Susquehanna River Rail Bridge Project

Appendix A

Alternatives Screening Report and Bridge Types

March 2017

Maryland Department of Transportation
AMTRAK

Susquehanna River Rail Bridge Project

Alternatives Retained for Detailed Study (ARDS)

September 2015

Maryland Department of Transportation
AMTRAK

Table of Contents

EXECUTIVE SUMMARY

The Federal Railroad Administration (FRA) and the Maryland Department of Transportation (MDOT) are preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts of the Susquehanna River Rail Bridge Project (the Proposed Project). Located between the City of Havre de Grace in Harford County, Maryland and the Town of Perryville in Cecil County, Maryland, the Susquehanna River Rail Bridge is a critical link along one of the U.S. Department of Transportation's (USDOT) designated high-speed rail corridors. The National Railroad Passenger Corporation (Amtrak), as bridge owner and operator, is providing conceptual and preliminary engineering designs in coordination with MDOT and FRA. The bridge is used by Amtrak, the Maryland Area Regional Commuter (MARC) service, and Norfolk Southern Railway (NS) to carry intercity, commuter, and freight trains across the Susquehanna River.

The primary purpose of the Proposed Project is to provide continued rail connectivity along the Northeast Corridor (NEC). As described in the Purpose and Need Statement, the problems posed by the existing Susquehanna River Rail Bridge include: functionally obsolete and aging infrastructure; speed and capacity constraints; operational inflexibility; maintenance difficulties; and conflicts with maritime uses.

The goals of the Susquehanna River Rail Bridge Project include:

- Improve rail service reliability and safety;
- Improve operational flexibility and accommodate reduced trip times;
- Optimize existing and planned infrastructure and accommodate future freight, commuter, intercity, and high-speed rail operations; and
- Maintain adequate navigation and improve safety along the Susquehanna River.

This Alternatives Retained for Detailed Study (ARDS) report explains the screening process the Project Team used to identify which alternatives should be eliminated from further consideration and which have been retained for detailed study and inclusion in the EA.

ES.1 SCREENING PROCESS

A two-step screening process (fatal flaw and detailed screening) was used to evaluate 25 alternatives, including 18 conceptual alternatives, a rehabilitation alternative, and six other alternatives. The Project Team developed the 18 conceptual alternatives (1A through 9B) based on engineering design factors such as: geometry, design speed, bridge spacing, navigational clearances, grades, and relationships to other projects. The Project Team also evaluated rehabilitation of the existing bridge (Rehab) as an alternative. Through the public outreach process six other alternatives were developed included three additional conceptual alternatives (CE), two alternatives suggested by the public (P), and a value engineering alternative (VE). Throughout the screening process, the Project Team considered input provided through public outreach efforts, coordination with local officials, Section 106 Consulting Party meetings, interagency review meetings, and other stakeholder meetings.

1. Fatal Flaw Screening

The first step in the screening process was a "fatal flaw screening." The fatal flaw screening evaluated the 25 alternatives based on significant impacts and on their ability to satisfy the following criteria developed from the Project's Purpose and Need Statement and impacts:

- Rail connectivity;
- Navigational requirements;

- Logical termini;
- Feasibility and constructability; and
- Avoidance of critical property impacts.

The fatal flaw screening eliminated 15 alternatives, including the Rehab alternative, nine of the 18 conceptual alternatives, and five of the six other alternatives. The 10 alternatives remaining after the fatal flaw analysis included Alternatives 1B, 4B, 4C, 4D, 4E, 8A, 8B, 9A, 9B, and VE.

2. Detailed Screening

The second step of the screening process (the "detailed screening") evaluated the 10 alternatives that remained after the fatal flaw screening, noted as preliminary alternatives. These 10 alternatives are described below by location, number of tracks, and maximum authorized train speeds.

- **Design to the east with four tracks**: Construction of a new two-track high-speed bridge slightly to the east of the existing bridge, followed by the decommissioning and removal of the existing bridge. Ultimately, a second new fixed bridge (two tracks) would be constructed on the existing bridge alignment. This design group includes alternatives:
    - 1B (140 mph)
    - 4B (160 mph)
    - 4C (135 mph)
    - 8A (120 mph,)
- **Design to the east with three tracks**: Construction of a new three-track bridge slightly to the east of the existing bridge. Two of the three tracks would be able to accommodate high-speed passenger rail service. The existing bridge would then be decommissioned and removed. This design group includes alternatives:
    - 4D (160 mph)
    - 4E (135 mph)
    - 8B (120 mph)
- **Design to the west with four tracks**: Construction of a new commuter rail and freight rail bridge slightly to the west of the existing bridge, followed by the decommissioning and removal of the existing bridge. Ultimately, a new fixed two-track bridge would be constructed on the existing bridge alignment. This design group includes alternatives:
    - 9A (160 mph)
    - 9B (150 mph)
- **Design to the east and west with four tracks:** Simultaneous construction of two new double-track bridges on either side of the existing bridge, followed by the decommissioning and removal of the existing bridge. This design includes the following alternative:
    - VE (140 mph, four tracks)

These preliminary alternatives were reviewed in more detail to assess their impacts to both the human and natural environment, their ability to meet more specific design and operational criteria, and their consistency with NEC plans and programs. (See Appendix B for the detailed Alternatives Comparison Matrix).

HUMAN ENVIRONMENTAL CONSIDERATIONS

Human environmental considerations included property impacts (i.e., permanent impacts to land use and community facilities), permanent impacts to parks and recreational facilities, a

preliminary assessment of impacts to cultural resources, and potential impacts to Section 4(f)/6(f) resources[1]. Depending on the alternative selected, the project would directly impact three to eight parcels (0.10 to 4.72 acres) of residential, commercial, institutional, park, and/or undeveloped property. The potential number of residential and/or commercial relocations ranges from zero to 16. The National Tire & Glass Sales, Inc. business would be displaced by Alternatives 4B, 4D, and 9A. Alternatives 4B, 4C, 4D, and 4E would require the demolition of the Lafayette Senior Housing Facility, which is a residential property that provides 15 units of affordable housing to the elderly and accepts Section 8 vouchers. While the census block group containing the Lafayette Senior Housing Facility is not considered low-income as a whole, the acquisition in full of this complex and the displacement of 15 low-income residents could result in environmental justice concerns.

The alternatives would impact between zero and two parks, with acquisition ranging from 0.14 to 2.56 acres. Alternatives 1B, 8A, and 8B would have no park impacts. David R. Craig Park, the Havre de Grace Middle/High School athletic fields, and Jean S. Roberts Park (which is partially owned by Havre de Grace and partially owned by Amtrak), would each be impacted by one or more alternatives.

Depending on the alternative selected, the project would have a potential impact on two to three known historic architectural resources (i.e., properties or districts listed on the National Register of Historic Places (NR) and/or the Maryland State Register of Historic Properties (SR), or determined eligible for such listing, and National Historic Landmarks). All alternatives are expected to impact the Susquehanna River Rail Bridge and its associated overpasses, which are SR/NR-eligible. Alternatives 9A and 9B would impact the Perry Interlocking Tower and Access Road Undergrade Bridge 59.39, which are contributing resources of the Perryville Railroad Station (SR/NR-eligible). All alternatives could require modification to the Access Road Undergrade Bridge 59.39. All alternatives are anticipated to impact the Havre de Grace Historic District (SR/NR-listed) since a new bridge structure would pass through the historic district and all alternatives would require some degree of property acquisition from within the historic district. The total acreage of potentially sensitive archaeological areas is similar across alternatives, ranging from 0.11 to 0.31 acre.

Most of the parks and cultural resources that would be impacted by the project are also considered Section 4(f) resources. The alternatives would impact between three and five Section 4(f) resources. Some impacts may be considered *de minimis*. Improvements to one property within the study area, the Havre de Grace Middle/High School complex, were undertaken utilizing Section 6(f) Land and Water Conservation Funds (LWCF). Several alternatives (Alternatives 4B, 4D, and 9A) would impact this Section 6(f) property.

NATURAL ENVIRONMENTAL CONSIDERATIONS

Natural environmental considerations included impacts to streams, wetlands, natural wetland buffers, floodplains, Chesapeake Bay Critical Area, forest, and Rare, Threatened, and Endangered (RTE) Species. Based on preliminary field and ArcGIS desktop surveys, natural environmental impacts were found to be similar among alternatives. Key environmental considerations are discussed below.

[1] USDOT Act of 1966 (23 USC. 138 and 49 USC. 303) and Section 6(f) of the Land and Water Conservation Fund Act (16 USC 460).

Each alternative would have three stream crossings. The impacts range from 271 to 450 linear feet of stream with Alternatives 4B and 4D impacting more than 400 linear feet. Impacts to the Susquehanna River depend on the bridge design type and are not identified at this time. The two step screening process for the alternatives is independent of the bridge design type.

Based on preliminary field surveys, wetland impacts are not expected to exceed one acre for any alternative. Wetland impacts range from 0.18 to 0.68 acre. Alternatives 9A and 9B would have the least amount of wetland impact (0.18 acre) and Alternative 4C would have the greatest impact (0.68 acre). Natural wetland buffer impacts are estimated to range from 0.72 to 1.71 acres. Natural wetland buffers exclude disturbed track bed area. Alternatives 4D, 4E, and 8B would impact less than one acre of natural wetland buffer, while Alternatives 1B, 4B, 9A, 9B, and VE would impact less than 1.50 acre of natural wetland buffer.

The project would impact 6.09 to 8.01 acres of Chesapeake Bay Critical Area depending on the alternative selected. Alternative VE would have the highest amount of Critical Area impacts. Critical Area impacts would be less than 6.50 acres for Alternatives 8B, 9A, and 9B and between 6.50 and 7.00 acres for Alternatives 1B, 4E, 8A, and 8B.

Forest impacts associated with the alternatives are expected to range from 0.17 to 2.92 acres. No alternative is anticipated to impact potential Forest Interior Dwelling Species (FIDS) habitat. Forest impacts would be less than one acre for Alternatives 4C, 4E, 8A, and 8B.

Based on preliminary coordination with the US Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Maryland Department of Natural Resources (DNR), all alternatives would have the potential to impact rare, threatened or endangered (RTE) species or habitat (RTE). Various terrestrial, aquatic, and marine species or habitat were identified within the project vicinity.

Based on a Phase I Environmental Site Assessment, there would be no major differences among the 10 preliminary alternatives with respect to contaminated and hazardous materials. Depending on the alternative selected, the project has the potential to directly impact two to three known contaminated properties.

OPERATIONAL AND ENGINEERING CONSIDERATIONS

The last step of the detailed screening process determined how well each of the 10 alternatives met the project's operational and engineering criteria. Several operational and engineering considerations were developed based on the project's Purpose and Need, including the need to improve rail service and reliability, improve operational flexibility and accommodate reduced trip times, optimize existing and planned infrastructure, and maintain adequate navigation and improve safety along the Susquehanna River.

A key operational consideration is the project's ability to optimize existing and planned infrastructure by providing for a maximum authorized train speed of 160 mph, while taking both benefits and potential impacts into consideration. The NEC Master Plan was developed with planned speed increases up to a Maximum Authorized Speed of 160 mph for this location along the NEC. Amtrak NEC Master Plan is consistent with the congressional mandate placed on Amtrak to reduce travel times along the NEC. The maximum authorized speed of the 10 alternatives ranges from 120 mph to 160 mph.

Another key operational consideration is the maximum number of tracks provided. Four tracks would enable an "excellent" reduction in operational conflicts along the NEC, while three tracks would provide a "fair" reduction in operational conflicts. The reduction in operational conflicts

is essential for improving operational flexibility and accommodating reduced trip times in support of the above-mentioned programs. The 10 preliminary alternatives provide for a maximum of either three or four tracks.

ES.2 ALTERNATIVES REMOVED FROM FURTHER CONSIDERATION

Based on the detailed screening, eight of the 10 preliminary alternatives have been eliminated from further study including Alternatives 1B, 4B, 4C, 4D, 4E, 8A, 8B and VE.

Alternative 4B provided for 160 mph and four tracks but was eliminated along with 4C, 4D, and 4E primarily due to the full acquisition of the low-income Lafayette Senior Housing Facility and the associated residential displacements. Alternative 4D provides for 160 mph, but provides only three tracks. Alternatives 1B, 4C, and 8A provide four tracks, but do not provide for 160 mph. Alternative 8A was eliminated along with 8B primarily due to an undesirable maximum authorized speed (120 mph).

Alternative VE was eliminated, because Alternative 9B offered higher authorized speeds (150 mph) with fewer property and natural environmental impacts. Alternative 1B was eliminated because Alternative 9B offered higher speeds (150 mph) and long term benefits consistent with plans and programs along the NEC. Alternative 1B also resulted in similar environmental impacts compared to Alternative 9B without some of the operational benefits.

ES.3 ALTERNATIVES RETAINED FOR DETAILED STUDY

The Project Team is retaining Alternatives 9A and 9B for detailed study in the EA. Alternative 9A offers a maximum authorized speed of 160 mph and a four track design. This alternative requires property acquisition from within the Havre de Grace Middle/High School athletic fields. Alternative 9B, which provides four tracks and a maximum authorized speed of 150 mph, does not directly impact the athletic fields. The Project Team is investigating opportunities to avoid, minimize, or mitigate the human/natural environmental impacts associated with both Alternatives 9A and 9B, including the possibility of relocating the Perry Interlocking Tower to minimize the potential impact to the historic Perryville Railroad Station. Additionally, the project is coordinating with Harford County Public Schools regarding potential impacts and mitigation opportunities related to the Havre de Grace Middle/High School athletic fields.

The EA will include comprehensive environmental analyses, including studies of transportation, land use, air quality, noise, vibration, visual and aesthetic considerations, socioeconomic conditions, parkland, historic and archaeological resources, environmental justice, indirect and cumulative effects, and construction impacts. The EA is anticipated to be completed in Spring 2016 and will be provided to the public for review and comment. A public meeting will be held for the project following the EA and prior to FRA making a final decision for this project.

A. OVERVIEW

A.1 INTRODUCTION

The Federal Railroad Administration (FRA) and the Maryland Department of Transportation (MDOT) are preparing an Environmental Assessment (EA) to evaluate the potential environmental impacts for the Susquehanna River Rail Bridge Project (also referred to herein as "the Proposed Project"). The EA is being prepared in accordance with the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] 4321 *et seq*.), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] parts 1500–1508), and FRA's *Procedures for Considering Environmental Impacts* (64 Federal Register [FR] 28545 [May 26, 1999] and 78 FR 2713 [January 14, 2013]). The EA also documents compliance with other applicable Federal environmental laws and regulations, including Section 106 of the National Historic Preservation Act, as amended (NHPA) (16 U.S.C. 470) and the Clean Air Act (42 U.S.C. 7401 *et seq*.).

The U.S. Secretary of Transportation selected MDOT for a grant award of $22 million in federal funding available through the High-Speed Intercity Passenger Rail Program. A cooperative agreement has been formed between FRA and MDOT for the NEPA and preliminary engineering phases of the Susquehanna River Rail Bridge Project. MDOT is proposing to improve the Susquehanna River Rail Bridge between the City of Havre de Grace in Harford County, Maryland and the Town of Perryville in Cecil County, Maryland (see Appendix A, Figure 1). MDOT is sponsoring the project. FRA is the lead federal agency for the EA. The National Railroad Passenger Corporation (Amtrak), as bridge owner and operator, is providing conceptual and preliminary engineering designs in coordination with MDOT and FRA.

The replacement of the Susquehanna River Bridge is a major infrastructure investment on the NEC that, as with the existing bridge, is potentially anticipated to provide service over 100 years. NEC and this project are incorporated in multiple national efforts including the High Speed Intercity Passenger Rail Program, NEC FUTURE Program, the 2008 Congressional Mandate for improved travel time on the NEC, and the Amtrak NEC Master Plan, described as follows:

- **High Speed Intercity Passenger Rail Program (HSIPR)**
    - Address the nation's transportation challenges by making strategic investments in an efficient network of passenger rail corridors that connect communities across the country
    - High Speed Rail Strategic Plan (FRA, April 2009)
- **NEC FUTURE Program**
    - FRA comprehensive planning effort to define, evaluate, and prioritize future investments in the NEC, from Washington DC to Boston, Massachusetts.
    - Improve the reliability, capacity, connectivity, performance, and resiliency of passenger rail service on the NEC for both intercity and regional trips
- **Congressional Mandate for Amtrak to reduce travel time along the Northeast Corridor**
    - Section 212(d) of the Passenger Rail Investment and Improvement Act of 2008 Public Law 110-432

  - Reduced Travel Time, Improved Train Operations, improved Service Capacity, Maintain Rail Services, and Cost Benefits
- **Amtrak NEC Master Plan (**May 2010)
  - "Provides the baseline of infrastructure investments needed to maintain the current NEC System in a state of good repair, integrate intercity commuter and freight service plans, and move the NEC forward to meet the expanded service, reliability, frequency, and trip-time improvements that are envisioned by the Northeast states and the District."
  - Developed for speed increases up to a Maximum Authorized Speed of 160 mph.

A.2 PURPOSE AND NEED OF THE PROJECT

The existing two-track Susquehanna River Rail Bridge is located on Amtrak's Northeast Corridor (NEC) at Milepost 60. It is located within Maryland's Chesapeake Bay watershed near the mouth of the Susquehanna River. The approaches to the existing rail bridge and the NEC right-of-way extend through the City of Havre de Grace and the Town of Perryville. The Proposed Project would span approximately six miles, between the "Oak" Interlocking at Milepost 63.5 south of the City Havre de Grace and the "Prince" Interlocking at Milepost 57.3 north of the Town of Perryville (see Appendix A, Figure 1).

This rail bridge is a critical link along one of the U.S. Department of Transportation's (USDOT) designated high-speed rail corridors. The NEC is the busiest passenger rail line in the U.S. The bridge is used by Amtrak, the Maryland Area Regional Commuter (MARC), and Norfolk Southern Railway (NS) to carry intercity, commuter, and freight trains across the Susquehanna River. NS operates between Harrisburg, Pennsylvania, and Baltimore, Maryland, using its "Port Road" route along the Susquehanna River between Harrisburg and Perryville, and using trackage rights along the NEC between Perryville and Baltimore. The existing bridge is roughly 0.75 miles in length and is the longest bridge with a movable span on the NEC. It is a swing-span type bridge; the movable span opens by rotating horizontally using a center pivot mounted on a pier in the river. When in the closed position, the existing bridge allows for a 52-foot vertical clearance for marine traffic through two 100-foot-wide channels. The swing span must be opened to allow for taller marine traffic, which disrupts rail operations.

As described in the Purpose and Need Statement, the problems posed by the existing Susquehanna River Rail Bridge include: functionally obsolete and aging infrastructure; speed and capacity constraints; operational inflexibility; maintenance difficulties; and conflicts with maritime uses.

Two of the factors that influence design speed are geometry and bridge type. The existing open-deck swing bridge limits the operating speed to 90 mph. A fixed (non-movable) bridge with either a ballasted or slab track (direct fixation) deck is required to support increased operating speeds higher than 90 mph for intercity rail service and to reduce maintenance and operating costs. The construction tolerances on an open deck bridge do not permit operating speeds greater than 90 mph.

The primary purpose of the Susquehanna River Rail Bridge Project is to provide continued rail connectivity along the NEC. The goals of the Susquehanna River Rail Bridge Project include:

- Improve rail service reliability and safety;
- Improve operational flexibility and accommodate reduced trip times;

- Optimize existing and planned infrastructure and accommodate future freight, commuter, intercity, and high-speed rail operations; and
- Maintain adequate navigation and improve safety along the Susquehanna River.

A.3 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

During the early phases of the Proposed Project, MDOT and FRA prepared an Agency Coordination and Public Involvement Plan. The plan identified a proactive approach to effectively engage the public and agencies. For the purposes of public outreach, a broad distribution list was prepared, which included elected officials, representatives from the City of Havre de Grace and the Town of Perryville, representatives from Harford County and Cecil County, freight rail operators, individuals and organizations who signed up for the mailing list, owners of adjacent properties, stakeholder groups, community facilities, agency contacts, and potential Section 106 consulting parties. The Project Team presented the Proposed Project at Interagency Review Meetings (IRMs), public outreach information sessions, and stakeholder meetings. The Project Team used a variety of methods to obtain feedback from the public and interested stakeholders throughout the planning process. Postcards, press releases, and public meeting announcements were sent prior to public outreach information sessions and a variety of comment mechanisms are available. As described in Section E of this document, the Project Team is soliciting public and agency input at each step of the process.

B. ALTERNATIVES DEVELOPMENT

This section describes the process used to develop and screen alternatives. In addition to the alternatives described herein, a No Action Alternative will be evaluated in the EA. The No Action Alternative assumes the Susquehanna River Rail Bridge would remain in service as-is, with no intervention besides minimal repairs and continuation of the current maintenance regime. The No Action Alternative will not include any changes to the existing track configuration. Service over the bridge would worsen in the future under the No Action Alternative. The bridge would continue to age, maintenance problems would occur more frequently, and the bridge would remain as a bottleneck, due to significant speed reductions; it would eventually need to be taken out of service. Major planned transportation projects within the study area that are expected to be completed before the Susquehanna River Rail Bridge Project build year (and are therefore included in the No Action Alternative) include:

- Components of Amtrak's State of Good Repair and Service Improvements
- MARC Fleet Plan
- MARC Northeast Maintenance Facility

The No Action Alternative will not meet the project purpose and goals, but will remain for detailed evaluation as a baseline to compare potential project impacts.

B.1 CONCEPTUAL ENGINEERING DESIGN FACTORS

The Project Team identified design factors to be incorporated into the conceptual alternatives (see Appendix A, Figure 2). These design factors were considered independently and collectively.

B.1.1 GEOMETRY

Any feasible conceptual alternative must consider the existing track geometry of the NEC. Existing alignments of commuter and freight facilities were also considered so as to not preclude rail operations, including use of NS's Port Road route and service to/from the Perryville MARC Station. Furthermore, Amtrak has standard plans and specifications that provide detailed geometry requirements for tracks carrying Amtrak passenger service. These standards are required to meet federal regulations, to assure passenger comfort, and provide a safe, maintainable design.

The existing geometry of approach tracks to the Susquehanna River Rail Bridge is one of the factors limiting train speeds along this segment of the NEC. Reducing curvature along this segment could enable faster train speed. Amtrak developed multiple geometric designs to determine the design speeds that could be accommodated within the existing right of way in comparison to the geometry and right of way required to meet the 160 mph design speed for the existing NEC.

During the initial conceptual design, the primary focus was on the alignment and geometry of the tracks for the main river crossing and its approaches. Interlockings were evaluated in a schematic manner (focusing on major elements such as crossovers) and the alignment tapered down to current track centers spacing before interlockings. As the engineering designs evolved and the team continued to coordinate with operations and planning personnel, the project team increased the track centers spacing for an extended area up to the interlockings, to meet the newer standards and accommodate long term operational goals along the NEC. The design for all alignments incorporates new standards for track centers spacing in preparation for higher speed rails (15- or 16-foot track centers spacing).

B.1.2 DESIGN SPEED

The design speed is a critical element in meeting the project's Purpose and Need to reduce trip times and optimize infrastructure to improve service and accommodate future high speed rail operations along the NEC. This need is consistent with the congressional mandate published in Section 212(d) of the Passenger Rail Investment and Improvement Act of 2008 Public Law 110 432 requiring Amtrak to reduce travel time along the NEC. Improvements at the Susquehanna River crossing were noted in Amtrak's report to Congress, An Interim Assessment of Achieving Improved Trip Times on the Northeast Corridor prepared in October 2009, with several other major infrastructure projects in order to reduce travel time, improve train operations, improve service capacity, and maintain rail services.

The NEC FUTURE Program and Amtrak are planning for a 160 mph speed along the existing NEC where feasible to improve travel times and passenger service. This 160 mph design speed is also consistent with the planned Amtrak purchase of new train sets and provides the benefits outlined in the FRA High Speed Intercity Passenger Rail Program (HSIPR). The purpose of the HSIPR is to address the nation's transportation challenges by making strategic investments in an efficient network of passenger rail corridors that connect communities across the country initiatives.

