then cross under the railroad on the east side of the Huron River just south of Barton Dam. This option was dismissed from further consideration due to the private easements that would be required, the work required on the property owned by the dam, and the resulting indirect way of accessing the Barton Nature area.

1.6 EXISTING SITE DESCRIPTION

The study area is located between the Huron River and the US-23 BR/M-14 bridge that crosses over Barton Dr, the Huron River, Bandemer Park, Barton Nature Area, and the Michigan Line railroad. The B2B Trail and access road into Bandemer Park is located on the north side of the railroad. Huron River Drive is located approximately 250-feet south of the railroad. The area south of the railroad tracks is heavily wooded while the area north of the tracks is developed with parking and grassy areas with the exception of areas along the Huron River, which are wooded (see **Exhibit 1-3**).

Exhibit 1-3: Existing site looking west at north side of tracks (left) and looking north from south of tracks (right)

The toe of slope of the railroad embankment gradually slopes down as you move closer to the Huron River. The relative flat grade of the railroad tracks results in an embankment height that grows as you approach the Huron River. The normal Huron River elevation is approximately 773 and the 100-Yr flood elevation is at 778.

The region's trail system is heavily used, especially in Ann Arbor. The trail is primarily hard surface, provides long sight lines, and is accessible. Most areas are dedicated trail while some connectivity is maintained on-street. **Exhibit 1-4** shows some typical trail features in the area.

Exhibit 1-4: Existing Trails in the Area

There are several challenging features located within the vicinity of this project site, which will influence the design of the pedestrian underpass as discussed in Section 2.0.

1.7 ALTERNATIVES CONSIDERED

Based on the structure types considered and refinement of the orientation and specific location of a new underpass, three path alignment alternatives and three structure type options were developed and evaluated here. Each are summarized on the following pages including side-by-side comparisons, see **Table 1-1** for Path Alignments and **Table 1-2** for Structure Types. Either of the Structure Types can be used with any of the Path Alignment options. All concept renderings are provided for sense of scale and do not include details such lighting, landscaping, benches, trash receptacles, etc. as well as aesthetics, color schemes, etc. These will be developed as part of the design process once an option has been selected.

For the purposes of this study, the following assumptions were made:

1. The build year for the Bandemer-Barton Pedestrian Underpass construction is 2022.
2. A 5% per year inflation rate was used to develop cost estimates from 2019 to the build year.
3. The pedestrian paths adjacent to the underpass connecting Bandemer Park to the Huron River Drive parking area will be constructed with the proposed underpass. The pedestrian path through the Barton Nature Area will be constructed separately. The estimates provided in this study include the underpass and adjacent pedestrian paths connecting to the south pedestrian bridge (south/west) over the Huron River and the park access road over the Huron River (north).

The findings of this study are considered conceptual and not final. Advancing specific alternative recommendations will require additional input from the community and governmental agencies (City, County, State, etc.). Additional environmental study and appropriate environmental clearance may also be required.

1.8 ALTERNATIVE PATH ALIGNMENTS STUDIED

1.8.1 Path Alignment 1 (PA-1): Perpendicular Crossing Near Huron River

This alignment involves constructing a pedestrian underpass located near the banks of the Huron River where the existing railroad berm embankment is taller (see **Exhibit 1-7**). This location maximizes an 'open' feeling as users approach the underpass since there is less of a cut section due to the existing grades being lower as you get closer to the river (see **Exhibit 1-5** and **Exhibit 1-6** for a comparison of the side slope conditions). The crossing is orientated perpendicular to the railroad tracks which minimizes the length of the underpass for those walking or riding under the railroad tracks. The alignment may require minor excavation/backfill within the 100-year floodplain.

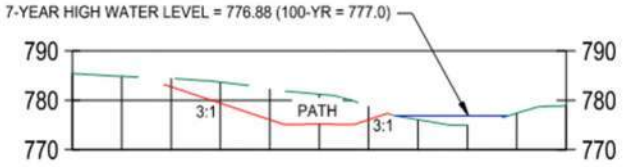


Exhibit 1-5: Section thru PA-1 (low topography)

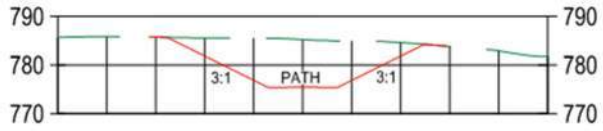


Exhibit 1-6: Section thru PA-2/3 (higher topography)

This alternative utilizes a meandering path north of the underpass in order to maintain ADA compliant grades. No switchbacks or retaining walls are required and a maximum grade of 5% was used for the conceptual vertical alignment layout. Horizontal curves as tight as a 30-feet radius were used in the layout. The alignment will encourage bicycle traffic to slow as they enter the underpass but still allows for passage of emergency vehicles and clear sight lines for pedestrians and bicyclists.

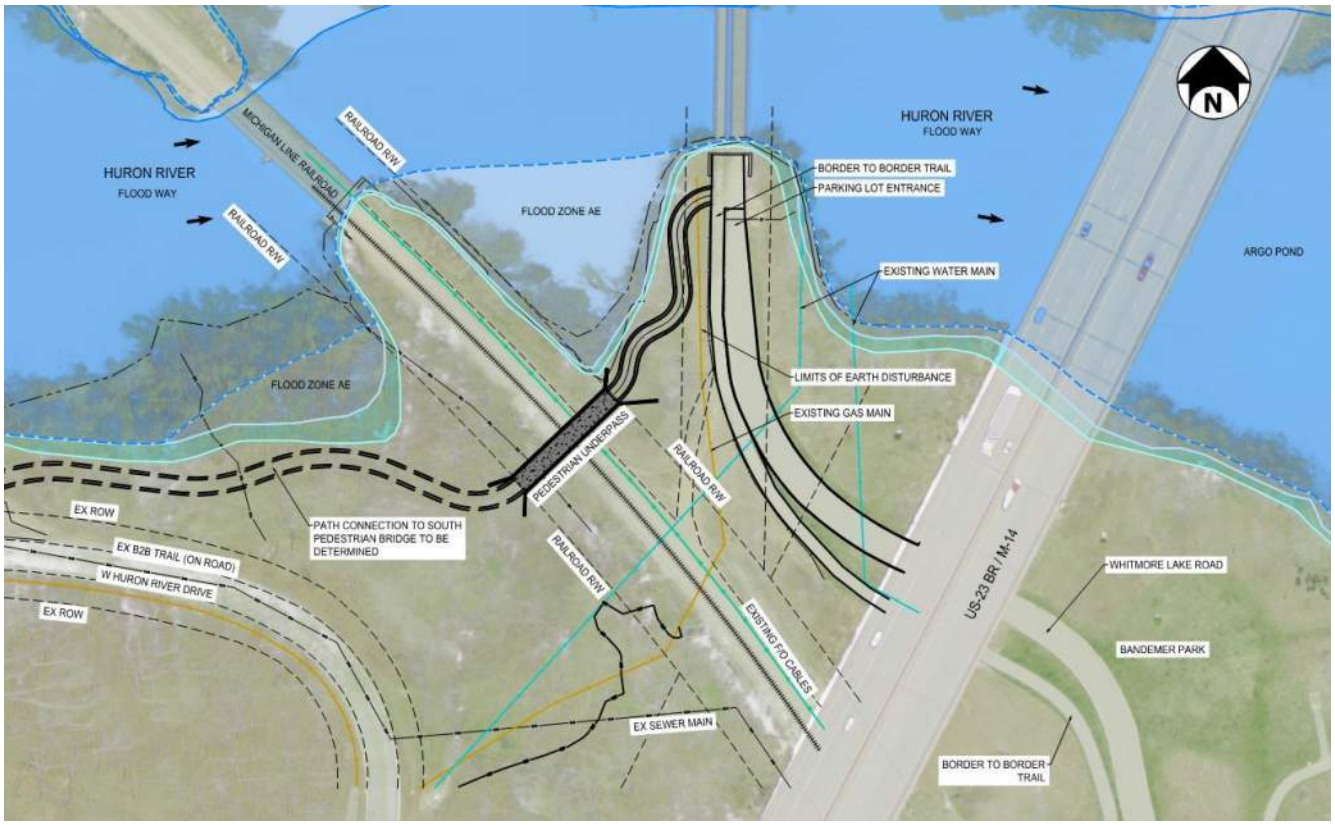


Exhibit 1-7: Plan View of PA-1

1.8.2 Path Alignment 2 (PA-2): Diagonal Crossing

This alignment involves constructing an underpass at an angle under the railroad, which avoids construction within the Huron River 100-year floodplain while taking advantage of the existing rail embankment height on the south/west side of the railroad tracks (see **Exhibit 1-8**). The underpass orientation results in a longer passageway than PA-1 and PA-3. The longer underpass is more costly to construct and maintain and will 'feel' more like a tunnel than the other alignment options studied due to the additional length. While the west/south side of the underpass

will be able to accommodate a linear entryway, the east/north entrance will be much lower than the surrounding grades and will require a 30-feet radius horizontal curve near the entrance to the underpass. This alignment allows for a relatively straight pathway on the east/north leg except for the horizontal curve just mentioned.

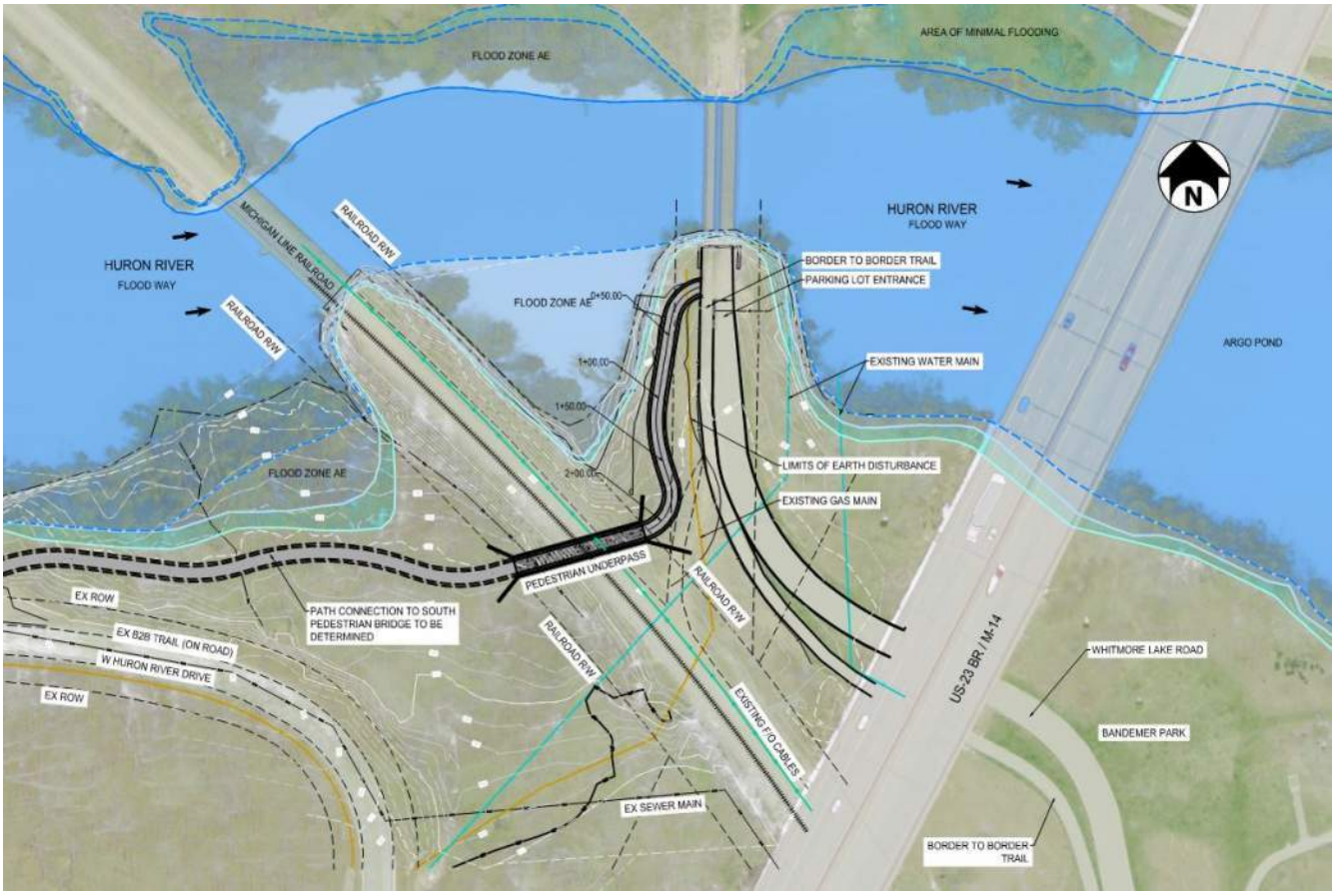


Exhibit 1-8: Plan View of PA-2

1.8.3 Path Alignment 3 (PA-3): Perpendicular Crossing Away From Huron River

This alignment involves constructing an underpass located as far away from the Huron River as possible in order to minimize impacts to the Huron River and reduce potential for water seeping into the pathway from the river. The location is set to avoid conflicts with the existing water main (see **Exhibit 1-9**). The pedestrian underpass is orientated perpendicular to the railroad tracks similar to PA-1. The existing topography along this alignment is higher on both ends of the underpass and will require grading (cut slopes) as the pathway descends below the railroad tracks (see **Exhibit 1-6** above). Similar to PA-2, the east/north pathway will be relatively straight with a horizontal curve near the underpass entrance. Locating the underpass away from the Huron River will avoid impacts to the floodplain.

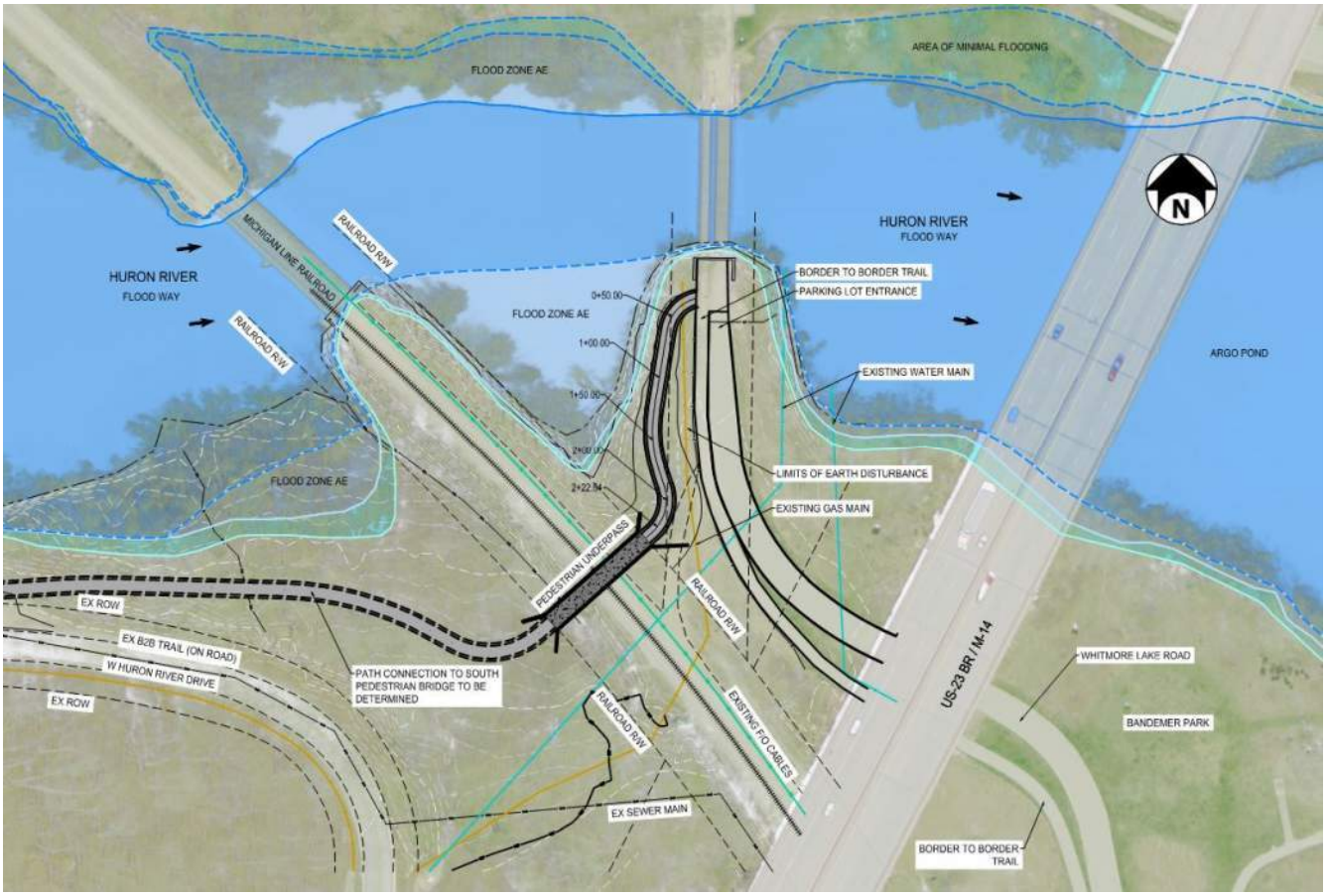


Exhibit 1-9: Plan View of PA-3

1.8.4 Other Alignments (Dismissed)

An option to provide a trail along the north side of the railroad tracks and cross under the railroad near the Barton Dam was dismissed due to the number private easements/impacts along that route and the proximity of that potential crossing to where the actual need is based on observed illegal crossings (which is at the site considered in this study).

Consideration was also given to building a pathway along the edge of the Huron River and crossing under the existing rail bridge over the Huron River. This option was dismissed due to the low vertical clearance available between the Huron River and the bottom of the railroad bridge beams (see **Exhibit 1-10**).

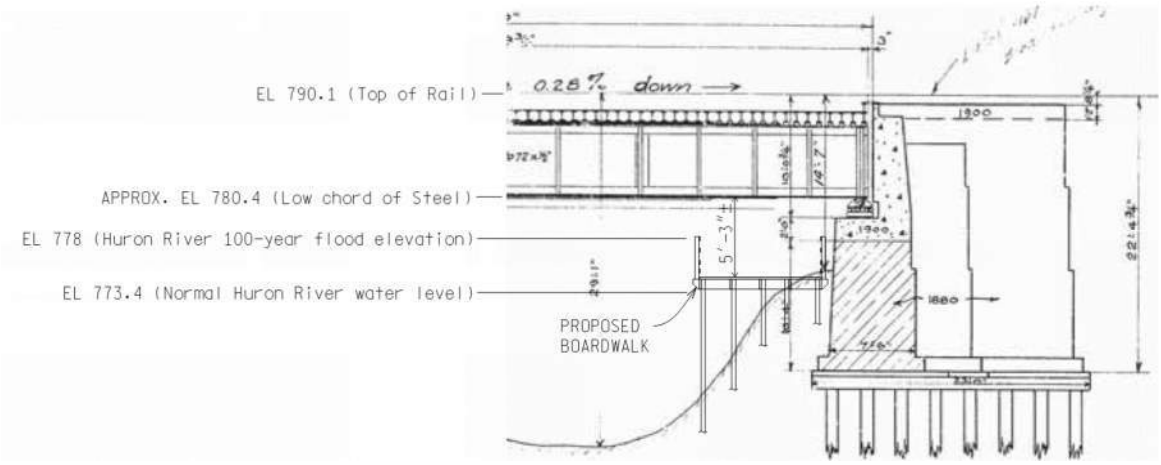


Exhibit 1-10: Existing Railroad Bridge over Huron River Elevation

Table 1-1: Side-by-Side Comparison of the Path Alignments Considered

METRIC	PATH ALIGNMENT 1 (PA-1): Perpendicular Crossing Near Huron River	PATH ALIGNMENT 2 (PA-2): Diagonal Crossing	PATH ALIGNMENT 3 (PA-3): Perpendicular Crossing Away from Huron River
Geometrics			
Underpass Length	Aligned perpendicular to the RR (up to 100-ft in length)	Skewed to the RR (up to 115-ft in length)	Aligned perpendicular to the RR (up to 100-ft in length)
Horizontal Curvature	Several 30-ft radius reverse curves	Relatively straight with 30-ft radius entering underpass	Relatively straight with 30-ft radius entering underpass
Vertical Alignment	Maximum 5% grades	Maximum 5% grades	Maximum 5% grades
North Approach Sight Line	Aligned	Curved	Curved
South Approach Sight Line	Can be Aligned or Curved	Aligned	Can be Aligned or Curved
User Experience			
Aesthetics	Open feel, close to the river, lower lying area	Longer underpass, larger cut side slopes	Larger cut side slopes
ADA Accessibility	Fully accessible	Fully accessible	Fully accessible
Safety	Clear sight lines, however, close to the river	Depressed section may not be highly visible in areas	Depressed section may not be highly visible in areas
Hydraulics/Environmental			
Floodplain Impacts	Impacts from grading (net cut)	No impacts	No impacts
Floodway Impacts	No impacts	No impacts	No impacts
Wetland Impacts	Evaluate near Huron River	No impacts	No impacts
Utilities			
Fiber Optic Cables	Impacts (requires relocation and/or staging)	Impacts (requires relocation and/or staging)	Impacts (requires relocation and/or staging)
Existing Watermain	No conflict	No conflict	Confirm watermain location (no conflict anticipated)
Constructability			
Site Access	Primarily from south side, north side limited due to bridge	Primarily from south side, north side limited due to bridge	Primarily from south side, north side limited due to bridge
Underpass Construction (related to alignment/location)	Perpendicular crossing is easiest to construct	Skewed crossing is more difficult to construct	Perpendicular crossing is easiest to construct
Maintenance			
Snow & Debris Removal	Accessible	Accessible	Accessible
Mowing	1V:3H cut side slopes	1V:3H cut side slopes	1V:3H cut side slopes

Green Indicates Alternative Positively Meets Criteria
Yellow Indicates Alternative May Have Shortcomings
Red Indicates Alternative Cannot Meet Criteria

1.9 ALTERNATIVE STRUCTURE TYPES STUDIED

The adjacent non-motorized trail will be a minimum of 10-feet wide (paved) with 2-feet wide shoulders (aggregate) (per AASHTO standards) that taper to 14-feet wide (paved) at the underpass limits (16 to 20-feet of horizontal clearance is more desirable). The pedestrian path will consist of an aggregate base with an asphalt riding surface. The maximum design grade allowed for the trail is 5% to avoid having handrails and level landings per ADA requirements. The non-motorized trail will meet criteria in AASHTO's "*Guide for the Planning, Design, and Operation of Pedestrian Facilities" and "Guide for Development of Bicycle Facilities*".

