LONG BRIDGE PROJECT
Connecting North and South Through our Nation's Capital

Appendix D3:

Environmental Consequences Report

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Long Bridge Project

Environmental Impact Statement (EIS)

Environmental Consequences Report

September 2019

District Department of Transportation

U.S. Department of Transportation
Federal Railroad Administration

Long Bridge Project

Environmental Consequences Report

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1.0 Overview

1.1. Introduction

The Federal Railroad Administration (FRA), jointly with the District Department of Transportation (DDOT), is preparing an Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act of 1969 (NEPA) for the Long Bridge Project (the Project).[1] The Project consists of potential improvements to the Long Bridge and related railroad infrastructure located between RO Interlocking near Long Bridge Park in Arlington, Virginia, and L'Enfant (LE) Interlocking near 10th Street SW in Washington, DC (collectively, the Long Bridge Corridor).[2] The Project connects logical termini; has independent utility even if no additional transportation improvements in the area are made; and does not restrict consideration of alternatives for other reasonably foreseeable transportation improvements in the area.

1.2. Purpose of This Report

This report describes the environmental consequences associated with the Project. Prior to issuing permits or approvals for a project, Federal agencies must consider the environmental effects of their actions in accordance with NEPA.[3] To comply with NEPA and the Council on Environmental Quality (CEQ) *Implementing Regulations for NEPA*, this analysis identifies the direct, indirect, and cumulative effects the Project could have on the human and natural environment.[4] The analysis also identifies measures to avoid, minimize, or mitigate potential adverse impacts. This section defines the impact analysis framework used in the EIS to adhere to the FRA *Procedures for Considering Environmental Impacts*.[5]

The level of information provided in this report for each resource provides the full results of the technical analysis of the environmental consequences to allow DDOT, FRA, and the Cooperating Agencies to review the results of the analysis.[6] As appropriate and as required by the CEQ regulations, this information may be condensed or summarized in the EIS resource chapters, proportionate to that resource's potential to be affected by the Project.

The following resource categories are included:

- Natural Ecological Systems and Endangered Species
- Water Resources and Water Quality
- Geologic Resources
- Solid Waste Disposal and Hazardous Materials

[1] 42 USC 4321
[2] Note that "RO" is the proper name of this interlocking. It is not an acronym.
[3] 42 USC 4321
[4] 40 CFR 1500-1508
[5] 64 FR 28545
[6] *Cooperating Agency* means any Federal agency other than a lead agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in 40 CFR 1501.6 and 23 USC 139. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe may by agreement with the lead agency become a cooperating agency.

- Transportation and Navigation
- Air Quality and Greenhouse Gas Emissions
- Energy Resources
- Land Use and Property
- Noise and Vibration
- Aesthetics and Visual Resources
- Cultural Resources
- Parks and Recreation
- Social and Economic Resources
- Public Health and Elderly and Persons with Disabilities
- Safety and Security
- Environmental Justice

1.3. Framework for Evaluating Impacts

FRA and DDOT analyzed the environmental impacts of the Project by comparing the probable consequences of the No Action Alternative and the Action Alternatives in the proposed Planning Year of 2040.[7] **Section 1.4, Alternatives**, describes the alternatives. The *Affected Environment Report* (May 2018) describes the 2017 affected environment (or existing) conditions, which provides the baseline for comparison as well as the impact analysis. The impact analysis considers direct, indirect, and cumulative impacts; evaluates post-construction (operational) and construction impacts; and evaluates the need for mitigation measures for the alternatives. The *Methodology Report* (January 2018) provides a detailed explanation of the methodology for the impact analysis for each resource.

1.3.1. Descriptions of Effects

"Effects" and "impacts" as used in the CEQ *Implementing Regulations* and this report are synonymous. Effects vary based on the environmental consequences of constructing and operating the Project. This report describes all effects EIS in terms of type, duration, significance, and outcome of potential effects related to the Project, as defined below:

- **Type**: The CEQ Implementing Regulations and Forty Most Asked Questions concerning CEQ's NEPA Regulations give the following key definitions for the three types of impacts:8
    - **Direct effects** are caused by the action and occur at the same time and place as the proposed action.9 Each resource chapter analyzes the direct effects of the No Action Alternative and the Action Alternatives.
    - **Indirect effects** are caused by the action and are later in time or farther removed in distance from the proposed action but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.10 Each resource chapter analyzes the indirect effects of the No Action Alternative and the Action Alternatives.
- **Cumulative impact** is the full impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future

[7] The baseline year used to establish the Affected Environment is 2017. This year was chosen because the EIS was initiated in 2016 and the majority of existing conditions data was collected in 2017.
[8] 46 FR 18026
[9] 40 CFR 1508.8
[10] 40 CFR 1508.8

actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions.[11] Cumulative impacts can result from individually minor but collectively major actions taking place over a period of time. See **Chapter 21, Cumulative Impacts**, for a separate analysis of cumulative impacts.

- **Duration:** The duration of an effect is the amount of time that effect is expected to last. Short-term effects are those that may occur only during a specific phase of the Project, such as during construction or commissioning activities. Long-term effects are those that would occur over a longer duration, such as the lifetime of the Project's operation or implementation.
- **Context and Intensity:** As defined in the CEQ *Implementing Regulations*, significance requires consideration of both context and intensity.[12] Depending on the nature of the topic, relevant contexts include society as a whole (for example, human, national), the affected region, the affected interests, and the locality. Intensity refers to the severity of impact and includes consideration of beneficial and adverse impacts, and a wide range of criteria. Criteria include public health and safety, unique characteristics of the geographic locale, the level of public controversy, whether the action threatens to violate other laws, and other considerations. For the purposes of this analysis, impacts as they apply to context and intensity are identified as negligible, minor, moderate, or major for ease of description:
    - **Negligible effects** may be adverse or beneficial but would occur at the levels that are not measurable.
    - **Minor effects** would be noticeable but would not affect the function or integrity of the resource.
    - **Moderate effects** would be readily apparent and would influence the function or integrity of the resource.
    - **Major effects** would be substantial and would result in severely adverse or exceptionally beneficial changes to the resource.
- **Outcome:** A **beneficial** effect may cause positive outcomes to the natural or human environment. An **adverse** effect may cause unfavorable or undesirable outcomes to the natural or human environment.

1.3.2. Analysis Methodology

In preparing the analysis presented in this report, FRA and DDOT followed FRA's *Procedures for Considering Environmental Impacts*, as well as other applicable guidance and regulations.[13] Each section of this report describes the most pertinent regulatory context that applies to the analysis and the methodologies used for the assessment. In accordance with CEQ's *Implementing Regulations*, the analysis identifies impacts based on their significance with respect to context and intensity.[14]

[11] 40 CFR 1508.7
[12] 40 CFR 1508.27
[13] 64 FR 28545
[14] 40 CFR 1508.27

Whenever applicable and practicable, FRA and DDOT conducted the analyses in accordance with the environmental review policies and guidance of relevant Federal agencies as well as state and local jurisdictions. In this way, the analysis will support the review of the document by Federal, state, and local agencies from which permits, or approvals are required for the Project. The analysis complies with the DDOT *Environmental Manual*, which addresses environmental processes and procedures as they relate to DDOT projects.[15] The analysis also complies with the Virginia Department of Environmental Quality's *Procedures Manual: Environmental Impact Review of Major State Facilities.*[16]

This report analyzes the direct and indirect effects of the No Action Alternative and the Action Alternatives on their environmental setting both during construction and operations. The technical analyses therefore consider the following:

- **Permanent or Long-Term Effects of the Alternatives:** This section considers the direct and indirect impacts of the No Action Alternative and the Action Alternatives once they are complete. This analysis considers conditions in the year 2040, by which time the Action Alternatives would be complete.
- **Temporary Effects of the Alternatives:** This section considers the direct and indirect temporary impacts of the No Action and Action Alternatives during construction, based on engineering design.
- **Measures to Avoid, Minimize, or Mitigate Impacts:** This section of each resource chapter identifies measures that will be undertaken by the Virginia Department of Rail and Public Transportation, the project sponsor for final design and construction, to minimize, avoid, or mitigate adverse temporary or permanent impacts of the No Action and Action Alternatives. FRA and DDOT identified such measures for adverse impacts wherever practicable.

1.3.3. Study Areas

The Project Area is the related railroad infrastructure located between the RO Interlocking in Arlington, Virginia, near Long Bridge Park, and LE Interlocking in Washington, DC, near 10th Street SW (**Figure 1-1**). Technical analysis within each resource chapter considered Local and Regional Study Areas representing where the Action Alternatives have the potential for permanent or temporary effects. The Local Study Area is generally proximate to the Project Area, while the Regional Study Area includes wider area to incorporate systems or transportation networks. The Study Areas differ by resource because the type and range of potential impacts vary. For example, the visual and aesthetic resources Local Study Area encompasses construction activities or permanent elements of the Action Alternatives that may be visible, while the traffic Local Study Area consists of roadways where traffic related to the Action Alternatives may adversely affect local traffic conditions. For the air quality analysis, the Local Study Area focuses on locations around the Project's emission sources where the public has access to ambient air, while the Regional Study Area encompasses the entirety of the District and Arlington County.

[15] DDOT. 2012. *DDOT Environmental Manual, 2nd Edition*.
[16] Virginia Department of Environmental Quality. 2017. *Procedures Manual: Environmental Impact Review of Major State Facilities.*

Figure 1-1 | Long Bridge Project Area

1.4. Alternatives

Three alternatives are evaluated in this report: Action Alternative A, Action Alternative B, and the No Action Alternative. Each Action Alternative involves constructing a new two-track bridge upstream of the existing Long Bridge and adding two tracks and related infrastructure throughout the Long Bridge Corridor, resulting in a four-track corridor. The Action Alternatives differ in whether they retain or replace the existing bridges over the George Washington Memorial Parkway (GWMP) and the Potomac River. The following sub-sections describe the No Action Alternative and the Action Alternatives in detail.

1.4.1. No Action Alternative

The CEQ regulations for implementing NEPA require consideration of a No Action Alternative, which is an alternative that represents the conditions that would exist in the analysis year (in this case, 2040) if a proposed action (in this case, the Project) is not implemented.[17] While the No Action Alternative does not meet the Project's Purpose and Need, it serves as a baseline for assessing the potential impacts of the Action Alternatives.

The Long Bridge Corridor is part of a multimodal transportation network that consists of railroads, transit, trails (bicycle and pedestrian), and roadways. As shown in **Figure 1-2,** the No Action Alternative consists of the existing transportation network, plus all transportation projects proposed to be completed by the planning year of 2040 within the Study Area (0.25 miles from the existing Long Bridge Corridor).[18] The No Action Alternative includes all projects that could affect or be affected by the Project. Because there are no non-transportation projects within the footprint of the Project, the No Action Alternative includes only transportation projects. The projects that are included in the No Action Alternative are described in detail below.

1.4.1.1. No Action Alternative Infrastructure

The No Action Alternative includes planned and funded transportation projects likely to be implemented by 2040, and maintenance projects necessary to keep the existing bridge and Corridor in service. These projects have independent utility from the Long Bridge Project and are shown in **Figure 1-2.**

The No Action Alternative includes the following railroad projects:

- **Fourth Track from AF to RO Interlocking:**[19] The Virginia Department of Rail and Public Transportation (DRPT) plans to add a fourth track from AF to RO Interlockings as part of corridor-wide upgrades to support higher operating speeds. This project is planned for completion by 2025 as part of the Washington, DC, to Richmond Southeast High-Speed Rail (DC2RVA) project.

[17] 40 CFR 1502.14
[18] The 0.25-mile radius was chosen for transportation projects because it encompasses changes to the transportation network that could affect operations within the Long Bridge Corridor.
[19] "AF" and "RO" are the proper names of the interlockings. They are not acronyms.

Figure 1-2 | No Action Alternative Projects

- **Fourth Track from LE to VA Interlocking**: VRE plans to provide an additional main track between the LE and VA Interlockings in the District. This project is planned for completion by fiscal year (FY) 2023.
- **VRE L'Enfant Station North and South Storage Track** (under construction): VRE is converting existing side tracks at VRE L'Enfant Station to storage tracks while the permanent Midday Storage Facility is being constructed. Storage tracks will be converted to a fourth mainline track after the Midday Storage Facility is built. This project is planned for completion in 2018.
- **VRE L'Enfant Station Improvements**: VRE plans to construct an island platform to allow for simultaneous boarding of two tracks at L'Enfant Station, and to extend and widen the platform to accommodate eight-car trains and a future fourth track. This project is planned for completion by FY 2024.
- **Virginia Avenue Tunnel** (under construction): CSX Transportation (CSXT) is replacing the existing tunnel with two new tunnels capable of accommodating double-stack intermodal freight trains.[20] This project is planned for completion by late 2018.

The No Action Alternative includes the following roadway projects:

- **Boundary Channel Drive Interchange:** Arlington County plans to redesign and reconstruct the Long Bridge Park Drive interchange with I-395 and Boundary Channel Drive to increase safety and better accommodate multimodal transportation. This project is planned for completion by 2021.

1.4.2. Action Alternatives

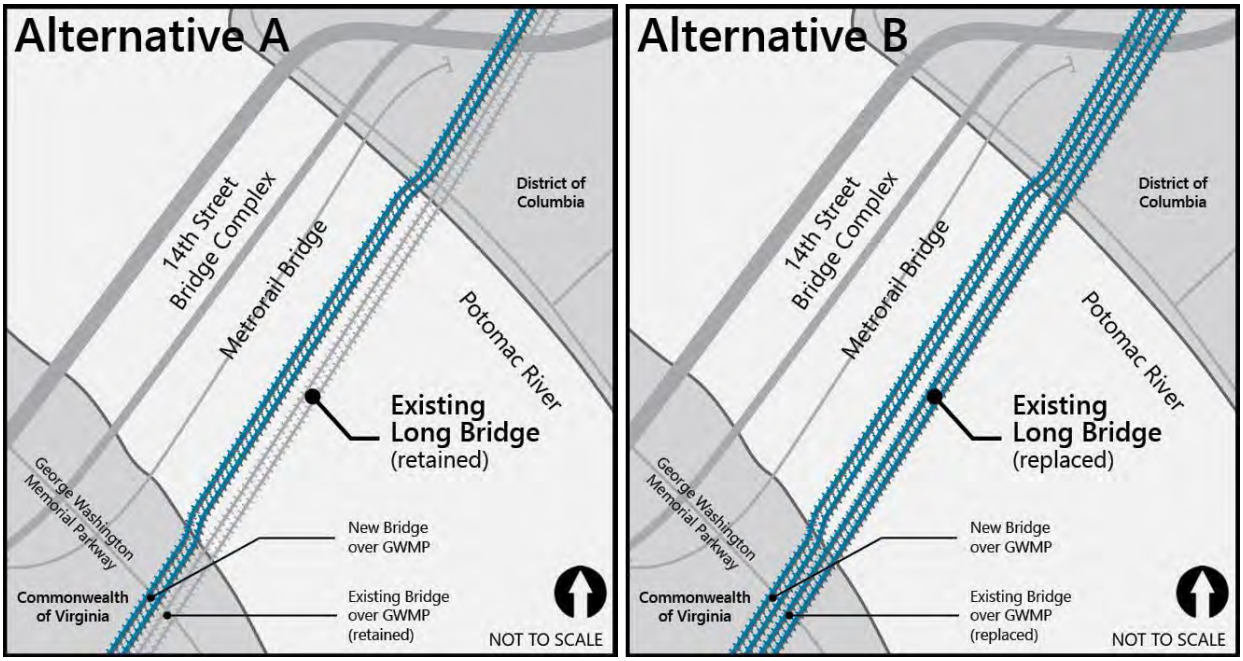
Based on the results of concept screening completed by FRA and DDOT, in addition to comments from agencies, the public, and Consulting Parties, FRA and DDOT selected two Action Alternatives to be evaluated in the DEIS. Action Alternative A and Action Alternative B are shown in **Figure 1-3**. Both Action Alternatives involve constructing a new two-track bridge upstream of the existing bridge. The Action Alternatives vary in whether they retain or replace the existing bridges over the GWMP and the Potomac River:

- **Action Alternative A**: The existing two-track Long Bridge would be retained, and a new two-track bridge would be constructed upstream of the existing Long Bridge to create a four-track crossing over the Potomac River. A new railroad bridge would also be constructed to span above the GWMP. The existing two-track railroad bridge above the GWMP would remain.
- **Action Alternative B:** The existing two-track Long Bridge would be replaced with a new two-track bridge and another new two-track bridge would be constructed upstream of the existing bridge, creating a four-track crossing over the Potomac River. Two new two-track railroad bridges would also be constructed to span above the GWMP, necessitating the removal of the existing bridge.

[20] The Virginia Avenue Tunnel is not within the Study Area, but directly relates to the operations and infrastructure of the Corridor and therefore was included as part of the No Action Alternative Infrastructure.

Outside of the Potomac River corridor, the Action Alternatives follow substantially the same course. These are described below.

Figure 1-3 | Action Alternatives to Be Evaluated in the DEIS



1.4.3. Action Alternative A

The southern Project limit is the RO Interlocking, a series of signals and track crossovers allowing trains to switch between tracks. As part of the DC2RVA project, DRPT is proposing a four-track crossover alignment at this location.[21] Action Alternative A would tie into the planned interlocking and add two new tracks in addition to the two existing tracks. The new and existing tracks would meet the switching and crossover length requirements necessary at an interlocking for interoperability.

Moving north from the RO Interlocking, the four-track alignment proposed for the Project would continue adjacent to the Long Bridge Park and would then cross over the GWMP on the existing two-track bridge and a new two-track bridge. A new two-track bridge would be constructed over the Mount Vernon Trail and continue across the Potomac River upstream of the existing bridge. Additional information on the proposed bridge design and engineering is provided in **Section 1.5, Bridge Structure Types.**

After crossing the Potomac River, the new bridge structure would extend over Ohio Drive SW in the District and end at an abutment north of the street. The new upstream bridge would extend into National Park Service (NPS) Parking Lot C. The two new western track alignments would continue north from NPS Parking Lot C with a new single-span bridge spanning the Washington Metropolitan Area

[21] DRPT. *DC2RVA Tier II DEIS*, Appendix A – Alternatives Technical Report. Accessed from http://dc2rvarail.com/files/9615/0413/6228/Appendix_A-Attachment_A_Corridor_Segments.pdf. Accessed on July 18, 2018.

Transit Authority Metrorail Yellow Line portal. Retaining walls would be required on both sides of each two-track alignment to retain embankment fills.

The four new tracks would continue across I-395 on two separate two-track bridges. After bridging I-395, the four tracks would converge into parallel alignments and widen to the east of the existing track alignment but would still be within the existing right-of-way. The four tracks would continue north along the Corridor and cross over Ohio Drive SW for a second time on a single new four-track bridge. Retaining walls would again be required on either side of the Corridor to retain embankment fill slopes.

The corridor would cross the Washington Channel at the mouth of the Tidal Basin on a single new four-track bridge that would replace the existing bridge. Just north of the Washington Channel crossing, the tracks would cross Maine Avenue SW and Maiden Lane on a new four-track bridge. The existing retaining wall to the west side of the tracks along the 14th Street SW off-ramp would be reconstructed, and the ramp may require re-alignment at the intersection. A new retaining wall would be required along the east side of the railroad Corridor between the tracks and the Washington Marina parking lot. The realignment of the two existing tracks and the addition of two new tracks would require that the Maine Avenue SW pedestrian bridge be replaced at a location east of the existing location.

The four-track alignment would proceed along the Corridor between the Mandarin Oriental Hotel and the Portals V development, and would continue underneath the Maryland Avenue SW overbuild, a four-span structure with center piers and crashwalls. The configuration through Maryland Avenue SW currently includes a siding track in the center western bay and two tracks in the center eastern bay. The siding track would be eliminated, and the four tracks would be divided into the two center bays of the overbuild.

From Maryland Ave SW, the tracks would travel along the Corridor underneath 12th Street SW, the 12th Street Expressway, and L'Enfant Plaza SW. Just north of L'Enfant Plaza SW, the four tracks would tie into the proposed four tracks at the LE Interlocking, again meeting the switching and crossover length requirements necessary at an interlocking for interoperability.

1.4.4. Action Alternative B

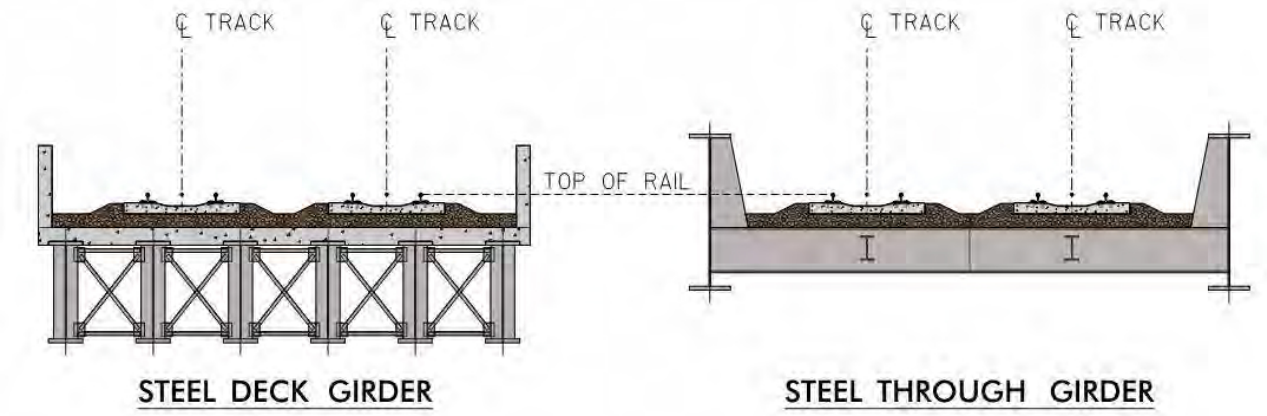
Action Alternative B is similar to Action Alternative A, but would replace the existing Long Bridge over the Potomac River and the railroad bridge over the GWMP rather than retaining those bridges. For the purpose of the EIS analysis, it is assumed that the entire bridge, including superstructure and substructures, would be replaced.

1.4.5. Bridge Structure Types

The same bridge types are being considered for both Action Alternatives. It is assumed that the new bridge(s) would be either a steel through girder bridge or a steel deck girder bridge, as shown in **Figure 1-4.** These are common types of structures for railroad bridges in the United States and are the two standard types used by CSXT. In addition, these structure types are considerably more cost effective than other structure types. To maintain an unobstructed view from Virginia and the Potomac River towards the Monumental Core of the District, the bridges would not feature signature navigational spans that would greatly stand out among the surrounding bridges. The structure must have a shallow depth over the Potomac River to maintain vertical clearance over the navigation channel without major

increases to the profile, which precludes the use of concrete girders at this location; therefore, only steel girders are proposed for the new bridge(s) over the river. More information on the evaluation and identification of the two proposed bridge structure types can be found in *Structures Study Summary Report* (September 2018).

Figure 1-4 | Structure Types Under Consideration



Over the navigation channel, a fixed span is proposed for the new bridge, with no ability to move or open for marine traffic. It is assumed that the pier and abutment locations would match the existing bridge, for a total of 22 piers across the river. However, consideration may be made during later design phases to lengthen the span over the navigation channel.

1.4.6. Train Volumes

FRA and DDOT developed estimates for train volume operations in the Long Bridge Corridor for the No Action Alternative and Action Alternatives to determine railroad performance in the Corridor and to inform the evaluation of the alternatives (**Table 1-1**). The current train volumes are based on existing operation agreements the railroad operators (VRE, Maryland Area Regional Commuter [MARC], Amtrak, and Norfolk Southern) have with CSXT, the owner of Long Bridge. These agreements specify a maximum number of trains each operator can run per day through the Long Bridge Corridor. Volume assumptions under the No Action Alternative were based on reasonably foreseeable decisions by the railroad operators given railroad capacity constraints.[22] This approach is consistent with the No Action Alternative train volumes assumed in the DC2RVA FEIS.[23] As the No Action Alternative would not increase the capacity of the Long Bridge Corridor, it is assumed that CSXT would not renegotiate the agreements with the railroad operators to give them additional slots. This assumption is based on CSXT's

[22] In order to test the capacity of the No Action infrastructure, the Phase II Study operations simulation assumed both freight and passenger operators would run their full desired service. As noted in **Section 2.2.2, Long Bridge Phase II Study, 2016**, the future No Action infrastructure scenario in this simulation resulted in fatally poor results that were operationally unacceptable for both passenger and freight operations.

[23] DRPT. *DC2RVA DEIS, Chapter 2*. Accessed from http://dc2rvarail.com/files/5315/0412/9086/Chapter_02_Alternatives_DC2RVA_DEIS.pdf. Accessed September 12, 2018.

need to maintain adequate capacity to allow for the operation of its present and future freight network demands.

The Action Alternatives assume the operators would run additional trains based on their long-range plans once the capacity is available. Planned train volumes for 2040 were confirmed based on input from the railroad operators, including VRE and MARC long-range plans, as well as from operations simulation modeling performed for the concurrent DC2RVA FEIS. Operator plans are based on the anticipated future demand for railroad service in the Corridor, driven by population and employment growth, roadway congestion, and freight growth.

Table 1-1 | Train Volumes in the Long Bridge Corridor

Train Operator	Current Number of Trains per Day[1]	No Action Alternative Number of Trains per Day[2]	Action Alternatives Number of Trains per Day[3]
VRE	34[4]	38	92
MARC	0	0	8
Amtrak/DC2RVA	24	26	44
CSXT	18	42	42
Norfolk Southern	0	6	6
TOTAL	**76**	**112**	**192**

[1] Current train volumes are based on existing operation agreements and confirmed by bridge stakeholders.
[2] Year 2040 No Action train volumes were established based on the concurrent DC2RVA EIS, Rail Service Growth in the No Build Alternative, Table 2.5-2, http://www.dc2rvarail.com/files/5315/0412/9086/Chapter_02_Alternatives_DC2RVA_DEIS.pdf, and confirmed by bridge stakeholders.
[3] Forecast year 2040 planned train volumes were established based on input from bridge stakeholders, including CSXT, VRE, Amtrak, Norfolk Southern, and MARC, as well as the concurrent DC2RVA EIS.
[4] The current number of VRE trains per day includes non-revenue movements.

1.5. Construction Overview

The construction methods, access and staging locations, and overall construction schedule represents an estimate of how the Action Alternatives could be constructed while maintaining two railroad tracks in operation throughout construction. The final construction methods used will require additional input from various disciplines, including geotechnical, hydraulics and drainage, utilities analysis, and more detailed structural design. The construction methods, access and staging locations, and overall construction schedule represents an estimate of how the Action Alternatives could be constructed while maintaining two railroad tracks in operation throughout construction. The final construction methods used will require additional input from various disciplines, including geotechnical, hydraulics and drainage, utilities analysis, and more detailed structural design.

1.5.1. Action Alternative A

This section describes the construction methods and activities for Action Alternative A, as well as the construction access and staging locations.

1.5.1.1. Construction Methods and Activities

Various construction methods and activities are anticipated during construction. The construction components for each bridge are similar, but access and construction at each area would require multiple methods, including implementing traffic control measures, employing phased construction, constructing temporary excavation support structures, constructing temporary finger piers, and working from barges.

The combination of a higher track profile than the existing profile and the creation of new embankments to accommodate the railroad alignment results in the need for retaining walls. The construction of the railroad subgrade, ballast, ties, tracks, drainage, and other railroad appurtenances would be constructed utilizing standard railroad construction methods.

The structure types along the Corridor are both through girder and deck girder structures. The through girder structures would be constructed at locations off-alignment while the deck girder structures allow for on-site phased construction, which would be comprised of three phases to maintain two-tracks in operation at all times. The Ohio Drive SW, I-395, Washington Channel, and Maine Avenue SW bridges would all require phased construction. During construction of these structures, extensive track shifts would be necessary to maintain railroad traffic.

Construction on Land

With high volumes of traffic along the roadways in the vicinity of the bridges in the Corridor, building new structures over the roadways will impact traffic. The structures over the GWMP, Ohio Drive SW, I-395, and Maine Avenue SW would require traffic control and potentially intermittent lane closures primarily during night-time hours for construction vehicle access. Lane shifts would be required as part of construction due to space constraints and would allow for activities pertaining to material and equipment deliveries, temporary support of excavation required to construct piers and abutments, and construction of superstructures and substructures. Certain activities may require cranes of various sizes to complete the steel erection, concrete deck work, and final finishing of the structure.

Construction over Water

Structures over the water would require cofferdams for construction of the piers and some abutments, as well as barges to store and assemble materials, to deliver labor and equipment, and to support various construction activities. Stationary, or spud, barges able to support a large crane would be placed at each pier for construction purposes as well as downstream for staging. The spud barges would be maneuvered by several tugboats and anchored during construction. Personal watercrafts would transport workers to and from the barges, and temporary finger piers would be built on each shore to allow materials and equipment to be loaded and unloaded from the barges. The finger piers would extend into the river enough to meet the depth required for a boat or barge to access the finger piers.

To install each bridge pier, a cofferdam would be constructed by installing steel sheeting around the limits of the pier so that the area can be dewatered down to the bottom of the footing elevation. Once sheeting is installed, the river bottom would be excavated to the depth needed to accommodate the installation of foundations and piers. Superstructures would be erected with barges and cranes and would likely require the delivery of materials from downstream. Due to the proximity to Ronald Reagan

Washington National Airport, the Federal Aviation Administration has a height restriction of 81' for maximum crane height in the project limits that would impact allowable crane sizes and material lifts.

1.5.1.2. Construction Access and Staging

Construction access and staging locations are summarized in **Table 1-2** and illustrated in **Figures 1-5** through **1-8**.

Table 1-2 | Summary of Action Alternative A Construction Access and Staging Locations

Activity	Description
RO Interlocking to Potomac River	
Staging & Access	• Within Long Bridge Park, south of future Aquatics Center • North of future Aquatics Center adjacent to GWMP • Adjacent to southbound GWMP roadway between I-395 and 14th Street Bridge
Access	• Limited use of GWMP for construction vehicles; temporary removal of center median
Staging	• Inside Boundary Channel Drive clover leaf • Adjacent to northbound GWMP roadway south of existing Long Bridge • Adjacent to northbound GWMP roadway between existing Long Bridge and Metrorail Bridge • Temporary relocation of Mount Vernon Trail to avoid construction
Potomac River	
Staging & Access	• Finger piers at each shoreline between new railroad bridge and existing Metrorail Bridge
Staging	• Temporary barge in Potomac River near Buckeye Drive SW
Potomac River to Maine Avenue SW	
Staging & Access	• Adjacent to railroad right-of-way between I-395 and the Washington Channel • Washington Marina parking lot
Access	• Access across Ohio Drive SW from NPS Parking Lots B and C • Access from west side of Project to avoid existing buildings • Finger pier between Ohio Drive SW and the Washington Channel
Staging	• NPS Parking Lots B and C • Temporary concrete plant in NPS Parking Lot B • Field adjacent to Ohio Drive SW and I-395 • Maine Avenue SW pedestrian bridge removed prior to start of construction
Maryland Avenue SW to L'Enfant Plaza	
Access	• Existing access road through the Portals V development along D Street SW between L'Enfant Plaza and the 12th Street Expressway • Hancock Park

Figure 1-5 | Construction Access and Staging Locations – RO Interlocking to Potomac River

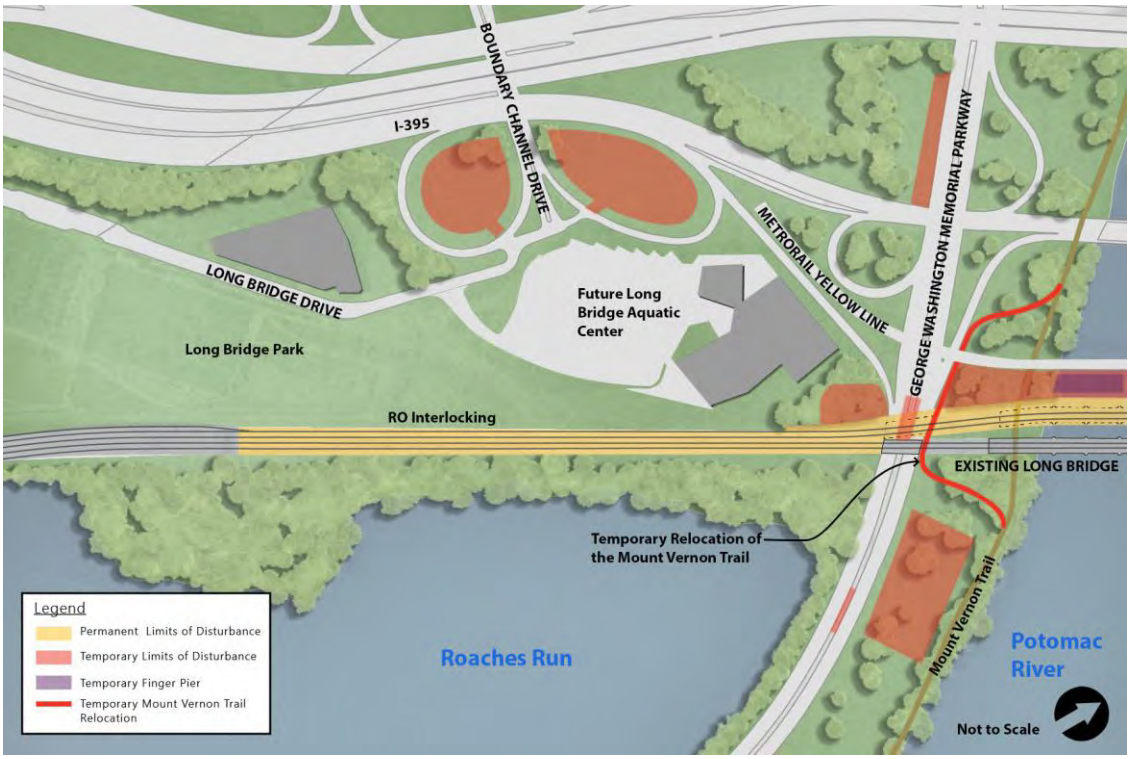


Figure 1-6 | Construction Access and Staging Locations – Potomac River

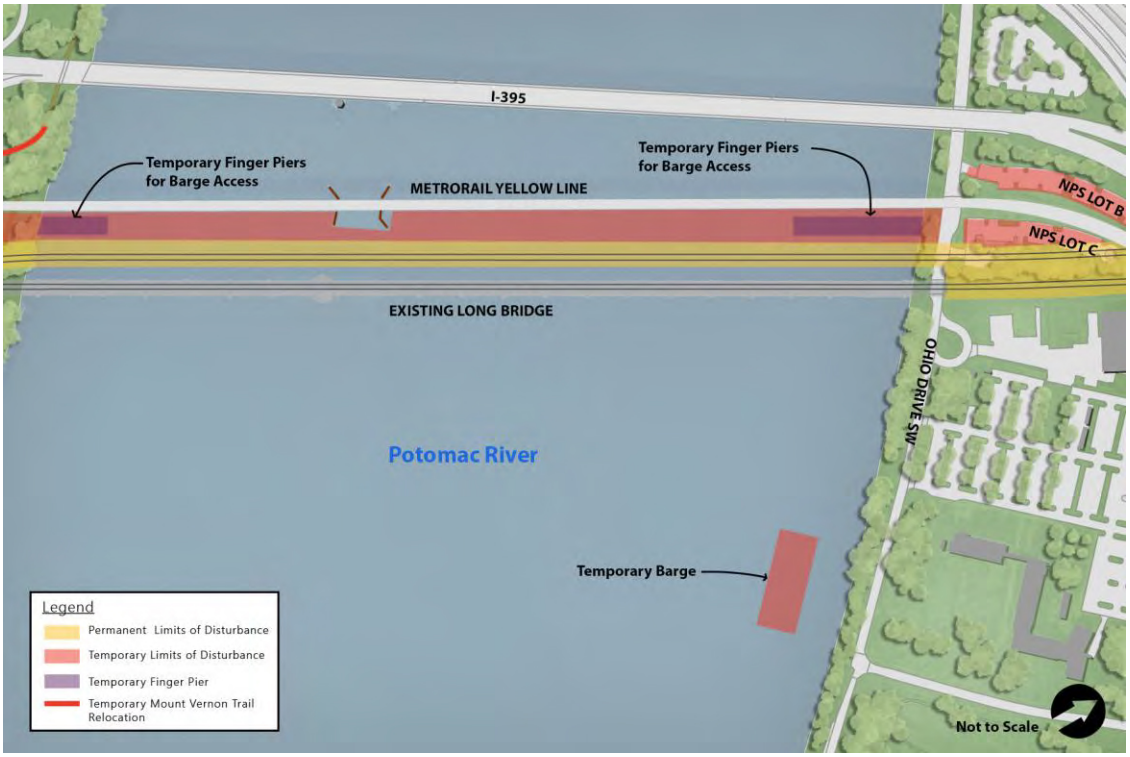


Figure 1-7 | Construction Access and Staging Locations – Potomac River to Maine Avenue SW

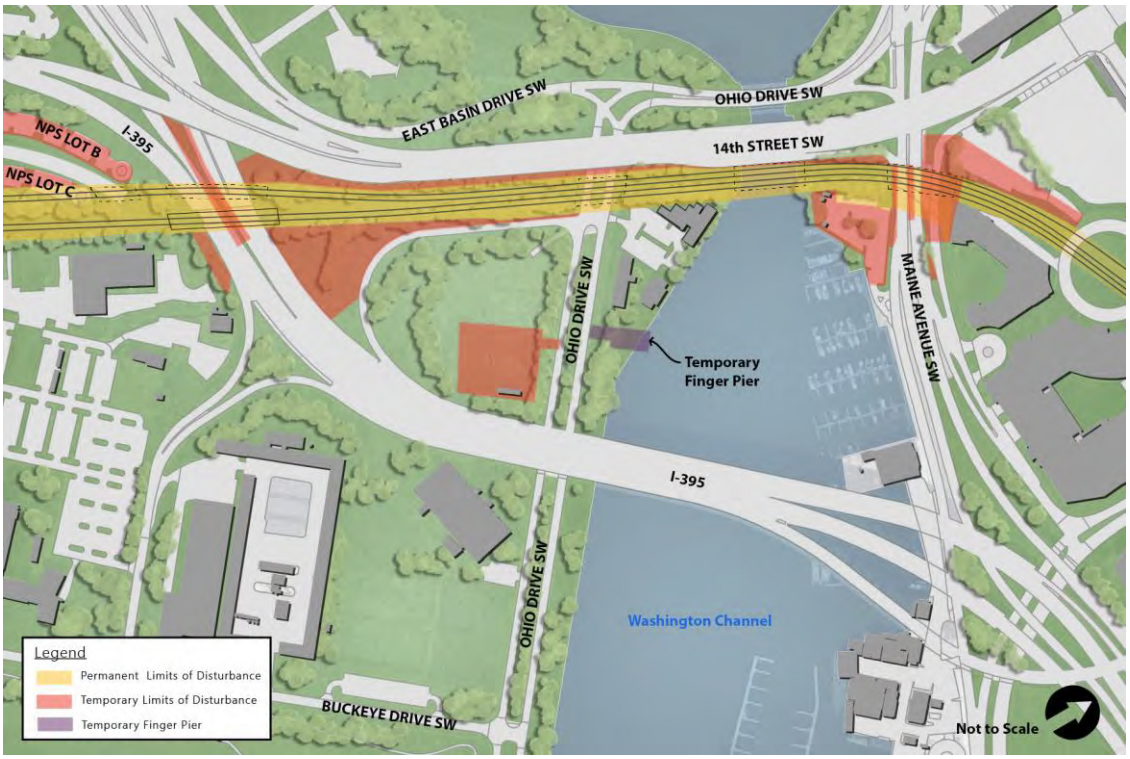
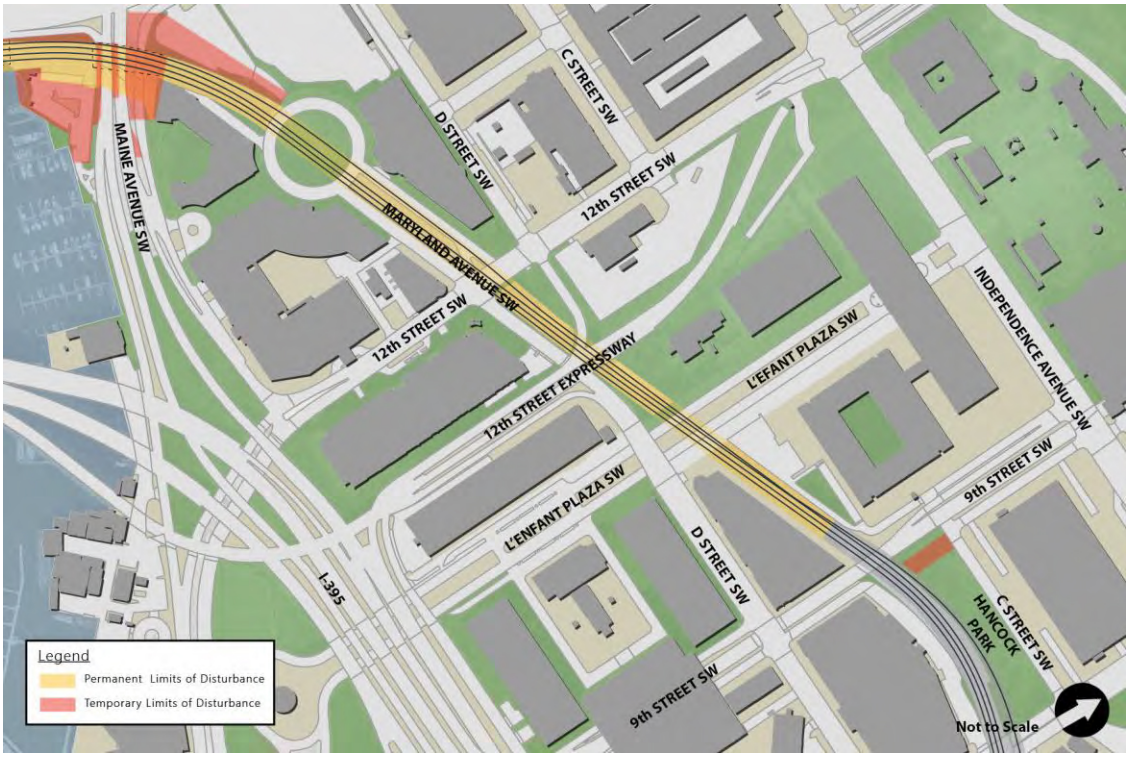


Figure 1-8 | Construction Access and Staging Locations – Maryland Avenue to L'Enfant Plaza



1.5.1.1. Construction Schedule

The estimated construction duration for Action Alternative A was determined based on assumed work hours that include anticipated work windows for night-time construction and lane closures, restricted access, site complexities, and work sequence. The total estimate construction duration is 60 months.

1.5.2. Action Alternative B

This section describes the construction methods and activities for Action Alternative A, as well as the construction access and staging locations.

1.5.2.1. Construction Methods and Activities

Action Alternative B would include the same activities in Action Alternative A (described in **Section 1.5.1, Action Alternative A**) and also includes replacing the existing bridge over the GWMP and the existing Long Bridge.

The existing structures at both the GWMP and Long Bridge would require demolition to accommodate the new structures proposed as part of Action Alternative B. Both existing superstructures consist of steel through girders that support the tracks. The removal of the Potomac River navigational channel truss would consist of torching or welding off existing bolts at bearings to release the truss from the substructures, placing the truss on a barge via jacking methods, and floating it off site for disposal. For the through girders, once the track is removed, a similar method as the truss would be used to release the girders from the bearings so they can be lifted via cranes. The steel can then be secured to trucks or barges and transported off-site for removal.

The piers and abutments consist of a combination of large stone masonry blocks and concrete on timber piles. There are several hundred timber piles that would be in conflict with the new substructures and piling, which would require their removal. Removal of the timber piles can be done by pulling the piles out with a crane or having the drilled shaft cut through the pile. Stone masonry would be lifted out in full blocks, or in some cases would require demolition, which includes breaking the concrete with an excavator to load smaller pieces onto barges or trucks for removal off-site. Cofferdams would be constructed around each pier for the removal and construction of new piers in the water.

The new structures could then follow similar construction means and methods as Action Alternative A for the new bridges over the GWMP and new upstream bridge over the Potomac River. Work would include additional traffic control, lane closures, staging areas and time to complete the construction.

1.5.2.2. Construction Access and Staging Locations

The construction access and staging for Action Alternative B would be similar to Action Alternative A. Additional construction access areas would be required east of the Long Bridge, extending from south of the GWMP bridge north across the Potomac River and Ohio Drive SW to accommodate the demolition and replacement of the existing bridge. There would be another relocation of the MVT to construct the new Long Bridge, similar lane closures with longer durations to remove the existing structure, and cofferdams around the existing substructures to allow for their removal and reconstruction.

1.5.2.3. Construction Schedule

The estimated duration for construction of Action Alternative B is 99 months. While all other work would be the same as Action Alternative A, replacing the existing bridge over GWMP and Long Bridge would add 38 and 57 months, respectively, to the construction schedule. Additionally, staging areas such as near Boundary Channel Drive, along the GWMP, and in NPS Parking Lots would continue for longer durations.

2.0 Natural Ecological Systems and Endangered Species

2.1. Introduction

This section defines the natural ecological systems and endangered species resources pertinent to the Long Bridge Project (the Project), provides the regulatory context, and describes the methodology for assessing these resources. For each Action Alternative and the No Action Alternative, this section describes the potential short-term and long-term impacts on natural ecological systems and endangered species. This section also discusses proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project.

Natural ecological systems include natural upland and aquatic communities and ecosystems, inclusive of their plant and animal components. Ecologically sensitive areas refer to natural areas that the state or Federal government has designated for conservation purposes. At the Federal level, ecologically sensitive areas include designated National Wildlife Refuges and "critical habitat" areas. At the state level, ecologically sensitive areas include those designated by the Virginia Department of Conservation and Recreation (VDCR) and the District's Department of Energy and Environment (DOEE) as Natural Area Preserves and Natural Community Areas.

The Endangered Species Act of 1973 (ESA) defines an **endangered species** as "any species which is in danger of extinction throughout all or a significant portion of its range."[1] The ESA also defines a **threatened species** as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

2.2. Regulatory Context and Methodology

This section describes the regulatory context for evaluating impacts to natural ecological systems and endangered species, as well as the methodology for evaluating current conditions and the probable consequences of the alternatives. The *Methodology Report* provides the complete list of laws, regulations, and other guidance and a full description of the analysis methodology.

2.2.1. Regulatory Context

Multiple Federal agencies play a role in regulating ecological systems, including the United States Army Corps of Engineers (USACE), the United States Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the United States Fish and Wildlife Service (USFWS). Each agency plays a role in the permitting, monitoring, restoring, and mapping of natural ecological systems nationwide.

USACE is responsible for overseeing the protection of wetlands and other waters of the US, and issuing permits under Section 404 of the Clean Water Act of 1972, which are required for dredge and fill activities within jurisdictional wetlands and waters.[2] The NOAA National Marine Fisheries Service (NMFS)

[1] 16 USC 1531
[2] 33 USC 1251

has regulatory oversight of endangered or threatened marine mammals and fishes. The USFWS is the Federal agency responsible for administration of the ESA, the Bald and Golden Eagle Protection Act of 1940,[3] and the Migratory Bird Treaty Act of 1918.[4] The ESA is the primary Federal legislation regulating threatened and endangered species.

Per USFWS, states serve as "Chief Stewards" for wildlife within their borders and may suggest species for listing, monitor species, assess habitats, and designate critical habitat regarding any Rare, Threatened, and Endangered (RTE) or candidate species. In Virginia, responsibilities are shared among the Virginia Department of Agriculture and Consumer Services, the Virginia Department of Game and Inland Fisheries (VDGIF), and VDCR's Division of Natural Heritage. The District acts in the role of a state government as well as a local government. Therefore, the District agency responsible for enforcing local wildlife laws is the DOEE.

2.2.2. Methodology

2.2.2.1. Natural Ecological Systems

The Local Study Area for natural ecological systems (**Figure 2-1**) includes the immediate Project footprint and lands and waters within 500 feet of the Project Area. The Local Study Area would capture any potential direct or indirect impacts caused by the footprint of the No Action and Action Alternatives. The Local Study Area also includes immediately adjacent waters connected to resources within the Project footprint as well as resources that may be affected, directly or indirectly, by the Project. For the assessment of impacts to submerged aquatic vegetation (SAV) in the Potomac River, the Local Study Area also includes approximately 2,000 feet upstream and downstream to address the potential for scour and deposition to SAV beds. The analysis did not include a larger Regional Study Area for Natural Ecological Systems, as widespread impacts are not anticipated for these resources due to the localized footprint of the No Action and Action Alternatives.

Evaluation of environmental consequences for this Project determined the impacts of the proposed alternatives on sensitive habitats or ecosystems. Impact evaluation included qualitative and quantitative methods to assess potential for direct and indirect impacts based on:

- Accessibility of habitat;
- Proximity of habitat and proximity to the Project; and
- Potential changes to important habitat characteristics (for example, water and air quality, noise and vibration), impacts to habitat, and ecological conditions.

[3] 16 USC 668-668d
[4] 16 USC 703-712; 50 CFR 10.13

Figure 2-1 | Natural Ecological Systems and RTE Species Study Area

2.2.2.1. Endangered Species

The Local Study Area for RTE species (**Figure 2-1**) includes the immediate footprint of the proposed Project and lands and waters within 500 feet of the Project Area. For the portion of the Project over the Potomac River, the Local Study Area also includes approximately 2,000 feet upstream and downstream to address the potential for scour and deposition to habitat for listed species. The analysis did not include a larger Regional Study Area for Endangered Species, as widespread impacts are not anticipated for these resources due to the localized footprint of the No Action and Action Alternatives.

The evaluation of the Environmental Consequences used qualitative and quantitative methods to analyze the direct and indirect impacts of the proposed Project's structures and operations on endangered species. The analysis identified the impacts by assessing:

- How the alternatives would affect or disrupt habitat or designated critical habitats (structure placement, vegetation removal);
- Changes to habitat conditions and quality for listed species due to proximity to the Project;
- Impacts to areas of seasonal importance for RTE species (such as breeding grounds and stopover sites);[5] and
- Impacts that have the potential to change migration patterns and accessibility of habitat to RTE species.

2.3. Permanent or Long-Term Effects

This section considers the direct and indirect impacts of the Action Alternatives and No Action Alternative.

2.3.1. Natural Ecological Systems

2.3.1.1. Terrestrial Vegetation

As described in the *Affected Environment Report*, the Local Study Area's terrestrial habitat is considered developed, with vegetation consisting of maintained grasses, landscaping, and small areas of disturbed forest and early-succession habitats mostly located adjacent to Roaches Run. Terrestrial vegetation impacts vary between the alternatives. Forest impacts are restricted to the portions of the alternatives that fall within the Commonwealth of Virginia, where forested areas occur between the existing railroad right-of-way and Roaches Run. Other vegetation impacts include areas of scrub-shrub field to the west of the existing tracks in Virginia, as well as small groups of trees, individual trees, and landscaped lawns and vegetation as the Long Bridge Corridor continues north from Virginia to the District. Trees and other vegetation removals that would be replaced following construction access and staging are considered temporary impacts, and are discussed in **Section 2.4, Temporary Impacts**. Permanent impacts are shown in **Table 2-1**. **Figures 2-2 through 2-4** depict the areas of permanent impacts to vegetated areas for Action Alternative A, while **Figure 2-5 through** Error! Reference source not found.**6** depict those for Action Alternative B.