Additional benefits associated with maintaining consistent speed levels along the NEC and minimal changes in acceleration / deceleration include improved rider comfort, reduced energy consumption, and increased equipment efficiency.

B.1.3 BRIDGE SPACING

When evaluating two structural bridges across the Susquehanna River, a phased construction of the bridges would be required to maintain continuous rail traffic across the river (i.e. two bridges would not be built simultaneously nor could the existing bridge be removed from service until a replacement bridge has been constructed). Maintaining continuous rail service during construction cannot, however, preclude navigation for extended periods of time. Sufficient bridge spacing between the existing bridge and the new bridges is required to reduce risk of construction-related damage to the existing bridge and higher associated construction costs. Construction staging can be planned based on the layout of bridge spacing so that the swing span of the existing bridge can remain operable for the majority of the construction period. Reducing the bridge spacing would complicate construction and increase risks to the existing bridge and its movable span operations. However, increasing the distance between bridges more than necessary would result in greater property acquisitions.

B.1.4 NAVIGATIONAL CLEARANCES

The existing bridge includes a movable span that provides a 52-foot vertical clearance in the closed position and a 127-foot clearance in the open position (limited by overhead transmission lines). The movable span is typically opened five to 10 times per year with 24 hours of advanced notice. A temporary winter closure of the movable span may be necessary during the construction period. This closure would temporarily restrict navigation of high-mast vessels during the winter months, which is the time of the year with the least navigation activity. Amtrak conducted a navigation study in 2013 to assess current and future navigation needs of marine users of the Susquehanna River. The study collected information from local marinas, commercial users, contractors, federal agencies, and local municipal employees. The study concluded that a vertical clearance of 60 feet above the mean high water elevation for any new river span would reasonably accommodate the needs of current and future marine users. The navigation study determined a 60-foot vertical clearance is the optimal balance between the needs of the mariners and the needs of the passenger and freight rail providers. As noted previously, a fixed bridge is required for high-speed passenger tracks. An excessively high clearance for a fixed bridge would require longer or steeper approach grades, greater right-of-way and viewshed impacts, and a more expensive bridge structure. Steeper approach grades have a greater impact on freight train service, as described below. The navigation study also determined that while the existing horizontal clearance (two 100-foot-wide channels) is sufficient, further widening of the horizontal clearance could increase sight distance, reduce vessel congestion, and aid tug boat and barge navigation through the bridge opening, increasing safety and resilience against potential bridge and fender system strikes.

B.1.5 GRADES

Amtrak's standards generally permit up to a 1.5 percent compensated grade on mainline tracks. This grade is consistent with industry standards for maximum grades on freight and passenger mainline track. However, the existing grades on NS's Port Road and Amtrak's NEC are less than this maximum, ranging from 0.14 percent to 0.24 percent for the NS Port Road route and between 0.3 percent and 0.68 percent north and south of the bridge. The conceptual designs considered the existing maximum effective or ruling grade for the route. In coordination with NS, the Project Team determined that, for this project with current and anticipated freight train usage, a 0.65 percent maximum grade is appropriate for tracks primarily dedicated to freight operation.

B.1.6 RELATIONSHIPS TO OTHER PROJECTS

All conceptual alternatives were designed not to preclude adjacent and related planned transportation projects (see Appendix A, Figure 3). Such projects include freight rail improvements (e.g. the Chesapeake Connector Project), Maryland Transit Administration's (MTA) MARC Northeast Maintenance Facility and Penn Line extension, Amtrak Capital Projects, FRA's NEC FUTURE, regional bicycle and pedestrian trails etc.

B.2 CONCEPTUAL ALTERNATIVES

Using the design factors described above, the Project Team developed 18 conceptual alternatives. Several alternatives were developed to achieve the desired 160 mph design speed. These alternatives require additional right of way and impact adjacent properties. Alternatives with lower speeds were also developed to determine the maximum speeds achievable within the existing Amtrak right of way and to minimize impacts within the project area. Locations of the 18 conceptual alternatives are shown in Appendix A, Figure 3. A description of each of the conceptual alternatives is detailed in Table 1.

These alternatives were grouped into four build scenarios, which are described below and shown in Appendix A, Figure 4. The build scenarios represent four specific construction staging approaches.

B.2.1 BUILD SCENARIO 1

Build Scenario 1 involves a new two-track high-speed bridge constructed slightly to the east of the existing bridge as the first activity. The existing bridge would then be decommissioned and removed. Finally, a second new fixed bridge would be constructed on the existing bridge alignment. Alternatives 1A, 1B, 3A, 3B, 4A, 4B, 4C, 5, 6, 7, and 8A would employ this approach.

B.2.2 BUILD SCENARIO 2

Build Scenario 2 involves a new two-track high-speed bridge constructed slightly to the west of the existing bridge with a flyover in Perryville over the existing right-of-way (to provide the desired rail connectivity for high-speed passenger trains). The existing bridge would then be decommissioned and removed. Finally, a new fixed bridge would be constructed on the existing bridge alignment. Alternatives 2A and 2B would use Build Scenario 2.

B.2.3 BUILD SCENARIO 3

Build Scenario 3 involves a new three-track bridge constructed slightly to the east of the existing bridge. Two of the three tracks would be able to accommodate high-speed passenger rail service. The existing bridge would then be decommissioned and removed. Alternatives 4D, 4E, and 8B are representative of Build Scenario 3.

B.2.4 BUILD SCENARIO 4

Build Scenario 4 involves construction of a new commuter rail and freight rail bridge slightly to the west of the existing bridge as the first activity. The existing bridge would then be decommissioned and removed. Finally, a new fixed two-track bridge would be constructed on the existing bridge alignment. Alternatives 9A and 9B are representative of Build Scenario 4.

Table 1
Description of 18 Conceptual Alternatives

Alt #	Alternative Description	Winter Swing Span Closure?	Maximum Number of Tracks	Maximum Speed
1A	• High-speed 2-track bridge to east of existing bridge • 1 or 2-track bridge in place of existing bridge – clear of swing span	No	4 tracks*	140 mph
1B	• Similar to 1A but new bridge closer to existing bridge–temporary closure of swing span	Yes	4 tracks*	140 mph
2A	• High-speed 2-track bridge to the west of existing bridge • 1 or 2-track bridge in place of existing bridge – clear of swing span • Flyover in Perryville	No	4 tracks*	135 mph
2B	• Similar to 2A but closer to existing bridge – temporary closure of swing span	Yes	4 tracks*	135 mph
3A	• Curved high-speed 2-track bridge to east of existing bridge • 1 or 2-track bridge in place of existing bridge	No	4 tracks*	160 mph
3B	• Similar to 3A but closer to existing bridge – temporary closure of swing span	Yes	4 tracks*	160 mph
4A	• Straight high-speed 2-track bridge to east of existing bridge • 1 or 2-track bridge in place of existing bridge • Would require rebuild of Lewis Lane overpass in Havre de Grace	No	4 tracks*	160 mph
4B	• Similar to 4A but closer to existing bridge – temporary closure of swing span	Yes	4 tracks*	160 mph
4C	• Similar to 4B but with reduced speed	Yes	4 tracks*	135 mph
4D	• High-speed 3-track bridge to the east of existing bridge – temporary closure of swing span • Would require rebuild of Lewis Lane overpass in Havre de Grace	Yes	3 tracks	160 mph
4E	• Similar to 4D but with fewer right-of-way impacts due to lower design speed	Yes	3 tracks	135 mph
5	• High-speed 2-track bridge to east of existing bridge • 1 or 2-track bridge in place of existing bridge – clear of swing span • Substantial curve to avoid right-of-way impacts	No	4 tracks*	130 mph
6	• High-speed 2-track bridge to east of existing, elevated through Havre de Grace • 1 or 2-track bridge in place of existing bridge • Extensive, complicated double decker structure	Yes	4 tracks*	160 mph
7	• High-speed 2-track bridge to east of existing bridge • 1 or 2-track bridge in place of existing bridge • Significant curvature to avoid Perryville substation	No	4 tracks*	160 mph
8A	• Similar to 1B but with fewer right-of-way impacts due to lower design speed	Yes	4 tracks*	120 mph
8B	• High-speed 3-track bridge to the east of existing bridge on 8A alignment – temporary closure of swing span	Yes	3 tracks	120 mph
9A	• 1 or 2 track 90 mph bridge to the west of existing bridge • High-speed 2-track bridge in place of existing bridge • Reconstruct Lewis Lane Bridge to accommodate track shift	Yes	4 tracks*	160 mph
9B	• Similar to 9A but with fewer right-of-way impacts due to lower design speed • Reconstruct Lewis Lane Bridge to accommodate track shift	Yes	4 tracks*	150 mph
*These alternatives could accommodate a 4-track scenario or a 3-track scenario with an option of a future 4th track expansion.				

B.3 REHABILITATION ALTERNATIVE

An alternative that would rehabilitate the existing bridge without modifying the track alignments was considered. In addition, the Project Team considered conversion of the swing bridge into a lift bridge during rehabilitation, since conversion to a lift bridge would permit a new bridge to be built close to the existing bridge. During the April 28, 2014 public outreach information session, two written comments suggested constructing a new bridge and rehabilitating the existing bridge

into a walking path to connect Havre de Grace and Perryville. Therefore, the Project Team also evaluated the possibility of rehabilitating the existing bridge for non-rail use.

B.4 OTHER ALTERNATIVES

After the Project Team developed the 18 conceptual alternatives and the Rehab alternative, six other alternatives were developed: three additional conceptual alternatives (CE), two alternatives suggested by the public (P), and one value engineering alternative (VE).

B.4.1 ADDITIONAL CONCEPTUAL ALTERNATIVES

Alternative CE1 involves the construction of two single-track bridges on either side of the existing bridge and would then replace the existing bridge with a third bridge. Alternative CE2 involves the utilization of the abandoned grade-separated crossing for freight movements to the north of the existing bridge. Alternative CE3 involves the construction of a three-track high-speed bridge to the west of the existing bridge.

B.4.2 ALTERNATIVES SUGGESTED BY MEMBERS OF THE PUBLIC

Members of the public suggested two alternatives during the alternatives screening process, described below.

High Speed Tunnel under the Susquehanna River (P1)

A comment received May 3, 2014 through the project's website suggested the consideration of an underground tunnel for high speed passenger trains.

Reroute to Utilize CSX Bridge (P2)

A comment submitted to the Project Team via email dated April 17, 2014 suggested rerouting the tracks to join the CSX bridge to the north of the existing bridge.

B.4.3 VALUE ENGINEERING ALTERNATIVE

During the conceptual engineering design process, Amtrak conducted a value engineering study to further improve the project. The value engineering alternative (VE) was recommended for further evaluation, consisting of two double-track bridges on either side of the existing bridge. The two new bridges would be constructed simultaneously, followed by the decommissioning and removal of the existing bridge.

C. STEP 1: FATAL FLAW SCREENING

The 18 conceptual alternatives, the Rehab alternative, and the six other alternatives (CE, P, and VE) were evaluated using a two-step screening process (see Appendix A, Figure 5). Fatal flaw screening, which was the first step of the screening process, is discussed below. The remaining alternatives (preliminary alternatives) then moved on to the second step for a more detailed screening.

C.1 FATAL FLAW CRITERIA

The criteria for the fatal flaw screening were developed from the project's Purpose and Need. Each alternative must satisfy all of the below criteria to advance to the next level of screening (see Appendix A, Figure 6).

C.1.1 RAIL CONNECTIVITY

The NEC is a critical link in the transportation network for a large portion of the northeast US. To be feasible, any alternative must provide for the continued freight and passenger rail movement along the NEC during project construction and operation. Except for limited outages and service cutovers, access to and from the Perryville MARC station across the Susquehanna River must be maintained and provide sufficient capacity at all times. Similarly, access for the NS freight trains entering and exiting the NEC from the Port Road Branch must be maintained at all times, along with the ability for the NS traffic to cross the river.

C.1.2 NAVIGATIONAL REQUIREMENTS

Marine traffic is subject to the same delays as rail traffic during bridge openings. To eliminate this conflict, feasible alternatives must provide a higher level bridge that allows for marine vessel passage without the need to suspend rail operations and maintains or increases horizontal clearance. Any feasible conceptual alternative must maintain navigation during the construction period to the extent practicable. Any alternative that would result in prolonged marine closure (e.g., a continuous and complete marine closure of more than one week) would be fatally flawed. However, to reduce the required right-of-way acquisitions for the project, several alternatives propose to construct the new bridge within the swing span of the existing movable span. This will prevent the existing bridge from opening for mariners while the channel span is being constructed, although the channel would remain open for use by vessels that clear the existing bridge. Therefore, these alternatives would require a temporary closure of the movable span while the new bridge is being constructed during off-peak winter months.

C.1.3 LOGICAL TERMINI

NEPA requires transportation improvement projects, particularly linear projects such as bridge or corridor improvements, to define logical termini[1]. Logical termini help ensure that each proposed project fully responds to the identified need for that given project, i.e., that the project is of a sufficient length to address the identified problem. By their very definition, logical termini also help separate a proposed project from adjacent or related projects along the same corridor while ensuring that the project considers all existing infrastructure within the corridor and the potential to maximize the use of this existing infrastructure. Furthermore, logical termini allow a project sponsor to define an appropriate area for the examination of potential project impacts; this area is then evaluated in the environmental review documentation.

Any alternative must have rational end points and must consider existing infrastructure. The logical termini for the Susquehanna River Rail Bridge Project are defined as Prince Interlocking north of Perryville (at MP 57.3) on the NEC to Oak Interlocking south of Havre de Grace (at MP 63.5). These project termini were defined in the grant and have been used to develop the project alternatives and to select study areas for technical analyses of environmental impacts.

C.1.4 FEASIBILITY AND CONSTRUCTABILITY

Any conceptual alternative must be feasible and practicable from a construction and engineering perspective. Feasible conceptual alternatives must be built off the existing tracks to the extent practical and cut into service with minimal impacts to existing operations**.** Additionally, feasible

[1] 23 CFR 771.111(f)

conceptual alternatives must be constructed in a timely and integrated manner to ensure compatibility with future planned projects.

C.1.5 AVOIDANCE OF CRITICAL PROPERTY IMPACTS

Through early coordination efforts, the Project Team sought input from the City of Havre de Grace and the Town of Perryville. Local officials identified properties of the utmost importance to the community, including but not limited to parks, government buildings, community facilities, schools, and historic places. Some of the identified properties are afforded additional protection under various regulations. For example, the Rodgers Tavern in Perryville (a historic site listed on the State and National Registers of Historic Places) must be evaluated in accordance with Section 4(f) of the USDOT Act as well as Section 106 of the NHPA. The Project Team considered critical property impacts throughout conceptual engineering.

C.2 RESULTS OF STEP 1: FATAL FLAW SCREENING

C.2.1 CONCEPTUAL ALTERNATIVES

As shown in Table 2, the fatal flaw screening eliminated nine of the 18 conceptual alternatives. Alternatives 2A and 2B were eliminated due to extraordinary constructability challenges, and because they would impact Rodgers Tavern. These two alternatives also did not pass the fatal flaw screening because of rail connectivity and issues with feasibility and constructability.

Alternative 1A was eliminated in the fatal flaw screening because it would not provide rail connectivity during construction and would not avoid critical property impacts. Alternative 1A would impact the American Legion Post 47 in Havre de Grace and the Havre de Grace Post Office.

Alternatives 3A and 3B did not pass fatal flaw screening based on rail connectivity. In addition, Alternative 3A would have impacted the Havre de Grace Activity Center, Board of Education Office property, and Havre de Grace Post Office, which are considered to be critical property impacts.

Alternative 4A did not pass fatal flaw screening based on rail connectivity and critical property impacts. Alternative 4A would have impacted the Havre de Grace Post Office, the American Legion Post 47 in Havre de Grace, the Havre de Grace Activity Center, and the Board of Education Office property.

Alternatives 5, 6, and 7 did not pass fatal flaw screening based on rail connectivity. In addition Alternative 6 was not considered feasible or constructible**.**

Nine alternatives from Build Scenarios 1, 3, and 4 were retained for the step two detailed screening, including Alternatives 1B, 4B, 4C, 4D, 4E, 8A, 8B, 9A, and 9B (see Appendix A, Figure 7).

C.2.2 REHABILITATION ALTERNATIVE

Amtrak conducted its most recent engineering inspection of the Susquehanna River Rail Bridge in the summer of 2013 (with a supplemental specialty pin testing program in the summer 2014), which indicated that the bridge superstructure is in poor to fair structural condition. The inspection revealed deficiencies requiring repair; the recommended repairs have been enumerated and prioritized into short, medium, and long-term time horizons. Short-term structural repairs involve addressing numerous cracked members and the installation of retrofits in an attempt to restrain movement and prevent cracking. The cracks and worn pin joints

allowing movement are so extensive in the pin-connected trusses and represent such a major portion of the overall bridge system that it is not deemed economical, prudent, or feasible to continue on this course of ongoing repair. Piecemeal repairs of fatigue cracks due to corrosion and section loss and out-of-plane bending, replacement of missing fasteners and patching holes in primary support members will not restore bridge members to their original condition as the fatigue damage has already been done.

The recommended repairs in the inspection report address specific deficiencies but would not upgrade the bridge to a state of good repair. A state of good repair assumes bridge management practices that minimize asset life-cycle costs and avoid service disruption and load restrictions as well as providing a reliable factor of safety. These goals cannot be achieved with a 100-year-old bridge that contains thousands of fractured critical members whose remaining fatigue life cannot be precisely determined. The engineering report concluded that the only practical way to restore this bridge to a state of good repair would be to replace the fatigue-damaged pin-connected deck truss spans with truss spans of modern design. This effort would entail removing the existing trusses, erecting new trusses, and installing the track and rail systems to restore service. Replacing the existing trusses without a new adjacent two-track bridge already in service would result in prolonged and unacceptable shutdowns of rail operations and would significantly and adversely impact the operations of Amtrak, MARC and NS. Rehabilitating the existing bridge in conjunction with building a new bridge would affect the alignment of the new bridge and result in additional property impacts or reduced operating speeds compared to options where the existing bridge is completely replaced. In addition, MARC and NS traffic would be confined to the existing bridge requiring more significant outages for rehabilitation work, compared to options where the existing bridge is completely replaced. Furthermore, substantial capital expenditures would be required to rehabilitate and strengthen piers and foundations to meet current design criteria and mitigate seismic forces that were not considered in the original design. Therefore, rehabilitation of the existing bridge offers no significant costs savings compared to bridge replacement.

Conversion of the swing bridge into a lift bridge during rehabilitation was also considered during conceptual engineering, since conversion to a lift bridge would permit the new bridge to be built close to the existing bridge. Under this scheme, only one new bridge would be built and the rehabilitated existing bridge would be retained. However, due to the condition of the bridge and its advanced age, this option is still problematic and cost ineffective as it would retain a more than 100-year-old structure that is in deteriorated condition. It would not satisfy the project's purpose and need, and would not meet the project goal to optimize existing and planned infrastructure and accommodate future freight, commuter, intercity, and high-speed rail operations.

Rehabilitating the existing bridge for non-rail use also did not pass the fatal flaw screening. The span over the navigation channel would need to be replaced to provide the necessary vertical clearance for mariners, with transition ramps from the existing trusses. The center swing-span pier and several approach spans would need to be removed. Retaining the area occupied by the existing bridge for non-rail use would negatively affect the new rail bridge alignments by increasing right-of-way impacts and/or reducing the achievable speed.

The rehabilitation alternative is not suitable for continued freight rail and/or passenger rail use, due to the current condition of the bridge and the infeasibility of reconstructing the bridge to a state of good repair without significant rail operations disruptions and prohibitive costs. The rehabilitation alternative would not allow for the required level of rail service during the

construction period. The rehabilitation alternative was, therefore, eliminated from further consideration.

C.2.3 OTHER ALTERNATIVES

The fatal flaw screening also eliminated five of the six other alternatives resulting in just the VE Alternative proceeding to the Step 2 detail screening.

Additional Conceptual Alternatives

Alternative CE1 would disrupt rail connectivity and was determined infeasible and impractical from a construction and engineering perspective. Alternative CE2 would disrupt rail connectivity, did not fall within logical termini of the project, and did not avoid critical property impacts. Alternative CE3 was determined infeasible and impractical from a construction, staging, and engineering perspective. Therefore, all three of these alternatives were found to be fatally flawed and were eliminated in the screening process.

Alternatives Suggested by Members of the Public

High Speed Tunnel under the Susquehanna River
This suggestion (Alternative P1) did not pass the fatal flaw screening based on rail connectivity, logical termini, and feasibility and constructability.

Reroute to Utilize CSX Bridge
This suggestion (Alternative P2) did not pass the fatal flaw screening based on rail connectivity, logical termini, and feasibility and constructability.

Value Engineering Alternative

As shown in Table 2, the value engineering alternative passed the fatal flaw criteria and advanced to the next level of screening.

Table 2
Fatal Flaw Screening of Conceptual Alternatives

Alt #	Build Scenario	Fatal Flaw Screening Criteria					
		Rail Connectivity	Navigational Requirements	Logical Termini	Feasibility & Constructability	Avoids Critical Property Impacts	Pass/Fail
1A	1	No	Yes	Yes	Yes	No	Fail
1B	1	Yes	Yes	Yes	Yes	Yes	Pass
2A	2	No	Yes	Yes	No	No	Fail
2B	2	No	Yes	Yes	No	No	Fail
3A	1	No	Yes	Yes	Yes	No	Fail
3B	1	No	Yes	Yes	Yes	Yes	Fail
4A	1	No	Yes	Yes	Yes	No	Fail
4B	1	Yes	Yes	Yes	Yes	Yes	Pass
4C	1	Yes	Yes	Yes	Yes	Yes	Pass
4D	3	Yes	Yes	Yes	Yes	Yes	Pass
4E	3	Yes	Yes	Yes	Yes	Yes	Pass
5	1	No	Yes	Yes	Yes	Yes	Fail
6	1	No	Yes	Yes	No	Yes	Fail
7	1	No	Yes	Yes	Yes	Yes	Fail
8A	1	Yes	Yes	Yes	Yes	Yes	Pass
8B	3	Yes	Yes	Yes	Yes	Yes	Pass
9A	4	Yes	Yes	Yes	Yes	Yes	Pass
9B	4	Yes	Yes	Yes	Yes	Yes	Pass
Rehab	N/A	Yes	No	Yes	No	Yes	Fail
CE1	N/A	No	Yes	Yes	No	Yes	Fail
CE2	N/A	No	Yes	No	Yes	No	Fail
CE3	N/A	Yes	Yes	Yes	No	Yes	Fail
P1	N/A	No	Yes	No	No	Yes	Fail
P2	N/A	No	Yes	No	No	No	Fail
VE	N/A	Yes	Yes	Yes	Yes	Yes	Pass

D. STEP 2: DETAILED SCREENING

The second step of the screening process was based on a more detailed evaluation of each of the 10 preliminary alternatives (see Appendix A, Figure 7). The detailed screening considered each alternative's impacts to environmental resources, including human and natural environmental impacts, as well each alternative's ability to meet the project's operational goals. Concurrent to conceptual engineering, the Project Team inventoried environmental resources in the study area, and then factored the environmental information into the detailed screening, as described below. Property impacts were further evaluated beyond the critical property assessment used in the fatal flaw screening. As described in Section E, "Public Involvement and Agency Coordination," public and agency meetings have been held at project milestones (including Purpose and Need, Feasible Alternatives, and Alternatives Retained for Detailed Study). Input received during such meetings was considered during the screening process. Section F, "Results of Detailed Screening," explains the conclusions of the detailed screening process.