1.9.1 Box Culvert (ST-1)

This structure type is a precast concrete box culvert that can be installed under a short term (under 24-hours) train outage using cut and cover construction. This method consists of cutting the existing tracks and temporarily stabilizing them in preparation for construction. Once the scheduled train outage begins, the earth embankment will be excavated, and bedding material can be placed followed by sequential placement of culvert pieces. Once the culvert is in place, the berm can be backfilled and the tracks placed over top followed by surfacing with new ballast material.

The box culvert pieces would be designed for train loading and would likely have top and bottom slab thicknesses between 18-24 inches. The box culvert is limited to a 16-feet width due to practical shipping and design constraints. Amtrak would consider a box culvert underpass as a pipe which requires 8-feet of cover between the tracks and the top of the culvert by their standards. This amount of cover is not practical at this location due to the river elevation and ADA grades needed to enter and exit the tunnel; however, a design variance can be obtained from the railroad with proper coordination. In this case, a minimum of 30-inches of cover will be required which allows track maintenance equipment to operate unimpeded above the structure.

The box shape could utilize an arch top slab, however, this would impact the vertical clearance within the tunnel due to the cover requirements between the top of the structure and the railroad tracks. A flat top box is recommended for this location in order to maximize the vertical clearance while providing the most elevated pathway feasible. The culvert rise would be approximately 12-feet which would provide 10-feet of vertical clearance and the drainage, aggregate and path surface that are placed inside the culvert. Headwalls and wingwalls will be cast-in-place at both ends of the culvert to retain the fill. See **Exhibit 1-11** and **Exhibit 1-12**.

Box culverts have a long lifespan and when installed correctly, they have minimal to no maintenance issues. More discussion on the service life and maintenance concerns is discussed in Section 1.9.7 below.

Exhibit 1-11: Box Culvert (ST-1) Looking Towards the Huron River (16-feet wide opening shown)

Exhibit 1-12: Box Culvert (ST-1) Inside the Underpass (16-feet wide opening shown)

1.9.2 Rail Bridge (ST-2)

Use of a rail bridge would allow for span(s) exceeding 16-feet. A single span rail bridge with wall type abutments and a 20-feet span provide additional width compared with a box culvert (see **Exhibit 1-13** and **Exhibit 1-14**). A 3-span trestle with 20-feet spans would further optimize an 'open' feel and improve natural light (entering from the ends of the structure) within the underpass as there would be 1V:2H slopes adjacent to the pathway up to the new abutments (see **Exhibit 1-15** and **Exhibit 1-16**). The structure would consist of steel or prestress concrete

superstructure elements supporting a closed ballasted deck. Foundations would consist of piling and precast concrete caps. Since this structure type is not considered a pipe, Amtrak requires a minimum of 12-inches of ballast below the rail ties. With the beam depths anticipated (26-inches), a steel ballast deck plate, and 12-inches of ballast, this option provides a thinner structure section below the tracks which optimizes the vertical clearance for the pathway.

Exhibit 1-13: Rail Bridge (ST-2) Showing a Single-Span Concept Looking South (20-feet span shown)

Exhibit 1-14: Rail Bridge (ST-2) Showing a Single-Span Concept (20-feet span shown)

Exhibit 1-15: Rail Bridge (ST-2) Showing a 3-Span Concept Looking South (20-feet wide main span shown)

Exhibit 1-16: Rail Bridge (ST-2) Showing a 3-Span Concept from Under the Structure (20-feet wide main span shown)

Construction of a rail bridge is more complex than a box culvert due to the need for constructing foundations (shallow spread footings are not feasible due to the in-situ soils and large train loads). Options for constructing foundations include: 1) build temporary jump spans at each location which allows for low clearance work below live train traffic and 2) build large mat foundations on each side of the track which can receive a precast cap to support the new superstructure. Either foundation construction method would require temporary sheet piling during construction and then a short-term train outage (24-hour) to set a precast substructure cap in position followed by

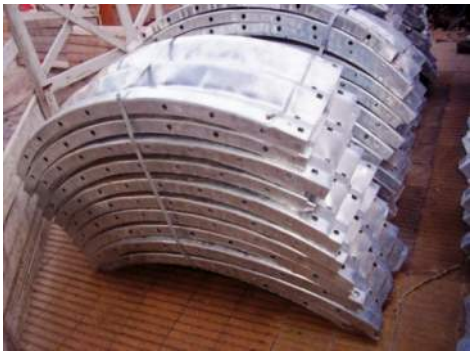
lifting a pre-assembled superstructure into place. The tracks would then be surfaced with new ballast and reopened to trains.

A rail bridge has a long service life, but can require more maintenance when compared with the other structure options. More discussion on the service life and maintenance concerns is discussed in Section 1.9.7 below.

1.9.3 Tunnel Liner Plate (ST-3)

A Tunnel Liner Plate structure (see **Exhibit 1-17**) works by incrementally excavating soils under the tracks and assembling pieces of a corrugated metal pipe structure as the excavation advances. Once the tunnel is complete, a pathway can be built below the tracks. The circular shape of this structure requires the overall diameter to be large enough to fit the required clearance envelope inside (see **Exhibit 1-18** for geometry needed for 14-ft and 16-ft pathway widths). Other shapes are available as well but would require similar pathway inverts to the circular option. This alternative might make it feasible to construct the underpass with minimal impacts to train traffic, however, railroad owners typically require 8-ft of cover if constructed under live traffic (though we have seen other railroads in other parts of the country accept as little as 5-ft of cover). Manufacturers require a minimum of 4-ft of cover to make sure the excavation is stable during construction. This requirement would put the pathway invert well below Huron River normal levels. This option also requires that soils within the excavation be cohesive to ensure stability during construction, which is not the case given the railroad berm is sand fill material (from 2005 boring data).

Fiber optic cables would need to be uncovered and temporarily raised to avoid conflicts during construction as well. The design phase could consider this option with some coordination and input from the railroads, however, given the highly sensitive nature of tunneling work close to an active railroad, low pathway invert requirements, and inadequate soils, this option is not recommended and has been eliminated from further consideration.



Tunnel Liner Plate pieces

Hand digging to install tunnel

Completed tunnel example

Exhibit 1-17: Example of a Tunnel Liner Plate

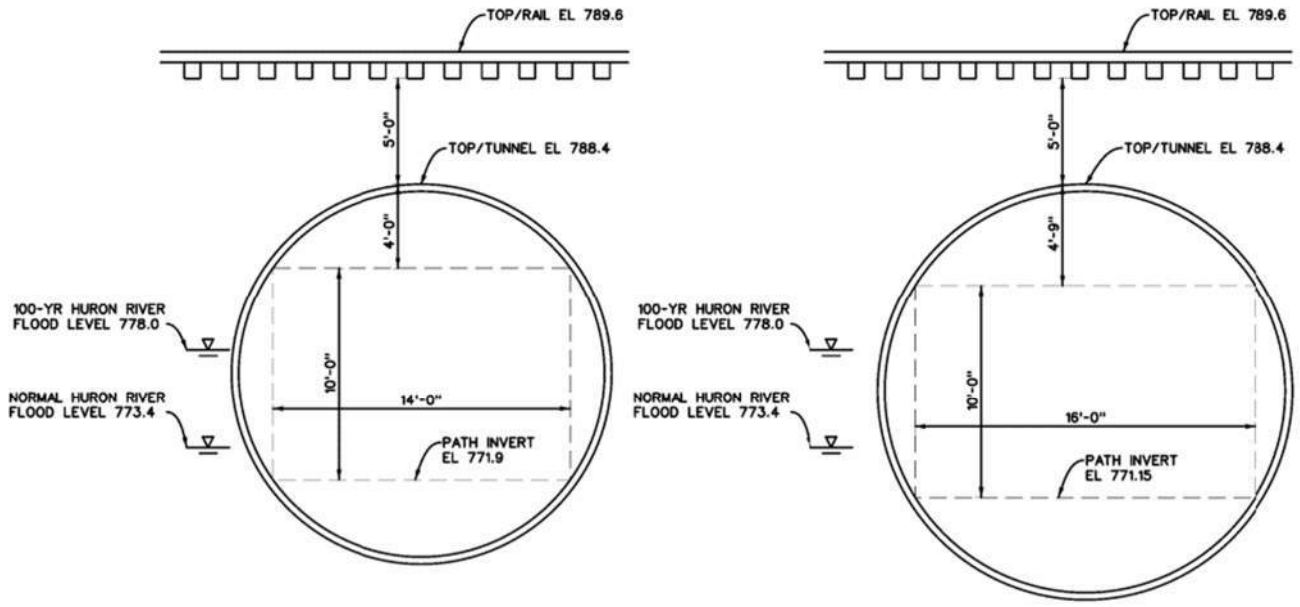


Exhibit 1-18: Tunnel Liner Plate structure: 14-ft horizontal clearance (left) and 16-ft horizontal clearance (right)

1.9.4 Other Structure Types (Dismissed)

Consideration was given to a pedestrian crossing over top of the railroad tracks, however, this was dismissed due to very long approach ramps on either side of the crossing. This structure would need to provide 23-feet of vertical clearance over the tracks and with a structure depth of approximately 3 to 4-feet, ADA ramps would need to elevate as much as 27-feet (this would require over 500-feet of ramp length at 5% grade on each side). Consequently, this option was eliminated from further consideration since the associated ramp lengths would make this an undesirable crossing for most users and would not be effective in deterring unsafe illegal crossings.

1.9.5 Length of Underpass

The length of the underpass could extend the full width of the railroad right-of-way (100-feet) or be shorter, extending under the existing single track and required clear widths only. The shorter option would provide more natural light, feel safer while inside the underpass, and be less expensive to construct, however, the underpass may need to be lengthened in the future per Amtrak and/or MDOT operational needs associated with a second track. All costs for the extension of the structure would be borne by the City and/or County at that time. The longer option would not need to be lengthened in the future, but it would provide less natural light, would feel more constricting, and will be more expensive to construct initially.

The renderings above were developed assuming the underpass is constructed for the existing railroad configuration, which is a single track and a maintenance-way. The length of the underpass would be between 30 and 35-feet to accommodate the existing track configuration. There is a possibility for a 2nd track to be installed during the life of the structure, in which case the underpass would need to be lengthened (or a longer structure can be constructed initially to accommodate the future track). The length of an underpass for a two-track section with a maintenance-way would be between 50 and 55-feet. Additional structure length for a skewed crossing (PA-2) would be required, adding approximately 20-feet. The actual length of the underpass will need to be discussed further with the railroad owner and its maintenance and operations team. Amtrak may require a minimum culvert length of 60-feet in order to provide 30-feet of clearance to the headwalls/fencing. Given the length of the underpass (for either a single or two-track rail configuration) is unknown at this time, conservative underpass lengths were used in developing the construction cost estimates.

Besides construction costs, the length of the underpass can impact the user experience. Constructing an underpass for a two-track configuration will mean a longer length for which trail users are within the structure. A comparison of a shorter underpass vs. a longer one is shown in **Exhibit 1-19** below.

Exhibit 1-19: Comparison of Single vs. Double Track Underpass Length

1.9.6 Constructability Considerations

Construction of the pedestrian underpass will require either a short-term track outage (24-hours) and/or temporarily maintaining train traffic (typically done utilizing a shoofly, which is a temporary track constructed adjacent to the existing). For this site, a shoofly is not practical due to the proximity to the rail bridge over the Huron River. A new structure would need to be built to temporarily carry trains over the Huron River in order to bypass the construction zone for this project making it not financially feasible. Furthermore, this line currently carries only passenger trains, which are on known schedules so work windows can be relatively reliable. It is recommended that the proposed work be coordinated with MDOT and Amtrak under short-term track outage(s), which could be scheduled to coincide with other work needed along the line. Some work on railroad property may be completed with the use of railroad flagging in between trains (i.e. pile driving, wall construction, grading, etc.). Any track outages would need to be coordinated as to the time of year, as well as time of day. Ideal timing for construction of the project may be in the late summer months (prior to the University of Michigan's fall semester) where water levels are typically at their lowest and the Ann Arbor train station (busiest station along this line) has the lowest ridership. Amtrak may also require temporary bus bridging service during the track outage in order to get passengers from the Ann Arbor station to the Jackson station during the track outage.

During a short-term track outage, the rails will be cut, and the track structure will be pulled out of the way. This will allow for work to commence below grade in each of the alternatives after which time, the track structure can be pulled back into position and reconnected to the adjacent track.

Construction equipment and material staging will be located on both sides of the railroad. The north side will be limited due to the Bandemer Park access road and the load posted vehicular bridge over the Huron River carrying the park's access road. The south side can be accessed through the wooded area connecting to Huron River Drive with an access road constructed in the footprint of the connector path to Barton Nature area.

The water table elevation (similar to Huron River levels) will likely be an issue during deeper excavation activity (as deep as elevation 768 with Huron River levels typically around elevation 773). It is anticipated that pumping will be required to keep the excavated area as dry as possible. Precautions should be taken (temporary shoring/bracing) to prevent cave-ins due to excavating sandy soil below the water table. The depth of the water table will also require consideration for buoyancy, though this will likely not control.

The box culvert structure (ST-1) would be constructed under a short-term track outage and use of a cut and cover as described above.

A rail bridge (ST-2) would be constructed as stated above. Once the track outage is in effect, the Contractor will excavate down to the bottom of cap elevation and install the precast sections, attaching them to the foundation piling. The superstructure sections can then be lifted into position followed by installation of ballast and resetting the track structure. After train traffic is moving again, the remaining excavation and pathway construction can be progressed without impacting live railroad traffic.

A tunnel liner plate structure (ST-3) could theoretically be built without any significant interruptions to train traffic. Work could progress in between scheduled trains and temporarily suspend upon a train passing overhead. The work could also be staged so that fiber optic cables are temporarily raised prior to start work so they are not in conflict with the tunneling operation. The stability of the soils during construction would be the biggest concern to ensure that trains can safely pass overhead while the tunneling work is advancing. Due to the risks involved with this construction method and the proximity to the live tracks, it is doubtful that the railroad owner and maintainer would approve this option when there are other feasible options available (ST-1 and ST-2).

1.9.7 Maintenance Considerations

The pathway alignment alternatives will all have similar maintenance requirements with no significant differences in cost or complexity associated with them except that PA-2 would have a longer structure along the path, which would theoretically incur more costs over its service life.

The structure types would have varying degrees of maintenance over their service life. The box culvert (ST-1) would have a design service life of 75 to 100 years. Maintenance activities may include concrete patching, surface coatings, and stabilizing embankment material where runoff is causing erosion (i.e. at the wingwalls). Maintenance on these types of structures is typically minimal.

The rail bridge (ST-2) would also be designed for a long service life (generally 75 years). However, it would require significant maintenance over its life. Items such as painting, steel repairs, concrete patching, and deck waterproofing, could be expected over its service life. Additional upfront investment at the time of construction can mitigate/reduce some of the expected maintenance (galvanized beams for instance), however, heavier repairs can be expected over its life when compared with ST-1 and ST-3.

The tunnel liner plate (ST-3) would have a similar design service life of 75 to 100 years and would be aluminum, which is resistant to corrosion. Concrete wingwalls and lining would require patching over the life of the structure.

1.10 STRUCTURE TYPE ALTERNATIVES SUMMARY

Table 1-2: Side-by-Side Comparison of the Structure Types Considered

METRIC	ST-1: Box Culvert	ST-2: Rail Bridge/Trestle	ST-3: Tunnel Liner Plate (Not Feasible)
Geometrics			
Vertical Clearance	Bottom of Rail Tie to Soffit = 4'-6"	Bottom of Rail Tie to Soffit = 3'-3"	Bottom of Rail Tie to Clearance Envelope = 9 to 10-feet
Horizontal Opening	Can Span Up to 16'-0"	Can Span Up to 20'-0"	Can Span Up to 16'-0"
User Experience			
Open Feel	Solid Walls	Wider opening and/or open sides (3 span bridge)	Solid Walls
ADA Accessibility	Fully Accessible	Fully Accessible	Fully Accessible
Safety	Requires Lighting	Requires Lighting but also has Natural Light (3 Span)	Requires Lighting
Potential for Flooding within Underpass	From Once Every 2 Years to 4 Times Per Year	From Once Every 2 Years to Once Per Year	2-feet Below Normal Huron River Level
Hydraulics/Environmental			
Floodplain Impacts	No Impacts	No Impacts	No Impacts
Wetland Impacts	No Impacts	No Impacts	No Impacts
Utilities			
Fiber Optic Cables	Can Coordinate/Stage with Minimal Impacts	Requires Relocations (Temporary and Permanent)	Little to No Impact
Constructability			
Maintaining Rail Traffic	Single 24-hour Track Outage (Cut and Cover)	Series of Track Outages (Jump Spans, Set Beams, etc.)	Completed Under Live Rail Traffic
Complexity of Construction	Simple – Excavate, Place Boxes, Backfill	Complex – Jump spans, substructures, beams, deck, etc.)	Highly Sensitive to Existing Soils, Difficult Tunneling
Construction Schedule/Duration	Fast	Medium	Medium
Maintenance			
Service Life	75-100 Years – Simple Maintenance	75 Years – Can Have Involved Maintenance	75-100 Years – Simple Maintenance
Lengthening of Underpass	Simple – Add on Box Sections	Moderately Complex – Widen Substructure, Super, Dowel	Simple – Add on Pipe Sections

Green Indicates Alternative Positively Meets Criteria
Yellow Indicates Alternative May Have Shortcomings
Red Indicates Alternative Cannot Meet Criteria

2.0 Site Considerations

2.1 MICHIGAN LINE RAILROAD

The project study area involves the Michigan Line near Mile Post (MP) 38.53 which is part of a designated High-Speed Rail Corridor. The railroad is a significant barrier to connecting non-motorized trails in the area. Currently pedestrians and bicyclists cross the railroad illegally to get from one trail to the other. The Michigan Department of Transportation (MDOT) intends to close these illegal crossings to improve safety throughout the corridor.

Communication with Amtrak and MDOT will be required to execute at least 4 legal documents/agreements:

1) Bridge Agreement with Amtrak
2) Occupancy Permit with MDOT
3) Design Agreement with Amtrak
4) Permit to Enter with Amtrak (separate for design and construction)

The railroads were not involved in the development of this study, however, experiences along this line (including the recently completed design of the Allen Creek Berm Opening) were used as a basis for summarizing the railroad coordination process outlined here.

2.1.1 Railroad Agreements

The *Bridge Agreement* must be executed prior to obligating the project and can take as much as 18-months to obtain. It is critical to factor this coordination into the design schedule. The Bridge Agreement will outline work required by Amtrak during construction. Amtrak will be compensated for all costs and expenses incurred during construction (flagging, trackwork, inspection, utility relocation, etc.). The City, who will assume ownership of this facility, is typically responsible for any damage to the railroad caused by the structure over its life and the railroad is responsible for train damage to the pedestrian structure resulting from track problems. The Bridge Agreement also defines that the railroad maintains the track structure from the bottom of the ballast up and the City would maintain the pedestrian structure and everything below the bottom of ballast. Inspection and load ratings will be required as part of this maintenance plan. In other similar situations, MDOT has assumed this responsibility for the crossings, but this will need to be coordinated during the agreement negotiations.

The Bridge Agreement will include an *Occupancy Permit* with MDOT allowing for the proposed structure to be within the railroad right-of-way. This permit will require legal descriptions defining the extent/limits of the new crossing and typically includes a general plan layout of the proposed crossing. Once MDOT approves, this will be included as an exhibit within the executed Bridge Agreement.