[5] The place where a migratory bird pauses between migratory flights is called a *stopover site.*

Figure 2-2 | Action Alternative A Permanent and Temporary Impacts to Vegetated Areas, RO Interlocking to the Potomac River

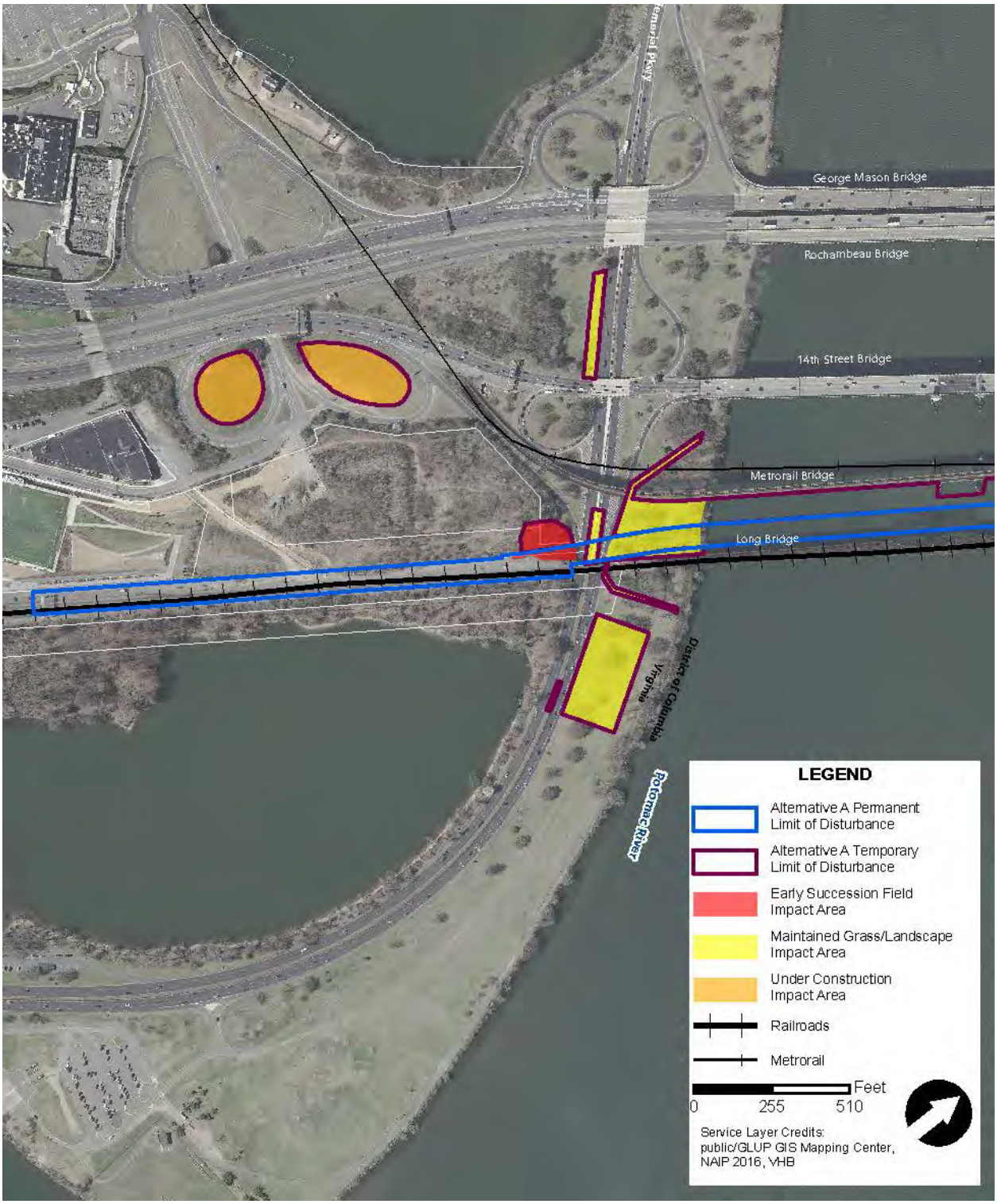


Figure 2-3 | Action Alternative A Permanent and Temporary Impacts to Vegetated Areas, Potomac River to Washington Channel

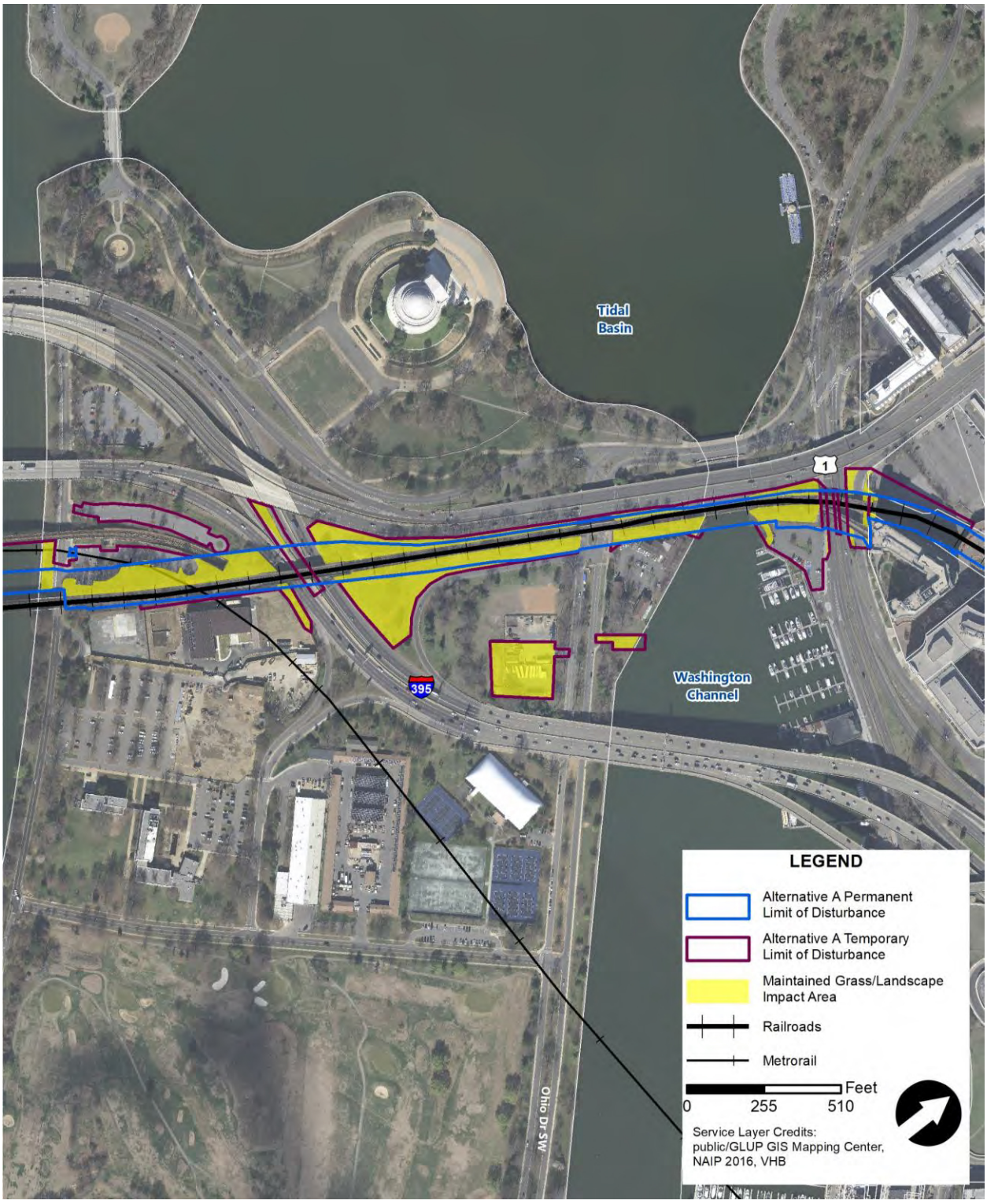


Figure 2-4 | Action Alternative A Permanent and Temporary Impacts to Vegetated Areas, Washington Channel to LE Interlocking

Figure 2-5 | Action Alternative B Permanent and Temporary Impacts to Vegetated Areas, RO Interlocking to over the Potomac River

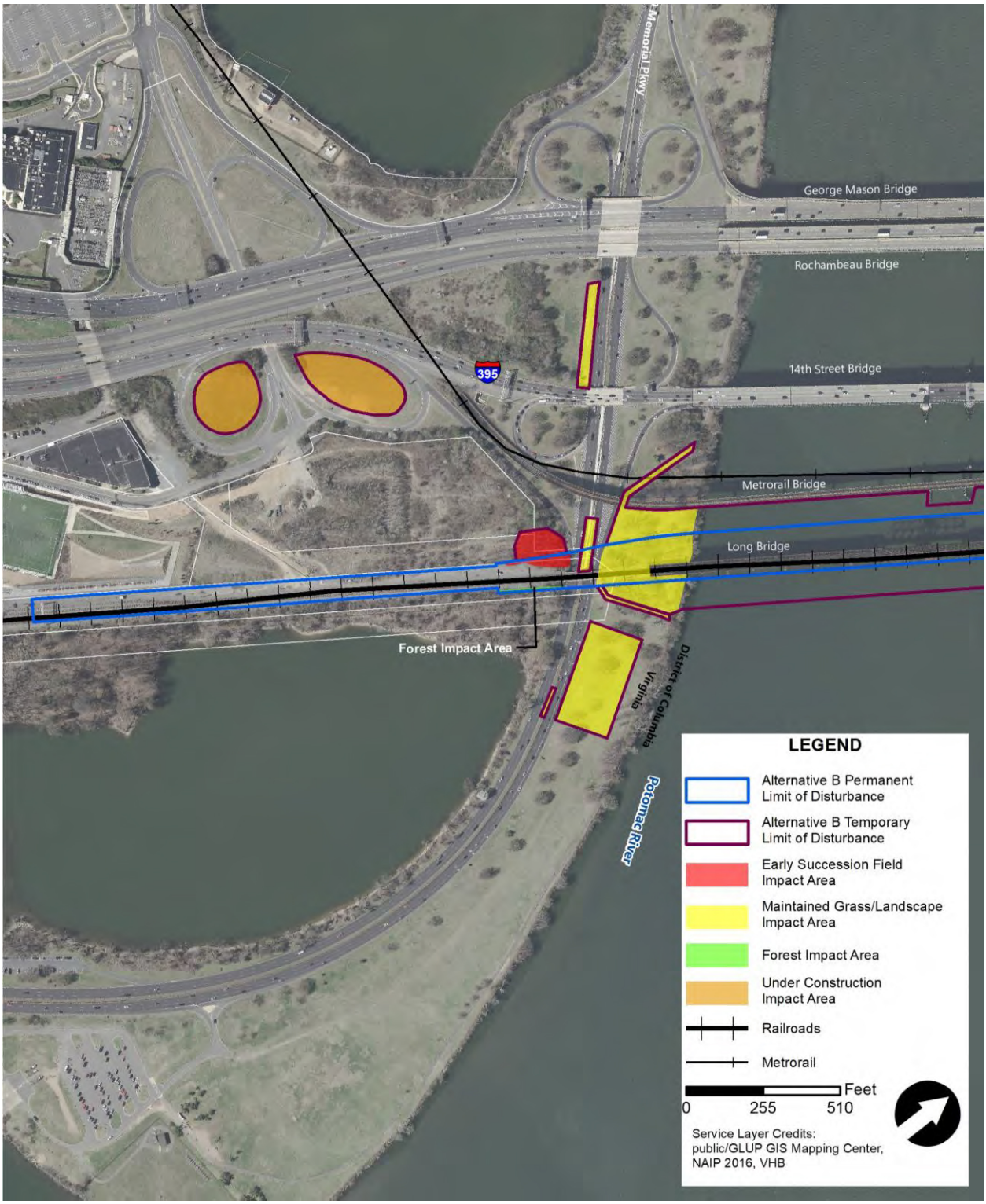


Figure 2-6 | Action Alternative B Permanent and Temporary Impacts to Vegetated Areas, Potomac River to Washington Channel

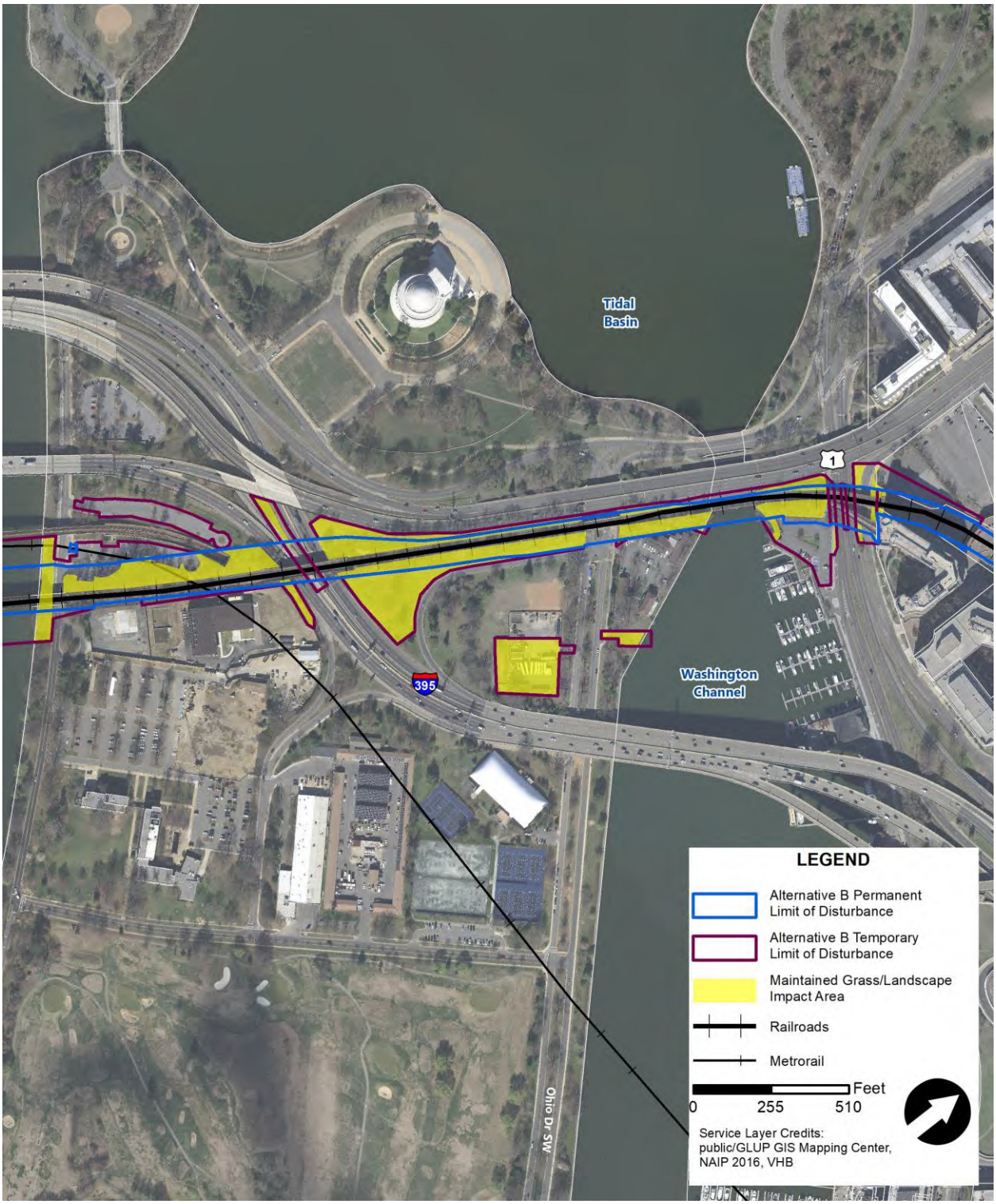


Table 2-1 | Permanent Impacts to Forests for Each Alternative

Alternative	Forests	Early Succession Field	Maintained Grass/Landscaping
Action Alternative A	0 sf (0 ac)	5,696 sf (0.1 ac)	156,836 sf (3.6 ac)
Action Alternative B	2,135 sf (<0.1 ac)	5,696 sf (0.1 ac)	177,594 sf (4.07ac)

No Action Alternative

The No Action Alternative may have some adverse permanent direct impact to natural ecological systems through the conversion of existing land coverage to railroad structures and maintained right-of-way. However, most of the land within the Local Study Area that would be affected by the projects in the No Action Alternative is already developed. In the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative assumes that Long Bridge remains in service, with continued maintenance as necessary. The No Action Alternative also assumes that the Virginia Department of Rail and Public Transportation (DRPT) and VRE complete the other planned railroad projects that would expand capacity to four tracks on either side of the Long Bridge Corridor. These projects may result in some limited removal of terrestrial vegetation, particularly within the Virginia portion of the Local Study Area. The Long Bridge Park project will also result in the removal of some of the early-succession forest located to the west of the existing railroad alignment.

Action Alternative A

Action Alternative A would have minor permanent direct adverse long-term impacts to terrestrial vegetation associated with the removal of vegetation required for the linear footprint of the additional two tracks. Permanent impacts would total 3.7 acres of narrow, short strips of terrestrial vegetation at Long Bridge Park, George Washington Memorial Parkway (GWMP), and East Potomac Park. There are no forest impacts under this Action Alternative.

Near where Long Bridge currently crosses the George Washington Memorial Parkway (GWMP), impacts to 5,696 square feet (0.1 acres) of early succession scrub-shrub areas and small tree clusters would occur from the installation of the new bridge deck and support structures (**Table 2-1**). Much of the woody vegetation at this location comprises non-native invasive species. Much of the remaining wooded area would be cleared and developed into further parkland as an addition to Long Bridge Park.[6] There would also be 156,836 square feet (3.6 acres) of permanent impacts to maintained/landscape areas within the Long Bridge Corridor that Action Alternative A would directly cross. These include several shade trees with maintained grass at the GWMP between the roadway and the Potomac River, as well as unmanaged patches of trees, vines, and shrubs adjacent to the existing tracks at the East Potomac Park.

[6] Note that all lands for Long Bridge Park are owned by Arlington County.

In addition to direct impacts to canopy cover, tree and vegetation removal or pruning from construction activities may result in indirect permanent impacts to the overall plant community, including loss of species diversity. The risk of invasive species naturally replacing native vegetation would also increase. Even if trees are not removed directly, but rather require pruning or other alterations to accommodate construction activities, improper tree care could result in tree degradation and death. Construction activities could result in delayed tree and vegetation impacts, as changes to surface water flow from compaction could impact the ability of trees to thrive. Similarly, if new areas are shaded and sunlight pathways change, vegetation could fail to thrive, resulting in mortality after construction is completed. If these circumstances arise, then temporary impacts would be considered permanent. Measures used to avoid and minimize impacts to terrestrial vegetation are included in **Section 2.5, Avoidance, Minimization, and Mitigation**.

Action Alternative B

Action Alternative B would have minor permanent direct adverse long-term impacts to terrestrial vegetation. This Action Alternative would impact 2,135 square feet (<0.1 acres) of existing ash–leaf maple–black cherry forest between Roaches Run and the GWMP due to a widened footprint as it approaches the Potomac River (**Table 2-1**). Action Alternative B would also affect an additional 20,758 square feet (0.48 acres) of maintained or landscaped areas where it crosses the GWMP and East Potomac Park. Action Alternative B would have the same indirect impacts as those described for Action Alternative A.

2.3.1.2. Wetland Vegetation

No Action Alternative

The No Action Alternative may have some adverse permanent direct impact to wetland vegetation through the conversion of existing land coverage to railroad structures and maintained right-of-way. However, most of the land within the Local Study Area that would be affected by the projects in the No Action Alternative is already developed. In addition, the majority of projects in the No Action Alternative are not located adjacent to wetlands. The DC2RVA Project would include work adjacent to Roaches Run, but as documented in the Final Environmental Impact Statement (FEIS) for that project, it would not affect that water body or its associated wetlands.[7] As noted in **Section 3, Water Resources and Water Quality**, the projects in the No Action Alternative would likely result in a slight increase in impervious area or conversion of a small area from previously disturbed vegetated area to rail ballast. However, the increased runoff would not be expected to be of sufficient volume to cause erosion of the wetlands nor carry enough sediment to fill in wetlands and cover vegetation.

Action Alternative A

Since impacts to the vegetated wetlands associated with Roaches Run would be avoided, there are no anticipated permanent direct or indirect adverse long-term effects on wetland vegetation from Action

[7] Virginia Department of Rail and Public Transportation. DC to Richmond Southeast High Speed Rail Final Environmental Impact Statement and Final Section 4(f) Evaluation, Updated Environmental Resource Mapbooks. May 2019. Accessed from http://dc2rvarail.com/files/4115/5380/5868/Part48b_Appendix_M1_Wetlands_Streams_Area1_-_Area2_Part1_DC2RVA_FEIS.pdf. Accessed July 16, 2019.

Alternative A. None of the work associated with this alternative would extend into wetland areas such as Roaches Run. While Action Alternative A would cause slight increases in impervious surface as described in **Section 3, Water Resources and Water Quality**, the increased runoff would not be expected to be of sufficient volume to cause erosion of the wetlands nor carry enough sediment to fill in wetlands and cover vegetation.

Action Alternative B

Action Alternative B would have the same impacts on wetland vegetation as Action Alternative A, as the permanent footprint of the new bridge piers would be identical to the existing bridge piers. While Action Alternative B would cause slight increases in impervious surface as described in **Section 3, Water Resources and Water Quality**, the increased runoff would not be expected to be of sufficient volume to cause erosion of the wetlands nor carry enough sediment to fill in wetlands and cover vegetation.

2.3.1.3. Submerged Aquatic Vegetation

No Action Alternative

The No Action Alternative would have no permanent direct impacts on SAV as none of the projects in the No Action Alternative would require construction within the Potomac River or Roaches Run that would cause additional shading of existing or potential SAV beds beyond the infrastructure already in place. In addition, the No Action Alterative would not cause increase sediment loads beyond current inputs that could result in sediment covering SAV and would not result in increased boat traffic that could negatively affect water clarity or cause propeller scarring of existing SAV beds.

Action Alternative A

Action Alternative A would result in one pier encroaching into a SAV bed found along the northern shore of the Potomac River. This would result in minor permanent direct adverse impacts to SAV in the amount of 1,750 square feet associated with the 70-foot by 25-foot cofferdam construction of the pier structure. Minor permanent impacts to SAV may occur over time via shading at this location caused by the new deck in the amount of 1,900 square feet, and minor permanent indirect adverse impacts could occur to downstream SAV beds in the Potomac River within the Local Study Area due to scour and deposition from installing the crossing piers

Action Alternative B

Action Alternative B would have similar impacts on SAV as Action Alternative A. The new upstream bridge would be identical to the new bridge in Action Alternative A and would therefore have the same impacts. The piers for the replacement downstream bridge would be within the same footprint as the piers for the existing bridge and would therefore not have additional SAV impacts.

2.3.1.4. Wildlife

Impacts to terrestrial wildlife generally relate to impacts to habitat, such as direct physical modification of habitat or secondary degradation from the introduction of chemicals or other pollutants that can disrupt community structure, composition, and function. Wildlife impacts can also be subtle and include minor shifts in distribution or composition resulting from modifications to habitat. According to the

District of Columbia Wildlife Action Plan[8] and *Virginia Wildlife Action Plan,*[9] both updated in 2015, the largest threats to terrestrial wildlife, including species of greatest conservation need and their habitats in the District and Northern Virginia, are invasive species and land use changes. While the Project would not directly result in significant land use changes, the Project's long-term effects could result in an incidental increase in invasive species that ultimately affects the distribution, composition, and abundance of wildlife. Habitat modification or degradation can also result in disruption of wildlife movements within corridors that link disjunct patches of wildlife habitat. Portions of the Project Area cross a potential corridor for disturbance-tolerant wildlife species that follow the Mount Vernon Trail (MVT). This corridor would remain open following construction so any potential impacts to wildlife habitat connectivity would be considered temporary. A discussion of potential long-term effects to wildlife is provided below for each alternative.

No Action Alternative

The No Action Alternative may have some permanent direct adverse impacts to wildlife habitat through the conversion of existing land coverage to railroad structures and maintained right-of-way. However, most of the land within the Local Study Area that would be affected by the projects in the No Action Alternative is already developed.

Action Alternative A

The permanent wildlife habitat impacts under Action Alternative A would represent minor permanent direct adverse long-term impacts overall, and would constitute a negligible adverse long-term impact to wildlife within this region. Long-term indirect effects to wildlife would also be considered negligible.

Impacts to wildlife from Action Alternative A would include direct permanent loss of habitat accessible to wildlife resulting from construction of two additional railroad tracks. Because Action Alternative A involves the addition of the two new tracks immediately adjacent to the existing railroad tracks, the effects would include removal of several mature hardwood trees within the GWMP and minor encroachments to brushy and narrow strips of trees and small forested habitat south of the Potomac River. The thin forest strips north of the Potomac River provide terrestrial habitat for wildlife in the urban setting and the trees may provide nesting habitat and roosting habitat for migratory birds and avian species common in urban settings, such as the American robin (*Turdus migratorius*), northern cardinal (*Cardinalis cardinalis*), and northern mockingbird (*Mimus polyglottos*). Action Alternative A would not result in any impacts to the existing forest adjacent to Roaches Run. The new tracks would mostly be placed within areas already disturbed and cleared of vegetation, creating only minor encroachment impacts to habitat. Terrestrial wildlife in this area would be minimally affected, particularly birds, as the majority of available habitat would remain.

Long-term indirect adverse effects could occur from an increase in invasive plant species following construction disturbance, as invasive plants typically colonize disturbed ground. This potential effect would be negligible because, following construction, the disturbed ground would be stabilized with a

[8] DOEE. 2015. *District of Columbia Wildlife Action Plan*. Accessed from https://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan. Accessed August 14, 2018.
[9] VDGIF. 2015. *Virginia Wildlife Action Plan*. Accessed from http://bewildvirginia.org/wildlife-action-plan/. Accessed August 14, 2018.

native seed mix and restored, limiting the colonization by invasive plants. In addition, NPS will require the washing of equipment for all and any outside debris prior to entering the park lands or river. NPS will also require that any soils, sod, mulch, seed, or other organic matter be certified weed seed free. Action Alternative A would also cause a negligible permanent indirect beneficial impact to wildlife that use bridge structures due to an increase in available surface for plants and immobile wildlife to use as habitat and nesting sites for birds.

Waterfowl using the Potomac River, Washington Channel and Tidal Impoundment, and Roaches Run may be temporarily displaced by construction activity, but would not be permanently affected by implementation of Action Alternative A. With the addition of a new bridge under Action Alternative A, there would be an increase in available habitat for wildlife that utilize bridge structures.

Action Alternative B

Permanent long-term direct and indirect impacts to wildlife and wildlife habitat from Action Alternative B would be similar to those of Alternative A, being negligible and minor, respectively, even though the amount of forest clearing adjacent to Roaches Run would be more than double that of Action Alternative A. Action Alternative B would permanently impact approximately 2,135 square feet (<0.1 acres) of the forest adjacent to Roaches Run. The additional forest clearing would occur near the crossing of the replacement bridge over the GMWP. Forest within this area is already disturbed and comprised of a mix of native and invasive trees and other plants. Wildlife use of this existing forested area is likely limited because of the small size and disturbed character, so the opportunity for impacts to wildlife would also be limited. Also, forest habitat would remain adjacent to Roaches Run, so any resident or transient wildlife would still have access to the remaining habitat.

2.3.1.5. Aquatic Biota

The anticipated permanent adverse impacts to aquatic biota from the Action Alternatives would result from installing shaft foundations and pier structures in the Potomac River and Washington Channel. These activities would result in permanent loss or alteration of aquatic habitat. Following coordination with NMFS, it was confirmed that no Essential Fish Habitat (EFH) exists within the Project Area. Under all Action Alternatives, no adverse long-term effects to EFH are expected. Potential permanent or long-term effects to aquatic biota under each Action Alternative are discussed below.

No Action Alternative

The No Action Alternative would have no permanent direct impacts on aquatic biota as none of the projects in the No Action Alternative would occur within the Potomac River or have impacts to fish habitat.

Action Alternative A

Action Alternative A would have minor permanent adverse long-term impacts to aquatic biota. Permanent long-term indirect effects to aquatic biota would be considered negligible. Permanent or long-term effects to aquatic biota would result from changes to aquatic habitat within the Local Study Area. Impacts to benthic invertebrates, such as aquatic worms and crustaceans, would result from the disturbance of soft substrate habitat on the river bottom due to the installation of bridge piers. The

bridge construction under Action Alternative A would include the installation of 22 piers in the Potomac River and replacing one pier in the Washington Channel and Tidal Impoundment with a larger pier, totaling 7,392 square feet (0.2 acres) and 1,115 square feet (<0.1 acres) of disturbed benthic habitat, respectively.

Impacts from habitat disturbance would have a minor, localized effect on benthic invertebrates due to the relative abundance of remaining available habitat within and adjacent to the Local Study Area. In addition to direct habitat disturbance, increased shading associated with the bridge deck may limit ecosystem productivity and benthic invertebrate density and diversity in areas that remain shaded for most of the day.[10] Although no SAV beds would be impacted by construction activities in the Potomac River, the spread of adjacent beds, a high-quality habitat for benthic invertebrates, fish, and other aquatic biota, may be constrained with increased shading associated with the additional two-track bridge construction under Action Alternative A.

The disturbance of bottom substrate would likely have negligible effects on fish communities, due to the abundance of similar benthic foraging habitat for fish surrounding the Project Area. In addition, the installation of hard, stable pier structures would present opportunity for colonization by sessile or immobile invertebrates,[11] as well as cover and foraging opportunities for many fish species found in the Potomac River and Washington Channel (for example, white perch [*Morone americana*], striped bass [*Morone saxatilis*], yellow perch [*Perca flavescens*], largemouth bass [*Micropterus salmoides*], and smallmouth bass [*Micropterus dolomieu*]).

Overall, permanent impacts under Action Alternative A are expected to be negligible for fish, including migratory species. For navigation and hydraulic reasons, the additional 22 piers in the Potomac River would line up with the pier structures on the existing bridge, minimizing permanent impacts to migratory species.

Action Alternative B

The permanent impacts (both direct and indirect) to aquatic biota under Action Alternative B would be the same as the impacts under Action Alternative A. Because the permanent footprint of the pier structures of the replaced bridge would be identical to the existing footprint, there would be no additional permanent impacts to aquatic biota.

2.3.2. RTE Species

Coordination and screening using the USFWS Information, Planning, and Consultation (IPaC) system identified no Federally listed RTE species, critical habitats, refuge lands, or fish hatcheries within the Local Study Area, and indicated that the project would have no effect on these resources or nesting bald eagles. Coordination with the NOAA Fisheries Protected Resources Division indicated that the Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*) are present in the Potomac River. The New York Bight, Chesapeake Bay, South Atlantic, and Carolina distinct

[10] Struck, S.D., C.B. Craft, S.W. Broome, M.D. Sanclements, and J.N. Sacco. 2004. *Effects of bridge shading on estuarine marsh benthic invertebrate community structure and function*. Environmental Management 34(1):99-111.
[11] Lippson, Alice J., and Robert L. Lippson. 2006. *Life in the Chesapeake Bay*. 3rd ed. Baltimore: Johns Hopkins University Press. Pp. 344.

population segments (DPSs) of Atlantic sturgeon are Federally endangered; the Gulf of Maine DPS is Federally threatened. NOAA Fisheries indicated that individuals originating from any of these DPSs could occur in the Project Area. However, as noted in the *Affected Environment Report*, there are no recent records of Atlantic Sturgeon upstream of Indian Head. Most records for this species occur downstream of the Harry Nice Bridge. Recent records exist of shortnose sturgeon below Little Falls at Chain Bridge, so it is likely that some individuals of this species pass beneath Long Bridge during annual spawning runs.

An official response from VDCR regarding the presence of natural heritage resources in the Commonwealth of Virginia indicated that no state-listed species occur within the Local Study Area. In addition, the VDGIF Fish and Wildlife Information Service identified nine Federally or state-listed threatened or endangered species likely to occur within 3 miles of the Local Study Area. None of these species have confirmed observations within the 3-mile radius. The VDGIF's Northern Long-Eared Bat (*Myotis septentrionalis*) Winter Habitat and Roost Trees application also indicated that no known occupied maternity roosts or hibernacula buffers are present within or adjacent to the Local Study Area.

NPS has reported the presence of nesting sites for Peregrine Falcons (*Falco peregrinus)* and Black-Crowned Night Heron (*Nycticorax nycticorax*) on the north side of the Washington Channel along the existing railroad tracks, although no reports have been posted on eBird checklists and DOEE did not indicate their presence. While not RTE species, these species are on the District's list of Species of Greatest Conservation Need.[12] Prior to construction, DRPT, the project sponsor for final design and construction, would conduct a survey during nesting season to determine the species' presence.

Based on the review of RTE species that have the potential to occur within the Local Study Area, only impacts to Atlantic and shortnose sturgeon are considered below.

Sturgeon could potentially occur within the Potomac River seasonally, and thus be affected by permanent changes to requisite habitat or secondary effects from Project-related long-term changes in water quality. Additional bridge piers in the Potomac River would permanently impact potential foraging habitat for sturgeon. Because of the availability of foraging and spawning habitat farther upstream in the Potomac River, it is unlikely that sturgeon would use the Washington Channel/Tidal Impoundment. A discussion of potential long-term effects to sturgeon for each Action Alternative is provided below.

2.3.2.1. No Action Alternative

The No Action Alternative may have some adverse permanent direct impact to RTE species through the conversion of existing land coverage to railroad structures and maintained right-of-way. However, most of the land within the Local Study Area that would be affected by the projects in the No Action Alternative is already developed.

2.3.2.2. Action Alternative A

Action Alternative A would have minor adverse long-term impacts to shortnose or Atlantic sturgeon. Long-term indirect effects to sturgeon would be considered negligible. Permanent or long-term direct effects to sturgeon could occur from permanent changes to available habitat within the Local Study Area

[12] DOEE. District of Columbia Wildlife Action Plan, 2015 Update. July 2015. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/00_2015WildLifeActionPlan_Chapters_07_31_2015_PublicVersion_0.pdf. Accessed May 20, 2019.

for the new two-track bridge crossing of the Potomac River. As noted above, shortnose sturgeon is the most likely species of sturgeon to occur within the Project Area, but Atlantic sturgeon cannot be completely ruled out. Also, the Potomac River up to Little Falls has been mapped as Critical Habitat for Atlantic sturgeon. One of the Atlantic sturgeon Critical Habitat components is availability of soft-bottom substrate for foraging within salinity ranges from 0 to 0.5 parts per thousand. The Local Study Area lies within this salinity range, so the impacted soft-bottom substrate for bridge piers would permanently impact Critical Habitat for Atlantic sturgeon. Adult and juvenile sturgeon typically forage on soft bottom substrates that likely occur within the Project Area, as well as available SAV.[13,14] No permanent impacts are anticipated to SAV from Action Alternative A, so long-term effects to juvenile shortnose sturgeon foraging habitat are not anticipated.

New bridge piers and bridge abutments would permanently disturb bottom substrate, reducing available foraging habitat for adult shortnose or Atlantic sturgeon and disturbing Critical Habitat for Atlantic sturgeon. At present, 22 in-water piers that are 8 feet wide by 42 feet long are proposed for the new railroad bridge, which would permanently remove 7,392 square feet (0.2 acres) of bottom foraging substrate from the Project Area. This would represent 7,392 square feet (0.2 acres) of Atlantic sturgeon Critical Habitat impact as well. This area of permanently removed Critical Habitat foraging area is relatively small in the overall extent of the undisturbed adjacent area of the river, and sufficient foraging habitat would still be available to sturgeon. Therefore, the permanent impacts to sturgeon and Atlantic sturgeon Critical Habitat would be considered minor and would not likely adversely affect shortnose or Atlantic sturgeon.

2.3.2.3. Action Alternative B

The permanent direct and indirect impacts to shortnose or Atlantic sturgeon under Action Alternative B would be the same as the impacts under Action Alternative A. Because the permanent footprint of the pier structures of the replaced bridge would be identical to the existing footprint, there would be no additional permanent impacts to sturgeon species or Atlantic sturgeon Critical Habitat.

2.4. Temporary Effects

This section considers the direct and indirect temporary impacts of the Action Alternatives during construction, based on conceptual engineering design.

2.4.1. Natural Ecological Systems

2.4.1.1. Terrestrial Vegetation

Temporary effects to vegetation would include disturbance related directly to construction, as well as disturbance in support of construction activities, such as for staging areas, construction parking, or temporary trails created to avoid bike/pedestrian interactions with construction areas. Following construction completion, areas would be restored to their pre-construction or better function and

[13] Shortnose Sturgeon Status Review Team. 2010. *A Biological Assessment of shortnose sturgeon (Acipenser brevirostrum)*. Report to National Marine Fisheries Service, Northeast Regional Office. November 1, 2010. 417 pp.
[14] Atlantic Sturgeon Status Review Team. 2007. *Status Review of Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)*. Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

appearance, either through reseeding or replanting of woody vegetation using native species. **Table 2-2** shows temporary impacts.

Table 2-2 | Temporary Impacts to Forests

Alternative	Forests	Early Succession Field	Maintained Grass/Landscape
No Action Alternative	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Action Alternative A	0 sf (0 ac)	13,717 sf (0.3 ac)	269,311 sf (6.1 ac)
Action Alternative B	0 sf (0 ac)	13,717 sf (0.3 ac)	289,165 sf (6.6 ac)

No Action Alternative

Projects included in the no Action Alternative may result in minor temporary direct adverse impacts due to limited removal of terrestrial vegetation for construction access and staging, particularly within the Virginia portion of the Local Study Area.

Action Alternative A

Action Alternative A would result in minor temporary direct adverse short-term effects to terrestrial vegetation. There are no anticipated temporary impacts to forest communities. Action Alternative A would impact 13,717 square feet (approximately 0.3 acres) of early succession scrub-shrub habitat just south of the GWMP due to construction staging and access. There would also be an additional 324,589 square feet (approximately 7.4 acres) of temporary impact to maintained landscape areas along the Long Bridge Corridor. A number of the staging areas would be located in existing surface parking areas, where vegetation impacts are unlikely. For staging areas located in vegetated medians, tree densities would be low enough to avoid altogether, depending on construction needs, and impacts may be localized to only grass or herbaceous land cover. Temporary impacts stemming from the diversions of the MVT would impact lawns and could impact landscaped features within the park. An equipment storage yard used by NPS was set up within a ball field next to Ohio Drive SW for construction of NPS facilities. While this storage yard is no longer active, and the ballfield has been restored, the Long Bridge project will utilize this same yard as a staging area. Staging area impacts would occur on the grass cover affiliated with the ball field. Similarly, the proposed staging area on the other side of Ohio Drive SW is also vegetated and would experience impacts to the grass cover. All of these areas would be restored and reseeded post-construction to ensure the impacts to these areas are temporary. Temporary vegetation impact areas for Action Alternative A are depicted in **Figures 2-2 through Figure** 2-4.

Action Alternative B

Action Alternative B would also result in minor temporary direct adverse short-term effects to terrestrial vegetation. Temporary impacts would be similar to Action Alternative A under this Action Alternative. However, temporary impacts to maintained landscape areas would increase to 344,478 square feet (approximately 7.9 acres). Temporary vegetation impact areas for Action Alternative B are depicted in **Figures Figure** 2-5 **through** Error! Reference source not found..

2.4.1.2. Wetland Vegetation

No Action Alternative

The No Action Alternative may have temporary adverse impacts to wetland vegetation due to the potential for construction work adjacent to or within Roaches Run for the DC2RVA Project.

Action Alternative A

Action Alternative A would have no temporary adverse impacts to wetland vegetation within the Local Study Area because implementing the avoidance and minimization techniques detailed in **Section 2.5, Avoidance, Minimization, and Mitigation** would prevent construction work impacts such as runoff from extending into wetland areas.

Action Alternative B

Like Action Alternative A, Action Alternative B would no temporary adverse impacts to wetland vegetation within the Local Study Area.

2.4.1.3. Submerged Aquatic Vegetation

No Action Alternative

There would be no temporary adverse effects to SAV as result of the No Action Alternative.

Action Alternative A

Action Alternative A would have minor temporary direct adverse impact on SAV in the amount of approximately 7,851 square feet associated with the temporary barge pier located along the northern shoreline of the Potomac River just upstream from Long Bridge. Minor temporary indirect adverse impacts could occur to the SAV beds further downstream from the construction zone within the Local Study Area due to temporary sedimentation from the installation of cofferdams. Turbidity curtains would minimize sediment releases from the installation of cofferdams. Construction impacts would occur over approximately 5 years.

Action Alternative B

Action Alternative B would have similar temporary impacts on SAV as Action Alternative A due to the temporary barge pier and potential downstream sediment from the cofferdams for the new bridge. Since no SAV occur underneath the existing bridge, no additional SAV would be directly impacted by demolition and replacement of the existing bridge. Action Alternative B, however, could cause temporary indirect adverse impacts to SAV beyond those shared with Action Alternative A due to temporary sedimentation caused by the installation of the cofferdams needed for the replacement bridge pile supports. With the use of turbidity curtains, the amount of sediment to downstream waters is expected to be low resulting in this alternative overall having minor impacts to SAV. Construction impacts would occur over approximately 8 years and 3 months.

2.4.1.4. Wildlife

Minor temporary direct adverse impacts to terrestrial wildlife during construction of the Action Alternatives could result from direct displacement during construction or avoidance behaviors of certain species of wildlife because of excessive noise levels. For example, waterfowl on the Potomac River may be displaced by the presence of barges and other construction equipment and activity. Temporary direct adverse impacts may also occur from a temporary loss of habitat for wildlife, such as clearing of forest or other vegetation. For some species, temporary impacts would be dependent upon the season of the year in which the construction occurs. Many terrestrial vertebrates (for example, reptiles and amphibians) hibernate during colder winter months. Therefore, assuming they are not hibernating within the proposed Action Alternative limits of disturbance during construction, reptiles and amphibians should not be affected by the construction during the winter seasons. Some bird species are seasonal residents or migrants through the Local Study Area, so these species may not be present during certain phases of the construction. A discussion of potential temporary impacts to wildlife from the Project is detailed below.

No Action Alternative

The No Action Alternative would have no temporary impact on wildlife or habitat within the Local Study Area due to No Action Alternative projects construction activities would be distant from the Local Study Area.

Action Alternative A

Short-term temporary adverse direct and indirect adverse effects to wildlife and wildlife habitat would be minimal. Temporary adverse impacts to wildlife would occur during construction of Action Alternative A by slightly reducing the availability of habitat for wildlife and, as noted above, by causing temporary avoidance of areas by some wildlife species (for example, waterfowl) that are sensitive to noise and human presence. The temporary Action Alternative A footprint would not encroach into the forest communities adjacent to Roaches Run. Action Alternative A would impact early succession scrub-shrub habitat just west of the GWMP, as well as individual landscape trees throughout the Long Bridge Corridor. These individual trees and habitats would not support many species of wildlife with the exception of a few common edge-loving bird species. Once construction has been completed and temporarily disturbed areas restored, wildlife would be expected to return to the restored habitat.

Action Alternative B

Short-term temporary adverse direct and indirect effects to wildlife and wildlife habitat for Action Alternative B would be similar to those of Action Alternative A, with the exception of slightly greater temporary adverse impacts to maintained landscape areas.

Any nesting birds using the existing bridge structure would be displaced during bridge demolition. These effects would be temporary, as the construction of the new bridge structure would potentially provide new nesting habitat.

2.4.1.5. Aquatic Biota

Temporary adverse effects to aquatic biota would primarily result from in-water construction of bridge substructures. Temporary adverse effects could include habitat disturbance for construction access, water quality impacts from sediment resuspension, noise and vibration effects from pier installation, and impacts associated with vessel traffic, such as vessel strikes and turbulence. Following coordination with NMFS, it was confirmed that no EFH exists within the Local Study Area. Under all Action Alternatives, no temporary effects to EFH are expected. The Long Bridge Project is early in design and details of construction are not fully known. Some general information is available regarding the planned construction of the Project, particularly as it relates to the proposed bridge crossings. Potential temporary effects to aquatic biota under each Action Alternative are discussed below.

No Action Alternative

The No Action Alternative would have no temporary impact on aquatic biota in the Local Study Area as no construction activities would occur within the Potomac River.

Action Alternative A

Short-term temporary adverse direct and indirect effects to aquatic biota would be minor. Under Action Alternative A, 22 piers would be installed in the Potomac River and one pier would be replaced in the Washington Channel with a larger pier. Additionally, temporary finger piers would be constructed, and a spud barge would be anchored. To install the shafts that would anchor each pier to the river bottom, the area surrounding the pier locations would be dewatered. For the construction of each pier, sheet piles would be installed to create enclosed cofferdams. Each pier would be anchored to the substrate with three cast-in-place concrete drilled shafts that would be installed to a depth of approximately 80 feet below the existing channel. Construction of the new piers would occur from barges, and the Potomac River appears to have sufficient depth (greater than 4 feet) in most areas for the use of “Flexifloat type” barges. Along each shoreline of the Potomac River, finger piers would be constructed to allow construction access within shallow water areas. A spud barge would be anchored with two 3-foot-diameter steel piles along the northern shoreline of the Potomac River. Four temporary finger piers would be extended into the water due to insufficient water depth for access to the barges from the shoreline. In addition, cofferdams would also be used along both banks of the Washington Channel/Tidal Impoundment during construction of the bridge abutments. Because bridge piers would be constructed in dry conditions, the installation of the cofferdams and subsequent dry conditions would result in mortality to benthic invertebrates, and potentially fish, as well as temporary habitat loss while dewatered. Through the use of finger piers and spud barge, temporary habitat loss under Action Alternative A would total 31,358 square feet (0.7 acres) in the Potomac River and 1,635 square feet (<0.1 acres) in the Washington Channel/Tidal Impoundment. The exact dimensions of the cofferdams and specific related impacts would be determined in later stages of design. The dewatering would also result in a localized loss of prey for benthic foraging fish species. However, remaining benthic foraging habitat in adjacent parts of the Potomac River would still be relatively abundant. Following construction activities, all cofferdams and finger piers would be removed, allowing for recolonization of those habitats by aquatic biota. Recolonization of disturbed habitats by benthic invertebrates can occur in less

than a year.[15] Overall, temporary effects to benthic invertebrate and fish communities from temporary habitat loss would be minor.

In addition to temporary direct loss of habitat, potential sediment releases during installation of the cofferdam sheet piles could impact aquatic biota in the surrounding area. Physical disturbances re-suspend and homogenize upper sediment layers, and while physical disturbance is a factor in shaping and altering ecosystems, intense and prolonged physical disturbances can alter or deplete benthic communities.[16, 17] Avoidance of areas with high suspended sediment levels has been observed in numerous fish species, including some migratory species.[18] According to the project schedule, each bridge pier would take approximately 3 months to construct, with the disturbance of installing the sheet piles lasting about 2 weeks. The disturbance of sediments for pile driving activities for bridge piers typically results in total suspended sediment concentrations of approximately 5.0 to 10.0 mg/L above background levels within approximately 300 feet of piles being driven.[19] Therefore, only minor sediment releases would occur during drilling. While sedimentation can lead to mortality of fish eggs and larvae,[20] including species found in the Project Area, the level of suspended sediment shown to have adverse effects on the most sensitive species of fish is 580 mg/L, over 50 times higher than the maximum expected increase in suspended sediments from pile driving.[21] Although installation of sheet piles may suspend sediment, disturbance activities would only slightly increase suspended sediments above background levels and would disperse within about 300 feet from the pile being driven. It is also likely that fish would avoid areas within 300 feet of pile driving because of the noise and vibration cause by the activity. Fish would likely move to other areas in the river away from construction noise and activity.

Potential temporary adverse impacts to fish under Action Alternative A also include sound and vibration associated with sheet pile installation and possible vessel strikes throughout the entire construction process. Installation of the sheet piles for the cofferdams and steel piles for the finger piers and spud barge would likely be drilled either by vibratory hammer or impact hammer, both methods having the potential to create underwater noise and vibration. Typically, vibratory hammers create less sound and pressure waves than impact hammers and utilizing a soft start with a few light taps would allow any mobile species enough time to vacate the area.

Under Action Alternative A, there would be a temporary increase in vessel traffic on the Potomac River for barge access during the construction of the new bridge. This could increase the chance of vessel strikes with fish; however, any increase would be negligible given the slow barge speeds. Sufficient

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[15] Blettler, M.C.M. and M.R. Marchese. 2005. *Effects of bridge construction on the benthic invertebrates structure in the Parana River Delta*. Interciencia. 30(2).
[16] Bonsdorff, E. 1983. *Recovery potential of macrozoobenthos from dredging in shallow brackish waters*. Oceanol. Acta, No. Sp: (Proc. 17th Eur. Symp. Mar. Biol.):27–32.
[17] Dernie, K. M., M. J. Kaiser, and R. M. Warwick. 2003. *Recovery rates of benthic communities following physical disturbance*. Journal of Animal Ecology 72:1043–1056.
[18] Boubee, J.A.T., T.L. Dean, D.W. West, and R.F.G. Barrier. 1997. *Avoidance of suspended sediment by the juvenile migratory stage of six New Zealand native fish species*. New Zealand Journal of Marine and Freshwater Research 31(1):61-69.
[19] Federal Highway Administration. 2012. Tappan Zee Hudson River Crossing Project. Final Environmental Impact Statement. August 2012.
[20] Wilber, D.H. and D. G. Clarke. 2001. *Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries*. North American Journal of Fisheries Management 21:855-875.
[21] Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc., 9200 Rumsey Road, Columbia, Maryland 21045.

space is present within the Potomac River to allow migratory fish to circumvent disturbance areas. Therefore, temporary impacts to fish related to noise, vibration, and vessel traffic would be minor with the use of various techniques detailed below in **Section 2.5, Avoidance, Minimization, and Mitigation**.

Action Alternative B

Short-term temporary adverse direct and indirect effects to aquatic biota from Action Alternative B would be similar to those of Action Alternative A. Under Action Alternative B, 22 additional bridge piers would be installed in the Potomac River for the reconstruction of the existing bridge. This would result in temporary river bed impacts for bridge pier construction totaling an additional 31,108 square feet. As stated in Action Alternative A, remaining benthic foraging habitat in adjacent parts of the Potomac River would still be relatively abundant. Construction impacts would occur over approximately 8 years and 3 months.

Because Action Alternative B includes the demolition and replacement of the existing two-track bridge structure, the duration of construction would be longer and the total area of temporarily dewatered riverbed would be greater. The extent of temporary impacts to surrounding fish would depend on the demolition techniques used (for example, blasting versus cutting), which can result in varying degrees of noise, vibration, and sediment disturbance and related localized avoidance by fish. The Project plans to remove the existing bridge over the Potomac River piecemeal and transporting the piece offsite for disposal. The Project does not plan to demolish the bridge using blasting. However, if blasting is used, techniques exist to minimize the effects of the blast on fish within the adjacent water column (see **Section 2.5, Avoidance, Minimization, and Mitigation**). Following demolition, the sections of the existing bridge would need to be removed from the area by barge and transported to an offsite disposal area, which would result in additional vessel traffic. These additional barge trips would increase the potential for collisions with fish within the Potomac River; however, the risk is not substantially higher than the existing vessel traffic in the Local Study Area.

With the demolition of the existing bridge under Alternative Action B, there would also be temporary impacts to the benthic invertebrate community that has colonized the existing bridge substructure. This would primarily impact sessile organisms that are attached to the pier structures, such as crustaceans and aquatic worms. Following the construction of the new piers, colonization by similar organisms would occur, resulting in negligible impacts overall.

Following demolition of the existing bridge, construction of a new two-track bridge structure would proceed in a similar manner to that of the first new bridge. Although the new bridge would have the same footprint as the existing bridge, temporary construction impacts to aquatic biota would also include habitat loss and mortality of benthic invertebrates, as well as potential increases in suspended sediment, sound and vibration, and vessel strikes. Impacts to the surrounding biotic community would be minor with implementation of appropriate avoidance and minimization techniques.

2.4.2. RTE Species

Temporary adverse effects to sturgeon would primarily result from in-water bridge construction. Construction related effects could include water quality impacts from sediment releases, habitat disturbance for the temporary construction access, noise and vibration effects from installation of the bridge piers, and vessel strikes from barges used during construction. The Project is early in design and

details of construction are not fully known. Some general information is available regarding the planned construction of the Action Alternatives, particularly as it relates to the proposed bridge crossings. Information regarding potential temporary effects to sturgeon and Atlantic sturgeon Critical Habitat are identified below.

2.4.2.1. No Action Alternative

The No Action Alternative would have no temporary impact on RTE species within the Local Study area as no construction activities would occur within the Potomac River.

2.4.2.2. Action Alternative A

Minor short-term temporary adverse direct effects to shortnose and Atlantic sturgeon or Atlantic sturgeon Critical Habitat would occur with the use of specific minimization techniques outlined below. Short-term temporary adverse indirect effects to sturgeon or Atlantic sturgeon Critical Habitat would be negligible with use of recommended minimization techniques. As noted previously, 22 in-water piers are proposed to be constructed to support the new two-track bridge. The position of the new bridge piers would be in line with the existing bridge piers to minimize hydraulic impacts. This would also reduce disruption to migrating sturgeon. Each bridge pier would be constructed by first installing sheet piles to form a cofferdam to allow construction of the pier piles in the dry. The pier piles would consist of three cast-in-place drilled shaft foundations. Construction of the new piers is proposed to occur from barges equipped with cranes and from finger piers along each shoreline. Water levels within the Potomac River appear to be of sufficient depth (greater than 4 feet) to allow access to most of the river via "Flexifloat type" barges. Construction access along both shorelines of the Potomac River would require temporary finger piers. As noted, once the cofferdams are in place, all pier support shaft construction would occur in dry conditions. Therefore, potential temporary impacts to sturgeon would primarily occur during installation of the sheet piles, temporary finger piers, and securing of a spud barge. Temporary adverse impacts to potential sturgeon foraging habitat on the river bottom would total 31,108 square feet for construction of the bridge piers. Temporary impacts to river bottom for installation of the finger piers and to secure the spud barge would total 250 square feet. These temporary effects are small in comparison to the total area of available river bottom habitat and would result in a minor adverse temporary effect on sturgeon.

Temporary adverse impacts to sturgeon from installation of the finger piers and spud barges could include increased sedimentation within the water column. If the turbidity caused by the sediment is high enough (generally greater than 1,000 mg/L), it could have a toxic effect on sturgeon. Turbidity curtains are proposed around all pile driving activities to reduce the release of sediment into the river. Installation of the sheet piles for the cofferdams would likely be drilled either by vibratory hammer or impact hammer. Driving of piles can create underwater noise and vibration levels emanating out from the pile being driven, which if in excess of 150 decibels, could result in injury or death of sturgeon. Typically, vibratory hammers create significantly less sound and pressure waves than impact hammers, and providing a soft start by initiating the driving with a few light taps would likely cause sturgeon to move far enough away to be outside the range of detrimental effect from sound and pressure waves. It may also be possible to use a cushion impact to further reduce the distance of harmful sound and pressure waves. Temporary increases in vessel traffic on the Potomac River for barge access during construction of the new bridge would increase chances of collisions with sturgeon that may be present in the water column during spawning runs in the spring. Once in the construction area, barges would

mostly be stationary, reducing the chances of collision with sturgeon if present. By implementing the avoidance and minimization techniques detailed in **Section 2.5, Avoidance, Minimization, and Mitigation**, the temporary adverse impacts related to noise, vibration, and vessel traffic resulting from Action Alternative A would be minor and would not likely adversely affect shortnose or Atlantic sturgeon.

2.4.2.3. Action Alternative B

Short-term direct and indirect adverse effects to shortnose and Atlantic sturgeon or Atlantic sturgeon Critical Habitat would be similar to those of Action Alternative A. Replacement of the existing bridge in addition to the new bridge would double the amount of temporary sturgeon river bottom habitat impacts. This would result in temporary river bed impacts for bridge pier construction totaling an additional 31,108 square feet. Even with double the amount of temporary river bed substrate impacted, a large area of suitable sturgeon foraging habitat would be available within that section of the Potomac River.