Each conceptual alternative's ability to meet the following goals and objectives of the Proposed Project were compared and contrasted:

- Improve rail service reliability and safety;
  - Ability to eliminate operational disruptions and delays;
  - Ability to connect to NS wye and provide grades acceptable for freight operations;
  - Ability to provide adequate number of bridge structures;
- Improve operational flexibility and accommodate reduced trip times;
  - Ability to reduce operational conflicts;
  - Ability to eliminate or reduce speed restrictions for intercity trains;
  - Ability to provide flexibility for operational and maintenance work windows;
- Optimize existing and planned infrastructure and accommodate future freight, commuter, intercity, and consistency with planned high-speed rail operations;
  - Ability to eliminate two-track section in this portion of the NEC;
  - Ability to not preclude future high-speed rail;
  - Ability to minimize impacts to Perry Electrical Substation;
  - Ability to allow for potential shared corridor with bike/pedestrian path;
- Maintain adequate navigation and improve safety along the Susquehanna River;
  - Ability to provide suitable vertical and horizontal clearance;
  - Construction-period effects to navigation (i.e. whether the alternative requires temporary winter closure of movable span).

D.1 ALTERNATIVES PROCEEDED TO STEP 2: DETAILED SCREENING

As described above, a total of 10 preliminary alternatives proceeded to detailed screening: 1B, 4B, 4C, 4D, 4E, 8A, 8B, 9A, 9B, and VE. All 10 preliminary alternatives include the decommissioning and removal of all or part of the existing bridge. The maximum achievable speed for the preliminary alternatives ranges from a low of 120 mph to a high of 160 mph. The total number of tracks ranges between three and four tracks.

A detailed Alternatives Comparison Matrix evaluating all human environmental considerations, natural environmental considerations, and operational and engineering considerations for each of the 10 preliminary alternatives is attached as Appendix B. The preliminary alternatives and environmental considerations are described in more detail below.

ALTERNATIVE 1B

Alternative 1B would construct a new bridge to the east of the existing bridge. To reduce right-of-way impacts, this alternative is close to the existing alignment, so it would require winter closure of the swing span during construction. It would improve the curve in Havre de Grace and maintain a separate alignment in Perryville. Alternative 1B would remove the existing bridge and would build a second bridge on the existing alignment. It would allow for 140 mph speeds and it could result in three or four tracks total.

ALTERNATIVE 4B

Alternative 4B would construct a new bridge to the east of the existing bridge. To reduce right-of-way impacts, the bridge is in close proximity to the existing alignment, so it would require winter closure of the swing span during construction. It would improve the curve in Havre de

Grace, allowing for speeds up to 160 mph. This option would remove the existing bridge and build a second bridge on the existing alignment. It could result in three or four tracks total.

ALTERNATIVE 4C

Alternative 4C would construct a new bridge to the east of the existing bridge. This alternative is in close proximity to the existing alignment, so it would require winter closure of the swing span during construction. This option is close to the existing alignment in Havre de Grace, and therefore reduces right-of-way impacts. This alternative would also remove the existing bridge and build a second bridge on the existing alignment. This alignment allows for speeds up to 135 mph and could include three or four tracks total.

ALTERNATIVE 4D

Alternative 4D would construct a new three-track bridge to the east of the existing bridge. This option is close to the existing alignment to reduce right-of-way impacts, so it would require winter closure of the swing span during construction. This alternative would also remove the existing bridge and would not replace it. This option would allow for 160 mph speeds and would include a total of three tracks.

ALTERNATIVE 4E

Alternative 4E would construct a new three-track bridge to the east of the existing bridge. This option is close to the existing alignment to reduce right-of-way impacts, especially in Havre de Grace, so it would require winter closer of the swing span during construction. This alternative would remove the existing bridge and would not replace it. It would allow for 135 mph speeds and would include a total of three tracks.

ALTERNATIVE 8A

Alternative 8A would construct a new bridge to the east of the existing bridge. To reduce right-of-way impacts, this option uses a lower design speed. This option is close to the existing alignment, so it would require winter closure of the swing span during construction. This option would include a crossover in Perryville between the conventional speed and high-speed bridges. This alternative would remove the existing bridge and build a second bridge on the existing alignment. This option would allow for speeds up to 120 mph and could include three or four tracks.

ALTERNATIVE 8B

Alternative 8B would construct a new three-track bridge to the east of the existing bridge. To reduce right-of-way impacts, this option uses a lower design speed. This option is close to the existing bridge, so it would require closure of the swing span during construction. It would remove the existing bridge and would not replace it. This alternative would allow for 120 mph speeds and a total of three tracks.

ALTERNATIVE 9A

Alternative 9A would construct a new bridge to the west of the existing bridge. It is close to the existing alignment to reduce right-of-way impacts, so it would require winter closure of the swing span during construction. The conventional speed bridge (for MARC and NS) would be built first to the west. Next, this alternative would remove the existing bridge and build a high speed bridge on the existing alignment. It would allow for speeds up to 160 mph and three or four tracks total.

ALTERNATIVE 9B

Alternative 9B is similar to 9A, but maintains a sharper curvature design which results in fewer right-of-way impacts but also limits the alignments maximum authorized speed. Alternative 9A would construct a new bridge to the west of the existing bridge. It is close to the existing alignment, so it would require winter closure of the swing span during construction. To the west, the conventional speed bridge (for MARC and NS) would be built first. This option would then remove the existing bridge and build a high speed bridge on the existing alignment. This alternative would allow for 150 mph speeds and three or four tracks total.

VALUE ENGINEERING ALTERNATIVE

The value engineering alternative was deemed feasible and consists of two double-track bridges on both sides of the existing bridge, totaling four tracks. This option is close to the existing bridge to reduce right-of-way impacts, so it would require closure of the swing span during construction. This option would then remove the existing bridge. This alternative allows for 140 mph speeds.

D.2 LAND USE AND COMMUNITY FACILITIES

The Alternatives directly impact three to eight parcels (0.10 to 4.72 acres) of residential, commercial, institutional, park, and/or undeveloped property. The potential number of residential and/or commercial relocations ranges from zero to 16 (the Lafayette Senior Housing Facility contains 15 of these displacements). Details are discussed below.

Parks, historic places[1], and community facilities within the study area are shown in Appendix A, Figures 8-10. The conceptual alternatives have varying potential property impacts, as shown in Appendix A, Figure 11, and detailed in Table 3. In terms of residential land uses, Alternatives 1B, 8A, and 8B would have no residential property impacts. Alternatives 9A, 9B, and VE would have minimal residential impacts in Perryville with no structure demolition required. Alternatives 4B, 4C, 4D, and 4E would demolish 15 residential units at the Lafayette Senior Housing Facility, which is a residential property that provides 15 units of affordable housing to the elderly and accepts Section 8 vouchers. The acquisition in full of this complex and the displacement of its low-income residents could possibly result in environmental justice concerns.

In terms of commercial uses, a majority of the alternatives would require partial acquisitions, ranging from 2.0 to 9.4 percent, primarily associated with the National Tire & Glass Sales, Inc. property located in Havre de Grace, but only impacts associated with three alternatives (4B, 4D, and 9A) would actually result in displacement of the commercial business. No alternatives would avoid the property associated with the National Tire & Glass Sales, Inc. Alternatives 4B, 4D and 9A would require partial acquisition, ranging from 10.0 to 47.76 percent, of the commercial privately-owned driveway associated with the National Tire & Glass Sales Inc. Alternatives 4B and 4D would require the entire acquisition and removal of the driveway. Alternative 9A would require the full acquisition of the private commercial driveway associated with the National Tire & Glass Sales Inc. as well as a portion of the commercial parcel itself. Since alternate access could not be provided to the business, the acquisition would affect the

[1] Includes known historic places listed or eligible for listing on the State/National Register of Historic Places as of the date of this report.

business's ability to function as it currently does; therefore, displacement of the entire commercial parcel would be required.

In terms of roadway uses, Alternative 4B and 4D would have a major effect on Warren Street in Havre de Grace between Adams Street to Stokes Street, as it will have to be closed. Alternatives 4C and 4E modify the Warren Street and Stokes Street intersection, which would result in a moderate effect. Alternatives 1B, 9A, and VE would impact the sidewalk and shoulder of Warren Street between Adams and Stokes Streets, resulting in a minimal effect. Alternative 9A and 9B would also realign Broad Street in Perryville resulting in a minimal effect.

Partial acquisition, ranging from 10.0 percent to 25.0 percent, of the vacant parcel adjacent to the Lafayette Senior Housing Facility in Havre de Grace is required under some of the alternatives. This vacant parcel adjacent to the Lafayette Senior Housing Facility would be fully acquired by Alternatives 4B, 4C, 4D, and 4E. In addition, Alternatives 4B and 4D would require the acquisition of approximately 7.7 percent of undeveloped land associated with another parcel in Havre de Grace.

Some of the alternatives would have impacts on community facilities. Alternatives 4B and 4D would require the acquisition of approximately 13.0 percent of the parcel associated with the United States Post Office in Havre de Grace, but no structure demolition would be required.

Alternatives 4B and 4D would result in an indirect impact to undeveloped land and the indirect loss of a commercial business primarily due to the loss of Warren Street frontage.

Figures 11 through 13 illustrate the potential property impacts from the conceptual alternatives (see Appendix A). For comparison purposes, more extensive potential property impacts from the worst-case conceptual alternatives (which, as discussed below, have been eliminated from further study) are shown on Figure 11 (see Appendix A). The potential property impacts from the Alternatives Retained for Detailed Study (discussed in Section F) are shown on Figures 12 and 13 (see Appendix A).

Table 3
Potential Land Acquisitions by Alternative

Alt. #	Lot Number	Map-Grid-Parcel	Owner	Property Type	Impact	Purchase Percent Property
1B	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Partial	25.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition	9.4%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	38.0%
4B	94	0601-0000-0652	Mayor and City Council of Havre de Grace	David R. Craig Park	Partial	15.4%
	93	0601-0000-0648-0000-23	500 N. Union Venture, LLC	Undeveloped land – zoned Residential Business District	Partial	7.7%
	92	0601-0000-0647	Lafayette Limited Partnership	Residential - Lafayette Apt Bldg	Total - Requires structure demolition	100.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Total	100.0%
	85	0601-0000-0596-0000-213	Richard E. Forton Properties, LLC	Undeveloped land – zoned Residential Business District	Indirect – loss of Warren St. frontage	0.0%
	84	0601-0000-0595	Can Machine, LLC	Commercial	Indirect – loss of Warren St. frontage	0.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Total - Requires structure demolition	100.0%
	81	0601-0000-591-0635-2	United States Postal Service	Institutional - United States Post Office	Partial - No structure demolition	13.0%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Total - Drive removed	100.0%
	80/80A	0602-0000-0792	Board of Education of Harford County	Track and Athletic Fields	Partial	4.1%
4C	94	0601-0000-0652	Mayor and City Council of Havre de Grace	David R. Craig Park	Partial	13.5%
	92	0601-0000-0647	Lafayette Limited Partnership	Residential - Lafayette Apt Bldg	Total - Requires structure demolition	100.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Total	100.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition required	7.8%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	20.0%
4D	94	0601-0000-0652	Mayor and City Council of Havre de Grace	David R. Craig Park	Partial	15.4%
	93	0601-0000-0648-000-23	500 N. Union Venture, LLC	Undeveloped land – zoned Residential Business District	Partial	7.7%
	92	0601-0000-0647	Lafayette Limited Partnership	Residential - Lafayette Apt Bldg	Total - Requires structure demolition	100.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Total	100.0%
	85	0601-0000-0596-0000-213	Richard E. Forton Properties, LLC	Undeveloped land – zoned Residential Business District	Indirect – loss of Warren St. frontage	0.0%
	84	0601-0000-0595	Can Machine, LLC	Commercial	Indirect – loss of Warren St. frontage	0.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Total - Requires structure demolition	100.0%
	81	0601-0000-591-0635-2	United States Postal Service	Institutional - United States Post Office	Partial - No structure demolition	13.0%

	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Total - Drive removed	100.0%
	80/80A	0602-0000-0792	Board of Education of Harford County	Track and Athletic Fields	Partial	4.2%
4E	94	0601-0000-0652	Mayor and City Council of Havre de Grace	David R. Craig Park	Partial	13.5%
	92	0601-0000-0647	Lafayette Limited Partnership	Residential - Lafayette Apt Bldg	Total - Requires structure demolition	100.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Total	100.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition required	7.8%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	20.0%
8A	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition required	2.0%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	10.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Partial	10.0%
8B	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition required	2.0%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	10.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Partial	10.0%
9A	95	0601-0000-0473	Mayor and City Council of Havre de Grace	Jean S. Roberts Park	Partial	2.26%
	N/A	0601-0000-2492	National RR Pass Corp	Jean S. Roberts Park	Total	100.0%
	226	0801-0020-0157	Private Residence	Residential	Partial - No structure demolition required	5.2%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Partial	12.6%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Total – Due to loss of access and portion of property	100.0%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Total - Drive removed	100.0%
	80/80A	0602-0000-0792	Board of Education of Harford County	Track and Athletic Fields	Partial	2.6%
9B	95	0601-0000-0473	Mayor and City Council of Havre de Grace	Jean S. Roberts Park	Partial	2.26%
	N/A	0601-0000-2492	National RR Pass Corp	Jean S. Roberts Park	Total	100.0%
	226	0801-0020-0157	Private Residence	Residential	Partial - No structure demolition required	5.20%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition required	9.36%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	47.76%
VE	95	0601-0000-0473	Mayor and City Council of Havre de Grace	Jean S. Roberts Park	Partial	2.26%
	N/A	0601-0000-2492	National RR Pass Corp	Jean S. Roberts Park	Total	100.0%
	91	0601-0000-1580	Lafayette Limited Partnership	Undeveloped land – zoned Residential District	Partial	25.0%
	83	0601-0000-0990-635-1	T&D Enterprises, LLC	Commercial - National Tire & Glass Sales Inc.	Partial - No structure demolition	9.4%
	82	0601-0000-0591-635-1A	T&D Enterprises, LLC	National Tire & Glass Sales Inc. Private drive	Partial - Drive maintained	38.0%

D.3 PARKS AND RECREATIONAL RESOURCES

The alternatives would impact between zero and two parks, ranging from 0.14 to 2.56 acres. David R. Craig Park, Havre de Grace Middle/High School athletic fields, and/or the Jean S. Roberts Park would each be impacted by one or more alternatives.

As detailed in the Alternatives Comparison Matrix, Alternatives 1B, 8A, and 8B would have no direct impacts on parkland. Alternatives 4B and 4D would require the acquisition of approximately 15.4 percent of David R. Craig Park in Havre de Grace. Alternatives 4C and 4E would require the acquisition of approximately 13.5 percent of David R. Craig Park. David R. Craig Park was purchased and/or improved using Maryland DNR Program Open Space (POS) funds. Impacts to parks that utilized POS funds would require additional coordination with DNR.

Alternatives 4B, 4D, and 9A would have impacts to the Havre de Grace Middle/High School athletic fields and track area. Additional coordination will be required with the school and Harford County Public Schools to determine the full extent of the impact and what potential mitigation options (i.e. relocating the track) may be available for further study during the EA development.

Amtrak owns a portion (0.26 acres of the total 0.87 acres) of Jean S. Roberts Park, which it leases to the City of Havre de Grace. Alternatives 9A, 9B, and VE would require the use of the entire Amtrak-owned portion of Jean S. Roberts Park as well as the acquisition of approximately 2.26 percent of the city owned potion of Jean S. Roberts Park. No parks would be directly affected in the Town of Perryville. For a summary of all potential property impacts, including impacts to parks and recreational resources (see Appendix A, Figure 12 and 13).

D.4 VISUAL AND AESTHETIC CONDITIONS

The visual effect of each of the preliminary alternatives would be relatively similar, but will vary depending on whether the alternative has one or two bridge structures. The aesthetics considerations will depend on bridge design type. The EA will include a comprehensive assessment of the visual and aesthetic effects of the retained alternatives.

D.5 CULTURAL RESOURCES

To assess the potential effects of the Susquehanna River Rail Bridge Project on cultural resources, the project team identified areas of potential effect (APEs) for the project alternatives in consultation with the Maryland Historical Trust (MHT), which is the State Historic Preservation Office (SHPO) for Maryland.

ARCHAEOLOGICAL RESOURCES

In order to assess the sensitivity of the archaeological area of potential effect (APE), the project team prepared an Archaeological Documentary Study (Phase IA Study), which used documentary sources to identify areas with potential to contain archaeological deposits relating to prehistoric or historic-period activities. For each area where prehistoric or historic-period activities may have yielded archaeological deposits, the project team evaluated construction activities and other recent ground disturbances to identify locations where any archaeological resources, if originally present, may have survived. The Phase IA Report assessed the proposed project's potential to affect archaeologically sensitive areas and provided recommendations for further archaeological testing to determine the presence or absence of significant archaeological

resources that could be affected by the proposed project. The preliminary alternatives would result in a range between 0.11 and 0.31 total acres of potentially sensitive archaeological areas.

ARCHITECTURAL RESOURCES

The known historic resources within the APE are listed in Table 4. This inventory includes properties or districts listed on the National Register of Historic Places (NR) and/or the Maryland State Register of Historic Properties (SR), or determined eligible for such listing, and National Historic Landmarks (NHL).

Table 4
Known Historic Resources Within the APE

No.	Name/Type	Address	Location	S/NR	S/NR-eligible	MIHP
KNOWN HISTORIC RESOURCES						
1	Havre de Grace Historic District	Havre de Grace	Havre de Grace	X		HA-1125
2	Southern Terminus, Susquehanna and Tidewater Canal - South Lock #1 and Toll House[1]	Erie & Water Streets	Havre de Grace	X		HA-112; HA-113
3	Martha Lewis (skipjack)[2]	Millard Tydings Memorial Park, Commerce St. at S. Strawberry La.	Havre de Grace	X		HA-2189
4	Rodgers Tavern[1]	Broad Street & River Road	Perryville	X		CE-129
5	Principio Furnace (Principio Iron Works)[3]	Principio Furnace Road (MD 7)	Cecil County	X		CE-112
6	Perry Point Mansion House and Mill	Sixth Street, Avenue A	Perryville	X		CE-146; CE-244
7	Perryville Railroad Station	650 Broad Street	Perryville		X	CE-1442
8	Amtrak Railroad Bridge over the Susquehanna River (Susquehanna River Rail Bridge) and Rail Bridge Overpasses	Union Avenue (MD 7) & Otsego Street, AMTRAK RR Bridge	Harford and Cecil Counties		X	HA-1712
9	Perry Point Veterans Administration Medical Center Historic District	VA Medical Center, Perry Point	Cecil County		X	CE-1544
10	Crothers House (Furnace Bay Golf Course Clubhouse)	79 Chesapeake View Road	Cecil County		X	CE-1566
11	Woodlands Farm Historic District[4]	Woodlands Farm Lane South	Cecil County		X	CE-145
12	Perryville United Methodist Church	359 Broad Street	Cecil County		X	CE-1573
13	Perryville Presbyterian Church	710 Broad Street	Cecil County		X	CE-1574

Notes:
There are no National Historic Landmarks (NHLs) located in the APE.
[1] Notes resource is also a MHT easement property.
[2] This resource is currently under restoration at Hutchins Park, MD.
[3] Although portions of this property are located in the APE, there are no structures associated with this resource located within the APE.
[4] This is an expansion of a boundary for the National Register-listed Woodlands Farm.
S/NR: Listed on the State and National Registers of Historic Places
S/NR-eligible: Officially determined eligible for listing on the State and National Registers of Historic Places
MIHP: Maryland Inventory of Historic Properties
Sources: MHT Online Resources

In addition to the known historic resources, the Project Team identified architectural resources that are potentially eligible for listing on the SR/NR based on field surveys, documentary research, and review of the Maryland Inventory of Historic Properties (MIHP). The reconnaissance-level survey identified an additional three potential architectural resources within the APE that had not been previously identified, which were the Susquehanna River Rail Bridge Overpasses, the Perryville United Methodist Church, and the Perryville Presbyterian Church. MHT concurred that all three of these are eligible for listing on the SR/NR. The survey also documented an additional 73 properties that met the SR/NR criterion, but did not appear eligible for the SR/NR. MHT concurred that all 73 of these properties were not SR/NR-eligible. Depending on the alternative selected, the project is expected to impact two to three cultural resources.

All alternatives would decommission and remove the existing bridge, which is eligible for listing on the State and National Registers of Historic Places (SR/NR-eligible). To some extent, all of the preliminary alternatives would impact the overpasses associated with the Susquehanna River Rail Bridge. Alternatives 9A and 9B would impact both the Perry Interlocking Tower and Access Road Undergrade Bridge 59.39, which are contributing resources of the Perryville Station (SR/NR-eligible). The remaining alternatives may impact the Access Road Undergrade Bridge 59.39, but not the tower. The study team is currently evaluating potential relocation opportunities for the Perry Interlocking Tower, which will be part of the detailed studies phase of the project.

None of the preliminary alternatives would directly impact Rodgers Tavern (SR/NR-listed). All alternatives are anticipated to impact the Havre de Grace Historic District (SR/NR-listed) due to the fact that a new bridge structure would pass through the historic district and all alternatives would require some degree of property acquisition from within the historic district.

D.6 SECTION 6(f) RESOURCES

Section 6(f) of the Land and Water Conservation Fund Act (16 USC 460) requires that the Secretary of the U.S. Department of the Interior approve any conversion of lands purchased or developed with assistance under this Act to a use other than public, outdoor recreation use. Any park or recreational resource that received grants from the Land and Water Conservation Fund is considered a Section 6(f) resource.

Improvements to the Havre de Grace Middle/High School complex were undertaken utilizing Section 6(f) Land and Water Conservation Act (LWCA) funds. Alternatives 4B, 4D, and 9A would impact this Section 6(f) property. Section 6(f) of the LWCA requires that the conversion of lands or facilities acquired with LWCA funds be coordinated with the National Park Service (NPS). Coordination with Harford County Public Schools (i.e., property owners) and the NPS regarding impacts to the 6(f) property will occur throughout the planning phase of the project and documented in the EA.

D.7 SECTION 4(f) RESOURCES

Section 4(f) of the USDOT Act of 1966 (49 USC § 303; 23 CFR § 774) prohibits the Secretary of Transportation from approving any program or project that requires the "use" of (1) any publicly owned parkland, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; or (2) any land from a historic site of national, state, or local significance (collectively, "Section 4(f) properties"), unless there is no feasible and prudent alternative to the use of such land and such program or project includes all possible planning to minimize harm to the park, recreation area, wildlife refuge, or historic site. The proposed use of land from a publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic or archaeological site, as part of a federally funded or approved transportation project, is permissible only if: 1) there is no feasible and prudent alternative to the use and (2) the project includes all planning to minimize harm; or (3) if the use is a *de minimis* impact.

Most of the parks and cultural resources that would be impacted by the project are also considered Section 4(f) resources, as shown in the Alternatives Comparison Matrix (see Appendix B). The alternatives would impact between three and five Section 4(f) resources. Some impacts may be considered *de minimis*. As detailed in the Alternatives Comparison Matrix, all preliminary alternatives would impact Section 4(f) resources in some way.

D.8 NATURAL RESOURCES

Natural resource impacts are discussed briefly below. Existing natural resources within the study area are shown on Figures 14 through 16 (see Appendix A). Potential impacts were determined based on a preliminary ArcGIS desktop inventory, preliminary field surveys, and agency coordination. For each alternative, a potential impact boundary was developed. The impact boundary likely represents the worst case impacts for each alternative and typically includes the known design limits with an additional 10 foot buffer. Natural resources identified within each alternative's impact boundary were identified in the Alternatives Comparison Matrix (see Appendix B) and quantified where appropriate.

D.8.1 WATERS OF THE U.S. (STREAMS AND WETLANDS)

Across the entire study area, 14 waters of the U.S., including wetlands, were identified. In Harford County, nine potential nontidal wetlands were identified within the study area. These include natural palustrine forested/scrub shrub/emergent wetlands and manmade palustrine emergent/open water wetlands. A large forested area in the southern portion of the study area is associated with unnamed tributaries to Swan Creek and Gashey's Creek and a Wetland of Special State Concern (WSSC). The WSSC is located just south of the Amtrak right-of-way along an unnamed tributary to Gashey's Creek in Harford County (see Appendix A, Figure 14). The WSSC will not be directly impacted by any of the proposed alternatives. Six perennial streams also cross the Amtrak right-of-way within Harford County. With the exception of the easternmost unnamed tributary to Gashey's Creek and the Susquehanna River, all perennial streams were identified as lower perennial and have a cobble/gravel substrate. The Susquehanna River at the existing rail bridge is classified as riverine. In addition to these perennial streams, based on aerial photographic interpretation and field surveys, it appears that several wet ditches and smaller intermittent or ephemeral streams run parallel to the existing track and to US 40 or MD 7. These smaller systems flow to the aforementioned streams. In Cecil County, two tidal wetland systems and four potential nontidal forested wetlands were identified within the study area. Mill Creek is the only perennial stream that crosses the study area in Cecil County.