The *Design Agreement* with Amtrak provides a mechanism for their staff to be compensated for reviewing the design plans and ultimately providing a Letter of No Exception for the project. This agreement defines the scope of their review including number of submittals and in-person meetings along with a force account estimate of cost. The Design Agreement can be combined with the Bridge Agreement,if desired. On its own, a design agreement can take 3 to 12 months to execute depending on the legal requirements desired by the City/County.

A *Permit to Enter* with Amtrak is required during the design phase in order perform geotechnical borings and survey. This permit can be obtained by the prime design firm and any subconsultants contracted with them can be included on a single Permit to Enter. Another Permit to Enter with Amtrak will be required during the construction phase, which will be obtained by the Contractor. All staff entering the railroad right-of-way must have proper credentials and safety training as well as a Permit to Enter. This permit can typically be obtained within 4-8 weeks with proper coordination.

2.1.2 Other Planned Railroad Crossings in the Region

There is a planned underpass to be constructed in 2020 near the Allen Creek outlet (near Depot St. and Main St.). This crossing will serve many users from the Downtown Ann Arbor area, Kerrytown, and neighborhoods east of North Main St. in accessing the B2B trail near Argo Dam. While the impetus for the project centered around flood reduction in the Depot/Main St. area, a safe pedestrian crossing was added as an important component to improve connectivity to the B2B trail and reduce high occurrences of illegal crossings.

There is also a study underway to provide access across the railroad tracks and North Main St. as part of the Treeline initiative. Phase 1 of the Treeline will extend from 721 N. Main St. (a City of Ann Arbor owned property) to the Argo Dam (and B2B trail). This crossing will enhance connectivity of the trail system including safe access for users located west of North Main St, a heavily traveled roadway, and the B2B trail located east of North Main St. This study will consider feasible alternatives for utilizing the newly constructed Allen Creek crossing mentioned above as well as a new crossing located just north.

The need for safe crossings between populated areas and recreational amenities along the Huron River is evident throughout the region. The crossings noted above will not conflict with this planned project given their proximate locations. This crossing will complement the planned southerly crossings in providing greater connectivity within the heavily used B2B trail system.

MDOT owns the rail line from Dearborn to Kalamazoo, which passes through Ann Arbor. The line continues west from Kalamazoo to Chicago, Illinois. Intercity passenger service is provided by Amtrak, who operates and maintains the railroad through an agreement with MDOT. Amtrak's Wolverine Service passenger trains currently include three eastbound and three westbound trains per day. According to Amtrak's published schedule, passenger trains pass through the Ann Arbor Train Station (located near Depot St. and Main St.) between 7:20AM and 10:57PM each day (inbound at 7:20AM, 11:32AM, and 7:06PM and outbound at 12:48PM, 6:34PM, and 10:57PM). Norfolk Southern Railway has trackage rights along this corridor, however, they do not currently use this section of track except for occasional late night/early morning trains. The pedestrian underpass and associated components should be designed to meet the American Railway Engineering and Maintenance-of-Way Association (AREMA) criteria. Amtrak and MDOT specifications will also be required.

2.1.3 Railroad Cross Section

The Michigan Line railroad was originally constructed in approximately 1900. The railroad currently has a single track through the study area, however, potential for a double track in the future is possible (on the north side of existing track where there is a maintenance-way). As noted in Section 1.9.5, this project may construct a crossing which accommodates the current track configuration, however, the underpass would need to be extended if the railroad elects to realign their tracks or add a second track through this area in the future. Constructing an underpass now for two tracks may result in a portion of the structure being uncovered by the earth berm until a second track is built. The actual length of the underpass to be constructed for either single or double track configurations will need to be confirmed with the railroad during the design phase to determine their needs. Estimates within this study are considered conservative in this regard.

2.1.4 Railroad Constraints

There is a rail bridge over the Huron River located just north/west of the study area. While this does not directly impact the options presented in this study, it does limit the practicality of construction options since a temporary shoo-fly (temporary track runaround) would require a temporary bridge over the Huron River which is cost prohibitive.

The track is within a horizontal curve at the project site while the grade is relatively flat. The existing top-of-rail elevation is approximately 789.6 with the toe of railroad embankment at approximately elevation 778 near the Huron River gradually rising to elevation 784 near the eastern limits of the study area. There do not appear to be any

defined ditches along the railroad embankment. A new underpass will need to accommodate the existing track grades and any work will need to address runoff along the railroad berm to ensure the current drainage patterns are maintained.

The railroads will likely accept any of the alignment alternatives; however, a perpendicular crossing (PA-1 or PA-3 would be preferred as these options limit the length of the property impacted by the work. Either ST-1 or ST-2 are feasible with the concerns as noted above. Significant coordination with both Amtrak and MDOT for obtaining a short-term track outage(s) will be required.

2.2 ADJACENT ROADWAYS AND PEDESTRIAN PATHWAYS

US-23 BR / M-14 is a limited access elevated roadway in the area of this project. The freeway connects the City of Ann Arbor with US-23, a major N-S freeway. This facility is located just south/east of the project site and has a long bridge over the railroad tracks, Whitmore Lake Road, and the Huron River. No impacts to this facility are anticipated.

West Huron River Drive is located just south/west of the project site and is a two-lane rural road. It connects N. Main Street with areas west and north of Ann Arbor. The road has many curves and bends and primarily parallels the Huron River. The B2B trail is on road through this stretch of roadway currently.

Whitmore Lake Road serves as an entry into Bandemer Park and is located just north/east of the project site. There is a vehicular bridge (limited in the weight it can carry) over the Huron River. The roadway extends under US-23 BR / M-14 to the Bandemer Park parking area. The local road is flanked by a trail on its south/west side, which is part of the B2B and extends south (along the Huron River). A new railroad crossing at this location would connect the B2B system on the north/east side of the railroad tracks with the on-road system along W. Huron River Drive. More importantly, when combined with the planned trail improvements described in Part 2 of this study, over a mile of on road B2B trail can now use dedicated trail.

2.3 EXISTING UTILITIES

There are several known underground utilities within the study area summarized in the Table 2-1: Adjacent UtilitiesTable 2-1. This study relied upon GIS and existing plans for identifying existing utilities. As part of the design process, public utilities within the project limits should be contacted to gather/confirm existing information.

Table 2-1: Adjacent Utilities

Utility Owner	***Utility***
Century Link	*Two fiber optic banks parallel to the tracks within the railroad right-of-way*
Amtrak	*One fiber optic bank and one copper line parallel to the tracks within the railroad right-of-way*
City of Ann Arbor	*Water main crosses perpendicular under the railroad between the Huron River and the US-23 BR/M-14 bridge*
DTE Gas	*Gas main crosses under the railroad at a slight angle between the existing water main and the US-23 BR/M-14 bridge; Continues north on the west side of the B2B Trail and Bandemer Barton Park access road*

The exact location of the buried fiber optic lines located parallel to the railroad tracks will need to be determined during the design phase. Century Link owns two fiber optic lines (one of which was originally owned by Level 3). Amtrak has a fiber optic line as well as a copper line through this area. Since the privately owned utilities are within the railroad right-of-way by easement, relocation and protection of these lines will be borne by the project. This work will need to be coordinated with the structure type chosen and the anticipated construction method. The fiber

optic lines must remain a minimum of 30-inches beneath the bottom of rail tie and may require protection (steel conduit). Agreements with Century Link and Amtrak will be required for relocating and/or protecting the lines during and after construction. On the Allen Creek Berm Opening project, these same lines will be impacted for installation of the new box culverts. Staging was designed such that the fiber lines could remain in service throughout construction, but this required steel sheet piling, temporary support of the fiber lines, and relocation of one line from under the Allen Creek crossing. Early coordination with the fiber line owner is critical for developing a plan specific to this site.

An existing City of Ann Arbor water main of unknown size and depth crosses perpendicular under the railroad between the Huron River and the US-23 BR/M-14 bridge. All alternatives are located west of the existing water main so it should not be impacted by this project.

A 12-inch diameter DTE gas main crosses under the railroad at a slight angle between the existing water main and the US-23 BR/M-14 bridge. After crossing under the railroad, the gas main runs north along the west side of the B2B Trail and Bandemer Park access road. The existing gas main could be impacted by the construction of the proposed pedestrian path where it ties into the existing B2B Trail which will need to be confirmed during design.

No overhead utilities were observed within the project area.

No enclosed storm water utilities were observed within the project area.

There is no clear advantage of any path alignment alternatives over another with respect to the fiber optic utilities; however, PA-1 would have the least potential for impacting the DTE gas main. The box culvert structure could be sequenced to avoid full relocation of the fiber optic lines similar to the method planned for the Allen Creek underpass where box culvert sections will be placed up to a fiber line and then the line is carefully lifted and moved atop the piece just placed allowing for the next section to be placed. A rail bridge would require at least one relocation of the lines to construct the bridge and would likely require a second relocation to place the lines back on top of the bridge if required by the cable owner(s). Full relocation of the fiber optic cables as described for the rail bridge option (ST-2) can cost considerably more than the work described above for sequencing around the box culvert sections (ST-1).

2.4 GEOTECHNICAL CONDITIONS

Based on information obtained from the USDA Soil Survey Database, the soil in the vicinity of the project site is Type WaA (Wasepi sandy loam with 0 to 4 percent slopes), which is depicted in **Exhibit 2-1.**

Soil borings were performed during the development of the *Pedestrian Underpass Feasibility Study* in 2005. These borings indicated sand fill overlying interbedded natural sands and clays extending to the end of the borings. Below is a description of the soils encountered in the 2005 investigation.

The sand fill was encountered at the ground surface and extended 12 to 13.5-feet below the existing ground surface. The sand fill contained varying amounts of silt, clay, and gravel. N-values in the fill ranged from 5 to 29 blows per foot (bpf), indicating a loose to medium dense condition.

The interbedded natural sands and clays extend from the sand fill down to 52-feet below the existing ground surface. The sand strata ranged in thickness from 1.5 to 18.5-feet. The clay strata ranged in thickness from 10 to 17.5-feet. N-values for the natural sands varied from 5 to 59 bpf, indicating a loose to very loose condition. However, most of the sands had N-values between 30 and 80 bpf indicating a dense to very dense condition. Shear strengths in the clays ranged from 3.25 ksf to more than 4.5 ksf indicating a very stiff to hard consistency. Moisture contents in the clay strata ranged from 11 to 14 percent.

Hardpan, or a dense clay till, was found below the natural sand and clay strata, beginning about 52-feet below the existing ground surface. The borings were terminated in the hardpan at a depth of about 54.5-feet. A standard

Proctor compaction test of the hardpan resulted in 100 blows per 5 inches of penetration. A one-hand penetrometer test indicated a shear strength in excess of 4.5 ksf. The moisture content in the hardpan was approximately 9 percent.

Groundwater was encountered during drilling of the soil borings at depths of 12 to 15-feet below the existing ground surface at the boring locations. This puts the groundwater table at an elevation between 772 and 775 feet, which is in the interbedded natural sand strata. Groundwater at this site will likely be consistent with the Huron River water level. However, due to the interbedded sands and clays, perched groundwater could be encountered at elevations above the Huron River water levels. This data indicates that groundwater may be encountered during construction, which would require pumps to dewater the area. Planning for construction during dry periods is also recommended if feasible.

Additional borings were not performed at the time of this study due to the costs and timing associated with accessing the railroad right-of-way, but will be completed once the preferred location of the underpass is determined. From the existing 2005 study data, it can be assumed that the existing soils are adequate for a box culvert installation with proper preparation and bedding. For a bridge option, deep foundations (piles or drilled shafts) can be assumed.

Exhibit 2-1: Existing Soil Characteristics

The railroad right-of-way may contain contaminated materials from nearly a century of treating timber ties and container spills. Excavated soil must be tested and if found to be contaminated, must be removed and taken to an appropriate landfill. If groundwater is encountered during construction, dewatering will require testing and proper treatment prior to discharge as well. Depending on the pollutants and concentration, treatment may be possible through a filter then discharged to the Huron River or it may need to be trucked to a disposal site. A Phase I/II site assessment can be conducted outside of railroad right-of-way, however, investigation on railroad property has historically not been permitted. On the Allen Creek Berm Opening project, the approach described above was used

to address the potentially contaminated groundwater and soils. Given the unknowns associated with this work, contract pay items and bidding can be difficult to estimate and there is a potential for overruns during construction.

2.5 FLOODPLAIN & FLOODWAY

The FEMA Flood Insurance Maps indicate the Huron River has a 100-yr floodplain elevation of approximately 778-feet and a 500-year floodplain elevation of approximately 780-feet (North American Vertical Datum of 1988 [NAVD88]) as depicted in **Exhibit 2-2.** This project would be subject to any regulatory impacts to the 100-yr floodplain (not required for areas impacting only 500-yr floodplain given the planned work).

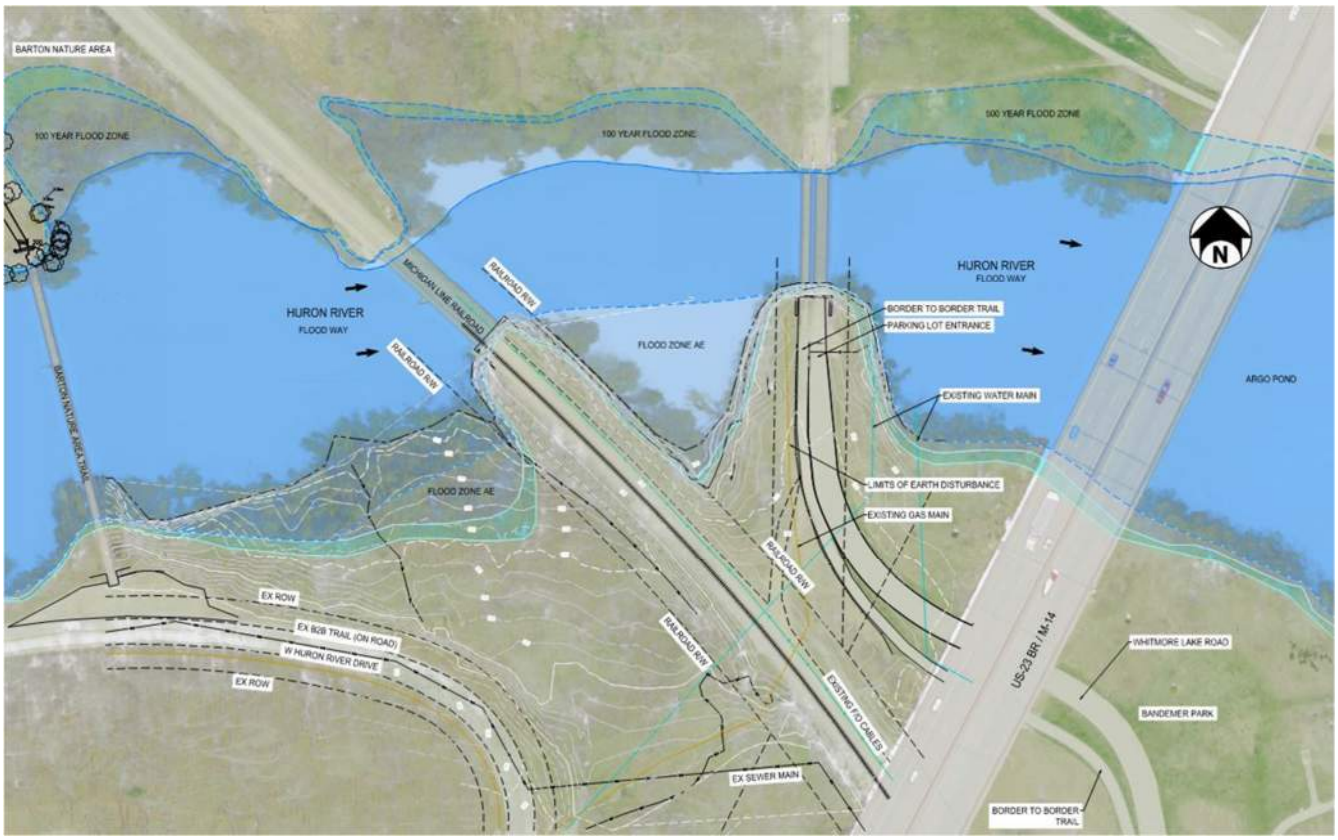


Exhibit 2-2: FEMA Floodplain Map

The proximity to the Huron River indicates there may be impacts to the floodplain. These impacts will need to be coordinated through the City's Floodplain Manager, who will determine if a Letter of Map Revision or a Letter of Map Amendment would be required, however, that is not likely for the minor impacts anticipated.

PA-1 involves work near the regulated floodplain while PA-2 and PA-3 would likely avoid impacting the floodplain at all. PA-1 includes excavation near the edge of the river and construction of a wingwall may require earth disturbance within the floodplain depending on the length of the underpass. The floodplain should not influence selection of a structure type as there would be minor impacts, if any. Hydraulic modeling of the Huron River would likely not be required for this work as the floodway is not near any of the planned construction.

2.6 WATERWAYS

As depicted in **Exhibit 2-2**, the Huron River is the only waterway within the vicinity of this project. The Huron River flows in an easterly direction and crosses under the Michigan Line railroad, Bandemer Park access road (Whitmore

Lake Road), and US-23 BR/M-14. The area is located between two dams (Barton Dam upstream and Argo Dam downstream). The Huron River water elevation is typically around elevation 773. Seven years of water elevation data was obtained from the City of Ann Arbor at the Barton Dam location which is indicative of the Huron River water levels near the project site. The highest recorded water elevation was 776.88 (just under the 100-year flood elevation) which was reached 4 times over the 7-year period. Elevation 775 was exceeded an additional 5 times over this same period.

The Huron River elevations can have a significant impact on the underpass proposed. PA-1 places the underpass closest to the river which puts it at a higher risk of being inundated during a high-water event. The cut section for the path as it enters the underpass on the north side would just barely be separated from the 100-year river elevation by existing earth grades. PA-2 and PA-3 have several feet of earth vertically between the top of existing earth and the Huron River high water levels and are also further offset from the river. See (**Exhibit 2-3** and **Exhibit 2-4**)

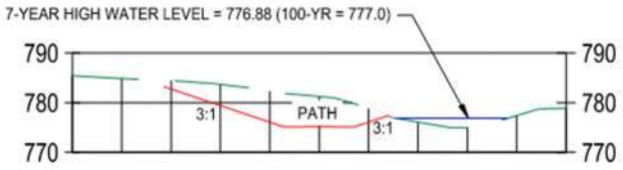


Exhibit 2-3: Section thru PA-1 (Huron High Water El)

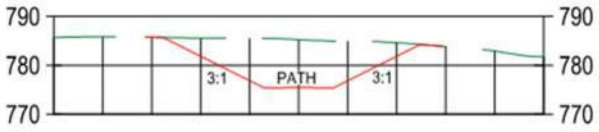


Exhibit 2-4: Section thru PA-2/3 (Separated from River)

The structure types provide different levels of protection from the pathway being inundated because they require different distances between the tracks and the top of the underpass. Below is a comparison of pathway inverts within the tunnel for each path alignment and structure type plotted for internal vertical clearances of 8-feet, 9-feet, and 10-feet. **Exhibit 2-5** shows data if a 16-feet wide pathway opening is provided while **Exhibit 2-6** shows data for a 20-feet wide opening (ST-2 only since a 20-feet opening is not feasible for the box culvert options ST-1).

The 7-year data set indicates the river levels would have exceeded the pathway invert of a box culvert (ST-1) option 4 times with 8-feet of clearance provided (approximately once every 2 years), 9 times with 9-feet of clearance provided (approximately once annually), and approximately 30 times with 10-feet of clearance provided (approximately 4 times a year).

Providing a 16-feet span bridge (ST-2) indicates river levels would not have exceeded the pathway invert for an 8-feet vertical clearance, would have exceeded the invert 4 times (approximately once every 2 years) for 9-feet of clearance, and 6 times (approximately once per year) for 10-feet of clearance.

Providing a 20-feet span bridge (ST-2) requires a thicker structure which lowers the pathway invert below. Comparing with the 7-years of Huron River data the path invert would have been exceeded 4 times (approximately once every 2 years) for 8-feet of vertical clearance, 6-7 times for 9-feet of clearance (approximately once per year), and 15 times for 10-feet over vertical clearance (approximate twice per year).