Construction of the replacement bridge would increase the number of instances and duration of pile driving, which could prolong potential effects to sturgeon. The types of piles and driving techniques discussed under Action Alternative A would help to minimize these potential effects. Similarly, construction of the replacement bridge would increase the potential for sediment releases and would increase vessel traffic within the river. Turbidity curtains would be used during pile driving activities for the replacement bridge to reduce sediment releases. The increase in vessel traffic could increase the chances of sturgeon colliding with a vessel during spring spawning runs through the Study Area. As noted above, barges would generally be stationary during construction, reducing the opportunity for collisions with sturgeon.

Details regarding the demolition of the existing bridge have not yet been developed at this stage of design, but options could include cutting (for example, diamond saws) or blasting. Blasting to demolish the existing bridge piers would have the greatest potential effect on all life stages of sturgeon if present, as the shock waves from blasting can be lethal to fish. If blasting is used, techniques exist to minimize the effects of the blast on fish within the adjacent water column (see **Section 2.5, Avoidance, Minimization, and Mitigation**). After demolition, the sections of the existing bridge would need to be removed from the area by barge and transported to an offsite disposal area. The exact location and number of potential barge trips to dispose of the existing bridge are not yet known. Disposal of spoils would be to an approved upland disposal location. These additional barge trips would increase the potential for collisions with sturgeon within the Potomac River and would not likely adversely affect shortnose or Atlantic sturgeon. Because of the potential effects to sturgeon from demolition and reconstruction of the existing bridge, Action Alternative B would have more effects on sturgeon than Action Alternative A. With the use of minimization methods outlined in **Section 2.5, Avoidance, Minimization, and Mitigation**, these additional effects would still be minimal.

2.5. Avoidance, Minimization, and Mitigation

This section discusses how impacts to natural ecological systems and RTE species would be avoided, minimized, or mitigated.

2.5.1. Natural Ecological Systems

2.5.1.1. Terrestrial Vegetation

FRA and DDOT have made efforts to avoid and minimize effects to natural resources, including terrestrial vegetation impacts, throughout Project Development by reducing the Project footprint to the extent practicable, given existing infrastructure and landowner impact constraints. These efforts include the removal of a culvert extension at Roaches Run included in earlier draft plans. DRPT would continue efforts to avoid and minimize impacts to terrestrial vegetation through later phases of the Project as design and construction details are refined. Proposed mitigation measures include:

- During final design, DRPT would adjust temporary access and staging areas to avoid trees and vegetation during refinement of the disturbance limits to ensure that vehicles and materials are only stored on vegetated surfaces when absolutely necessary.
- DRPT would require the contractor to employ tree protection measures and measures to prevent or limit equipment access to adjacent forested areas through protective fencing; these measures would minimize impacts to trees and vegetated areas. DRPT would require the contractor to protect both forest areas and individual trees within construction staging and access areas prior to construction, under the supervision of a licensed arborist or other qualified professional to be approved by NPS. The arborist would also perform any necessary pruning in ways that would maximize tree survival both during and following bridge construction. Any removal, cutting, or pruning of trees or shrubs would follow all NPS rules, including timing restrictions windows.
- DRPT would require the contractor to wash all equipment prior to entering NPS lands to be free of all and any debris, to minimize the spread or introduction of invasive species.
- DRPT would require that all introduced organic material such as soil, mulch, and seed be certified weed seed free, to minimize the spread or instruction of invasive species.
- DRPT would require the contractor to install fencing, mulch, and planking to reduce injury and compaction when vegetated surfaces are the only option for staging near the Project. DRPT would reestablish terrestrial vegetation removed for both permanent and temporary construction activities where possible and in coordination with any reforestation requirements.

Following construction completion, DRPT would restore areas to their pre-construction or better function and appearance, either through reseeding or replanting of woody vegetation using native species.

2.5.1.2. Wetland Vegetation

FRA and DDOT have made efforts to avoid and minimize impacts to wetland vegetation throughout the planning process and DRPT would continue to do so as the Project moves forward to more detailed stages of design. The selection of an upstream alignment for the new bridge, rather than a downstream alignment has minimized potential impacts to wetland vegetation. This alignment allows the tracks to expand westward rather than encroaching on Roaches Run, which supports numerous wetlands. Additional coordination with the DC2RVA project at RO Interlocking has allowed for the elimination of a culvert extension into Roaches Run, which would have caused impacts to vegetated wetlands. Wetland

vegetation only occurs on the eastern side of the railroad corridor associated with adjacent wetlands to Roaches Run. The railroad improvements in both Action Alternatives would avoid these areas.

DRPT would require the contractor to employ erosion control and stormwater management measures during construction to reduce disturbance to wetland vegetation from erosive forces, such as stormwater runoff.

2.5.1.3. Submerged Aquatic Vegetation

SAV beds are located along the northern shoreline of the Potomac River just upstream of Long Bridge. One SAV bed would be impacted by the Action Alternatives associated with the northernmost bridge pier and the temporary barge pier. While FRA and DDOT have made efforts to minimize impacts to SAV throughout the planning process, complete avoidance of SAV is not possible. During construction, steps to mitigate SAV impacts would include protecting water quality around the work area by keeping suspended sediments from leaving the construction zone via silt curtains. In addition, the construction contractor would be advised of SAV locations and required to avoid boat traffic within shallow water areas where SAV could be damaged by boat motor propellers. Once the new railroad bridge is built under each Action Alternative and the temporary barge pier is removed, it is expected that SAV will become re-established within this shallow water shelf where it resides now.

Lining up the new piers with existing piers will help to minimized potential impacts to SAV by decreasing the number and footprint of new piers within areas that SAV could occupy in the future. By eliminating the downstream bridge alignments from consideration, FRA and DDOT have developed alternatives that expand the tracks westward rather than encroaching on Roaches Run. Additional coordination with DC2RVA at RO Interlocking has allowed for the elimination of a culvert extension into Roaches Run, which would have impacted a small area of SAV.

DRPT would require the contractor to employ erosion control and stormwater management measures during construction to reduce disturbance to downstream SAV from erosive forces and sedimentation resulting from stormwater runoff.

2.5.1.4. Wildlife

FRA and DDOT have made efforts to avoid and minimize terrestrial wildlife, including a reduction in the overall footprint of the Action Alternatives where practicable. This has led to a reduction in forest impacts, reducing effects to wildlife that may occur within the forested areas. The construction of the new tracks on the side of the existing tracks away from Roaches Run would minimize wildlife impacts resulting from the Action Alternatives. Likewise, the elevated overland extension of the new bridge that would carry the two new railroad tracks over the Potomac River would help to minimize disturbance to lands on the approaches to the bridge. While the area beneath the bridge likely would not provide much habitat, it would maintain potential wildlife passage along the banks of the Potomac River. Proposed mitigation measures include:

DRPT would require that the contractor use Best Management Practices and currently acceptable design and construction procedures would reduce or eliminate anticipated undesirable effects resulting from construction. DRPT would plan construction activities to minimize unnecessary disturbance of wildlife habitat. For example, where appropriate and practicable, construction crews would perform activities

affecting avian wildlife during months when migratory birds are not nesting. The contractor would also conduct a survey for nesting birds prior to starting construction. Erosion control and stormwater management during construction would reduce disturbance to wildlife habitat from erosive forces, such as stormwater runoff.

2.5.1.5. Aquatic Biota

Avoidance and minimization of construction impacts can include construction methods to reduce noise, vibration, sedimentation, or turbidity, and time-of-year restrictions to protect areas of seasonal importance for migratory species. Depending upon the specific construction methods for the proposed Project, DRPT would investigate various techniques to avoid or minimize impacts to aquatic biota. A survey would be conducted prior to construction to gather additional data on benthic macroinvertebrates. Proposed minimization and mitigation measures include:

- Avoiding dredging to extent practicable. The current construction plan proposes no dredging. The avoidance of dredging would minimize overall impacts to existing riverbed habitats as well as minimize sedimentation and resuspension of sediment into the water column. DRPT would avoid dredging to the extent practicable.
- Reducing turbidity. To reduce turbidity from potential sediment releases during construction of the new bridge piers, the contractor would perform work behind cofferdams. This would allow pile driving of the pier supports in the dry, avoiding releases of sediment that can occur if pile driving occurs in water. Installation of the sheet piles for the cofferdam can create minor sediment releases, but these are typically installed using a vibratory hammer, which minimizes the disturbance to the bottom sediments. Additional pile driving for the temporary finger piers and to anchor the spud barge are proposed in the wet. Turbidity curtains would be used around all in-water pile driving operations. Turbidity curtains may also be used during installation of the cofferdam sheet piles if sediment releases appear to be more than minimal.
- If installation of the piles requires an impact hammer, the contractor would use noise attenuating tools such as a cushion block to reduce those levels below injury or behavioral modification thresholds for fish. Contractors would also make several light taps at the start of pile driving to warn fish to leave the area before the heavier pile driving begins. Sufficient space is present within the Potomac River to allow fish to escape the area prior to the start of potentially harmful sound and pressure waves.
- During installation of cofferdams, contractors would net and remove fish as the space within the cofferdam gets down to the last 3 to 4 feet of water.
- Regulatory agencies would require time-of-year restrictions on in-stream construction work to avoid impacting migratory fish species during specific periods when they are most likely to be present in the Project Area. Sufficient space is present within the Potomac River to allow migratory fish to circumvent disturbance areas, assuming that construction activities are staggered, and work is not occurring across the entire river at one time.

Avoidance and minimization techniques for Action Alternative B would be the same as for Action Alternative A. However, Action Alternative B would require demolition of the existing bridge prior to its replacement. DRPT would minimize impacts during demolition of the existing bridge by using saws rather than blasting to remove the existing bridge piers. If blasting is required, techniques, such as

bubble curtains, would be used to attenuate sound and pressure waves to sub-lethal levels to fish. Bubble curtains serve as a pneumatic barrier that releases gas below the water surface and breaks the propagation of waves and spreading of particles.

2.5.2. RTE Species

Avoidance and minimization of construction impacts include construction methods to reduce noise, vibration, sedimentation, or turbidity, and time-of-year restrictions to protect areas of seasonal importance. Depending upon the specific construction methods used, DRPT would investigate various techniques during later phases of design to avoid or minimize impacts to sturgeon or Atlantic sturgeon Critical Habitat. Techniques include:

- To reduce turbidity from potential sediment releases during construction of the new bridge piers, contractors would work behind cofferdams. This would allow pile driving of the pier supports in the dry, avoiding releases of sediment that can occur if pile driving were to occur in water. Installation of the sheet piles for the cofferdam can create minor sediment releases, but contractors would install these using a vibratory hammer, which minimizes the disturbance to the bottom sediments. Installation of the temporary finger piers and spud barge anchorage will require the drilling of smaller steel piles. DRPT would require the contractor to use turbidity curtains to minimize sediment releases.
- If installation of the cofferdam sheet piles and temporary finger pier and spud barge steel piles require an impact hammer, contractors may use a cushion block and other noise attenuating tools to reduce noise levels below sturgeon injury or behavioral modification thresholds. Contractors would also make several light taps at the start of pile driving to warn fish to leave the area before the heavier pile driving begins. Sufficient space is present within the Potomac River to allow fish, including sturgeon, to escape the area prior to the start of potentially harmful sound and pressure waves.
- Regulatory agencies would require time-of-year restrictions on in-stream construction work to avoid impacting sturgeon during specific periods when they are most likely to be present in the area. Based upon recent capture information, the most likely time for adult shortnose sturgeon to be present within the Project Area would be during the spring spawning run, between mid-March and mid-May. However, the likelihood of sturgeon being within the Project Area is so low that use of other avoidance and minimization measures may preclude the need for time-of-year restrictions. Additional informal consultation with NMFS further along in the design process would be necessary to confirm whether Action Alternative A is not likely to adversely affect sturgeon. Additional coordination with NMFS would also be necessary in later phases of design to confirm potential construction restrictions.

Avoidance and minimization techniques for Action Alternative B would be the same as for Action Alternative A. However, Action Alternative B would require demolition of the existing bridge prior to its replacement. DRPT would minimize impacts during demolition of the existing bridge by using saws rather than blasting to remove the existing bridge piers. If blasting is required, techniques, such as bubble curtains, would be used to attenuate sound and pressure waves to sub-lethal levels to fish. Bubble curtains serve as a pneumatic barrier that releases gas below the water surface and breaks the propagation of waves and spreading of particles.

3.0 Water Resources and Water Quality

3.1. Introduction

This section defines the water resources and water quality resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. This section summarizes the analysis of the No Action Alternative and each Action Alternative and their potential construction and permanent or long-term impacts on water resources and water quality. Proposed avoidance, minimization, and mitigation measures to reduce potential adverse impacts of the Project on water resources and water quality are also provided.

This section focuses on five water resource categories: water quality, wetlands and other waters of the United States, floodplains, Chesapeake Bay Preservation Areas, and coastal zone management. This section provides an overview and key definitions for each of the water resource categories analyzed in this chapter.

Water quality applies to groundwater and surface water. Groundwater collects and flows beneath the Earth's surface as aquifers, springs, and wells, originating from rain, as well as melted snow and ice. Surface water collects on the surface of the ground such as rivers, lakes, wetlands, seas, and oceans.

Waters of the United States include all waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including but not limited to all waters that are subject to the ebb and flow of the tide; all interstate waters including interstate wetlands; and other waters such as rivers and streams (including intermittent streams), the use, degradation, or destruction of which could affect interstate or foreign commerce; tributary waters; and wetlands adjacent to waters.[1]

Wetlands are jointly defined by the United States Environmental Protection Agency (EPA) and United States Army Corps of Engineers (USACE), as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[2] Wetlands generally include swamps, marshes, bogs, and similar areas.

Floodplains are defined as any land area susceptible to inundation by floodwaters from any water source.[3] The Federal Emergency Management Agency (FEMA) identifies the 100-year floodplain as the area with a 1 percent chance of being inundated or exceeded by a flood event in any given year and is

[1] 33 CFR 329
[2] EPA. Section 404 of the Clean Water Act: How Wetlands are Defined and Identified. Accessed from https://www.epa.gov/cwa-404/section-404-clean-water-act-how-wetlands-are-defined-and-identified. Accessed May 3, 2018.
[3] 44 CFR 59

considered the base flood. FEMA also identifies the 500-year floodplain as the area with a 0.2 percent chance of being inundated by a flood event in any given year.

Resource Protection Areas (RPAs) as defined in the Arlington County Chesapeake Bay Preservation Ordinance (Chapter 61.5), "consist of sensitive lands adjacent to water bodies with perennial flow that have intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may cause significant degradation to the quality of State waters."[4] The purpose of an RPA is to provide a buffer between development and sensitive water resources such as streams. A natural buffer provides water quality benefits to downstream resources, such as the Chesapeake Bay. RPAs include tidal wetlands, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, tidal shores, a buffer area not less than 100 feet adjacent to and landward of these water bodies, and such other lands considered by the Arlington County Board to meet some or all the criteria described above.

Coastal zones are coastal waters (including the lands therein and thereunder) and the adjacent shorelands, strongly influenced by each other and in proximity to the shorelines of the coastal states. Designated coastal zones include islands, transitional and intertidal areas, wetlands, salt marshes, and beaches.[5]

The Washington Aqueduct is managed by USACE and withdraws water from two locations on the Potomac River upstream of the Project Area. Since there are no private or public water supply wells or springs in or near the Local Study Area, it is anticipated that none of the alternatives would result in any long-term impact to drinking water quality or quantity. As a result, discussion of drinking water quality is not included in this analysis.

3.2. Regulatory Context

Several Federal regulations govern wetlands, floodplains, and waters of the United States to ensure that proper consideration is given to the avoidance, minimization, and mitigation of adverse effects. Some of these regulations include the Clean Water Act (CWA) and the Water Quality Act of 1987 Sections 401 through 404,[6] the Safe Drinking Water Act of 1974 (SDWA),[7] the United States Ground Water Rule,[8] the National Pollutant Discharge Elimination System (NPDES), Energy Independence and Security Act of 2007 (EISA),[9] and Executive Order (EO) 13508: Chesapeake Bay Protection and Restoration.[10] The EPA also offers the Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of EISA.

[4] Arlington County Code Chapter 61
[5] 16 USC 1451
[6] 33 USC 1251-1376
[7] 42 USC 300f
[8] EPA. 2006. U.S. Ground Water Rule. Accessed from https://www.epa.gov/dwreginfo/ground-water-rule. Accessed January 12, 2018.
[9] Public Law 110-140
[10] EO 13508

3.2.1. Water Quality

Water quality is enforced at the state level, based on standards set by the District Department of Energy & Environment (DOEE), the Virginia Department of Environmental Quality (VDEQ), and the EPA. States can choose to adopt national water quality standards (SDWA and CWA) or revise and adopt state specific standards.

Water Quality Standards (WQS) establish the environmental baselines used for measuring the success of CWA, to protect aquatic life and wildlife, recreational uses, and sources of drinking water. WQS establish goals for waterbodies and provide regulatory basis for establishing water quality–based effluent limits beyond the technology-based levels of treatment required by the CWA. WQS include:

- Designated use or uses such as "supporting aquatic life" or "recreation;"
- Criteria necessary to protect the designated uses;
- Antidegradation requirements; and
- General policies affecting the application and implementation of WQS that states and authorized tribes may include at their discretion.

In compliance with Sections 303(d), 305(b), and 314 of CWA and SDWA, states develop a prioritized list of water bodies that currently do not meet water quality standards.

3.2.2. Wetlands and Waters of the United States

Any unavoidable impacts to wetlands and waters of the United States would be regulated under state and Federal wetlands and waterways permits issued for the project. Permits would be obtained from the USACE, the United States Coast Guard, DOEE, and VDEQ prior to construction activities. USACE would likely issue a Nationwide Permit #15 (subject to regional conditions and impact threshold limits and require the issuance of pre-construction notification with NMFS) for United States Coast Guard (USCG) Approved Bridges, which covers "discharges of dredged or fill material incidental to the construction of a bridge across navigable waters of the United States, including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills, provided the construction of the bridge structure has been authorized by the USCG under section 9 of the Rivers and Harbors Act of 1899 for construction of a new bridge over a navigable waterway.[11]" In addition, a Section 404 permit for CWA would be required for filling causeways and approaches. A permit would also be required under Section 10 of the Rivers and Harbors Appropriation Act of 1899 for alterations in or over navigable waters. DOEE would issue a permit under Section 401 of the CWA for any impacts to the Potomac River and Washington Channel/Tidal Impoundment. A Section 401 permit acknowledges that USACE issues the Nationwide permit and allows the District to add specific conditions to ensure all the District's water quality standards are met. Impacts to Commonwealth of Virginia tidal wetlands and waters would likely require a Virginia Water Protection Permit, a Section 401 Water Quality Certificate, a Virginia Marine Resources Permit, and a Section 404 permit from USACE. The Virginia Department of Rail and Public Transportation (DRPT), the project sponsor for final design and construction, will work with appropriate agencies and authorities to obtain applicable permits.

[11] 33 CFR 330. USACE Nationwide Permit Program.

3.2.3. Flood Hazards and Floodplain Management

FEMA's National Floodplain Insurance Regulations requires that no new construction, substantial improvements, or other development (including fill) shall be permitted within a Zone AE Special Flood Hazard Area subject to inundation by the 1 percent annual chance flood where base flood elevations have been determined on the community's Flood Insurance Rate Map (as is the case within the Local Study Area) unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, would not increase the water surface elevation of the base flood (100-year floodplain) by more than 1 foot at any point within the community. The National Flood Insurance Program (NFIP) allows communities to approve certain development that would increase the water surface elevation of the base flood by more than 1 foot, provided that other requirements are met, including an evaluation of alternatives and demonstration of why those alternatives are not feasible.

3.2.4. Coastal Zone Management

The Coastal Zone Management Act of 1972 (CZMA) protects coastal areas and the surrounding habitat by defining inland coastal areas and the protection of these buffer zones within CZMA.

Virginia participates in the National Coastal Zone Management Program and has a state coastal zone management plan that includes Arlington County. However, according to the National Oceanic and Atmospheric Administration Office for Coastal Management, the District does not have a coastal zone management plan. Any Federal activities being conducted within the coastal zone are required to be consistent with the criteria set forth in the approved state plan or program. To comply with CZMA, activities that would affect the coastal zone, including development projects, must be identified by the Federal agency and reviewed for consistency with the state-specific coastal zone management plan.

3.3. Methodology

The Study Area boundary for water resource and water quality (**Figure 3-1**) includes the immediate railroad corridor, bridge superstructure and pilings, abutments, and a corridor width of 500 feet on either side of the Project Area. This Study Area allows for evaluation of impacts to surface and groundwater resources and infrastructure both within and adjacent to the Project Area and encompasses all potential direct and indirect impacts to wetlands and other waters of the United States, areas that fall within Special Flood Hazard Areas associated with the Potomac River, and the Coastal Zone. This Study Area is also sufficient to capture water resources and the RPA 100-foot buffer of landward tidal wetlands, nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, and tidal shores. Therefore, a wider Regional Study Area is not necessary for these topics.

Figure 3-1 | Study Area for Water Resources and Water Quality

3.3.1. Water Quality

The water quality assessment included a comprehensive description and mapping of existing water resources. To better characterize the overall water quality conditions of the surface waters, data were collected from waters connected to resources within the Local Study Area, as well as resources that may be directly or indirectly affected by the Project. This was done to better characterize the overall water quality conditions of the surface waters within the Study Area. The Environmental Consequences analysis evaluated the Project's direct and indirect impacts on water quality during construction and operation of the Project.

3.3.2. Wetlands and Other Waters of the United States

The study identified wetlands and other waters of the United States in the Study Area in coordination with USACE, the National Park Service, VDEQ, and DOEE, and include the Potomac River and associated waterbodies, including Roaches Run, the Washington Channel, and the Tidal Basin.

The inventory began with a preliminary evaluation of existing mapping and online sources such as the National Wetlands Inventory, soil survey data, topographic surveys, existing reports, gauge data, and aerial imagery prior to field investigations. Submerged aquatic vegetation (SAV) information was obtained from the Virginia Institute of Marine Science. Additional information on SAV is presented in **Section 2.0, Natural Ecological Systems and Endangered Species**.

Wetlands were identified in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0.*[12] All identified waters of the United States, including wetlands, were classified according to *A Classification of Wetland and Deep-Water Habitats in the United States.*[13] Data were collected to support the delineation to include dominant vegetation, soil descriptions, and evidence of wetland hydrology. A request was prepared and submitted to USACE on December 11, 2018, to inspect and confirm the limits of wetlands and other waters of the United States as delineated in the field.

Using Geographic Information Systems (GIS), the amount of impacts was determined for each alternative in terms of permanent impacts from dredge and fill activities, shading impacts to emergent wetlands and submerged aquatic vegetation, and temporary impacts due to construction. The impacts analysis also evaluated the loss of wetland functions and values.

[12] USACE. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-20. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[13] U.S. Fish and Wildlife Services. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. eds. Cowardin LM, Carter V, Golet FC, LaRoe ET. Washington D.C. Report #FWS/OBS-79/31.

3.3.3. Flood Hazards and Floodplain Management

Resources used to identify floodplains within the Study Area include Flood Insurance Rate Maps and Digital Flood Insurance Rate Maps.[14, 15] The 100-year and 500-year flood zones within the Study Area were mapped using the National Flood Hazard Data Layer available for download from the FEMA Map Services Center. The analysis compiled an inventory of natural communities and manmade infrastructure within the flood zones to identify any nearby features potentially affecting the extent and intensity of flooding such as finger piers and flood gates. The analysis assessed the functional value of the floodplains based on a literature review and professional judgement.

The Environmental Consequences analysis evaluated the quantitative impacts to floodplain areas for each alternative. The impact to the floodplain was evaluated using methods consistent with the specifications for a FEMA Letter of Map Revision Process.[16]

3.3.4. Chesapeake Bay Preservation Areas

To assess impacts to RPAs, GIS mapping was used to identify those resources that overlap with the permanent limits of disturbance for the Action Alternatives. The evaluation of impacts relied on the analyses conducted for impacts to wetlands, ecological systems, and water quality.

3.3.5. Coastal Zone Management

To assess impacts to coastal features, GIS mapping was used to identify those resources that overlap with the permanent limits of disturbance for the Action Alternatives. The evaluation of impacts relied on the analyses conducted for impacts to wetlands, ecological systems, and water quality. To evaluate project consistency with CZMA, a Coastal Zone Consistency Determination for the project was prepared and submitted to the VDEQ.

3.4. Permanent or Long-Term Effects

This section discusses the permanent or long-term impacts following the construction of the No Action Alternative, Action Alternative A, or Action Alternative B on water quality and water resources.

3.4.1. Water Quality

Water quality impacts for the alternatives were compared using Stormwater Retention Volume (SWRv) per the DOEE *Stormwater Management Guidebook*,[17] proposed mitigation strategies, and qualitative assessment of each alternative's compliance with NPDES Total Maximum Daily Load (TMDL) requirements. The SWRv represents the volume of stormwater that would need to be retained on-site to mimic pre-development hydrologic conditions and protect District waterbodies. An increase in SWRv

[14] FEMA. 2015. Federal Flood Risk Management Standard. Accessed from http://www.fema.gov/federal-flood-risk-management-standard-ffrms. Accessed May 3, 2018.
[15] DOEE. 2010. Digital Flood Insurance Rate Map. Accessed from http://maps2.dcgis.dc.gov/dcgis/rest/services/DCGIS_DATA/Environment_WebMercator/MapServer/8. Accessed May 3, 2018.
[16] FEMA. 2017. FEMA Letter of Map Revision Process. Accessed from https://www.fema.gov/flood-map-revision-processes. Accessed June 20, 2018.
[17] DOEE. 2013. *Stormwater Management Guidebook*. Accessed from https://doee.dc.gov/swguidebook. Accessed August 24, 2018.

from existing conditions would indicate a long-term adverse impact on stormwater infrastructure and water quality, unless the Project included stormwater best management practices (BMPs) to mitigate that increase.

The existing stormwater retention volume was calculated to set a baseline for evaluating stormwater impacts to each of the three watersheds, which include the District Municipal Separate Storm Sewer System (MS4) watershed, the Potomac River, and Roaches Run in Arlington, Virginia. Land covers for areas within each watershed were used to calculate SWRv associated with a 1.2-inch rainfall event based on the DOEE *Stormwater Management Guidebook* guidance for calculating SWRv for major land-disturbing activity.[18] As ballast contains voids and pores that retain and reduce the velocity of stormwater runoff, these areas were classified as compacted. To consider pollutant buildup and wash-off on existing open-deck bridges over water, existing open-deck bridge areas over water were considered impervious for the SWRv calculations.

As it is anticipated that the Project will not connect to the NPS MS4 in the vicinity of the GWMP, this watershed was not included in the analysis.

For this analysis, the SWRv from 1.2 inches of rainfall was calculated for each watershed. **Table 3-1** describes the area within the Local Study Area and an estimation of SWRv.

Table 3-1 | Stormwater Retention Volume for the Local Study Area

	Existing Conditions Local Study Area[1]					
Watershed	**Paved[2] (acres)**	**Open-Deck Bridge Over Water[3] (acres)**	**Compacted[4] (acres)**	**Natural[5] (acres)**	**Total Area (acres)**	**Existing SWRv[6] (cf)**
District MS4	90.3	0.0	21.1	0.0	111.4	396,702
Potomac River	3.7	1.8	7.6	0.0	13.1	31,074
Roaches Run	9.3	0.0	20.2	19.5	48.9	60,263
TOTAL	103.3	1.8	48.9	19.5	173.4	488,039

[1] Local Study Area – the immediate railroad corridor, bridge superstructure and pilings, abutments, and a corridor width of 500 feet on either side of the Project Area.

[2] As the bridges over the Washington Channel and Tidal Basin are closed-deck, their footprints are counted as impervious area for calculating SWRv.

[3] Open-deck bridge over water counted as impervious area for calculating SWRv.

[4] Compacted Area: Land disturbed and/or graded for use as managed turf or landscaping.

[5] Natural Area: Land that is undisturbed and exhibits hydrologic properties equal to or better than meadow in good condition.

[6] Calculated using 1.2 inches of rainfall as required for Major Land Disturbing Activities.

[18] DOEE. 2013.

3.4.1.2. No Action Alternative

The No Action Alternative includes planned and funded transportation projects likely to be implemented by 2040, and maintenance projects necessary to keep the existing bridge and corridor in service. Projects within the Local Study Area include the Fourth Track Virginia (VA) to L'Enfant (LE) Interlocking and the L'Enfant South Storage Track projects, both located in the northeastern portion of the Local Study Area, and the DC to Richmond Southeast High Speed Rail (DC2RVA) project, located at the southeastern extent of the Local Study Area. Each of these projects would likely result in a slight increase in impervious area or conversion of a small area from previously disturbed vegetated area to rail ballast.

Groundwater

Under existing conditions, the Local Study Area generally consists of only shallow discharges to groundwater in the unconfined surficial aquifer that flows toward the Potomac River. No public wellhead protection areas are located within the Local Study Area. Under the No Action Alternative, these groundwater flow patterns would be maintained.[19]

While existing ground cover in this area consists almost entirely of impervious cover that inhibits groundwater recharge, the projects associated with the No Action Alternative may result in a slight increase in impervious area within the Local Study Area. As a result, the No Action Alternative would have negligible long-term adverse impacts on groundwater quantity through the reduction in groundwater recharge. This reduction in groundwater recharge could be mitigated through implementation of stormwater BMPs. If designed in accordance with the DOEE *Stormwater Management Guidebook* or Arlington County *Stormwater Manual*,[20] these BMPs would provide the prescribed recharge volume to mitigate any long-term adverse impacts to groundwater quantity.

The No Action Alternative would not introduce pollutants into the groundwater. As a result, it would have no long-term impact to groundwater quality.

Surface Water

Under the No Action Alterative, stormwater within the Local Study Area would continue to be conveyed either through the District MS4 to the Potomac River, directly to the Potomac River, or via overland flow to Roaches Run, as described in the Affected Environment section. Runoff from the railroad west of the George Washington Memorial Parkway, adjacent to Roaches Run in Virginia, including the proposed Fourth Track VA to LE Interlocking project area, likely flows overland to Roaches Run. Under the No Action Alternative, this drainage pattern would be maintained. Without mitigation, slight increases in impervious area for the No Action Alternative could cause direct, negligible long-term adverse impacts to surface water quality due to increased stormwater runoff and pollutant transport from that area. If the No Alternative Action projects were to implement BMPs designed in accordance with the DOEE

[19] W*ellhead protection areas are* surface and subsurface land *areas* regulated to prevent contamination of a well or well-field supplying a public water system. Established under the Safe Drinking Water Act (42 USC 330f-300j), this program is implemented through state governments.

[20] Arlington County Department of Environmental Services. *Stormwater Manual: A Guide to Stormwater Requirements for Land Disturbing Activities in Arlington County*. January 2015. Accessed from http://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/21/2014/06/DES-Stormwater-Management-Ordinance-Guidance-Manual.pdf. Accessed January 12, 2018.

Stormwater Management Guidebook or Arlington County *Stormwater Manual*, these long-term adverse impacts to surface water quality would be mitigated.

Under the No Action Alternative, the existing open-deck Long Bridge over the Potomac River would remain in place. Precipitation within the bridge footprint discharges directly to the Potomac River through bridge openings, carrying with it any pollutants built up on the bridge, including hydrocarbons (from spills, drips, and lubricant applied to the rails), metals (from the wear of wheels, breaks, and rails), deicing chemicals, and polycyclic aromatic hydrocarbons (PAHs) (from atmospheric deposition of fossil fuel exhaust). Given the anticipated pollutant load from the area relative to the volume of the receiving surface water body, it is anticipated that the existing bridge would continue to have minor long-term adverse impact on surface water quality within the Potomac River. Action Alternative A could also have a negligible adverse direct impact on surface water quality within the Potomac River due to a potential increase in birds nesting on the bridge, which could result in an increase in pathogen pollutants.

Runoff from the L'Enfant South Storage Track project and proposed Fourth Track from RO to AF Interlocking project would be collected through the District MS4 and therefore would not discharge directly to surface waters. Water quality impacts for these projects are addressed in the **Stormwater** section below.

Creosote-treated rail ties areas are a known source of PAHs. PAHs are currently listed as a Category 3 impairment for Washington Channel and the Tidal Basin, as there is insufficient available data to make a use determination.[21] As a TMDL has not been established for these substances, the No Action Alternative would comply with the requirements of all TMDLs for the receiving surface water bodies.

Stormwater

While the projects associated with the No Action Alternative may result in slight changes in land cover, and therefore SWRv, in the Local Study Area, stormwater BMPs for the projects would be required to comply with DOEE or Arlington County requirements for water quality treatment.

As only slight changes in land cover are anticipated from the No Action Alternative, the SWRv for the No Action Alternative is assumed to be the same as the Existing Conditions SWRv, as presented in **Table 3-1**.

3.4.1.3. Action Alternative A

In Action Alternative A, a new two-track bridge is proposed northwest (upstream) of the existing bridge at the crossing of the Potomac River, and the existing bridge would be retained to create a four-track crossing.

Within the Roaches Run watershed in Virginia, Action Alternative A includes the addition of two tracks and construction of a new bridge over the George Washington Memorial Parkway to carry these tracks. This work would result in an increase in impervious area of less than 0.01 acres, as almost the entire area within the bridge footprint is impervious under existing conditions.

[21] DOEE. 2016. *District of Columbia Water Quality Assessment 2016 Integrated Report to the US Environmental Protection Agency and Congress Pursuant to Sections 305(b) and 303(d) Clean Water Act (P.L. 97-117)*. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/2016%20Final%20IR.pdf. Accessed August 24, 2018.

Within the Potomac River watershed, Action Alternative A includes a new, closed-deck bridge over the Potomac River, parallel to the existing open-deck bridge to remain. The new bridge would result in an approximately 1.9-acre increase in impervious area in the Potomac River watershed. This increase in impervious area would have a negligible long-term adverse impact on groundwater recharge, peak runoff rates, or total runoff volume reaching the Potomac River. However, since the increase in impervious area would allow for buildup and wash-off of pollutants, there would be a minor permanent adverse impact on water quality in the Potomac River.

In the District MS4 watershed, Action Alternative A includes extending the two new tracks from the new bridge over the Potomac River, as well as modifying the existing two tracks from the existing Long Bridge and adding or replacing six additional bridges. As these new bridges are typically located over existing impervious areas and the alignment of the proposed railroad would require replacing existing impervious area with rail ballast, this work would result in an approximate 0.8-acre decrease in impervious area within the District MS4 watershed.

As indicated in **Table 3-2**, these changes to land cover anticipated within each of the three watersheds within the Local Study Area would result in an increase in SWRv for the Potomac River watershed. Without mitigation, these increases in SWRv would result in direct, minor long-term adverse impacts to surface water quality.

Table 3-2 | Action Alternative A SWRv Comparison to No Action Alternative

Watershed	Action Alternative A Change from No Action Alternative within Local Study Area[1]					SWRv[7] Change from Existing / No Action Alternative (cf)	SWRv Change from Existing / No Action Alternative (%)
	Paved[2] (acres)	Open-Deck Bridge Over Water[3] (acres)	Open Water[4] (acres)	Compacted[5] (acres)	Natural[6] (acres)		
District MS4	-0.8	0.0	-0.2	1.0	0.0	-2,190	-0.6
Potomac River	1.9	0.0	-1.9	0.0	0.0	7,796	25.1
Roaches Run	0.0	0.0	0.0	0.0	0.0	1	0.0
TOTAL	1.1	0.0	-2.1	1.0	0.0	5,607	1.1

[1] Local Study Area – the immediate railroad corridor, bridge superstructure and pilings, abutments, and a corridor width of 500 feet on either side of the Project Area.

[2] As the bridges over the Washington Channel and Tidal Basin are closed-deck, their footprints are counted as impervious area for calculating SWRv.

[3] Open-deck bridge over water counted as impervious area for calculating SWRv.

[4] Open Water excluded from SWRv calculation.

[5] Compacted Area: Land disturbed and/or graded for use as managed turf or landscaping or rail ballast.

[6] Natural Area: Land that is undisturbed and exhibits hydrologic properties equal to or better than meadow in good condition.

[7] Calculated using 1.2 inches of rainfall as required for Major Land Disturbing Activities.

Groundwater

The Local Study Area generally consists of only shallow discharges to groundwater in the unconfined surficial aquifer that flows toward the Potomac River. No public wellhead protection areas are located within the Local Study Area. Under Action Alternative A, these groundwater flow patterns would be maintained. [22]

Action Alternative A would result in an increase in impervious area of less than 0.01 acres within the Roaches Run watershed. As a result, Action Alternative A would have negligible permanent adverse impacts on groundwater quantity through reduction in groundwater recharge.

Action Alternative A would result in an increase in impervious area within the Potomac River watershed as a result of the new closed bridge deck; however, since almost the entire increase is in an area of existing open water, Action Alternative A would have permanent adverse negligible impacts on groundwater quantity through reduction in groundwater recharge.

Action Alternative A would not introduce pollutants into the groundwater. As a result, it would have no permanent adverse impact to groundwater quality.

Surface Water

No changes to drainage subwatersheds are anticipated as a result of Action Alternative A.

As Action Alternative A would result in an increase in impervious area of less than 0.01 acres tributary to Roaches Run, permanent negligible adverse impacts on surface water quality would be anticipated.

Under Action Alternative A, the existing open-deck Long Bridge over the Potomac River would remain in place. Precipitation within the bridge footprint discharges directly to the Potomac River through bridge openings, carrying with it any pollutants built up on the bridge, including hydrocarbons (from spills, drips, and lubricant applied to the rails), metals (from the wear of wheels, breaks, and rails), de-icing chemicals, and PAHs (from atmospheric deposition of fossil fuel exhaust). Action Alternative A would include a new bridge with a closed deck and a closed drainage system to collect runoff within the bridge footprint. The footprint of this new bridge would be subject to the same pollutants as the existing bridge, resulting in an increase in area for these pollutants to build up and wash-off. Stormwater would be conveyed by this system to the Potomac River. Given the anticipated pollutant load from the area relative to the volume of the receiving surface water body, it is anticipated that the existing and proposed bridges would have minor permanent adverse impact on surface water quality within the Potomac River. Action Alternative A could also result in an increase in birds nesting on the bridge, which could result in a negligible increase in pathogen pollutants.

[22] W*ellhead protection areas* are surface and subsurface land areas regulated to prevent contamination of a well or well-field supplying a public water system. Established under the Safe Drinking Water Act (42 USC 330f-300j), this program is implemented through state governments.

Given the anticipated pollutant load from the area relative to the volume of the receiving surface water body, it is anticipated that the reduction in impervious area tributary to the District MS4 would have long-term negligible beneficial impact on surface water quality within the Potomac River.

Creosote-treated rail ties areas are a known source of PAHs. PAHs are currently listed as a Category 3 impairment for Washington Channel and the Tidal Basin, as there is insufficient available data to make a use support determination.[23] As a TMDL has not been established for these substances, Action Alternative A would comply with the requirements of all TMDLs for the receiving surface water bodies.

Permit requirements for wetlands and surface waters are discussed in **Section 6.2.1.2.**

Stormwater

Action Alternative A is not anticipated to have long-term impacts to stormwater infrastructure.

Under Action Alterative A, stormwater within the Local Study Area would continue to be conveyed either through the District MS4 to the Potomac River, directly to the Potomac River, or via overland flow to Roaches Run, as described in the Affected Environment section.

As Action Alternative A would result in an increase in impervious area of less than 0.01 acres tributary to Roaches Run, slight increase to SWRv and negligible long-term adverse impacts on stormwater quality would be anticipated.

Action Alternative A would result in a 1.9-acre increase in impervious area within the Potomac River watershed as a result of the new closed bridge deck. Since this increase in impervious area is almost entirely over existing open water, Action Alternative A would have a negligible long-term adverse impact on recharge, peak runoff rates, or total runoff volume in the Potomac River watershed. Given the anticipated pollutant load from the area relative to the volume of the receiving surface water body, it is anticipated that Action Alternative A would have minor long-term adverse impact on surface water quality within the Potomac River.

As Action Alternative A would result in reduction in impervious area tributary to the District MS4, a minor decrease in SWRv and minor long-term beneficial impacts on stormwater quality would be anticipated.

Minor modifications to District, NPS, and Arlington County drainage infrastructure within the Local Study Area, such as new catch basins, drainage pipes, water quality inlets, and pipe connections within the District may be required to accommodate new bridges and other changes to the railroad configuration.

At the design phase, a Stormwater Management Plan would be developed for the project in compliance with Chapter 60 of the Arlington County Code and in accordance with DOEE review requirements. The Stormwater Management Plan would detail the location and design of all planned stormwater management facilities serving the project.

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[23] DOEE. 2016. *District of Columbia Water Quality Assessment 2016 Integrated Report to the US Environmental Protection Agency and Congress Pursuant to Sections 305(b) and 303(d) Clean Water Act (P.L. 97-117)*. Accessed from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/2016%20Final%20IR.pdf. Accessed August 24, 2018.

In addition, stormwater management facilities would be designed in accordance with Title 40 Code of Federal Regulations (CFR) Part 122.26 – Storm Water Discharges; the District's Water Pollution Control Act of 1984; the District's Storm Water Permit Compliance Amendment Act of 2000; and Title 21 of the District's Municipal Regulations (Chapter 11- Water Quality Standards and Chapter 19 – Water Quality Monitoring Regulations).

3.4.1.4. Action Alternative B

In Action Alternative B, a new two-track bridge would be constructed upstream of the existing bridge and the existing bridge would be replaced with a new two-track bridge, creating a four-track crossing.

Changes to the Roaches Run watershed in Virginia are the same as Action Alternative A, resulting in an increase in impervious area of less than 0.01 acres within the watershed.

Within the Potomac River watershed, Action Alternative B includes two new, closed-deck bridges over the Potomac River and removal of the existing open-deck bridge. The new bridges would result in an approximately 3.8-acre increase in impervious area in the Potomac River watershed. Similar to Action Alternative A, this increase in impervious area would have a negligible long-term adverse impact on recharge, peak runoff rates, or total runoff volume and a minor permanent direct adverse impact on water quality.

Changes to the District MS4 watershed are the same as Action Alternative A, resulting in an approximate 0.8-acre decrease in impervious area within the watershed.

As indicated in **Table 3-3**, these changes to land cover anticipated within each of the three watersheds within the Local Study Area would result in an increase in SWRv for the Potomac River watershed. Without mitigation, these increases in SWRv would result in long-term minor direct adverse impacts surface water quality.

Groundwater

Long-term groundwater quality impacts of Action Alternative B are similar to Action Alternative A.

Surface Water

The long-term surface water quality impacts of Action Alternative B are similar to Action Alternative A. Negligible long-term adverse impacts on surface water quality would be anticipated within Roaches Run and minor long-term adverse impact would be anticipated within the Potomac River.

Stormwater

Long-term stormwater quality impacts of Action Alternative B are similar to Action Alternative A. It is anticipated that Action Alternative B would have negligible long-term adverse impacts within Roaches Run, minor long-term adverse impact within the Potomac River, and minor long-term beneficial impacts within the District MS4.

Table 3-3 | Action Alternative B SWRv Comparison to No Action Alternative

Watershed	Action Alternative B Change from No Action Alternative within Local Study Area[1]					SWRv[7] Change from Existing / No Action Alternative (cf)	SWRv Change from Existing / No Action Alternative (%)
	Paved[2] (acres)	Open-Deck Bridge Over Water[3] (acres)	Open Water[4] (acres)	Compacted[5] (acres)	Natural[6] (acres)		
District MS4	-0.8	0.0	-0.2	1.0	0.0	-2,190	-0.6
Potomac River	3.8	-1.8	-2.0	0.0	0.0	8,340	26.8
Roaches Run	0.0	0.0	0.0	0.0	0.0	1	0.0
TOTAL	3.0	-1.8	-2.2	1.0	0.0	6,151	1.3

[1] Local Study Area – the immediate railroad corridor, bridge superstructure and pilings, abutments, and a corridor width of 500 feet on either side of the Project Area.

[2] As the bridges over the Washington Channel and Tidal Basin are closed-deck, their footprints are counted as impervious area for calculating SWRv.

[3] Open-Deck Bridge Over Water counted as impervious area for calculating SWRv.

[4] Open Water excluded from SWRv calculation.

[5] Compacted Area: Land disturbed and/or graded for use as managed turf or landscaping or rail ballast.

[6] Natural Area: Land that is undisturbed and exhibits hydrologic properties equal to or better than meadow in good condition.

[7] Calculated using 1.2 inches of rainfall as required for Major Land Disturbing Activities.

3.4.2. Wetlands and Other Waters of the United States

The anticipated permanent waters of the United States impacts from the Action Alternatives would result from placing piers in the Potomac River and Washington Channel/Tidal Impoundment. **Table 3-4** summarizes permanent impacts for wetlands and other waters of the United States by delineated feature for each Action Alternative. Based on this table, there is no difference in impacts to wetlands and other waters of the United States for each Action Alternative.

3.4.2.1. No Action Alternative

The No Action Alternative would have no adverse direct or indirect impacts to wetlands and other waters of the United States as none of the projects included in the No Action Alternative are expected to affect the wetlands within the Local Study Area because the projects are located inland.

3.4.2.2. Action Alternative A

Action Alternative A would have minor permanent direct adverse impacts to wetlands and other waters of the United States due to the placing of piers in the Potomac River and Washington Channel/Tidal Impoundments. There would be no indirect impacts to wetlands and other waters of the United States under Action Alternative A. Impacts are displayed in **Figure 3-2**.

3.4.2.1. Action Alternative B

The permanent impacts to wetlands and other Waters of the United States under Action Alternative B would be the same as the impacts under Action Alternative A. **Figure 3-3** displays the impacts.

Table 3-4 | Permanent Impacts to Waters of the United States (Including Wetlands) by Feature

Resource	State	No Action Alternative	Action Alternative A	Action Alternative B
Wetland 1 (PSS1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Wetland 2 (PFO1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Wetland 3 (PEM1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Roaches Run (R1UBV)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Potomac River (R1UBV)	District of Columbia	0 sf (0 ac)	22,000 sf (0.5 ac)	22,000 sf (0.5 ac)
Washington Channel/Tidal Impoundment (R1UBV)	District of Columbia	0 sf (0 ac)	1,037 sf (<0.1 acre)	1,037 sf (<0.1 acre)
Total Wetlands	-	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Total Waters	-	0 sf (0 ac)	23,037 sf (0.5 acre)	23,037 sf (0.5 acre)

PSS1R = palustrine scrub-shrub broad-leaved deciduous, seasonally flooded tidal
PFO1R = palustrine forested broad-leaved deciduous, seasonally flooded tidal
PEM1R = palustrine emergent persistent, seasonally flooded tidal
R1UBV = riverine tidal unconsolidated bottom permanent-tidal

Figure 3-2 | Action Alternative A Impacts to Wetlands and Waterways

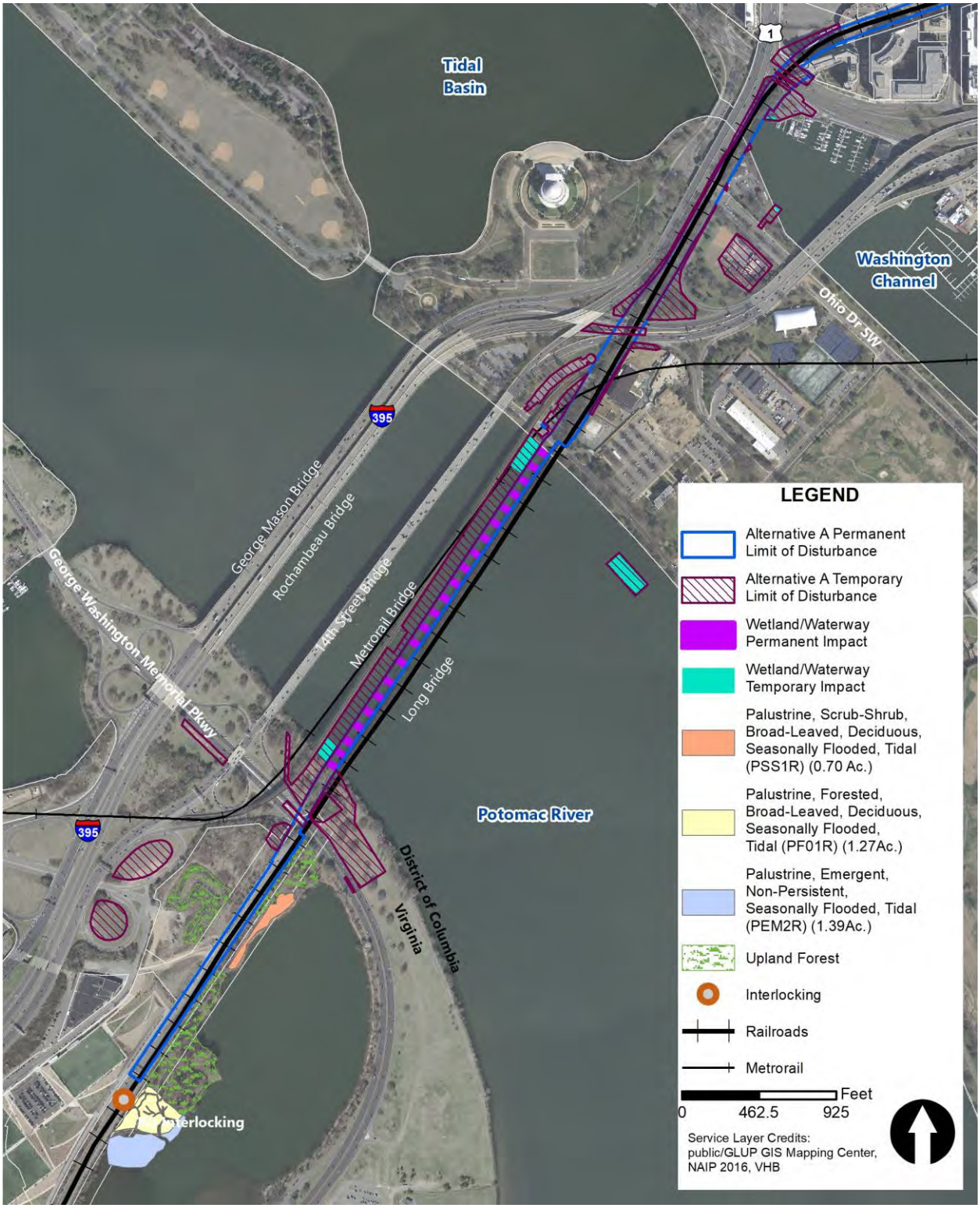
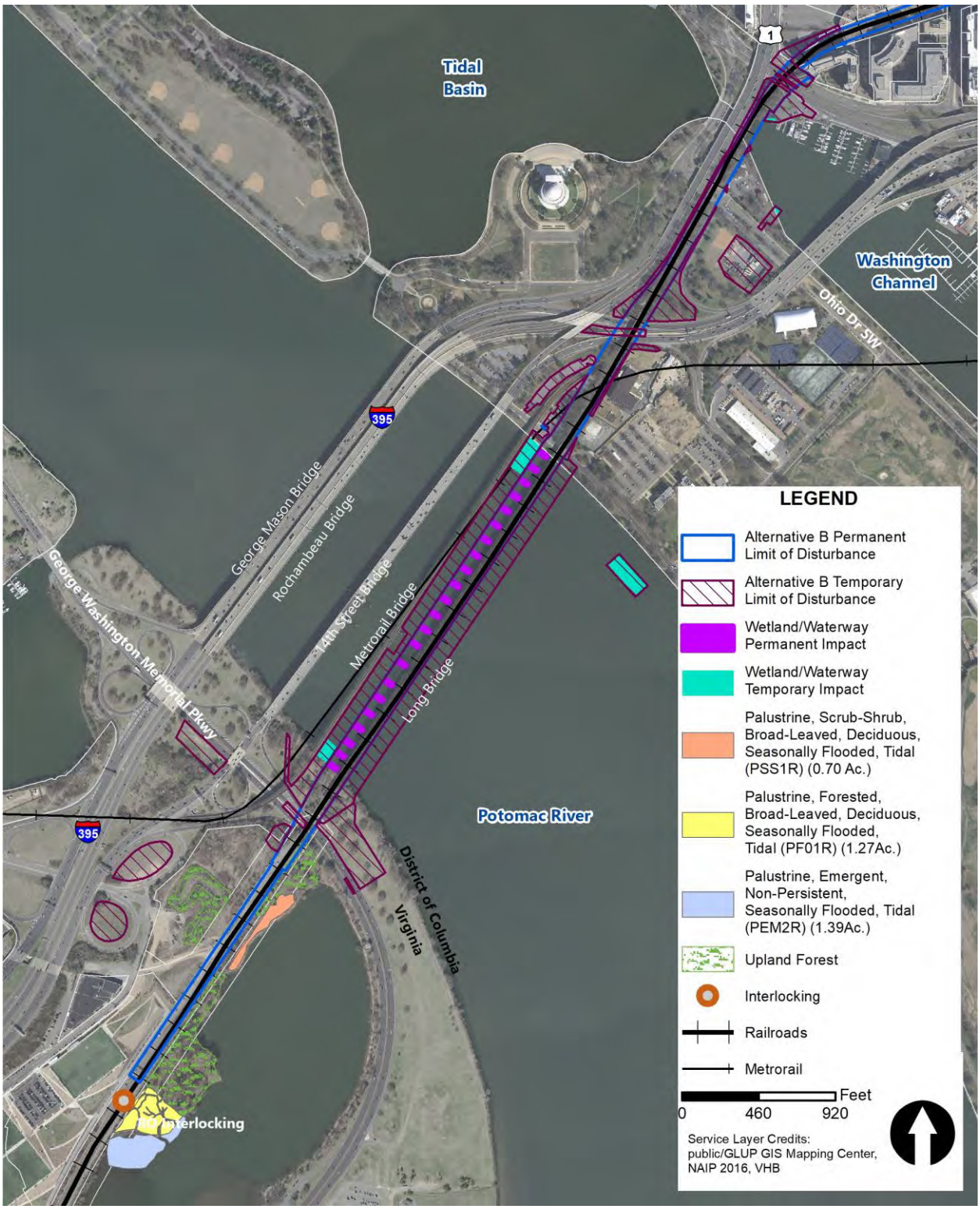


Figure 3-3 | Action Alternative B Impacts to Wetlands and Waterways



3.4.3. Flood Hazards and Floodplain Management

The No Action Alternative would have no adverse direct or indirect impacts to the base flood (100-year floodplain) elevation or boundary. Under the No Action Alternative, the existing railroad bridge and infrastructure throughout the Long Bridge Corridor would continue to function and operate under existing conditions. None of the projects included in the No Action Alternative are expected to affect the base flood elevation or boundary within the Local Study Area.