The alternatives would traverse the Susquehanna River and three additional streams within the immediate vicinity of the existing bridge. Not including impacts to the Susquehanna River, streams impacts within the study area would range from 269 to 450 linear feet depending on the alternative chosen. Impacts to the Susquehanna would depend on the type of bridge constructed for the project, which will be chosen at a later stage. Excluding Susquehanna River impacts, only Alternatives 4B and 4D would impact more than 400 linear feet of streams. During the March 12, 2015 field visit, several agencies expressed support for the use of bottomless culverts or actual bridge structures to reduce impact to the stream channel and/or aquatic habitat. The study team will evaluate these design approaches in more detail as the project progresses.

Based on a preliminary field survey, wetland impacts are not expected to exceed one acre for any alternative. Ranges for wetland impacts are from 0.18 to 0.68 acre. Alternatives 9A and 9B would impact 0.18 acre of wetland, while the other alternatives would impact over 0.50 acre of wetland.

Natural wetland buffers are wetland buffers located outside existing disturbed track areas. Impacts to wetland buffers within existing disturbed areas would not typically be counted as impacts and, therefore, are excluded from calculations. Natural wetland buffer impacts are estimated to range from 0.72 to 1.71 acres. Alternatives 4D, 4E, and 8B would impact less than

one acre of natural wetland buffer, while Alternatives 1B, 4B, 9A, 9B, and VE would impact less than 1.50 acre of natural wetland buffer.

D.8.2 FLOODPLAINS

Floodplain impacts are largely associated with the Susquehanna River. The alternatives are anticipated to impact approximately 1.87 to 3.29 acres of 100-year floodplains and 47.63 to 58.99 acres of 500-year floodplains.

D.8.3 CHESAPEAKE BAY CRITICAL AREAS

The 1,000-foot Chesapeake Bay Critical Area (Critical Area) overlay protection zone within the City of Havre de Grace includes areas designated as Intensely Developed Areas (IDA) and Resource Conservation Areas (RCA). Because of the City's intense historic development patterns, much of the IDA area immediately adjacent to the water's edge (the 100-foot buffer) is designated as a Buffer Exempt Area (BEA). In the Town of Perryville, certain areas have been mapped and classified as Special Buffer Areas, where it has been sufficiently demonstrated that the existing pattern of residential, industrial commercial, institutional or recreational development in the Critical Area prevent the buffer from fulfilling its intended functions for water quality protection and wildlife habitat conservation.

It is anticipated that approximately 6.09 to 8.01 acres of Critical Area will be impacted by the alternatives. Alternative VE would have the highest amount of Critical Area impacts. Critical Area impacts would be less than 6.50 acres for Alternatives 8B, 9A, and 9B and between 6.50 and 7.00 acres for Alternatives 1B, 4E, 8A, and 8B. The majority of the impacts are mostly within the existing rail bridge and approaches on both sides of the river. A small portion of the proposed impacts are outside of the existing rail infrastructure. Coordination with DNR's Critical Area Commission and local planning officials will ensure that this project complies with all Critical Area criteria and regulations.

D.8.4 SUBMERGED AQUATIC VEGETATION (SAV)

According to the Virginia Institute of Marine Science (VIMS), presence and density of submerged aquatic vegetation (SAV) vary from year to year and are mapped annually within the Chesapeake Bay. Over a five-year period (2009 to 2013), the location of SAV beds in the Lower Susquehanna River portion of the study area have remained relatively consistent. During the time period of 2009 through 2013, the areal extent and density (extent of coverage by vegetation in the beds) of the beds went through a decline in 2011, but have increased in recent years. Within the Upper Bay/Susquehanna Flats portion of the study area, SAV beds have shown a similar decrease in areal extent and density with the majority of the Susquehanna Flats bed remaining at dense cover where present. The changes in SAV beds in 2011 reflect the effects of Hurricane Irene in August and Tropical Storm Lee in September that resulted in high turbidity and deposition of large amounts of sediment in the system (VIMS 2013). Direct impacts to SAV from bridge pier construction are expected to range from 0.57 to 0.74 acres under the alternatives.

Shading from overhead structures can negatively impact SAV. An analysis of potential shading impacts was completed for this project to determine what indirect impacts the various bridge options could have on SAV. The existing bridge is approximately 32 feet wide and the base of the catwalk and girder structure is approximately 25 feet high over the Susquehanna River at the approaches (the river segments of the track outside of the channel section). The height to the solid base of the bridge that supports the tracks is approximately 55 feet. Based on the estimated

widths and heights of the various replacement bridge options, a height to width ratio was calculated for each option to determine if shading impacts could occur to existing SAV beds. These results suggest that SAV should continue to be able to grow beneath the replacement bridge, regardless of which alternative is selected. The Project Team will continue to consult with DNR and other appropriate resource agencies regarding SAV as the project progresses.

D.8.5 FOREST RESOURCES

The presence of forests was determined through a combination of mapping resources and preliminary field surveys. A majority of the forest resources within the study area consist of smaller patches of deciduous forest that lie between the Amtrak right-of-way and residential or commercial properties. Therefore, these forests are not likely of high quality. One of the exceptions is a large forested area in the southern portion of the study area in Harford County. This area is associated with unnamed tributaries to Swan Creek and Gashey's Creek and a WSSC. Based on a review of aerial coverage, the interior of this forested area may also be considered regulated Forest Interior Dwelling Species (FIDS) habitat, as it is a part of a large (>500 acres) contiguous forest that lies within the Critical Area. No impacts to this forest resource are anticipated.

Forest impacts associated with the alternatives are expected to range from 0.17 (Alternative 4E) to 2.92 acres (Alternative 9A). Of these forest impacts, none are anticipated to impact potential FIDS habitat. Forest impacts would be less than one acre for Alternatives 4C, 4E, 8A, and 8B. As detailed studies are conducted, coordination will continue with DNR for forest impacts in accordance with the Maryland Forest Conservation Act.

D.8.6 IN-STREAM RESTRICTIONS AND NOTED FISHERIES INFORMATION

Federally Listed Species

An on-line project review with the US Fish and Wildlife Service (USFWS) indicated suitable habitat is located within the study area for the federally-listed threatened northern long-eared bat (NLEB) (*Myotis septentrionalis*). NLEB roost during the summer months in forested areas; therefore, alternatives impacting the greatest amount of forest have a higher potential for impacts to NLEB habitat. Additional coordination with the USFWS will be required to determine the level of coordination and potential avoidance/minimization activities that would be required as part of the proposed alternatives. In addition, critical habitat is present for the federally-endangered Maryland darter (*Etheostoma sellare*). However, Maryland darter has not been found within the state for many years, and is now considered extirpated from Maryland. The Project Team sent a letter requesting information on threatened and endangered species to the NOAA National Marine Fisheries Service (NMFS) on February 14, 2014. In a response dated March 5, 2014, NOAA-NMFS identified the Shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), Kemp's ridley sea turtle (*Lepidochlys kempi*), green sea turtle (*Chelonia mydas*), and leatherback turtle (*Dermochelys coriacea*) as endangered species that may occur within the study area. The threatened species found in the waters of the area may include the Atlantic sturgeon and the loggerhead sea turtle (*Caretta caretta*).[1] In addition, the project is located above the estuarine mixing zone in tidal fresh waters. It is not designated as an essential fish habitat (EFH) for federally managed species. It is

[1] Atlantic sturgeon as a species are subdivided into five Distinct Population Segments (DPSs) based on the river in which the sturgeon originated. Although most of the DPSs are listed as endangered, the Gulf of Maine DPS is listed as threatened.

however an important migration area for species such as American shad, alewife, blueback herring, striped bass, hickory shad, gizzard shad, and American eel.

State Listed Species

The Project Team sent a similar letter to DNR's Integrated Policy Review Unit on February 14, 2014. In a response dated October 22, 2014, DNR identified American eel as an important fishery within the study area, as discussed previously, and the presence of sturgeon (shortnose and Atlantic) within the study area. Both sturgeon are protected species, and have specific management requirements and efforts by NMFS, USFWS, and cooperation with DNR. DNR also identified the presence of freshwater mussels within the study area, some of which are state-listed as threatened or endangered. The DNR Wildlife and Heritage Service is the state lead for state-listed freshwater mussel species. As there is a potential for these species to be found within the study area, further coordination will be necessary on the potential mussel presence and Best Management Practices for their protection.

Logperch

Logperch is state-listed in Maryland as threatened and is considered imperiled or critically imperiled due to its rarity. This freshwater perch in the family Percidae is most commonly found in riverine habitats characterized by coarse sand and gravel substrates with or without aquatic vegetation. This species can be found in swift currents or slow-moving lotic habitats. Adult logperch may occur year-round upstream of the study area between the Conowingo Dam and the Interstate 95 bridge. Spawning occurs in the spring and summer between March and July. Further coordination with DNR will be necessary on the potential presence of logperch.

Map Turtle

The state-listed endangered Northern Map Turtle (*Graptemys geographica*) is documented in the study area both within and along the banks of the Susquehanna River. The shores of the Susquehanna River are used by the Map Turtle for habitant nesting and foraging and the turtles hibernate on the river bottom in winter. DNR may require restrictions on construction projects in order to protect Map Turtles including, but not limited to: conducting nesting surveys during the nesting season to identify the presence/absence of nests within a project area, in-stream time-of-year restrictions from November 1st through April 1st, and/or removal of turtles from the work zone using trained scuba divers. Coordination with DNR on protection of the Map Turtle is ongoing.

D.8.7 OTHER RARE, THREATENED AND ENDANGERED SPECIES NOTED

Listed Species

For state listed species and species of statewide importance, DNR Wildlife and Heritage Unit issued a letter dated March 20, 2014 that identifies potential Rare, Threatened, and Endangered (RTE) species or species of statewide importance that could occur within the study area. The letter identified the presence of a WSSC located within the Swan Creek drainage just south of the Amtrak right-of-way at the western end of the study area. At the eastern end of the study area, the DNR letter identified the presence of a known site within the Furnace Bay wetlands that supports a population of state-listed endangered water horsetail (*Equisetum fluviatile*) and vetchling (*Lathyrus palustris*). Both plant species are found in aquatic habitats. No other state-listed species were documented by the DNR as potentially occurring within the study area. There are no impacts anticipated with the WSSC or the state listed species.

Waterfowl Concentrations

The presence within the study area of historic waterfowl concentration and staging areas within the Susquehanna River was also referenced in the March 20, 2014 DNR letter. According to the Maryland Environmental Resources and Land Information Network (MERLIN) online mapping tool, two waterfowl areas occur within the study area, one in the Susquehanna River crossed by the existing Susquehanna River Rail Bridge and the other within Furnace Bay at the extreme eastern end of the study area. These waterfowl areas are historic waterfowl staging areas and wintering sites for waterfowl, such as diving ducks, swans, and geese that forage on fish and shellfish near the mouth of the Susquehanna River and within Furnace Bay. The boundary of the waterfowl area within the Susquehanna River lies primarily within Cecil County, from the US 40 Bridge to the mouth of the river. The Furnace Bay waterfowl area lies outside of the Proposed Project limits of disturbance. Any potential impacts associated with the waterfowl concentration areas will be coordinated with DNR.

D.9 CONTAMINATED AND HAZARDOUS MATERIALS

The Project Team performed a Phase 1 Environmental Site Assessment and identified potential contaminated and hazardous materials. The project team identified nine sites, in addition to the current rail line, as sites that may have environmental impacts on the Proposed Project based on the impact boundaries. Of those sites, two appear to intersect the impact boundaries. The seven sites that do not appear to intersect are sufficiently close and potentially contaminated and may have potential impacts. The sites include:

- Former Carroll's Laundry
- Former Pennsylvania Railroad Shops
- A-1 Sales, Inc.
- Former Gas Stations
- Gilbert Tank Farm
- Perryville Substation
- Norfolk Southern Railroad
- Perryville Chevron
- Amtrak Maintenance Facility Yard

There would be no major differences among the 10 alternatives with respect to contaminated and hazardous materials. There are two known contaminated properties directly impacted by Alternatives 1B, 4C, 4E, 8A, 8B, 9A, 9B, and VE. For Alternatives 4B and 4D, there are three known contaminated properties that would be directly impacted. The potential effects of contaminated and hazardous materials for each retained alternative will be discussed in more detail in the EA.

D.10 CONSTRUCTION EFFECTS

While the duration of the construction period varies between four and five years for each alternative, there would be no major differences in impacts to communities during construction between the 10 preliminary alternatives. All alternatives would require the temporary winter closure of the span and similar staging areas. The construction effects of each retained alternative will be evaluated in detail in the EA.

E. PUBLIC INVOLVEMENT AND AGENCY COORDINATION

During the conceptual alternatives development and the two-step screening process, the Project Team sought input from the public and various governmental agencies. For a list of all meetings held to date, see Table 5. A more detailed summary on public involvement and agency coordination is included in Appendix C.

Table 5
All Meetings Held to Date

Meeting Date	Meeting Topic
Public Involvement Meetings	
April 28, 2014	POIS Purpose & Need/ Project Introduction
August 13, 2014	POIS Feasible Alternatives
December 10, 2014	POIS Alternatives Retained for Detailed Study
Stakeholders Meetings	
June 6, 2014	Bicycle-Pedestrian stakeholders meeting
June 17, 2014	Presentation to the Town of Perryville
July 1, 2014	Presentation to Cecil County
November 6, 2014	Meeting with Susquehanna River Rail Bridge Project Advisory Board
December 2, 2014	Bicycle-Pedestrian Coordination Meeting
March 9, 2015	Section 106 Consulting Parties
March 26, 2015	Meeting with Susquehanna River Rail Bridge Project Advisory Board
July 7, 2015	Meeting with Harford County Public Schools
July 18, 2015	Meeting with Harford County Public Schools
July 28, 2015	Baltimore Metropolitan Council (BMC) Meeting
August 17, 2015	Meeting with Harford County Public Schools
August 18, 2015	Section 106 Consulting Parties
Agency Coordination Meetings	
July 17, 2013	IRM Project Introduction
February 19, 2014	IRM Purpose & Need Meeting
March 19, 2014	Project Coordination Meeting with NS/FRA/MDOT/Amtrak
April 16, 2014	IRM Purpose & Need/ Conceptual Alternative
June 18, 2014	IRM Feasible Alternatives
February 18, 2015	IRM Preliminary Alternatives Retained for Detailed Study
March 12, 2015	IRM Agency Field Visit
April 15, 2015	IRM ARDS Field Visit Recap
June 17, 2015	IRM Refined Alternatives Retained for Detailed Study

Notes:
POIS = Public Outreach Information Session
IRM = Interagency Review Meeting
NS = Norfolk Southern
FRA= Federal Railroad Administration
MDOT= Maryland Department of Transportation

F. RESULTS OF DETAILED SCREENING

As described in Section D, the second step of the screening process was based on a more detailed evaluation of the 10 alternatives that passed the fatal flaw screening (see Appendix A, Figure 7). Environmental impacts in comparison to the operational needs of the project were

evaluated. The replacement of the Susquehanna River Bridge is a major infrastructure investment on the NEC that, as with the existing bridge, is potentially anticipated to provide service over 100 years. Therefore, the detailed screening process included a review of the alternative's consistency with the planning efforts associated with the High Speed Intercity Passenger Rail Program, NEC FUTURE Program, the 2008 Congressional Mandate for improved travel time on the NEC, and the Amtrak NEC Master Plan.

The Alternatives remaining after the detailed screening met engineering criteria (including design, operational, and construction goals), were consistent with the NEC planning, minimized environmental impacts as much practicable and incorporated public and agency comments. These alternatives will be retained for more detailed evaluation in the EA.

F.1 ALTERNATIVES REMOVED FROM FURTHER CONSIDERATION

The alternatives that satisfy critical operational requirements: a maximum authorized speed of 160 mph and four tracks across the Susquehanna River include Alternatives 4B and 9A. Alternative 4B provides for 160 mph and four tracks but was eliminated along with 4C, 4D, and 4E primarily due to the acquisition in full of the Lafayette Senior Housing Facility. The Lafayette Senior Housing Facility is a residential property that provides 15 units of affordable housing to the elderly and accepts Section 8 vouchers. Alternative 4B is also among the highest impacts to linear feet of streams and forest acreage compared to the other proposed alignments.

In addition to the impacts to the Lafayette Senior Housing Facility, Alternatives 4C and 4E have maximum speeds of 135 mph, which is considerably lower than the 160 mph speeds planned along the NEC. Alternative 4E also only provides three tracks across the Susquehanna River which would not meet corridor wide improvement goals along the NEC.

Though Alternative 4D can reach a maximum authorized speed of 160 mph it only provides three track bridge, and both Alternatives 4B and 4D would result in major impacts to Perry Electrical Substation.

Alternatives 8A and 8B were eliminated for having the lowest allowable speeds of any of the proposed alignments, and Alternative 8B provides for only three tracks. The lower speeds do not support the Congressional mandate to improve travel times along the NEC or optimize planned infrastructure. Even with the lower speeds, these alternatives result in major impacts to Perry Electrical Substation.

Similarly, the VE Alternative has a design speed of 140 mph, and has major impacts to Perry Electrical Substation. The VE Alternative would also have the highest acreage of impacts to the Chesapeake Bay Critical Area compared to other alternatives and was eliminated from further study.

Alternative 1B provides a maximum speed of only 140 mph and offers the flexibility of three or four tracks. Alternative 1B is relatively comparable to Alternatives 9A and 9B in terms of human and natural environmental impacts. Alternative 1B has less property impacts, more impacts to the Perry Electrical Substation, and more potential wetland impacts than Alternatives 9A and 9B. Alternatives 9A and 9B provide more long-term benefits due to the higher speed allowances (160/150 mph vs. 140 mph).

An analysis was prepared to compare the costs associated with the travel-time differences at 140, 150, and 160 mph. Table 6 lists the value of travel time savings of 160 mph or 150 mph vs. 140 mph for the current year as well as over a 75 year estimated life span of the Susquehanna Bridge.

After comparing all the factors for Alternatives 1B with the 140 mph maximum authorized speed, Alternative 1B is not being retained for detailed study.

Table 6
Value of Travel Time Savings

	160 mph vs. 140 mph	150 mph vs. 140 mph	160 mph vs. 150 mph
Current Year	$801,000	$280,000	$521,000
Full 75 Years	$339,000,000	$118,000,000	$220,000,000

The value of the travel time savings was calculated by multiplying the minutes saved per passenger by the Value of travel time savings per hour, developed by the US DOT, to determine the total value. The assumptions are listed below:

- Maximum Authorized Speed: 160 mph or 150 mph vs. 140 mph.
- Air and High Speed Rail Value per Hour[1]: Business - $62.35 & Personal - $34.77.
- High Speed Trains per day: 64 per weekday & 32 per weekend day.[2]
- Seats per Train: 436 seats.
- Average Load Factor: 80%.
- Business vs Personal Travel: Weekdays: 80% Business / 20% Personal & Weekends: 25% Business / 75% Personal.
- Life Span of Bridge: 75 Years
- Yearly Inflation over Life Span of Bridge: 3.9%[3]

F.2 ALTERNATIVES RETAINED FOR DETAILED STUDY

Based on the detailed screening shown in Figure 5 (see Appendix A) and the environmental screening shown in Section D, "Step 2: Detailed Screening", the following preliminary alternatives were retained for detailed study: Alternative 9A and Alternative 9B (see Appendix A, Figure 17)**.** The primary differentiators in selecting the alternatives retained for detailed study included: maximum authorized speed, potential property impacts and the total number of tracks across the river. Based on operational information, a four-track river crossing (or a three-track river crossing with the potential for the addition of a fourth track) and a maximum authorized speed of 160 mph is desired to optimize the NEC as a high-speed rail corridor.

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[1] http://www.dot.gov/sites/dot.dev/files/docs/vot_guidance_092811c.pdf, Inflated to 2015 based on CPI from the Bureau of Labor Statistics.

[2] 2020 Service Plan with half hourly weekday and hourly weekend service assumed over entire 75 year service life of bridge. 3rd hourly frequency not assumed.

[3] http://www.bls.gov/data/inflation_calculator.htm Inflation over last 75 years assumed to be the same over the next 75 years. This works out to 3.884% average inflation per year.

Alternative 9A has some higher human environmental impacts compared to other alternatives. Opportunities to mitigate the environmental impacts are being identified, including the possibility of relocating the Perry Interlocking Tower (a contributing element of the S/NR-eligible Perryville Railroad Station) to avoid demolition. Additionally, the project is coordinating with Harford County Public Schools regarding potential impacts to the Havre de Grace Middle/High School athletic fields. In comparison to Alternative 9A, Alternative 9B provides for a maximum authorized speed of only 150 mph; however it avoids impacts to the Havre de Grace Middle/High School athletic fields and has fewer property impacts due to its lower design speed.

Alternatives 9A and 9B offer the flexibility of providing three or four tracks across the river and allow for a maximum speed between 150 and 160 mph. The FRA and MDOT determined that Alternative 9A and Alternative 9B meet the goals and objectives of the project while minimizing overall impacts. FRA and MDOT will conduct detailed analyses and evaluate the potential environmental impacts of a full four-track river crossing for these two alternatives. FRA and MDOT will continue to investigate opportunities to further minimize and mitigate the environmental impacts in coordination with the public and resources agencies.

G. BRIDGE DESIGN TYPES

Independent of the Alternative Screening Process and selection of alternatives for detail study, the Project Team is reviewing four bridge types for the project. The bridge types are independent from the two step screening process since any of the bridge types are feasible with the alternative locations under consideration (See Appendix A, Figure 18). The impacts to the Susquehanna River, natural resources, visual and aesthetic considerations, and the construction impacts associated with each type are still being evaluated and coordinated with the resource agencies and public. The four bridge design types being evaluated are described below.

G.1 GIRDER APPROACH / ARCH MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 21 in-water piers. The proposed west bridge would have 20 in-water piers. Sixteen (16) piers would be removed from the existing bridge and 13 remnant piers would be removed for a net gain of 12 overall piers. The girder approach / arch main span bridge design is based on 170 foot approach spans.

G.2 DELTA FRAME APPROACH / ARCH MAIN SPAN

This bridge design type consists of a network tied arch over the navigable channel with delta frames for the approach spans. Under this bridge design type, the proposed east bridge would have a total of 17 in-water piers. The proposed west bridge would have 18 in-water piers. 16 piers would be removed from the existing bridge and 13 remnant piers would be removed for a net gain of 6 overall piers. The delta frame approach / arch main span bridge design is based on 200 foot approach spans.

G.3 TRUSS APPROACH / TRUSS MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 15 in-water piers. The proposed west bridge would have 15 in-water piers. 16 piers would be removed from the existing bridge and 13 remnant piers would be removed for a net gain of one overall pier. The truss approach / truss main span bridge design is based on 240 foot approach spans.

G.4 GIRDER APPROACH / TRUSS MAIN SPAN

Under this bridge design type, the proposed east bridge would have a total of 21 in-water piers. The proposed west bridge would have 20 in-water piers. 16 piers would be removed from the existing bridge and 13 remnant piers would be removed for a net gain of 12 overall piers. The girder approach / truss main span bridge design is based on 170 foot approach spans.

H. CONCLUSION

The Project Team evaluated 25 alternatives for the Susquehanna River Rail Bridge Project using a two-step screening process. The first step eliminated fifteen conceptual alternatives based on fatal flaws, and the second step eliminated eight preliminary alternatives based on a review of purpose and need, operational goals, and a comparison of environmental impacts. Two alternatives, Alternatives 9A and 9B remain for detailed study and evaluation in the EA.