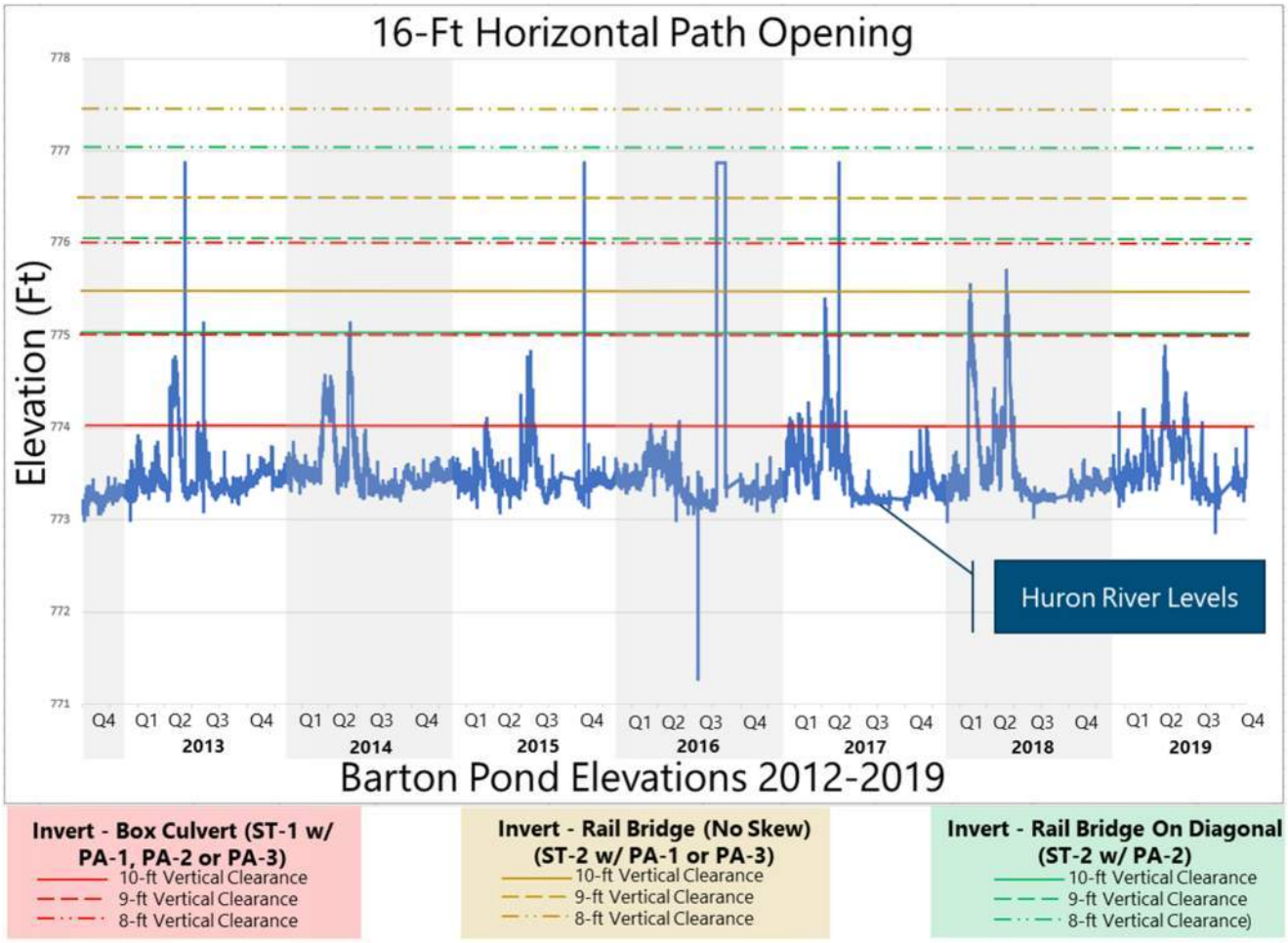


Exhibit 2-5: High Water Elevations over 7-Year Period Compared w/ Pathway Invert Elevations of Various Options

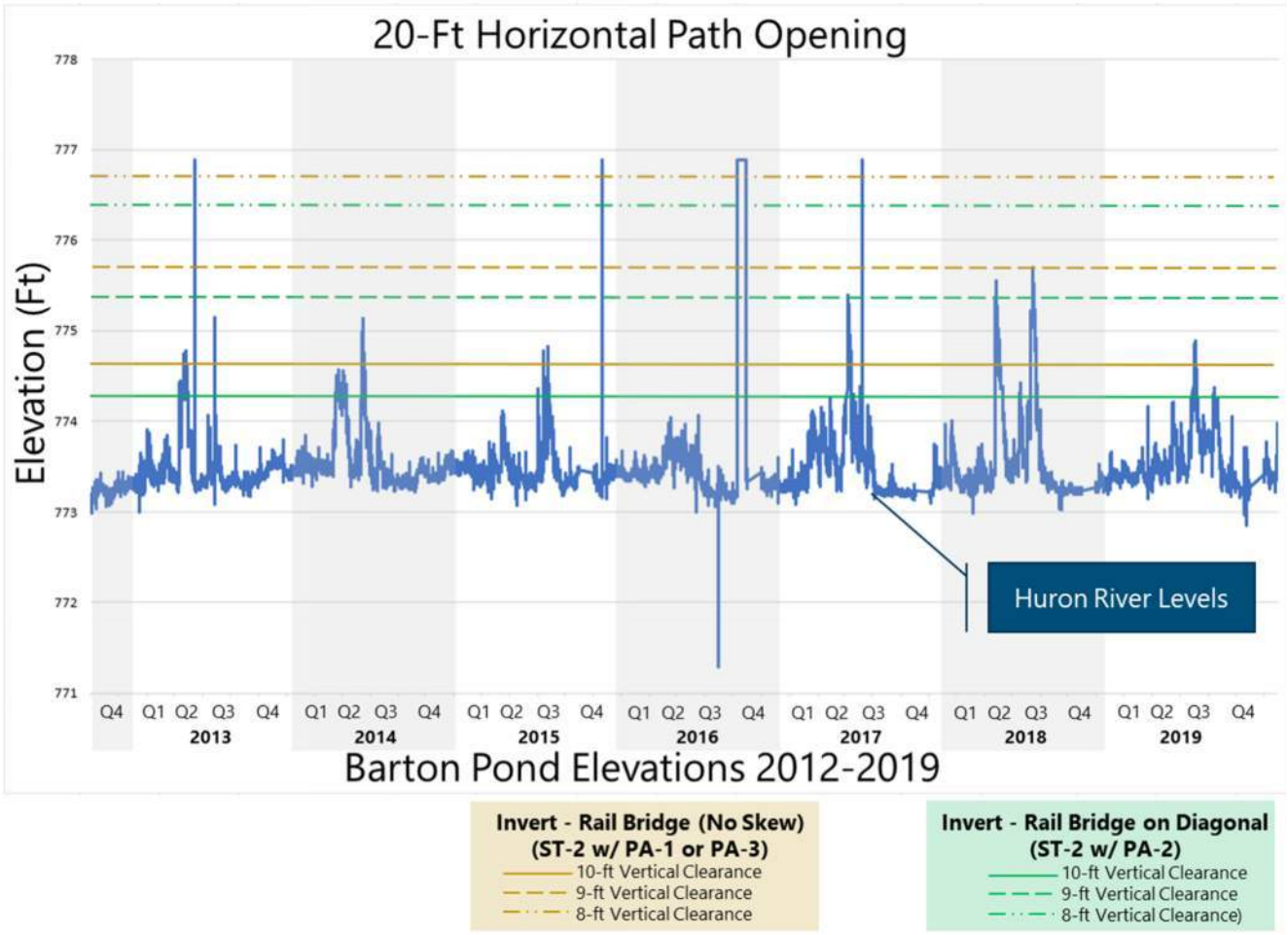


Exhibit 2-6: High Water Elevations over 7-Year Period Compared w/ Pathway Invert Elevations of Various Options

Total depth of inundation within the underpass may not reach the same elevation as the Huron River; however, if it did, the maximum depth expected for a box culvert (ST-1) would be around 3-feet vs 2-feet for a bridge option (ST-2). In order to inundate the underpass, water would need to seep through the soils/cut section and would pool in this area with little to no velocity. This means that inundation levels may not reach that of the Huron River and would not have significant flow. Barricades could be placed at both ends of the underpass indicating trail closure during these inundation periods.

Since there is no impermeable barrier between the river and this site, periods of river flooding which inundate the underpass would render it closed until the flood recedes. Unlike the Allen Creek Berm Opening project where potential exists for pumping water from the underpass when it is inundated, this crossing is close to the river and pumping flood water may not be effective since it would continuously fill. Additional analysis can be performed during the design phase to evaluate dewatering options.

2.7 STORMWATER

Based on the topography of this area, overland stormwater runoff flows from southeast to northwest and discharges into the Huron River. As noted previously, runoff from the railroad right-of-way flows along undefined ditches towards the Huron River. Constructing the pedestrian underpass and approaches will require swales which can be graded in the northeast and southeast quadrants of the pedestrian underpass to ensure stormwater drainage is

preserved. Drainage structures can be installed to collect the runoff and convey it under the approach pathways via culvert into the Huron River.

The existing site may be graded to minimize the amount of water entering the underpass during rain events. A typical rain event will result in water within the underpass as it is set below the surrounding ground. A drainage system will be constructed along the full length of the western edge of the pedestrian underpass to collect runoff and outlet it to the Huron River. If the Huron River water levels are above the pathway within the underpass, a backflow preventer can be used to keep Huron River water from entering into the underpass. However, during these periods there would be no way for water entering the tunnel from the surrounding ground to drain.

The addition of impervious area due to the trail construction will be exempt from City of Ann Arbor stormwater requirements because this is a public project. Coordination with the City of Ann Arbor stormwater staff will be required to ensure the process if properly followed.

2.8 SECTION 4(F) PROPERTIES/PUBLIC LAND/RECREATIONAL AREAS

There are four recreational areas within the vicinity of this project. Bandemer Park, which is located on the north side of the Michigan Line railroad, can be accessed via the access road crossing the Huron River from Whitmore Lake Road. The second area is Barton Nature Area, which is located on the south side of the Michigan Line railroad. This area can be accessed via Huron River Drive. The third area is the B2B trail which extends primarily along the Huron River in Washtenaw County and is part of the Iron Belle Trail. The B2B is located along Huron River Drive in the area of this project. The fourth area is the Huron River Trail (a National Water Trail) which is the Huron River itself located just north and west of the project area.

Construction of a new underpass should not negatively impact these properties for any of the options considered. Construction equipment and vehicles will not be staged within the designated park areas. Since the trail construction is intended for recreational use, there would likely not be an issue with constructing the trails themselves on park land, but this will need to be vetted if federal funding is used on the project.

There are no known 6(f) properties in the area and if there are, they would likely not be adversely impacted as this work would not be changing the use of these parks.

2.9 HISTORICAL SITES

No historic sites were identified within the vicinity of the project limits (defined as 50-feet from the pathway or proposed underpass location). A cultural resources survey should be conducted along the Huron River near the project area to verify this assumption. During a site walk through of potential pathway options, the team observed portions of foundations and remnants of old buildings in the forested area between the proposed underpass and the south pedestrian bridge. It is not known how old these elements were and they would need to be investigated further.

2.10 WETLANDS AND TREES

Based on a review of the USFWS National Wetland Inventory, there are no wetlands near the project site (see **Exhibit 2-7**). The mapping indicates that west of the US-23 BR bridge is Riverine Wetland and east of the bridge is Lake Wetland. These are both associated with the Huron River itself and are not actual wetlands. However, there is likely fringe wetland located along the banks of the Huron River that would need to be mitigated if impacted. A wetland delineation was not performed as part of this study but should be performed to determine whether they exist and if so, to assess the quality. Regardless, a Part 301 Permit through MDEGLE will be required due to the work areas proximity to the Huron River.

A tree survey will need to be completed in the forested area south and west of the proposed underpass (Barton Priority Area 4 Woodland) (see **Exhibit 2-8**) as well as on the other side of the railroad tracks (though there are far less trees on that side). It is anticipated that construction will not impact any large diameter or old growth trees

based on observations in the field. Tree removals may be needed beyond the footprint for the proposed path and underpass due to construction access (specifically through the forested area between Huron River Drive and the proposed underpass).

Exhibit 2-7: Wetland Delineation Map

Exhibit 2-8: Barton Priority Area Map

2.11 EXISTING ENDANGERED AND THREATENED SPECIES

Based on the Michigan Natural Features Inventory and the U.S. Fish and Wildlife Services Environmental Conservation, Washtenaw County has:

- Four (4) extirpate species
- Twenty-eight (28) endangered species
- Fifty-three (53) threatened species
- Seventy-nine (79) special concern species

Based on data provided by the City of Ann Arbor, the following species that are Threatened, Endangered, or of Special Concern, may be present at Barton Nature Area. Special care will be taken to avoid impacts to these species.

- Butler's garter snake, *Thamnophis butleri*, Special Concern
- Twinleaf, *Jeffersonia diphylla*, Special Concern
- American water-willow, *Justicia americana*, Threatened
- Oval ladies' tresses, *Spiranthes ovalis*, Threatened
- Pipevine swallowtail, *Battus philenor*, Special Concern

3.0 Other Considerations

3.1 PEDESTRIAN SAFETY & USER EXPERIENCE

The proposed pedestrian underpass will require the use of short headwalls and wingwalls to retain the fill of the railroad berm. The existing site will be regraded to provide an 'open' feel with long sight lines at the pedestrian underpass approaches rather than using long retaining walls or steep grades (1V:2H), which could result in a 'constricted' feel and sharp turns that prevent long sight lines. If smaller radius curves are necessary, blind spots can be mitigated with the use of convex mirrors to allow users to see around any tight corners.

Lighting will be utilized within the tunnel. The approaches will also have lighting leading up to the pedestrian underpass entrance and exit which will transition from the brightly lit tunnel to the unlit pathway. Power may be fed from the grid or use of solar lighting could be considered. The latter may be adversely impacted by the large amount of trees present south of the underpass and a combination of solar and grid fed power could be considered.

Emergency Code Blue telephones can be placed along the trail and near the tunnel to enhance safety.

The new underpass and pathway approaches will be lower than the surrounding ground and will require proper drainage as well as diligent maintenance to keep debris off of the pathway. During the winter months, snow plowing and addressing ice on the pathway will be necessary.

3.2 AESTHETICS

The pedestrian underpass is near a heavily used portion of the trail system and should appear welcoming and not detract from its natural setting. The pathway and underpass should be aesthetically pleasing and can be enhanced to provide a pleasant user experience. For example, adding a natural stone façade to the interior and on the exterior wing walls will create an appealing, natural aesthetic. The area adjacent to the non-motorized trail may have landscaping features such as benches, planters, trash bins, etc.

3.3 PERMITS & APPROVALS

Prior to construction (part of the design process), the following permits need to be obtained:

- Michigan Department of Environment, Great Lakes, and Energy (EGLE) / US Army Corp of Engineers (joint permit)
- City of Ann Arbor (site plan approval, building permit, soil erosion permit)
- City of Ann Arbor Park Advisory Commission (input)
- Amtrak (approval)
- MDOT Office of Rail (approval and Bridge Agreement)

3.4 FUNDING SOURCES

A portion of the pedestrian underpass could be funded by grants. Applying for grant funding requires that all state and federal design standards be met.

- Local funding (WCPARC / City of Ann Arbor)
- Huron Waterloo Pathways Initiative (non-profit fundraising to support the B2B)
- MDOT Transportation Alternatives Program (TAP) grant
- CRISI Grants from Federal Railroad Administration
- Michigan Natural Resources Trust Fund Grant (MDNR)

4.0 Recommended Alternative

A recommended alternative will be developed once input from the stakeholders and public have been received and their concerns are addressed.

The next steps include:

1.) Coordination/input from stakeholders (City of Ann Arbor, WCPARC) – Part of this Study
2.) Stakeholder engagement and buy-in – Part of this Study
3.) Obtain survey data for the construction influence area – Part of this Study
4.) Obtain geotechnical information for the proposed pedestrian underpass location – Part of this Study
5.) **City and County to evaluate funding feasibility for project – Pre-Design Phase**
6.) Environmental documentation and clearance – Pre-Design Phase
7.) Secure project funding – Pre-Design Phase
8.) Coordination with MDOT, Amtrak, and fiber optic utilities - Design Phase
    a. Coordinate with Amtrak for Permit to Enter
    b. Obtain Preliminary Engineering Agreement (between County/City and Amtrak)
9.) Design and Construction

Attachments
Cost Estimates

ENGINEER'S PRELIMINARY ESTIMATE OF COST
Feasibility Study: Summary of Alternative Costs

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ALT COMBINATIONS	BUILD 60ft/70ft LONG UNDERPASS NOW	BUILD 40ft/50ft LONG UNDERPASS FUTURE	TOTAL COST - BUILD NOW and WIDEN FUTURE	BUILD 100ft/120ft LONG UNDERPASS NOW
PA-1 w/ ST-1	$3.2M	$1.7M	$4.9M	$3.5M
PA-1 w/ ST-2	N/A	N/A	N/A	$8.6M
PA-2 w/ ST-1	$3.7M	$1.8M	$5.5M	$4.1M
PA-2 w/ ST-2	N/A	N/A	N/A	$9.3M
PA-3 w/ ST-1	$3.4M	$1.7M	$5.1M	**$3.7M**
PA-3 w/ ST-2	N/A	N/A	N/A	$8.7M

Note: ST-2 options were not estimated for a build now vs. build future scenario due to the large initial costs with respect to ST-1.