3.4.3.2. No Action Alternative

The No Action Alternative would have no direct or indirect adverse impacts to the base flood (100-year floodplain) elevation or boundary, as the existing railroad bridge and infrastructure throughout the Long Bridge Corridor would continue to function and operate under existing conditions. Based on the current and foreseeable use as an active railroad right-of-way, there would be no new impacts within the footprint of the floodplain nor to the base flood (100-year floodplain) elevation or boundary at or adjacent to the Project Area, and therefore no adverse effect is anticipated.

3.4.3.3. Action Alternative A

Action Alternative A would have negligible permanent direct or indirect adverse impacts to the base flood (100-year floodplain) elevation or boundary. Constructing a new two-track bridge upstream of the existing Long Bridge and the redevelopment of the existing corridor to expand the north-south rail system from two tracks to four tracks would require 22 new piers within the Potomac River as well as earthwork, abutments, and piers within the upland in and adjacent to the floodplain. The new bridges, piers, and abutments would be designed with consideration of their impacts to the Potomac River floodplain.

The floodplain at the location of the Project encompasses a wide space that includes the Pentagon Lagoon on the Virginia side of the river, the Tidal Basin, West Potomac Park and connection to the 17th Street Levee, and the large flood zone beyond the levee within the National Mall and other areas of the District. Given the expanse of the current flood zone, the placement of the 22 new piers in the river is expected to cause a negligible increase in the elevation or extent of the floodplain. Furthermore, the bottom of the bridge superstructure is 18 feet above Mean High Water, or more than 9 feet above the 100-year floodplain, and therefore would have negligible impact on the floodplain. Construction of the bridge embankments and piers would result in an impact of approximately 12,000 cubic yards within the 100-year floodplain. The level of impact is not expected to trigger FEMA's 1-foot threshold requirement described above. Prior to final design and permitting taking into consideration the full extent of the work and specific design elements (including pier size, orientation, shape and quantity, abutments, and bridge deck height), an analysis of the potential flooding increase would be performed using a FEMA-approved model to demonstrate no significant rise in, and thus no adverse effect of, the water surface of the base flood (100-year floodplain).

3.4.3.4. Action Alternative B

Impacts to the base flood (100-year floodplain) elevation or boundary, would be the same as impacts under Action Alternative A.

3.4.4. Chesapeake Bay Preservation Areas

RPAs, as defined by the Chesapeake Bay Preservation Ordinance in Arlington County, were derived in conjunction with the wetland delineation. Chesapeake Bay Preservation Areas within the Project Area include all protected wetland and waters, as well as the 100-foot upland buffer from the delineated edge for the purpose of protecting water quality of the Chesapeake Bay. Because wetland and water impacts are discussed in **Section 3.3.2, Wetlands and Other Waters of the United States**, the following sections specifically discuss the 100-foot upland buffer. As these resources are only delineated under Commonwealth of Virginia law, these resources end at the Virginia edge of the Potomac River and are not delineated in the District. The 100-foot RPA buffer occurs in a number of locations within the Virginia portion of the Long Bridge Corridor. Areas include the southern end of the Local Study Area and along the Potomac River shoreline in Virginia. Permanent impacts to RPA upland buffers would include those areas converted to infrastructure and impervious surface that could increase pollutant loads to the Potomac River. Portions of the RPA that are currently impervious were not considered in the impact analysis.

3.4.4.2. No Action Alternative

Most of the projects in the No Action Alternative would not be located near RPAs and would therefore have no adverse direct or indirect impacts to RPAs. However, the DC2RVA Project would have adverse impacts to the RPA associated with Roaches Run, as documented in the FEIS for the project. [24]

3.4.4.3. Action Alternative A

Under Action Alternative A, there would be minor permanent direct adverse impacts to the RPA. The new bridge structure would cross over the RPA along the Potomac River at the southern end of the Local Study Area. The decking of the new bridge would create additional impervious surface causing a permanent impact to the RPA through increased pollutant loading to waterbodies and loss of vegetation underneath bridge areas. This impact is estimated to total 7,359 square feet (0.2 acres) for Action Alternative A. There would be no indirect impacts to the RPA under Action Alternative A. **Figure 3-4** displays impacts to the RPA for this alternative.

3.4.4.4. Action Alternative B

Under Action Alternative B, there would be minor permanent direct adverse impacts to the RPA. The new bridge structure would cross over the RPA along the Potomac River at the southern end of the Local Study Area, and result in similar pollutant concerns and vegetation loss as with Action Alternative A. In addition, there would be a slight increase in the deck width of the replacement bridge compared to the existing bridge. This impact is estimated to total 11,462 square feet (0.3 acre) for Action Alternative B. There would be no indirect impacts to the RPA under Action Alternative B. **Figure 3-5** displays impacts to the RPA for this alternative.

[24] Virginia Department of Rail and Public Transportation. DC to Richmond Southeast High Speed Rail Final Environmental Impact Statement and Final Section 4(f) Evaluation, Updated Environmental Resource Mapbooks. May 2019. Accessed from http://dc2rvarail.com/files/4115/5380/5868/Part48b_Appendix_M1_Wetlands_Streams_Area1_-_Area2_Part1_DC2RVA_FEIS.pdf. Accessed July 16, 2019.

Figure 3-4 | Action Alternative A Impacts to Vegetation within the RPA

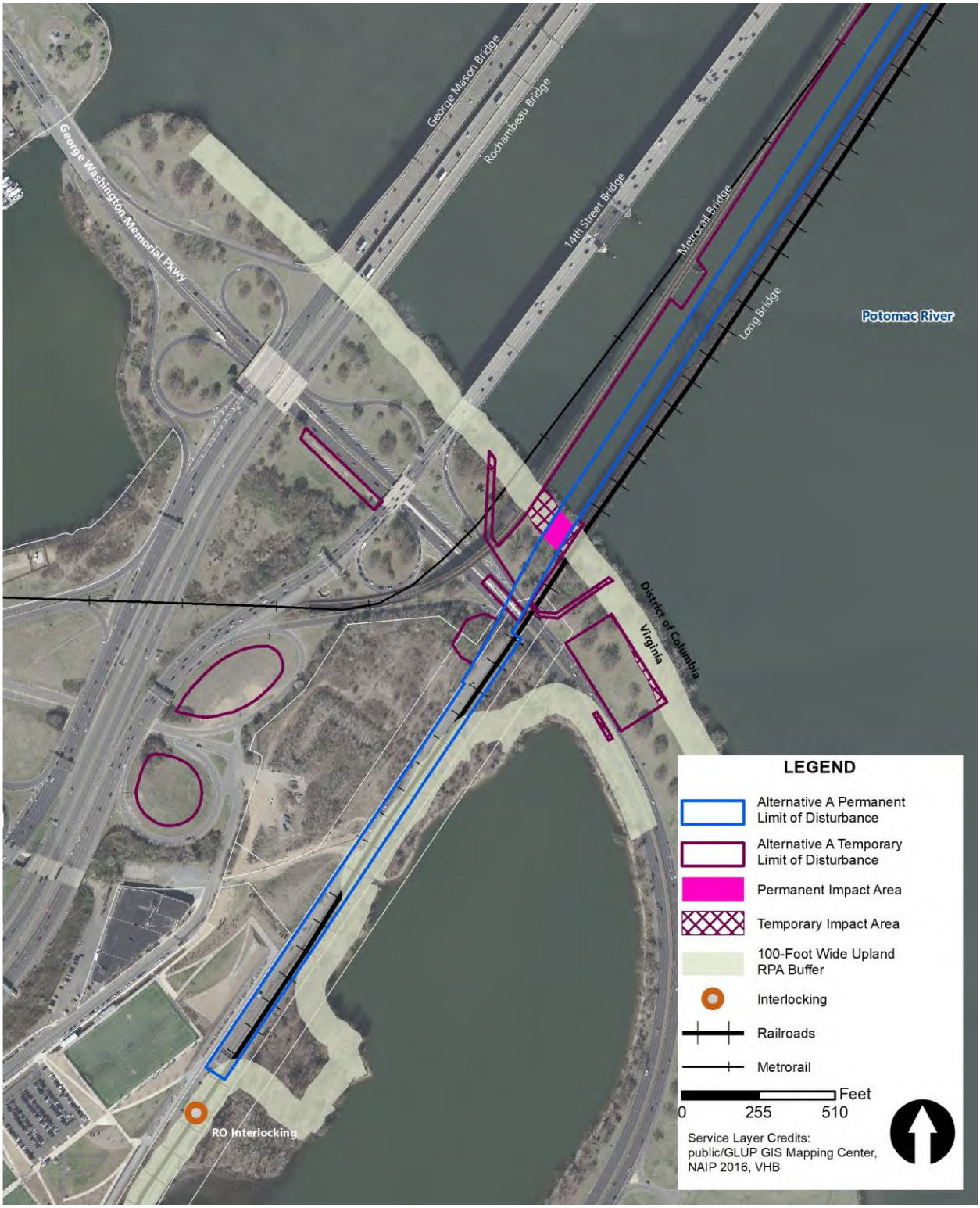
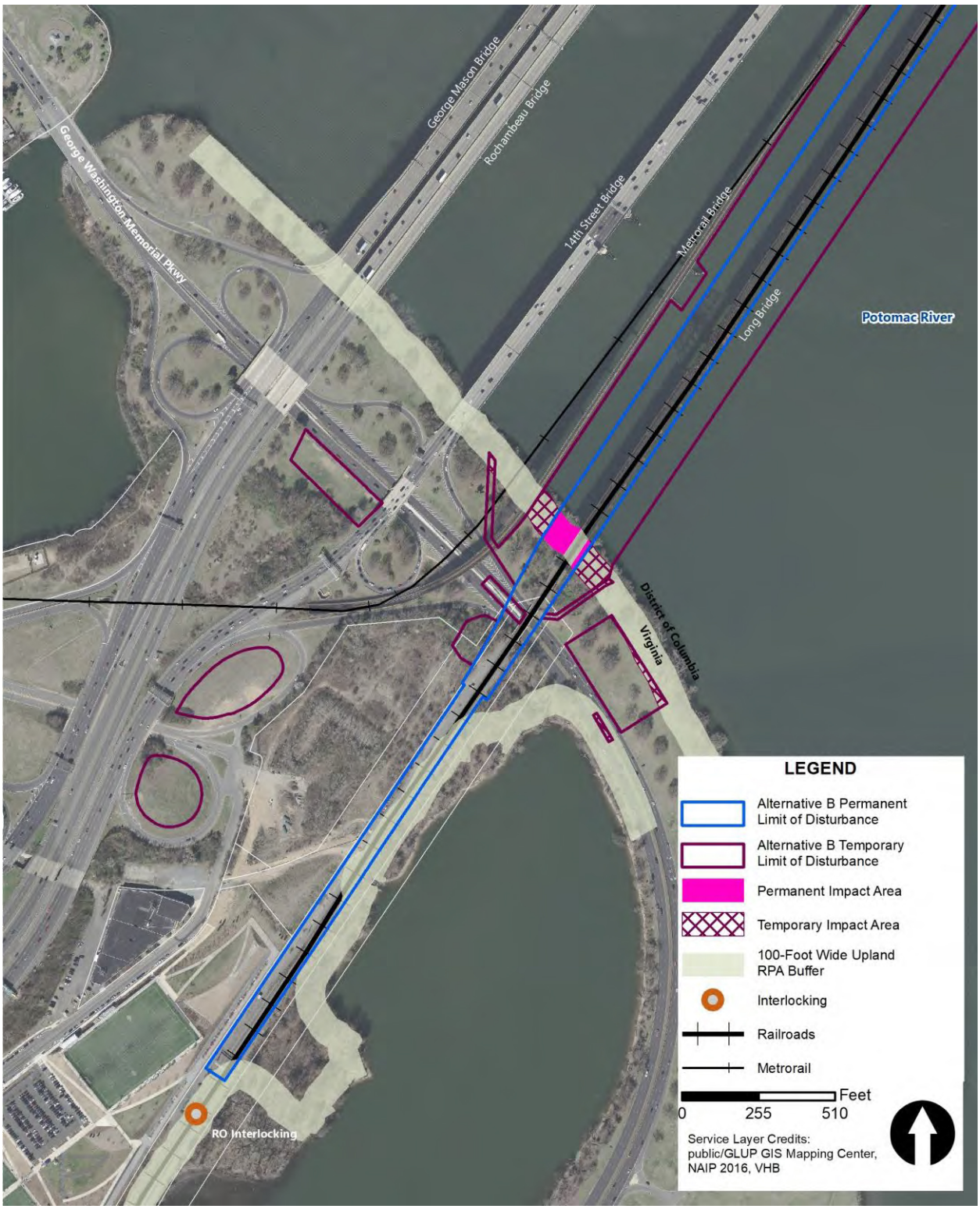


Figure 3-5 | Action Alternative B Impacts to Vegetation within the RPA



3.4.5. Coastal Zone Consistency

FRA and DDOT expect the Project to be consistent with the enforceable policies of Virginia's CZMP, as described in the draft Consistency Determination (pending review by VDEQ). FRA's draft Consistency Determination was submitted to VDEQ on August 9, 2019. The Federal Consistency Determination commits the Project to a variety of actions related to consistency with Virginia's CZMP, including obtaining permits and approvals related to stormwater management, RPAs, coastal lands, water resources, and other environmental resources.

3.5. Temporary Effects

This section discusses the temporary effects of construction activities that have the potential to affect water quality and water resources.

3.5.1. Water Quality

Soil erosion and sedimentation caused by construction activities may result in temporary adverse impacts on water quality within Local Study Area. These activities can include construction of the railroad bed, tracks, bridges, staging and laydown areas, access locations, and dewatering operations. In addition, construction activities could result in increased likelihood of spills of fuels, lubricants, or other pollutants.

Each alternative would be designed and constructed in accordance with EPA's 2017 NPDES Construction General Permit, Virginia Erosion and Sediment Control Regulations, the DDOE *Stormwater Management Guidebook*, the Anacostia Waterfront Development Zone, and the Arlington County *Stormwater Manual*.

Despite protective measures, each Alternative could result in temporary adverse effects to water quality, including sedimentation, turbidity, and pollutants entering groundwater or surface water.

3.5.1.1. No Action Alternative

Groundwater

Construction activities associated with projects in the No Action Alternative are not anticipated to extend into the water table.

Surface Water

The proposed DC2RVA project area would result in land-disturbing activities immediately upgradient of Roaches Run, and the Fourth Track VA to LE Interlocking and the L'Enfant South Storage Track projects would result in land-disturbing activities tributary to the District MS4. The No Action Alternative construction activities will include erosion and sediment controls and management of construction wastes to prevent stormwater impacts, in compliance with EPA's 2017 NPDES Construction General

Permit,[25] DOEE's *Erosion and Sediment Control Manual*,[26] and the *Virginia Erosion and Sediment Control Handbook*.[27] Suspended solids from urban runoff and construction activities are implicated in the Chesapeake Bay Watershed TMDLs and addressed in corresponding implementation plans. Erosion and sediment control practices prevent the transport of sediment from a construction site to city streets, drainage systems, and water bodies. If the contractor complies with construction-phase stormwater management requirements, the No Action Alternative construction is not expected to impact surface water quality in Roaches Run or the Potomac River.

Construction staging, laydown areas, access locations, dewatering operations, and other required disturbance to groundcovers can also result in erosion and sedimentation, which could result in temporary, minor adverse impacts to surface water quality in Roaches Run. However, it is anticipated that adverse impacts to surface water quality would be avoided through implementation of temporary treatment measures designed to satisfy the requirements of the erosion and sedimentation control requirements referenced above.

Stormwater

Projects associated with the No Action Alternative that are tributary to the District MS4 have the potential to adversely impact District MS4 infrastructure by transporting sediment into drainage infrastructure during construction. Sediment in a drainage system can result in lost conveyance capacity and shallow flooding. It is anticipated that any temporary adverse impact would be mitigated through these projects' compliance with EPA's 2017 NPDES Construction General Permit,[28] DOEE's *Erosion and Sediment Control Manual* and the *Virginia Erosion and Sediment Control Handbook*.

3.5.1.2. Action Alternative A

The anticipated construction duration for Action Alternative A is approximately 60 months. Temporary land-disturbing activities include the temporary relocation of the Mount Vernon Trail (MVT), laydown areas and access points the Potomac River and Washington Channel.

Construction of piers and some abutments in the water would require temporary cofferdams, as well as barges to store and assemble materials, to deliver labor and equipment, and to support various construction activities. Temporary spud barges would also be required at each pier to support a crane and for staging. Temporary finger piers extending into the river would be built on each shore to allow materials and equipment to be loaded and unloaded from the barges.

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[25] US Environmental Protection Agency (EPA). 2017. *National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities*. Accessed from https://www.epa.gov/sites/production/files/2017-06/documents/2017_cgp_final_permit_508.pdf. Accessed June 15, 2018.

[26] District Office of Energy and Environment. 2017. *Erosion and Sediment Control Manual*. Accessed from https://doee.dc.gov/esc. Accessed June 15, 2018.

[27] VDEQ. Undated. Virginia Erosion and Sediment Control Handbook. Accessed from http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx. Accessed January 12, 2018.

[28] US Environmental Protection Agency (EPA). 2017. *National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities*. Accessed from https://www.epa.gov/sites/production/files/2017-06/documents/2017_cgp_final_permit_508.pdf. Accessed June 15, 2018.

To install each bridge pier, a cofferdam would be constructed by installing steel sheeting around the limits of the pier so that the area can be dewatered down to the bottom of the footing elevation. Once sheeting is installed, the river bottom would be excavated to the depth needed to accommodate the installation of foundations and piers.

Groundwater

Excavation for bridge footings and for work within the tunnel under Maryland Avenue SW associated with Action Alternative A would likely occur below the water table and would therefore need dewatering. The contractor would need to comply with NPDES construction general permit dewatering requirements,[29] as well as DOEE, DC Water, and VA DEQ requirements for treatment and metering of pumped groundwater. The contractor would also be required to monitor and control the amount of active dewatering on the site so that the dewatering would not create subsidence in and around adjacent properties. If the contractor complies with these requirements, Action Alternative A construction is not expected to impact groundwater quality or quantity.

Pumped groundwater from excavations would be discharged to either the District MS4 or via overland flow to surface waters. See the **Surface Water** and **Stormwater** sections below for discussion of water quality impacts.

Surface Water

Action Alternative A construction activities must include erosion and sediment controls and management of construction wastes to prevent stormwater impacts, in compliance with EPA's 2017 NPDES Construction General Permit,[30] DOEE's Erosion and Sediment Control Manual,[31] and the Virginia Erosion and Sediment Control Handbook.[32] Since the area of ground disturbing impacts will exceed 5,000 square feet., an Erosion and Sedimentation Plan and a Stormwater Management Plan with BMPs will need to be submitted to DOEE. If the contractor complies with construction-phase stormwater management requirements, Action Alternative A construction is not expected to impact surface water quality.

It is anticipated that piers for Action Alternative A proposed bridge spanning the Potomac River upstream of the existing Long Bridge would be constructed using barges, finger piers, and cofferdams. This type of in-water work, which is expected to have a duration of approximately 50 months, has the potential to result in suspension of sediment and temporary, minor adverse impacts on water quality in the Potomac River. DOEE and VDEQ would issue permits under Section 401 of the Clean Water Act, which includes requirements for work within Waters of the U.S. Additional information on Section 401 is

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[29] US Environmental Protection Agency (EPA). 2017. *National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities. Section 2.4 Construction Dewatering Requirements*. Accessed from https://www.epa.gov/sites/production/files/2017-06/documents/2017_cgp_final_permit_508.pdf. Accessed June 15, 2018.

[30] EPA. 2017. *National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities*. Accessed from https://www.epa.gov/sites/production/files/2017-06/documents/2017_cgp_final_permit_508.pdf. Accessed June 15, 2018.

[31] District Office of Energy and Environment. 2017. *Erosion and Sediment Control Manual*. Accessed from https://doee.dc.gov/esc. Accessed August 24, 2018.

[32] VDEQ. Undated. Virginia Erosion and Sediment Control Handbook. Accessed from http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/Publications/ESCHandbook.aspx. Accessed January 12, 2018.

provided in **Section 3.2.2, Wetlands and Other Waters of the United States**. Additional information on handling and disposal of hazardous materials and spill prevention are included in **Section 5.0, Solid Waste Disposal and Hazardous Materials**.

Construction staging, laydown areas, access locations, dewatering operations, and other required disturbance to groundcovers can also result in erosion and sedimentation, which could result in temporary, minor adverse impacts to surface water quality in the Potomac River, Roaches Run, and the Washington Channel. However, it is anticipated that adverse impacts to surface water quality would be avoided through implementation of temporary treatment measures designed to satisfy the requirements of the erosion and sedimentation control requirements referenced above.

Stormwater

Action Alternative A construction activities within areas tributary to the District, Arlington, and NPS MS4s include removal of impervious and previously developed pervious surfaces to accommodate the proposed rail ballast areas. In addition, the work would include excavation for the construction of bridge abutments, which could result in construction dewatering and exposure of erodible soils. Construction staging, laydown areas, access locations, dewatering operations, and other required disturbance to groundcovers can also result in erosion and sedimentation. These activities have the potential to contribute sediment to the District, Arlington, and NPS MS4s, potentially resulting in temporary minor adverse impact to stormwater quality and a loss of capacity of the existing closed drainage systems. If the contractor complies with construction-phase stormwater management requirements, Action Alternative A construction would result in a negligible temporary direct adverse impact to stormwater quality or stormwater infrastructure.

3.5.1.3. Action Alternative B

Temporary land-disturbing activities associated with Action Alternative B work are similar to those for Action Alternative A, including the temporary relocation of the MVT, laydown areas and access points the Potomac River and Washington Channel. However, demolition of the original Long Bridge and the anticipated construction duration for Action Alternative B is twice that of Action Alternative A, at approximately 8 years and 3 months. As a result, Action Alternative B has greater potential to adversely impact water quality.

Groundwater

Temporary groundwater quality impacts of Action Alternative B are similar to Action Alternative A. If the contractor complies with applicable requirements, Action Alternative B construction is not expected to impact groundwater quality or quantity.

Surface Water

Temporary surface water quality impacts of Action Alternative B are similar to Action Alternative A. Minor adverse impacts to surface water quality in the Potomac River, Roaches Run, and the Washington Channel are anticipated during the approximately 97-month duration of the in-water work. However, it is anticipated that these adverse impacts would be avoided through implementation of temporary treatment measures designed to satisfy the requirements of the erosion and sedimentation control requirements referenced above.

Stormwater

Temporary stormwater quality impacts of Action Alternative B are similar to Action Alternative A. If the contractor complies with construction-phase stormwater management requirements, Action Alternative B construction is not expected to result in a temporary adverse impact to stormwater quality or stormwater infrastructure.

3.5.2. Wetlands and Other Waters of the United States

Anticipated temporary impacts to waters of the United States from the action alternatives would result from temporary finger pier placement and construction of a spud barge the Potomac River and barge access to the Washington Channel/Tidal Impoundment. There would also be temporary impacts to waters of the United States as a result of cofferdam placement and associated riverbed dredging for construction of the piers in the Potomac River and construction of the bridge abutments in the Washington Channel/Tidal Impoundment. **Table 3-3** summarizes temporary impacts for wetlands and other waters of the United States by delineated feature for each action alternative.

3.5.2.2. No Action Alternative

The No Action Alternative would have no adverse temporary impacts to wetlands and other waters of the United States as construction of the projects included in the No Action Alternative is not expected to affect the wetlands within the Local Study Area.

3.5.2.3. Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts to wetlands and other waters of the United States over a period of approximately 5 years. No jurisdictional vegetated wetlands would be temporarily impacted by Action Alternative A. However, this alternative would directly impact a total of 50,099 square feet (1.2 acres) of tidal waters in the District classified as R1UBV. Of this amount, 42,781 square feet (0.9 acres) would be for impacts to the Potomac River due to temporary finger pier placement, construction of a spud barge, and use of cofferdams around each bridge pier. An additional 7,319 square feet (0.2 acres) would be for impacts to the Washington Channel/Tidal Impoundment due to barge access and use of a cofferdam around the bridge abutment. No temporary impacts to waters of the United States are proposed in the Commonwealth of Virginia for this Action Alternative. There would be no indirect temporary impacts to wetlands and other waters of the United States under Action Alternative A. **Figure 3-2** depicts impacts.

3.5.2.1. Action Alternative B

Action Alternative B would also have minor temporary direct adverse impacts to wetlands and other waters of the United States over a period of approximately 8 years and 3 months. The impacts under Action Alternative B would be the similar to the impacts under Action Alternative A, with the exception of impacts to the Potomac River. Temporary impacts to the Potomac River would increase to 66,599 square feet (1.5 acre) due to the additional cofferdams needed to remove and reconstruct the piers on the existing bridge. **Figure 3-3** depicts impacts.

Table 3-5 | Temporary Impacts to Waters of the United States (Including Wetlands) by Feature

Resource	State	No Action Alternative	Action Alternative A	Action Alternative B
Wetland 1 (PSS1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Wetland 2 (PFO1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Wetland 3 (PEM1R)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Roaches Run (R1UBV)	Commonwealth of Virginia	0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Potomac River (R1UBV)	District of Columbia	0 sf (0 ac)	42,781 sf (0.9 ac)	59,280 sf (1.4 ac)
Washington Channel/Tidal Impoundment (R1UBV)	District of Columbia	0 sf (0 ac)	7,319 sf (0.2 ac)	7,319 sf (0.2 ac)
Total Wetlands		0 sf (0 ac)	0 sf (0 ac)	0 sf (0 ac)
Total Waters		0 sf (0 ac)	50,100 sf (1.1 ac)	66,599 sf (1.5 ac)

PSS1R = palustrine scrub-shrub broad-leaved deciduous, seasonally flooded tidal
PFO1R = palustrine forested broad-leaved deciduous, seasonally flooded tidal
PEM1R = palustrine emergent persistent, seasonally flooded tidal
R1UBV = riverine tidal unconsolidated bottom permanent-tidal

3.5.3. Flood Hazards and Floodplain Management

3.5.3.1. No Action Alternative

The projects included in the No Action Alternative are not expected to require construction activities within the floodplain in the Local Study Area. Therefore, there would be no construction and therefore no changes within the floodplain or to the base flood (100-year floodplain) elevation or boundary at or adjacent to the Local Study Area. Therefore, no temporary impacts would occur.

3.5.3.2. Action Alternative A

Action Alternative A would have negligible direct adverse impact to the base flood (100-year floodplain) elevation or boundary. During the construction phases of Action Alternative A, temporary measures would be required within the floodplain footprint for construction access. The initial phase of construction, prior to construction of the bridge structure, would require constructing temporary stockpile areas, laydown areas, and barge access areas within the floodplain, both in the upland and waterside areas. Stockpile and laydown areas are expected to contain construction materials and be

used for equipment yards. These materials would cause temporary loss of flood storage and could cause temporary impacts to the flood zone if a major flood event occurred during construction.

During construction of the bridge structure, temporary cofferdams at the bridge piers would be installed and removed on a phased schedule. It is expected that no more than six cofferdams would be placed in the river at any one time. Once the pier footing is installed, the cofferdam associated with that footing would be dismantled. Temporary impacts to flooding as a result of the cofferdams would include a small loss in flood storage and the potential for water quality impacts from lose materials washing downstream during a catastrophic flood event. However, a single cofferdam itself within the footprint of the floodplain would have a negligible effect on the base flood (100-year floodplain) elevation or boundary.

Construction activities would also include installing a staging area within the Potomac River along the northern shoreline. This work would include constructing a trestle finger pier of pilings and rigid platform for barges to load and move construction equipment and materials to and from the pier construction sites. This work would cause a negligible temporary loss of flood storage until such time that the staging area is removed after construction is completed. Materials would be temporarily stored on the pier prior to loading onto the barge, and there is potential for unsecured or loose materials washing downstream during a significant flood event. The small area required for this work is expected to have a negligible effect on the Potomac River floodplain.

3.5.3.3. Action Alternative B

The temporary impacts under Action Alternative B would be the same as the impacts under Action Alternative A.

3.5.4. Chesapeake Bay Preservation Areas

3.5.4.1. No Action Alternative

The No Action Alternative would have no adverse temporary impacts to RPAs as construction of the projects included in the No Action Alternative is not expected to affect RPAs within the Local Study Area.

3.5.4.2. Action Alternative A

Minor temporary direct adverse impacts are expected within the RPA for Action Alternative A, totaling 19,554 square feet (0.4 acres). Impacts would occur associated with vegetation disturbances to install construction access and staging areas for the railroad improvements. Temporary impacts for Action Alternative A would occur within the Potomac River RPA buffer, and would be substantial due to the parallel, linear nature of the Mount Vernon Trail rerouting that would occur along the Potomac River. **Figure 3-4** shows the locations of the RPA buffer.

3.5.4.3. Action Alternative B

Minor temporary direct adverse impacts are expected within the RPA for Action Alternative B, totaling 27,757 square feet (0.6 acres). The types of impacts would be similar to those from Action Alternative A, with the exception of an additional temporary laydown area in the RPA along the Potomac River. **Figure 3-5** shows the locations of the RPA buffer.

3.6. Avoidance, Minimization, and Mitigation

This section discusses how impacts to water quality and water resources within the Local Study Area would be avoided, minimized, or mitigated.

3.6.1. Water Quality

The following mitigation measures are proposed to minimize or mitigate for adverse impacts to groundwater, surface water, and stormwater.

3.6.1.2. Construction-Phase Mitigation

Erosion and sedimentation controls would be implemented in accordance with EPA's 2017 NPDES Construction General Permit, DOEE *Stormwater Management Guidebook*, DDOT *Green Infrastructure Standards*, DC Water *Green Infrastructure Utility Protection Guidelines*, DC Water *Project Design Manual Volume 3 Infrastructure Design*, and the Arlington County *Stormwater Manual*. These include requirements to provide an effective means of eliminating discharges of spilled or leaked chemicals, including fuels and oils, from construction activities. The contractor would also be required to store, handle, and dispose of materials in a manner that prevents exposure of the products to precipitation and/or stormwater.

On-site treatment of pumped groundwater would be in accordance with DOEE, DC Water, and VDEQ requirements for treatment and metering of pumped groundwater. The discharge of treated pumped groundwater directly to surface waters may be implemented to minimize temporary MS4 infrastructure capacity and sedimentation impacts.

3.6.1.3. Post-Construction Stormwater BMPs

If necessary, long-term adverse impacts to water quality in the Roaches Run and Potomac River watersheds would be mitigated through implementation of stormwater BMPs. If designed in accordance with NPS requirements, the DOEE *Stormwater Management Guidebook,*[33] or the Arlington County *Stormwater Manual*,[34] these BMPs would decrease runoff volume and peak flow rate and would provide the prescribed treatment volume to mitigate adverse impacts to surface water and stormwater. These BMPs would also provide the prescribed recharge volume to mitigate adverse impacts to groundwater quantity and quality.

Due to the limited space within the right-of-way in the project area, installation of open-air infiltration-type stormwater BMPs, such as bioretention areas and infiltration basins, is likely infeasible. Treatment BMPs such as oil/grit separators could be implemented to treat runoff prior to discharge; however, these BMPs would not mitigate increases in runoff volume or peak flow rate. Design of stormwater BMPs would be completed during final design.

[33] DOEE. 2017.

[34] Arlington County. *Stormwater Manual: A Guide to Stormwater Requirements for Land Disturbing Activities in Arlington County.* 2018. Accessed from https://building.arlingtonva.us/wp-content/uploads/sites/38/2016/09/DES-Stormwater-Management-Ordinance-Guidance-Manual.pdf. Accessed September 19, 2018.

Due to the length and configuration of the existing bridge and proposed bridges, use of BMPs would likely not mitigate minor long-term adverse impacts resulting from wash-off of pollutant buildup on the bridge.

3.6.2. Wetlands and Other Waters of the United States

Efforts to avoid and minimize impacts have occurred throughout the planning process and would continue as the project moves forward to more detailed stages of design. Some of the avoidance and minimization measures to date include aligning the new piers to the existing piers to reduce hydrologic impacts; selecting alternatives with a new upstream bridge (rather than a downstream bridge) in order to expand the tracks westward rather than encroaching on Roaches Run; and the use of construction methods to reduce sedimentation and turbidity.

Potential impacts to waters of the United States would be minimized by aligning the new piers with existing piers, which decreases the number and footprint of new piers. Additional coordination with DC2RVA at RO Interlocking has allowed for the elimination of a culvert extension into Roaches Run, which would have impacted jurisdictional wetlands and other waters of the United States. Erosion control and stormwater management would be implemented by DRPT during construction to reduce disturbance to waters of the United States from erosive forces, such as stormwater runoff. To reduce turbidity from potential sediment releases during construction of the new bridge piers, work would be conducted behind cofferdams, which would allow pile driving of the pier supports in the dry avoiding releases of sediment that can occur if pile driving occurs in-water. Installation of the sheet piles for the cofferdam can create minor sediment releases, but these are typically installed using a vibratory hammer, which minimizes the disturbance to the bottom sediments. The expected sediment release from this activity is low, but if needed, turbidity curtains could be used to further reduce turbidity within the Potomac River.

3.6.3. Flood Hazards and Floodplain Management

Construction of a new two-track bridge upstream of the existing Long Bridge and the redevelopment of the existing corridor would result in work within the existing floodplain.

Avoidance and minimization of work within the floodplain would begin in the design phase and be applied during the construction phase to reduce the potential for any net rise in the base flood or impacts to the floodplain from construction activities. Adherence to avoidance and minimization measures must be completed concurrently with other objectives, including but not limited to meeting bridge structural requirements, waterway navigability, and prevention of bridge scour and debris and ice jam potential.

Although impacts to the floodplain would be unavoidable, several steps would be taken to minimize floodplain impacts during the design and construction phases. Minimization efforts would include pier support design having an elliptical shape that would allow smoother flood flow conveyance underneath the bridge with minimal turbulence and hydraulic force against the pier walls. Avoidance and minimization measures during construction would include establishing staging yards landward of the 100-year floodplain as much as possible. While several construction staging sites must be placed in the floodplain, the contractor would be required to adhere to a plan of action in the event of an oncoming flood event. Such actions would include the transfer of equipment and any fuel/oils to an area landward

of the floodplain. The plan would also require methods of insuring erosion and sedimentation control measures are properly installed, as well as securing barges and other floating forms of equipment that could become dislodged and washed downstream.

Mitigation of long-term effects are limited given the natural and built environment in the vicinity of the Project. However, mitigation of temporary effects would, at a minimum, involve restoration of temporarily disturbed areas and construction zones and measures within the floodplain to return them to the pre-existing condition.

3.6.4. Chesapeake Bay Preservation Areas

The nature of the project as bridge construction over an RPA, the Potomac River, and its buffer means complete avoidance of the RPA is not feasible.

In areas of bare ground, proper erosion and sediment control techniques would help reduce runoff that could negatively affect RPAs. Efforts made to avoid forest and vegetation impacts as part of the terrestrial vegetation avoidance and minimization would also provide avoidance and minimization in the RPA buffer. Additional coordination with DC2RVA at RO Interlocking has allowed for the elimination of a culvert extension into Roaches Run, which would have impacted forests and vegetation within the RPA buffer of Roaches Run.

4.0 Geologic Resources

4.1. Overview

This section describes the geologic and soil resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. This section also describes the analysis of the No Action Alternative and each Action Alternative and their potential construction and permanent or long-term impacts on geology and soil. This section also discusses proposed avoidance, minimization, and mitigation measures to reduce potential adverse impacts of the Project on geologic and soil resources.

Geologic and soil resources include geologic formations or features such as point bar deposits, creek/river channels, sediments, banks, and other Coastal Plain and Piedmont sediments that comprise the foundation upon which the Project would be constructed. The Piedmont is mostly made of metamorphic rocks, and the Coastal Plain is made of sedimentary rocks. Geologic and soil resources are considered in this Draft Environmental Impact Statement because the Project would cause ground altering activities that have the potential for impacts. Key features of the geologic resources for the Project include the soil or sediment types, texture, percent slope, and erodibility of upland and estuarine areas; geomorphic features or the form of the landscape such as bars, channels, and river banks; and geologic hazards such as faults and fractures or potential earthquake zones.

4.2. Regulatory Context and Methodology

This section describes the most important regulatory context for evaluation of impacts to geological and soil resources and provides a summary of the methodology used to evaluate the current conditions of the resource and the probable consequences of the alternatives. This section also includes a description of the Study Area for each resource category. The *Methodology Report* provides a full list of laws, regulations, and other guidance considered and a full description of the analysis methodology followed for these resources.

4.2.1. Regulatory Context

There are no relevant Federal, state, or local laws, regulations, or Executive Orders for geologic resources. However, a geotechnical evaluation of geologic resources, including soil borings and collections, would be required during final design to determine appropriate foundations for the project. As a result, authorization would be required from the National Park Service (NPS), typically granted through a Scientific Research and Collecting Permit, for activities on property owned by NPS. Permits would be required by the District of Columbia (the District), Arlington County, and the United States Army Corps of Engineers (USACE). The USACE having regulatory authority through Section 10 of the Rivers and Harbors Act of 1899[1] would likely issue a Nationwide Permit 6 – Survey Activities to authorize

[1] 33 USC 403, 33 CFR 322

the geotechnical evaluation work. In addition, soil sampling and testing may be required to evaluate levels of contaminants. Reporting and disposal of soils samples are regulated by the local jurisdiction.

Approval by the local jurisdictions (the District and Arlington County) of an erosion and sediment control plan would be required as part of the construction plan documents. Upon approval of the erosion and sediment control plan, the local jurisdictions would provide review and approval of a Stormwater Pollution Prevention Plan (SWPPP) to ensure that erosion control measures are permitted, implemented, monitored, and reported under the National Discharge Elimination System of the Clean Water Act of 1972.[2]

4.2.2. Methodology

The Local Study Area (**Figure 4-1**) is based on an estimated area for the Limits of Disturbance required for construction and construction access and staging. The Local Study Area was defined as a 0.25-mile buffer around the Long Bridge Corridor. The Regional Study Area considered the greater Washington Metropolitan Region, which encompasses the geologic resources of interest for the Project.

Evaluation of direct and indirect effects identified and determined the likelihood that the Project alternatives would affect or impact geologic and soil resources and considered both temporary and permanent effects.

4.3. Permanent or Long-Term Effects

This section discusses the permanent or long-term effects following the construction of the No Action Alternative, Action Alternative A, and Action Alternative B on the geologic and soil resources within the Local Study Area.

4.3.1. Geologic Resources

4.3.1.1. No Action Alternative

The No Action Alternative would have no long-term effects to geologic resources because there would be no changes to the existing geologic or geomorphic features within the Local Study Area. Potential construction activities within the Local Study Area include the addition of a fourth track from the AF to RO Interlocking and LE to VA Interlocking, VRE L'Enfant Station Improvements, and VRE's North and South Storage Tracks. Additionally, proposed improvements at Long Bridge Park include a new aquatics center, parking, and support facilities. These projects would not alter or change any geologic or geomorphic features since they are located outside the river floodplain, river banks, river thalweg, and shallow flats of the river. The existing railroad bridge and infrastructure throughout the Long Bridge Corridor would continue to function and operate under existing conditions. The existing bridges and structural components would continue to be susceptible to earthquake activity occurring in the Regional Study Area.

[2] 33 USC 1251

Figure 4-1 | Study Area for Geologic Resources

4.3.1.2. Action Alternative A

Action Alternative A would have minor permanent direct adverse effects to geologic resources since the footprint of the railroad widening and bridge structures is relatively small and localized and would not affect the function or integrity of the resource. Specifically:

- Construction of a new two-track bridge upstream of the existing Long Bridge and the redevelopment of the existing corridor to expand the north-south railroad system from two to four tracks would require new foundation systems secured into the ground or riverbed of the Potomac River and Washington Channel, as well as earthwork and earth retaining structures within the corridor.
- Minor alterations to the geomorphic features within the Local Study Area would include grading and filling of approximately 5,000 square feet of floodplain for landside track expansion and bridge construction, but these modifications would not affect the function or integrity of the resource. See **Section 3.3.3, Water Resources and Water Quality**, for further discussion on the effects to floodplain functions.
- Bridge foundations within the river would exist below the riverbed with only cylindrical piles extending through the water column to support the new bridge structures. For the Potomac River, the new bridge structures would impact approximately 600 square feet of the broad, shallow flats located on either side of the river channel. The Washington Channel bridge piles would impact approximately 100 square feet of the river bed, but the effects from both crossings would be minor, localized and would not affect the function or integrity of the resource.
- New bridges and structures would be less susceptible than existing structures to earthquake activity occurring in the Regional Study Area since they would be constructed in accordance with current seismic structural criteria. However, the existing bridges and structural components would continue to be susceptible to earthquake activity occurring in the Regional Study Area.

The new bridges, retaining walls, and embankment construction would be designed in accordance with recommendations based on site-specific geotechnical and hydrologic and hydraulic investigations to be completed during final design. These investigations would further the understanding and assessment of effects and would include a scour analysis to assess the stability of the geomorphic features adjacent to the proposed structures. These future studies would also include potential mitigative measures should major negative effects be identified.

4.3.1.3. Action Alternative B

Action Alternative B would have similar effects as Action Alternative A. However, demolition and replacement of the existing bridge would require replacing abutments, foundations, and bridge structures between the George Washington Memorial Parkway (GWMP) and Ohio Drive SW. The replacement work would occur within the same general footprint as the existing infrastructure and would represent small, localized changes to geomorphic features within the Local Study Area. All project improvements under Action Alternative B would be less susceptible to earthquake activity occurring in the Regional Study Area since everything would be constructed in accordance with current seismic structural criteria.

4.3.2. Soils

4.3.2.1. No Action Alternative

The No Action Alternative would have permanent direct adverse impacts to soil resources because there would be soil disturbances or surficial changes within the Local Study Area. Potential improvements within the Local Study Area would be the same as those described in **Section 4.3.1.1, Geologic Resources, No Action Alternative.** These projects would result in a net loss of soils as buildings, parking, and track expansions are added within the Local Study Area. However, most of the expansion areas would occur upon existing impervious surfaces. The existing railroad bridge and infrastructure within the Local Study Area would continue to function and operate under existing conditions. Any railroad maintenance activities within the corridor would disturb railroad ballast stone, and would not affect natural soils.

4.3.2.2. Action Alternative A

Action Alternative A would have minor permanent direct adverse impacts to soil resources since the footprint of the railroad widening and bridge structures would be relatively small and localized and would not affect the function or integrity of the resource. Construction of a new two-track bridge upstream of the existing Long Bridge and the redevelopment of the existing corridor to expand the north-south railroad system from two to four tracks would require earthwork activities to expand the railroad embankments, to construct new bridge abutments, and to install supporting infrastructure. Approximately 4,200 square feet of soil resources would be replaced with structural elements associated with Action Alternative A.

The primary concern related to soils is the potential for soil loss from erosion during and following construction. Removal of existing vegetative cover like trees and grasses can destabilize soils, making them susceptible to erosion during rainfall events. The erodibility of existing soils in the Local Study Area is variable due to previous disturbance and potentially imported materials. However, further investigations during the design phase would identify appropriate temporary and permanent soil stabilization measures for specific locations that could include items such as silt fences, rock check dams, soil stabilization blankets, turbidity curtains, and temporary and permanent seeding. A SWPPP would be developed to provide guidance and strict adherence to erosion and sediment control measures developed for the project.

The project would require the excavation and removal of more than 29,000 cubic yards of soil for foundation construction. These soils would be removed and disposed of offsite in accordance with applicable laws and regulations. See **Section 5.0, Solid Waste and Hazardous Materials**, for further discussion on the offsite disposal of potential soil materials.

4.3.2.3. Action Alternative B

Action Alternative B would result in similar effects as described for Action Alternative A, minor permanent direct adverse long-term impacts to soil resources. The primary difference with Action Alternative B is the replacement of existing infrastructure within the corridor that would include replacing abutments, foundations, and new bridge structures between the GWMP and Ohio Drive SW. The additional infrastructure replacement would occur within the same general footprint as the existing

infrastructure, representing small, localized changes or disturbances to soils within the Local Study Area. Best management practices would be implemented as described in Action Alternative A to minimize soil loss during and after construction.

4.4. Temporary Effects

This section discusses the temporary effects as a result of construction activities that have the potential to affect the Local Study Area under the No Action Alternative, Action Alternative A, or Action Alternative B. During the construction phase of the Project, each Action Alternative is expected to have construction access and staging areas that could disturb the existing landside and waterside features adjacent to the permanent improvements.

4.4.1. Geologic Resources

4.4.1.1. No Action Alternative

The No Action Alternative would have no temporary effects to geologic resources. Potential improvements within the Local Study Area would be the same as those described in **Section 4.3.1.1, Geologic Resources, No Action Alternative.** These projects would be located outside geologic resources being evaluated such as the floodplain, river banks, thalwag, and shallow river flats. Under the No Action Alternative, the existing railroad bridge and infrastructure throughout the Long Bridge Corridor would continue to function and operate under existing conditions.

4.4.1.2. Action Alternative A

Action Alternative A would have minor temporary direct adverse effects to geologic resources. During the construction phases of Action Alternative A, various points of access would occur throughout the corridor including areas such as Long Bridge Park, East Potomac Park, and the Potomac River shoreline. Impacts associated with temporary construction access roads, storage, and staging would temporarily disturb approximately 5.7 acres of floodplain. Demolition of the existing two-track bridges over I-395, Ohio Drive, Washington Channel, Maine Avenue, and Maiden Avenue would occur, but once demolition and construction are completed the temporarily disturbed features would be returned to pre-construction conditions.

Temporary impacts to riverine features, such as the shallow riverbed adjacent to the channel, would occur through the installation of cofferdams around the 22 proposed bridge piers. Riverbed material would be removed from within the cofferdam to facilitate construction of the bridge foundations. The cofferdam structures, covering approximately 42,000 square feet of riverbed, would be removed once the foundation construction was complete and the riverbed adjacent to the new bridge supports would be returned to pre-construction conditions. The restored riverbed would be exposed to existing tidal currents and frequent flood events that constantly move river sediments, potentially returning these temporary impact areas to more natural conditions in a relatively quick timeframe.

4.4.1.3. Action Alternative B

Action Alternative B would result in similar effects as described for Action Alternative A, minor temporary direct adverse impacts to geologic resources, except that Action Alternative B would include additional temporary effects from the replacement of existing infrastructure within the corridor.

Additional work would include demolishing and replacing abutments, foundations, and bridge structures between the GWMP and Ohio Drive SW. The additional infrastructure replacement would occur within the same general footprint as the existing infrastructure, representing small, localized changes or disturbances to geologic resources (floodplain and riverbed features) within the Local Study Area.

4.4.2. Soils

4.4.2.1. No Action Alternative

The No Action Alternative would have adverse temporary effects to soil resources. Potential improvements within the Local Study Area would be similar to those described in **Section 4.3.1.1, Geologic Resources, No Action Alternative.** These projects would cause temporary soil disturbances due to construction access, staging and stockpiling, and construction work. However, portions of the expansion areas would occur in areas where there are no soil resources due to urban development. In this case, there would be no adverse temporary effects to soil resources. Under the No Action Alternative, the existing railroad bridge and infrastructure throughout the Long Bridge Corridor would continue to function and operate under existing conditions.

4.4.2.2. Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts to soil resources since the footprint of the railroad widening and bridge structures is relatively small and localized and would not affect the function or integrity of the resource. Construction of a new two-track bridge upstream of the existing Long Bridge and the redevelopment of the existing corridor to expand the north-south railroad system from two to four tracks would require temporary disturbances to existing vegetation, earthwork activities to expand the railroad embankments, construction of new bridge abutments, and installation of supporting infrastructure. Similar disturbances would occur during the demolition phase of the existing two-track bridges over I-395, Ohio Drive, Washington Channel, Maine Avenue, and Maiden Lane.

The primary concern related to soils is the potential for soil loss from erosion during and following demolition and construction. Removal of existing vegetative cover like trees and grasses can destabilize soils, making them susceptible to erosion during rainfall events. The erodibility of existing soils in the Local Study Area is variable due to previous disturbance and potentially imported materials. However, further investigations during the design phase would identify appropriate temporary stabilization measures for specific locations that could include items such as silt fences, rock check dams, soil stabilization blankets, turbidity curtains, and temporary seeding. A SWPPP would be developed to provide guidance and strict adherence to erosion and sediment control measures developed for the project.

The project would require the excavation and removal of more than 29,000 cubic yards of soil for foundation construction. These soils would be removed and disposed of offsite in accordance with applicable laws and regulations. See **Section 5.0, Solid Waste Disposal and Hazardous Materials**, for further discussion on the offsite disposal of potential soil materials. Temporary disturbances within the Potomac River and Washington Channel have the potential to increase localized levels of suspended

sediments in the water column and effect water quality. See **Section 3.0, Water Resources and Water Quality**, for further discussion of suspended sediments.

4.4.2.3. Action Alternative B

Action Alternative B would generate temporary effects similar in location and extent as those caused in Action Alternative A, resulting in minor temporary direct adverse impacts to soil resources. The primary difference with Action Alternative B is the replacement of existing infrastructure within the corridor that would include the demolition and replacement of abutments, foundations, and new bridge structures between the GWMP and Ohio Drive SW. To enable the replacement of this infrastructure, approximately 16,000 cubic yards of soil would need to be removed, in addition to the 29,000 cubic yards that would be excavated and removed for the construction of the new structures, totaling approximately 45,000 cubic yards. The additional work would occur within the same general footprint as the existing infrastructure, representing small, localized changes or disturbances to soils within the Local Study Area. Temporary stabilization measures would be implemented as described in Action Alternative A to minimize temporary soil loss during construction.

4.5. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the impacts to geologic resource and soil resources.

4.5.1. Geology

Minor adverse effects to geomorphic features like the floodplain and riverbed may occur due to construction of a new two-track bridge upstream of the existing Long Bridge. These geomorphic features cannot be avoided while achieving the goals and objectives of the Project. Adverse effects to the floodplain feature have been minimized through the use of retaining walls along the track expansion. The vertical retaining walls would reduce the footprint and preserve existing floodplain features to the greatest extent practicable. Impacts would be minor, localized, and not affect the function or integrity of the resource, no mitigation is proposed.

4.5.2. Soils

4.5.2.1. Action Alternative A

The Action Alternatives would have minor adverse effects on soil resources within the Local Study Area due to the expanded railroad embankments, bridge abutment construction, and supporting infrastructure. Erosion of soil resources would be minimized through the use of soil stabilization blankets, silt fences, rock check dams, and other best management practices designed to control soil loss during and following construction. The use of retaining walls would also minimize the project footprint and disturbance to soil resources. In addition, final construction documents would include an approved erosion and sediment control plan and an approved SWPPP from the Virginia Department of Environmental Quality and the District Department of Energy and Environment, further minimizing long-term erosion hazards. Impacts would be minor, localized, and not affect the function or integrity of the resource, no mitigation is proposed.

5.0 Solid Waste Disposal and Hazardous Materials

5.1. Overview

This section defines the solid waste and hazardous materials resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. For each Action Alternative and the No Action Alternative, this section summarizes the potential construction and permanent or long-term impacts on solid waste and hazardous materials. This section also provides proposed avoidance, minimization, and mitigation to limit potential impacts of the Project to solid waste and hazardous materials.

Solid waste includes both hazardous and non-hazardous wastes. The United States Environmental Protection Agency (EPA) defines solid waste as any "garbage or refuse, sludge for a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities."[1] Hazardous wastes are certain solid wastes that require additional regulation because they are dangerous or known to be harmful to human health or the environment. Solid waste also includes construction debris and excavated soils.

The term **hazardous materials** is a broader term collectively used to describe:

- Hazardous wastes, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA);[2]
- Hazardous substances, as defined in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) section 101(14) and listed at 40 Code of Federal Regulations (CFR) 302 to include listed hazardous wastes or unlisted solid wastes that exhibit specific characteristics such as ignitability, corrosivity, reactivity or toxicity characteristic;[3]
- Asbestos, referring to the naturally occurring fibrous minerals used in many commercial and industrial applications also defined under 40 CFR 302 as a hazardous substance;[4]
- Petroleum products (materials derived from crude oil such as fuel oil and gasoline);
- Any item or chemical which, when being transported or moved in commerce, is a risk to public safety of the environment and is regulated as such under its Pipeline and Hazardous Materials Safety Administration Regulations and the US Department of Transportation;[5] and

[1] EPA. Undated. *Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions*. Accessed from https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions#solidwaste. Accessed April 30, 2018.
[2] 42 USC 6309
[3] 40 CFR 302
[4] 40 CFR 302
[5] 49 CFR 100-199

- Any substance or chemical which is a "health hazard" or "physical hazard" as defined by the Occupational Safety and Health Administration.[6]

5.2. Regulatory Context and Methodology

This section describes the regulatory context for evaluation of impacts to solid waste and hazardous materials, as well as the methodology used to evaluate current conditions and the probable consequences of the alternatives. The *Methodology Report* provides a complete list of laws, regulations, and other guidance and a full description of the analysis methodology followed for these resources**.**

5.2.1. Regulatory Context

Many laws and regulations govern the use and disposal of waste. At a Federal level, non-hazardous industrial solid waste and municipal solid waste are managed under the Solid Waste Program (RCRA Subtitle D), which sets criteria for municipal solid waste landfills and other solid waste facilities and prohibits the open dumping of solid waste.[7] The Hazardous Materials Transportation Act of 1975 is applicable to the transportation of hazardous materials in commerce, including interstate and intrastate carriers.[8] Hazardous materials in railroad cars may only be shipped by persons registered by the United States Department of Transportation (USDOT) and the hazardous material must be properly classed, described, packaged, marked, labeled, and in condition for shipment.