The proposed project is a major infrastructure project for the NEC with an expectation to have a life span well over 75 years, which is not unlike people's expectations of the existing bridge over 100 years ago. The decisions for this project must balance the consequences of the construction of this project with the long term vision of the NEC, the existing national High Speed Rail Program, and the continuous growth and upgrades in Amtrak services consistent with the 2008 Congressional Mandate and their NEC Master Plan.

Alternatives 9A and 9B provide for the planned rail operational needs, are consistent with long-range NEC programs, and have relatively minimal impacts to the human and natural environment as outlined in this report. The impact evaluation in progress for the specific types of bridge designs will be coordinated with the resource agencies and the public prior to the EA.

The EA will include a comprehensive environmental analyses for Alternatives 9A and 9B, including the bridge type design(s) resulting from the ongoing evaluation and stakeholder coordination. These environmental analyses will include studies of transportation, land use, air quality, noise, vibration, visual and aesthetic considerations, socioeconomic conditions, parkland, historic and archaeological resources, environmental justice, indirect and cumulative effects, and construction impacts. The analyses results in addition to comments received from the resources agencies, stakeholder, and the public will be the basis for FRA to select the preferred alternative, which will be documented in the EA.

The EA is scheduled to be completed in Spring 2016 and will be provided to the public for review and comment. A public meeting will be held for the project following the EA and prior to FRA making a final decision for this project.

Figure 1

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RAIL BRIDGE PROJECT

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Project Limits

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Figure 2

Conceptual Alternatives Development

Design Factors

Geometry	• Reduce curves to enable faster train speed. • Consider existing NEC and NS's Port Road Route.
Design Speed	• Consider 120 mph to 160 mph for intercity passenger trains. • 160 mph preferred speed for intercity passenger trains.
Bridge Spacing	• Minimize ROW impacts. • Consider existing swing span. • Consider constructibility.
Navigational Clearances	• Accommodate marine traffic with fixed bridge. • Horizontal clearance maintained or improved.
Grades	• Higher fixed bridge requires steeper grades. • Heavy freight trains require lower grades.
Relationships to other projects	• Freight rail improvements. • MARC Maintenance Facility and Penn Line extension. • NEC Future Tier I EIS. • Regional bicycle and pedestrian trails.

Figure 3

Conceptual Alternatives Development

18 different alignments

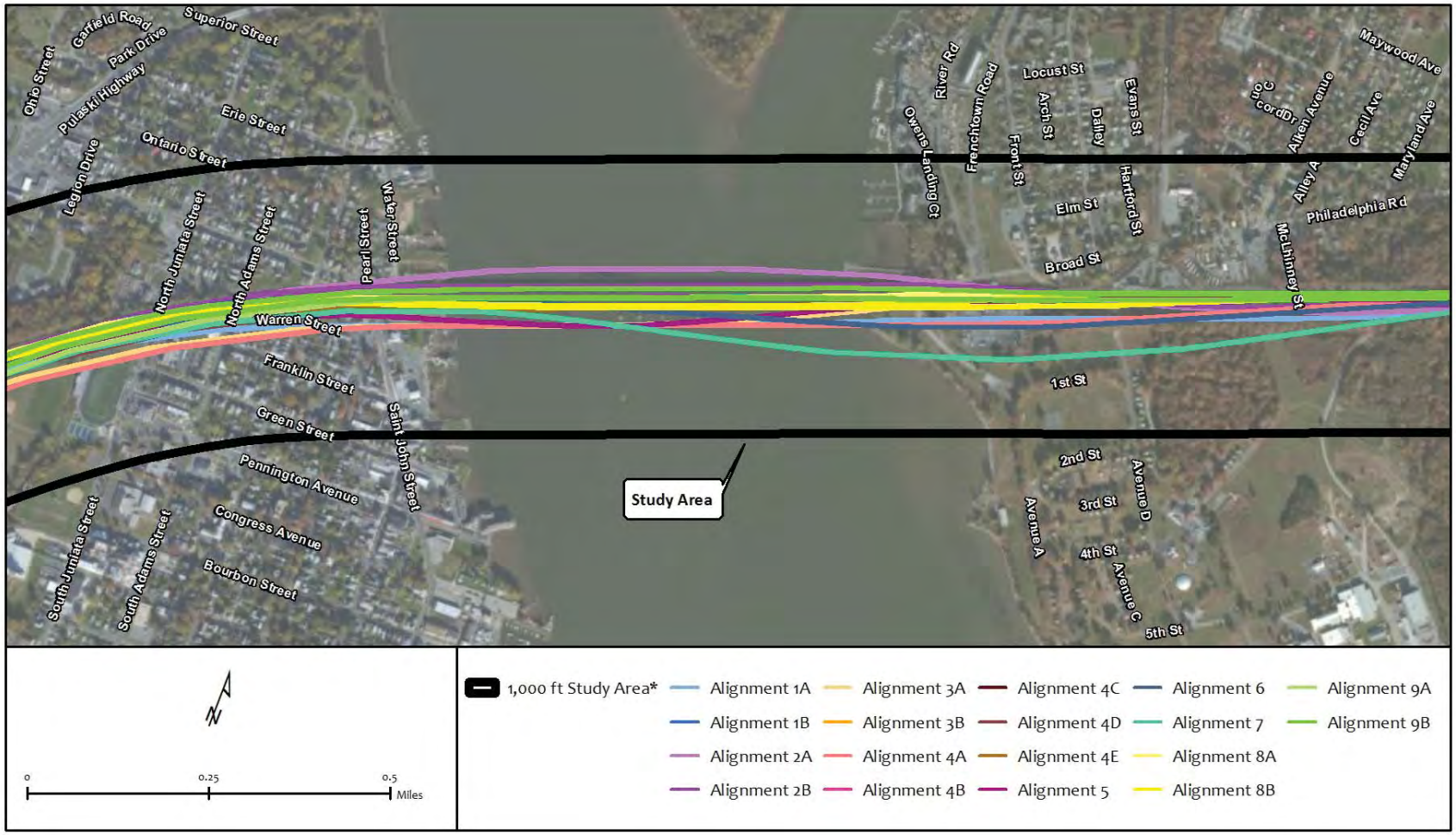
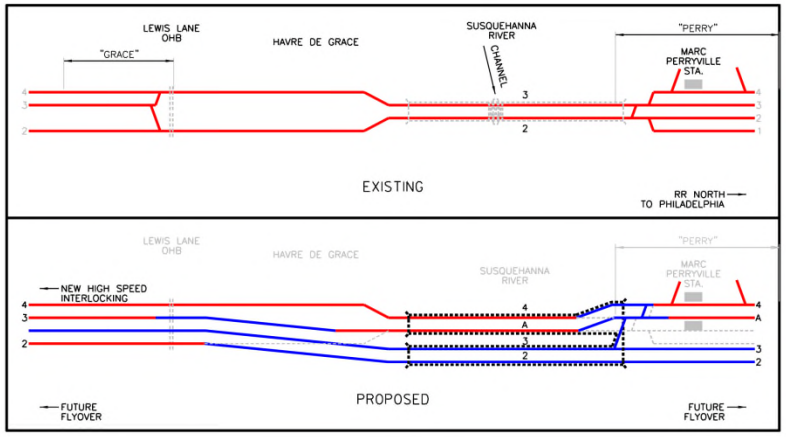


Figure 4

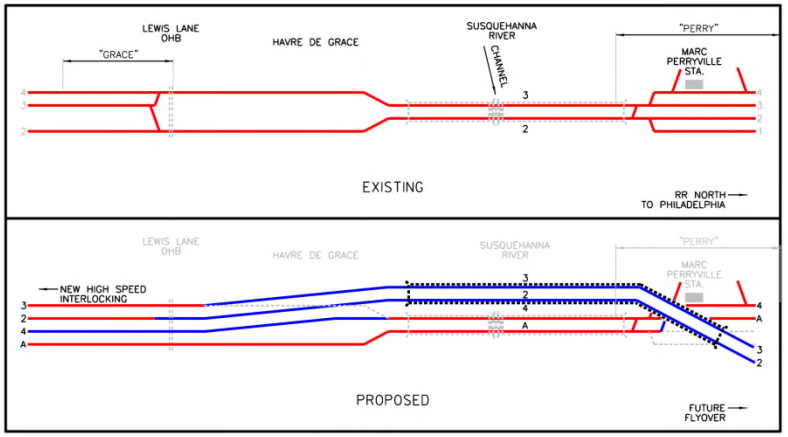
SUSQUEHANNA RIVER
RAIL BRIDGE PROJECT

Build Scenario Groupings

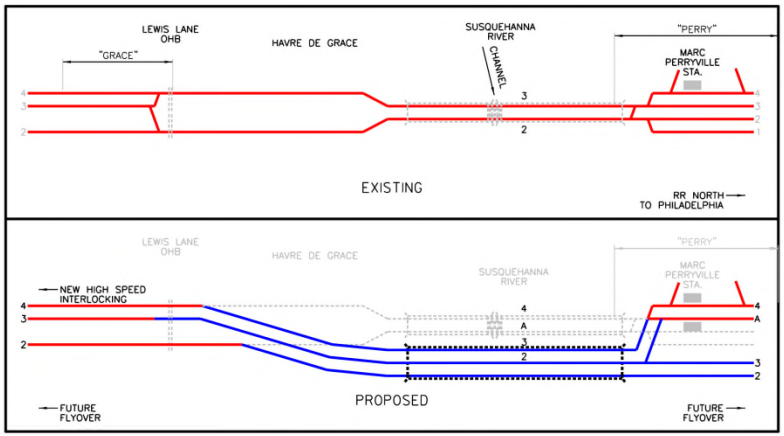
Build Scenario Group 1



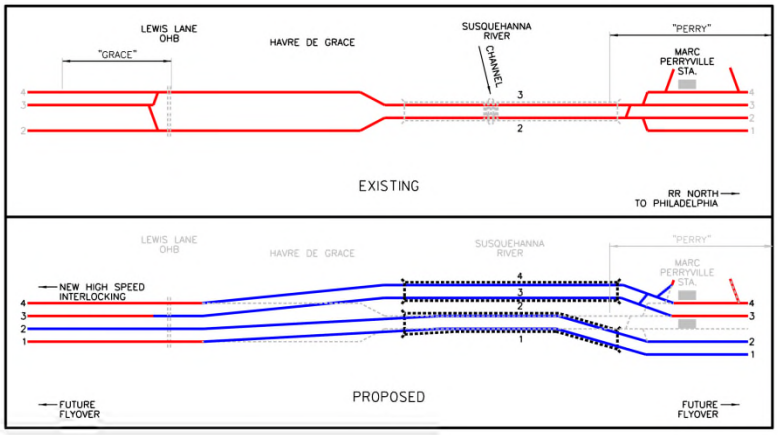
Build Scenario Group 2



Build Scenario Group 3



Build Scenario Group 4



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Two-Step Alternatives Screening Process

Step 1: Fatal Flaw Screening—criteria developed from Purpose & Need

➤ ***Pass/fail test—alternative must satisfy all criteria to advance***

- Provides rail connectivity
- Meets navigation requirements
- Has logical termini
- Is feasible & constructible
- Avoids critical property impacts (developed from community input)

Step 2: Detailed Screening—based on specific project goals

➤ ***Relative test—compare/contrast each alternative's ability to meet goals & objectives***

- Optimizes existing and planned infrastructure
- Considers operational, design, construction requirements
- Minimizes environmental/cultural/socioeconomic/property impacts

Figure 6

SUSQUEHANNA RIVER
RAIL BRIDGE PROJECT

Fatal Flaw Screening

Compare each alignment to fatal flaw criteria

Input from freight RRs →

Rail Connectivity
Maintain NEC rail connectivity

← **Input from FTA/MTA**

Input from USCG →

Navigational Requirements
Maintain navigation along river

← **Input from mariners**

Logical Termini
NEC from MP 57.3 to MP 63.5

Feasibility and Constructability
Practical to engineer & construct

Input from Perryville →

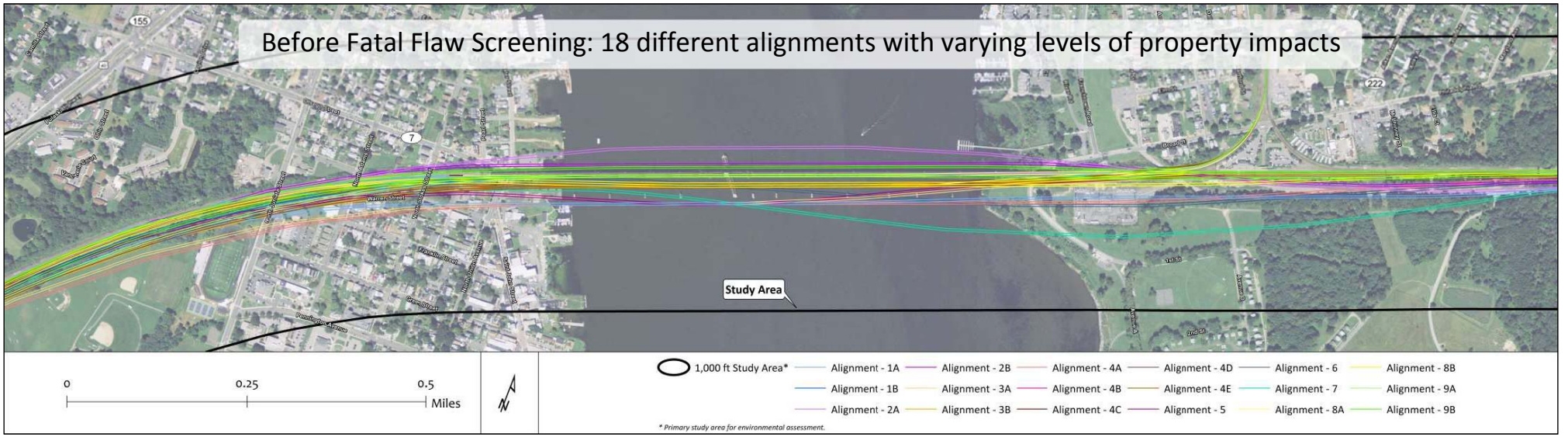
Critical Property Impacts
(e.g. Rodgers Tavern, Legion)

← **Input from Havre de Grace**

Figure 7

SUSQUEHANNA RIVER
RAIL BRIDGE PROJECT

Conceptual Alignments Considered



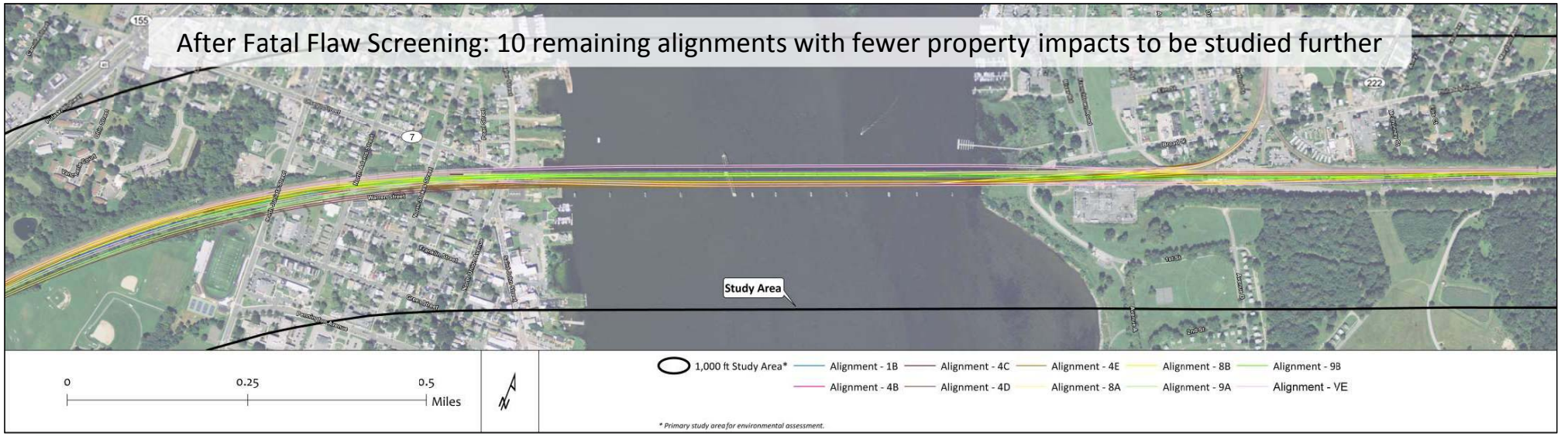


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Figure 8

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RAIL BRIDGE PROJECT

Parks and Community Facilities

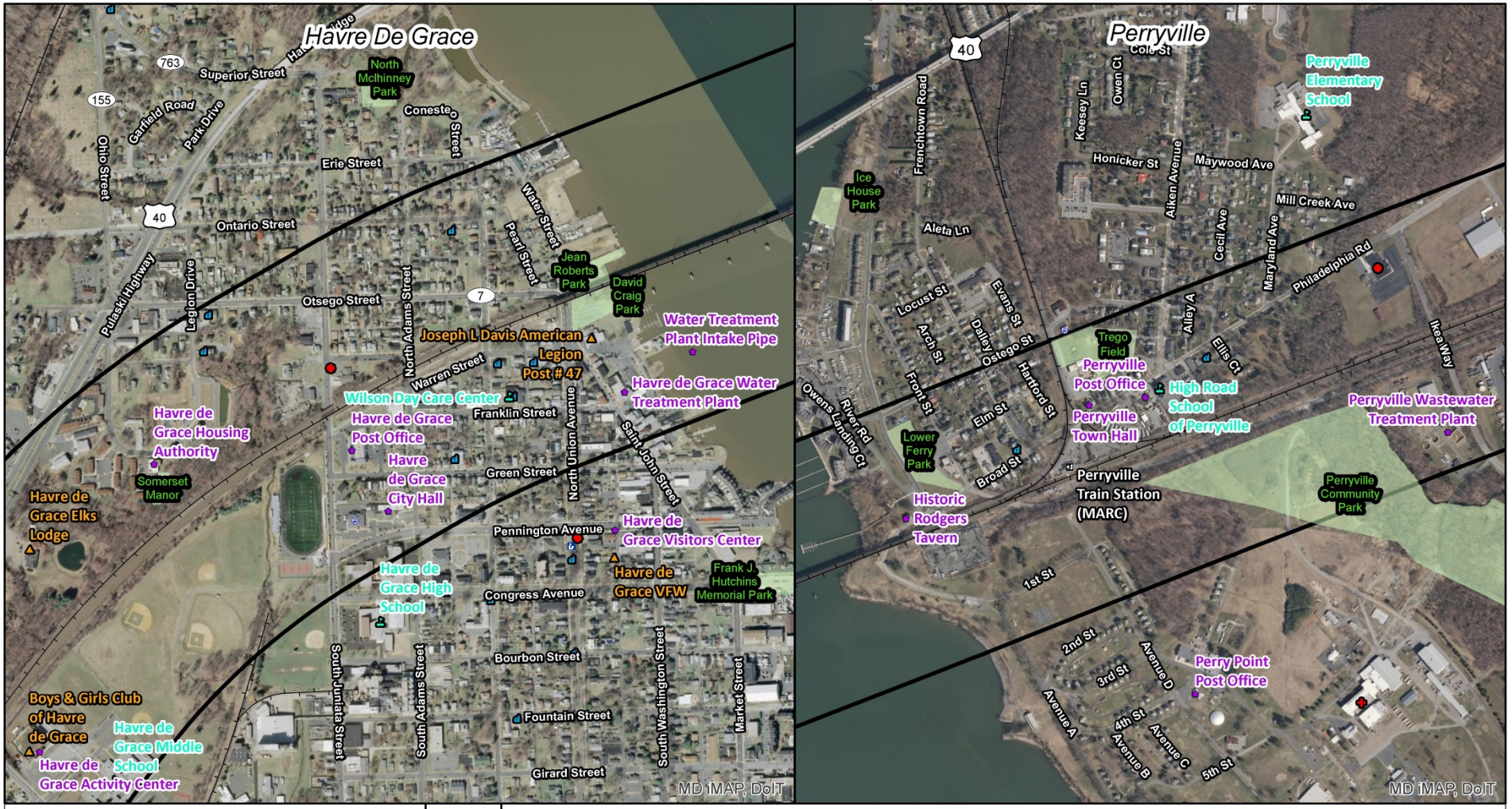

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Figure 9

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RAIL BRIDGE PROJECT

Historic Architectural Resources – Havre de Grace

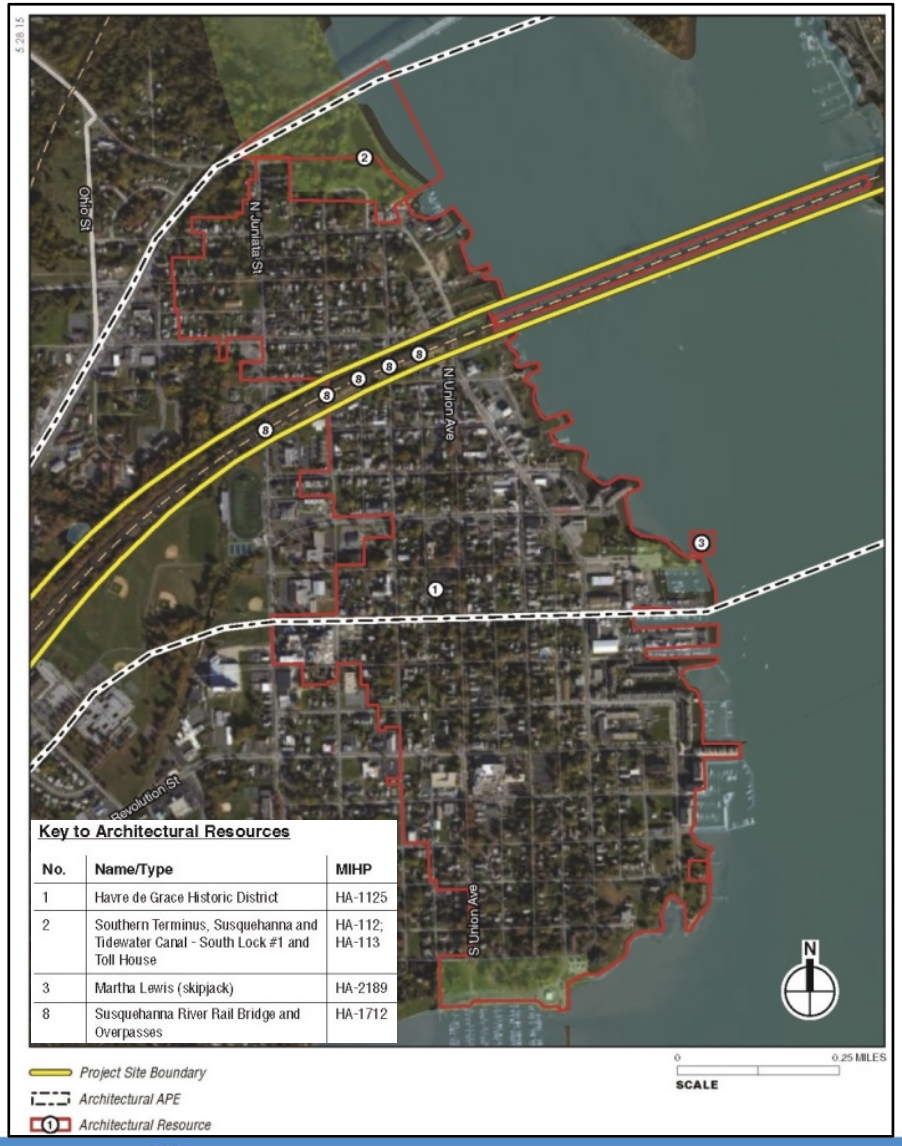

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Figure 10

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Historic Architectural Resources - Perryville