Printed:3/4/2020

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-1 w/ ST-1 (Box Culvert Near Huron River) - Full Buildout (Assume 100-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		2175	Cyd	$25.00	$54,375.00
2060002	Backfill, Structure, CIP		851	Cyd	$30.00	$25,533.33
2060010	Excavation, Fdn		1740	Cyd	$15.00	$26,100.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	100	Ft	$70.00	$7,000.00
4017021		Culvert Bedding *	156	Cyd	$70.00	$10,920.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		78	Cyd	$60.00	$4,666.67
4040033	Underdrain, Fdn, 6 inch		300	Ft	$6.00	$1,800.00
4017001		Culv, Precast Conc Box, 14 foot by 12 foot, Modified *	100	Ft	$3,500.00	$350,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		156	Syd	$50.00	$7,777.78
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		115	Cyd	$600.00	$69,000.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Bench *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$1,782,197.78**
Escalation to 2022 (10% /Year)	$534,659.33
Contingency (%)	10
Contingency ($)	$178,219.78
Construction Costs	**$2,495,076.89**
Design Costs	$499,015.38
Construction Inspection/Administration	$374,261.53
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$3,518,353.80**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-1 w/ ST-2 (Trestle Bridge Near Huron River) - Full Buildout (Assume 100-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$455,100.00	$455,100.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		7500	Cyd	$25.00	$187,500.00
2060002	Backfill, Structure, CIP		1500	Cyd	$30.00	$45,000.00
2060010	Excavation, Fdn		6000	Cyd	$15.00	$90,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		1089	Syd	$12.00	$13,066.67
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
4040033	Underdrain, Fdn, 6 inch		200	Ft	$6.00	$1,200.00
8060040	Shared use Path, HMA		220	Ton	$230.00	$50,600.00
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	1000	Sft	$40.00	$40,000.00
7050026	Pile, CIP Conc, Furn and Driven, 16 inch		3600	Ft	$60.00	$216,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		37100	Lb	$1.05	$38,955.00
7060100	Substructure Conc		370	Cyd	$600.00	$222,000.00
7060110	Superstructure Conc		56	Cyd	$500.00	$28,000.00
7070050	Structural Steel, Mixed, Erect		576435	Lb	$1.25	$720,544.00
7070051	Structural Steel, Mixed, Furn and Fab		576435	Lb	$2.25	$1,296,979.20
7100001	Joint Waterproofing		420	Sft	$5.00	$2,100.00
7100010	Conc Surface Coating *		1	LSUM	$5,000.00	$5,000.00
7067011		Anti-Graffiti Coating *	180	Syd	$40.00	$7,200.00
7107011		High Quality Natural Stone Facade *	180	Syd	$65.00	$11,700.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Bench *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$300,000.00	$300,000.00
2090001	Project Cleanup		1.0	LSUM	$4,000.00	$4,000.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$5,005,169.87**
Escalation to 2022 (10% /Year)	$1,501,550.96
Contingency (%)	10
Contingency ($)	$500,516.99
Construction Costs	**$7,007,237.81**
Design Costs	$700,723.78
Construction Inspection/Administration	$700,723.78
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$8,558,685.38**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-2 w/ ST-1 (Skewed Box Culvert Crossing) - Full Buildout (Assume 120-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		4250	Cyd	$25.00	$106,250.00
2060002	Backfill, Structure, CIP		2333	Cyd	$30.00	$70,000.00
2060010	Excavation, Fdn		3400	Cyd	$15.00	$51,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	100	Ft	$70.00	$7,000.00
4017021		Culvert Bedding *	179	Cyd	$70.00	$12,530.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		93	Cyd	$60.00	$5,600.00
4040033	Underdrain, Fdn, 6 inch		390	Ft	$6.00	$2,340.00
4017001		Culv, Precast Conc Box, 14 foot by 12 foot, Modified *	120	Ft	$3,500.00	$420,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		187	Syd	$50.00	$9,333.33
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		267	Cyd	$600.00	$160,200.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	420	Syd	$40.00	$16,800.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Fence *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$2,070,078.33**
Escalation to 2022 (10% /Year)	$621,023.50
Contingency (%)	10
Contingency ($)	$207,007.83
Construction Costs	**$2,898,109.67**
Design Costs	$579,621.93
Construction Inspection/Administration	$434,716.45
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$4,062,448.05**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-2 w/ ST-2 (Trestle Bridge on Skewed Alignment) - Full Buildout (Assume 120-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$497,600.00	$497,600.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		8250	Cyd	$25.00	$206,250.00
2060002	Backfill, Structure, CIP		1700	Cyd	$30.00	$51,000.00
2060010	Excavation, Fdn		6600	Cyd	$15.00	$99,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		1089	Syd	$12.00	$13,066.67
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
4040033	Underdrain, Fdn, 6 inch		200	Ft	$6.00	$1,200.00
8060040	Shared use Path, HMA		220	Ton	$230.00	$50,600.00
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	1000	Sft	$40.00	$40,000.00
7050026	Pile, CIP Conc, Furn and Driven, 16 inch		3600	Ft	$60.00	$216,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		50200	Lb	$1.05	$52,710.00
7060100	Substructure Conc		540	Cyd	$600.00	$324,000.00
7060110	Superstructure Conc		62	Cyd	$500.00	$31,000.00
7070050	Structural Steel, Mixed, Erect		653658	Lb	$1.25	$817,072.67
7070051	Structural Steel, Mixed, Furn and Fab		653658	Lb	$2.25	$1,470,730.80
7100001	Joint Waterproofing		450	Sft	$5.00	$2,250.00
7100010	Conc Surface Coating *		1	LSUM	$5,000.00	$5,000.00
7067011		Anti-Graffiti Coating *	200	Syd	$40.00	$8,000.00
7107011		High Quality Natural Stone Facade *	200	Syd	$65.00	$13,000.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Bench *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$300,000.00	$300,000.00
2090001	Project Cleanup		1.0	LSUM	$4,000.00	$4,000.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$5,472,705.13**
Escalation to 2022 (10% /Year)	$1,641,811.54
Contingency (%)	10
Contingency ($)	$547,270.51
Construction Costs	**$7,661,787.19**
Design Costs	$766,178.72
Construction Inspection/Administration	$766,178.72
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$9,344,144.62**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-3 w/ ST-1 (Box Culvert Crossing Away from Huron River) - Full Buildout (Assume 100-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		2175	Cyd	$25.00	$54,375.00
2060002	Backfill, Structure, CIP		851	Cyd	$30.00	$25,533.33
2060010	Excavation, Fdn		1740	Cyd	$15.00	$26,100.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	100	Ft	$70.00	$7,000.00
4017021		Culvert Bedding *	156	Cyd	$70.00	$10,920.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		78	Cyd	$60.00	$4,666.67
4040033	Underdrain, Fdn, 6 inch		300	Ft	$6.00	$1,800.00
4017001		Culv, Precast Conc Box, 14 foot by 12 foot, Modified *	100	Ft	$3,500.00	$350,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		156	Syd	$50.00	$7,777.78
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		267	Cyd	$600.00	$160,200.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Fence *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$1,873,397.78**
Escalation to 2022 (10% /Year)	$562,019.33
Contingency (%)	10
Contingency ($)	$187,339.78
Construction Costs	**$2,622,756.89**
Design Costs	$524,551.38
Construction Inspection/Administration	$393,413.53
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$3,690,721.80**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-3 w/ ST-2 (Trestle Bridge Away from Huron River) - Full Buildout (Assume 100-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$465,300.00	$465,300.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		1000	Cyd	$20.00	$20,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		7500	Cyd	$25.00	$187,500.00
2060002	Backfill, Structure, CIP		1500	Cyd	$30.00	$45,000.00
2060010	Excavation, Fdn		6000	Cyd	$15.00	$90,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		1089	Syd	$12.00	$13,066.67
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
4040033	Underdrain, Fdn, 6 inch		200	Ft	$6.00	$1,200.00
8060040	Shared use Path, HMA		220	Ton	$230.00	$50,600.00
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	1000	Sft	$40.00	$40,000.00
7050026	Pile, CIP Conc, Furn and Driven, 16 inch		3600	Ft	$60.00	$216,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		47740	Lb	$1.05	$50,127.00
7060100	Substructure Conc		522	Cyd	$600.00	$313,200.00
7060110	Superstructure Conc		56	Cyd	$500.00	$28,000.00
7070050	Structural Steel, Mixed, Erect		576435	Lb	$1.25	$720,544.00
7070051	Structural Steel, Mixed, Furn and Fab		576435	Lb	$2.25	$1,296,979.20
7100001	Joint Waterproofing		420	Sft	$5.00	$2,100.00
7100010	Conc Surface Coating *		1	LSUM	$5,000.00	$5,000.00
7067011		Anti-Graffiti Coating *	180	Syd	$40.00	$7,200.00
7107011		High Quality Natural Stone Facade *	180	Syd	$65.00	$11,700.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Bench *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$300,000.00	$300,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$300,000.00	$300,000.00
2090001	Project Cleanup		1.0	LSUM	$4,000.00	$4,000.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$5,117,741.87**
Escalation to 2022 (10% /Year)	$1,535,322.56
Contingency (%)	10
Contingency ($)	$511,774.19
Construction Costs	**$7,164,838.61**
Design Costs	$716,483.86
Construction Inspection/Administration	$716,483.86
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$8,747,806.34**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-1 w/ ST-1 (Box Culvert Crossing Near Huron River) - Partial Buildout (Assume 60-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		600	Cyd	$20.00	$12,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		2175	Cyd	$25.00	$54,375.00
2060002	Backfill, Structure, CIP		851	Cyd	$30.00	$25,533.33
2060010	Excavation, Fdn		1740	Cyd	$15.00	$26,100.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	60	Ft	$70.00	$4,200.00
4017021		Culvert Bedding *	94	Cyd	$70.00	$6,580.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		47	Cyd	$60.00	$2,800.00
4040033	Underdrain, Fdn, 6 inch		220	Ft	$6.00	$1,320.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	60	Ft	$4,000.00	$240,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		93	Syd	$50.00	$4,666.67
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		115	Cyd	$600.00	$69,000.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Bench *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$1,651,600.00**
Escalation to 2022 (10% /Year)	$495,480.00
Contingency (%)	10
Contingency ($)	$165,160.00
Construction Costs	**$2,312,240.00**
Design Costs	$462,448.00
Construction Inspection/Administration	$346,836.00
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$3,271,524.00**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-1 w/ ST-1 (Box Culvert Crossing Near Huron River) - Build Remaining 40-feet in Future

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$80,000.00	$80,000.00
2010001	Clearing		0.5	Acre	$11,000.00	$5,500.00
2040080	Exploratory Investigation, Vertical		0	Ft	$30.00	$0.00
2050010	Embankment, CIP		400	Cyd	$20.00	$8,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		150	Cyd	$25.00	$3,750.00
2060002	Backfill, Structure, CIP		96	Cyd	$30.00	$2,880.00
2060010	Excavation, Fdn		120	Cyd	$15.00	$1,800.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		495	Ft	$2.50	$1,237.50
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		156	Syd	$12.00	$1,866.67
8507051		Temp Haul Road *	1	LSUM	$20,000.00	$20,000.00
4027001		Slotted Drain, Galv, 6 inch *	40	Ft	$70.00	$2,800.00
4017021		Culvert Bedding *	63	Cyd	$70.00	$4,410.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		31	Cyd	$60.00	$1,866.67
4040033	Underdrain, Fdn, 6 inch		180	Ft	$6.00	$1,080.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	40	Ft	$4,000.00	$160,000.00
8060040	Shared use Path, HMA		35	Ton	$230.00	$8,050.00
8060020	Shared use Path, Conc		62	Syd	$50.00	$3,111.11
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		0	Ea	$1,500.00	$0.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		115	Cyd	$600.00	$69,000.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	200	Ft	$90.00	$18,000.00
8087001		Fence, Chain Link, 72 inch, Special *	0	Ft	$25.00	$0.00
8007050		Trash Receptacle *	0	Ea	$2,000.00	$0.00
8007050		Pedestrian Bench *	0	Ea	$1,500.00	$0.00
8100404	Sign, Type IIIA		0	Sft	$21.00	$0.00
8100405	Sign, Type IIIB		0	Sft	$25.00	$0.00
8100371	Post, Steel, 3 lb		0	Ft	$12.00	$0.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	0	LSUM	$25,000.00	$0.00
8197051		Utility Work, CenturyLink *	0	LSUM	$75,000.00	$0.00
8197051		Utility&Track Force Account Work, Amtrak *	0	LSUM	$150,000.00	$0.00
2090001	Project Cleanup		1.0	LSUM	$2,000.00	$2,000.00
8160100	Slope Restoration, Type A		1000.0	Syd	$5.00	$5,000.00
8160101	Slope Restoration, Type B		50.0	Syd	$7.00	$350.00
8197051		LIGHTING ESTIMATE	1	LSUM	$40,000.00	$40,000.00
8507060		Railroad Inspection and Flagging *	75000	Dlr	$1.00	$75,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$25,000.00	$25,000.00
8507060		Railroad Protection *	15000	Dlr	$1.00	$15,000.00

Subtotal	**$803,001.94**
Escalation to 2022 (10% /Year)	$240,900.58
Contingency (%)	10
Contingency ($)	$80,300.19
Construction Costs	**$1,124,202.72**
Design Costs	$224,840.54
Construction Inspection/Administration	$168,630.41
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$1,667,673.68**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-2 w/ ST-1 (Box Culvert On Skewed Alignment) Build - Partial Buildout (Assume 70-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		600	Cyd	$20.00	$12,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		4250	Cyd	$25.00	$106,250.00
2060002	Backfill, Structure, CIP		2333	Cyd	$30.00	$70,000.00
2060010	Excavation, Fdn		3400	Cyd	$15.00	$51,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	70	Ft	$70.00	$4,900.00
4017021		Culvert Bedding *	109	Cyd	$70.00	$7,630.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		54	Cyd	$60.00	$3,266.67
4040033	Underdrain, Fdn, 6 inch		290	Ft	$6.00	$1,740.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	70	Ft	$4,000.00	$280,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		109	Syd	$50.00	$5,444.44
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		267	Cyd	$600.00	$160,200.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	420	Syd	$40.00	$16,800.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Fence *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$1,908,256.11**
Escalation to 2022 (10% /Year)	$572,476.83
Contingency (%)	10
Contingency ($)	$190,825.61
Construction Costs	**$2,671,558.56**
Design Costs	$534,311.71
Construction Inspection/Administration	$400,733.78
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$3,756,604.05**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-2 w/ ST-1 (Box Culvert on Skewed Alignment) - Build Remaining 50-feet in Future

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$80,000.00	$80,000.00
2010001	Clearing		0.5	Acre	$11,000.00	$5,500.00
2040080	Exploratory Investigation, Vertical		0	Ft	$30.00	$0.00
2050010	Embankment, CIP		400	Cyd	$20.00	$8,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		250	Cyd	$25.00	$6,250.00
2060002	Backfill, Structure, CIP		160	Cyd	$30.00	$4,800.00
2060010	Excavation, Fdn		200	Cyd	$15.00	$3,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		495	Ft	$2.50	$1,237.50
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		156	Syd	$12.00	$1,866.67
8507051		Temp Haul Road *	1	LSUM	$20,000.00	$20,000.00
4027001		Slotted Drain, Galv, 6 inch *	50	Ft	$70.00	$3,500.00
4017021		Culvert Bedding *	78	Cyd	$70.00	$5,460.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		39	Cyd	$60.00	$2,333.33
4040033	Underdrain, Fdn, 6 inch		200	Ft	$6.00	$1,200.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	50	Ft	$4,000.00	$200,000.00
8060040	Shared use Path, HMA		35	Ton	$230.00	$8,050.00
8060020	Shared use Path, Conc		78	Syd	$50.00	$3,888.89
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		0	Ea	$1,500.00	$0.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		115	Cyd	$600.00	$69,000.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	200	Ft	$90.00	$18,000.00
8087001		Fence, Chain Link, 72 inch, Special *	0	Ft	$25.00	$0.00
8007050		Trash Receptacle *	0	Ea	$2,000.00	$0.00
8007050		Pedestrian Bench *	0	Ea	$1,500.00	$0.00
8100404	Sign, Type IIIA		0	Sft	$21.00	$0.00
8100405	Sign, Type IIIB		0	Sft	$25.00	$0.00
8100371	Post, Steel, 3 lb		0	Ft	$12.00	$0.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	0	LSUM	$25,000.00	$0.00
8197051		Utility Work, CenturyLink *	0	LSUM	$75,000.00	$0.00
8197051		Utility&Track Force Account Work, Amtrak *	0	LSUM	$150,000.00	$0.00
2090001	Project Cleanup		1.0	LSUM	$2,000.00	$2,000.00
8160100	Slope Restoration, Type A		1000.0	Syd	$5.00	$5,000.00
8160101	Slope Restoration, Type B		50.0	Syd	$7.00	$350.00
8197051		LIGHTING ESTIMATE	1	LSUM	$40,000.00	$40,000.00
8507060		Railroad Inspection and Flagging *	75000	Dlr	$1.00	$75,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$25,000.00	$25,000.00
8507060		Railroad Protection *	15000	Dlr	$1.00	$15,000.00

Subtotal	**$851,736.39**
Escalation to 2022 (10% /Year)	$255,520.92
Contingency (%)	10
Contingency ($)	$85,173.64
Construction Costs	**$1,192,430.94**
Design Costs	$238,486.19
Construction Inspection/Administration	$178,864.64
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$1,759,781.78**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-3 w/ ST1 (Box Culvert Away from Huron River) - Partial Buildout (Assume 60-feet Long Underpass)

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$127,000.00	$127,000.00
2010001	Clearing		2	Acre	$11,000.00	$22,000.00
2040080	Exploratory Investigation, Vertical		150	Ft	$30.00	$4,500.00
2050010	Embankment, CIP		600	Cyd	$20.00	$12,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		2175	Cyd	$25.00	$54,375.00
2060002	Backfill, Structure, CIP		851	Cyd	$30.00	$25,533.33
2060010	Excavation, Fdn		1740	Cyd	$15.00	$26,100.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		990	Ft	$2.50	$2,475.00
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		933	Syd	$12.00	$11,200.00
8507051		Temp Haul Road *	1	LSUM	$50,000.00	$50,000.00
4027001		Slotted Drain, Galv, 6 inch *	60	Ft	$70.00	$4,200.00
4017021		Culvert Bedding *	94	Cyd	$70.00	$6,580.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		47	Cyd	$60.00	$2,800.00
4040033	Underdrain, Fdn, 6 inch		220	Ft	$6.00	$1,320.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	60	Ft	$4,000.00	$240,000.00
8060040	Shared use Path, HMA		200	Ton	$230.00	$46,000.00
8060020	Shared use Path, Conc		93	Syd	$50.00	$4,666.67
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		2	Ea	$1,500.00	$3,000.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		267	Cyd	$600.00	$160,200.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	400	Ft	$90.00	$36,000.00
8087001		Fence, Chain Link, 72 inch, Special *	800	Ft	$25.00	$20,000.00
8007050		Trash Receptacle *	2	Ea	$2,000.00	$4,000.00
8007050		Pedestrian Fence *	4	Ea	$1,500.00	$6,000.00
8100404	Sign, Type IIIA		4	Sft	$21.00	$84.00
8100405	Sign, Type IIIB		30	Sft	$25.00	$750.00
8100371	Post, Steel, 3 lb		68	Ft	$12.00	$816.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	1	LSUM	$25,000.00	$25,000.00
8197051		Utility Work, CenturyLink *	1	LSUM	$75,000.00	$75,000.00
8197051		Utility&Track Force Account Work, Amtrak *	1	LSUM	$150,000.00	$150,000.00
2090001	Project Cleanup		1.0	LSUM	$3,200.00	$3,200.00
8160100	Slope Restoration, Type A		2000.0	Syd	$5.00	$10,000.00
8160101	Slope Restoration, Type B		100.0	Syd	$7.00	$700.00
8197051		LIGHTING ESTIMATE	1	LSUM	$130,000.00	$130,000.00
8507060		Railroad Inspection and Flagging *	150000	Dlr	$1.00	$150,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$50,000.00	$50,000.00
8507060		Railroad Protection *	30000	Dlr	$1.00	$30,000.00

Subtotal	**$1,742,800.00**
Escalation to 2022 (10% /Year)	$522,840.00
Contingency (%)	10
Contingency ($)	$174,280.00
Construction Costs	**$2,439,920.00**
Design Costs	$487,984.00
Construction Inspection/Administration	$365,988.00
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$3,443,892.00**

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

ENGINEER'S PRELIMINARY ESTIMATE OF COST

Feasibility Study: PA-3 w/ ST-1 (Box Culvert Away from Huron River) - Build Remaining 40-feet in Future

PROJECT NAME

Bandemer-Barton Pedestrian Underpass

LOCATION

City of Ann Arbor, MI

ITEM CODE	PAY ITEM DESCRIPTION	SUPPLEMENTAL DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL AMOUNT
1500001	Mobilization, Max. ____		1.0	LSUM	$80,000.00	$80,000.00
2010001	Clearing		0.5	Acre	$11,000.00	$5,500.00
2040080	Exploratory Investigation, Vertical		0	Ft	$30.00	$0.00
2050010	Embankment, CIP		400	Cyd	$20.00	$8,000.00
2050031	Non Haz Contaminated Material Handling and Disposal, LM		250	Cyd	$25.00	$6,250.00
2060002	Backfill, Structure, CIP		160	Cyd	$30.00	$4,800.00
2060010	Excavation, Fdn		200	Cyd	$15.00	$3,000.00
2080016	Erosion Control, Gravel Access Approach		2	Ea	$2,000.00	$4,000.00
2080036	Erosion Control, Silt Fence		495	Ft	$2.50	$1,237.50
2080014	Erosion Control, Filter Bag		2	Ea	$450.00	$900.00
3020020	Aggregate Base, 8 inch		156	Syd	$12.00	$1,866.67
8507051		Temp Haul Road *	1	LSUM	$20,000.00	$20,000.00
4027001		Slotted Drain, Galv, 6 inch *	40	Ft	$70.00	$2,800.00
4017021		Culvert Bedding *	63	Cyd	$70.00	$4,410.00
4027051		Dewatering System for Contaminated Groundwater, Site *	1	LSUM	$100,000.00	$100,000.00
4027050		Hazardous Waste Operations and Emergency Response Training *	2	Ea	$4,000.00	$8,000.00
4037050		Clean Out *	4	Ea	$1,000.00	$4,000.00
4037050		Dr Structure, 18 inch dia, Special *	1	Ea	$2,000.00	$2,000.00
8230052	Gate Valve and Box, 8 inch		2	Ea	$3,000.00	$6,000.00
2060001	Aggregate, 6A		31	Cyd	$60.00	$1,866.67
4040033	Underdrain, Fdn, 6 inch		180	Ft	$6.00	$1,080.00
4017001		Culv, Precast Conc Box, 16 foot by 12 foot, Modified *	40	Ft	$4,000.00	$160,000.00
8060040	Shared use Path, HMA		35	Ton	$230.00	$8,050.00
8060020	Shared use Path, Conc		62	Syd	$50.00	$3,111.11
7047010		Steel Sheet Piling, Temp, Left in Place, Special *	2000	Sft	$40.00	$80,000.00
7060040	Elec Grounding System		0	Ea	$1,500.00	$0.00
7060092	Reinforcement, Steel, Epoxy Coated		6000	Lb	$1.05	$6,300.00
7060100	Substructure Conc		115	Cyd	$600.00	$69,000.00
7100001	Joint Waterproofing		120	Sft	$5.00	$600.00
7100010	Conc Surface Coating (Box Culvert) *		1	LSUM	$8,000.00	$8,000.00
7067011		Anti-Graffiti Coating *	400	Syd	$40.00	$16,000.00
7107011		High Quality Natural Stone Facade *	100	Syd	$65.00	$6,500.00
8087001		Ornamental Aluminum Fence, 72 inch *	200	Ft	$90.00	$18,000.00
8087001		Fence, Chain Link, 72 inch, Special *	0	Ft	$25.00	$0.00
8007050		Trash Receptacle *	0	Ea	$2,000.00	$0.00
8007050		Pedestrian Bench *	0	Ea	$1,500.00	$0.00
8100404	Sign, Type IIIA		0	Sft	$21.00	$0.00
8100405	Sign, Type IIIB		0	Sft	$25.00	$0.00
8100371	Post, Steel, 3 lb		0	Ft	$12.00	$0.00
8120160	Ltg for Night Work		1	LSUM	$5,000.00	$5,000.00
8197051		Utility Work, Level 3 *	0	LSUM	$25,000.00	$0.00
8197051		Utility Work, CenturyLink *	0	LSUM	$75,000.00	$0.00
8197051		Utility&Track Force Account Work, Amtrak *	0	LSUM	$150,000.00	$0.00
2090001	Project Cleanup		1.0	LSUM	$2,000.00	$2,000.00
8160100	Slope Restoration, Type A		1000.0	Syd	$5.00	$5,000.00
8160101	Slope Restoration, Type B		50.0	Syd	$7.00	$350.00
8197051		LIGHTING ESTIMATE	1	LSUM	$40,000.00	$40,000.00
8507060		Railroad Inspection and Flagging *	75000	Dlr	$1.00	$75,000.00
8507051		Railroad Track Monitoring *	1	LSUM	$25,000.00	$25,000.00
8507060		Railroad Protection *	15000	Dlr	$1.00	$15,000.00