Under RCRA, the District and Virginia has the authority to ensure safe and effective hazardous waste management and to establish a program to regulate the generation, storage, transportation, treatment, and disposal of hazardous waste on land.[9]

District and state policies, regulations, and guidance that may pertain to solid waste and hazardous materials include:

- Voluntary Remediation Program, Virginia Department of Environmental Quality (VDEQ), Land Protection and Revitalization
- VDEQ Waste Management Act Title 10.1 Chapter 14.
- District of Columbia (DC) Department of Environment and Energy (DOEE) Control of Asbestos, Title 20 DCMR 800;
- Asbestos Notification Form, DOEE, Air Quality Division;
- District of Columbia Hazardous Waste Regulations, 20 District of Columbia Municipal Regulations (DCMR) Chapters 40 through 54;
- Green Construction Code, Sections 406 and 503 of Title 12K of the District of Columbia Municipal Regulations (12K DCMR 406, 503);

[6] 29 CFR 1910.1200
[7] EPA. Undated. Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions. Accessed from https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions. Accessed May 18, 2018.
[8] 42 USC 6309
[9] District Law 2-64, District Code 8-1301 to 8-1322, and Virginia Code 10.1-1400 et seq.

- DOEE Control of Asbestos, Title 20 DCMR 800; and
- District of Columbia Illegal Dumping Enforcement Amendment Act of 1994, DC Law 10-117, DC Official Code 8-901 et seq.

Following excavation for work occurring within the Potomac River, soil that needs to be transported by vessel must be done in accordance with United States Coast Guard (USCG) regulations.

5.2.2. Methodology

The Local Study Area for solid waste and hazardous materials is the Project Area, which includes the construction limits of disturbance. The Regional Study Area consists of the public and government land within a 1-mile radius of the Project Area, as shown in **Figure 5-1**. This radius was selected as it is generally consistent with the recommended search distance for standard environmental record sources suggested by the American Society for Testing and Materials (ASTM) E1527-13, Standard Practice for Environmental Site Assessment Process. The Regional Study Area consists of mostly public and government land within the 379-acre corridor surrounding the proposed bridge improvements and railroad infrastructure.

The Regional Study Area is sufficient in size to:

- Capture the proposed Project elements detailed in the alternatives, which would include all aspects of construction;
- Evaluate adjacent land uses to the Project or alternative footprint and construction areas, and identify land uses that could be particularly sensitive to impacts from solid wastes, or which could generate hazardous materials that may affect soils or groundwater within the Project Area.

5.2.2.1. Solid Waste

The Environmental Consequences analysis evaluated solid waste impacts qualitatively and quantitatively for both direct and indirect impacts. The analysis considered the generation of new types of solid waste and the relative sensitivity of areas within the Local Study Area to solid waste arising from operations or maintenance of the alternatives. The analysis also evaluated how the Project would manage solid waste and the impacts from solid waste disposal sites.

5.2.2.2. Hazardous Materials

Environmental Consequences analysis for direct and indirect impacts considered:

- New sources of hazardous materials that would be introduced, such as potential contaminants associated with the operation of the Action Alternatives and hazardous materials stored or used at or along the Project Area;
- Existing resources identified near the Action Alternatives, which were evaluated for potential impacts during construction;

Figure 5-1 | Regional Study Area for Solid Waste and Hazardous Materials

- Hazardous materials requiring disposal in railroad cars, which would be shipped by persons registered by the USDOT;
- Historical documentation, including aerial photographs, topographic, and Sanborn fire insurance maps;
- Historical USGS topographic maps showing the Local Study Area for the years 1900, 1945, 1951, 1956, 1965, 1971, 1972, 1979, 1980, 1983, 2013, and 2014; and
- Potential sites located within the Regional Study Area that may be impacted by hazardous and contaminated materials.

5.3. Permanent or Long-Term Effects

This section discusses the permanent or long-term impacts following the construction of the No Action Alternative, Action Alternative A, or Action Alternative B on the generation and handling of solid waste including hazardous materials within the Local and Regional Study Area.

5.3.1. Solid Waste

5.3.1.1. No Action Alternative

The No Action Alternative would have no adverse permanent direct impacts on the environment and human health relative to existing solid waste generation or disposal. Based on the current and foreseeable use of the Local Study Area as an active railroad right-of-way, there is currently no solid waste generated or stored within the Local Study Area except for occasional wastes derived from track maintenance, which is properly disposed of in accordance with applicable local and federal regulations. There are currently no solid waste facilities or landfills within the Regional Study Area that would be impacted by the No Action Alternative, and it is not anticipated that a new solid waste facility would be constructed based on the current and foreseeable layout and space constraints of the Regional Study Area. The projects included in the No Action Alternative are not expected to increase solid waste generation, and therefore no adverse effect is anticipated.

5.3.1.2. Action Alternative A

Action Alternative A would have minor permanent indirect adverse impacts on the environment due to an increase in solid waste generation and disposal. Long-term direct impacts would be negligible and related to track maintenance; permanent indirect impacts would be minor and related to the ultimate off-site disposal location for soil generated during construction of the Project.

Although there will be a marginal increase in solid waste generated during routine maintenance, no new on-site sources of solid waste are expected to be introduced for Action Alternative A. The addition of two tracks within the existing corridor for four tracks total, with the construction of a new two-track bridge upstream of the existing Long Bridge, would result in approximately 32,100 feet of new or realigned track that would require occasional maintenance once the track is in service. However, solid waste derived from track maintenance would, similar to existing maintenance-related waste, be properly disposed of and not have an adverse effect. The construction of power substations, track

greasers, and other features potentially containing oil and/or hazardous materials is not anticipated and therefore would not have an adverse effect.

Up to 29,000 cubic yards of sediment generated during construction will ultimately require off-site disposal at a landfill or other type of facility depending on the chemical characteristics of the sediment. Sediment that is not contaminated above residential thresholds can typically be reused at an off-site location with no adverse human or environmental impacts. Contaminated sediments must be handled appropriately in accordance with local and state regulations. There is anticipated to be a minor adverse environmental effect associated with the off-site disposal of contaminated sediments, since these sediments would be moved to another location where they would result in the use of new land for their disposal. However, these soils are expected to be stored to prevent future impacts to human health and the environment via appropriate containment within a properly licensed/permitted disposal facility. Several potential receiving facilities have been identified within 40 miles of the Local Study Area. Therefore, the placement of construction soils at an off-site location is considered to result in a minor adverse impact.

5.3.1.3. Action Alternative B

The permanent impacts associated with Action Alternative B would be similar to the impacts under Action Alternative A. The difference between the alternatives is that Action Alternative B will generate slightly more soil due to the construction of a new two-track bridge upstream of the existing Long Bridge and the replacement of the existing Long Bridge, resulting in approximately 38,200 feet of new or realigned track. Action Alternative B would have approximately 45,000 cubic yards of sediment generated during construction, requiring the same off-site disposal measures as Action Alternative A.

5.3.2. Hazardous Materials

5.3.2.1. No Action Alternative

The No Action Alternative would have adverse permanent impacts on the environment and human health relative to hazardous materials. As noted in the *Affected Environment Report*, the Local Study Area has a long history of use as a railroad right-of-way. Railroad rights-of-way are often impacted with residual OHM due to creosote- or arsenic-laced railroad ties, herbicides, lubricating oils, diesel fuel, diesel exhaust, and fill material of unknown origin used to bring tracks to grade. There are also documented releases of hazardous materials at nearby properties as listed in the **Affected Environment Report**. These have likely resulted in direct impacts to environmental media (such as soil and groundwater). Under the No Action Alternative, some contaminated environmental media (soil and groundwater), if present in the Local Study Area, could be disturbed by the planned railroad projects.

No changes in vegetation management practices are anticipated. The use of herbicides would likely continue throughout the railroad right-of-way, in accordance with local and state regulations. Therefore, no new adverse effects are predicted in association with vegetation management.

While rare, potential releases of hazardous materials from freight trains can occur along the corridor either from train mechanical systems or cargoes. The quantity of hazardous wastes currently transported within the Project Area is unknown due to data collection limitation; therefore, it is

considered infeasible to project potential future hazardous waste shipments. There is also an even slighter potential for release of petroleum based constituents from passenger trains from mechanical systems. Since these events are rare, although there would be an increase in the number of freight and passenger trains, an increase in adverse effects cannot be approximated. Therefore, there are no new adverse effects of trains and their cargoes anticipated in relation to the No Action Alternative.

5.3.2.2. Action Alternative A

Action Alternative A would have minor permanent indirect adverse impacts on the environment and human health relative to hazardous materials. Long-term direct impacts would be negligible and related to vegetation management and releases of oil and hazardous materials (OHM), and indirect impacts would be related to the ultimate off-site disposal location for any contaminated soil generated during construction of the Project.

Following the construction of the new two-track bridge located upstream of the existing bridge and the additional two tracks within the existing right-of-way, vegetation along the new bridge as well as within the corridor must be managed as vegetation along railroad lines presents a fire hazard as well as an obstruction in visibility. Vegetation management practices often include the application of herbicides, which would have an intended impact on plants within the Local Study Area. Vegetation management practices would likely increase slightly once the new tracks are constructed as part of Action Alternative A; however, this increase is negligible as the same length of railroad right-of-way is being managed. These practices would be conducted in accordance with local and Federal regulations to not result in an adverse effect.

Potential releases of OHM could occur from freight trains and their cargoes traveling along the Action Alternative A corridor. However, since there are no additional freight train trips compared to the No Action Alternative, no new adverse effects of trains and their cargoes are anticipated as a result of Action Alternative A.

As noted in **Section 5.3.1.2, Action Alternative A**, the disposal of contaminated soils at an off-site location, such as a landfill, would have a minor adverse indirect environmental impact since these soils would be moved to another location to an appropriate processing facility where they would properly treated or disposed of. These soils are expected to be stored to prevent future impacts to human health and the environment via appropriate containment within a properly licensed/permitted disposal facility. Several potential receiving facilities have been identified within 40 miles of the Local Study Area.

5.3.2.3. Action Alternative B

The impacts under Action Alternative B would be the same as the impacts under Action Alternative A, except that soil generation from construction would be higher for Action Alternative B.

5.4. Temporary Effects

This section discusses the temporary effects as a results of construction activities that have the potential to impact the Local Study Area of the No Action Alternative, Action Alternative A, or Action Alternative B. During the construction phase of the Project, each Action Alternative is expected to generate hazardous materials and solid waste. The types of solid waste and hazardous materials to be generated during construction would likely be related to environmental media (such as soil and groundwater),

demolition debris (for example, hazardous building materials and hazardous materials-containing equipment), and construction materials (such as machinery and supplies).

5.4.1. Solid Waste

5.4.1.1. No Action Alternative

The No Action Alternative may have temporary adverse direct and indirect impacts on human health and the environment due to an increase in solid waste generation and disposal during construction activities. Direct impacts would be associated with the excavation and removal of solid waste, and indirect impacts would primarily consist of the off-site transportation of these materials.

5.4.1.2. Action Alternative A

Action Alternative A would have minor temporary direct and indirect adverse impacts on human health and the environment due an increase in solid waste generation and disposal. Direct impacts would be minor and associated with the excavation and removal of solid waste, and indirect impacts would be minor and primarily consist of the off-site transportation of these materials. The ultimate disposal of these material is discussed as a minor adverse permanent or long-term impact in **Section 5.3, Permanent or Long-Term Effects**.

During the construction phases of Action Alternative A, a moderate amount of construction debris is anticipated due to construction of the new bridge located upstream of the existing bridge. Construction debris would also be generated during construction and realignment of track within the railroad corridor. This debris may include materials such as steel, concrete, railroad ties, and ballast.

A total of approximately 22,000 cubic yards of sediment will be removed from the Potomac Upstream Crossing and an additional 1,000 cubic yards of sediment will be removed at the Washington Channel for pier and abutment work. The construction of the bridges over land will generate approximately 6,300 cubic yards of soil. These materials would be removed off-site and shipped to an appropriate receiving facility depending on chemical characteristics. Appropriate receiving facilities for contaminated soils may include landfills or recycling facilities. Several potential receiving facilities have been identified within 40 miles of the Local Study Area. There is a small risk of improper disposal or handling of impacted soils and sediments, which is considered a minor adverse impact.

Asbestos-containing materials may be encountered if demolition disturbs unidentified conduits beneath the tracks, depending on their age. In addition, lead-based paint, mercury, polychlorinated biphenyls (PCBs), and other special wastes may also be present in conduits and bridge structures. The abatement of these materials would be performed in accordance with appropriate regulations to ensure that there would be no adverse effect from these materials. Following proper abatement, hazardous materials shall be disposed of at a licensed disposal facility (likely the Fort Totten Waste Transfer Station then to other private licensed disposal facilities in the area). An appropriate disposal facility shall be selected based on the type and quantity of the hazardous materials produced.

Used wooden railroad ties are typically coated with chemical preservatives including creosote, which contains semi-volatile organic compounds (sVOCs) and would require special handling procedures.

Since the solid waste (that is, construction debris and soils) must be managed and disposed of in accordance with applicable regulations, their generation is not anticipated to result in a major adverse effect. Action Alternative A is projected to generate approximately 12,000 cubic yards of concrete and 3,000 tons of steel. There is a small risk of improper disposal (that is, misdirected solid waste) during their handling, which is considered a minor adverse impact.

5.4.1.3. Action Alternative B

The impacts under Action Alternative B would be similar to the impacts under Action Alternative A, except for a decrease in soil generated during construction phases of the Project. Action Alternative B will generate the same quantity of soil listed in Alternative A in addition to approximately 16,000 cubic yards of sediment required for the construction of new piers. The construction of the bridges over land will generate approximately 8,520 cubic yards of soil. While this is considered to have a higher impact when compared to Action Alternative A, it is still considered a minor adverse impact.

Action Alternative B will generate a higher volume of construction debris during the demolition of the existing bridge which includes approximately 40,000 cubic yards of concrete and 10,000 tons of steel. This includes a higher potential to encounter hazardous building materials such as lead-based paint, mercury, PCBs, and other special wastes may also be present in conduits and bridge structures compared to Alternative A. Although there is a higher risk compared to Alternative A, the risk of improper disposal (that is, misdirected solid waste) during handling is still considered a minor adverse impact.

5.4.2. Hazardous Materials

5.4.2.1. No Action Alternative

The No Action Alternative may have temporary adverse direct and indirect impacts on human health and the environment due to an increase in solid waste generation and disposal during construction activities. Contaminated environmental media (that is, soil, sediment and groundwater), if present, within the Local Study Area Within the Local Study Area, could be potentially disturbed by construction activities for railroad projects included in the No Action Alternative and require proper removal.

5.4.2.2. Action Alternative A

Action Alternative A would have minor temporary direct and indirect adverse impacts on the environment and human health relative to hazardous materials. Direct impacts would be related to the excavation and transportation of contaminated soils/sediments, and potential spills from construction-related equipment, and indirect impacts would primarily consist of the off-site transportation of these materials. The ultimate disposal of contaminated soils/sediments is discussed as a minor adverse permanent or long-term impact in **Section 5.3, Permanent or Long-Term Effects**.

With the construction of the new two-track bridge and construction and realignment of track within the railroad right-of-way, potential hazardous and non-hazardous soils and sediments would likely be excavated and require proper removal. All soil, sediments, and hazardous waste removed from the Project Area would be hauled by DOEE or VDEQ Division of Land Protection and Revitalization-approved private haulers in accordance with Federal and state regulations and guidance, and the DOEE's Remediation and Site Response Program. Soil, sediments, and hazardous waste would be disposed of at

one or more appropriate licensed disposal facilities in Virginia.[10,11] Several potential receiving facilities have been identified within 40 miles of the Local Study Area. Railroad rights-of-way are often impacted with residual OHM, including metals, pesticides, and petroleum constituents such as polycyclic aromatic hydrocarbons (PAHs). Railroad-related sources of OHM may include creosote- or arsenic-laced railroad ties, herbicides, lubricating oils, diesel fuel, and diesel exhaust. Fill of unknown origin is often used to bring tracks to grade which may contain debris, coal, coal ash, coal slag, or other potential contaminants. Urban runoff within the Regional Study Area is likely to have historically impacted sediments located at the bottom of the Potomac River with contaminants such as heavy metals, petroleum hydrocarbons such as PAHs and PCBs. No documented releases of OHM are anticipated to be encountered during construction of Action Alternative A.

Due to the industrial nature of the Regional Study Area, it is anticipated that some soils and sediments generated during the Project will be impacted with OHM. Although the quantity of impacted soils and sediments cannot be determined at this phase of the Project, all impacted soils and sediments would require proper disposal during the construction phases of the Project, which may require resources such as vehicles and barges for off-site transportation. Impacted sediments would be disposed of in accordance with the applicable USCG regulations. During construction phases of the Project, the movement of soil and sediment shall be managed under a Soil Management Plan which shall dictate best management strategies to minimize the potential from cross-contamination and exposures to workers. The movement of contaminated materials within the Local Study Area could have a minor adverse impact on the Regional Study Area during the transportation, disposal, and management of contaminated media due to the potential for improper handling, and misdirection of wastes.

Construction-related equipment contains mechanical fluids that have the potential to result in spills or leaks when not maintained in good working order. Contractors working within the Local Study Area may also employ the use of supplies containing hazardous materials to conduct their work. Although the spill or release of OHM in the process of construction is an unlikely event, spill prevention plans would be required to prevent and control any such spills. Therefore, construction-related equipment is anticipated to result in a negligible adverse effect.

A temporary concrete plant would be required during the construction phase of the Project. The process of creating concrete involves the use of aggregate, sand, and water, which would need to be transported to and stored within the Local Study Area. The raw materials associated with concrete generation may originate from a variety of sources and have the potential to contain OHM. Therefore, materials containing OHM would need to be stored properly either on impermeable surfaces covered as needed to prevent erosion, or within containers to prevent the materials from impacting the surrounding environment. The generation of concrete also involves the use chemical additives, lubricants, and fuel, the use of which has the potential to impact environmental media within the Local Study Area. These materials would be stored in vessels such as tanks and drums with secondary containment in order to prevent an accidental spill. The contractor operating the plant would also need to implement a Spill Prevention Plan to respond to a release of fuel or chemicals, if an incident were to occur. Finally, the

[10] VDEQ. 2018. *Virginia Facilities Accepting Creosote Treated Poles, Pilings, and Railroad Ties.* Accessed from https://www.deq.virginia.gov/Portals/0/DEQ/Land/Facilities_Accepting_Creosote_Poles.pdf. Accessed October 25, 2018.
[11] VDEQ. 2018. Virginia Facilities Accepting Friable and Non-Friable Asbestos-Containing Waste Material. Accessed from https://www.deq.virginia.gov/Portals/0/DEQ/Land/Asbestos_Disposal_Options_and_Requirements.pdf. Accessed October 25, 2018.

process of creating concrete may generate dust, which would need to be monitored and suppressed to prevent off-site migration of particulate matter. Based on the processes noted above, the operation of the concrete plant would likely have a minor temporary adverse impact on the Local Study Area and indirect impacts based on the potential for dust generation, spills of OHM (that would be cleaned up if they occur), and transportation impacts (truck emissions and fuel usage).

5.4.2.3. Action Alternative B

The impacts under Action Alternative B would be the same as the impacts under Action Alternative A.

5.5. Avoidance, Minimization, and Mitigation

This section discusses how solid waste and hazardous material impacts within the Local Study Area would be avoided, minimized, or mitigated. As noted in the above sections, the primary impacts associated with the Action Alternatives stem from hazardous building debris abatement, and contaminated soil/sediment generation.

5.5.1. Solid Waste

The construction of a new bridge and construction and realignment of track within the railroad right-of-way would result in the generation of construction debris. Solid waste generated during clearing and grubbing, demolition, and other construction operations would be removed and disposed of according to local and federal regulations.

Potentially hazardous building materials (such as asbestos, lead-based paint, PCBs, etc.) would be inventoried prior to any structural demolition or renovation work. If these hazardous materials are found to be present in the structures, then they must be properly abated by a qualified contractor. The qualified abatement contractor(s) must be licensed to conduct lead and asbestos abatement if this work is required. The contractor(s) shall obtain all necessary permits and approvals prior to initiating the work. The work must be conducted in accordance with Federal, state, and local regulatory guidelines and procedures. The qualified abatement contractor(s) shall use proper personal protective equipment based on the contaminants of concern and known or suspected hazards. The appropriate RCRA permits must be obtained, as needed, and the waste must be shipped to a receiving facility licensed to handle the specific type of solid and hazardous waste under the appropriate shipping documents such as manifests. Records would be maintained for a prescribed period of time and in a manner consistent with Federal, state, and local regulations.

5.5.2. Hazardous Materials

The construction of a new bridge and construction and realignment of track within the railroad right-of-way would likely result in the generation of hazardous materials (such as contaminated soil and sediment) during the construction phases of the Project. A Soil Management Plan (SMP) would be developed in accordance with Federal Railroad Administration specifications based upon the results of subsurface investigations. Soil analytical results from these subsurface investigations would be used to pre-characterize soils that are designated for excavation during construction phases of the Project. The SMP typically outlines standards and procedures for the identification and disposal of contaminated materials that may be encountered on the Project site during construction. Soil tracking protocols would be detailed in the SMP to include tracking soils from the point of excavation to designated testing areas

and to the ultimate disposal site. Fugitive dust would be controlled through wetting, sweeping, and other suppression techniques. Furthermore, a Health and Safety Plan would be developed which would provide the minimum health and safety specifications that contractors must meet during construction including requirements for environmental monitoring, personnel protective equipment, site control and security, and training. The implementation of an SMP is applicable to both Action Alternatives.

Spills and leaks associated with vehicles, train collisions, and heavy machinery can be appropriately mitigated through the implementation of spill response programs that specify procedures for emergency response in the event a spill or leak occurs. Depending on the nature of the spill or discharge to the environment, it may also be necessary to contact regulatory agencies such as the National Response Center, the EPA Region 3 Office, the USCG Marine Safety Office, Virginia Department of Emergency Service, and the DOEE. NPS must also be notified of a spill or discharge within or adjacent to NPS lands. The agency to be contacted would depend on the nature and amount of the spilled material and the location of the spill.

6.0 Transportation and Navigation

This section defines the transportation and navigation resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. For each Action Alternative and the No Action Alternative, this section describes the potential short-term and long-term impacts on transportation and navigation. Proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project are also provided.

The **transportation system** assessed includes all transportation modes, including passenger railroads (Amtrak, Virginia Railway Express [VRE], Maryland Area Regional Commuter [MARC]); freight railroads (CSX Transportation [CSXT], and Norfolk Southern [NS]); the transit system (Metrorail and local bus operations); the pedestrian and bicycle network; parking; the surrounding roadway network; aviation; and marine transportation.

6.1. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluation of impacts to transportation and navigation, and summarizes the methodology used to evaluate current conditions and the probable consequences of the alternatives. This section also includes a description of the Study Area. The complete list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report***.**

6.1.1. Regulatory Context

When evaluated as an affected resource under the National Environmental Policy Act of 1969 (NEPA), transportation involves a variety of regulatory agencies, depending on the mode of transportation affected and its location in the Study Area. The Federal Railroad Administration (FRA) regulates railroad operations, including intercity railroad and commuter rail service. Roadway operations, including parking and bus service, fall under the regulatory jurisdiction of the District Department of Transportation (DDOT), the Virginia Department of Transportation (VDOT), and, for certain roadways and parking, the National Park Service (NPS). Bicycle and pedestrian infrastructure in the Study Area is regulated by DDOT, Arlington County, and NPS. Finally, marine operations are regulated by the United States Coast Guard (USCG) and navigation channels are maintained by the United States Army Corps of Engineers (USACE). Aviation falls under the jurisdiction of the Federal Aviation Administration (FAA). All of these agencies play a variety of roles in the modes of transportation in the Study Area.

Various statutes, regulations, and guidance documents are applicable to the different modes of transportation that would be affected by the Project. Railroad safety is overseen by FRA for intercity railroads.[1] FTA has a role in safety for public transit service other than for commuter rail service, which falls under the jurisdiction of FRA.[2] Roadway traffic operations during construction are guided in Virginia through VDOT's *Work Zone Safety: Guidelines for Temporary Traffic Control* and its *Traffic Operations*

[1] 49 CFR Chapter II
[2] 49 CFR 673

and Safety Analysis Manual,[3,4] while DDOT guides traffic operations in the District during construction through the *DC Temporary Traffic Control Manual: Guidelines and Standards* and its *Work Zone Safety and Mobility Policy*.[5,6] Both VDOT and DDOT are also required to comply with the Federal Highway Administration's *Work Zone Safety and Mobility Rule*.[7] NPS has regulations applicable to both roadway traffic operations and bicycle and pedestrian facilities located within National Park boundaries, and provides guidance in its *Management Policies* on transportation systems and alternative transportation.[8] In accordance with Section 9 of the Rivers and Harbors Act of 1899, the USCG has jurisdictional authority over construction of structures over or in navigable waters.[9] A permit is required from the USACE for any work in Federal navigable waters pursuant to Section 10 of the Rivers and Harbors Act of 1899.[10] In addition, Section 14 of the Rivers and Harbors Act of 1899 requires approval from USACE for the alteration or permanent occupation or use of any sea wall, finger pier, jetty, dike, levee, wharf, pier, or other work built by the United States.[11]

6.1.2. Methodology

As shown in **Figure 6-1**, the Local Study Area for transportation and navigation encompasses the Project Area and 0.25 miles immediately adjacent to the Project Area footprint. It includes the tracks, signals, bridges, and related railroad infrastructure that may be affected by the Action Alternatives. It also includes roads, intersections, trails, sidewalks, and waterways that could be impacted by the construction activities for the Action Alternatives. For the purposes of evaluating boat traffic, marinas outside the Local Study Area are also identified.

The Regional Study Area includes the jurisdictions covered within the Metropolitan Washington Council of Governments *Financially Constrained Long-Range Transportation Plan*. This includes the District; the Cities of Manassas, Manassas Park, Fairfax, Falls Church, and Alexandria, and Prince William, Loudoun, Fairfax, and Arlington Counties in Virginia; and Charles, Prince George's, Montgomery, and Frederick Counties in Maryland.

[3] VDOT. *Work Zone Safety: Guidelines for Temporary Traffic Control*. June 2007. Accessed from http://www.virginiadot.org/VDOT/Business/Const/asset_upload_file51_30870.pdf. Accessed August 8, 2016.
[4] VDOT. *Traffic Operations and Safety Analysis Manual, Version 1.0*. November 2015. Accessed from http://www.virginiadot.org/business/resources/TOSAM.pdf. Accessed August 8, 2016.
[5] DDOT. *DC Temporary Traffic Control Manual: Guidelines and Standards*. 2006. Accessed from https://ddot.dc.gov/page/temporary-traffic-control-manual. Accessed August 8, 2018.
[6] DDOT. *Work Zone Safety and Mobility Policy*. 2007. Accessed from https://ddot.dc.gov/page/work-zone-safety-and-mobility-policy. Accessed August 8, 2018.
[7] 23 CFR 630(J)
[8] 36 CFR 4 - 5
[9] 33 USC 401
[10] 33 USC 403
[11] 33 USC 408

Figure 6-1 | Local Study Area for Transportation and Navigation

6.1.2.1. Transportation

The transportation analysis addresses the various modes of travel within the study including the surrounding road network, sidewalks, bike system, transit system, and railroad infrastructure.

The Environmental Consequences analysis qualitatively and quantitatively evaluated both direct and indirect impacts on transportation, including the potential impact of the Action Alternatives on future railroad operations in the planning year (2040) based on the operators' Long-Range Service Plans. The analysis also evaluated the impacts of the alternatives to the roadway network, marine travel, sidewalks, bicycle system, and transit system.

The analysis of permanent or long-term impacts qualitatively evaluated impacts to the roadway, sidewalk, and bicycle networks as the alternatives did not have substantial impacts to specific intersections or roadway and trail networks that would necessitate a higher level of assessment. However, construction staging and access impact area roadways, and were therefore evaluated using Synchro and Highway Capacity Software (HCS) analyses as appropriate.[12] Potential benefits to the transportation network in terms of enhanced multimodal connectivity, safety, and impacts to the railroad network were also analyzed.

6.1.2.2. Navigation

The Affected Environment documented current navigational conditions within the Local Study Area using the USACE survey and mapping that define the Federal channel limits, existing depths, and design depths. National Oceanic and Atmospheric Administration Nautical Chart US12289 provided additional information on nearby navigational obstructions including current bridge clearances, both horizontal and vertical. Other details documented included river currents, flood levels, and normal tide fluctuations. Discussions with local waterway law enforcement officials, including the USCG and District of Columbia Harbor Patrol officials that patrol these waters, provided information related to the type of vessels that navigate this portion of the river and the frequency of use.

6.2. Permanent or Long-Term Effects

This section identifies the potential impacts to the transportation network that are frequent, extend from the end of construction through the life of the Project, or cause a permanent change in the transportation network that would last beyond the life of the Project even if the actions that caused the impacts were to cease. This section describes potential impacts of the alternatives on future railroad operations and potential impacts from alternatives to the roadway network, marine travel, sidewalks, bicycle system, parking, and transit system.

6.2.1. Railroad Infrastructure and Operations

This section discusses the effects of the Project on railroad infrastructure and operations, including both Amtrak passenger rail service and freight rail service. Amtrak, CSXT, and NS all plan to increase rail

[12] Synchro is a traffic analysis, optimization, and simulation software produced by Trafficware. Synchro is used to perform macroscopic analyses and optimization of both signalized and unsignalized intersections. HCS is a traffic engineering and transportation planning software produced by the University of Florida Transportation Institute. HCS is used to perform deterministic analysis of highway and arterial roadways.

service between Virginia and Washington, DC, as shown in **Table 6-1**. **Section 6.2.2, Transit**, evaluates VRE and MARC service along with other transit infrastructure and service

6.2.1.1. No Action Alternative

The No Action Alternative would result in moderate beneficial effects on train service frequency but would result in major adverse effects on railroad service capacity. As described in **Section 1.4.1, No Action Alternative**, the No Action Alternative includes several railroad projects on the approaches to the Long Bridge Corridor, including the addition of a fourth track from AF to RO Interlockings in Virginia[13], the addition of a fourth track from L'Enfant (LE) to Virginia (VA) Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project.

The No Action Alternative would have a beneficial effect on operational flexibility and railroad service capacity, as these projects would relieve some of the congestion outside the Long Bridge Corridor. In the No Action Alternative, the Long Bridge Corridor would continue to provide only two tracks. Therefore, the No Action Alternative would not provide sufficient capacity for operators to run their desired number of trains. **Table 6-1** shows the anticipated number of trains per day under the No Action Alternative. These volumes are based on the assumption that, without additional capacity in the corridor, CSXT would not renegotiate its existing operation agreements with the railroad operators, but that each operator would fully utilize the slots allocated. This assumption is based on CSXT's need to maintain adequate capacity to allow for the operation of its present and future freight network demands.

The No Action Alternative would result in beneficial direct effects on train service frequency with an anticipated increase of 32 intercity passenger and freight trains per day, including an additional two Amtrak trains and an additional 30 freight trains (**Table 6-1**). However, substantial delays are expected to occur to train operations under the No Action Alternative due to the increase in the number of trains with no associated increase in the number of tracks. Because of the continued limited two tracks across the river, passenger train operators would not be able to run their planned level of service between the District and Richmond, Virginia.

6.2.1.2. Action Alternative A

Action Alternative A would result in major permanent direct beneficial impacts on the volume of trains that the Long Bridge can accommodate compared to the No Action Alternative, allowing major permanent direct beneficial impacts on train service frequency. Action Alternative A would also have major direct beneficial effects on railroad operational flexibility for both passenger and freight operators, due to installation of additional tracks enabling separation of passenger and freight trains and changes in the track configuration under Maryland Avenue SW. While the tracks would be interoperable for passenger and freight trains, the two western tracks would typically carry passenger trains and the two eastern tracks would typically carry freight trains. The added tracks would also reduce the delays under normal operating conditions and would allow continued operation of two-track service during periods of maintenance and breakdowns, minimizing delays.

[13] VRE. 2014. *Virginia Railway Express System Plan 2040*. Accessed from https://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf. Accessed September 18, 2018.

As described in **Section 1.4.2, Action Alternatives**, Action Alternative A would retain the existing two-track bridge and construct a new two-track bridge upstream of the existing Long Bridge, along with necessary infrastructure to create a four-track corridor between RO and LE Interlockings. This additional capacity would enable operators to run additional trains based on their long-range plans, as shown in **Table 6-1**. It is anticipated that Amtrak (as well as VRE and MARC—discussed below under transit) would provide additional service between Virginia and the District.

The design of the railroad infrastructure under Maryland Avenue SW would provide for 14-foot track centers and 7.5-foot minimum lateral clearances. While this is less than the 15-foot track centers and 9-foot lateral clearances preferred by CSXT, it provides more clearance than the existing 13-foot track centers with 8.5-foot minimum lateral clearances. Action Alternative A would also enable separation of passenger and freight trains, while maintaining interoperability when needed. This would result in moderate beneficial effects on operational flexibility, resiliency, and redundancy.

6.2.1.3. Action Alternative B

The impact to railroad operations resulting from Action Alternative B would be the same as for Action Alternative A, as shown in **Table 6-1**. As described in **Section 1.4.2, Action Alternatives**, Action Alternative B would replace the existing two-track bridge with a new two-track bridge in the same location and would construct a new two-track bridge upstream of the existing Long Bridge, along with necessary infrastructure to create a four-track corridor between RO and LE Interlockings. However, Action Alternative B would delay the benefit of increased operational flexibility and railroad service capacity by approximately 3 years because of the longer construction time required for the demolition and replacement of the existing two-track bridge.

Table 6-1 | Train Volumes in the Long Bridge Corridor

Train Operator	Current Number of Trains per Day[1]	No Action Alternative Number of Trains per Day[2]	Action Alternatives Number of Trains per Day[3]
Amtrak	24	26	44
CSXT	18	42	42
NS	0	6	6
TOTAL	**42**	**74**	**92**

[1] Current train volumes are based on existing operation agreements and confirmed by bridge stakeholders.
[2] Forecast year 2040 No Action train volumes were established based on the concurrent Washington, DC to Richmond Southeast High Speed Rail (DC2RVA) EIS, Rail Service Growth in the No Build Alternative, Table 2.5-2, http://www.dc2rvarail.com/files/5315/0412/9086/Chapter_02_Alternatives_DC2RVA_DEIS.pdf, and confirmed by bridge stakeholders.
[3] Forecast year 2040 planned train volumes were established based on input from bridge stakeholders, including CSXT, VRE, Amtrak, NS, and MARC, as well as the concurrent DC2RVA EIS.
[4] The current number of VRE trains per day includes non-revenue movements.

6.2.2. Transit

This section discusses the permanent or long-term effects of the Project on transit operations under the No Action Alternative and Action Alternatives A and B.

6.2.2.1. VRE Commuter Rail

VRE provides commuter rail service throughout Northern Virginia and across Long Bridge, connecting to the District.

No Action Alternative

In the No Action Alternative, there would continue to be two tracks available for VRE service across the Potomac River. The No Action Alternative includes the expansion to four tracks on both sides of the Potomac River and station improvements at VRE's Crystal City and L'Enfant Plaza stations. It is assumed that VRE would fully utilize its existing track rights in the Long Bridge Corridor, increasing its number of trains per day from 34 to 38. However, due to the increase in the number of trains with no associated increase in the number of tracks, substantial delays are expected to occur to train operations under the No Action Alternative. Because of the continued limited two tracks across the river, VRE would not be able to run its desired number of trains with the existing capacity in the Long Bridge Corridor. The No Action Alternative would result in direct beneficial effects on VRE service frequency. However, this increase would be well below VRE's planned service levels in 2040.

Action Alternative A

Action Alternative A would result in major permanent direct beneficial impacts on the volume of trains that the Long Bridge can accommodate, contributing to major permanent direct beneficial impacts on VRE service frequency by helping enable VRE to run the full 92 trains per day envisioned by its *System Plan 2040* (**Table 6-2**), an increase of 54 trains per day over the No Action Alternative.[14] Action Alternative A would also have moderate permanent direct beneficial effects on railroad operational flexibility, due to the installation of additional tracks enabling separation of passenger and freight trains and changes in the track configuration under Maryland Avenue SW.

Action Alternative B

The effects to VRE service resulting from Action Alternative B would be the same as for Action Alternative A, as shown in **Table 6-2.** However, Action Alternative B would delay the benefit of increased operational flexibility and the volume of trains that the Long Bridge can accommodate by approximately 3 years because of the longer construction time required for the demolition and replacement of the existing two-track bridge.

6.2.2.2. MARC Commuter Rail

MARC currently operates service from West Virginia and Maryland into Union Station in the District. By 2040, MARC plans to extend service from Union Station into Northern Virginia.

[14] VRE. 2014. *Virginia Railway Express System Plan 2040*. Accessed from https://www.vre.org/vre/assets/File/2040%20Sys%20Plan%20VRE%20finaltech%20memo%20combined.pdf. Accessed September 18, 2018.

No Action Alternative

The No Action Alternative would result in a direct adverse effect on planned MARC operations. Without additional capacity through the Long Bridge Corridor, CSXT would not negotiate operations agreements with new operators and MARC would not be able to run planned future service to Northern Virginia.

Table 6-2 | Commuter Rail Transit Volumes in the Long Bridge Corridor

Train Operator	Current Number of Trains per Day[1]	No Action Alternative Number of Trains per Day[2]	Action Alternatives Number of Trains per Day[3]
VRE	34[4]	38	92
MARC	0	0	8
TOTAL	**34**	**38**	**100**

[1] Current train volumes are based on existing operation agreements and confirmed by bridge stakeholders.
[2] Forecast year 2040 No Action train volumes were established based on the concurrent DC2RVA EIS, Rail Service Growth in the No Build Alternative, Table 2.5-2, http://www.dc2rvarail.com/files/5315/0412/9086/Chapter_02_Alternatives_DC2RVA_DEIS.pdf, and confirmed by bridge stakeholders.
[3] Forecast year 2040 planned train volumes were established based on input from bridge stakeholders, including CSXT, VRE, Amtrak, NS, and MARC, as well as the concurrent DC2RVA EIS.
[4] The current number of VRE trains per day includes non-revenue movements.

Action Alternative A

Action Alternative A would result in major permanent direct beneficial effects on the volume of trains that the Long Bridge can accommodate, contributing to major permanent direct beneficial impacts on MARC service frequency by helping enable MARC to run through service in Northern Virginia. [15] With the additional capacity provided by Action Alternative A combined with other capacity-enhancing projects, MARC would be able to operate through-running service to Virginia. Action Alternative A would also have moderate permanent direct beneficial impacts on railroad operational flexibility, due to the installation of additional tracks enabling separation of passenger and freight trains and changes in the track configuration under Maryland Avenue SW.

Action Alternative B

The effects to MARC service resulting from Action Alternative B would be the same as for Action Alternative A, as shown in **Table 6-2**.

6.2.2.3. Washington Metropolitan Area Transit Authority Metrorail Passenger Service

The Washington Metropolitan Area Transit Authority (WMATA) Metrorail Yellow, Blue, Orange, Silver, and Green Lines operate within the Local Study Area. The lines operate underground within the Local

[15] Implementation of run through service would require an agreement between CSXT (the owner of the railroad corridor) and MARC, as well as between MARC and the owner of the new railroad bridge (to be determined).

Study Area, with the exception of the Metrorail Yellow Line as it crosses the Potomac River on the Charles R. Fenwick Bridge (Metrorail bridge) immediately upstream of Long Bridge.

No Action Alternative

The Metrorail system within the Local Study Area operates on completely separated infrastructure, which would not be affected by any of the projects in the No Action Alternative. Therefore, no long-term effects to Metrorail are anticipated as part of the No Action Alternative.

Action Alternative A

Action Alternative A would construct a new two-track railroad bridge downstream of the Metrorail bridge, and would also require construction of a bridge over the Metrorail Yellow Line portal where the line transitions from underground to above ground. The bridge would be constructed with sufficient clearance based on WMATA joint development standards, and therefore there would be no long-term effects to Metrorail as part of Action Alternative A.

Action Alternative B

The long-term effects on Metrorail under Action Alternative B would be identical to those under Action Alternative A.

6.2.2.4. Local and Commuter Bus

WMATA operates the following bus routes within the Local Study Area: 11Y, 5A, 16E, 16X, and D51. Additionally, Potomac and Rappahannock Transportation Commission (PRTC) and Loudoun County Transit (LCT) offer commuter bus service between Northern Virginia and the District.

No Action Alternative

The No Action Alternative would not affect streets or facilities used by existing local and commuter bus service. Therefore, no permanent or long-term impacts to local and commuter bus services are anticipated under the No Action Alternative.

Action Alternative A

Action Alternative A would not affect streets or facilities used by existing local and commuter bus service beyond the effects of the No Action Alternative. Therefore, no additional permanent or long-term impacts to local and commuter bus services are anticipated under Action Alternative A.

Action Alternative B

The permanent effects on local and commuter bus service under Action Alternative B would be identical to those under Action Alternative A.

6.2.3. Pedestrian and Bicycle Network

This section discusses the permanent or long-term effects of the Project on the pedestrian and bicycle network under the No Action Alternative and Action Alternatives A and B. In addition to the effects described below, the project sponsor for final design and construction, the Virginia Department of Rail

and Public Transportation (DRPT), would construct a bike-pedestrian crossing upstream of the new upstream railroad bridge in either Action Alternative. See **DEIS Chapter 22, Bike-Pedestrian Crossing**, for consideration of the effects of the new crossing on the pedestrian and bicycle network.

6.2.3.1. No Action Alternative

The No Action Alternative would have no adverse permanent impacts on the pedestrian and bicycle network. The decision to not construct the Project would not change the pedestrian and bicycle network. The No Action Alternative does include beneficial permanent impacts to the pedestrian and bicycle network because of the Boundary Channel Drive Interchange Project, which includes enhanced pedestrian and bicycle connections from the MVT to Long Bridge Drive and Long Bridge Park. Therefore, the No Action Alternative would have a moderate positive impact on the pedestrian and bicycle network within the Local Study Area.

6.2.3.2. Action Alternative A

Action Alternative A would result in minor permanent direct beneficial impacts on the pedestrian network, as the replaced pedestrian bridge between Maryland Avenue SW and Washington Marina would be Americans with Disabilities Act of 1990 accessible, and the relocated retaining wall along the 14th Street ramp at Maine Avenue SW will improve sight distance for pedestrians.

6.2.3.3. Action Alternative B

Action Alternative B would have minor permanent direct beneficial impacts on the pedestrian and bicycle network, as the permanent effects on the pedestrian and bicycle network under Action Alternative B would be similar to those under Action Alternative A.

6.2.4. Roadway Network

This section discusses the permanent or long-term effects of the Project on the roadway network under the No Action Alternative and Action Alternatives A and B.

6.2.4.1. No Action Alternative

The No Action Alternative would have no adverse permanent impacts on the roadway network. The decision to not construct the Project would not change the roadway network. The No Action Alternative does include beneficial permanent impacts on the roadway network because of the Boundary Channel Drive Interchange Project, which will convert the existing full cloverleaf interchange design to a partial cloverleaf configuration and improve traffic operations along Boundary Channel Drive.

6.2.4.2. Action Alternative A

Action Alternative A would not require permanent modification of and streets, roads, or highways. Construction of new railroad bridges over roads and highways would not impair vehicular or other roadway uses. Therefore, no long-term effects are anticipated to the roadway network under Action Alternative A.

6.2.4.3. Action Alternative B

The permanent effects on the roadway network under Action Alternative B would be identical to those under Action Alternative A.

6.2.5. Parking

This section discusses the permanent or long-term effects of the Project to parking under the No Action Alternative and Action Alternatives A and B.

6.2.5.1. No Action Alternative

The No Action Alternative would have no adverse permanent impacts on parking. None of the projects included in the No Action Alternative would affect parking, and the decision to not construct the Project would not change parking options within the Local Study Area. Additional off-street parking may be planned as part of new developments within the Local Study Area, and to the extent that this parking may be publicly accessible, a minor beneficial impact to parking may result.

6.2.5.2. Action Alternative A

Action Alternative A would result in moderate permanent direct adverse impacts to parking in two limited areas: NPS Parking Lot C and the Washington Marina parking lot. First, approximately 50 of the existing 67 metered public surface parking spaces at NPS Parking Lot C at East Potomac Park would be permanently removed to accommodate the addition of the two-track railroad structure directly west of the existing two-tracks. NPS Parking Lot C is one of three surface parking areas in close proximity, located between the bridges crossing East Potomac Parks. In total, there are 247 spaces in the three surface parking areas. Approximately one-third of the private parking spaces for marina customer use (of approximately 88 spaces) at the Washington Marina directly adjacent to the existing tracks and Maine Avenue SW would need to be removed to relocate the existing pedestrian bridge. The exact number of parking spots removed would be determined as design advances, as the surface parking areas would be reconfigured to minimize long-term loss of parking spaces.

6.2.5.3. Action Alternative B

Action Alternative B would result in moderate permanent direct adverse impacts to parking in two limited areas: NPS Parking Lot C and the Washington Marina parking lot; these effects would be identical to those under Action Alternative A.

6.2.6. Aviation

This section discusses the permanent or long-term effects of the Project to aviation under the No Action Alternative and Action Alternatives A and B. The Long Bridge Corridor is located within a mile north of Ronald Reagan Washington National Airport and is within a common flight path for plane landings. The FAA has set the upper limit of the vertical clearance limits for all structures in the location of the bridge at 81 feet above mean sea level.[16]

[16] This height limit was provided by the Metropolitan Washington Airports Authority in their Scoping comments in an email dated October 6, 2016. See the *Scoping Summary Report* (January 2017), Appendix D.

6.2.6.1. No Action Alternative

The No Action Alternative would have no adverse permanent impacts on aviation. Under the No Action Alternative, the Project would not be constructed and therefore no changes to bridge height which may affect aviation in the Local Study Area would occur.

6.2.6.2. Action Alternative A

The top of structure of the new bridge under Action Alternative A would be within the limit set by the FAA. Therefore, no permanent or long-term effects on aviation are anticipated under Action Alternative A.

6.2.6.3. Action Alternative B

Under Action Alternative B, impacts to aviation would be the same as under Action Alternative A.

6.2.7. Navigation

This section discusses the permanent or long-term effects of the Project to navigation under the No Action Alternative and Action Alternatives A and B. The main span of the Long Bridge allows for 18 feet of navigational vertical clearance with a horizontal clearance of 100 feet based on NOAA Nautical Chart US12285. The majority of vessels traveling under Long Bridge are smaller commercial and recreational vessels, such as sightseeing cruise vessels and water taxis.

6.2.7.1. No Action Alternative

The No Action Alternative would have no adverse permanent impacts on navigation. None of the projects in the No Action Alternative would affect the bridges crossing the Potomac River, and the decision to not construct the Project would not change the bridges crossing the river.

6.2.7.2. Action Alternative A

Action Alternative A would have no permanent adverse impacts on navigable waters. Under Action Alternative A the new bridge structure would provide additional vertical clearance beyond the 18 feet provided by the existing Long Bridge. Existing horizontal clearances would be maintained.

6.2.7.3. Action Alternative B

Alternative B would have no permanent adverse impacts on navigable waters, as both the new bridge and the replacement for the existing Long Bridge would provide additional vertical clearance beyond the 18 feet provided by the existing Long Bridge. Existing horizontal clearances would be maintained.

6.3. Temporary Effects

This section identifies the potential impacts to transportation and navigation that are intermittent, infrequent, or last only for the duration of the construction period. This section addresses the change in operational conditions from construction activities, specifically, road, sidewalk, and trail closures as well as altered public transportation schedules or operations and impacts to railroad operations. These

impacts are broadly discussed in terms of location, duration, and type of activity (both transportation and construction activity).

6.3.1. Railroad Infrastructure and Operations

This section discusses anticipated effects on railroad operations that are temporary in nature or related to construction of the Project. Railroad operations described in this section include CSXT freight operations and Amtrak passenger service.

6.3.1.1. No Action Alternative

The No Action Alternative would have adverse temporary impacts on railroad operations. Under the No Action Alternative, Projects that would occur within the railroad right-of-way would include the addition of a fourth track from AF to RO Interlockings in Virginia, the addition of a fourth track from LE to VA Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project. Construction of those projects is anticipated to have some temporary disruptions of railroad service due to work within the right-of-way during construction. These projects would involve the construction of new or realigned track or station platforms within the active railroad corridor. Construction activities would likely require temporary track outages, off-peak track holds, and other minor disruptions to railroad operations.

6.3.1.2. Action Alternative A

Action Alternative A would have moderate temporary direct adverse impacts on railroad operations beyond those of the No Action Alternative. Construction of the new two-track bridge and trackwork in Virginia and the District would be completed in several stages to minimize interruptions in service for railroad operators. As described in **Section 1.5, Construction Methods**, work during the first stage would begin with adding new track and shifting track between I-395 and the L'Enfant Plaza VRE station, as well as initial work on the new two-track Long Bridge structure. During the second stage, reconstructing the RO Interlocking in Virginia between the VRE Crystal City Station and the George Washington Memorial Parkway (GWMP) would help to facilitate work in later stages by allowing trains to switch across all four tracks. The last stage of construction would involve work between East Potomac Park and VRE L'Enfant Plaza Station, including a new bridge over I-395 and demolition of the old structure.

DRPT would work with CSXT to develop the necessary agreements for work within CSXT's right-of-way. Construction staging would be determined by CSXT and coordinated with Amtrak and VRE. Construction work would be performed by CSXT or contractors working under the direction of CSXT. Construction staging would be designed to maintain two tracks of railroad service operational during the entire construction period, except for some limited track outages. Interruptions to two-track service would be scheduled primarily for nights and weekends to complete track shifts and realignments and would be kept to a minimum. Outages would be further defined during final design, but it is anticipated that over the duration of the project, there would be seven night outages, one day outage, and three 55-hour weekend outages that would affect maintaining two-track operations. Additional outages may be required; however, they are not anticipated to affect two-track operations. These outages assume work forces will have full on-track time during the outage to complete the work and do not include foul time, which may be needed for adjacent track construction or material transport.

6.3.1.3. Action Alternative B

Action Alternative B would have major temporary direct adverse impacts on railroad operations. The types of temporary effects on railroad infrastructure and operations under Action Alternative B would be similar to those under Action Alternative A, but the duration of construction would approximately 3 years longer to provide for the removal and replacement of the existing two-track Long Bridge structure, pushing some of the limited outages of two-track service further into the future. Construction staging plans would be similar for Action Alternative B, except that the third stage of construction would include the demolition and replacement of the existing two-track structure, and connections to the new bridge would take place approximately 3 years later than connections to the existing bridge under Action Alternative A. Although the level of disruption to two-track service would be the same as under Action Alternative A, four-track railroad service would be delayed by approximately 3 years compared to Action Alternative A.

6.3.2. Transit

This section discusses the temporary effects of the Project on transit operations under the No Action Alternative and Action Alternatives A and B.

6.3.2.1. VRE Commuter Service

No Action Alternative

The No Action Alternative would have adverse temporary impacts on railroad operations. Under the No Action Alternative, there are planned projects to expand to four tracks on both sides of the Potomac River and improve the VRE Crystal City and L'Enfant Plaza stations. These construction projects would likely temporarily affect railroad operations, which may be more pronounced on VRE service given its relatively higher frequency of service and ridership levels in the vicinity of VRE projects under the No Action Alternative. These projects would involve the construction of new or realigned track or station platforms within the active railroad corridor. Construction activities would likely require temporary track outages and other minor disruptions to railroad operations. Because VRE service is most frequent during the peak AM and PM periods and only runs on weekdays, scheduling these activities during off-peak hours would minimize disruptions for VRE service.

Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts to VRE service beyond the effects of the No Action Alternative. Construction staging would be developed to maintain two-track service in the Local Study Area as much as feasible, with disruptions scheduled primarily for nights and weekends. Because VRE service is most frequent during the peak AM and PM periods and only runs on weekdays, this approach would minimize disruptions for VRE service.

Action Alternative B

Action Alternative B would result in minor temporary direct adverse impacts to VRE service beyond the effects of the No Action Alternative. Temporary effects for VRE service under Action Alternative B would be similar to those for Action Alternative A, except that replacement of the existing bridge would require additional outages of two-track service. Although the level of disruption to two-track service

would be similar as under Action Alternative A, four-track railroad service would be delayed by approximately 3 years compared to Action Alternative A.

6.3.2.2. WMATA Metrorail Passenger Service

No Action Alternative

The No Action Alternative is not anticipated to have temporary effects on Metrorail passenger service. None of the projects included in the No Action Alternative would require construction near Metrorail right-of-way.