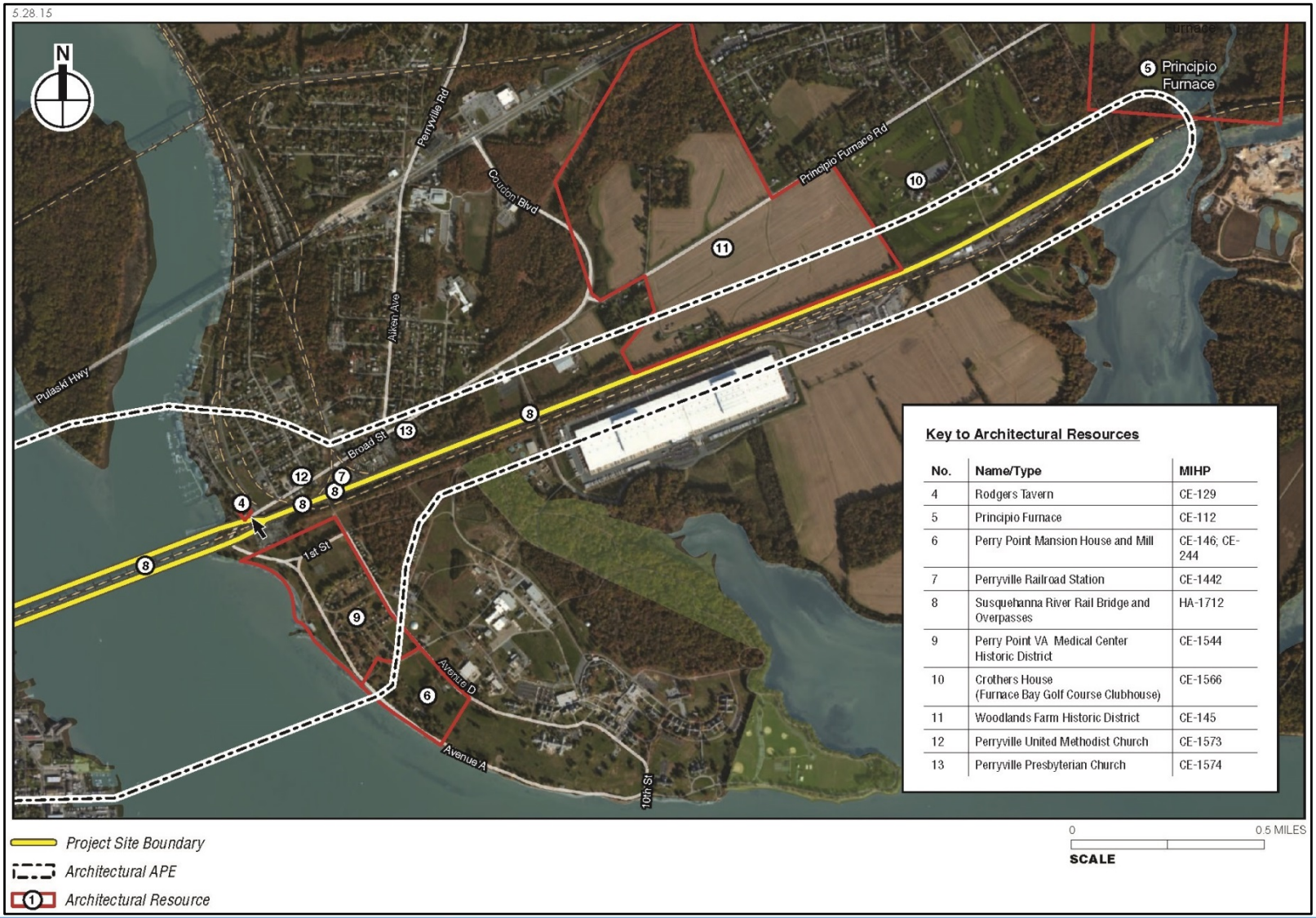

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Figure 11

SUSQUEHANNA RIVER
RAIL BRIDGE PROJECT

Potential Property Impacts from Eliminated Alternatives

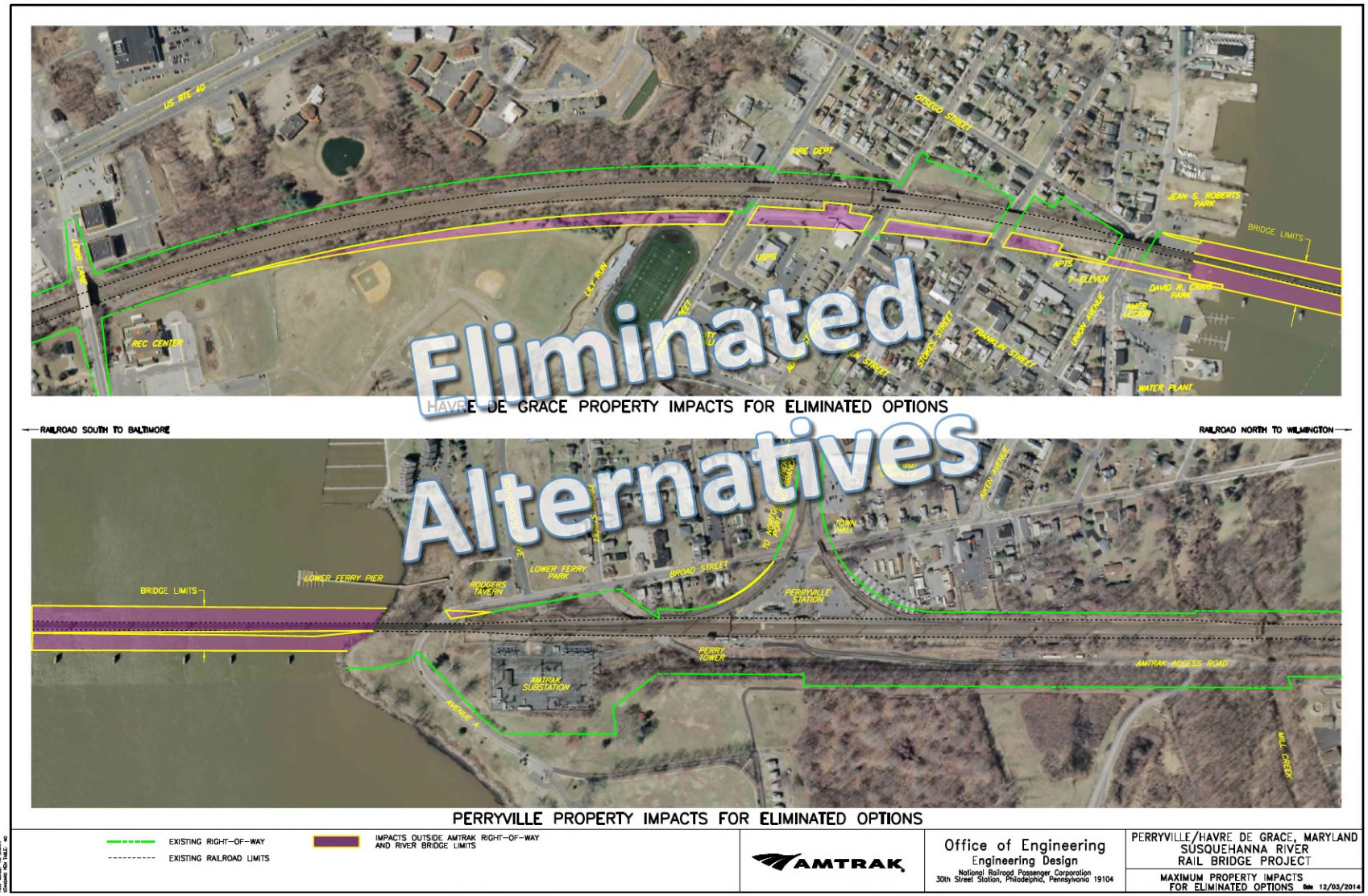

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Figure 12

SUSQUEHANNA RIVER
RAIL BRIDGE PROJECT

Potential Property Impacts from Retained Alternatives

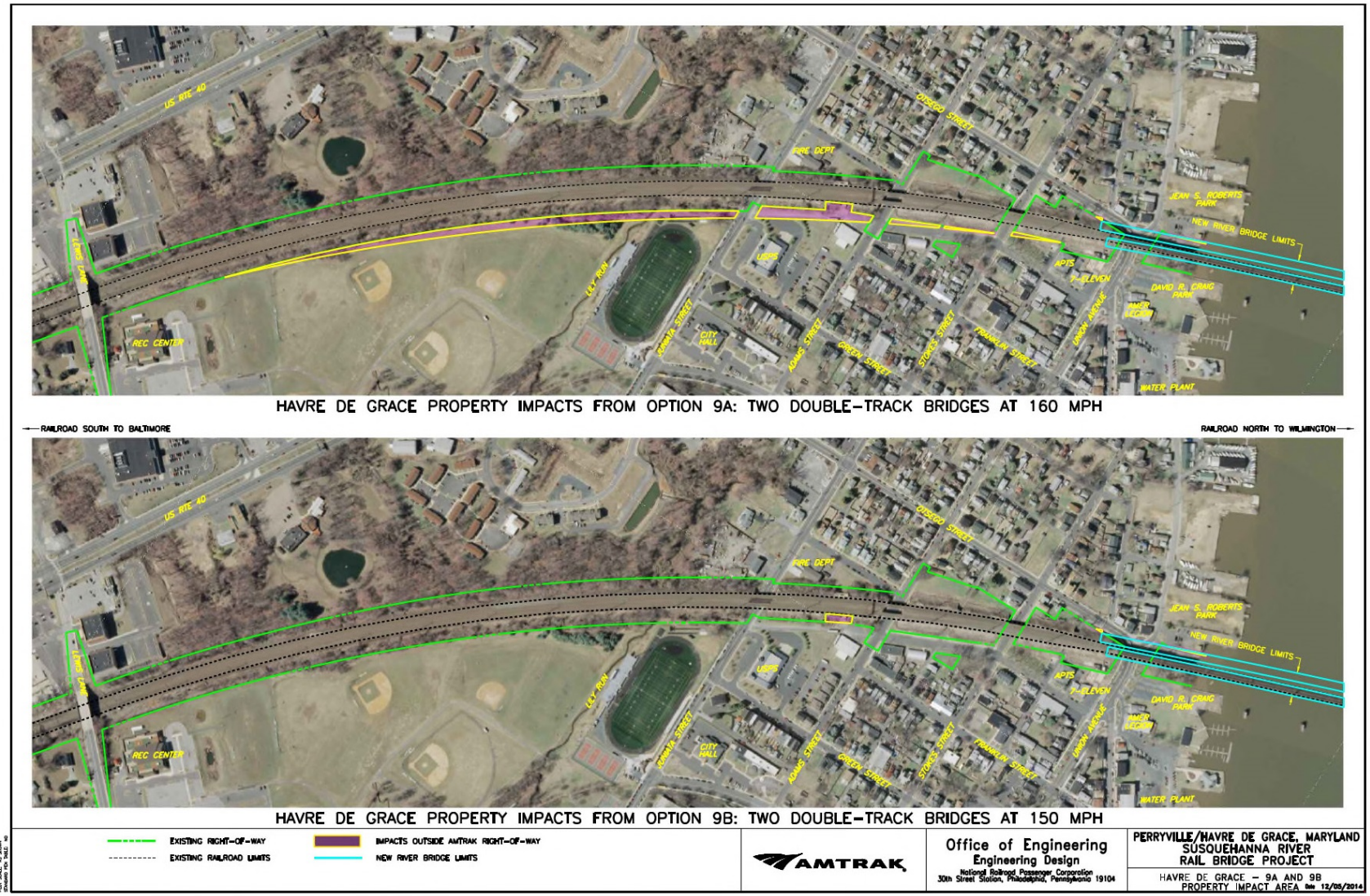

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Figure 13

SUSQUEHANNA RIVER
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Potential Property Impacts from Retained Alternatives

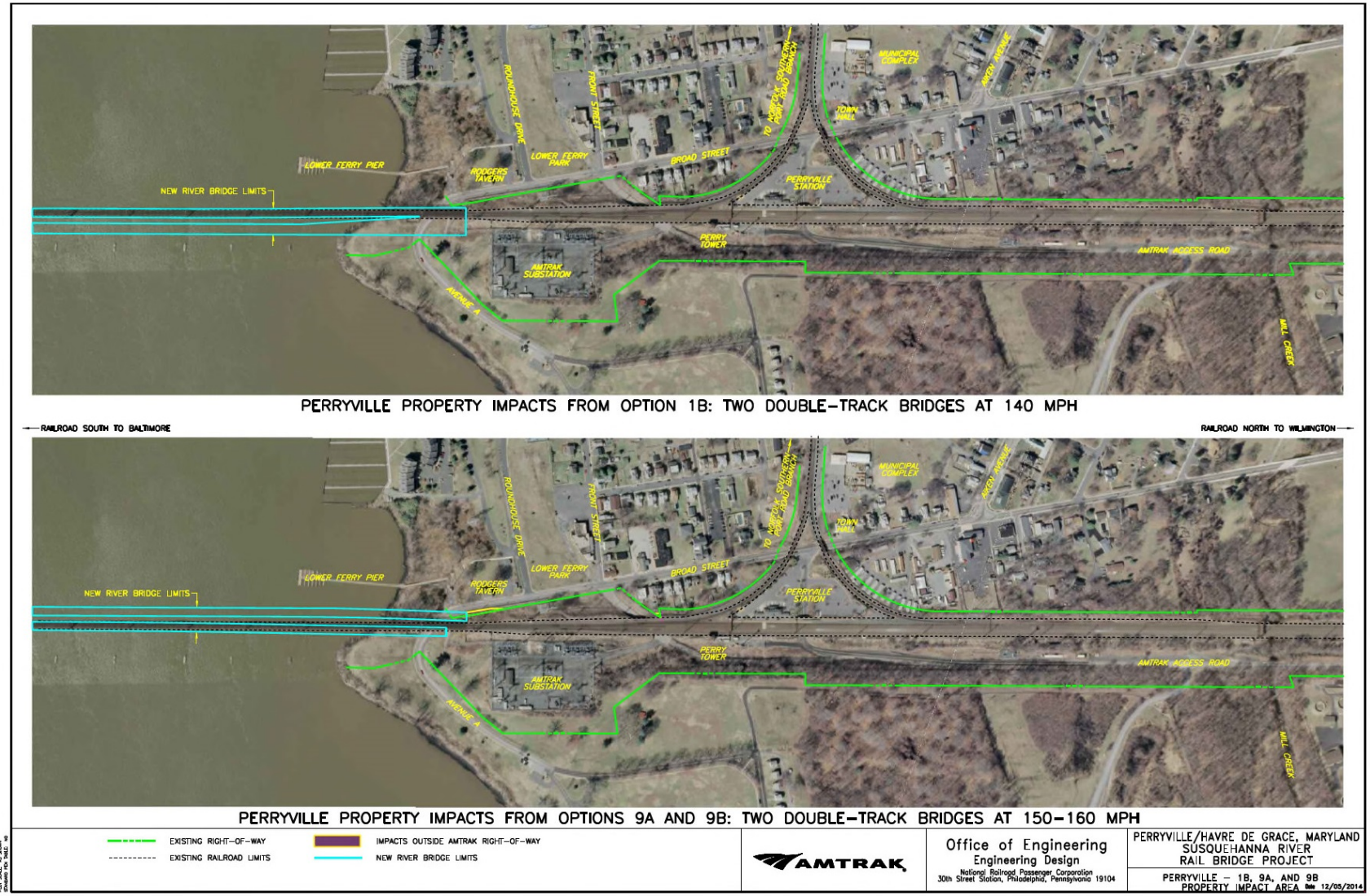

Figure 14

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Natural Resources

Began With Desktop Studies

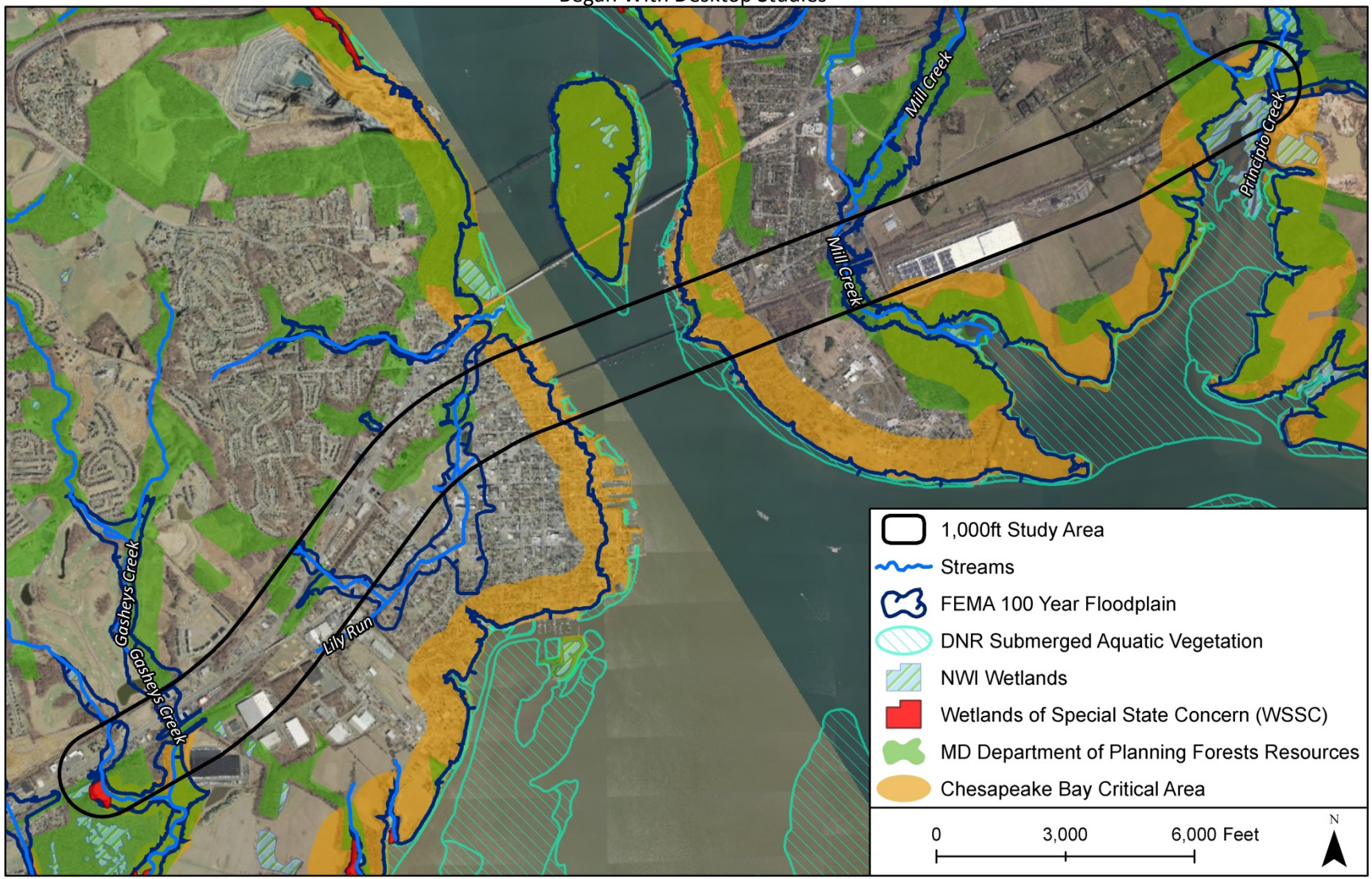

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Figure 15

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Natural Resources – Havre De Grace

Combining Desktop Studies with Field Surveys

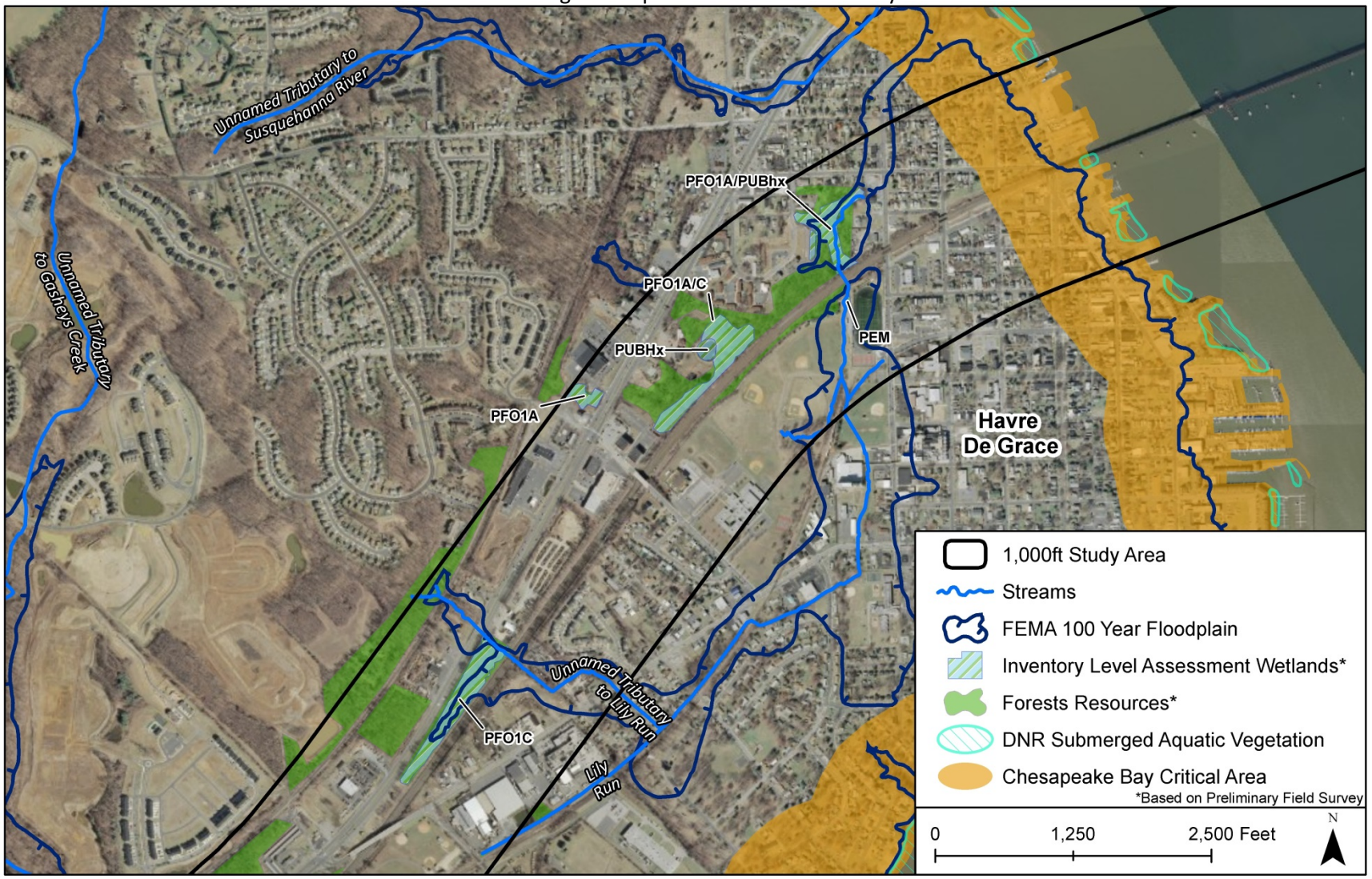

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Figure 16

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Natural Resources - Perryville