Subtotal	**$808,621.94**
Escalation to 2022 (10% /Year)	$242,586.58
Contingency (%)	10
Contingency ($)	$80,862.19
Construction Costs	**$1,132,070.72**
Design Costs	$226,414.14
Construction Inspection/Administration	$169,810.61
Amtrak Engineering Review Costs	$150,000.00
GRAND TOTAL	**$1,678,295.48**

Attachments
Alternative Comparisons

Pedestrian Underpass Path Alignment Alternative Comparison			
	PA-1 **Near Huron River**	**PA-2** **On Skewed Alignment**	**PA-3** **Away from Huron River**
Rail Impacts			
Operations & Maintenance	Crossing at 90 degrees to minmize impacts to rail maintenance equipment.	Skewed crossing marginally elongates area impacting rail maintenance equipment.	Crossing at 90 degrees to minmize impacts to rail maintenance equipment.
Standards	All Amtrak/AREMA/MDOT Standards can be met.	All Amtrak/AREMA/MDOT Standards can be met.	All Amtrak/AREMA/MDOT Standards can be met.
Track Impacts (Construction)	No equipment to cross tracks without RR permission and a temp crossing.	No equipment to cross tracks without RR permission and a temp crossing.	No equipment to cross tracks without RR permission and a temp crossing.
Hydrualics			
Pedestrian Use During Huron River Highwater	Closest to the Huron River with increased risk of inundation.	Skewed alignment places entrances away from Huron River. Lower risk of inundation.	Furthest from the Huron River with lowest risk of inundation.
Huron River Floodplain Cut/Fill Attributed to Ped Access	100 yr floodplain may be impacted (no net fill) in NW quadrant by regrading slopes.	No Impacts.	No impacts.
Pedestrian Safety			
Safety	"Open" feeling with existing sideslopes/grades minimized. Good sight lines into and out of the underpass on the north side.	Longer underpass due to skew will be in enclosed area longer. 30-ft radius bend at north entrance into the underpass will have reduced sight lines.	Open feeling with good sight lines but taller sideslopes due to existing grades. 30-ft radius bend at north entrance into the underpass will have reduced sight lines.
Constructability			
Easements	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.
Groundwater Levels	Groundwater may be an issue during construction due to Huron River levels.	Groundwater may be an issue during construction due to Huron River levels.	Groundwater may be an issue during construction due to Huron River levels.
Construction Access	General access can be achieved by using Whitmore Lake Dr on the north side of the RR. Due to the narrow bridge on Whitmore Lake Dr, heavy equipment and large loads will need to access the project site thru a clearing on the south side of the RR.	General access can be achieved by using Whitmore Lake Dr on the north side of the RR. Due to the narrow bridge on Whitmore Lake Dr, heavy equipment and large loads will need to access the project site thru a clearing on the south side of the RR.	General access can be achieved by using Whitmore Lake Dr on the north side of the RR. Due to the narrow bridge on Whitmore Lake Dr, heavy equipment and large loads will need to access the project site thru a clearing on the south side of the RR.
Utilities			
Fiber Optic Cables	Conduits located within RR ROW will need to be relocated/protected.	Conduits located within RR ROW will need to be relocated/protected.	Conduits located within RR ROW will need to be relocated/protected.
Gas Main	No impacts antcipated.	No conflicts anticipated. Will need to check grading for conflicts with north approach.	No conflicts anticipated. Will need to check grading for conflicts with north approach.
Water Main	No conflicts anticipated.	No conflicts anticipated.	Existing watermain is located perpendicular to the RR tracks southeast of proposed tunnel location (exact location of watermain is unknown). Need to confirm it is clear.
Geometrics			
ADA Requirements	Trail will be fully compliant.	Trail will be fully compliant.	Trail will be fully compliant.
Pathway Elevation Under Tracks	See Report (No Advantages in any Alignment Option)	See Report (No Advantages in any Alignment Option)	See Report (No Advantages in any Alignment Option)
Vertical Clearance	See Report (No Advantages in any Alignment Option)	See Report (No Advantages in any Alignment Option)	See Report (No Advantages in any Alignment Option)
Tunnel Length	Underpass is aligned perpendicular to RR tracks, resulting in 100-ft of length maximum.	Underpass is aligned at a 28-degree skew to the RR tracks, resulting in 120-ft of length.	Underpass is aligned perpendicular to RR tracks, resulting in 100-ft of length maximum.
Existing Topography Requiring Retaining Walls	Headwalls and wingwalls are required at both ends to retain fill around culvert. Retaining walls are not required along pathway.	Headwalls and wingwalls are required at both ends to retain fill around culvert. Retaining walls are not required along pathway.	Headwalls and wingwalls are required at both ends to retain fill around culvert. Retaining walls are not required along pathway.
Geotechnical			
Design/Construction Risks	Groundwater during construction may require mitigation such as temporary pumping. Closest to Huron River which elevates risk.	Groundwater during construction may require mitigation such as temporary pumping.	Groundwater during construction may require mitigation such as temporary pumping.
Environmental			
Endangered/Threatened Species	Could be affected at this location, given proximity to Huron River.	Could be affected at this location but work will be limited near the river.	Could be affected at this location but work will be limited near the river.
Wetland Impacts	Possibility of impacts in the NW quadrant of proposed underpass location.	Possibility of impacts in the NW quadrant of proposed underpass location.	No wetland impacts anticipated, thought grading for switchbacks may impact them.

Pedestrian Underpass Structure Alternative Comparison			
	ST-1 Box Culvert	**ST-2: Trestle Bridge**	**ST-3: Tunnel Liner Plate**
Rail Impacts			
Operations & Maintenance	Requires regular bridge inspection and load rating in accordance with FRA rules. Requires interruption to some maintenance operations due to proximity of culvert to rail. Will not impact normal rail operations.	Requires regular bridge inspection and load rating in accordance with FRA rules. Requires interruption to some maintenance operations due to proximity of culvert to rail. Will not impact normal rail operations.	Requires regular bridge inspection and load rating in accordance with FRA rules. Requires interruption to some maintenance operations due to proximity of culvert to rail. Will not impact normal rail operations.
Standards	Requires Design Variance from Amtrak for "Pipe" cover.	All Amtrak/AREMA/MDOT Standards can be met.	Requires Design Variance from Amtrak for "Pipe" cover.
Track Impacts (Construction)	A 24-hour track outage will be required for constructing open cut, installing culvert, and backfilling. Intermittent work between trains with rail flagging (utility work, temporary sheeting, etc.).	A 24-hour track outage will be required for constructing substructures and setting superstructure. Intermittent work between trains with rail flagging (driving piles, utility work, temporary sheeting, etc.).	An undetermined duration track outage may be required for constructing the underpass since soil stability will be a concern. Intermittent work between trains with rail flagging (utility work, temporary sheeting, etc.).
Hydrualics			
Pedestrian Use During Huron River Highwater	Continuous enclosure to block groundwater. Open ends allow for water to enter during high flows.	Highest pathway elevation reduces risk of indundation (and at lower levels). Open structure with increased risk of groundwater entering along length of underpass.	Continuous enclosure to block groundwater. Open ends allow for water to enter during high flows. Lowest elevation with high likelihood of inundation for long periods of time.
Huron River Floodplain Cut/Fill Attributed to Ped Access	Wingwall in NW quadrant may require cut and fill in floodplain. There will be a net cut in the existing floodplain.	Wingwall in NW quadrant may require cut and fill in floodplain. There will be a net cut in the existing floodplain.	Wingwall in NW quadrant may require cut and fill in floodplain. Excavation depths greatest with increased risk of impacting the floodplain. There will be a net cut in the existing floodplain.
Pedestrian Safety			
Safety	Limited natural light and will require lighting inside the culvert and transition lighting at the ends.	Natural light with 3-span but may still require lighting. Allows for largest opening (width).	Limited natural light and will require lighting inside the culvert and transition lighting at the ends.
Constructability			
Easements	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.	No easements anticipated. Occupancy Permit required with MDOT for Rail R/W.
Groundwater Levels	Requires excavation below the normal Huron River levels. Some dewatering anticipated.	Requires excavation below the normal Huron River levels. Requires least amount of excavation depth of all options. Some dewatering anticipated.	Require excavation well below normal Huron River levels. Dewater anticipated.
Construction Access	Equipment needed includes excavator, dozer, and crane capable of lifting large box culvert pieces. Work can commence from south end and work north.	Equipment needed includes excavator, dozer, and crane capable of lifting foundation piles, structural beams, forms, etc. Work would likely be performed within "jump spans" which has limited overhead clearances.	Equipment will primarily be small with significant amount of hand digging.
Utilities			
Fiber Optic Cables	Conduits located within RR ROW will need to be relocated (potentially can be protected with minimal work).	Conduits located within RR ROW will need to be relocated (potentially twice).	Conduits located within RR ROW will need to be protected with minimal work.
Gas Main	No advantages among other alternatives.	No advantages among other alternatives.	No advantages among other alternatives.
Water Main	No advantages among other alternatives.	No advantages among other alternatives.	No advantages among other alternatives.
Geometrics			
ADA Requirements	No advantage over other alternatives.	Requires least amount of grade change overall.	Requires most amount of grade change overall.
Pathway Elevation Under Tracks	See report summary for various vertical clearance options.	See report summary for various vertical clearance options.	See report summary for various vertical clearance options.
Vertical Clearance	See report summary for various vertical clearance options.	See report summary for various vertical clearance options.	See report summary for various vertical clearance options. Not feasible due to depth of trail.
Tunnel Length	No advantage over other alternatives.	No advantage over other alternatives.	No advantage over other alternatives.
Existing Topography Requiring Retaining Walls	No advantage over other alternatives.	No advantage over other alternatives.	No advantage over other alternatives.
Geotechnical			
Design/Construction Risks	Addressing unforseen subgrade conditions during the short track outage may jeopordize the schedule. Groundwater during installation of the culvert may require mitigation such as temporary pumping.	Requires foundation piling driving between live trains. Track maintenance and embankment stability may be an issue.	Significant risks involved with tunneling operation give existing soils.
Environmental			
Endangered/Threatened Species	No advantage over other alternatives.	No advantage over other alternatives.	No advantage over other alternatives.
Wetland Impacts	No advantage over other alternatives.	No advantage over other alternatives.	No advantage over other alternatives.

Attachments
Regulatory Agencies

Regulatory Requirements*			
Regulatory Agency	**Documents/Specification/Etc**	**Design Criteria**	**Impacts to Design/Permitting/Construction**
Washtenaw County			
MDOT	**"General Guidance for Longitudinal-Use of State-Owned Rail Property: Minimum Requirements for Shared-Use Pathways"**	N/A (tunnel/pathway will be transverse to the RR)	N/A
	Soil Contamination	Soils within the RR R/W are treated as if they are contaminated. Any contaminated material excavated or groundwater must be disposed of at an appropriate landfill.	Coordinate with MDOT Office of Rail
	Groundwater Contamination	Groundwater within RR R/W to be tested and treated/disposed of properly.	Investigate locations for disposal
	Track Outage	A track outage will affect RR operations.	Coordinate with MDOT Office of Rail on track outage dates; MDOT will then coordinate with Amtrak (bus bridging may be required as a project cost to maintain passenger service during the outage)
Amtrak	**Specification EP3003**	N/A (blasting)	N/A
	Specification EP3006	N/A (overhead bridges)	N/A
	Specification EP3014	Safety and Protection of RR Traffic and Property	Applicable
	Specification EP3016	N/A (stormwater)	N/A
	Specification 150	(Stormwater Management)	Applicable
EGLE	**Floodplains**	Work within the floodplain will require a Part 31 permit, No fill will be allowed in the floodway	A project that is net cut or balanced will require substantially less effort to obtain permit
	Inland Lakes and Streams	No permit required if impacts are outside of the OHWM	Path and temporary facilities could be kept outside of the OHWM of the Huron River to avoid permit requirements.
	Wetlands	A public path project qualifies as a minor project as long as wetland fill is kept to 1/10 of an acre or less	Keeping the wetland fill to less than 1/10 of an acre would simplify the permitting effort. If impacts are greater that mitigation will likely be required.
	Michigan Natural Features Inventory Database for Protected Species	Presence could result in an Environmental Assessment.	Environmental Assessment could delay design process.
	U.S. Fish and Wildlife Service threatened and endangered species list for Washtenaw County	The area is known long eared bat and Indiana Bat habitat.	If tree removal is kept to the period between Oct 1st and March 31st, then no permit is required.
	Michigan Natural Features Inventory (MNFI) rare species review	Presence could result in an Environmental Assessment.	Environmental Assessment could delay design process.
Michigan State Historic Preservation Office (SHPO)	**Cultural Resources Assessment**	Presence could result in an Environmental Assessment.	Environmental Assessment could delay design process.
Fiber Optic Utilities	**-----**	Must be maintained throughout construction	Investigate temporary works and/or staging options.

* See "Ped Culvert Design Criteria" tab for AASHTO, AREMA, and City of Ann Arbor requirements

AttachmentsDesign Criteria

Table of Values for Determination of Scope of Conformance									
Pedestrian Underpass and Approach Pathway Geometry									
Item	**AASHTO**	**City of Ann Arbor**	**AREMA**	**AMTRAK**	**ADA**	**Culvert Manufacturer Specs**	**Other Controlling Factors**	**Notes/Calculations**	**Proposed**
Min Structure Clear Width	**GBF (5.2.10) - 14ft GPF (3.2.9) - 8ft**	**Division II (Section 8C) - 8ft min**	NA	NA		NA	NA	AASHTO = 10ft min pathway width + 2ft offset on each side = 14ft min for Shared Use pathways. Assume Shared Use Pathway.	**14ft clear min (Consider 16-ft to 20-ft clear)**
Min Culvert Rise/Vertical Clearance	**GBF (5.2.10) - 10ft GPF (3.2.9) - 8ft**	NA	NA	NA		NA	NA	Assume Shared Use Pathway. Assume 10ft underclearance from bottom of top slab to pathway surface. Haunch geometry is 1ft x 1ft and will encroach by 1ft into this underclearance in the corners of the culvert.	**12ft rise (includes 2ft thick pavmt/base in culvert) (10ft for Trestle Alternatives)**
Min Culvert Length	NA	NA	**Section 3.6 - Table 28-3 3 - 14ft**	**70050.001.8 - Design Standard**		NA		Assume 2 tracks at 14ft per AREMA chapter 28 section 3.6 per AMTRAK standards. Depends on culvert elevation and F/O line location. Consider grading needs BEFORE double track.	**Proposed to extend entire width of R/W for Costs**
Approach Pathway Width	**GBF (5.2.10) - 14ft GPF (3.2.9) - 8ft**	**Division II (Section 8C) - 8ft min**	NA	NA		NA	NA	10ft min pathway width + 2ft offset on each side = 14ft for Shared Use pathways. Assume Shared Use Pathway.	**10ft pathway with 2ft shoulders on each side = 14ft**
Max Pathway Grade	**GBF (5.2.7) - 5% GPF (3.2.7) - 5%**	**Division II (Section 8B and 8C) - 5%**	NA	NA		NA	NA	5% max grade for both ped and bike pathway	**5% max grade unless 5ft long landings are provided.**
Depth of Cover	NA	NA	NA	**8' per EP3005 (Design Variance is needed)**	NA	NA	NA	Confirm cover with F/O owners. May require protective sleeves in area of reduced cover (less than 30 inches).	**30" below bottom of rail tie if Design Variance is obtained**
Top Slab Thickness (Alts 2, 4, and 6)	NA	NA	**AREMA Table 8-2-10**	NA				AREMA deflection control criteria for constant depth members is given in Table 8-2-10 and is based on span length. (S+10)/20 = min for top slab. Assume 14ft clear span.	**1ft - 6in is assumed based on correspondance with fabricators.**
Bottom Slab Thickness (Alts 2, 4, and 6)	NA	NA	**AREMA Table 8-2-10**	NA				AREMA deflection control criteria for constant depth members is given in Table 8-2-10 and is based on span length. S/16 = min for bottom slab. Assume 14ft clear span.	**1ft - 6in is assumed based on correspondance with fabricators.**
Wall Thickness (Alts 2, 4, and 6)	NA	NA	NA	NA				From culvert manufacturer	**1 ft is assumed based on correspondance with fabricators.**
Structure Depth (Alts 1, 3, and 5)							Preliminary Design	21" to 24" deep beam, 1" deck plate, 12" of ballast, 9" tie, and 6/12" rail.	**4.5ft +/-**
100 year Water Surface Elevation								See Vertical Geometry tab	**El. 778+/-**
Ped Surface Elevation								See Vertical Geometry tab	**Varies w/ Alternative**
Huron River Water Surface Elevation								See Vertical Geometry tab	**El. 773+/-**
Bottom of Bottom Slab Elevation (Alts 2, 4, and 6)							Invert minus cross slope and depth of fill within culvert for paved surface.		**Varies w/ Alternative**
Haunch Height/Width (Alts 2, 4, and 6)								From culvert manufacturer	**1 ft x 1 ft**
Headwall/Wingwall Height/Width								Must be tall enough to contain earth fill plus a min reveal.	**TBD Detail Design**
ADA Max Grade No Landings					5%				
ADA Max Grade w/ Landings					8.33%				
Landing Spacing					30ft				
Landing Length					5ft				
Skew Angle	n/a	n/a	n/a	n/a	n/a	n/a	n/a	A perpendicular crossing or a crossing with a slight skew are both permissible.	**TBD**

Retaining Walls/ Fencing

Item	AASHTO	City of Ann Arbor	AREMA	AMTRAK	Culvert Manufacturer S		Other Controlling Factors	Notes/Calculations	Proposed
Retaining Wall Geometry								Determine where retaining walls are required. Aesthetic details will determine wall thickness.	
Fence Height	NA	NA	NA	NA		NA	NA	MDOT requires 6ft tall fencing. (Limits along RR TBD)	**6ft**

Track Design

Item	AASHTO	City of Ann Arbor	AREMA	AMTRAK	Culvert Manufacturer S		Other Controlling Factors	Notes/Calculations	Proposed
Track Design Speed	NA	NA	**Chapter 8 Concrete Structures: Freight = 80mph Passenger = 90 mph**			NA		Up to 110mph	**110mph (however station nearby, may be able to obtain design variance if needed)**
Temp Work (Shoofly)	NA	NA	**TBD**			NA		Nearby river bridge. Not feasible.	**Track Outage**
Track Profile	NA	NA				NA	**Existing bridge over Huron River**	Any revised track profile will be controlled by the existing bridge over the Huron River to the west	**Maintain Existing**
Double Track Section	NA	NA	**Section 3.6 - Table 28-3 3 - 14ft**	**70050.001.8 - Design Standard**		NA	NA	Assume 2 tracks at 14ft per AREMA chapter 28 section 3.6 per AMTRAK standards	**14ft track spacing to CL tracks**

Aesthetics/ Lighting

Item	AASHTO	City of Ann Arbor	AREMA	AMTRAK	Culvert Manufacturer S		Other Controlling Factors	Notes/Calculations	Proposed
Aesthetic Details								Aesthetic details for culvert/retaining walls/fencing/etc.	**TBD**
Lighting Requirements								Lighting is required inside the tunnel and at the approaches.	**Lighting under structure and transition at ends**

Structural Design Criteria

Item	AASHTO	City of Ann Arbor	AREMA	AMTRAK	Culvert Manufacturer S		Other Controlling Factors	Notes/Calculations	Proposed
Culvert/Structure Design Method	NA	NA	**LFD/ASD**	NA		NA	NA		**AREMA - LFD/ASD**
Structural Capacity	NA	NA	**AREMA section 2.2.3 c and d**	NA		NA	NA	AREMA section 2.2.3c and d	**Cooper E-80 + impact**
Culvert Live Loading	**GSDPB 3.1 - 90psf**	NA	NA	NA		NA	NA	If there are no physical barriers preventing vehicle passage, a H10 design vehicle shall be designed for loading. Assume no vehicle passageway.	**90 psf**
Live Load Deflections	NA	NA	**AREMA Table 8-2-10**	NA		NA	NA	AREMA deflection control criteria for constant depth members is given in Table 8-2-10 and is based on span length. (S+10)/20 = min for top slab and S/16 = min for bottom slab. Assume 14ft clear span.	**Min Top slab = 14.5in Min Bottom Slab = 10.5in**
Culvert Concrete Strength	NA	NA	**AREMA 16.2.4 -4ksi min**	NA			NA	Based on manufacturers box culvert design. AREMA states 4ksi min.	
Steel Reinforcement Grade	NA	NA	**AREMA 16.2.5 -Grade 60**	NA		NA	NA		**Grade 60**
Steel Reinforcement Minimum Area (Longitudinal)	NA	NA	**AREMA 16.5.4**	NA			NA	Minimum longitudinal reinforcement area equals 0.4% of concrete area for top and bottom slab and walls if fill depth over culvert is <= 10ft.	**0.4% of concrete area minimum**
Bearing Pressure Design	NA	NA						Allowable bearing pressure and allowable settlement to be checked.	**AREMA - LFD**

GBF - AASHTO Guide for the Development of Bicycle Facilities

GPF - AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities

GSDPB - AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges

AttachmentsPublic Meeting

Border-to-Border Trail: Barton-Bandemer Connection Project

Public Meeting Comments Summary

A public meeting was held on February 26, 2019 at 6:30pm at Forsythe Middle School to seek initial public feedback to the City of Ann Arbor and Washtenaw County Parks and Recreation Commission (WCPARC) regarding the Border-to-Border Trail (B2B) Barton-Bandemer Connection Project. Sixty members of the public signed in at the meeting, which consisted of a brief presentation by staff, followed by open discussion questions, then open house format with more detailed maps and staff/consultants at each.