Action Alternative A

Action Alternative A would result in minor temporary direct adverse impacts to Metrorail Yellow Line service. Current Metrorail operations involve running Metrorail Yellow Line service between Virginia and the District, over a bridge upstream of Long Bridge and upstream of the new span that would be constructed under Action Alternative A. Metrorail Yellow Line trains currently enter a tunnel at a portal at East Potomac Park directly adjacent to the existing Long Bridge tracks. Action Alternative A would require construction of a bridge over the existing Metrorail tunnel portal, resulting in some limited service disruptions to Metrorail Yellow Line service, primarily during nights and weekends, when Metrorail service is already less frequent than during the peak AM and PM periods on weekdays.

Action Alternative B

Action Alternative B would result in minor temporary direct adverse impacts to Metrorail Yellow Line service. Temporary effects for Metrorail passenger service under Action Alternative B would be identical to those for Action Alternative A.

6.3.2.3. Local and Commuter Bus

No Action Alternative

Construction associated with No Action Alternative projects may cause additional congestion throughout the study area. The No Action Alternative may therefore have temporary effects on local and commuter bus service.

Action Alternative A

Action Alternative A would have moderate to major temporary direct adverse impacts to local and commuter bus service. Metrobus service routes 11Y, 5A, 16E, and 16X would suffer major direct adverse impacts, as they utilize the section of I-395 impacted by construction. Metrobus service route D51 may suffer moderate direct adverse impacts due to construction along Maine Avenue. Regarding commuter bus service, Potomac and Rappahannock Transit Commission (PRTC) routes DC-E, LR-E, R1-E, and MC-E, and Loudoun County Transit (LCT) routes 100E, 200E, 250E, 300E, and 400E would suffer major direct adverse impacts along I-395. Additionally, the PRTC DC-E route and all mentioned LCT routes would suffer moderate direct adverse impacts due to traffic congestion associated with construction impacts to Maine Avenue SW.

Action Alternative B

Impacts to local and commuter bus service under Action Alternative B would be similar to those for Action Alternative A. While the overall construction duration for Action Alternative B is substantially longer than Action Alternative A, the duration of construction impacts to the section of I-395 used by local and commuter bus service would be the same

6.3.3. Pedestrian and Bicycle Network

Under the No Action Alternative, there would be no construction affecting the multiuse trails in the Local Study Area. However, construction of the projects include in the No Action Alternative could require temporary traffic control measures or use of sidewalks for construction access, thereby having temporary adverse impacts on the pedestrian and bicycle network. This section discusses the temporary effects of the Project to the pedestrian and bicycle network under the No Action Alternative and Action Alternatives A and B.

6.3.3.1. No Action Alternative

Under the No Action Alternative, there would be no construction affecting the multiuse trails in the Local Study Area. However, construction of the projects included in the No Action Alternative could require temporary traffic control measures or use of sidewalks for construction access, thereby having temporary adverse impacts on the pedestrian and bicycle network.

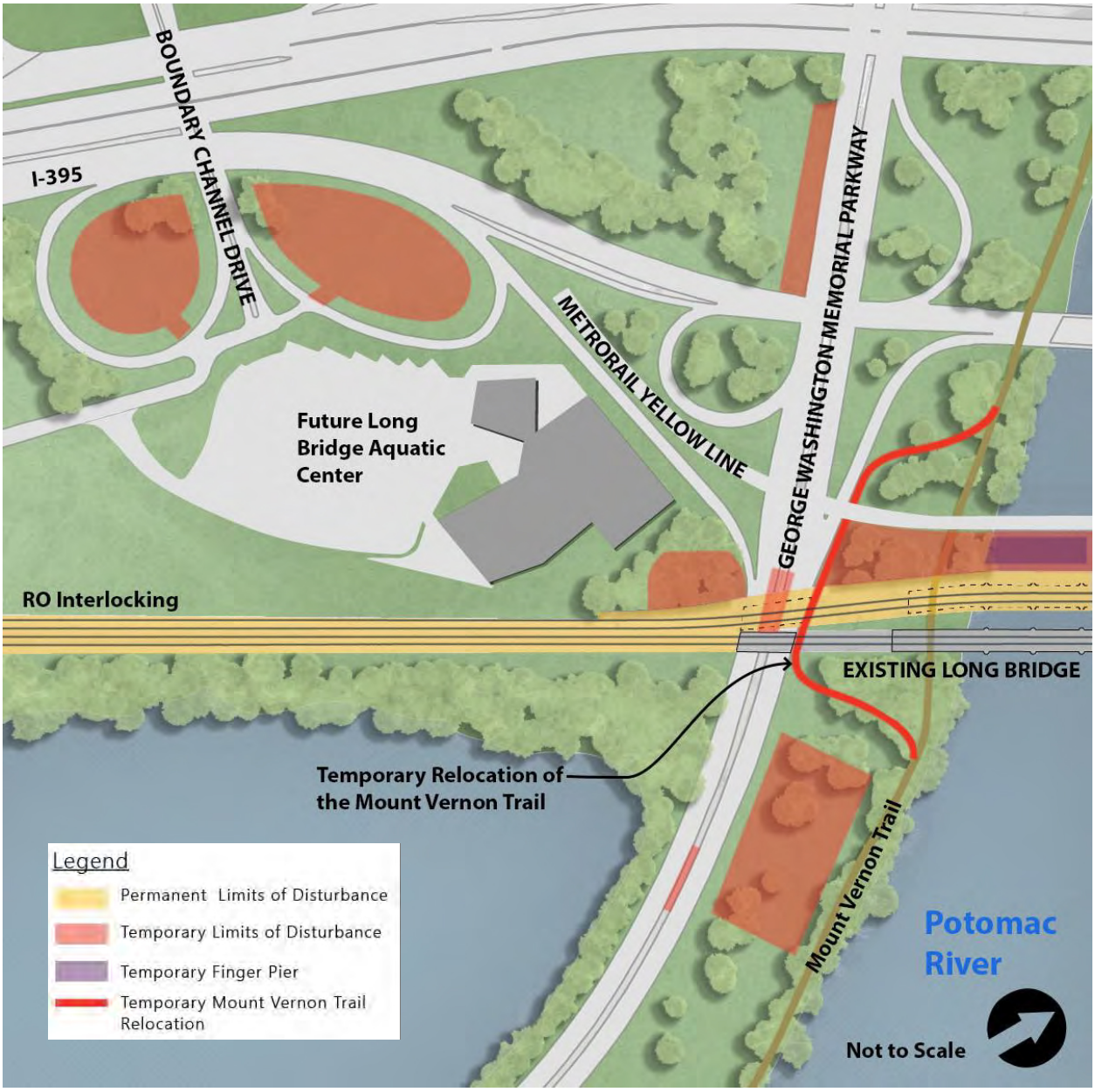
6.3.3.2. Action Alternative A

Action Alternative A would have moderate temporary direct adverse impacts on the pedestrian and bicycle network. Action Alternative A would involve constructing a new two-track railroad bridge over the MVT in Virginia. According to bi-directional counter data available on the public website of BikeArlington, a program of Arlington County, the George Mason Memorial Bridge path at the MVT had an average weekday volume of 2,247 bicyclists and 303 pedestrians in July 2017, an average weekday volume of 2,149 bicyclists and 266 pedestrians in July 2018, and a total of 551,185 bicycle trips between August 2017 and July 2018.[17] This important pedestrian and bicycle connection is the most frequently used trail in Arlington County.

During construction, a staging area will be placed adjacent to the GWMP, resulting in the need to reroute the MVT as shown in Error! Reference source not found.. Because of the current trail alignment, the MVT would be closed from a point south of the Rochambeau Bridge underpass to a point north of the Metrorail
Yellow Line underpass. The trail would be realigned for the Project construction period, and conceptual draft-level designs show a temporary realignment following the eastern berm of the GWMP.

[17] BikeArlington. Undated. Counter Dashboard. Accessed from http://counters.bikearlington.com/. Accessed October 21, 2018.

Figure 6-2 | Construction Staging and Access in the Vicinity of the George Washington Memorial Parkway



The final temporary realignment would depend on final Maintenance of Traffic (MOT) plans for the GWMP and would need to be approved by NPS. Impacts on non-motorized travel time are anticipated to be minimal, but the final realignment must carefully consider safety concerns due to the trail's probable temporary proximity to the Parkway. Temporary full closures to safeguard trail users may be necessary at limited times during construction for the movement of vehicles and materials, estimated to last between minutes and hours.

In addition, pedestrian use of walkways within East Potomac Park and along Maine Avenue SW near the construction of the new rail bridge likely would need to be closed and/or rerouted on a temporary basis during construction.

Action Alternative A would also require demolition of an elevated pedestrian structure in the District that crosses Maine Avenue SW near the Mandarin Oriental Hotel, just east of where the existing Long Bridge Corridor crosses Maine Avenue SW. The pedestrian structure would be replaced after construction with a comparable structure. Prior to the replacement of the pedestrian structure, pedestrians can be accommodated by a signed detour route using existing sidewalks.

Road closures on Maine Avenue SW, described below, would also impact sidewalks, which would have a moderate negative effect on pedestrians and bicyclists. In addition to one travel lane closure in the eastbound and westbound direction (not to occur concurrently), the sidewalk space would also be temporarily closed for durations lasting up to several weeks for construction activities on the same side as the lane closure. Because of detour routes, bicyclists and pedestrians would face increased travel time and additional street crossings to complete their trips. Final MOT plans including detour routes would be determined in coordination with DDOT.

6.3.3.3. Action Alternative B

The extended duration of impacts to the MVT due to Action Alternative B (5 years and 2 months) and East Potomac Park (8 years and one month) would result in major adverse direct effects to the pedestrian and bicycle network. Other bicycle and pedestrian impacts would be similar to Action Alternative A.

6.3.4. Roadway Network

This section discusses the temporary effects of the Project to the roadway network under the No Action Alternative and Action Alternatives A and B.

6.3.4.1. No Action Alternative

Some roadways in the study area, such as I-395 and Maine Avenue SW, would operate under LOS F in the No Action Alternative based on the output of the Synchro and HCS analysis.[18] Construction associated with the No Action Alternative projects may result in impacts due to additional congestion throughout the study area.

6.3.4.2. Action Alternative A

Action Alternative A would have major temporary direct adverse impacts on the roadway network due to temporary impacts to I-395 and Maine Avenue SW during construction. I-395 and Maine Avenue would continue to operate under LOS F during peak periods and during construction.[19] The existing roadway network within the Local Study Area contains several regionally significant arterial and collector roadways that carry large volumes of traffic each day. The high traffic volumes during peak

[18] Level of Service (LOS) is the transportation industry's standard of measurement of traffic congestion graded from A (light to normal traffic conditions) to F (very heavy congestion). The current conditions of I-395 and Maine Avenue SW are based on the HCS and Synchro analyses performed for the Project.
[19] Level of Service (LOS) is a measure of traffic graded from A (light to normal traffic conditions) to F (very heavy congestion).

commute times, which can extend for several hours, result in heavy congestion on these roadways causing major delays and poor and sometimes failing LOS in the existing condition. Construction activities may cause a reduction in traffic operations. These reductions in operations would vary depending on the day, time of day, duration of construction activity, and other factors.

Crystal Drive, Long Bridge Drive, and Boundary Channel Drive

Construction access and staging would have negligible to minor adverse direct effects along Crystal Drive, Long Bridge Drive, and Boundary Channel Drive. As discussed in **Section 1.5, Construction Methods**, several staging areas and access points have been identified along the railroad corridor in Long Bridge Park, at the clover leaf at Boundary Channel Drive and Long Bridge Drive, and in the triangular section of land between I-395, the 14th Street Bridge, and the GWMP. The proximity of the clover leaf to I-395 with direct access to the GWMP and the triangular plot's access from I-395 to the GWMP reduces the use of the GWMP for construction vehicles.

Along Crystal Drive, Long Bridge Drive, and Boundary Channel Drive, there would be increased heavy truck traffic at this location with associated congestion impacts. Furthermore, there could be temporary short-term minutes-long flagged closures as trucks deliver and remove construction material from the staging access site.

George Washington Memorial Parkway

Construction access and staging would result in moderate adverse direct effects on traffic operations on the GWMP. Construction of the new railroad bridge over the GWMP would require traffic control measures, temporary lane closures, and temporary lane shifts on the GWMP for delivery of materials and equipment, and for construction activities for the abutments, piers, and superstructure while maintaining a safe work zone. In addition to lane closures on the southbound lanes of the GWMP for deliveries from I-395, temporary removal of the center median would allow for construction vehicle movement into the newly created access drive for laydown and staging located between the GWMP, MVT, and the existing Long Bridge. The median railing located east of the railroad bridge crossing the GWMP would be removed and replaced with a temporary median barrier. The crossing of the GWMP by construction vehicles to bring in materials and equipment would be limited to nighttime hours and two lanes would be maintained at all times. Construction vehicles would enter and exit the GWMP via I-395.

I-395

Lane closures required for pier construction and staging would result in major adverse direct effects on traffic operations to I-395 in both the northbound (towards the District) and southbound (towards Virginia) directions, primarily on the ramps connecting the general-purpose travel lanes and the high-occupancy vehicle (HOV) lanes. The merge ramp from the northbound HOV lanes to northbound I-395, and the diverge ramp from southbound I-395 to the southbound HOV lanes, would be affected by the construction and would require all-day mainline lane closures to accommodate shifted merge/diverge areas and ramp access.

HCS was used to estimate the magnitude of impact caused by reductions in available travel lanes during construction. Traffic volumes were projected to 2025 levels, and the analysis was limited to one "critical hour"—the hour with the highest volumes between the AM and PM peak traffic hours. In the northbound (towards the District) direction, this was found to be the PM hour, while in the southbound

(towards Virginia) direction, this was found to be the AM hour. To analyze results in a "worst-case" manner, it was assumed that no motorists would change their travel patterns as a reaction to the construction.

It is important to note that even in the absence of construction activity and lane reductions, traffic congestion during peak hours on I-395 would be severe, with more vehicles attempting to use the travel lanes than capacity allows. However, conditions would deteriorate significantly with the removal of one lane in each direction, with twice the amount of traffic attempting to use I-395 compared to what the roadway can handle. Motorists would notice severe congestion, and periods of congestion would last significantly longer than they would compared to No Action Alternative conditions.

Ohio Drive SW

Construction access across Ohio Drive SW would result in negligible adverse direct effects on traffic operations. To accommodate the ingress and egress of construction materials between barges and the staging area at NPS Parking Lot C, the Project anticipates the use of flagging at Ohio Drive SW at NPS Parking Lot C and along Ohio Drive SW at the ballfields and finger pier for approximately 4 years and 9 months. To encourage traffic to make use of other routes, additional access points to East Potomac Park would be clearly signed as detour routes and would include Maine Avenue SW to Ohio Drive SW near the 14th Street Bridge and I-395 to Buckeye Road. Construction of the new bridge over Ohio Drive SW and the Washington Channel would result in negligible adverse direct effects on traffic operations due to lane shifts and the use of flagging. Construction activities would not block park entrances or limit travel on public roads.

Maine Avenue SW

Lane closures required for construction of the new railroad bridge over Maine Avenue SW would result in major adverse direct effects on traffic operations, which would be affected by multiple stages of construction. For the construction of new abutments or a center pier, one lane and the adjacent sidewalk would need to be closed in each direction. These one-lane closures would occur along Maine Avenue SW between the 14th Street Bridge on-ramp (westbound Maine Avenue) and the 14th Street Bridge off-ramp (eastbound Maine Avenue).

A combination of Synchro software and HCS was used to estimate the magnitude of impact caused by these closures. These tools were determined to be acceptable as operational issues are anticipated to be limited to the vicinity of construction and would not have serious adverse impacts on multimodal operations. Traffic volumes were projected to 2025 levels, and the analysis was limited to one "critical hour"—the hour with the highest volumes between the AM and PM peak traffic hours. In the eastbound direction, this was found to be the AM hour, while in the westbound direction, this was found to be the PM hour.

In the eastbound direction, the analysis found that a one-lane closure affecting the peak period would have a serious adverse effect on traffic operations. Without the closure, under existing conditions, motorists would experience significant wait times because of traffic congestion. With the closure, these wait times would increase significantly and would most likely extend past the peak hour. Furthermore, the amount of traffic attempting to access the road would greatly exceed the road's capacity, indicating

that queues would be longer than under No Action conditions and would most likely impact other nearby roads adjacent to Maine Avenue SW.

In the westbound direction, the analysis found that a one-lane closure affecting the peak period would have an adverse effect on traffic operations. Without the closure, motorists would still experience heavy congestion, as they do under existing conditions. However, the amount of traffic attempting to access the roadway would not exceed the road's capacity, indicating that while congestion would still be heavy, the roadway would not experience breakdown conditions. With a one-lane closure and the associated reduction in capacity, the amount of traffic attempting to access the facility would exceed capacity, leading to increased congestion, queues on other roadways and ramps, and longer wait times extending past the current peak period.

Occasionally, during off-peak overnight periods, both eastbound lanes on Maine Avenue SW would be closed, which would require the closure of the ramp from 14th Street NW. Drivers would be instructed to continue north on 14th Street NW and utilize alternate routes to reach their destination. Patrons visiting the restaurants, bars, and clubs in the redeveloping mixed-use areas along Maine Avenue SW generate traffic during off-peak overnight hours. While DDOT does not have traffic counts for the off-peak hours in those locations, it can reasonably be assumed that the overnight closures of these lanes would affect these travelers by requiring them to take potentially longer routes to reach their destinations. The use of alternative routs due to the temporary lane closures would result in higher off-peak traffic volumes on these routes.

Maryland Avenue SW

The Long Bridge Project will be designed with 14-foot track spacing underneath Maryland Avenue SW, resulting in no impact or effect on the Maryland Avenue overbuild. No roadway impacts are anticipated.

D Street SW

Lane closures at D Street SW between the 9th Street Expressway and 12th Street SW are anticipated to result in negligible to minor direct adverse effects on traffic operations. Brief intermittent lane closures would be needed to provide safe and secure delivery of construction material, and to guarantee secure track access.

6.3.4.3. Action Alternative B

Temporary impacts during construction under Action Alternative B would be similar to Action Alternative A, except that the extended duration of impacts to the GWMP (5 years and 2 months) would result in a major adverse direct effect, and the duration of impacts on Ohio Drive SW (8 years and 1 month) would result in a minor adverse direct effect.

6.3.5. Parking

This section discusses the temporary effects of the Project to parking under the No Action Alternative and Action Alternatives A and B.

6.3.5.1. No Action Alternative

Based on their current level of conceptual design, construction activities associated with the projects included in the No action Alternative are not expected to temporarily adversely affect parking in the Local Study Area.

6.3.5.2. Action Alternative A

Action Alternative A would result in minor to major temporary direct adverse impacts on parking. In addition to the permanent loss of parking at NPS Parking Lot C in East Potomac Park and the parking spaces at the Washington Marina, temporary loss of additional public, metered parking spaces (at NPS Parking Lots B and C) and private parking spaces (at Washington Marina) is expected to occur for purposes of construction staging. This would involve the temporary closure of all of NPS Parking Lots B and C for approximately 4 years and 9 months and temporary closure of the surface parking area at the Washington Marina for approximately 4 years and 1 month. Access to the construction area and finger pier from Ohio Drive SW on the Washington Channel side of East Potomac Park would require temporary removal of several on-street parking spaces. Closure of the NPS parking lots would be considered a major impact; while it would substantially reduce the supply of parking at that location, the lots are currently lightly used except during peak season (during the National Cherry Blossom Festival) and special events. In addition, other surface parking in the area would still be available. Loss of surface parking at Washington Marina would be considered a major impact because it constitutes the entirety of the marina's parking. Approximately 15 on-street metered, public parking spaces on Maiden Lane would also be temporarily lost during the 4 years and 1 month of construction in that location.

6.3.5.3. Action Alternative B

Action Alternative B would have similar effects on parking to Action Alternative A, except that the adverse effects due to loss of parking at NPS Parking Lots B and C would be major due to the extended duration during which surface parking would be unavailable to the public (8 years and 1 month.

6.3.6. Aviation

This section discusses the temporary effects of the Project to aviation under the No Action Alternative and Action Alternatives A and B.

6.3.6.1. No Action Alternative

The No Action Alternative would have no adverse temporary impacts on aviation. Under the No Action Alternative, there would be no construction and therefore no impacts to aviation in the Local Study Area.

6.3.6.2. Action Alternative A

No temporary effects on aviation are anticipated under the Action Alternative A. The maximum permitted obstruction height during construction is 81 feet above mean sea level. All cranes and other tall equipment would be below that height.[20]

6.3.6.3. Action Alternative B

The temporary effects on aviation under Action Alternative B would be identical to those under Action Alternative A.

6.3.7. Navigation

This section discusses the temporary effects of the Project to navigation under the No Action Alternative and Action Alternatives A and B.

6.3.7.1. No Action Alternative

The No Action Alternative would have no adverse temporary impacts on navigation. Under the No Action Alternative, there would be no construction over the Potomac River and therefore no changes to the railroad infrastructure that would affect navigation in the river.

6.3.7.2. Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts on navigation on the Potomac River. During construction, mariners would follow work zone safety guidelines established by the USCG and be advised that periodic closures of the main navigation channel and adjacent spans may occur due to ongoing construction. The contractor would be required to sign the closure and coordinate via radio with approaching vessels. Closures or stoppages in the channel may require the contractor to provide flagmen to stop traffic. The amount of closures and anticipated times for closures would be conveyed to mariners using traditional methods, such as radio, as well as social media. It is anticipated that construction activities over the river would last approximately 3 years and 4 months.

6.3.7.3. Action Alternative B

Action Alternative B would have moderate temporary direct adverse impacts on navigation on the Potomac River, as the types of effects of Action Alternative B would be similar to the effects of Action Alternative A, but they would be longer in duration due to the demolition and replacement of the existing two-track Long Bridge (approximately 8 years and 1 month).

6.4. Avoidance, Minimization, and Mitigation

This section describes potential mitigation for permanent and temporary impacts to vehicular, pedestrian, bicycle, marine, transit, and railroad modes, as appropriate. As there are no anticipated permanent adverse effects to transportation or navigation, mitigation measures are proposed to address temporary impacts, such as closure or reduction in capacity to segments of the transportation

[20] This height limit was provided by the Metropolitan Washington Airports Authority in their Scoping comments in an email dated October 6, 2016. See the *Scoping Summary Report* (January 2017), Appendix D.

network, modifications to signal systems, or other operational changes. Mitigation measures may include the replacement or construction of new transportation facilities. For each area, mitigation has not been identified for the No Action Alternative, as the projects under that alternative are being undertaken and designed by a number of different jurisdictions at different points in time. Thus, potential mitigation is only discussed for Action Alternatives A and B.

6.4.1. Railroad Infrastructure and Operations

This section describes proposed avoidance, minimization, and mitigation measures for impacts to railroad infrastructure and operations.

Beneficial permanent effects on railroad infrastructure and operations are the intended outcome of the Project, by providing additional capacity for railroad service. Temporary effects on railroad infrastructure are due to the need to complete construction in the vicinity of existing freight and passenger railroad operations and would be primarily limited to the duration of construction. As described in **Section 6.3, Temporary Effects** CSXT would determine construction staging and coordinate work with Amtrak and VRE. CSXT or contractors working under the direction of CSXT would perform the construction work. Construction staging would be designed to maintain two tracks of railroad service operational during the entire construction period, except for some limited track outages for construction activities.

Construction staging, as described in **Section 1.5, Construction Methods**, has been designed to maintain two-track railroad service to the extent feasible, and minimize impacts to railroad operations. In addition, all efforts would be made to limit disruptions to two-track service to nights and weekends.

6.4.2. Transit

This section describes proposed avoidance, minimization, and mitigation measures for impacts to transit operations.

6.4.2.1. VRE

As with railroad service described above, temporary effects to VRE service would be due to the need to complete construction in the vicinity of existing railroad operations and would be primarily limited to the duration of construction. As noted previously, construction staging has been designed to maintain two-track railroad service to the extent feasible. In addition, all efforts would be made to limit disruptions to two-track service to nights and weekends, where it would have fewer, if any, effects on VRE commuter rail service, which runs primarily during the peak periods in the peak direction of travel.

6.4.2.2. WMATA Metrorail Passenger Service

Temporary impacts to Metrorail Yellow Line service are unavoidable, as construction of a new bridge over the tunnel portal would require short-term interruptions in service. To the extent practicable, work that requires interruption in service would be performed during nights and weekends, when Metrorail service is less frequent.

6.4.2.3. Local and Commuter Bus

For bus routes that operate on roadways that may experience delays due to construction, operators may consider temporary detours or rerouting to maintain reliability. Depending on the duration of the impacts, schedule revisions could reduce the effect of additional congestion on transit passengers. The project sponsor for final design and construction, the Virginia Department of Rail and Public Transportation (DRPT), would require the contractor to coordinate with transit operators to help the operators determine the appropriate steps to take.

6.4.3. Pedestrian and Bicycle Network

This section describes proposed avoidance, minimization, and mitigation measures for impacts to the pedestrian and bicycle network.

Wayfinding signage would be installed, as appropriate, to redirect pedestrian and bicycle traffic during temporary closures due to construction. DRPT would require the contractor to construct the temporary MVT. In addition, temporary crossings of trails for materials delivery would be scheduled during evening hours to the extent practicable, to minimize impacts to trail users. DRPT could fund construction of a new bike-pedestrian bridge as part of both Action Alternatives, as potential mitigation under Section 4(f) of the U.S. Department of Transportation Act of 1966. This potential mitigation would improve connectivity between parks and within the regional trail network.

Washington Marina Pedestrian Bridge Reconstruction

During construction, while the pedestrian bridge is not available, pedestrians would need to walk a longer distance between Maryland Avenue SW and the Washington Marina. Currently, the walk from the traffic circle to the marina surface parking area takes 5 minutes using the pedestrian bridge. During construction, walking travel time would increase to about 13 minutes using the street network. Wayfinding signage would be considered as mitigation during the time that the pedestrian bridge is unavailable.

6.4.4. Roadway Network

This section describes proposed avoidance, minimization, and mitigation measures for impacts to the roadway network.

The construction of Action Alternative A would require typical maintenance of traffic measures such as lane and shoulder closures, lane shifts, potential detours and a host of temporary traffic mitigation strategies to minimize the impacts to the traveling public. The implementation of these measures and strategies would be necessary to construct the project safely while allowing for reasonable production of construction operations. Under Action Alternative A, the contractor would be required to develop, with approval by DDOT and NPS, a project-wide Traffic Management Plan (TMP) that includes temporary traffic control plans, the analysis of traffic operations, and a public outreach campaign. The development of the TMP would be completed following the Final Environmental Impact Statement as the design, construction phasing, sequencing and scheduling details would be much better defined. During development of the TMP, additional coordination with the Project stakeholders and the public would inform the specific measures laid out in the plan. The sections below describe potential mitigation measures for specific locations within the Local Study Area.

Crystal Drive, Long Bridge Drive, and Boundary Channel Drive

Because impacts to access at this location are anticipated to be intermittent, no major mitigation strategies have been developed. However, reducing closures to nights or weekends would reduce the impact on local motorists.

George Washington Memorial Parkway

MOT plans would be developed to ensure continued through and ramp access along the GWMP as the bridges, embankments, and retaining walls are constructed. Lane closures would be limited to off-peak hours to reduce the impact to motorists to the extent practicable. The crossing of the GWMP by construction vehicles to bring in materials and equipment would be limited to nighttime hours and two lanes would be maintained at all times. Variable message signs (VMS) and detour route signage would be placed in advance of the affected area to increase motorist awareness of potential delays and to offer alternative routes. DRPT and contractor would develop MOT plans with approval by NPS.

I-395

Mainline lane closures on I-395 would have major adverse impacts, especially considering that they would last for extended periods of time and would impact peak periods. Extensive MOT plans and the TMP program described above would be critical for preventing facility breakdown if closures do not only occur overnight. These plans would need to:

- Develop strategies for driver diversion;
- Incentivize the use of non-motorized modes, such as Metrorail Yellow Line or bus service;
- Identify and clearly sign potential detour routes; and
- Develop driver-awareness campaigns regarding probable severe congestion for the duration of the semi-permanent impact.

VMS can offer operational relief to traffic in the area by warning drivers well in advance of expected congestion and alternative routes to downtown Washington, DC. Signs would be placed well in advance to alert motorists to the new traffic pattern during construction to prevent motorist confusion at the point where operational changes are noticed.

Ohio Drive SW

Because impacts to access at this location are anticipated to be intermittent, no major mitigation strategies have been developed. However, during peak usage (such as during the National Cherry Blossom Festival), it may be advisable to encourage use of other routes through detour route signage utilizing access from I-395 and from Independence Avenue near the 14th Street Bridge. DRPT may provide temporary access to other surface parking or opening additional on-street parking at accessible areas.

Maine Avenue SW

One-lane closures on eastbound and westbound Maine Avenue SW are anticipated to have major effects on through traffic and traffic destined for the 14th Street Bridge. For this reason, a TMP program similar to the one described for I-395 would be critical to mitigation traffic at this location.

During temporary closure of the ramp from 14th Street, the project would need to employ portable and VMS to alert drivers to detour routes. Because these closures are anticipated to be limited to overnight hours, VMS communication would be more effective than detour signage.

D Street SW

Because only brief and intermittent change of access is anticipated at this location, no mitigation strategies would be required.

6.4.5. Parking

This section describes proposed avoidance, minimization, and mitigation measures for impacts to parking.

Permanent and temporary loss of parking due to the design of the new track structures and due to construction staging is not avoidable. Potential replacement of permanent parking would be evaluated as project design progresses further.

National Park Service Parking Lot C

During final design, DRPT would coordinate with NPS to identify temporary parking or parking shuttles during construction as potential mitigation for the loss of parking spaces at NPS Parking Lot C, especially during periods of heavy usage, such as during the National Cherry Blossom Festival. Temporary parking locations would be evaluated for ease of access to East Potomac Park facilities and special event locations.

Washington Marina Parking Lot

Depending on the ultimate number of surface parking spaces that would be removed during construction, alternate parking accommodations would be evaluated to consider the use of public and private parking facilities to mitigate the temporary loss of parking.

Remote parking accommodations could be considered while encouraging patrons to utilize other options such as the Southwest Shuttle.

6.4.6. Navigation

This section describes proposed avoidance, minimization, and mitigation measures for impacts to navigable waters due to periodic closures of the main navigation channel and adjacent spans due to construction activities.

While there would be no permanent impacts to navigation, temporary impacts during construction would be unavoidable. Construction contractors will follow all USCG requirements for safeguarding river traffic during construction and would attempt to minimize disruptions, especially during times of heavy river traffic, such as holidays. Mitigation may include using flaggers to stop vessel traffic during closures of the channel. The amount of closures and anticipated times for closures would be conveyed to mariners, including posting in the USCG's weekly notice to mariners, on local radio/news sites, and using social media.

6.4.7. Aviation

No permanent or temporary effects on aviation are anticipated from any of the alternatives, so no mitigation has been identified.

7.0 Air Quality and Greenhouse Gases

7.1. Introduction

This section defines the air quality and greenhouse gas (GHG) resources pertinent to the Long Bridge Project (the Project), and provides the regulatory context, methodology, and baseline for assessing the Affected Environment and impacts of the Action and No Action Alternatives. For each Action Alternative and the No Action Alternative, this section describes the potential short-term and long-term impacts on air quality and GHG emissions in comparison to the No Action Alternative. Proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project are also provided.

Air pollution is a general term that refers to one or more substances determined to degrade the quality of the atmosphere. The United States Environmental Protection Agency (EPA) identified the following six main air pollutants, collectively referred to as criteria pollutants, as being of nationwide concern, based on their potential effect on human health:

- Carbon monoxide (CO);
- Sulfur oxides (SOx), including sulfur dioxide (SO2);
- Nitrogen oxides (NOx), including nitrogen dioxide (NO2);
- Ozone (O3);
- Particulate matter sized 10 micrometers or less (PM10) and sized 2.5 micrometers or less (PM2.5); and
- Lead (Pb).

Pollutants that are considered **GHGs** are gases that trap heat in the atmosphere and affect climate change. The precise sources of these pollutants, their effects on human health and general welfare, and their final disposition in the atmosphere vary considerably. Some major GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases (hydrofluorocarbons, perfluorocarbons, etc.).

7.2. Regulatory Context and Methodology

This section describes the most important regulatory context for evaluation of impacts to air quality and greenhouse gases and provides a summary of the methodology used to evaluate the current conditions of the resource and the probable consequences of the alternatives. This section also includes a description of the Study Area for each resource category. The full list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

7.2.1. Regulatory Context

The Clean Air Act of 1970, as amended (CAA) and Conformity Rule are the primary Federal legislation regulating air quality; both play a role in setting the nation's air quality standards for pollutants and

adopting emission control programs.[1,2] The CAA authorizes the EPA to "protect public health by regulating emissions of harmful pollutants." The National Environmental Policy Act of 1969 (NEPA) also requires the analysis of potential impacts in terms of the project's context, intensity, and duration. The Federal Railroad Administration (FRA) *Procedures for Considering Environmental Impacts* states that an environmental document should consider possible impacts on air quality.[3]

Under authority of the CAA, EPA has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants to protect the public health and welfare.[4] The NAAQS are standards that one evaluates ambient air quality against to determine whether pollutant concentration levels are harmful. The EPA classifies an area as nonattainment for a pollutant if that pollutant exceeds the NAAQS.

EPA promulgated the final General Conformity and Transportation Conformity regulations to ensure that Federal agencies do not adopt, accept, approve or fund activities that are not consistent with the CAA.[5] Transportation conformity is required in areas designated nonattainment and maintenance and for FHWA and FTA projects. General conformity applies to all Federal actions that do not include FHWA and FTA projects.[6] As FRA activities are not covered under Transportation Conformity, General Conformity regulations apply to the Project. The EPA has established *de minimis* thresholds to help determine whether a General Conformity determination is required. If *de minimis* thresholds are exceeded, a General Conformity determination would establish the Project's compliance with the SIP.

The District Department of Energy and Environment (DOEE) establishes and enforces the District's air quality regulations, which prevent or minimize emissions into the atmosphere to protect and enhance the quality of the District's air quality. These regulations apply to controlling emissions from both stationary sources and mobile sources, controlling fugitive dust from construction activities, and controlling on-road engine and non-road diesel engine idling. In addition, the Virginia Department of Environmental Quality (VDEQ) Air Division is responsible for carrying out the mandates of the Virginia Air Pollution Control Law, as well as meeting Virginia's federal obligations under the CAA.[7] Arlington County does not have regulations or ordinances that govern air pollutant emissions.

There are no established thresholds for assessing the significance of a project's GHG emissions. For informational purposes, the GHG emissions related to the Project have been evaluated and are available for consideration in future local GHG planning. Several local plans have been developed for the areas that provide guidance and direction on GHG emissions. The Commonwealth of Virginia has developed plans to reach GHG reduction goals and sustainability objectives in the *Virginia Energy Plan*.[8] The District

[1] 42 USC 7401
[2] 40 CFR parts 51 and 93
[3] 64 FR 28545
[4] 40 CFR part 50
[5] 40 CFR part 93
[6] U.S. Department of Transportation, Federal Highway Administration. Transportation and General Conformity FAQs. Accessed from https://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/faqs/genfaqsmemo.cfm. Accessed October 16, 2018.
[7] 9 VAC 5-160
[8] Department of Mines, Minerals, and Energy, Commonwealth of Virginia. Undated. The Virginia Energy Plan. October 1, 2014.

has developed multiple plans to reach GHG reduction goals and sustainability objectives, including the *Sustainable DC Plan* and the *Climate Ready DC Plan*.[9,10]

7.2.2. Methodology

The Environmental Consequences analysis evaluated the Project's direct and indirect impacts on air quality on both local and regional levels because of post-construction operations for mobile sources and for construction emissions. The analysis was conducted following the procedures and guidance outlined in the District Department of Transportation *Environmental Manual.*[11] The analysis included local assessment, regional assessment and mobile source air toxics (MSAT) assessment. The GHG impacts analysis considered impacts from railroad emission sources for direct and indirect effects as well as impacts of climate change in the context of resilience. The *Methodology Report* provides more detailed methods used to assess effects of the Project.

This analysis examines the impact of criteria pollutants at both the local and regional levels. The Local Study Area, as shown in **Figure 7-1**, includes locations around the Project's emission sources where the public has access to ambient air. In addition, the Local Study Area includes sensitive receptor locations around the Project that are accessible by the public, where impact from increased train activity could be felt.

The Regional Study Area is defined as the District and Arlington County, Virginia, which includes data collection sources such as the air quality monitoring station at the Aurora Hills Visitor Center and meteorological data from Ronald Reagan Washington National Airport, both in Arlington, Virginia. The documentation of the Affected Environment included obtaining ambient air quality conditions from DOEE, VDEQ, and EPA air quality monitoring data.

7.2.2.1. Local Assessment

The local emissions assessment involved qualitative assessment and considered the potential relative concentrations of air pollutants during the No Action and for each Action Alternative. The assessment considered railroad operations, emission source location and heights, and receptor location and heights for each analysis scenario. Local receptors are typically not subject to impact from railroad sources since locomotive pass-bys are typically short, resulting in minor exposure periods. As a result, quantitative analysis of pollutant concentrations was not warranted.

[9] DOEE, District Office of Planning (DCOP), and Office of the Mayor. 2016. The Sustainable DC Plan. Accessed from http://www.sustainabledc.org/wp-content/uploads/2017/03/SDC_Plan_2016_compressed2.pdf. Accessed June 8, 2017.
[10] Climate Ready DC: The District of Columbia's Plan to Adapt to a Changing Climate. Undated.
[11] District Department of Transportation. "Environmental Manual" 2nd Edition. June 20, 2012.

Figure 7-1 | Local Study Area for Air Quality and Greenhouse Gas

7.2.2.2. Regional Assessment/General Conformity

Regional analyses are called mesoscale analyses and focus on pollutant inventories and the mass of pollutants being emitted by a project. As part of the regional assessment, emissions inventories were prepared for VOC, NOx, CO, and PM10/PM2.5 for the air quality Local Study Area (**Figure 7-1**). The emissions inventories included emissions from the diesel locomotives. Daily and annual emissions inventories were prepared for each pollutant. Railroad emissions were developed based on EPA guidance *Emission Factors for Locomotives*.[12] The regional pollutant burden analysis was compared to *de minimis* thresholds to show a General Conformity determination is not required. Emissions were compared in terms of trends over time, and emissions from the Action Alternatives were compared with the No Action Alternative. Inventories were prepared for the existing conditions, the No Action, and the Action Alternatives in the Project's design year (2040). In addition, a qualitative discussion of the Project's impacts on future Ozone and PM air quality index was presented.

The regional air quality analysis utilized specific conditions for the District and Arlington County, Virginia, including region-specific input data for the MOVES emission factors, data collection sources such as air quality monitoring levels from the Aurora Hills Visitor Center and meteorological data from Ronald Reagan Washington National Airport, both in Arlington, Virginia. This agrees with the methodology used by the EPA for determining air attainment status for the area.

7.2.2.3. Greenhouse Gas Emissions

Annual GHG emissions were evaluated at a regional/mesoscale level and included emissions from the diesel locomotives in the air quality/GHG Local Study Area (see **Figure 7-1**) using the operating conditions developed in the transportation analysis. Annual emissions inventories were prepared for the emitted GHGs. Railroad emissions were developed based on EPA guidance *Emission Factors for Locomotives*.[13] Each Action Alternative was compared to the No Action Alternative in the planning year (2040).

7.2.2.4. MSAT Assessment

For the assessment of MSATs, a qualitative assessment was prepared following FHWA's guidelines on air toxics, the *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents.*[14] The MSATs of concern was identified, and the trends of MSAT emissions for both the Action and No Action Alternatives were described. For the screening-level analysis, a review of the proposed Project's conceptual engineering plans, profiles, and project description was used to identify new or modified air toxic emissions sources.

7.2.2.5. Temporary Effects

Construction, by definition, is temporary and transitory. As the construction duration is expected to exceed 5 years, a quantitative air quality analysis was completed. The quantitative construction air

[12] EPA, Office of Transportation and Air Quality. *Emissions Factors for Locomotives.* EPA-420-F-09-025. April 2009. Accessed from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100500B.pdf. Accessed September 17, 2018.
[13] EPA-420-F-09-025. 2009.
[14] Biondi, Emily. "Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA." Federal Highway Administration. October 18, 2016.

quality analysis included the evaluation of construction vehicles (worker cars and construction trucks), stationary construction equipment, and fugitive source activities. Emission factors for the emission sources were determined using a combination of EPA's Non-Road, Motor Vehicle Emission Simulator 2014b (MOVES2014b) and the Compilation of Air Emissions Factors (AP-42) models, where appropriate for each source. Emissions inventories were developed for the entirety of the construction periods under each of the Action Alternatives. The analysis was conducted using preliminary phasing schedules, activities, and equipment lists developed for the Action Alternatives. The emissions inventory of the peak year of construction (defined as the year in which the largest amount of pollutant emissions occurs) is then compared to the *de minimis* thresholds to determine if a General Conformity decision is required.

7.3. Permanent or Long-Term Effects

This section considers the direct and indirect impacts of the Action Alternatives and No Action Alternative. This analysis considered conditions in the year 2040, by which time the Action Alternatives would be complete. The locomotive fleet in 2040 is anticipated to be cleaner as newer locomotives are put into service and older locomotives are phased out.

7.3.1. No Action Alternative

The section presents the environmental consequences associated with the No Action Alternative. The No Action Alternative includes planned and funded transportation projects likely to be implemented by 2040, and maintenance projects necessary to keep the existing bridge and corridor in service. The analysis considered the air quality and GHG impacts associated with this alternative at a local and regional level.

7.3.1.1. Local Assessment

The No Action Alternative would have adverse impacts on direct local emissions based on the short durations of pollutant exposure associated with moving locomotives. The No Action Alternative would see daily train operations increase from 76 trains per day to 112 trains per day. In addition to the existing passenger railroad service and CSXT freight railroad operations, Norfolk Southern would operate six freight trains in the No Action Alternative. The track layout in the No Action Alternative would be similar to the existing conditions between RO and L'Enfant (LE) Interlockings, with just two tracks available for crossing over the Potomac River.[15] "Track 0" would be constructed in the southern portion of the study area to the east of Long Bridge Park.

The No Action Alternative has the potential to increase local concentrations of air pollutants due to the increased number of trains and degraded operations resulting from the lack of capacity increase on the corridor. However, the increases would not be substantial given the temporary nature of locomotive emissions. Emissions associated with rail operations primarily occur from combustion occurring in the locomotive engines, not with coaches or freight cars. Localized receptors would only experience pollutant emissions from a locomotive for a short duration. For instance, a Virginia Railway Express (VRE) locomotive traveling at 30 mph would pass a receptor location in 1.5 seconds.

[15] "RO" is the name of the interlocking and is not an acronym.

7.3.1.2. Regional Assessment/General Conformity

The No Action Alternative would have adverse impacts on direct regional emissions based on the increase in emissions related to the increased rail service projected under the No Action Alternative (**Table 7-1)**. The objective of the regional assessment is to estimate the change in area-wide emissions of CO, NOx, VOC, PM, and GHG. The mesoscale analysis considers the 2040 locomotive emissions through the air quality/GHG Local Study Area for the No Action Alternative and 2017 emissions for the existing conditions. Locomotive emissions reflect the planned future operations for the No Action Alternative railroad services using diesel locomotives.

Table 7-1 | No Action Alternative Regional Emissions Inventory

Scenario	CO Tons/Year	NOx Tons/Year	VOC Tons/Year	PM10 Tons/Year	PM2.5 Tons/Year	GHG Metric Tons CO2/Year
Existing Condition	20	147	5.9	6.2	4.0	7,070
No Action Alternative	31	240	8.9	9.4	5.9	10,727
Increase	11	94	3.0	3.1	1.9	3,657

Source: VHB
VOC – Volatile Organic Compounds, NOx – Oxides of Nitrogen, CO- Carbon Monoxide, PM10 – Particulate Matter 10, PM2.5 – Particulate Matter 2.5

7.3.2. Action Alternative A

Action Alternative A would have minor direct adverse impacts on local emissions based on the short durations of pollutant exposure associated with moving locomotives. In Action Alternative A, a new two-track bridge would be constructed west (upstream) of the existing bridge at the crossing of the Potomac River, and the existing bridge would be retained to create a four-track crossing. The Long Bridge Project would increase capacity, which would enable the operation of additional trains. Action Alternative A would have daily operations of 192 trains per day, due to additional capacity. In addition to the existing passenger railroad service and CSXT freight operations, Norfolk Southern would operate new freight trains and MARC would operate new passenger service.

Local sensitive receptors in proximity to the rail Corridor include Long Bridge Park, the Mount Vernon Trail, the Rock Creek Park Trail, the National Mall and Memorial Parks headquarters complex, the ballfields along Ohio Drive SW, and the Portals V residential development. Other areas like sidewalks and surface parking where the public may have access are also sensitive.

Action Alternative A may increase local concentrations of air pollutants over the No Action Alternative due to the increased operations on the Corridor and reduced distances between emissions sources and receptors. However, Action Alternative A would likely have a minor impact to local air quality due to the short durations of pollutant exposure associated with moving locomotives. Localized receptors would only experience pollutant emissions from a locomotive for a short duration. For instance, a Virginia

Railway Express (VRE) locomotive traveling at 30 miles per hour would pass a receptor location in 1.5 seconds.

Action Alternative A would have minor adverse impacts on direct regional emissions based on increased capacity and rail service. However, these emissions would remain well below the *de miminis* thresholds and would not require a General Conformity decision. Although not quantified, the additional railroad service would likely result in a modal shift, causing a reduction of regional motor vehicle activity. This reduction in regional motor vehicle activity would likely result in reduced pollutant emissions from vehicles on the roadways. **Table 7-2** provides Action Alternative A mesoscale inventories for the studied pollutants associated with railroad activity. When compared to the No Action Alternative, Alternative A would see increases of 9 tons per year of CO, 12 tons per year of NOx, 0.5 tons per year of VOC, 0.5 tons per year of PM10, 0.2 tons per year of PM2.5, and 3,242 metric tons per year of GHG. As both the No Action and Action Alternative emission inventories include the effects of other projects occurring independently of the Project, it is necessary to subtract the No Action Alternative from the Action Alternative to determine the emissions directly resulting from the Project.

Table 7-2 | Alternative A Regional Emissions Inventory

Scenario	CO Tons/Year	NOx Tons/Year	VOC Tons/Year	PM10 Tons/Year	PM2.5 Tons/Year	GHG Metric Tons CO_2/Year
Existing Condition	20	147	5.9	6.2	4.0	7,070
No Action Alternative	31	240	8.9	9.4	5.9	10,727
Action Alternative A	40	252	9.4	9.9	6.1	13,969
Project Increment	9	12	0.5	0.5	0.2	3,242
De Minimis	*100*	*100*	*50*	*100*	*100*	-

Source: VHB
VOC – Volatile Organic Compounds, NOx – Oxides of Nitrogen, CO- Carbon Monoxide, PM10 – Particulate Matter 10, PM2.5 – Particulate Matter 2.5

Indirect stationary source emissions of GHG would occur during the operation of Action Alternative A due to the use of electricity by track switches and bridge lighting. An estimate of energy consumption by these sources in the Existing Condition and Action Alternative A is presented in Chapter 8 of this report. An assessment of GHG emissions associated with the electricity consumption of the Project was developed using region-specific emission factors for power generation and accounting for line losses of electricity through the transmission grid.[16] The emissions estimates are presented in **Table 7-3**. In the Existing Condition, 416,100 kWh of electricity is consumed resulting in 150 metric tons of per year of GHG. With the operation of Action Alternative A, 810,300 kWh of electricity would be used, indirectly

[16] EPA. *Emissions and Generation Resource Integrated Database (eGRID) 2016*. Accessed from: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid. Accessed on October 18, 2018.

emitting 292 metric tons per year of GHG. The resulting Project Increment is 142 metric tons per year. Stationary sources GHG emissions associated with the Project would be relatively small and a fraction of the anticipated increase in regional GHG emissions would be associated with the rail activity.

Table 7-3 | Alternative A Stationary Source GHG Emissions

Scenario	Annual Electricity Consumption kWh/Year	GHG Emissions Metric Tons CO_2/Year
Existing Condition	416,100	150
Action Alternative A	**810,300**	**292**
Project Increment	394,200	142

Source: VHB
kWh - Kilowatt Hours

7.3.2.1. MSAT Assessment

Action Alternative A is anticipated to have minor adverse impacts on direct local emissions based on the short durations of pollutant exposure associated with moving locomotives. Action Alternative A is anticipated to have minor adverse impacts on direct regional emissions based on increased rail service projected by the Project's enhancements. However, these emissions would still be well below the *de miminis* thresholds. For Action Alternative A, the amount of MSAT emitted would be proportional to the amount of railroad activity. The railroad activity estimated for Action Alternative A is higher than that for the No Action Alternative because of the additional capacity associated with the new tracks. The increase in railroad activity associated with Action Alternative A would lead to higher diesel particulate matter emissions (a component of MSAT) in the Regional Study Area. The higher emissions could be offset somewhat by two factors: the decrease in regional truck and commuter traffic due to increased use of railroad service for inbound and outbound commuters, and increased speeds on area highways due to the decrease in traffic. The additional railroad activity as part of Action Alternative A would have the effect of increasing diesel emissions in the vicinity of nearby homes, parks, and businesses; therefore, in Action Alternative A, there may be localized areas where ambient concentrations of MSAT would be higher than in the No Action Alternative.

Emissions would likely be lower than present levels in the design year due to EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050.[17] Local conditions may differ from these national projections in terms of fleet mix and turnover, vehicle miles traveled (VMT) growth rates, and local control measures. However, the EPA-projected reductions would be major (even after accounting for VMT growth) that MSAT emissions in the Local Study Area would likely to be lower in the future as well.

Action Alternative A in the design year could be associated with higher levels of MSAT emissions in the Local Study Area, relative to the No Action Alternative, along with some benefit from improvements in railroad speeds and reductions in region-wide motor vehicle traffic. There also could be slightly higher differences in MSAT levels in Action Alternative A in a few localized areas where railroad activity occurs

[17] U.S. Department of Transportation, Federal Highway Administration. October 18, 2016. Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Accessed from https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/. Accessed June 6, 2018.

closer to homes, parks, and businesses. However, MSAT levels would likely to decrease over time due to nationally mandated cleaner vehicles and fuels.

7.3.3. Action Alternative B

The air quality and GHG impacts of the operation of Action Alternative B would be the same as Action Alternative A. Action Alternative B would have minor adverse impacts on direct local emissions based on the short durations of pollutant exposure associated with moving locomotives. Action Alternative B would have minor adverse impacts on direct regional emissions based on the increased emissions, rail service, and capacity created by the Project. Emissions from Action Alternative B would be well below the *de miminis* thresholds.

7.4. Temporary Effects

This section considers the direct and indirect temporary impacts of the Action Alternatives during construction, based on the conceptual engineering design.

7.4.1. No Action Alternative

The No Action Alternative would result in emissions related to the construction of other projects such as the addition of a fourth track from AF to RO Interlockings in Virginia, the addition of a fourth track from L'Enfant (LE) to Virginia (VA) Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project. Since these projects and the associated construction would be outside this project's Study Area, there is no need to assess potential construction emissions impacts for the No Action Alternative. The emissions related to the construction of these projects and any other large capital projects would be assessed and any required mitigation would be determined within the context of each project. As discussed in the following sections, the emissions related to the construction would typically be temporary in nature.

7.4.2. Action Alternative A

The Action Alternative A is anticipated to have minor temporary direct adverse impacts on local and regional emissions based on the short duration of pollutant exposure associated with the temporary nature of the Project's construction activities. The Project would result in temporary effects on air quality and GHG emissions due to the various emission sources associated with construction. Pollutant emissions during construction occur because of emissions from on-site diesel equipment, increased truck traffic to and from the construction site on local roadways, and fugitive dust. **Section 1.5, Construction Methods**, details the construction methods and activities for Action Alternative A, including information on construction sequence, duration, equipment used, and staging. Construction activities primarily include track construction throughout the corridor, bridge construction at abutments, bridge construction over the Potomac River, and pier and decking construction at Maryland Avenue SW. The estimated construction duration for Action Alternative A was determined based on the allowable work hours, restricted access, site complexities, and work sequence. The estimated duration is 60 months.

The air quality review of the Temporary Effects included estimating emissions generated by the various construction sources. Emission factors for the various emission sources were determined using a combination of EPA's Non-Road, MOVES2014a, and AP-42 models, where appropriate. Using a

preliminary estimate of the construction schedule, working days and equipment information, an emissions inventory for the entire construction of Action Alternative A was created. As the *de minimis* criteria were based on emissions over one year, the peak construction emission year was determined to be Quarter 3 of 2022 to Quarter 2 of 2023. **Table 7-4** shows the emissions during this peak year by the construction activities occurring throughout the year. In the peak year of Action Alternative A construction, CO emissions were estimated to be 13.4 tons per year, NOx emissions to be 26.9 tons per year, VOC emissions to be 4.5 tons per year, PM10 emissions to be 0.5 tons per year, PM2.5 emissions to be 0.5 tons per year and GHG to be 14,055 metric tons per year. The table also shows the *de minimis* thresholds (tons per year) associated with each of the pollutants. As presented in **Table 7-4**, it is unlikely that the *de minimis* thresholds would be exceeded based on the preliminary construction schedule and equipment. As such, no major adverse effects would be expected during the construction of Action Alternative A and a General Conformity determination is not required.

7.4.1. Action Alternative B

The Action Alternative B is anticipated to have minor temporary direct adverse impacts on local and regional emissions based on the short duration of pollutant exposure associated with the temporary nature of the Project's construction activities. The estimated duration for construction of Action Alternative B is 99 months. While all other work is the same as Action Alternative A, the replacement of the existing bridge over GWMP and the replacement of the existing Long Bridge would lengthen the construction schedule for Action Alternative B. An analysis of the emissions occurring during the construction of Action Alternative B found that the peak year emissions would be similar to that of Action Alternative A, occurring from Quarter 3 of 2022 to Quarter 2 of 2023. As the peak year emissions for Action Alternative B would be similar to those presented in **Table 7-5**, construction of Action Alternative B would not exceed the *de minimis* thresholds and General Conformity determination is not required. As such, minor temporary impacts would be expected during the construction of Action Alternative B.