Combining Desktop Studies with Field Surveys

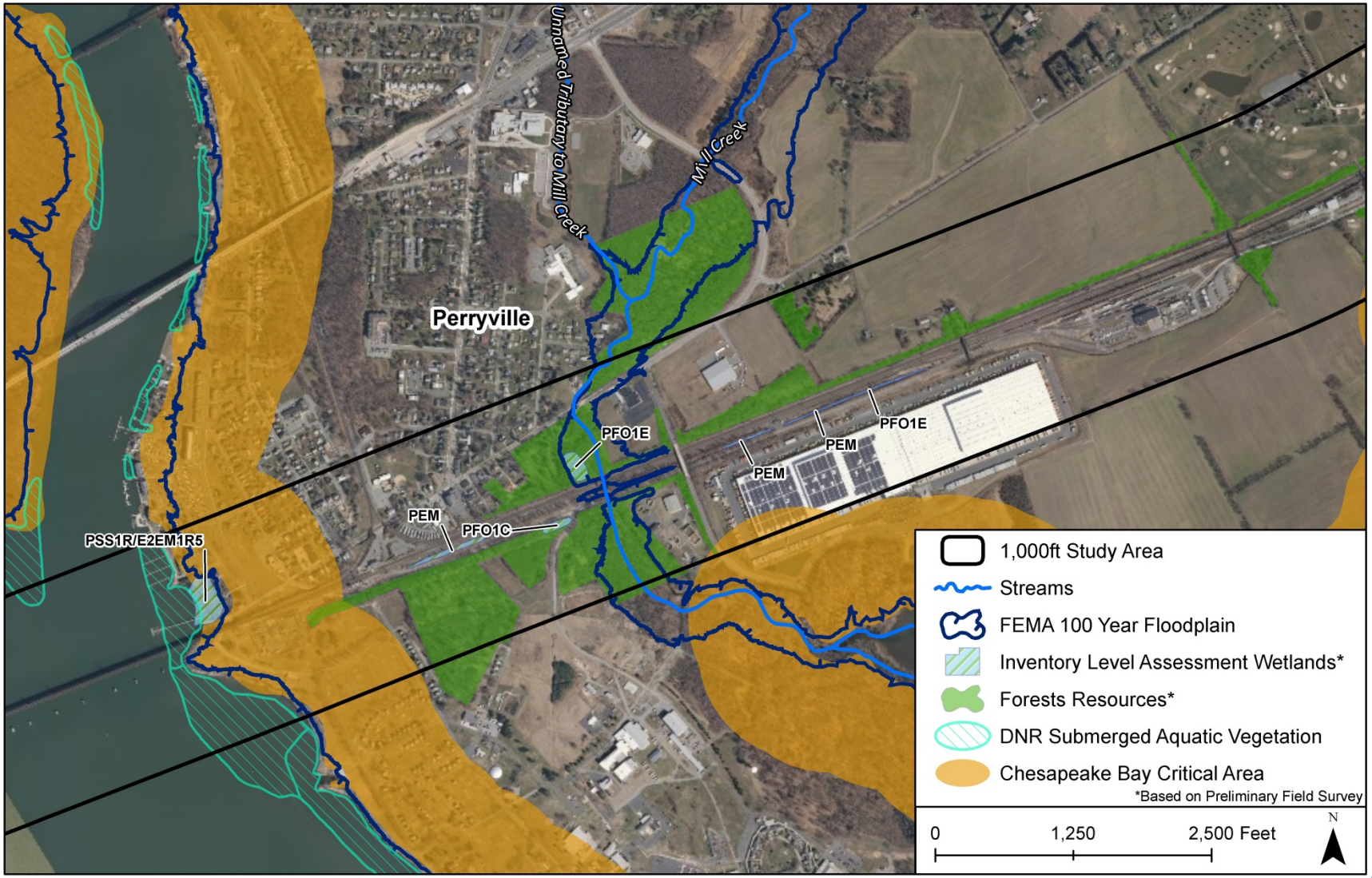

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Figure 17

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Alternatives Retained for Detailed Study Design Limits

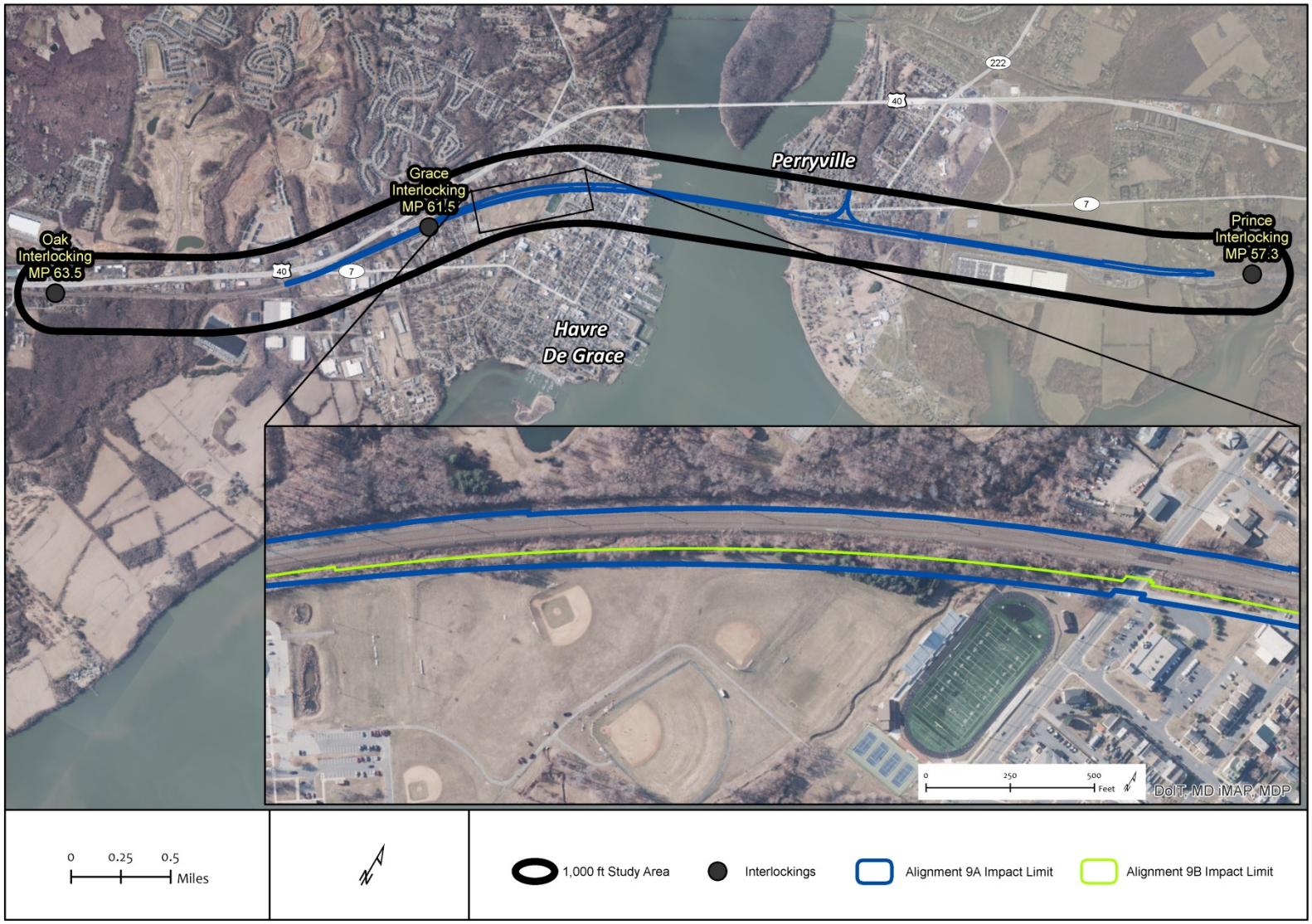

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Figure 18

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Bridge Design Types – Example Renderings

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EVALUATION CRITERIA AGENCY PRE-DRAFT		Units	Alternative 1B	Alternative 4B	Alternative 4C	Alternative 4D	Alternative 4E	Alternative 8A	Alternative 8B	Alternative 9A	Alternative 9B	VE
Alternatives Comparison Matrix - Environmental Considerations												
Human Environmental Considerations												
Permanent Impacts to Land Use and Community Facilities (Where structure demolition is required, a full parcel acquisition is assumed) °The Lafayette Senior Living Center accounts for 15 residential displacements.	Residential	Number of Parcels / Combined Acreage	0	1 parcel / 0.29 ac°	1 parcel / 0.29 ac°	1 parcel / 0.29 ac°	1 parcel / 0.29 ac°	0	0	1 parcel / <0.01 ac	1 parcel / <0.01 ac	0
	Commercial		2 parcels / 0.25 ac	2 parcels / 1.14 ac	2 parcels / 0.15 ac	2 parcels / 1.14 ac	2 parcels / 0.15 ac	2 parcels / 0.06 ac	2 parcels / 0.06 ac	2 parcels / 1.14 ac	2 parcels / 0.30 ac	2 parcels / 0.25 ac
	Institutional / Community Facility		0	1 parcel / 0.33 ac	0	1 parcel / 0.32 ac	0	0	0	0	0	0
	Park		0	2 parcels / 2.52 ac	1 parcel / 0.14 ac	2 parcels / 2.56 ac	1 parcel / 0.14 ac	0	0	2 parcels / 1.51 ac	1 parcel / 0.01 ac	1 parcel / 0.01 ac
	Undeveloped / Vacant		1 parcel / 0.10 ac	2 parcels / 0.41 ac	1 parcel / 0.40 ac	2 parcels / 0.41 ac	1 parcel / 0.40 ac	1 parcel / 0.04 ac	1 parcel / 0.04 ac	1 parcel / 0.05 ac	0	1 parcel / 0.09 ac
	Total Number of Parcels	#	3	8	5	8	5	3	3	6	4	5
	Total Acreage	Acres	0.35	4.69	0.98	4.72	0.98	0.10	0.10	2.71	0.32	0.36
	Potential Number of Residential and/or Commercial Relocations	#	0	16	15	16	15	0	0	1	0	0
Permanent Impacts to Parks and Recreational Resources (Parks avoided include Lower Ferry Park & Pier, Trego Field/Mini-Park, Perryville Community Park, and Existing bike/ped trails)	Jean Roberts Memorial Park [Amtrak and City owned Parcels]	Acres / Percent of Parcel Impacted	0	0	0	0	0	0	0	Total Combined Acreage 0.79 ac / 100% of Amtrak owned and 2.26 % of the City owned portion of the park impacted	Total Combined Acreage 0.79 ac / 100% of Amtrak owned and 2.26 % of the City owned portion of the park impacted	Total Combined Acreage 0.79 ac / 100% of Amtrak owned and 2.26 % of the City owned portion of the park impacted
	David Craig Park*		0	0.16 ac / 15.40%	0.14 ac / 13.50%	0.16 ac / 15.40%	0.14 ac / 13.50%	0	0	0	0	0
	Havre de Grace MS/HS Athletic Fields**		0	2.36 ac / 4.10%	0	2.40 ac / 4.2%	0	0	0	1.5 ac/ 2.60%	0	0
	Total Number of Parks Affected		0	2	1	2	1	0	0	2	1	1
	Total Acreage		0	2.52	0.14	2.56	0.14	0	0	2.29	0.79	0.79
Potential Impacts to Cultural Resources (The impacts to historic resources were identified based on right of way impacts and proximity based on conceptual design. Section 106 Effect Determination in consultation with MHT and the consulting parties will be provided for the alternatives retained for detailed study.)	**Number of Impacted Historic Properties**	#	2-3	2-3	2-3	2-3	2-3	2-3	2-3	3	3	2-3
	Total Acreage of Potentially Sensitive Archaeological Areas	Acres	0.20	0.20	0.20	0.11	0.11	0.20	0.11	0.31	0.31	0.31

First Tier of Impacts | Second Tier of Impacts | Third Tier of Impacts

EVALUATION CRITERIA AGENCY PRE-DRAFT		Units	Alternative 1B	Alternative 4B	Alternative 4C	Alternative 4D	Alternative 4E	Alternative 8A	Alternative 8B	Alternative 9A	Alternative 9B	VE
Potential Impacts to Section 4(f) Resources	Susquehanna River Rail Bridge (including Railroad Overpasses & Culverts)	Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Perryville Railroad Station [including Perry Interlocking Tower]		Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)	Yes (Perry Interlocking Tower and Access Road Overpass 59.39)	Yes (Perry Interlocking Tower and Access Road Overpass 59.39)	Yes (Access Road Overpass 59.39)
	Lower Ferry Park & Pier		No	No	No	No	No	No	No	No	No	No
	Havre de Grace Historic District		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Havre de Grace MS/HS Athletic Fields**		No	Yes	No	Yes	No	No	No	Yes	No	No
	Rodgers Tavern		No	No	No	No	No	No	No	No	No	No
	Jean Roberts Memorial Park [City owned parcel]		No	No	No	No	No	No	No	Yes	Yes	Yes
	David Craig Park*		No	Yes	Yes	Yes	Yes	No	No	No	No	No
	Total Number of Section 4(f) Resources with Potential Impacts	#	3	5	4	5	4	3	3	5	4	4
Natural Environmental Considerations			First Tier of Impacts / Second Tier of Impacts / Third Tier of Impacts									
Number of Stream Crossings*		#	3	3	3	3	3	3	3	3	3	3
Impacts to Streams* **	Existing Crossings	Linear Feet	191	191	191	191	191	191	191	191	191	191
	New Crossings		139	259	101	239	80	99	78	185	117	142
	Total Stream Impacts		330	450	292	430	271	290	269	376	308	333
Impacts to Wetlands** **		Acres	0.65	0.66	0.68	0.60	0.59	0.65	0.59	0.18	0.18	0.65
Impacts to Natural Wetland Buffers			1.41	1.47	1.71	0.78	0.72	1.41	0.72	1.15	1.15	1.42
Impacts to Floodplains	100 year floodplain		2.40	3.29	2.23	2.94	1.87	2.23	1.91	2.70	2.15	2.48
	500 year floodplain		52.66	58.99	51.27	56.44	48.43	50.21	47.63	55.45	51.67	56.07
Impacts to Chesapeake Bay Critical Area			6.90	7.27	7.13	7.25	6.98	6.79	6.46	6.23	6.09	8.01
Impacts to Submerged Aquatic Vegetation			0.63	0.57	0.57	0.57	0.57	0.63	0.64	0.60	0.59	0.74
Number of known / suspected contaminated properties directly impacted		#	2	3	2	3	2	2	2	2	2	2
Impacts to Rare, Threatened or Endangered Species Habitat		Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Impacts to Forest** **		Acres	1.74	2.75	0.59	2.34	0.17	0.63	0.23	2.92	2.08	2.08
Bridge Deck Acreage over Susquehanna River*** **			6.30	6.30	6.30	4.30	4.30	6.30	4.30	6.30	6.30	6.30
Existing Pier Removal Acreage			0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Retained for further evaluation										**Yes**	**Yes**	
Elimination Rationale			**Lower maximum allowable speed than 9B with comparable environmental impacts**	**Impact to Lafayette Senior Housing Facility**	**Impact to Lafayette Senior Housing Facility and low maximum authorized speed**	**Impact to Lafayette Senior Housing Facility; provides three tracks only**	**Impact to Lafayette Senior Housing Facility; offers low maximum authorized speed and three tracks only**	**Undesirable maximum authorized speed**	**Undesirable maximum authorized speed**			**Higher property and natural environmental impacts, but lower speed than 9B**

*Facility was purchased or improved with DNR Program Open Space funds.
**Facility was improved with 6(f) Land and Water Conservation Act (LWCA) funds.
*** Does not include the Susquehanna River. All alternatives cross the Susquehanna River.
**** Based on preliminary field survey
*****Actual impacts to be determined by bridge type.

EVALUATION CRITERIA AGENCY PRE-DRAFT	Units	Alternative 1B	Alternative 4B	Alternative 4C	Alternative 4D	Alternative 4E	Alternative 8A	Alternative 8B	Alternative 9A	Alternative 9B	VE
Alternatives Comparison Matrix - Operational and Engineering Considerations											
Improve rail service reliability and safety											
Eliminates operational disruptions/delays	Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Connects to NS wye and provides grades acceptable for freight operations		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of bridge structures	#	2	2	2	1	1	2	1	2	2	2
Improve operational flexibility and accommodate reduced trip times		First Tier of Impacts	Second Tier of Impacts	Third Tier of Impacts							
Reduces operational conflicts	Level at which alterntaive meets criteria	Excellent	Excellent	Excellent	Fair	Fair	Excellent	Fair	Excellent	Excellent	Excellent
Eliminates or reduces existing speed restrictions for intercity trains		Eliminates	Eliminates	Eliminates	Eliminates	Eliminates	Reduces	Reduces	Eliminates	Eliminates	Eliminates
Provides flexibility for operational and maintenance work windows		Very Good	Very Good	Very Good	Good	Good	Very Good	Good	Very Good	Very Good	Very Good
Ability to provide for NS/MARC Operations during Construction		Good	Good	Good	Good	Good	Good	Good	Excellent	Excellent	Good
Optimize existing and planned infrastructure		First Tier of Impacts	Second Tier of Impacts	Third Tier of Impacts							
Eliminates two-track section in this portion of NEC and meets corridor wide improvement needs along NEC	# of tracks provided by alternative	4 tracks	4 tracks	4 tracks	3 tracks	3 tracks	4 tracks	3 tracks	4 tracks	4 tracks	4 tracks
Meets future planned 160 mph corridor-wide improvement without future speed restrictions for intercity trains	Y/N - Maximum allowable speed (mph)	No - 140 mph	Yes - 160 mph	No - 135 mph	Yes - 160 mph	No - 135 mph	No - 120 mph	No - 120 mph	Yes - 160 mph	No - 150 mph	No - 140 mph
Impacts to Perry Electrical Substation	Level of impact	Major	Major	Major	Major	Major	Major	Major	Minor	Minor	Major
Allows shared corridor with Bike/Ped path (feasibility evaluation in progress)	Whether alternative precludes	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude	Does not preclude
Maintain adequate navigation and improve safety along the Susquehanna River											
Provides suitable vertical clearance (at least 60')	Y/N - Clearance provided (feet)	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'	Yes - 60'
Maintains or widens horizontal clearance (at least 200')		Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +	Yes - 200' +
Requires temporary winter closure of movable span?	Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retained for further evaluation									**Yes**	**Yes**	
Elimination Rationale		**Lower maximum allowable speed than 9B with comparable environmental impacts**	**Impact to Lafayette Senior Housing Facility**	**Impact to Lafayette Senior Housing Facility and low maximum authorized speed**	**Impact to Lafayette Senior Housing Facility; provides three tracks only**	**Impact to Lafayette Senior Housing Facility; offers low maximum authorized speed and three tracks only**	**Undesirable maximum authorized speed**	**Undesirable maximum authorized speed**			**Higher property and natural environmental impacts, but lower speed than 9B**

APPENDIX C

PUBLIC INVOLVEMENT AND AGENCY COORDINATION

I. PUBLIC OUTREACH INFORMATION SESSIONS

Public outreach information sessions have been held on April 28, 2014, August 13, 2014, and December 10, 2014. Future public outreach information sessions will continue to be held at project milestones.

APRIL 28, 2014 — PURPOSE & NEED / PROJECT INTRODUCTION

The first public outreach information session was held in an open house format where stakeholders reviewed project displays and a fact sheet handout, spoke with Project Team members, and submitted written comments. This format allowed stakeholders flexibility to participate at their convenience and allow them to engage with the Project Team. Topics presented to the public included the Purpose and Need, environmental resources and constraints within the study area, conceptual alternatives, and the anticipated project schedule. Feedback from comment sheets allowed the Project Team to gauge the priorities and concerns of the public. This meeting offered the opportunity for new conceptual alternatives or design considerations to be suggested by the public and other stakeholders. No interpreters were requested for the meeting. All display materials and handouts were posted on the project website within one week of the meeting.

This public outreach information session was held at the Havre de Grace Activity Center on April 28, 2014 from 5pm to 8pm. Approximately 115 people attended and 30 written comments were provided to the Project Team that night. The major themes of the public comments received include: importance of aesthetics and bridge design; construction of a bicycle/pedestrian path across the river; transit/traffic/parking improvements; minimizing property acquisition; maintaining jobs; enhancing public parks; and encouraging tourism and local businesses. At the meeting and in the days following this public outreach information session, the public provided input on the long list of alternatives considered in the initial screening process, and reiterated critical properties to be avoided if possible.

AUGUST 13, 2014 — FEASIBLE ALTERNATIVES

Based on the input from the April public outreach information session, the IRMs, and the results of conceptual engineering, the Project Team presented the feasible conceptual alternatives to the public. This included the comprehensive "long list" of all conceptual alternatives identified to date. The presentation explained the fatal flaw screening rationale used for eliminating conceptual alternatives deemed infeasible. The Project Team developed a summary of comments after the meeting and posted all display materials and handouts on the project website within one week of the public meeting.

This public outreach information session was held at the Perryville Fire House on August 13, 2014 from 5pm to 8pm. Approximately 60 people attended and 10 written comments were received by the Project Team that night. The major themes of the public comments received include: construction of a bicycle/pedestrian path across the river; importance of aesthetics and bridge design; alternatives preference; removal of remnant piers/existing bridge; and transit improvements/concerns.

A few comments indicated a preference for a particular alternative. From the August 13, 2014 public information session, one attendee commented in favor of Alternative 9B. Another comment from the August 13, 2014 public outreach information session favored Alternative 8A. A written submission received September 2, 2014 favored the alternative with the construction of a new bridge as well as the replacement of existing to allow for a total of four tracks. The majority of public input did not indicate the preference for a particular alternative.

DECEMBER 10, 2014 — ALTERNATIVES RETAINED FOR DETAILED STUDY

A third public outreach information session was held at the Havre de Grace High School on December 10, 2014 from 5pm to 8pm. This presentation explained the screening process used to determine the alternatives retained for detailed study. A comprehensive Alternatives Comparison Matrix was presented to the public to explain the detailed screening rationale used to determine the alternatives that would progress to detailed study in the EA. Potential property impact maps for the alternatives retained for detailed study were shared with the public (Figures 11 through 13). None of the public input received at the meeting indicated a preference for a particular alternative. Overall, the Project Team received positive feedback regarding minimization of permanent property impacts.

II. COORDINATION WITH LOCAL OFFICIALS

The Proposed Project is located within Cecil County, Harford County, the Town of Perryville and the City of Havre de Grace. Coordination with these local governments is ongoing. Briefings with local government officials have been used as an opportunity to introduce the project to county/local officials, provide updates at project milestones, and facilitate the flow of information between the officials, FRA, MDOT, and Amtrak.

The Project Team has exchanged written correspondence with municipal representatives and elected officials. The Project Team delivered presentations to the Town of Perryville, Cecil County, and Havre de Grace. Early input from the Town of Perryville and the City of Havre de Grace regarding important local properties was factored into conceptual engineering and the fatal flaw screening. At the August 13, 2014 public outreach information session, Havre de Grace officials expressed preference for Alternative 9B over 9A, as it reduced impacts to the high school track and athletic fields.

Two meetings were held with representatives from Harford County Public Schools on July 7, 2015 and August 17, 2015. During the first meeting, the Project Team presented plans for Alternatives 9A and 9B and the potential impacts to the Havre de Grace High School and Middle School recreational facilities. Alternative 9A would not directly impact the football field and grandstands. However, Alternative 9A would impact the existing pole vault, shed, and long running start. After the meeting, Harford County provided design plans for planned future recreational improvements, including new tennis courts and realigned ballfields near the track.

During the August 17th meeting, Harford County Public Schools representatives provided an overview of their comments on the project alternatives. Key concerns included impacts to the race track starting block area, space limitations associated with potential ball field relocations, and potential impacts to a proposed City of Havre de Grace floodplain mitigation site along Lily Run. Based on the information provided, school officials verbally expressed a preference for Alternative 9B over Alternative 9A. Alternative 9B would not require any acquisition of school property and would not directly impact the athletic fields.

III. SUSQUEHANNA RIVER RAIL BRIDGE PROJECT ADVISORY BOARD

The Project Team is coordinating with Susquehanna River Rail Bridge Project (SRRBP) Advisory Board. The SRRBP Advisory Board is a group of community representatives organized to proactively convey input to the Project Team. The Project Team has been invited on two occasions to attend SRRBP Advisory Board meetings (November 6, 2014 and March 26, 2015). At a meeting on November 6, 2014, the SRRBP Advisory Board itemized the following top six priorities:

- Request for a Special Briefing;
- Bridge Architecture;
- Bridge Abutment Area;
- Westerly Right-of-Way and Alignments;
- Street and Lane Underpasses; and
- Rail Commuter Station.

Since the initial meeting, the Project Team has continued to coordinate with the SRRBP Advisory Board, who has provided additional advisory bulletins regarding river navigation, the safe harbor jetty proposal, pedestrian and bicycle river crossing, bridge historical preservation and display, easterly right-of-way and alignments in Perryville, street underpasses in Perryville, and rail operation noise control in Perryville. The Project Team will continue coordinating with the SRRBP Advisory Board as the project progresses.