In total, 60 written comments have been received for this project as of March 12, 2019 – all of which are available upon request. Nineteen written comments were collected by the end of the initial meeting and staff received 13 emails and 28 on-line form submissions during the two weeks afterwards. The meeting's power point and maps were posted on the same site as the comment sheets to provide as much information as possible to the public who were unable to attend the meeting. Per the request of some members of the public, the comment period has been re-opened and left open-ended.

The vast majority of responses were in favor of both the tunnel project and paving in Barton Nature Area. The information below summarizes the types of comments that were received:

- The tunnel is essential for the future success of the B2B and bike and pedestrian traffic to move in to and out of the City in the North Main/Huron River Drive area.
- Support for the tunnel portion of the project because of a clear desire for the pedestrian connection and a desire by the rail to prevent crossing the tracks
- Concern that the project will take too long to implement and a desire to implement the project quickly
- Concern for how the trail and tunnel will change demand for the current parking lot near Barton Dam and the use of any of the nature trails in Bird Hills and surrounding nature areas.
- Request of the team to make the tunnel feel safe through use of sight lines, lightning, and other measures.
- Support for the tunnel because it also connects the hiking and biking trails of the adjacent nature areas to parking areas and the B2B in Bandemer Park
- Support for the overall project to provide a safe bike route along N. Main at the M-14 interchange.
- Concern for overall project costs and how to pay for it.
- Overall project would be a benefit to the community
- Why can't we build a gated crossing instead of a tunnel, it would be much cheaper?
- Support or no concern for paving the main (existing woodchip) trail through Barton Nature Area as long as it is part of a regional system.
- Build the tunnel but don't touch the nature area because it is nice as-is.
- Support of paving in the nature area if disturbance and path width is kept to a minimum to keep as much existing vegetation and feel.

- Concern for stormwater runoff from a paved trail in the nature area
- Is it possible to add a limestone or dirt path next to the paved path for runners?
- Consider alternate materials to asphalt for the trail in the nature area such as porous paving or limestone.
- Support of improving ADA connections and improving safety
- Current woodchip trail is often muddy and difficult to use, paving would solve this
- Oppose paving the wood chip trail in the nature area.
- Have all of the alternatives to paving the trail been explored?
- Concern for increased incursion into natural areas

Please see the separate comment sheets for complete information.

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

OHM
Advancing Communities

PART 2
Bandemer-Barton Trail Study
Bandemer Park and Barton Nature Area

Washtenaw County, MI

Parks&Recreation
CITY OF ANN ARBOR

WASHTENAW COUNTY PARKS & RECREATION COMMISSION

Bergmann

Office:
7050 W. Saginaw Highway Suite 200
Lansing, MI 48917

Phone: 517.272.9835

Email: jhedden@bergmannpc.com
www.bergmannpc.com

OHM Advisors

Office:
34000 Plymouth Road
Livonia, MI 48150

Phone: 734.522.6711

November 13, 2020

TABLE OF CONTENTS – PART 2 (BARTON NATURE TRAIL)

1.0 Part 1 – Pathway through Barton Nature Area

1.1 PROJECT BACKGROUND

The pedestrian trail system throughout the City of Ann Arbor is a highly valued means of recreation and transportation within the community. In addition, parts of this system help make up an even larger trail system within the region which is known as the Border-to-Border Trail (B2B). A crucial section for the continuation of this trail is a proposed pathway that will create a connection from Bandemer Park to Huron River Drive, through the Barton Nature Area. This new pathway will aid in balancing the natural aesthetics of the area while providing fully accessible pedestrian facilities along the trail, increasing both functionality and pedestrian safety while minimizing impacts to the surrounding area. The new pathway connection between the Bandemer Park and Barton Nature Area will significantly enhance the B2B Trail and expand the existing trail system within the City of Ann Arbor.

In order to determine the preferred alternative, a detailed site investigation was conducted at both Bandemer Park and the Barton Nature Area. This investigation was a collaborative team effort made up of members from the Ann Arbor Parks and Recreation Department, Washtenaw County Parks and Recreation Commission, Ann Arbor Natural Area Preservation (NAP), and the consultant team made up of OHM Advisors, Bergmann, and SME. The information gathered during the site investigation has assisted in the evaluation of the existing path and in the conceptualization of a new path which prioritizes the safety and accessibility of all users as well as minimizes the impacts to the surrounding natural environment.

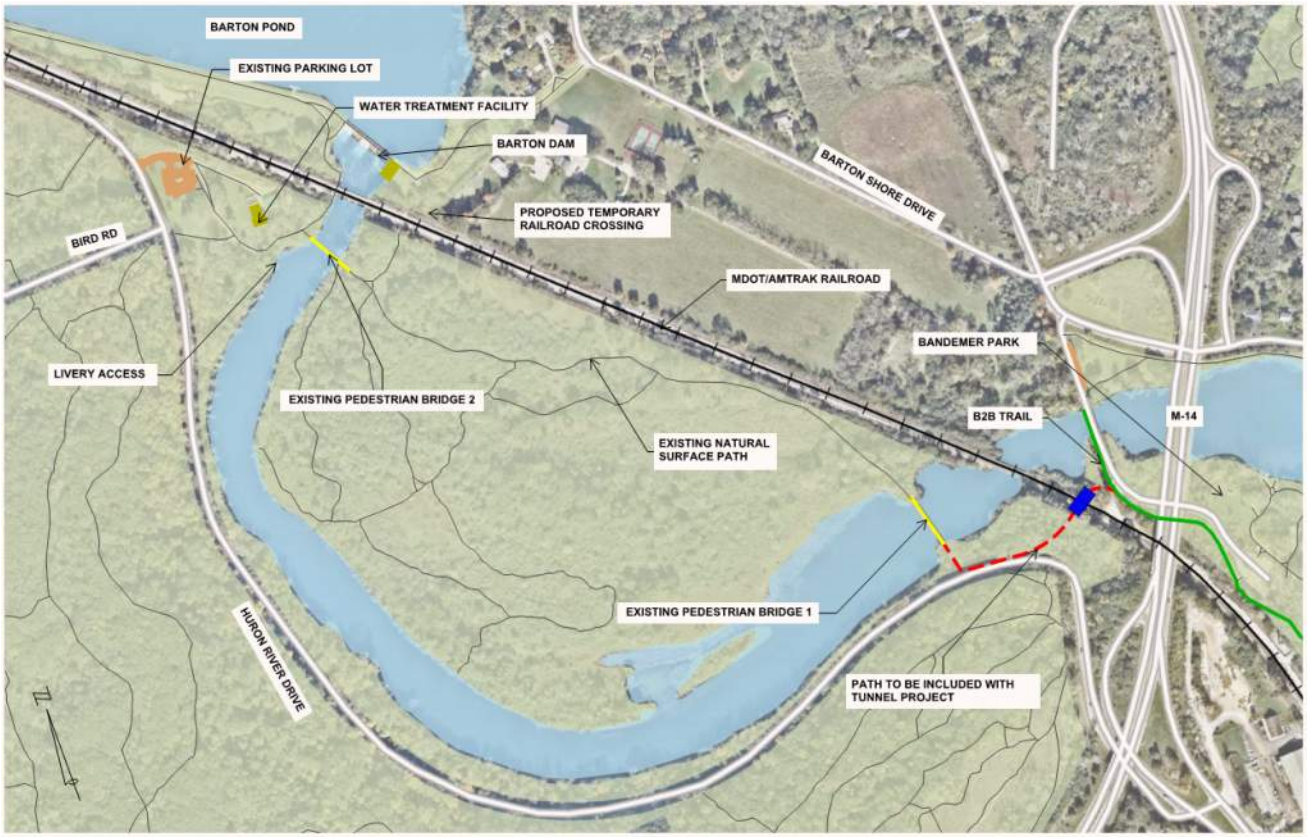


Exhibit 1-1: Area Map

1.2 PUBLIC ENGAGEMENT

A public meeting was held on February 26, 2019 at 6:30pm at Forsythe Middle School to seek initial public feedback to the City of Ann Arbor and Washtenaw County Parks and Recreation Commission (WCPARC) regarding the Border-to-Border Trail (B2B) Barton-Bandemer Connection Project. 60 members of the public signed in at the meeting, which consisted of a brief presentation by City and County staff, followed by open discussion/questions, then an open-house format with more detailed maps and staff/consultants at each station to discuss the project with interested parties.

In total, 60 written comments have been received (as of March 12, 2019), 19 of which were written comments collected at the public meeting, 13 were in the form of emails to County and City staff, and 28 were received through on-line form submissions during the two weeks afterwards. The meeting's presentation and figure displays were posted on the same website as the comment sheets to provide as much information as possible to the public who were unable to attend the meeting. Per the request of some members of the public, the comment period has been re-opened and left open-ended.

Common themes supporting the project expressed include (not representative of quantity of expression):

- The underpass is essential for the future success of the B2B and bike and pedestrian traffic to move in to, and out of, the city in the North Main St./Huron River Drive area
- Support for the underpass portion of the project because of a clear desire for the pedestrian connection and a desire by the rail to prevent crossing the tracks
- Support for the underpass because it also connects the hiking and biking trails of the adjacent nature areas to parking areas and the B2B in Bandemer Park
- Support for the overall project to provide a safe bike route along N. Main St. at the M-14 interchange.
- Overall project would be a benefit to the community
- Support or no concern for paving the main (existing woodchip) trail through Barton Nature Area as long as it is part of a regional system
- Support of paving in the nature area if disturbance and path width is kept to a minimum to keep as much existing vegetation and feel
- Support of improving ADA connections and improving safety
- Current woodchip trail is often muddy and difficult to use, paving would solve this

Common themes with concerns for the project expressed include (not representative of quantity of expression):

- Concern that the project will take too long to implement and a desire to implement the project quickly
- Concern for how the trail and underpass will change demand for the current parking lot near Barton Dam and the use of any of the nature trails in Bird Hills and surrounding nature areas
- Request of the team to make the underpass feel safe through use of sight lines, lightning, and other measures
- Concern for overall project costs and how to pay for it
- Need an explanation for why a gated crossing (much cheaper) could not be used instead of an underpass
- Build the underpass but don't touch the nature area because it is nice as-is
- Concern for stormwater runoff from a paved trail in the nature area
- Would like to add a limestone or dirt path next to the paved path for runners
- Consider alternate materials to asphalt for the trail in the nature area such as porous paving or limestone
- Oppose paving the wood chip trail in the nature area
- Need to ensure all of the alternatives to paving the trail been explored
- Concern for increased incursion into natural areas

1.3 ALTERNATIVES STUDIED

1.3.1 Alternative 1: Alignment Parallel to the Railroad Tracks

The first pathway alternative proposes to construct a path parallel to the existing railroad tracks at the northeast end of the nature area. This alignment would be located outside of the railroad Right-of-Way (ROW) and maintain a safe distance from the tracks. This path follows the existing natural surface trail from Bridge 1, nearest to Bandemer Park, to a point several hundred feet to the northwest. From here, the proposed alignment diverges from the existing path across a more open area with less tree impacts. This alignment reconnects with the existing natural surface trail several hundred feet south of Bridge 2 of the Barton Nature Area before continuing across the bridge. Upon crossing Bridge 2, the path diverges from the existing gravel drive to run parallel to Huron River Drive along the south side of the existing parking lot.

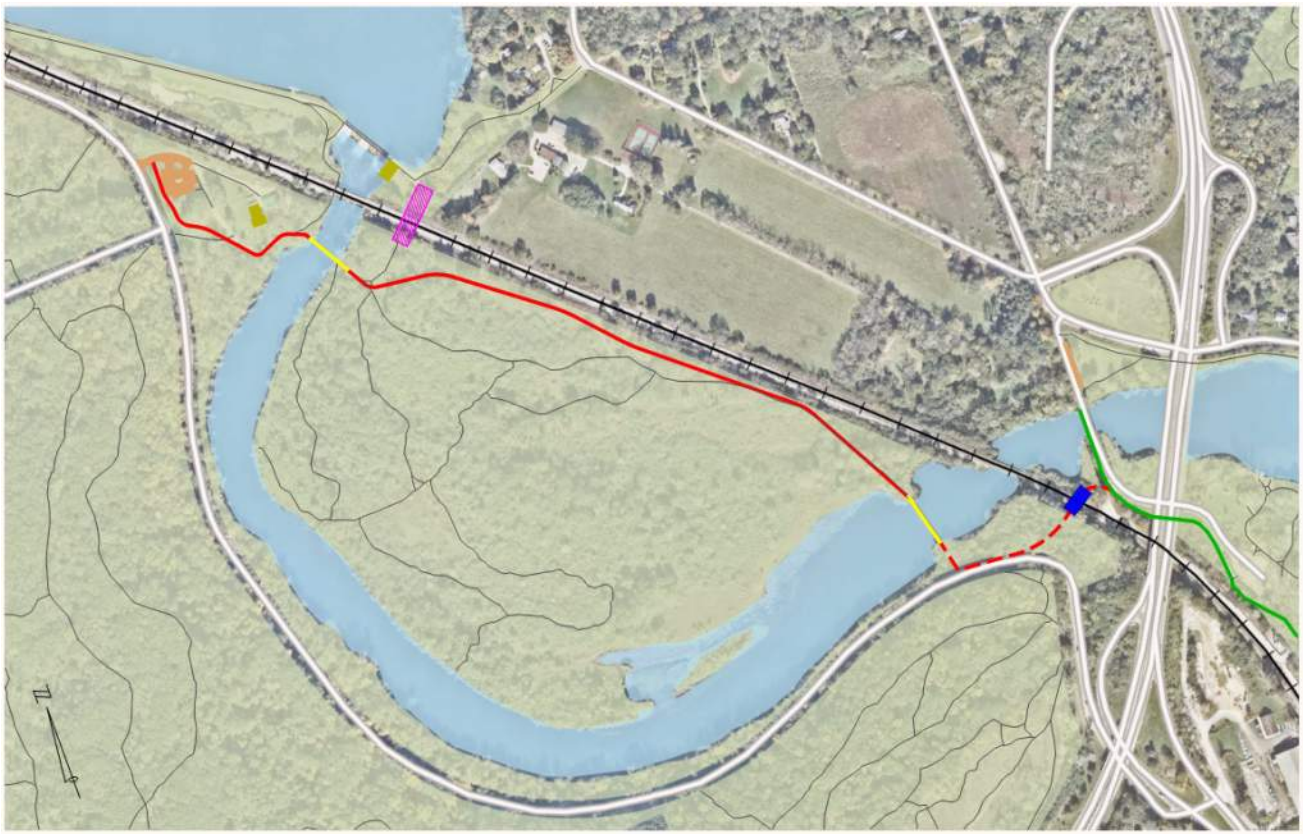


Exhibit 1-2: Alternative 1 Plan View

1.3.2 Alternative 2: Alignment along the Existing Natural Surface Trail with Minor Improvements

The second alternative for the pathway proposes to construct the path following the route of the existing natural trail that cuts through Barton Nature Area. This proposed alignment would closely match the existing alignment but would make adjustments to improve rideability and sight distance, while accommodating a 10-foot wide path. These adjustments would also involve impacts to surrounding trees and brush. Upon crossing Bridge 2, the path would continue along the east side of the parking lot and the existing gravel drive.

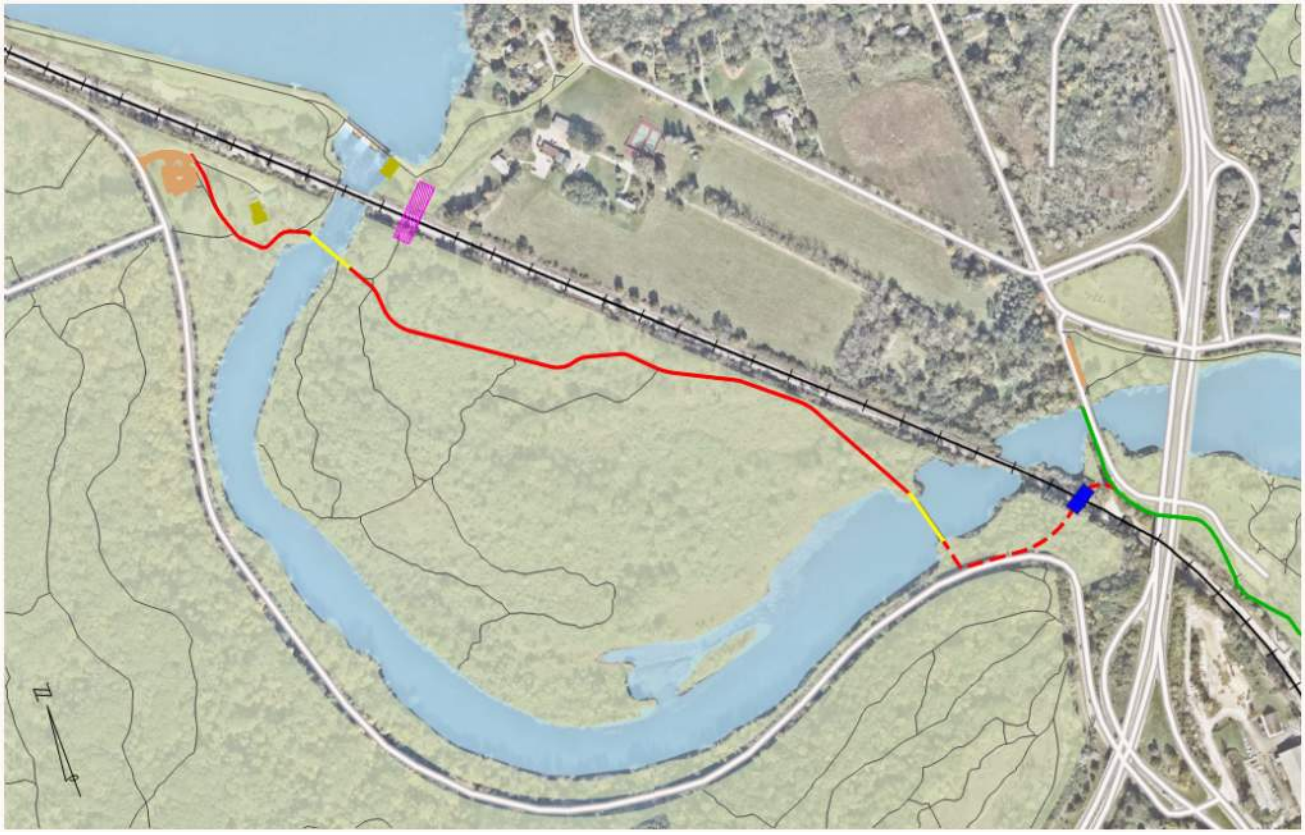


Exhibit 1-3: Alternative 2 Plan View

1.3.3 Alternative 3: Alignment along the Existing Natural Surface Trail

The third pathway alternative proposes to match the existing natural surface trail alignment. The impacts would be limited to the surrounding immediate area only to accommodate a 10-foot wide path. Rideability and sight distance would remain the same as existing conditions but would have reduced visibility when compared with Alternative 2. Between the parking lot and Bridge 2, the alignment would match the Alternative 2 proposal.