The construction duration of Action Alternative B is estimated to nearly double the duration of Action Alternative A. As such, pollutant emissions would extend for a longer period of time than construction of Action Alternative A. Although the peak year emissions of Action Alternative B would be similar to Action Alternative A, the construction evaluation shows that the additional construction activities would cause Action Alternative B to result in approximately 1.6 times the total pollutant emissions of Action Alternative A throughout the entire construction schedule. As peak year emissions for Action Alternative B would be similar to Action Alternative A, emissions would not exceed the *de minimis* thresholds. As such, the construction of Action Alternative B would not cause major adverse impacts and would not require a General Conformity determination.

Table 7-4 | Action Alternative A Peak Year Emissions Inventory

Construction Activity	CO Tons/yr	NOx Tons/yr	VOC Tons/yr	PM10 Tons/yr	PM2.5 Tons/yr	CO2 Metric Tons/yr
Trackwork	2.834	2.814	0.326	0.043	0.042	876
Demolition	0.042	0.085	0.011	0.003	0.003	28
Place Parapet	0.026	0.035	0.006	0.002	0.002	12
Place Deck	0.077	0.037	0.007	0.002	0.002	13
Install Steel Deck	0.243	0.467	0.070	0.007	0.007	209
Form Deck	0.143	0.060	0.024	0.001	0.001	67
Dryrun	0.006	0.002	0.001	0.000	0.000	3
Through Girders	0.315	0.606	0.091	0.009	0.009	271
Deck Girders	0.158	0.303	0.046	0.004	0.004	135
Deck Rebar	0.013	0.113	0.016	0.002	0.002	49
Waterproof	0.084	0.029	0.013	0.001	0.001	36
Parapet Rebar	0.003	0.024	0.003	0.000	0.000	10
Form Crew	1.525	0.532	0.234	0.012	0.012	658
Backfill	0.447	2.752	0.301	0.036	0.035	963
Excavation	0.228	0.466	0.061	0.018	0.018	155
Land Soe	0.161	0.561	0.118	0.014	0.014	352
Land Pile Drive	0.217	0.754	0.163	0.019	0.019	486
Retaining Wall	0.247	1.647	0.173	0.022	0.021	542
Traffic	0.370	2.470	0.259	0.033	0.032	813
Access	0.041	0.274	0.029	0.004	0.004	90
Cofferdam	1.203	3.525	0.745	0.070	0.068	2,496
Water Piles	0.688	2.005	0.430	0.040	0.039	1,442
Pier Formwork	3.183	3.051	0.827	0.047	0.045	2,818
Tremmie Pours	0.561	0.826	0.138	0.033	0.032	328
Pier Excavation/Backfill	0.559	3.440	0.376	0.045	0.044	1,203
Peak Year Total Emissions	13.370	26.878	4.469	0.467	0.453	14,055
De Minimis Threshold	*100*	*100*	*50*	*100*	*100*	-

Source: VHB, 2018

Table 7-5 | Action Alternative B Peak Year Emissions Inventory

Construction Activity	CO Tons/yr	NOx Tons/yr	VOC Tons/yr	PM10 Tons/yr	PM2.5 Tons/yr	CO2 Metric Tons/yr
Trackwork	4.534	4.502	0.521	0.068	0.067	1,401
Demolition	0.067	0.136	0.017	0.004	0.004	44
Place Parapet	0.041	0.056	0.009	0.003	0.003	19
Place Deck	0.123	0.059	0.011	0.003	0.003	20
Install Steel Deck	0.388	0.747	0.112	0.011	0.011	334
Form Deck	0.228	0.096	0.038	0.001	0.001	107
Dryrun	0.009	0.003	0.001	0.000	0.000	4
Through Girders	0.504	0.969	0.145	0.014	0.014	433
Deck Girders	0.252	0.484	0.073	0.006	0.006	216
Deck Rebar	0.020	0.180	0.025	0.003	0.003	78
Waterproof	0.134	0.046	0.020	0.001	0.001	57
Parapet Rebar	0.004	0.038	0.004	0.000	0.000	16
Form Crew	2.440	0.851	0.374	0.019	0.019	1,052
Backfill	0.715	4.403	0.481	0.057	0.056	1,540
Excavation	0.364	0.745	0.097	0.028	0.028	248
Land Soe	0.257	0.897	0.188	0.022	0.022	563
Land Pile Drive	0.347	1.206	0.260	0.030	0.030	777
Retaining Wall	0.3952	2.635	0.276	0.035	0.033	867.2
Traffic	0.592	3.952	0.414	0.052	0.051	1,300
Access	0.065	0.438	0.046	0.006	0.006	144
Cofferdam	1.924	5.640	1.19	0.112	0.108	3,993
Water Piles	1.100	3.20	0.688	0.064	0.062	2,307
Pier Formwork	5.092	4.881	1.323	0.075	0.072	4,508
Tremmie Pours	0.897	1.321	0.220	0.052	0.051	524
Pier Excavation/Backfill	0.894	5.504	0.6016	0.072	0.070	1,924
Peak Year Total Emissions	21.398	43.004	7.148	0.747	0.729	22,488
De Minimis Threshold	*100*	*100*	*50*	*100*	*100*	-

Source: VHB, 2018

7.1. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the impacts to air quality. The Project would cause minor air quality impacts during operations. The Project will meet all applicable air quality laws and regulations.

Although no major adverse impacts would be anticipated during construction for either Action Alternative, measures would be taken to reduce pollutant emissions during construction in accordance with all applicable laws and regulations. These include dust suppression measures, idling restrictions, and the use of Ultra Low Sulfur Diesel (ULSD). More specifically this would include, but not be limited to, maintenance of all motor vehicles, machinery, and equipment associated with construction activities and proper fitting of equipment with mufflers or other regulatory-required emissions control devices. The excessive idling of construction equipment engines would also be prohibited. Typical methods of reducing idling include driver training, periodic inspections by site supervisors, and posting signage.

The Project proponent would enforce the District's and Virginia's anti-idling laws during all construction phases of the Project. The Project construction in the District would comply with the District's anti-idling regulation at in 20 DCMR 900 limiting non-road engine idling to 3 minutes. Construction components in Virginia would comply with 9 VAC 5-40-5670 limiting motor vehicle idling to 3 minutes unless providing auxiliary power for purposes other than heating or air conditioning. Idling restriction signs would be placed on the premises to remind drivers and construction personnel of the idling regulations.

Construction contractors would be required to utilize ULSD fuel for all off-road construction vehicles as an additional measure to reduce air emissions from construction activities. The Project proponent would require that any non-road diesel equipment rated 50 horsepower or greater meet EPA's Tier 4 emission limits or be retrofitted with appropriate emission reduction equipment. Emission reduction equipment could include EPA-verified or California Air Resources Board-verified diesel oxidation catalysts or diesel particulate filters.

The contractors would be required to implement protective measures around the construction and demolition work to protect pedestrians and prevent dust and debris from leaving the site or entering the surrounding community in accordance with 20 DCMR 605. Appropriate methods of dust control would be determined by the surfaces affected (such as roadways or disturbed areas) and would include, as necessary, the application of water, the use of stone in construction roads, and vegetative cover. Dust generated from earthwork and other construction activities, such as stockpiled soils, would be controlled by spraying with water to mitigate wind erosion on open soil areas. Other dust suppression methods, such as wheel washing, may be implemented to minimize the off-site transport of dust. Regular sweeping of the pavement of adjacent roadway surfaces may be required during the construction period to minimize the potential for vehicular traffic to create airborne dust and particulate matter. Another way to reduce air quality impacts is to recycle construction waste and demolition materials.

8.0 Energy

8.1. Introduction

This section defines the energy resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. This section describes the analysis of the No Action Alternative and each Action Alternative and their potential construction and permanent or long-term impacts on energy resources. This section also discusses proposed avoidance, minimization, and mitigation measures to limit potential impacts of the Project to energy resources.

Energy resources, as discussed in this chapter, refer to energy end use, or consumption. Energy use is divided into operational and construction energy consumption. Energy sources considered include electricity and other fuels as applicable, such as natural gas, gasoline, diesel fuel, and propane.

Operational energy consumption, for this Project, is a function of the following:

- The energy used by the bridge itself including lighting, signals, transportation sensors, communications equipment, and any other energy-consuming stationary equipment located on the bridge;
- The energy consumed in equipment used for bridge and track maintenance; and
- The energy consumed by the trains running over the bridge.

Construction energy consumption consists of one-time or temporary energy use associated with the construction of the physical infrastructure associated with the Project. The energy consumption considered includes electricity and other fuel use related to construction vehicles, construction equipment, mobile generators, and any temporary structures used on the construction site.

8.2. Regulatory Context and Methodology

This section describes the regulatory context for evaluation of impacts to energy resources, as well as the methodology used to evaluate current conditions and the probable consequences of the alternatives. The *Methodology Report* provides the complete list of laws, regulations, and other guidance considered and a full description of the analysis methodology followed for these resources**.**

8.2.1. Regulatory Context

The Federal Railroad Administration *Procedures for Considering Environmental Impacts* require that the evaluation of impacts consider use of energy resources.[1] In addition, a number of policies, programs, and local guidance documents outline goals and objectives for reduced energy consumption throughout the built environment and transportation sectors. At the Federal, state, and local levels, these policies and guidance documents articulate the need to reduce dependence on foreign oil and increase energy efficiency with the benefits of reduced costs, improved air quality, and reduced greenhouse gas (GHG)

[1] 64 FR 28550

emissions. These documents include Executive Order 13783, *Promoting Energy Independence and Economic Growth*;[2] EO 13834, *Efficient Federal Operations*,[3] the *Sustainable DC Plan*;[4] the *Virginia Energy Plan*;[5] and the Arlington County *Community Energy Plan*.[6] The District also has an engine anti-idling law.[7]

8.2.2. Methodology

The Local Study Area for energy resources includes the footprint of the Project Area and any staging or transport areas for construction within the vicinity of the Project Area.

A Regional Study Area is not warranted for the analysis of the energy resource area for this project. The Project do not have implications either currently or into the future for the No Action or Action Alternatives for the regional energy grid as a whole. Energy use outside of fuel consumption in trains is negligible for this Project and does not and will not place any substantial demands on the local or regional grid.

The analysis assessed energy resources used on the existing Long Bridge and the magnitude of the consumption of energy resources on the bridge to describe the existing 2017 direct energy use profile. The assumptions on the energy consumption of the existing bridge were based on estimates of the energy consuming equipment at each of the three interlockings involved in the Project and bridge, which include a small amount of lighting and signal equipment—such as those contained in signal bridges, central instrument houses, and location houses—but consume very little energy. The impact analysis assessed energy consumption for direct, indirect, and construction impacts for each Alternative. The analysis established a profile of direct energy use for the No Action Alternative and for each Alternative, for the year 2040, by which time the Action Alternatives would be in operation. In particular, energy use was calculated for trains during operation in the area of the bridge, construction equipment using the same data as **Section 7.0, Air Quality and Greenhouse Gas Emissions**, anticipated upgrades to on-bridge lighting and signaling equipment, and anticipated additions of lighting and maintenance associated with the bike-pedestrian crossing under the Proposed Action Alternatives. These analyses were conducted based on reasonable assumptions and anticipations, as precise data is not available for quantification of energy consumed for these features.

[2] 82 FR 16093

[3] 83 FR 23771

[4] District Department of Energy and Environment; District Office of Planning; and Office of the Mayor. *The Sustainable DC Plan*. 2016. Accessed from http://www.sustainabledc.org/wp-content/uploads/2017/03/SDC_Plan_2016_compressed2.pdf. Accessed June 8, 2017.

[5] Department of Mines, Minerals, and Energy, Commonwealth of Virginia. *The Virginia Energy Plan*. October 1, 2014. Accessed from https://www.dmme.virginia.gov/DE/2014_VirginiaEnergyPlan2.shtml. Accessed May 16, 2018.

[6] Arlington County. *Community Energy Plan*. 2013. Accessed from https://environment.arlingtonva.us/energy/community-energy-plan-cep/.
Accessed June 8, 2017.

[7] Washington, D.C. *Onroad Engine Idling and Nonroad Diesel Engine Idling*. 2015. Accessed from https://dcregs.dc.gov/Common/DCMR/SectionList.aspx?SectionId=7740. Accessed October 19, 2018.

Figure 8-1 | Energy Resources Local Study Area

The primary source used to estimate energy consumption of the trains is the Bureau of Transportation Statistics – Energy Intensity of Class I Railroad Freight Service and Energy Intensity of Amtrak Services[8] and Oak Ridge National Laboratory Transportation Energy Data Book.[9] The GHG emissions impact of the energy consumed by the trains and construction equipment is addressed in **Section 7.0, Air Quality and Greenhouse Gas Emissions**.

8.3. Permanent or Long-Term Effects

This section discusses any permanent or long-term impacts resulting from the No Action Alternative, Action Alternative A, and Action Alternative B on energy consumption within the Local Study Area.

8.3.1. No Action Alternative

The No Action Alternative would have negligible permanent direct adverse on energy consumption in the existing Long Bridge Corridor, and minor adverse direct impacts to train operations. The No Action Alternative would maintain the existing Long Bridge Corridor, which consumes negligible energy for bridge lighting, signals, and other sensors and communication equipment. Precise energy data is not available for such equipment, but energy use of existing on-bridge equipment is estimated to be 1,420 million British Thermal Units (MMBtu) annually. Under the No Action Alternative, it is assumed that this amount would not change

Energy would also be consumed in the vehicles and equipment used for ongoing maintenance of the bridge and railroad tracks. Some level of reduction in fuel consumption over time is likely to occur as equipment efficiency is incrementally improved. Some reduction would also occur as lighting and signal equipment is replaced with newer, more efficient equipment.

The most substantial source of energy consumption resulting from this project is the trains operating in the Corridor. It is assumed that the bridge owner (CSX Transportation) would run an additional 36 trains compared to existing volumes (112 compared to 76 trains), based on continuing growth in demand for freight service, consuming an anticipated additional 48,487 MMBtu of energy (31,449 MMBtu compared to 79,935 MMBtu) or 352,936 gallons of diesel every year (**Table 8-1**). Under the No Action Alternative, it is possible that with the addition of the trains in the Corridor, under increased congestion conditions, more fuel would be consumed by the trains as they are not able to efficiently move through the Corridor. The additional trips and congestion would regionally increase demand for diesel energy. However, given the hundreds of billions of gallons of fuel consumed annually nationwide, this is a negligible amount, as these resources are not in short supply and are considered readily available. Also, it is assumed that more energy efficient trains and equipment would come on line in the future. As a result, the use of these resources is not expected to result in an adverse effect upon their continued availability. Alternatively, the increased congestion could shift freight from trains to trucks, increasing energy use by up to four times.[10]

[8] "Section 4.C – Transportation Energy Intensity and Fuel Efficiency," Bureau of Transportation Statistics. https://www.bts.gov/topics/
national-transportation-statistics. Accessed August 17, 2018.
[9] Oak Ridge National Laboratory. *Transportation Energy Data Book: Edition 36.2 2018*. Accessed from https://cta.ornl.gov/data/tedbfiles/Edition36_Chapter02.pdf. Accessed October 18, 2018.
[10] CSX. Fuel Efficiency. Accessed from https://www.csx.com/index.cfm/about-us/the-csx-advantage/fuel-efficiency/. Accessed October 18, 2018.

Table 8-1 | Alternatives Energy Consumption Summary Table

	Anticipated Annual Energy Consumption (estimated trillions of Btus)		
Energy Source	**No Action Alternative**	**Action Alternative A**	**Action Alternative B**
On-Bridge Equipment	0.0014	0.0027	0.0027
Trains	0.0799	0.1079	0.1079
Construction (Most Intensive Year)	n/a	0.0732	0.1079

8.3.2. Action Alternative A

Action Alternative A would have minor permanent direct adverse impacts on energy consumption. Action Alternative A would add a new two-track bridge and expand the existing Corridor to four tracks. Energy consumed by bridge lighting, signals, and other sensors or communication equipment would continue to be negligible. The total energy consumed by this new equipment is anticipated to be 2,713 MMBtu annually, a 1,293 MMBtu increase over the No Action Alternative (**Table 8-1**). Given that national rail operations consume over 500 trillion Btu annually (based on the most recent 2015 data),[11] and the District consumes 174 trillion Btu of energy, including 21 trillion Btu for the transportation sector every year (based on the most recent 2016 data),[12] the additional energy demand generated by the new bridge can be accommodated by the energy grid and fuel supplies (**Table 8-2**).

Table 8-2 | District Energy Consumption Summary Table

Source	Annual Energy Consumption (trillions of Btu)
District – All Sources	174
District – Transportation Sector	21

Energy also would be consumed in the vehicles and equipment used for ongoing maintenance of the bridges and rail tracks. While it is not possible to precisely quantify the amount of fuel required to operate this equipment, based on estimates, it is assumed that this fuel consumption would be approximately doubled for Action Alternative A compared to the No Action Alternative, since there would be two railroad bridges to be maintained within the Project Area. As with the on-bridge equipment, the additional fuel demand generated by the new vehicles can be accommodated by available fuel supplies, resulting in a negligible impact.

[11] Oak Ridge National Laboratory. *Transportation Energy Data Book: Edition 36.2 2018*. Accessed from https://cta.ornl.gov/data/tedbfiles/Edition36_Chapter09.pdf. Accessed October 18, 2018.
[12] U.S. Energy Information Administration. Table C1. Energy Consumption Overview: Estimates by Energy Source and End-Use Sector, 2016. 2016. Accessed from https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_sum/html/sum_btu_1.html&sid=US. Accessed October 18, 2018.

The most substantial source of energy consumption resulting from Action Alternative A is the trains operating in the Corridor. The Project includes additional tracks through the Corridor that would enable railroad operators to increase operations and run additional passenger and freight trains as described in **Section 1.4.6, Train Volume Operations**. It is estimated that under Action Alternative A, 192 trains would move through the Project area, consuming 107,863 MMBtu per year, compared to 112 trains consuming 79,935 MMBtu under the No Action alternative (**Table 8-1**). This difference represents 203,430 gallons of diesel. Therefore, the additional 80 additional trips (compared to the No Action Alternative) would regionally increase demand for diesel energy. However, given the hundreds of billions of gallons of fuel consumed annually nationwide, this is a negligible amount, as these resources are not in short supply and are considered readily available. As a result, the use of these resources is not expected to result in an adverse effect upon their continued availability. Further, the additional tracks would reduce idling time for trains waiting, thereby increasing efficiency and reducing the per train diesel energy demand.

8.3.3. Action Alternative B

Action Alternative B would add a new two-track bridge and expand the existing Corridor to four tracks. Because the on-bridge equipment and train operations would be the same between both Action Alternatives, the permanent or long-term energy consumption effects from Action Alternative B would be minor, the same as for Action Alternative A. .

8.4. Temporary Effects

This section discusses the temporary effects to energy consumption as a result of construction activities that have the potential to impact the Local Study Area for the No Action Alternative, Action Alternative A, or Action Alternative B.

8.4.1. No Action Alternative

The No Action Alternative would result in energy usage related to the construction of other projects such as the addition of a fourth track from AF to RO Interlockings in Virginia, the addition of a fourth track from L'Enfant (LE) to Virginia (VA) Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project. The energy use related to the construction of these projects and any other large capital projects would be assessed and any required mitigation would be determined within the context of each project. While it is not possible to develop a quantitative estimate of energy usage, it is likely to include energy consumed by vehicles and equipment during construction.

8.4.2. Action Alternative A

Action Alternative A would have negligible temporary direct adverse impacts to energy due to construction. Temporary effects for Action Alternative A related to energy include the energy consumed by vehicles and equipment during construction. Action Alternative A would require a significant number of trucks and other equipment that consume fuel throughout the course of their operation, most likely in the form of diesel fuel. At this level of design, the precise number of vehicle trips, distance traveled, or hours of operation have not yet been determined, but fuel usage can be estimated based on the construction data estimates in **Section 7.0, Air Quality and Greenhouse Gas Emissions**. Those construction fuel usage estimates (gas and diesel) were converted to MMBtu using standard conversion

factors and summed to estimate energy consumption from construction equipment. It is anticipated that energy consumption from construction vehicles and equipment would occur at varying levels throughout the 60-month construction duration for Action Alternative A. In total, it is estimated that construction equipment total energy use would be 184,799 MMBtu over the course of the entire construction period and 73,167 MMBtu during the most energy intensive construction year. These figures represent negligible amounts considering that the District consumes 174 trillion Btu annually (based on the most recent 2016 numbers), and the railroad sector consumes over 500 trillion Btu of energy annually (based on the most recent 2015 numbers), as shown in **Table 8-2 and** Error! Reference source not found..

8.4.3. Action Alternative B

Temporary effects for Action Alternative B related to energy include the energy consumed by vehicles and equipment during construction. The temporary energy consumption effects from Action Alternative B would be the same as for Action Alternative A for the most intensive energy consumption year because the activities would be equivalent under both Action Alternatives. it is estimated that Action Alternative B construction equipment total energy use would be 306,495 MMBtu over the course of the entire 8 years and 3 months long construction period. These figures represent negligible amounts considering that the District consumes 174 trillion Btu annually (based on the most recent 2016 numbers), and the railroad sector consumes over 500 trillion Btu of energy annually (based on the most recent 2015 numbers).

8.5. Avoidance, Minimization, and Mitigation

Use of energy efficient technologies wherever feasible would reduce energy use in the ongoing operations of Long Bridge. These technologies and anticipated continued improvements in energy efficiency would reduce energy use, normalized per piece of equipment or train mile traveled. These reductions would be associated with on-bridge equipment (for example, lighting), maintenance equipment, construction equipment, and trains, due to adoption of technologies such as LED lights and higher efficiency engines. These efficiency improvements are anticipated to (partially) offset any energy consumption increases from the Project

Temporary impacts during construction would primarily result from fuel consumed in vehicles and equipment. Construction staging and access areas have been strategically planned to minimize the distance traveled by construction vehicles or trucks hauling materials to or from the site. In addition, construction plans would emphasize minimizing, to the greatest extent possible, vehicle idling times in accordance with the District's anti-idling law. While some vehicles and equipment, such as cement mixers, may require ongoing engine use and are therefore exempt from the law, other applicable vehicles should adhere to this policy. The policy also would encourage contractors to use fuel efficient or alternative fuel vehicles to the greatest extent feasible. The Project would consider Solar-powered generators as an alternative to diesel generators wherever feasible.

9.0 Land Use and Property

9.1. Overview

This section defines the land use and property resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. This section describes the analysis of the No Action and each Action Alternative and their potential construction and permanent or long-term impacts on land use and property. Proposed avoidance, minimization, and mitigation measures to reduce potential adverse impacts of the Project on land use and property are also provided.

The land use and property analysis considers the land uses, development trends, and property that may be affected by the Project, and determines whether the Project is compatible with those conditions or may affect them. The analysis also considers the Project's consistency with, and effect on, the area's zoning and land use plans.

Land Use is characterized by the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change, or maintain it.[1] Examples of typical land uses include residential and commercial development, transportation, resource management, and agricultural lands.

Zoning is the legal method by which municipalities define what land uses are allowed on a given parcel of land and the physical restrictions, such as bulk, height, or setbacks, for development on that parcel.

9.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluating impacts to land use and property, as well as the methodology used to evaluate current conditions and probable consequences of the alternatives. The complete list of laws, regulations, and other guidance, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

9.2.1. Regulatory Context

A combination of Federal, state, and local regulations and policies govern the use of land and property within the Project area. The Federal Land Policy and Management Act of 1976 establishes principles and procedures for the administration of public lands.[2] Federal sites fall under jurisdiction of the appropriate managing Federal entities, including the National Park Service (NPS), the United States Department of Defense (DOD), and the National Capital Planning Commission (NCPC). Planning guidance for Federally owned land is provided by the following plans:

- NCPC *Comprehensive Plan for the National Capital – Federal Elements* (2016)[3]

[1] Natural Resources Management and Environment Department. Undated. Land Cover Classification System (LCCS). Accessed from http://www.fao.org/docrep/003/X0596E/x0596e01e.htm. Accessed May 3, 2018.
[2] 43 USC 1701
[3] NCPC. 2016. *Comprehensive Plan for the National Capital-Federal Elements*. Accessed from https://www.ncpc.gov/plans/compplan/. Accessed May 10, 2018.

- NCPC *SW Ecodistrict Plan* (2013)[4]
- NCPC *Monumental Core Framework Plan* (2009)[5]
- NCPC *Legacy Plan* (1997)[6]
- NPS *National Mall Plan* (2010)[7]NPS *National Mall and Memorial Parks Foundation Document* (2017)[8]
- NPS *George Washington Memorial Parkway Foundation Document* (2014)[9]
- NCPC *Memorials and Museums Master Plan* (2001)[10]

Federal regulations, such as those under the National Environmental Policy Act of 1969, also direct that possible conflicts and inconsistencies with Federal, regional, state, and local land use plans, policies, and controls be examined.

The Project Local Study Area for land use and property includes Federal, state, and local lands. The Project has the potential to impact land under Federal, Arlington County, and District of Columbia (District) control. Local land use policies and plans guide land use in the District and Arlington County under the District's Zoning Regulations of 2016[11] and the Arlington County Zoning Ordinance (2017);[12] local zoning controls do not apply to Federal properties. Changes to zoning controls would require review and approval of local governing bodies. Properties or businesses may also be impacted by the Project, requiring displacement or relocation according to both local and Federal laws. At the Federal level, the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 establishes minimum standards for acquiring properties for Federally funded programs and projects.[13]

Additional planning guidance for non-Federal land in the Arlington County portion of the Local Study Area is provided by the *Arlington County General Land Use Plan* (amended 2017),[14] the *Crystal City Sector Plan* (2010),[15] and the *Pentagon City Phased Development Site Plan* (2000). Planning guidance for non-Federal land in the District is provided by the *District Elements of the Comprehensive Plan for the*

[4] NCPC. 2013. *Southwest Ecodistrict Plan*. Accessed from https://www.ncpc.gov/initiatives/swecodistrict/. Accessed January 12, 2018.
[5] NCPC. 2009. *Monumental Core Framework Plan*. Accessed from https://www.ncpc.gov/plans/framework/. Accessed January 12, 2018.
[6] NCPC. 1997. Legacy Plan. Accessed from https://www.ncpc.gov/plans/legacy/. Accessed May 23, 2019.
[7] NPS. 2010. *National Mall Plan*. Accessed from https://www.nps.gov/nationalmallplan/National%20Mall%20Plan.html. Accessed January 12, 2018.
[8] NPS. 2017. National Mall and Memorial Parks Foundation Document. Accessed from https://www.nps.gov/nama/learn/management/upload/NAMA_FD_SP2.pdf. Accessed May 15, 2019.
[9] NPS. 2014. *George Washington Memorial Parkway Foundation Document*.
[10] NCPC. 2001. *Memorials and Museums Master Plan*. Accessed from https://www.ncpc.gov/plans/memorials/. Accessed January 12, 2018.
[11] DCMR 11
[12] Arlington County Zoning Ordinance. Accessed from https://building.arlingtonva.us/resource/zoning-ordinance/. Accessed January 12, 2018.
[13] 49 CFR 24
[14] Arlington County. 2017. *General Land Use Plan*. Accessed from https://projects.arlingtonva.us/plans-studies/general-land-use-plan/. Accessed January 12, 2018.
[15] Arlington County. 2010. *Crystal City Sector Plan*. Accessed from https://projects.arlingtonva.us/neighborhoods/crystal-city-development/crystal-city-sector-plan/. Accessed January 12, 2018.

National Capital (2006, amended 2011),[16] and by two small area plans for land near the Project Area: the *Maryland Avenue SW Small Area Plan* (2012)[17] and the *Southwest Neighborhood Small Area Plan* (2014).[18]

9.2.2. Methodology

The Local Study Area for land use and property includes the footprint of the Project Area and adjacent land in the surrounding area that has the potential to be affected by the Project. The Local Study Area was determined based on an initial 0.5-mile buffer surrounding the Project Area. However, the analysis of land use also considered some properties just outside the 0.5-mile buffer where land uses of local, regional, or national importance are present, or to document potentially sensitive land uses. The boundaries of this Local Study Area are shown in **Figure 9-1**, along with geographic points indicating the presence of potentially sensitive land uses. A Regional Study Area was not established for Land Use and Property, since land use and property impacts related to this resource are not likely to occur at a regional scale. However, land uses beyond the Local Study Area are considered generally to place the Local Study Area in context.

The environmental consequences analysis qualitatively assessed the impacts of each alternative on local land use, land use controls, comprehensive regional planning, and development within the Local Study Area by comparing the alternatives to existing land use planning and ownership information, as well as planned land use changes. Impacts were analyzed to determine if there would be any permanent changes to land use, consistent with the analysis framework and methodology presented in **Section 1.3, Framework for Evaluating Impacts**. The analysis assessed whether the Project's goals align with local and regional land use policies, goals, and objectives. The analysis also identified properties that would need to be acquired or relocated as a result of the Project.

Land use impacts from construction were evaluated based on whether any construction activities in the Local Study Area would cause temporary modifications or delays to existing or planned land uses in the Local Study Area. Any acquisition or extended use of property to facilitate construction activities (such as staging areas or temporary access roads) was identified based on the limits of construction staging.

Mitigation recommendations appropriate to the intensity and duration of the potential impacts were identified. Mitigation was developed in accordance with Federal guidelines and evaluated based on its effectiveness in mitigating the impacts of the alternatives.

[16] District of Columbia Office of Planning (DCOP). 2012. *Comprehensive Plan for the National Capital, District Elements*. Accessed from https://www.ncpc.gov/plans/compplan/. Accessed January 12, 2018.
[17] DCOP. Undated. *Maryland Avenue SW Small Area Plan*. Accessed from https://planning.dc.gov/publication/maryland-ave-small-area-plan. Accessed January 12, 2018.
[18] DCOP. Undated. *Southwest Neighborhood Small Area Plan*. Accessed from https://planning.dc.gov/publication/southwest-neighborhood-plan. Accessed January 12, 2018.

Figure 9-1 | Land Use Local Study Area

9.3. Permanent or Long-Term Effects

This section considers the direct and indirect impacts of the Action Alternatives and No Action Alternative, as described and illustrated in **Section 1.4, Alternatives**. For analyzing future land use, this analysis considered conditions in the year 2040, by which time the Action Alternatives would be completed. This analysis is consistent with the analysis framework and methodology established in **Section 1.3, Framework for Evaluating Impacts**.

9.3.1. Land Use

9.3.1.1. No Action Alternative

In the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative presumes that Long Bridge remains in service, with continued maintenance as necessary. The No Action Alternative also presumes that the Virginia Department of Rail and Public Transportation (DRPT) and VRE complete the other planned railroad projects that would expand capacity to four tracks on either side of the Long Bridge Corridor.

Without expanded capacity across the Potomac River, VRE and Amtrak would be unable to increase commuter and passenger railroad service in accordance with their plans.[19] In addition, Maryland Area Regional Commuter (MARC) would likely be unable to extend service to Northern Virginia. As travel demand between Maryland, the District, and Northern Virginia continues to grow, particularly with the selection of Crystal City as the site of Amazon's HQ2, the lack of railroad service would push travelers to other modes, increasing congestion on roadways and Metrorail. Eventually, this would have negative effects on the region's economy that could inhibit development and land use change, creating an adverse indirect effect. Locally, the No Action Alternative would have no direct effect on land uses within the Local Study Area.

9.3.1.2. Action Alternative A

Action Alternative A would cause minor permanent direct adverse impacts to land use through conversion of land to railroad use. Action Alternative A would also cause moderate permanent indirect adverse impacts to land use due to noise and visual effects.

In Arlington County, Action Alternative A would cause minor permanent direct adverse impacts to Long Bridge Park. This is due to the conversion of park land within Long Bridge Park to railroad use. The area is currently vegetated and serves as a buffer between the park and surrounding transportation infrastructure, including railroad and roadways. Sufficient land would remain to serve as a buffer between the park users and transportation infrastructure. Action Alternative A would cause moderate permanent direct adverse effects to the George Washington Memorial Parkway (GWMP) through the conversion of the landscaped area between the existing Long Bridge and Metrorail Bridge to railroad. The landscaping in this area currently screens this transportation infrastructure from the view of park users. The conversion of this land to railroad use would reduce the ability to screen these views. In

[19] While VRE and Amtrak would each be able to increase their service by two trains per day in the No Action Alternative, this is not consistent with their plans. VRE plans to run an additional 58 trains per day by 2040 and Amtrak (through DRPT's DC to Richmond High Speed Rail project) plans to add an additional 20 trains per day.

addition, moderate permanent indirect adverse impacts to land use in Long Bridge Park would occur as a result of noise. Noise impacts would result from the increase in train operations and addition of tracks closer to receptors. Noise impacts are described in greater detail in **Section 10, Noise and Vibration.**

In the District, Action Alternative A would cause minor adverse direct effects, with the greatest area of impact in the Monumental Core sub-area. Effects would include use of East and West Potomac Parks lands and reconfiguration of NPS Parking Lot C, including relocation of the parking lot entrance, but these effects would be relatively small and localized and would not affect the function of the land uses. Effects would also include loss of Washington Marina parking lot spaces and small impacts to properties along the railroad right-of-way; however, these impacts would not affect the function of the land uses. In addition, moderate adverse indirect effects to land use would occur as a result of noise impacts to both the existing Mandarin Oriental Hotel and the Portals V residential uses.

The sections below describe specific land use effects in greater detail by land use sub-area. The land use sub-areas are shown in **Figure 9-2**.

Arlington County

Crystal City and Long Bridge Park Sub-Area

Action Alternative A would have minor adverse direct impacts to land use in the Crystal City and Long Bridge Park sub-area, as the impacts would be relatively small and localized and would not affect the function of the land uses in the area. The tie-in to RO interlocking and construction of new track would take place within the existing railroad right-of-way. A retaining wall would be constructed within the railroad right-of-way at the north end of Long Bridge Park to minimize impacts, but a small portion of Arlington County property (approximately 0.04 to 0.14 acres) would be converted into railroad right-of-way to accommodate the construction, as shown in **Figure 9-3**. This land is currently forested and intended to serve as an edge and buffer zone for the next phase of park development, currently under construction. Conversion of the land would not alter the use or experience of planned park facilities at Long Bridge Park.

Moderate adverse indirect impacts to land use in Long Bridge Park would occur as a result of noise, due to the proximity of the tracks to park and the increased frequency of trains traveling the Corridor. The intensity of noise impacts would vary by location within the park, depending on the location. Noise impacts are described in greater detail in **Section 10.3, Noise and Vibration, Permanent or Long-Term Effects**.

Pentagon and Pentagon City Sub-Area

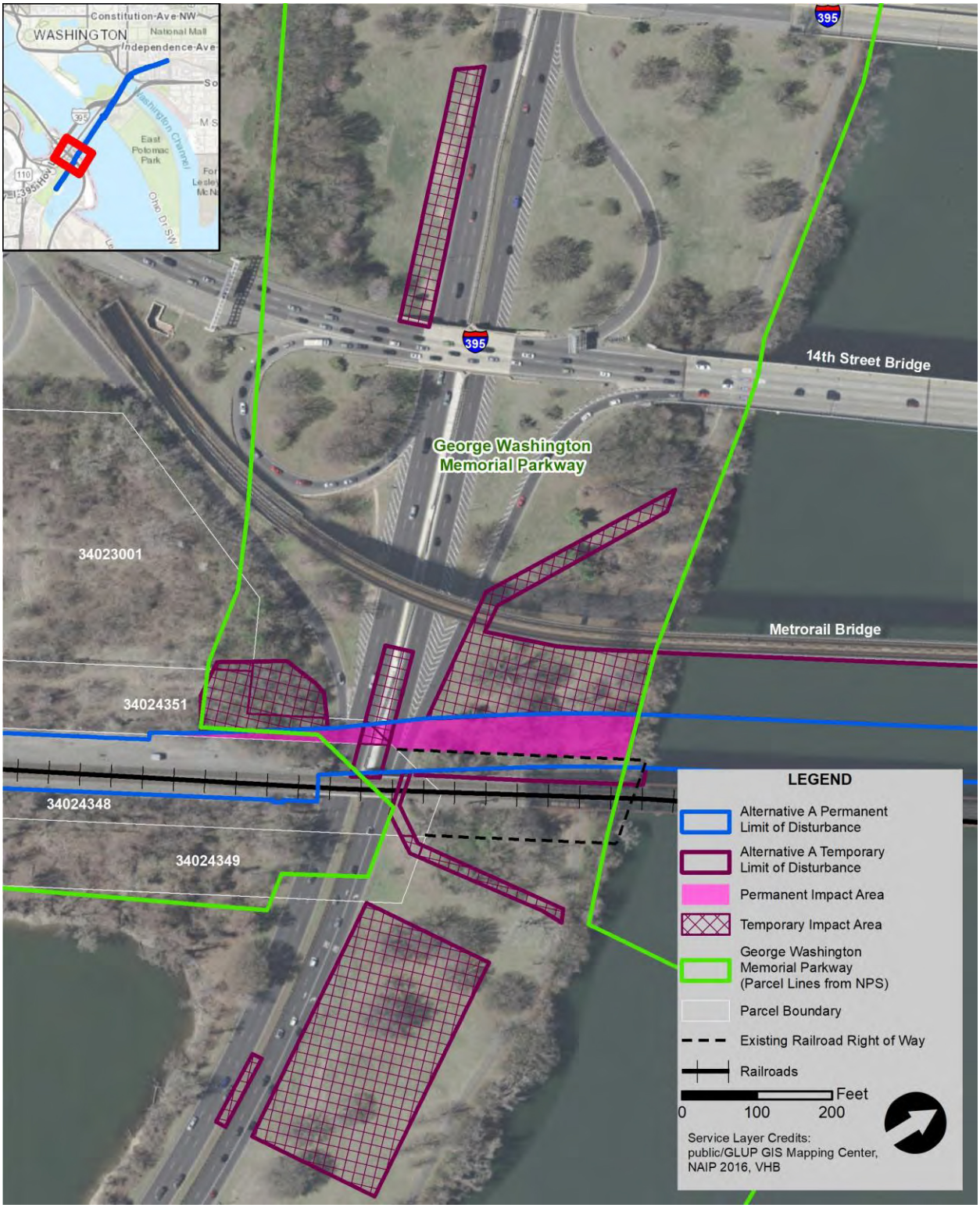
Action Alternative A would result in no permanent direct or indirect effects to land use in the Pentagon and Pentagon City portions of the Local Study Area.

Potomac Waterfront and East of Long Bridge Corridor Sub-Area

Action Alternative A would cause moderate adverse direct effects to the GWMP through the conversation to railroad use of the landscaped area between the existing Long Bridge and the Metrorail Bridge. The landscaping in this area currently screens this transportation infrastructure from the view of park users. The conversion of this land to railroad use would reduce the ability to screen these views.

Figure 9-2 | Land Use Sub-Areas

Figure 9-3 | Action Alternative A Land Use and Property Impacts - Long Bridge Park and GWMP



Action Alternative A would require constructing a new railroad bridge over the GWMP to the west of the existing alignment. The bridge structure would require placing piers on NPS property and would add a new overhead element within a section of parkland that is dominated by other bridges and automotive uses. Retaining walls would be required to support the two new tracks between the roadway and the Mount Vernon Trail (MVT). New piers would be constructed aligned with the piers of the existing bridge as the new structure crosses the MVT. As shown in **Figure 9-3**, these actions would require the use or acquisition of approximately 0.4 to 0.5 acres of the GWMP. The railroad corridor would bridge approximately 0.26 acres of the GWMP over the MVT and the GWMP roadway, requiring a transfer of air rights. Effects to land use are limited by the fact that there would be no permanent changes to the use of the MVT and the GWMP. Both the trail and the roadway would run underneath the proposed bridges and would continue to function as they do today.

District of Columbia

Monumental Core Sub-Area

Action Alternative A would result in minor adverse direct impacts to East and West Potomac Parks, as the impacts would be relatively small and localized and would not affect the use or function of the park. The new bridge over the Potomac River would pass through East Potomac Park, which is Federal land and part of the Monumental Core. This portion of the District receives special planning consideration as the heart of the historic capital. Action Alternative A would place piers and retaining walls outside of existing right-of-way as the railroad corridor crosses the park to accommodate the proposed new bridge and associated structures (**Figures 9-4 and 9-5**).

Action Alternative A would permanently alter a portion of existing NPS Parking Lot C, resulting in a loss of 50 of the existing 67 parking spaces and alterations to a turnaround area. The lot is not at capacity most of the year but is heavily utilized during peak holidays or events such as the National Cherry Blossom Festival. This lot is one of several in the immediate area, which together hold several hundred parking spaces. While NPS Parking Lot C would still be able to function as a parking lot, the entrance would need to be moved and redesign or restriping would be required to maintain the lot's functionality, representing a minor adverse direct impact on the use of this land. As the railroad corridor passes through East Potomac Park and crosses I-395, any corridor widening would shift to the east to avoid impacts to the ramp from the 14th Street Bridge to Maine Avenue. The existing embankment between I-395 and Ohio Drive SW, which has a number of mature trees that screen the railroad right-of-way, would be replaced with a retaining wall to minimize the area of land within the park that would require a transfer of jurisdiction. The new bridges over I-395 would require a wider span over I-395 and use of adjacent open space on both sides of I-395, representing a minor direct adverse effect because these changes would not impact any buildings and would not affect the use and function of I-395 or adjacent parcels.

In total, Action Alternative A would require the use of approximately 2.4 acres of Federal park property within East Potomac Park. However, the areas of impact would not affect the use of the park, no buildings or areas of active recreation would be impacted, and no full parcels would require a transfer of jurisdiction. Only the use of the existing NPS Parking Lot C would be affected by Action Alternative A. Therefore, direct adverse effects to land use within East Potomac Park would be minor overall.

Figure 9-4 | Action Alternative A Land Use and Property Impacts - East Potomac Park

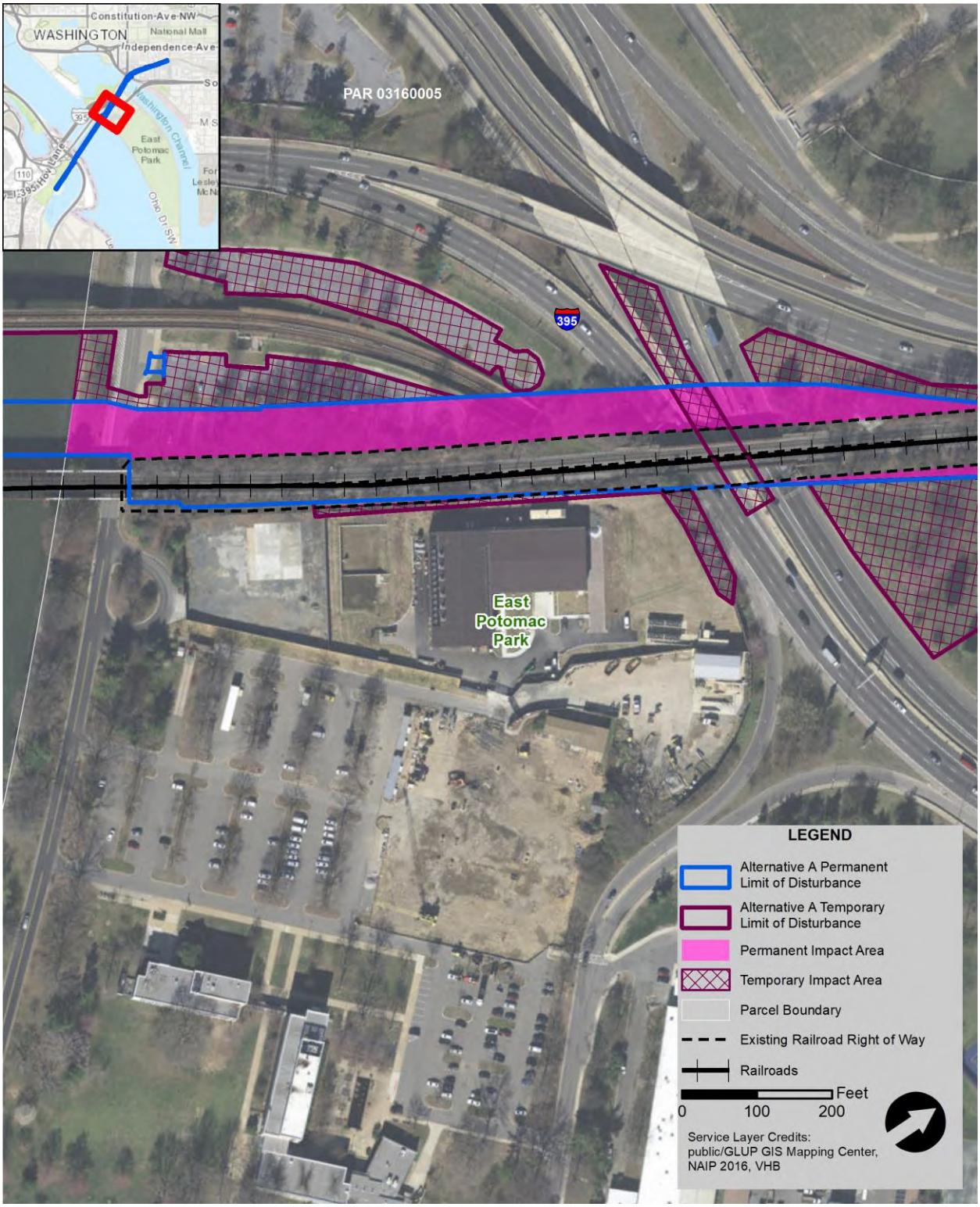
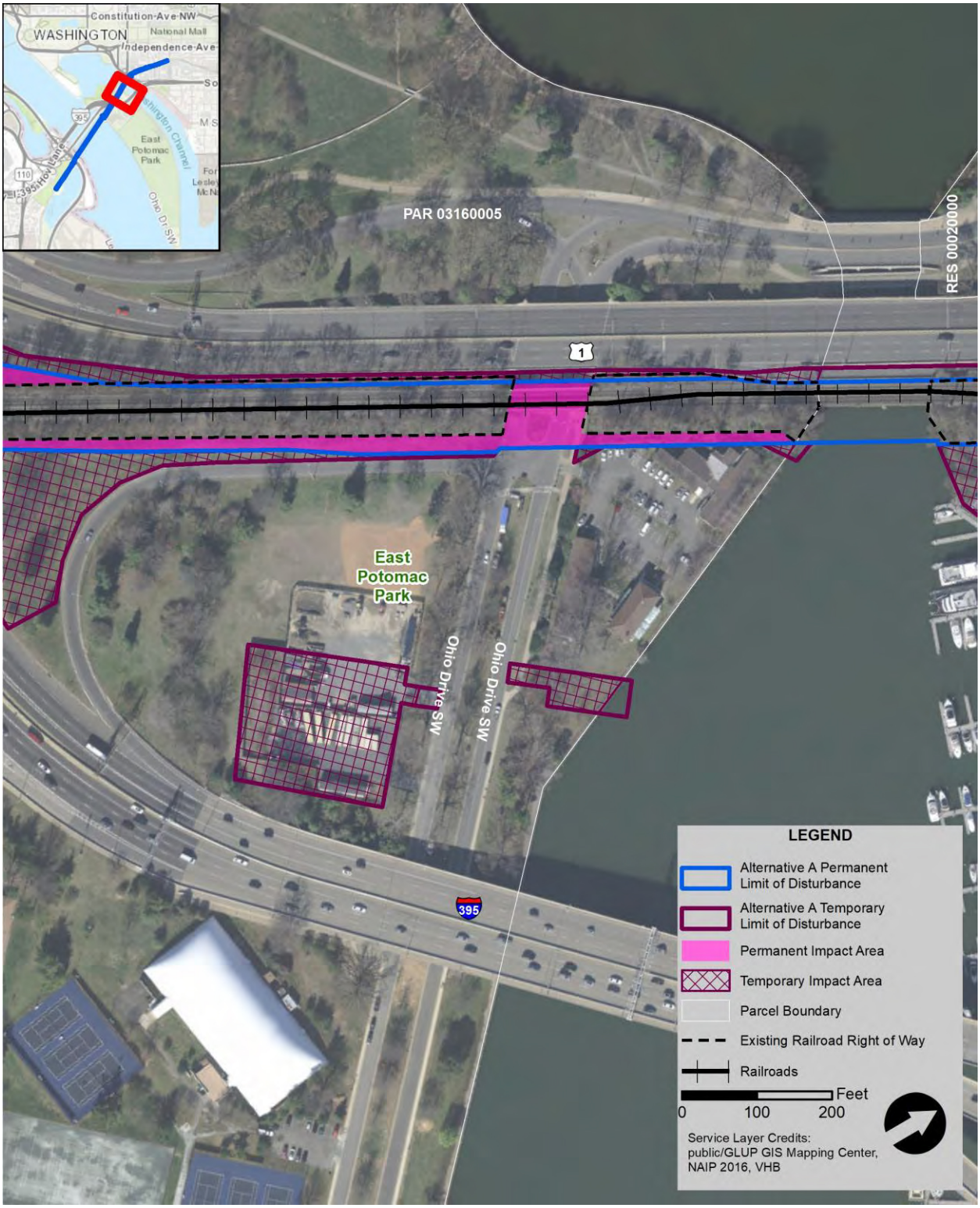


Figure 9-5 | Action Alternative A Land Use and Property Impacts - East Potomac Park to Washington Channel



L'Enfant Plaza North and South Sub-Area

Overall, Action Alternative A would have minor direct effects to land uses in the L'Enfant Plaza North and South Sub-Area. Action Alternative A would require the reconstruction of the pedestrian bridge that crosses Maine Avenue SW and provides access to the Mandarin Oriental Hotel. Because the access from the hotel to activities across Maine Avenue would be maintained, no effect is anticipated. The reconstruction of the pedestrian ramp and the right-of-way needed for the additional tracks would result in minor adverse direct impacts on the western side of the Washington Marina parking lot, causing a loss or relocation of several parking spaces, but still allowing approximately 80 percent of the lot to continue to function as it does in the existing condition.

After the railroad corridor crosses Maine Avenue, it passes through the Portals development, which includes the Maryland Avenue "overbuild," a street constructed above the railroad right-of-way. The buildings in the Portals development all have their primary access from Maryland Avenue, with some garage and service access from the same level as the railroad tracks. Action Alternative A would have minor direct effects to these land uses due to small impacts to parcels immediately adjacent to the railroad right-of-way. However, the majority of new infrastructure would be within the existing railroad right-of-way, as shown in **Figure 9-6**. No buildings would be directly affected.

Past 12th Street SW, Action Alternative A would impact three parcels that abut the railroad right-of-way, including NPS-owned Reservation 197, as shown in **Figure 9-7**. However, all improvements in this area would be located between the existing retaining walls. Additional survey and property documentation would be performed during final design to establish exact impacts, if any. Impacts would be considered minor, as they would not affect the function of the property.

Moderate adverse indirect effects to land use would occur because of noise impacts to both the existing Mandarin Oriental Hotel and the Portals V residential uses. Noise impacts would result from the increase in train operations, addition of tracks closer to receptors, and introduction of special trackwork. Noise impacts are described in greater detail in **Section 10.3, Noise and Vibration, Permanent or Long-Term Effects**.

Southwest Neighborhood and Waterfront Sub-Area

Action Alternative A would result in no permanent direct or indirect impacts to land use in the Southwest Neighborhood and Waterfront portion of the Local Study Area.

9.3.1.3. Action Alternative B

Effects to land use resulting from Action Alternative B would be similar to those resulting from Action Alternative A. Action Alternative B would require replacement of the existing Long Bridge over the GWMP. The replacement bridge would also cross over the MVT and the Potomac River. As this replacement bridge would be constructed in the same location as the existing bridge, and future use would continue as it does today, there would be no additional effects to land use.