IV. BICYCLE-PEDESTRIAN STAKEHOLDERS

The Project Team has received substantial public input requesting inclusion of a bicycle and pedestrian river crossing into the Proposed Project. Several organizations responsible for trail planning (such as the Lower Susquehanna Heritage Greenway and the Maryland DNR), advocacy organizations (such as the East Coast Greenway Alliance and the September 11th National Memorial Trail Alliance), a number of elected officials, and members of the public have expressed support for a multi-use path across the river. Specifically, some commenters have noted that a connection between Cecil and Harford County would fulfill a "missing link" in several regional trails and provide a new multi-modal option for travel between communities. While bicycle and pedestrian facilities were not expressly addressed in the scope of the project grant, as part of the public involvement process, FRA, MDOT, and Amtrak are working with government agencies and interested organizations to assess the feasibility of coordinating the Susquehanna River Rail Bridge Project with potential bicycle and pedestrian access across the river.

Connectivity to the existing road network and existing or planned trails (and the attendant property acquisitions and environmental impacts) must be evaluated in the context of regional bicycle-pedestrian planning. MDOT and the Project Team have hosted stakeholder meetings (June 2014 and December 2014) with trail planning organizations and bicycle-pedestrian advocacy groups to discuss the Proposed Project in the context of ongoing trail and greenway planning efforts (including MDOT's 2014 *Maryland Twenty-Year Bicycle & Pedestrian Master Plan* and MDOT's 2002 *Susquehanna River Pedestrian Bridge Crossing Feasibility Study*).

Furthermore, to respond to the input received regarding a multi-use path, MDOT and Amtrak are conducting a feasibility evaluation. The evaluation entails: reviewing prior studies of Susquehanna River bicycle/pedestrian crossings; ensuring that the Proposed Project does not adversely affect the existing bicycle and pedestrian trails within the Proposed Project's study

area; making efforts not to preclude the potential for a future multi-use path across the Susquehanna River; and assessing the feasibility of constructing a multi-use path in conjunction with a new rail bridge.

The Project Team is considering a multitude of factors, including visual impacts, safety and security, constructability, effects to rail alignments, cost, noise and vibration, in-water impacts, functionality, and community impacts. The Project Team will continue to evaluate the feasibility of accommodating a multi-use path within the project limits in coordination with the high-speed rail project. The Project Team is conducting a Susquehanna River Rail Bridge Project Bicycle/Pedestrian Crossing Hazard Analysis and Security Risk Assessment. If deemed feasible, a separate project would be required for design, environmental review, and identification of potential funding for a bicycle/pedestrian crossing. The Project Team will continue to obtain input from stakeholders on the feasibility evaluation.

V. U.S. COAST GUARD AND MARINERS

Upon project inception, Amtrak and its representatives reached out to local marina owners and operators, shippers, dock managers, the U.S. Coast Guard (USCG), and other members of the maritime community. The purpose of this outreach was to understand the current navigational uses along this segment of the Susquehanna River and the anticipated USCG requirements for the vertical clearance of any potential fixed bridge. This information was factored into conceptual engineering. As stated above, the navigation survey concluded that any new high-level fixed bridge should provide a minimum 60-foot vertical clearance.

VI. FREIGHT RAILROADS

The Project Team has been coordinating with NS and CSX regarding their current and planned freight rail operations in the area (CSX trains currently use a separate Susquehanna River crossing, located to the north of the Susquehanna River Rail Bridge). NS trains currently use the Susquehanna River Rail Bridge. A coordination meeting with NS, Amtrak, FRA, and MDOT was held on March 19, 2014. The Project Team will continue to seek input from the freight rail operations throughout the NEPA process and engineering design.

VII. MARC

The Project Team is also coordinating with the Maryland Transit Administration (MTA). MTA is the operator of the MARC Penn Line service over the bridge. Coordination between the Project Team and MTA is also essential to ensuring the Proposed Project's compatibility with MTA's proposed MARC Northeast Maintenance Facility.

VIII. SECTION 106 COORDINATION

Since the Susquehanna River Rail Bridge is S/NR-eligible, FRA (as the lead federal agency) has initiated consultation in accordance with Section 106 of the NHPA. FRA has invited the Advisory Council on Historic Preservation (ACHP) to participate in the Section 106 consultation. On August 22, 2014, the ACHP declined to participate and will instead rely on the MHT to provide comments and concurrence. FRA submitted to MHT a Section 106 consultation initiation package (dated April 10, 2014), including the proposed APEs, analysis methodologies, and a list of potential consulting parties. MHT sent a response letter on June 16, 2014. The Project Team sent a letter to MHT on September 24, 2014 regarding potential historic resources. The Project Team received a letter from MHT on November 12, 2014 providing guidance regarding cultural resources and is proceeding accordingly with the cultural resources inventory.

All Section 106 consulting parties were invited to each public outreach information session and a dedicated Section 106 meeting was held on March 9, 2015. The dedicated Section 106 meeting was held at the Havre de Grace Activity Center at 1pm. Several Section 106 Consultation Parties were in attendance. Topics presented included an overview of Section 106 regulations and process, and how the Section 106 process would run parallel with the environmental studies following the compliance process for NEPA. The Project Team and the consulting parties discussed the known adverse effects to the Susquehanna River Rail Bridge and Overpasses and the Perry Interlocking Tower, along with conceptual ideas for mitigation. The Project Team will continue to coordinate with MHT and consulting parties throughout the Section 106 process.

A second dedicated Section 106 Consulting Parties meeting was held in Perryville on August 18, 2015 at 1pm. Topics included potential project impacts on various historic resources, potential avoidance/mitigation measures, and opportunities for design input. The Perry Interlocking Tower—a contributing element of the S/NR-eligible Perryville Railroad Station—was discussed at length. The Perry Interlocking Tower would conflict with the proposed rail alignment for Alternatives 9A and 9B, but not for the other remaining alternatives. The Project Team is investigating the feasibility of shifting the tower, rather than demolishing it. Several consulting parties expressed a preference for preserving the tower, either in place or in a new location.

IX. INTERAGENCY REVIEW MEETINGS

This section describes the IRM presentations delivered by the Project Team to date. The Maryland IRM process is intended to achieve the timely and efficient identification, evaluation, and resolution of environmental and regulatory issues. Future IRMs will be held at project milestones.

PROJECT INTRODUCTION IRM MEETING (JULY 17, 2013)

FRA, MDOT, and Amtrak presented the general history, project goals, and anticipated schedule at the IRM.

PURPOSE AND NEED IRM MEETING (FEBRUARY 19, 2014)

The goal of the second IRM was to review the project introduction, Purpose and Need, project description, environmental resources, and public involvement.

PURPOSE AND NEED / CONCEPTUAL ALTERNATIVE IRM MEETING (APRIL 16, 2014)

The Purpose and Need Statement was circulated to the IRM agencies two weeks prior to the meeting. During the presentation, the Project Team solicited agency feedback on the Purpose and Need Statement. The remainder of the presentation provided information regarding the conceptual alternatives development process. The Project Team responded to agency comments regarding the conceptual alternatives.

FEASIBLE ALTERNATIVES IRM MEETING (JUNE 18, 2014)

Based on the input from the April IRM, the public outreach information session (described below), and the results of conceptual engineering, the Project Team presented the feasible conceptual alternatives to the IRM. This included the comprehensive "long list" of all conceptual alternatives identified to date (including alternatives suggested by members of the public). The presentation explained the "fatal flaw screening" rationale used for eliminating conceptual alternatives deemed infeasible.

ALTERNATIVES RETAINED FOR DETAILED STUDY IRM MEETING (FEBRUARY 18, 2015)

The purpose of the IRM was to review the team's alternatives screening process, present the alternatives retained for detailed study (ARDS) and provide an update on public outreach efforts to date. The team reviewed the two step alternatives screening process which included the fatal flaw screening and the more detailed screening based on specific project goals. An Alternatives Comparison Matrix along with a natural environmental impacts matrix was presented and used as the basis for choosing Alternatives 9A and 9B for further study. The meeting concluded with an agreement to schedule a field visit to allow the agencies to observe the range of resources potentially affected by the Proposed Project.

AGENCY FIELD VISIT IRM MEETING (MARCH 12, 2015)

In response to request made during the February 18, 2015 IRM the resource agencies attended a field visit to evaluate the quality of the natural and human environmental resources within the study area. As a result of the field review some of the original resources were re-characterized and in some cases new resources were identified.

ARDS FIELD VISIT RECAP IRM MEETING (APRIL 15, 2015)

The purpose of the IRM was to recap the results of the agency field review, update the agencies on the status of the engineering design and to explain the status of the ARDS package. The team reviewed the updated natural environmental features including a re-characterized wetland / stream system and a newly discovered potential wetland close to the Perryville Railroad Station. The team also updated the group on design modifications that would ultimately affect the natural and human environmental impacts for the project. The group also received updates regarding the bike/pedestrian path feasibility study and next steps for the project.

REFINED ALTERNATIVES RETAINED FOR DETAILED STUDY IRM MEETING (JUNE 17, 2015)

The purpose of the IRM was to provide a project update and overview of the key operational considerations associated with maximum allowable speeds and travel times. The team presented the agencies with a revised Alternatives Comparison Matrix, which was based on updated human / natural resource information and new design details. The team also discussed the approach for ARDS package resubmittal.

Appendix A-2: Bridge Design Selection Memo

INTRODUCTION

The Maryland Department of Transportation (MDOT), project sponsor, is proposing to improve the Susquehanna River Rail Bridge between the City of Havre de Grace, Harford County, Maryland and the Town of Perryville, Cecil County, Maryland in order to provide continued rail connectivity along the Northeast Corridor (NEC). The U.S. Secretary of Transportation selected the MDOT for an award of $22 million through a cooperative agreement between the Federal Railroad Administration (FRA) and MDOT for the preliminary engineering and National Environmental Policy Act of 1969 (NEPA) phases of the Proposed Project.

FRA is the lead federal agency and the National Railroad Passenger Corporation (Amtrak), as bridge owner and operator, is providing conceptual and preliminary engineering designs and is acting in coordination with MDOT and FRA.

The Susquehanna River Rail Bridge is at Milepost 60 along the NEC. The Proposed Project would span approximately six miles, between the "Oak" Interlocking at Milepost 63.5 south of the City of Havre de Grace and the "Prince" Interlocking at Milepost 57.3 north of the Town of Perryville. The 109-year-old bridge is a critical link along one of the U.S. Department of Transportation's (USDOT) designated high-speed rail corridors. The NEC is the busiest passenger rail line in the United States. The bridge is used by Amtrak, the Maryland Area Regional Commuter (MARC), and Norfolk Southern Railway (NS) to carry intercity, commuter, and freight trains across the Susquehanna River.

The Project Team prepared an Alternatives Retained for Detailed Study report in order to screen alignments alternatives for the Proposed Project. Alignment Alternative 9A and Alternative 9B were retained for detailed study. Independent of the Alignment Alternative Screening Process, the Project Team reviewed four bridge design types pertaining to approach spans (the spans connecting the abutment with the main span) and channel spans (span over the navigation channel). Any of these bridge design type alternatives are feasible with the alignment alternatives under consideration. The four bridge design types include:

- the girder approach / arch main span bridge design;
- the delta frame approach / arch main span bridge design;
- the truss approach / truss main span bridge design; and
- the girder approach / truss main span bridge design.

This memo serves to provide further explanation regarding the screening of these four bridge design types and selection of the girder approach / arch main span bridge design for detailed study in the NEPA Environmental Assessment (EA).

The Project Team also evaluated pier designs that could be combined with any of the alignment alternatives. The pier design options include:

- Delta Frame Pier Design;
- Key Hole Pier Design;
- Fluted Pier Design;
- Wall Pier Design.

Of the four pier designs, the key hole pier design has been retained for detailed study in the EA.

METHODOLOGY

Each of the four bridge type alternatives was evaluated based on environmental resource considerations, engineering and operations considerations, and public and agency input received. For environmental considerations, in terms of natural resources, the bridge type alternatives were evaluated based on the number of in-water piers, the size of in-water piers, surface area at Mean High Water, and potential impact to benthic habitat. The Proposed Project would remove the 16 existing piers associated with the Susquehanna River Rail Bridge, which was accounted for in the natural resources assessments. In addition, 11 remnant piers located just downstream of the existing bridge, which were left in place following demolition of the 1866 Philadelphia, Wilmington & Baltimore Railroad (PW&B) bridge, would also be removed. Therefore, the four bridge design types account for the removal of 27 piers in the quantitative analysis.

In terms of historic resources, none of the bridge design types would be similar to the existing historic Susquehanna River Rail Bridge. However, the four bridge design types were evaluated based on compatibility with the historic bridge.

For engineering and operations considerations, the bridge type alternatives were evaluated based on ease of maintenance for the approach and channel spans, structural redundancy, ease of construction, trespasser resistant from water, side span navigation clearance, and overall cost. Input was solicited and received through agency and public coordination and was considered in the screening of bridge design types.

BRIDGE TYPE ALTERNATIVES

The Project Team evaluated a variety of bridge types that are appropriate for the Proposed Project and existing site conditions. The four bridge design types were studied in detail in the *Final Feasibility Report: Susquehanna River Rail Bridge Project*, January 30, 2015 and have since been modified in order to minimize environmental effects. The four bridge design types are described below.

Girder Approach / Arch Main Span

Under the girder approach / arch main span bridge design, the proposed replacement bridges would have a total of 38 in-water piers (each of the two replacement bridges would have 19 in-water piers. With the removal of the 27 piers, as discussed above, there would be a net increase of 11 in-water piers with the Girder Approach / Arch Main Span design. The girder approach / arch main span bridge design is based on 170 foot approach spans. See **Figure 1** for a rendering of the girder approach / arch main span bridge design.

Delta Frame Approach / Arch Main Span

The delta frame approach / arch main span bridge design consists of a network tied arch over the navigable channel with delta frames for the approach spans. Under this bridge design type, the

Delta Frame / Arch

Girder / Arch

Girder / Truss

Truss / Truss

Bridge Design Type Renderings
Approach Span/Channel Span
Figure 1

proposed replacement bridges would have a total of 26 in-water piers (each of the two replacement bridges would have 13 in-water piers). With the removal of the 27 piers, as discussed above, there would be a net reduction of one in-water pier with the delta frame approach / arch main span bridge design. The delta frame approach / arch main span bridge design is based on 200 foot approach spans (see **Figure 1**).

Truss Approach / Truss Main Span

Under the truss approach / truss main span bridge design, the proposed replacement bridges would have a total of 26 in-water piers (each of the two replacement bridges would have 13 in-water piers). With the removal of the 27 piers discussed above, there would be a net reduction of one in-water pier with the truss approach / truss main span bridge design. The truss approach / truss main span bridge design is generally based on 260 foot approach spans (see **Figure 1**).

Girder Approach / Truss Main Span

Under the girder approach / truss main span bridge design, the proposed replacement bridges would have a total of 38 in-water piers (each of the two replacement bridges would have 19 in-water piers). With the removal of the 27 piers discussed above, there would be a net gain of 11 in-water piers with the girder approach / truss main span bridge design. The girder approach / truss main span bridge design is based on 170 foot approach spans (see **Figure 1**).

PIER DESIGN OPTIONS

The delta frame pier design is the only bridge pier design possible with the delta frame approach / arch main span bridge (see **Figure 2A**). Originally, the girder approach / arch main span initially had a basic wall pier design. Based on public input, different variations of pier designs were developed as options within the girder approach bridge type. These designs were developed in part due to public input received throughout the project; specifically, the desire for a special "signature" bridge. These various pier designs are shown in **Figure 2B** and include the key hole pier, fluted pier and wall pier designs.

BRIDGE DESIGN SCREENING

PUBLIC INVOLVEMENT

Preliminary bridge design renderings of the four bridge design types were first presented to the public at a public outreach information session on December 10, 2014, held in the City of Havre de Grace, Maryland. The Project Team also held a public outreach information session on November 10, 2015 in the Town of Perryville, Maryland to review and discuss the bridge design types. In order to notify the public of this meeting, invitations were sent to the Proposed Project's mailing list. The meeting's information and bridge type renderings were also posted to the project website. As part of this public outreach information session, the Project Team presented the Bridge Type Comparison Matrix (**see Figure 3**).

The November 10, 2015 public outreach information session served as a chance to receive additional public feedback on the bridge design types. In response to comments received during the December 2014 meeting, a set of renderings from vantage points in both the City of Havre de Grace and the Town of Perryville were presented to obtain feedback on bridge aesthetic options, especially related to pier designs. At the meeting, an informal "bridge survey" was conducted to help identify public sentiment related to overall bridge design types and specific pier design elements. The Project Team received one vote for the truss approach / truss main span bridge design, two votes for the delta frame approach / arch main span bridge, and three

Existing View

Delta Frame Pier Design

Bridge Pier Design Renderings for Delta Frame Approach/
Arch Main Span
Figure 2A

1.15.16

Existing View

Wall Pier Design

Fluted Pier Design

Key Hole Pier Design

Bridge Pier Design Renderings for Girder Approach/Arch Main Span, Truss Approach / Truss Main Span, and Girder Approach / Truss Main Span

	DELTA / ARCH	TRUSS / TRUSS	GIRDER / ARCH	GIRDER / TRUSS
INPUT RECEIVED				
Incorporates Mariners Input	YES	YES	YES	YES
Incorporates Public Input on Design Aesthetic	More Favorable	Less Favorable	More Favorable	Less Favorable
ENVIRONMENTAL RESOURCE CONSIDERATIONS				
Number of In-Water Pier Pairs	13	13	19	19
Size of In-Water Piers	More Favorable	Less Favorable	Less Favorable	Less Favorable
Impact to Surface Water	More Favorable	Less Favorable	More Favorable	More Favorable
Impact to Mud Line (river bottom)	Less Favorable	Less Favorable	More Favorable	More Favorable
Compatibility with Historic Bridge	Less Favorable	More Favorable	Favorable	Favorable
ENGINEERING AND OPERATIONS CONSIDERATIONS				
Ease of Maintenance - Approach Spans	Very Good	Good	Excellent	Excellent
Ease of Maintenance - Channel Span	Very Good	Good	Very Good	Good
Structural Redundancy - Approach Spans (key factor)	Excellent	Fair	Excellent	Excellent
Structural Redundancy - Channel Span (key factor)	Very Good	Fair	Very Good	Fair
Ease of Construction	Fair	Good	Excellent	Excellent
Trespasser Resistent From Water and Land	Fair	Good	Excellent	Excellent
Side Span Navigation Clearance	Good	Very Good	Excellent	Excellent
Estimated Cost (2015 $)	$577 Million	$623 Million	$494 Million	$516 Million

LEGEND

- Excellent
- Very Good
- Good
- Fair
- Less Favorable

Bridge Design Type Comparison Matrix

Figure 3

votes for the girder approach / arch main span bridge design. The girder approach / arch main span bridge design and the delta frame approach / arch main span bridge designs received the most support. The top factors of public preference, based on input received, are the overall look, cost minimization, and opening up views to the Susquehanna River. For those who could not attend this public meeting, the presentation boards were posted for the public to the project website shortly after the public meeting.

AGENCY COORDINATION

An Interagency Review Meeting was held on December 9, 2015. The Project Team provided more detailed information on the four bridge design types. At this time, all four bridge design types were designed at the same level of detail, based on shaft diameter at less than 10 percent environmental engineering design. The Detailed Bridge Type Comparison Matrix, comparing environmental considerations between the four bridge types, was shown at the Interagency Review Meeting on December 9, 2015 (see **Figure 4**).

PRELIMINARY BRIDGE DESIGN EVALUATION

Environmental Considerations

Based on the Bridge Type Comparison Matrix shown at the public outreach information session, the delta frame approach / arch main span bridge design is more favorable in terms of the size of in-water piers, while the other three bridge design types are less favorable (**see Figure 3**). The truss approach / truss main span bridge design is less favorable in terms of the impact to surface water, while the other three bridge design types are more favorable.

The delta frame approach / arch main span bridge design and the truss approach / truss main span bridge design are less favorable for their impacts to the mud line, while the girder approach / arch main span bridge design and the girder approach / truss main span bridge design are more favorable.

For compatibility with the historic Susquehanna River Rail Bridge, the truss approach / truss main span bridge design is more favorable, as it is the most similar to the traditional railroad bridge. The girder approach / arch main span bridge design and the girder approach / truss main span bridge design are favorable. The delta frame approach / arch main span bridge design is less favorable, since it is considered the most modern design and the least similar to the existing historic bridge.

As discussed above, **Figure 4** shows more specific calculations for environmental resource considerations. Overall, based on environmental resource considerations, the girder approach / arch main span bridge design is more favorable than the other bridge design types. Although the delta frame approach / arch main span bridge design has fewer piers than the girder approach / arch main span bridge design, the piers under the delta frame approach / arch main span bridge design would be larger in diameter than those for the girder approach / arch main span bridge design, equating to 12,200 cubic yards for 13 piers as compared to 13,200 cubic yards for 19 piers under the girder approach / arch main span bridge design. The main differentiator between the girder approach / arch main span bridge design and the delta frame approach / arch main span bridge design is that the latter has almost 60 percent higher impacts to benthic habitat.

Therefore, the delta frame approach / arch main span bridge design is less favorable than the girder approach / arch main span bridge design due to its impacts to benthic habitat and its modern design being the least similar to the existing historic bridge. In terms of environmental

Environmental Considerations	Delta / Arch	Truss / Truss	Girder / Arch	Girder / Truss
Number of in-water pier pairs	13	13	19	19
Size of in-water piers / structure volume (cy)	12,200	13,100	13,200	13,200
Surface Area at MHW (sf)	49,300	53,000	49,500	49,500
Impact to mud line / benthic habitat (sf)	7,300	7,300	4,600	4,600
Incorporates mariners input	Yes	Yes	Yes	Yes
Incorporates public input on design aesthetic	Favorable	Less Favorable	Favorable	Less Favorable
Bridge length between abutments (ft)	4,360	4,360	4,310	4,310
Cost	$577 Million	$623 Million	$494 Million	$516 Million

Detailed Bridge Type Comparison Matrix

considerations, the girder approach / arch main span bridge design is therefore the most favorable of the bridge design types.

Engineering and Operations Considerations

Based on the Bridge Type Comparison Matrix shown at the public outreach information session, from an engineering and operations perspective, the girder approach / arch main span bridge design is excellent in terms of ease of maintenance for approach spans, structural redundancy for approach space, ease of construction, trespasser resistant from water and land, side span navigation clearance, and estimated cost (**see Figure 3**)

The girder approach / truss main span bridge design, as compared to the girder approach / arch main span bridge design, is also considered excellent in terms of the same considerations, but has a lower ease of maintenance for the channel spans, has fair structural redundancy with the channel span, and has a higher estimated cost.

The delta frame approach / arch main span bridge design is considered excellent in structural redundancy of the approach spans; very good in ease of maintenance of the approach spans, ease of maintenance of the channel span, and structural redundancy of the channel span; good in the side span navigation clearance; and fair in the ease of construction and trespasser resistant from water and land.

The truss approach / truss main span bridge design is considered very good for the side span navigation clearance; good for the ease of maintenance of the approach and channel spans, ease of construction, and trespasser resistant from water; fair for structural redundancy of approach and channel spans; and has the highest construction costs.

Therefore, based on engineering and operations considerations, the girder approach / arch main span bridge design is the most favorable of the bridge design types.

CONCLUSION

The bridge design type selection was based on the Bridge Type Comparison Matrix shown at the public outreach information session, the Detailed Comparison Matrix shown at the Interagency Review Meeting, and public and agency sentiment from various meetings. Overall, the girder approach / arch main span meets mariners input and the public's desire for long spans with openness and cost minimization. The girder approach / arch main span is also more favorable in terms of natural resources, including impacts to surface water and benthic habitat. In addition, the girder approach / arch main span is most favorable in terms of engineering and operations, including ease of maintenance, structural redundancy, ease of construction, safety and security, and cost. Based on these assessments and the public and agency input received, the girder approach / arch main span bridge design has been retained for detailed study in the EA. As the project progresses and engineering plans proceed, refinements regarding environmental impact assessment of the girder approach / arch main span (the preferred bridge design) will be made. In addition, of the pier designs, the key hole pier design within the girder approach bridge type has been retained for detailed study in the EA based on aesthetics, as it provides a more open look, and in collaboration with the local community.