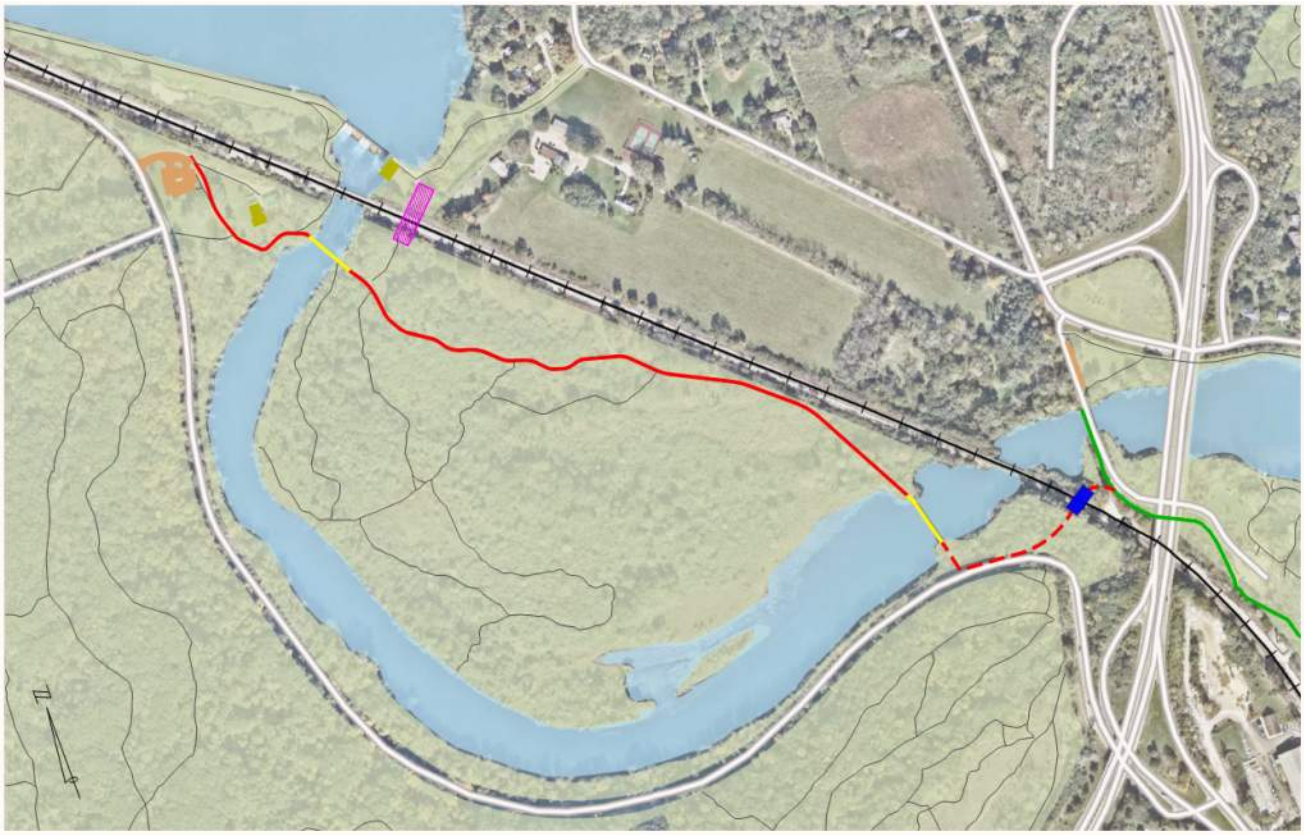


Exhibit 1-4: Alternative 3 Plan View

1.4 OTHER ALTERNATIVES CONSIDERED

Throughout the development of the three alternative paths, other possibilities were considered as further alternatives to the pathway connection between Bandemer Park and the Barton Nature Area.

One additional alignment was proposed to run south of the primary existing trail. This idea was eliminated as it would require the pathway to be constructed through a low-lying area. Low-lying areas are generally more saturated which can lead to issues in finding suitable subbase and drainage for the pathway. In addition to the large impact on the trees in this area, a number of existing foot trails would be significantly impacted by the construction of this alternative. Although the trees in this area are of lower quality, and the foot trails are supplementary, it would be beneficial for this area to remain unimpacted by the project to provide a well-rounded experience for the area.

Another addition to Alternative 2 and Alternative 3 was considered as well. As these alignments would be impacting the primary natural surface trail in the nature area, a parallel footpath adjacent to the proposed trail alignment was considered. This option was ultimately ruled out due to additional tree impacts.

2.0 Existing Project Conditions

2.1 EXISTING SITE CONDITIONS

The Barton Nature Area, which makes up much of the proposed site location in the City of Ann Arbor, is located between the Huron River and the Michigan Line Railroad. Nearby features include a Water Treatment Plant, a gravel parking lot, a canoe launch area for the livery, and the Barton Dam north of the railroad. Currently, this area is served by one primary natural surface pathway in addition to several side trails which predominantly extend south towards the Huron River. The primary trail within the Barton Nature Area is connected at both ends by pedestrian bridges. At the southern end, Bridge 1 is 8-feet wide, is in need of moderate repairs, and has a small roadside parking area adjacent to Huron River Drive. At the northern end, Bridge 2 is 10-feet wide, and is in good condition with minor repairs needed, and connects pedestrians to a nearby parking lot and livery area. Note that any upgrades or improvements to either of the pedestrian bridges are not included in this project and are being investigated by the City of Ann Arbor. Along the primary trail, there are two areas with steep side slopes which currently include fencing for pedestrian safety. These locations are north of Bridge 1 and Bridge 2 and will require improvements to the fence with any new alignment.

2.1.1 Existing Utilities

The Barton Nature Area is mostly a natural, untouched environment; however, there are existing utilities, as well as ongoing utility projects, which should be noted during the design and construction of this pathway. It is not anticipated that the utilities themselves will be impacted by the proposed pathway construction.

Existing overhead electric lines run parallel with the railroad tracks along the north side of the site. The Alternative 1 alignment would be most affected by the location of these electric lines. Any path located near these lines would have to maintain proper clearance, both from poles and the lines themselves, and there could be a potential for a conflict during future utility work on these lines. There are also fiber optic cables within the railroad right of way. Although the fiber optic cables will not be impacted by any proposed pathway alignment, they will likely require some additional protection for temporary construction access.

A water main project is currently being proposed in the northwest corner of the Barton Nature Area. Here, a new raw water main would be constructed to transfer water from Barton Pond to the City's Water Treatment Plant. This is a critical project as Barton Pond is a raw water supply source for the City's Water Treatment Plant. The City of Ann Arbor has identified this project in their Capital Improvement Plan (CIP) and has assigned it great importance as it would replace the existing aging infrastructure. The proposed water main would extend to the southwest of Barton Pond, south of the Huron River, before crossing underneath the river, and tying into the water treatment plant. Any new path constructed through this area would require additional coordination with the City to determine the best location to avoid future conflicts. Additionally, a permit for working within the Railroad property will be required for both the water main and pathway projects. The City has expressed a desire to include both the new water main and pathway projects under the same permit. The construction access and overall constructability is discussed further in 3.1.2.

2.2 ENVIRONMENTAL REVIEW

The impacts on the surrounding trail network within the Barton Nature Area were weighed heavily in the design of alternatives. In order to minimize the impacts on the environment, multiple factors were assessed.

2.2.1 Tree Survey

A tree survey was conducted to determine the location, type, and quality of trees in proximity to the existing trails as well as which trees may need to be removed as part of the construction of a new trail. All alternatives were designed to avoid impacts to any high-quality trees; however, impacts to other trees will be apparent with any of

these alternatives. Although the preferred alternative does not have the least impact on trees, Natural Area Preservation unit of Ann Arbor Parks & Recreation (NAP) has reviewed these impacts and is comfortable with this option.

2.2.2 Ecological Areas

The Ann Arbor NAP provided a map of Barton Nature Area highlighting the quality of the ecological areas throughout the area (see **Exhibit 2-1** below). NAP advised that the green areas should be avoided as much as possible, as they contain high quality prairie habitat. This played a large role in the selection of the preferred alternative. NAP was less concerned with yellow, red, and orange areas and as there are already existing trails in this area, a new trail along the existing trail with a slightly larger footprint was deemed acceptable.

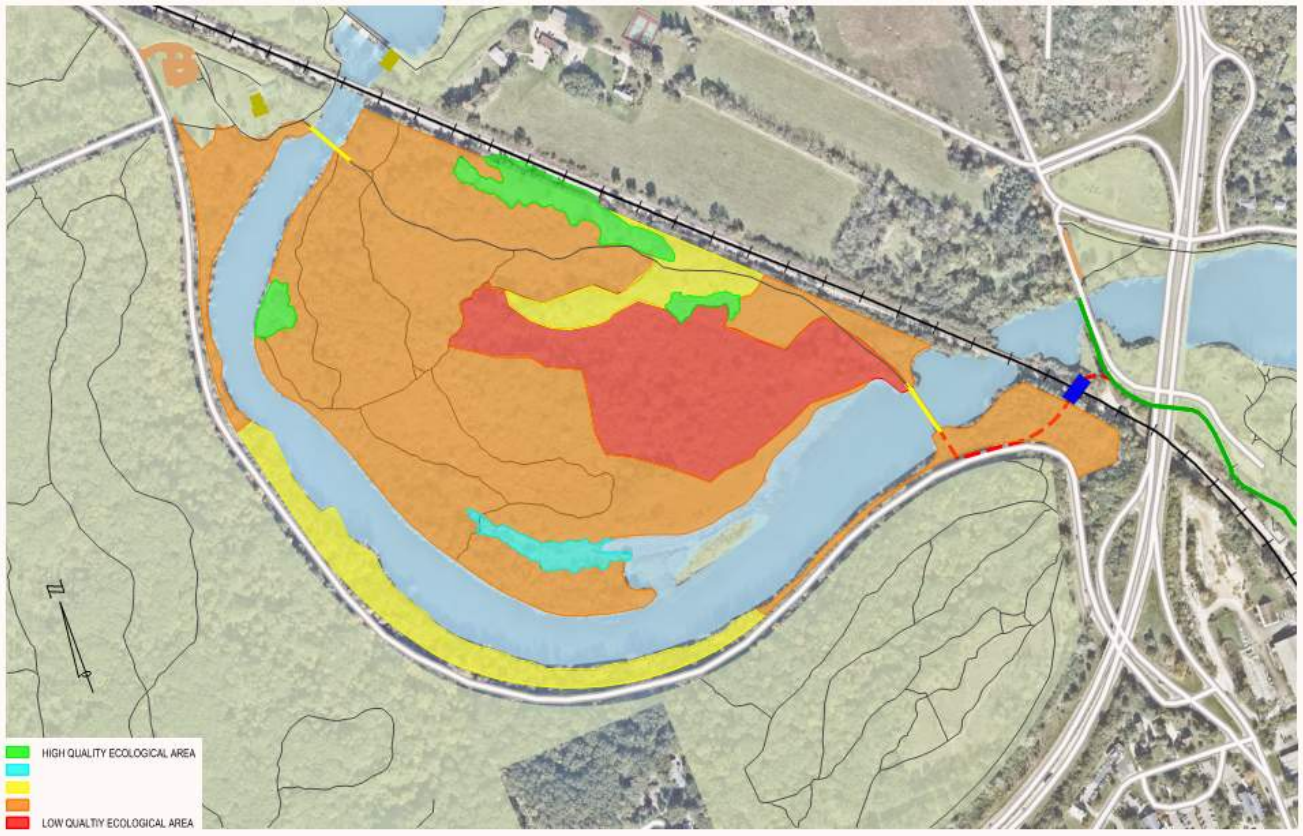


Exhibit 2-1: Ecological Areas

3.0 Proposed Alternatives

3.1 ALTERNATIVE INTRODUCTION

The connection between Bandemer Park and the Barton Nature Area has been previously identified as an important piece in the City of Ann Arbor trail system and the Border-to-Border Trail (B2B). The alternatives provided in this document represent recommendations for improving the current trail through the Barton Nature Area. While balancing trail aesthetics, functionality, and minimizing environmental impact were important factors, prioritizing user safety and accessibility was paramount in the selection and design of the presented alternatives.

3.1.1 Geometrics

The alternative path designs were created following the MDOT Road Design Manual guidelines on bicycle facilities and the 2012 AASHTO Guide to the Development of Bicycle Facilities, 4th edition. A minimum path width of 8-10 feet with a 2-foot minimum clearance from adjacent obstructions, in addition to an 18-mph design speed for horizontal curves, were determined to be two of the driving factors in both the creation and selection of the alternatives. A final design will incorporate ADA compliant cross slopes of 2% or less and profile grades preferably 5% or less but no greater than 8.3%. The area just north of Bridge 2 will require extra attention to achieve ADA compliance as there is a short, but steep hill. A switchback is proposed as a part of the preferred alternative to circumvent this issue without needing to significantly change the existing ground profile.

3.1.2 Constructability

All three alternatives encounter many of the same challenges during the construction process. Access to the Barton Nature Area by construction equipment is limited by the Huron River and the MDOT/Amtrak railroad. Temporary bridges and/or barges to transport equipment to the peninsula would be both complex and costly. The ideal access point is just southeast of the Barton Dam but will require a temporary railroad crossing permit for this designated high-speed rail corridor. The water main project previously identified in this area could be coordinated as an access point for construction on this project. The City and the County have expressed the desire to have a Joint Permit for a temporary crossing to provide access for both projects.

North of Bridge 2, all three alternatives are anticipated to encounter the same constructability issues. Access to the parking lot will need to remain open throughout construction. Additionally, there is a canoe livery access point to the Huron River that the trail construction will impact. The canoe livery is operated by Ann Arbor Parks and Recreation, so additional coordination with them through design and construction will be required to maintain access.

Heavy construction traffic damaging the proposed pathway is an item of concern. To accommodate construction equipment, the proposed pathway section will be greater than a typical trail. A 4 inch asphalt section over a 12 inch aggregate base course is under consideration as well as other section options. Although construction loads were the driving force behind a thicker section, there is also the added benefit of an extended lifespan for a pathway with limited construction access.

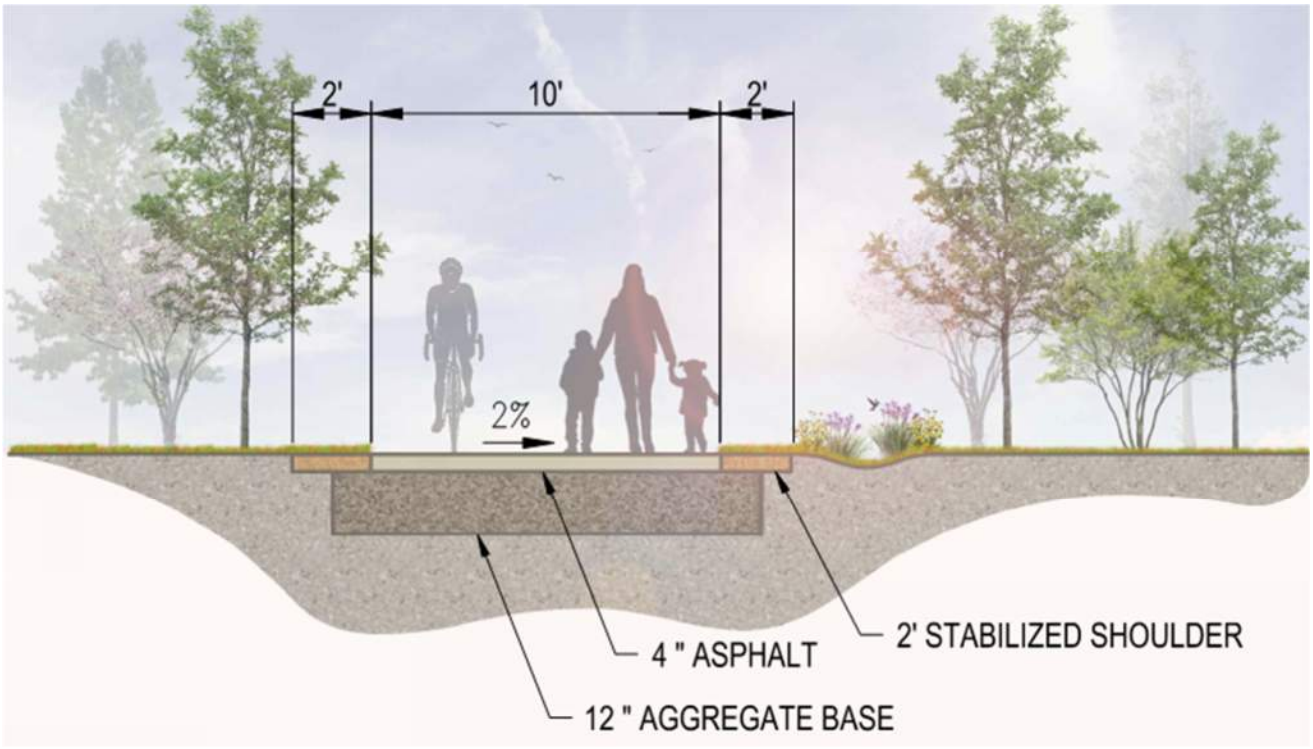


Exhibit 3-1: Conceptual Cross-Section

3.1.3 Drainage

All alternative pathways will take into account improvements to the existing drainage. The proposed cross-section will have a uniform cross slope directed to the lower lying area of the path, the direction and slope will vary to accommodate drainage and curvature of the pathway. Areas with existing culverts will be re-evaluated to accommodate new drainage patterns. The size and condition of the culverts will also be evaluated to determine if a replacement is needed. Specific areas along the trail, specifically near the Water Treatment Plant, as well as in the area a few hundred feet north of the southern bridge, were identified as having existing drainage issues. These are low lying areas with apparent poor soils where water collects and could potentially have adverse impacts on a proposed pathway if not addressed. Providing positive drainage through grading, culverts, and profile corrections will be incorporated in the proposed design.

3.2 ALTERNATIVE COMPARISON

While all three alternatives share many of the same design characteristics, they also vary from one another in terms of location and alignment. The advantages and disadvantages produced by each alternative are described below to provide an overall outline.

1.2.1 Alternative 1: Alignment Parallel to the Railroad Tracks

Alternative 1 is a path constructed parallel to and south of the Michigan Line Railroad tracks. In comparison to the existing primary trail, this path provides pedestrians with better sight distance and will impact fewer surrounding trees. This path leaves much of the south portion of the existing natural surface trail intact, which in turn will provide two different experiences of the nature area. The proximity of this alignment to the railroad did pose concerns about user experience. Another concern is that this alignment significantly impacts the largest high-quality ecological area within the Nature Area. NAP has strongly discouraged this proposed alignment.

3.2.1 Alternative 2: Alignment along the Existing Natural Surface Trail

Alternative 2 is a path constructed along the primary existing trail through the Barton Nature Area. By following the existing alignment, more of the surrounding area will be left natural. The existing trail has already been established as the thru route through the Nature Area. By using this alignment, the primary route would benefit from improved sight distance, drainage improvements, and a wider pathway. However, those improvements would result in additional impacts; for example, more clearing and tree removal than the other two alternatives.

3.2.2 Alternative 3: Alignment matching the Existing Natural Surface Trail

Alternative 3 is a path constructed along the alignment of the existing trail. While this would reduce the removal of trees and the impacts to the surrounding area, it does not provide the safest option. As a continuation of the B2B trail and the upgrade to a paved surface, this trail will see an increase in bicycle traffic, as well as pedestrian traffic, and does not provide for adequate sight distance or safe horizontal curve radii.

4.0 Recommended Alternative

Upon review of the information provided in this report, Alternative 2 is the recommended pathway alignment. This option provides all pedestrians and bicyclists with a safe and aesthetic route through the Barton Nature Area with a level of impact that is acceptable to the Ann Arbor NAP. Furthermore, preliminary cost estimates were compared for the three alternatives and no significant cost savings was found based on alignment alone.

Several items are being considered for inclusion in this alternative and discussions will continue as the design progresses. Site furnishings such as benches and trash cans may be included in the project. There is a switchback area that is currently proposed on the north side of Bridge 2 that will need to be further detailed. This will provide an ADA compliant portion of the pathway without needing to significantly change the existing profile of the main path. It also provides an enhanced connection to the pathway to the Barton Dam. North of Bridge 1, the existing and proposed trail alignment encounters steep side slopes on both sides of the trail. In addition, the width of the trail will need to be reduced in this area as the bridge is also only 8 feet in width. Several options are being considered for this area including, but not limited to, the following: narrowing the pathway from 10 feet wide to 8 feet wide where the side slopes begin to steepen, cutting the profile of the proposed pathway to accommodate a 10-foot wide pathway while limiting grading limits, and/or potentially constructing an observation deck and pull off area at the north end of the bridge to provide space for passing cyclists and pedestrians.

The project team has held discussions with the canoe livery in order to accommodate their needs both during and after construction. Several options are currently being considered to accommodate their operations, however none of these options impacted the selection of the preferred alternative. The canoe livery will be included in discussions throughout the design process.

Parking has also been an item of discussion. The parking lot nearest Barton Dam will likely require ADA improvements. There is also roadside parking along Huron River Drive near the potential railroad underpass area; however, any proposed improvements to those areas, as well as the trail south of Bridge 1, will be a part of the underpass portion of the project.

Moving forward with the design of Alternative 2 will lead to the following actions commencing:

1.) Obtain Parks Advisory Commission (PAC) approval to pave within the nature area.
2.) Soil borings will be conducted along the proposed alignment in strategically chosen locations to determine the subsurface conditions. These borings will provide crucial information needed for any profile corrections as well as the development of a proposed trail cross-section. The preliminary estimate (Appendix A) depicts a 4-inch pavement section atop a 12-inch aggregate base course to accommodate heavy construction traffic and increase the longevity of the path. This cross-section can be further evaluated during detailed design.

3.) Coordination with the canoe livery will commence to determine how to accommodate their operations during construction. In addition, a permanent layout will be developed to provide river access for both the livery and the public while maintaining a safe path through the construction area.
4.) Wetland and floodplain delineation will occur throughout the project limits.
5.) Coordination with MDOT, Amtrak, and the Water Treatment Plant for the temporary railroad crossing.