Figure 9-6 | Action Alternative A Land Use and Property Impacts – Maine Avenue SW

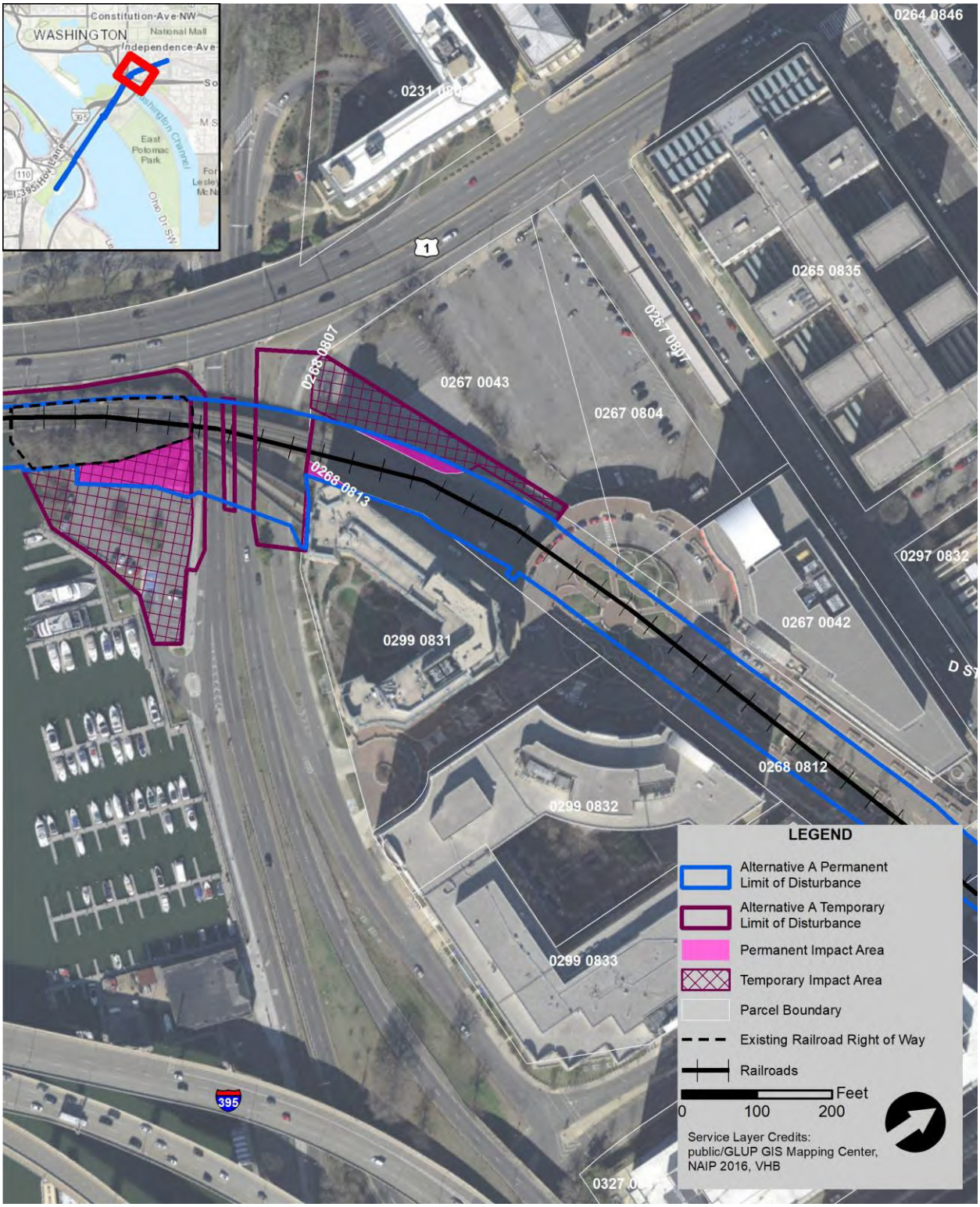
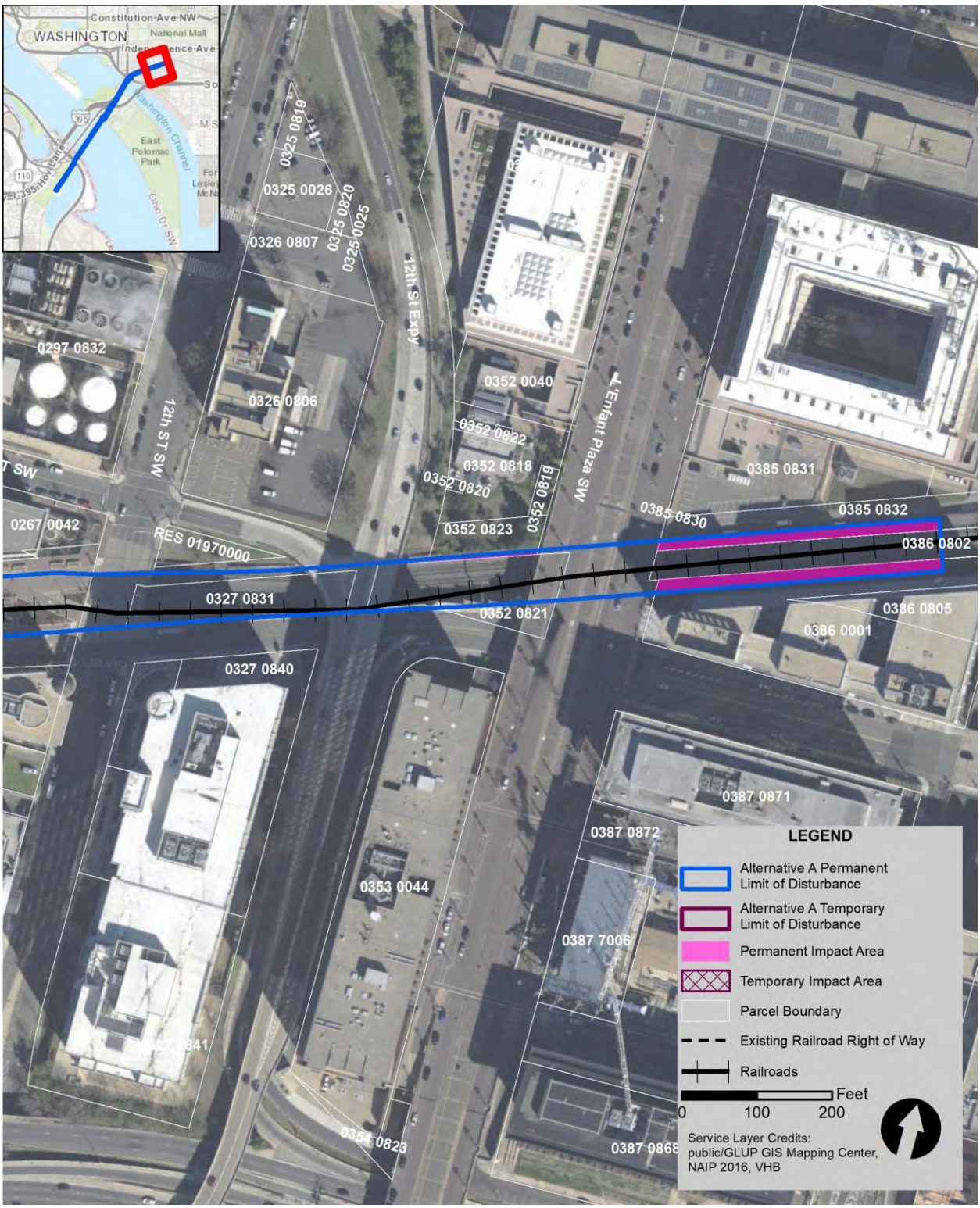


Figure 9-7 | Action Alternative A Land Use and Property Impacts – 12th Street SW to 9th Street SW



9.3.2. Property

9.3.2.1. No Action Alternative

In the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative presumes that Long Bridge remains in service, with continued maintenance as necessary. The No Action Alternative also presumes that DRPT and VRE complete the other planned railroad projects that would expand capacity to four tracks on either side of the Long Bridge Corridor.

Based on current information, the Washington, DC to Richmond Southeast High Speed Rail (DC2RVA) Project, the VRE L'Enfant Station Improvements, and the fourth track between L'Enfant and Virginia interlockings are not expected to have property impacts.

9.3.2.2. Action Alternative A

Action Alternative A would result in minor to moderate permanent direct adverse impacts to property. While there would be several private properties affected, none of the property impacts would result in displacement of residences or businesses. The majority of the property impacts (approximately 3.08 acres) would affect local or Federal park properties. These impacts, approximately three-quarters of which would be in East and West Potomac Parks, would occur in areas that are predominantly characterized by transportation uses. Therefore, the property impacts would not affect the function of the property.

Action Alternative A would impact two parcels in Virginia and eight parcels in the District. Four of the parcels affected are within Federal properties, including the GWMP, East Potomac Park, and other NPS property. The total property impact area resulting from Action Alternative A would be approximately 3.46 acres, as shown in **Table 9-1** and illustrated in **Figures 9-3** through **9-6**. None of the property impacts would result in displacement of residences or businesses. Action Alternative A would also affect 22,000 square feet of the Potomac River bottom, which is owned by NPS. Affected property owned by NPS will require either an exchange of land or a transfer of jurisdiction. In addition, airspace approval would be required from FHWA for the new railroad bridge over I-395. Airspace approval would also be required from DDOT for the replacement railroad bridge over Maine Avenue SW.

Property impacts were calculated based on available Geographic Information Systems (GIS) data from Arlington County, the District, and NPS, as well as as-built plans for the railroad Corridor. None of this data show dedicated railroad right-of-way between the GWMP roadway and the east bank of the Potomac River. Therefore, the extent of the existing right-of-way was assumed based on the location of railroad infrastructure. In addition, NPS and Arlington County data conflict near the GWMP, resulting in the range of potential impact shown in **Table 9-1**. Finally, several small parcel impacts are shown for properties bordering the railroad corridor between the 12th Street Expressway and 9th Street SW. However, there would be no impacts outside of the existing retaining walls that border the railroad right-of-way. During final design, a title search and survey would be required to establish definitive property ownership and any other existing easements or agreements.

Table 9-1 | Action Alternative A Permanent Property Impacts

Property Description/ Ownership	GIS Parcel ID	Sub-Area	Impact Area (Acres)
Arlington County			
Long Bridge Park	34024351	Long Bridge Park	0.04 or 0.14[1]
GWMP	None	Potomac Waterfront	0.4 or 0.5[1]
Subtotal, Virginia			0.54
District of Columbia			
East Potomac Park	03160005	Monumental Core	2.4
Washington Marina	n/a	L'Enfant Plaza South	0.16
Private	0267 0043	L'Enfant Plaza North	0.04
Private	0268 0813	L'Enfant Plaza South	0.01
Private	0299 0831	L'Enfant Plaza South	0.02
NPS	0352 0823	L'Enfant Plaza North	0.02
NPS	0385 0832	L'Enfant Plaza North	0.12
Private	0386 0001	L'Enfant Plaza South	0.15
Subtotal, District of Columbia			2.92
	Total		3.46

[1]The range in impact area for Long Bridge Park and the GWMP is due to the discrepancy in property records. The total impact is 0.74 acres total for the two parks.

Source: Arlington Virginia, District of Columbia, and NPS Property Data, VHB, GIS analysis.

9.3.2.3. Action Alternative B

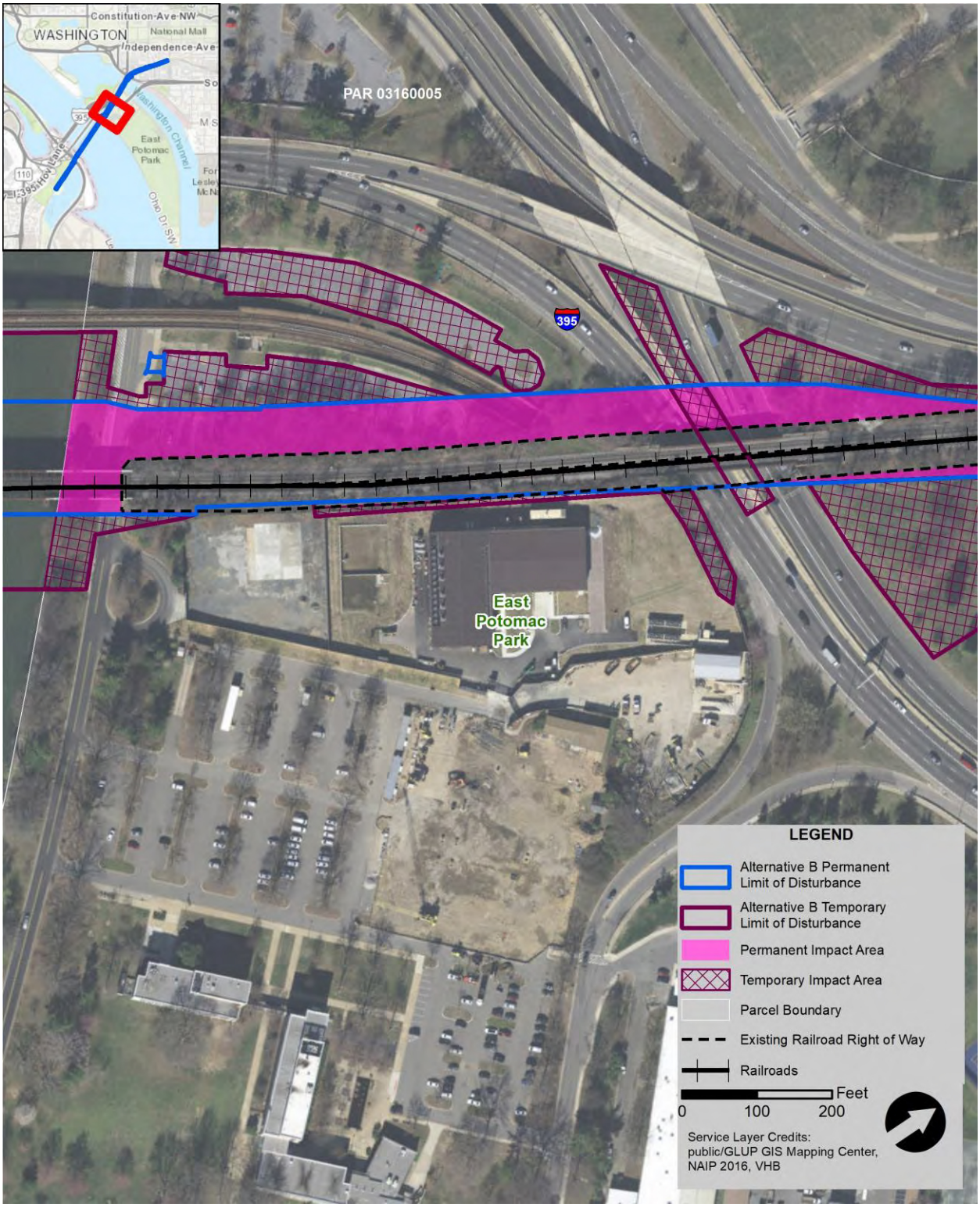
Action Alternative B would cause the same property impacts as Action Alternative A, plus an additional 0.2-acre impact in East Potomac Park. As Action Alternative B would replace the existing bridge, it would require the Project acquire a wider right-of-way over Ohio Drive SW, as shown in **Figure 9-8**.

9.3.3. Consistency with Local and Federal Plans

9.3.3.1. No Action Alternative

As noted above, in the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative would have adverse direct impacts on consistency with local plans because it would not include expansion of the Long Bridge Corridor from two tracks to four tracks, a goal articulated in numerous local and Federal plans. A series of NCPC plans for the Local Study Area—starting with *Extending the Legacy* and the *Monumental Core Framework Plan* and elaborated in later plans such as the *Federal Elements of the Comprehensive Plan of the National Capital* and the *SW Ecodistrict Plan*—have recommended the expansion of the railroad right-of-way from two tracks to four tracks, specifically in the portion of the Local Study Area adjacent to Maryland Avenue SW. The No Action Alternative would not implement these capacity improvements.

Figure 9-8 | Action Alternative B Land Use and Property Impacts – Potomac River to I-395



9.3.3.2. Action Alternative A

Overall, Action Alternative A would have minor permanent direct beneficial impacts on consistency with local and Federal plans because it would be either largely consistent or not inconsistent with plans that do not directly address the Project or similar projects. In some instances, however, Action Alternative A would be potentially in conflict with, or would fail to fully realize, certain policies and recommendations of both Federal and local plans, as described below.

Arlington County

Action Alternative A would be consistent with local plans for Arlington County, including the *General Land Use Plan* and the *Crystal City Sector Plan*, both of which envision the continuation of railroad service within the CSX Transportation (CSXT) right-of-way. Action Alternative A would require acquisition of a small portion of property planned for Long Bridge Park (less than 0.1 acres). However, it would not affect any of the planned elements or activities within the park.

Action Alternative A would be consistent with aspects of Federal plans for the GWMP and MVT, including the NCPC *Federal Elements of the Comprehensive Plan of the National Capital*. While the plan does not directly address the construction of railroad bridges in the Local Study Area, it emphasizes the importance of protecting the natural and historic character of the Potomac River shoreline as well as the iconic and scenic vistas along the GWMP and across the Potomac River. Policy UD.B.2.4 of the Urban Design Element of the *Federal Elements* recommends maintaining and enhancing the characteristics and natural settings of the NPS parks and parkways and, "if transportation system impacts are unavoidable," requiring actions "to minimize and mitigate negative impacts to maintain parkway characteristics." Policy UD.B.2.5 includes the recommendation to "design and locate bridges to minimally affect local riverine habitat, waterways, shorelines, and valleys, as described within the Federal Environment Element."

District of Columbia

In the District, Action Alternative A would be largely consistent with local and Federal plans for the Local Study Area, including the future land uses identified in the *District Elements of the Comprehensive Plan of the National Capital*. However, Action Alternative A would pose potential conflicts with, or would fail to fully realize, some specific policies and recommendations of both Federal and local plans described below.

A series of NCPC plans for the Local Study Area—starting with *Extending the Legacy* and the *Monumental Core Framework Plan* and elaborated in later plans such as the *Federal Elements of the Comprehensive Plan of the National Capital* and the *Southwest Ecodistrict Plan*—have recommended the expansion of the adjacent CSXT right-of-way capacity from two to four tracks, the reestablishment of Maryland Avenue SW as a grand boulevard, and reconnecting the surrounding street grid. To achieve this vision, these plans all recommend decking over the existing CSXT railroad tracks to enhance the streetscape, allow for the creation of new development parcels, and restore views along Maryland Avenue SW. Some of these plans also advocate for shifting the railroad right-of-way slightly to the south to support this vision. While Action Alternative A would not fulfill the vision of decking over the railroad tracks, it would not preclude this from happening in the future as part of a separate action.

Action Alternative A would be inconsistent with certain recommendations in the NCPC *Monumental Core Framework Plan*. This plan recommends the relocation and realignment of railroad and other transportation infrastructure crossing the Potomac River. The plan recommends realigning the I-395 vehicular bridges to the south, relocating the existing CSXT railroad corridor parallel to the vehicular bridges, and constructing a tunnel under a portion of East Potomac Park. Action Alternative A is also potentially incompatible with the plan's vision for the construction of a new low-scale development at the western end of Potomac Park along the Washington Channel as well as the proposed construction of a north-south channel connecting the Washington Channel to the Potomac River through East Potomac Park. Action Alternative A would not conflict with other key recommendations of the *Monumental Core Framework Plan.*

The NCPC *Memorials and Museums Plan* identifies one site in East Potomac Park, just east of the Project Area, as one of 20 "prime candidate sites" for a future memorial or museum. Tied to the relocation of the 14th Street Bridges recommended in NCPC's *Extending the Legacy* and subsequently in the *Monumental Core Framework Plan,* the potential memorial site is not incompatible with the Preferred Alternative.

Finally, Action Alternative A would add new visual elements to significant viewsheds and vistas identified in the Urban Design Element and associated technical addendum of the *Federal Elements,* NPS cultural landscape reports, and other NCPC, NPS and District plans. Impacts on aesthetics and visual resources are addressed in further detail in **Section 11.0, Aesthetics and Visual Resources**.

9.3.3.3. Action Alternative B

Under Action Alternative B, consistency with local plans would be the same as described for Action Alternative A as its footprint would be similar. While this alternative would require replacement of the existing Long Bridge, this difference would not affect its consistency with current plans.

9.4. Temporary Effects

This section considers the direct and indirect temporary impacts of the Action Alternatives to land use and property during construction, based on conceptual engineering design.

9.4.1. Land Use

9.4.1.1. No Action Alternative

The No Action Alternative may result in temporary land use impacts due to the need for staging areas during construction. The land use impacts related to the construction of projects included in the No Action Alternative as well as any other large capital projects would be assessed and determined within the context of each project.

9.4.1.2. Action Alternative A

Overall, Action Alternative A would result in moderate temporary direct adverse impacts to land use due to construction. This is because construction activities and staging (for example of construction cranes) affecting the GWMP (including temporary relocation of the MVT) and East and West Potomac Parks would make portions of these parks unavailable to park users for approximately 2 years to slightly less

than 5 years. Construction activities within the GWMP would require temporary relocation of the MVT and use of portions of the landscaped area between the roadway and the Potomac River to the north and south of the existing Long Bridge. Within East Potomac Park, construction activities would affect two surface parking areas and two ballfields. However, the majority of park uses would remain undisturbed. Within the GWMP, access would be maintained for roadway and trail users. Access to East Potomac Park roadways would be maintained, and construction activities would take place away from the tennis center, golf course, swimming pool, and picnic areas within the park. Other land uses affected by construction include:

- Open space at the south end of Long Bridge Park (negligible adverse direct impact).
- Cloverleafs at I-395 and Boundary Channel Drive (negligible adverse direct impact).
- Undeveloped open space at the north end of Long Bridge Park (negligible adverse direct impact).
- NPS Parking Lots B and C and additional areas of temporary access (moderate adverse direct impact).
- Washington Marina parking lot (significant direct adverse impact, as temporary loss of parking would impact the use and operation of the business).
- Hancock Park, also called NPS Reservation 113 (minor adverse direct impact).

9.4.1.2.1. Arlington County

Crystal City and Long Bridge Park Sub-Area

Construction of Action Alternative A would result in negligible adverse direct impacts to parcels at the southern end of Long Bridge Park (**Figure 9-9**), within the I-395 cloverleafs at the Boundary Channel Drive interchange (**Figure 9-10**), and at the northern end of Long Bridge Park within a portion of the property adjacent to the CSXT right-of-way and the GWMP (**Figure 9-3**). The parcel at the southern end of Long Bridge Park is currently used as open space. The temporary use would not affect the function of the property. The cloverleafs are typically unused, although as of November 2018 they were being used as construction staging areas. The portion of Long Bridge Park is an undeveloped area intended as edge and buffer zone for the next phase of park development, currently under construction. Temporary use of the land would not alter the use or experience of planned park facilities at Long Bridge Park.

Pentagon and Pentagon City Sub-Area

Construction of Action Alternative A would result in no temporary effects in the Pentagon and Pentagon City sub-area.

Potomac Waterfront and East of Long Bridge Corridor Sub-Area

Construction of Action Alternative A would result in moderate adverse direct impacts to the GWMP and MVT due to trail relocation, disruption of park uses, and the proximity of construction vehicles and staging to portions of the GWMP over a period of approximately two years (**Figure 9-3**). Construction staging and access areas would be located at the GWMP crossing in the median of the roadway as well as west and east of the crossing. An area north of the I-395 North bridge would also be required. Construction would require temporary relocation of a portion of the MVT for public safety and to allow construction access and staging along the water.

Figure 9-9 | Temporary Land Use and Property Impacts – Crystal City (Action Alternative A)

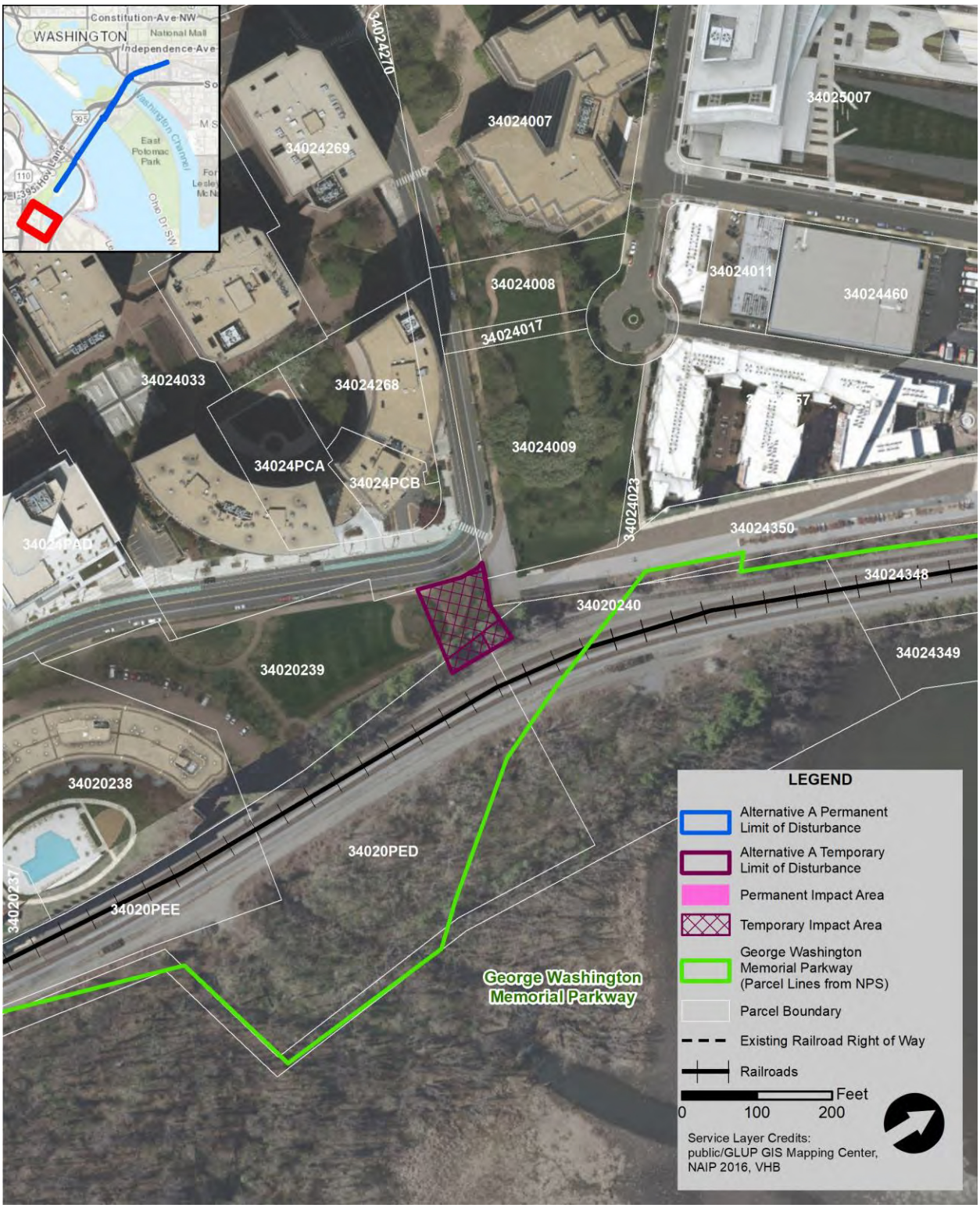
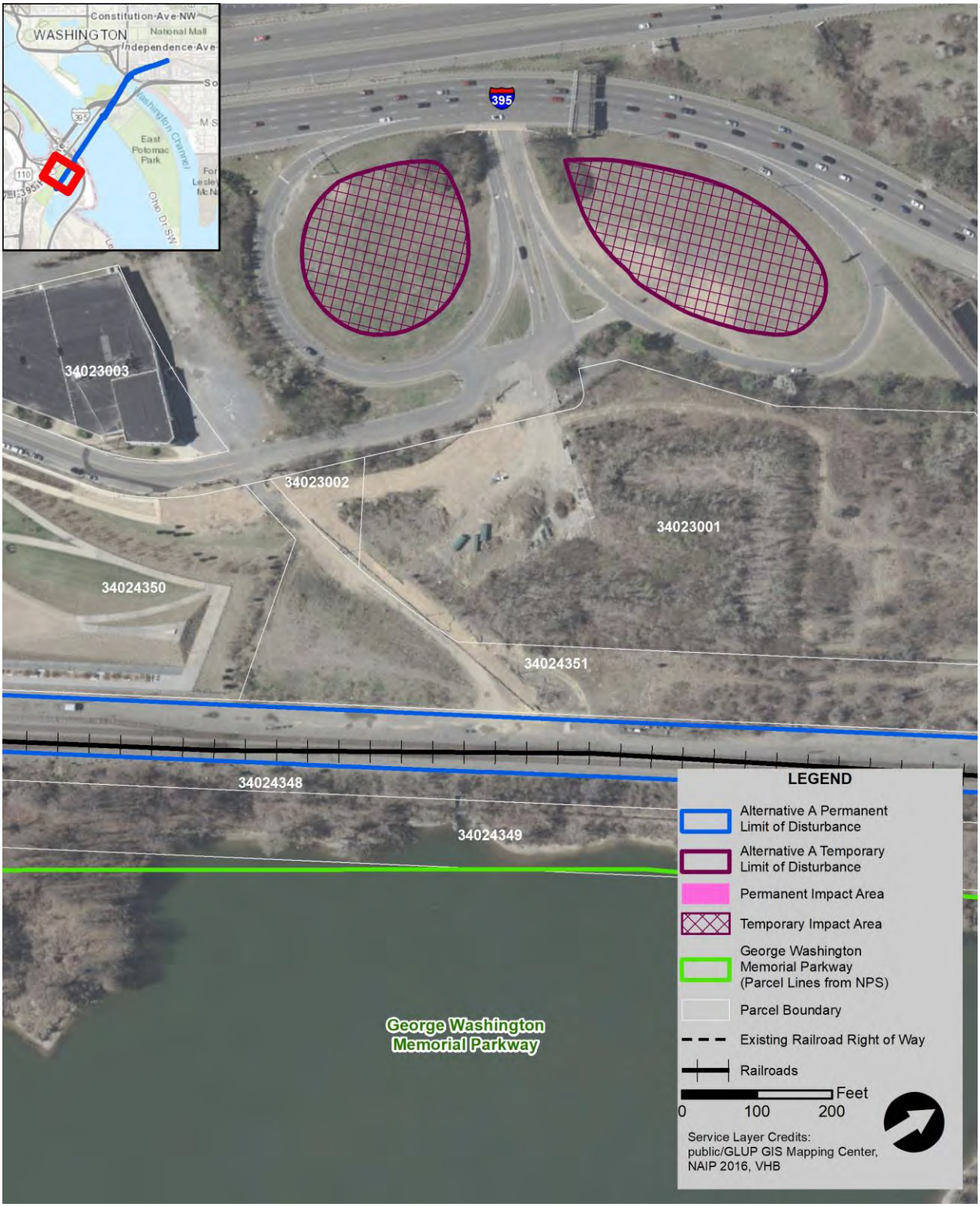


Figure 9-10 | Temporary Land Use and Property Impacts – I-395 Cloverleaf (Action Alternative A)



9.4.1.2.2. District of Columbia

Monumental Core Sub-Area

Construction activities for Action Alternative A would require temporary use of, and access to, various areas of East Potomac Park (**Figures 9-4** and **9-5**). Both NPS Parking Lot B and NPS Parking Lot C would be closed during construction and used for construction staging and access. It is anticipated that one of the surface parking areas would be the site of a temporary concrete plant during construction. These surface parking areas provide access to the Tidal Basin and Jefferson Memorial for park visitors; while the lots are heavily used in early spring when the Japanese cherry blossom plantings bloom, the lots experience very light usage the remainder of the year.

Temporary construction access and staging areas would also be required for areas between Ohio Drive SW and the I-395 North lanes, a small access area adjacent to the I-395 North lanes on the Washington Channel southern bank, and in a larger section along that same southern bank.

The overall duration of these impacts would be close to 5 years. Use of the NPS parking lots, and additional areas of temporary access—all on Federal land and over a period of close to 5 years—would constitute a moderate temporary adverse direct impact on land use.

L'Enfant Plaza North and South Sub-Area

Construction activities for Action Alternative A would require use of the entire Washington Marina parking lot the western side of Maine Avenue SW and a small area on the eastern side of Maine Avenue SW adjacent to the Mandarin Hotel (**Figure 9-6**). Use of adjacent land and closure of the marina surface parking lot result in a significant adverse direct impact on land use and property that could last 49 months. Visitors typically drive to the marina, and temporary loss of parking would therefore impact the use and operation of the Washington Marina enterprise. Mitigation in the form of coordination, interim transportation options, and compensation for loss of revenue may be considered. For additional information regarding parking-related impacts, refer to **Section 6.0, Transportation**.

Construction of Action Alternative A would also require use of the western portion of NPS Reservation 113, also known as Hancock Park (adjacent to 9th Street SW) for up to 3 years. Although measures would be taken to preserve and retain existing trees in the area, this would cause a minor adverse direct impact due to the use of Federal land and the temporary closure of an existing public open space.

Southwest Neighborhood and Waterfront Sub-Area

Construction of Action Alternative A would result in no temporary effects in the Southwest Neighborhood and Waterfront sub-area.

9.4.1.3. Action Alternative B

Construction activities under Action Alternative B would generate temporary impacts similar in location and extent as those caused in Action Alternative A. However, the durations for several of Action Alternative B's construction activities would be substantially longer. Impacts to the GWMP would last over 5 years and impacts in East Potomac Park would last over 8 years.

9.4.1.3.1. Arlington County

Crystal City and Long Bridge Park Sub-Area

Construction activities in Long Bridge Park for Action Alternative B would last an additional two and a half years compared to Action Alternative A. However, direct adverse impacts would remain negligible because this portion of the property is an undeveloped area intended as edge and buffer zone and temporary use of the land would not alter the use or experience of planned park facilities.

Pentagon and Pentagon City Sub-Area

As with Action Alternative A, construction of Action Alternative B would result in no temporary effects in the Pentagon and Pentagon City sub-area.

Potomac Waterfront and East of Long Bridge Corridor Sub-Area

Construction of Action Alternative B would result in moderate adverse direct impacts to the GWMP and MVT due to trail relocation, disruption of park uses, and the proximity of construction vehicles and staging to portions of the GWMP over a period of more than 5 years (**Figure 9-3**).

9.4.1.4. District of Columbia

Monumental Core Sub-Area

Construction activities for Action Alternative B would be similar in location and extent as those of Action Alternative A. However, the overall duration of these impacts would last approximately 8 years (**Figures 9-4** and **9-5** above).

L'Enfant Plaza North and South Sub-Area

Action Alternative B would cause the same temporary impacts as Action Alternative A in this sub-area.

Southwest Neighborhood and Waterfront Sub-Area

As with Action Alternative A, construction of Action Alternative B would result in no temporary effects in the Southwest Neighborhood and Waterfront sub-area.

9.4.2. Property

9.4.2.1. No Action Alternative

The No Action Alternative may result in temporary property impacts due to the need for staging areas during construction. The property impacts related to the construction of projects included in the No Action Alternative as well as any other large capital projects would be assessed and determined within the context of each project.

9.4.2.2. Action Alternative A

Action Alternative A would result in minor to major temporary direct adverse impacts due to use of property outside the existing railroad right-of-way for construction access and staging. The majority of the property impacts (approximately 3.08 acres) would affect local or Federal park properties. These impacts would occur in areas predominantly characterized by transportation uses. Therefore, the property impacts would not affect the function of the property. Action Alternative A would impact 10 parcels in Virginia and 6 parcels in the District. Three of the parcels affected are within Federal properties, including the GWMP, East Potomac Park, and Reservation 113. The total property impact area resulting from Action Alternative A would be approximately 11.2acres, as shown in **Table 9-4** and illustrated in **Figures 9-5** through **9-10**.

Table 9-2 | Action Alternative A Temporary Property Impacts

Property Description/ Ownership	GIS Parcel ID	Impact Area (Acres)
Long Bridge Park	34024351 & 34023001	0.01 or 0.41[1]
GWMP	None	2.8 or 3.2[1]
I-395 Cloverleaf	None	2.076
Private	34020239	0.163
Private	34020240	0.022
Private	34024009	0.003
Private	34024033	0.002
Arlington County	34024349	0.21
Private	34020PED	0.030
Subtotal, Virginia		5.72
East Potomac Park	03160005	4.27
Washington Marina	n/a	0.76
Private	0267 0043	0.33
Private	0268 0813	0.01
Private	0299 0831	0.01
Hancock Park (Reservation 113)	RES 01130000	0.10
Subtotal, District of Columbia		5.48
Total		11.2

Action Alternative A would result in a major temporary direct adverse impact to the Washington Marina property through use of its surface parking for approximately 4 years and 1 month. Without mitigation, this use of the marina's surface parking area would affect its ability to operate, since many of the marina users access the facility by car. Therefore, alternate parking accommodations would be evaluated as described in **Chapter 9.0, Transportation**.

Action Alternative A would also temporarily affect 42,781 square feet of the Potomac River bottom, which is owned by NPS. Therefore, NPS would need to issue a permit for temporary use of the river bottom during construction.

9.4.3. Consistency with Local and Federal Plans

As local plans are generally focused on long-term actions and goals, the No Action Alternative and the Action Alternatives are neither consistent nor inconsistent with the plans analyzed earlier in this chapter.

9.5. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the impacts to land use and property.

9.5.1. Land Use

Potential measures that the Virginia Department of Rail and Public Transportation (DRPT), the project sponsor for final design and construction, would employ to avoid, minimize, or mitigate the adverse impacts of the Project on land use include:

- Using areas already disturbed for construction of other projects, such as the cloverleafs at I-395 and Boundary Channel Drive, to minimize the impacts of construction staging.
- Screening construction staging areas as practicable to minimize impacts to adjacent land uses.
- Following construction, restoring land or property adversely impacted by construction activities (including trees, other vegetation, and landscaping), to the extent practicable.
- Incorporating vegetative buffers and screening as practicable between new transportation infrastructure and potentially-sensitive land uses to minimize adverse impacts on business activities and building tenants.
- Coordinating with property owners, Arlington County, the District, and NPS regarding traffic control strategies to minimize traffic disruptions and maintain vehicular, pedestrian, and bicycle mobility on roadways in and around the Local Study Area.
- Constructing a new bike-pedestrian bridge connecting Long Bridge Park, GWMP, and East and West Potomac Parks. The new connection would mitigate adverse impacts to the parks. This new connection is proposed as mitigation for impacts under Section 4(f) of the U.S. Department of Transportation Act of 1966.[20]
- Maintaining visitor access to parkland and trails in the Local Study Area to the extent practicable during construction.

9.5.2. Property

For impacts to NPS-administered properties requiring a change in ownership, DRPT would coordinate with NPS to identify the appropriate mechanism. Potential mechanisms include a transfer of jurisdiction or an exchange of land in accordance with 54 USC 102901(b) or other applicable authorities. If a land

[20] 49 USC 303

exchange is required, DRPT and NPS would identify appropriate properties for the exchange during final design.

DRPT would be responsible for potential measures to avoid, minimize, or mitigate adverse impacts of the Project on property including:

- For privately-owned properties, compliance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, and applicable District, Commonwealth of Virginia, and Arlington County laws in any instances where property acquisition or displacement would be necessary to implement the Project. If full property acquisition is required, DRPT would fairly compensate property owners for the land acquired and, if necessary, provide relocation assistance.
- Establishing agreements with private property owners and building tenants to provide construction access in a manner that minimizes adverse impacts to business activities and other land uses. Coordinate with property owners to address specific access requirements and minimize disruptions, wherever possible.
- For impacts to parking, working with property owners to temporarily relocate parking spaces where feasible, or appropriately compensate property owners for loss of parking spaces and revenue.

9.5.3. Consistency with Local and Federal Plans

Potential measures that would be employed to avoid, minimize, or mitigate adverse impacts of the Project on property include:

- Where the Project may be inconsistent, or potentially in conflict with, local plans, coordinating with the Arlington Department of Community Planning, Housing & Development; District of Columbia Office of Planning; NCPC; and NPS on strategies to minimize adverse impacts on these plans and to avoid or minimize potential conflicts with the implementation of local plans.

10.0 Noise and Vibration

10.1. Introduction

This section defines noise and vibration as related to the Long Bridge Project (the Project), and provides the regulatory context, and methodology for assessing effects. For each Action Alternative and the No Action Alternative, this section also describes the potential short-term and long-term impacts due to noise and vibration. This section also discusses proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project.

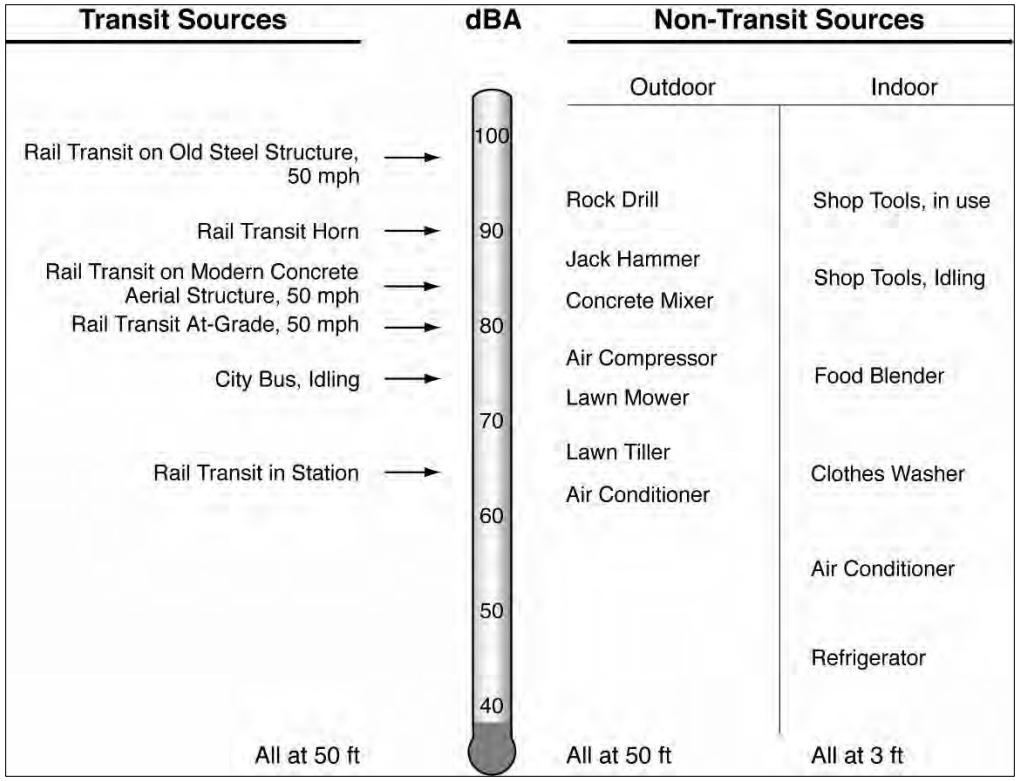
This analysis defines noise as unwanted or undesirable sound. The analysis evaluates noise based on its potential to cause human annoyance. Because humans hear certain frequencies or pitches of sound better than other pitches of sound, the analysis measures and reports sound levels using a descriptor called the A-weighted sound level, notated as dBA.

The following sound level metrics are used in the noise assessment for the Project:

- **Maximum A-weighted Level (Lmax)** represents the highest sound level generated by a source. For mobile sources, the maximum level typically occurs when the source is closest to the measurement or analysis location. **Figure 10-1** presents typical maximum sound levels including transit sources and non-transit sources.
- **Energy-average Level (Leq)** is a single value that is equivalent in sound energy to the fluctuating levels over a period. The Leq accounts for how loud events are during the period, how long they last, and how many times they occur. Typically, Leq sound levels are used to describe the time-varying sound level over a one-hour period and may be denoted as $Leq_{1h.}$ Leq is commonly used to describe environmental noise and relates well to human annoyance.
- **Day-night Average Level (Ldn)** is a single value that represents the sound energy over a 24-hour period with a 10-decibel (dB) penalty applied to sound that occurs between 10:00 PM and 7:00 AM, when people are more sensitive to noise. Ldn accounts for how loud events are, how long they last, how many times they occur, and whether they occur at night. Ldn is commonly used to describe environmental noise and relates well to human annoyance at places where people sleep.

Ground-borne vibration is the oscillatory motion of the ground caused by sources such as trains or construction equipment. Trains generate ground-borne vibration when forces associated with the wheel-rail interaction are transmitted through the track structure into the ground and into adjacent buildings. Vibration may be perceptible and disturb people or sensitive activities in nearby buildings. Vibration levels much higher than the thresholds of human perception can increase the risk of structural damage to buildings.

Figure 10-1 | Typical A-weighted Maximum Sound Levels for Transit Sources and Non-Transit Sources

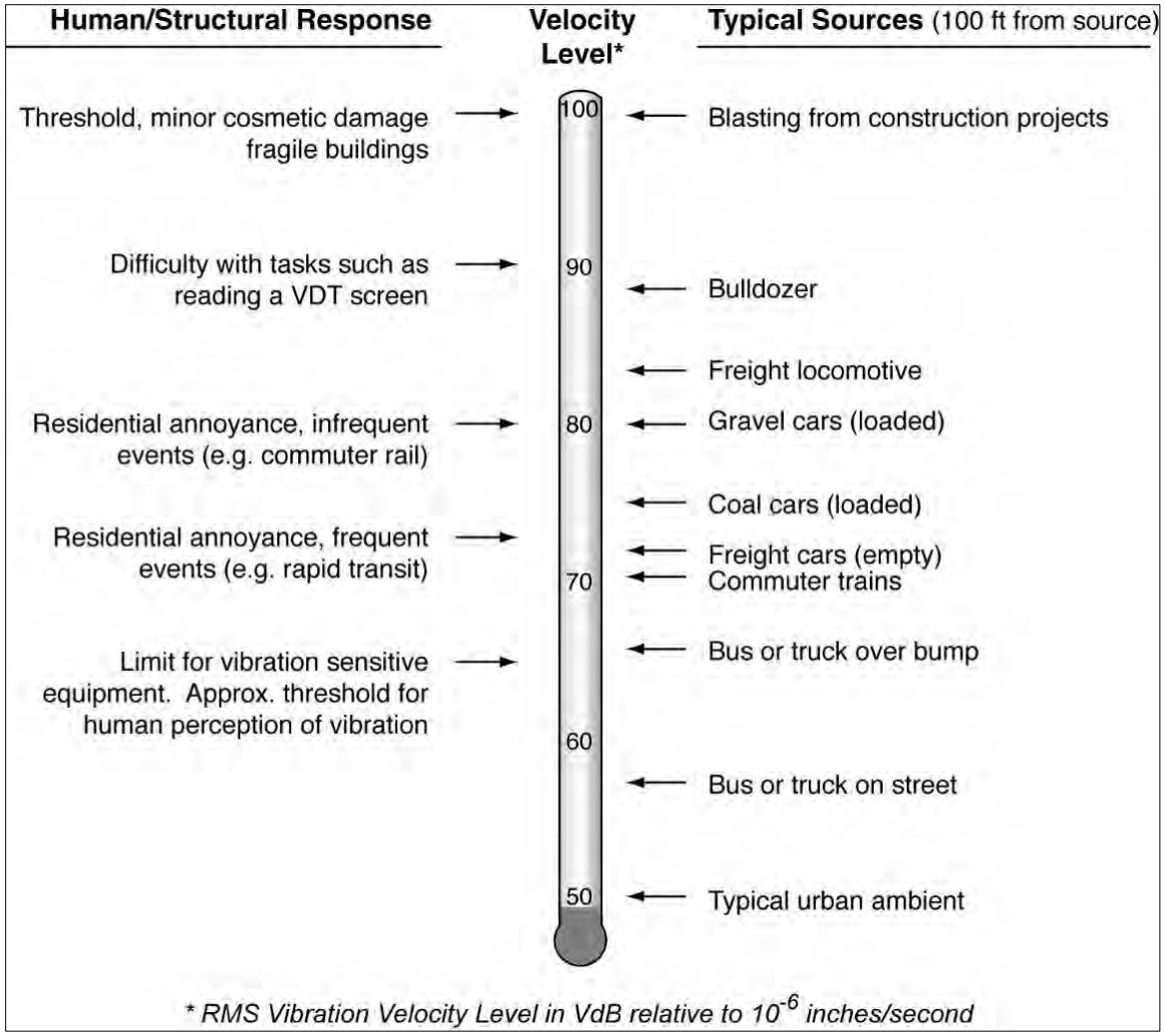


Source: Federal Transit Administration (FTA), 2006

Vibration levels are expressed in decibel notation as **dBV** to differentiate them from sound decibels. Vibration oscillations occur in a range of different frequencies or cycles per second (Hertz or Hz). Humans perceive and have the greatest response to vibration in a particular frequency range similar to the way humans can generally hear sound between 20 and 20,000 Hz but cannot hear very low or very high frequency sound. Overall vibration levels reported in this study include frequencies between 4 and 400 Hz to correspond to human response. **Figure 10-2** presents typical ground-borne vibration velocity levels from transportation and construction sources and the typical human and structural response.

Ground-borne noise is generated when vibration propagates into a room and causes the walls, ceilings, and floor to vibrate and generate a low frequency rumble. Ground-borne noise is generally only perceptible in buildings where airborne paths, such as paths through windows or openings, are not present. Ground-borne noise is of concern for special-use buildings such as theaters and recording studios. Ground-borne noise is expressed in A-weighted sound level decibels like airborne noise.

Figure 10-2 | Typical Ground-borne Vibration Velocity Levels



Source: FTA, 2006

10.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluation of impacts to noise and vibration and provides a summary of the methodology used to evaluate the Existing Conditions of the resource and the probable impacts of the alternatives. This section also includes a description of the Study Area for noise and vibration. The full list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

10.2.1. Regulatory Context

The National Environmental Policy Act of 1969 (NEPA) and the Federal Railroad Administration (FRA) *Procedures for Considering Environmental Impacts* require consideration of the potential effects of

Federal actions on noise and vibration.[1] Noise and vibration from the proposed Project were analyzed according to the FTA *Noise and Vibration Impact Assessment* guidance manual.[2,3] This guidance manual describe the technical approach for assessing noise and vibration for railroad and transit projects with train speeds below 90 miles per hour (mph), and the process for evaluating the need for and effectiveness of potential mitigation.[4]

The National Park Service (NPS) prescribes methods to characterize ambient soundscapes in NPS's *Reference Manual #47*.[5] This methodology is implemented for acoustic studies intended to characterize the existing sound conditions at NPS properties and to allow NPS Park Managers to manage sound as a resource of the park. Since the focus of the proposed Project is to evaluate the potential noise and vibration effects from improvements to the Long Bridge Corridor, rather than fully characterize sound as a park resource, ambient sound measurements at NPS sites have been conducted according to FTA methods with additional consideration of NPS methods.

The District of Columbia (District) noise ordinance (District of Columbia Municipal Regulations Chapters 20–27) and the *Arlington County Noise Control Code, Chapter 15* primarily apply to construction-period activities and sound generated by stationary equipment.[6] The noise ordinances impose construction period noise limits during day and nighttime hours and require that contractors implement all feasible procedures and measures customarily used in the industry to minimize noise. Sound generated by trains, other than Washington Metropolitan Area Transit Authority (WMATA) railcars, is specifically exempt from the District ordinance.

10.2.2. Methodology

The process to assess noise and vibration impact included identifying noise- and vibration-sensitive receptors, understanding the predominant sources of noise and vibration, characterizing existing noise and vibration conditions through measurements, predicting noise and vibration conditions for the No Action and Action Alternatives, comparing to applicable FTA criteria, and evaluating potential mitigation, as warranted.

10.2.2.1. Operational Impact Assessment Methodology

Operational noise and vibration impact has been assessed by measuring and predicting noise and vibration conditions for the existing and future Action Alternatives and comparing to applicable criteria. Accurately evaluating impact is important for future decisions regarding alternatives, mitigation measures, and commitments.

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[1] 64 FR 28545
[2] FRA. September 2012. *High-Speed Ground Transportation Noise and Vibration Impact Assessment*. Report DOT/FRA/ORD-12/15. Accessed from https://www.fra.dot.gov/eLib/Details/L04090. Accessed June 6, 2017.
[3] FTA. May 2006. *Transit Noise and Vibration Impact Assessment*. Report FTA-VA-90-1003-06. Accessed from https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf. Accessed June 6, 2017.
[4] The maximum operating speed in the Project Area is between 30 and 45 mph for passenger operations and between 25 and 40 mph for freight operations.
[5] NPS – Director's Order #47: Soundscape Preservation and Noise Management. Accessed from https://www.nps.gov/policy/dorders/dorder47.html. Accessed June 6, 2017.
[6] DC Municipal Regulations (DCMR) Chapter 20-27.

A Detailed Noise Assessment was conducted based on *Chapter 6* of the FTA Manual to predict and assess future operational noise conditions. A Detailed Vibration Assessment was conducted based on *Chapter 8* of the FTA Manual to predict and assess future vibration conditions from trains. Since the Project already has existing railroad infrastructure and the same trains would be operating, vibration has been predicted based primarily on measurements of existing trains. Vibration propagation conditions were determined through measurement of existing sources at a range of distances. Typical adjustments were included, as needed, such as outdoor-to-indoor vibration attenuation, changes in vibration due to train speeds, track condition, and/or presence of special trackwork (track turnouts or crossovers where increased noise and vibration occurs due to gaps in the rail running surface).

10.2.2.2. Noise and Vibration Sensitive Land Use Categories

Existing noise- and vibration-sensitive receptors in the Local Study Area were identified based on a review of aerial photography, District Office of Zoning database information, Arlington County Geographic Information Systems database, and field investigations. Receptors were categorized according to their use as defined by the FTA; the FTA definitions are provided in **Table 10-1**.

Table 10-1 | FTA Land Use Categories and Metrics for Transit Noise Impact Criteria

FTA Land-Use Noise Category	Noise Metric (dBA)	Description of Land-Use Category
1	Outdoor Leq*	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor Ldn	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor Leq[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, and museums can also be considered in this category. Certain historical sites, parks, campgrounds, and recreational facilities are also included.

Notes: ***1 - Leq for the noisiest hour of related activity during hours of noise sensitivity.***

Source: ***FTA, 2006. Transit Noise and Vibration Impact Assessment***

Noise-sensitive receptors were categorized into the FTA Land Use Noise Categories based on the human use of the property as it relates to the potential for noise to cause human annoyance. Receptors are primarily located at ground level outdoor areas of frequent human use. If an upper-floor multi-family residence or hotel has exterior areas such as balconies or roof decks, then receptors are located at these upper elevations. For some residences and institutional facilities, such as medical facilities, museums, schools, and recording studios, receptors may be located inside of the building if there are no areas of frequent outdoor human use.

Whether a park is noise-sensitive depends on its use. Most parks used primarily for active recreation are not sensitive to noise. Parks that are used for passive recreation such as talking, reading, or meditating are generally considered sensitive to noise because it can interfere with these activities. Noise typically does not interfere with recreational activities such as running, cycling, or playing sports.

Commercial and industrial properties are not typically evaluated for operational noise impact unless there are outdoor areas of frequent human use. Residential, institutional, commercial, and industrial land uses are typically evaluated for construction-period noise effects.

In relation to human annoyance, vibration-sensitive land uses are similar to noise-sensitive land uses except that vibration is only evaluated inside buildings and is not evaluated at parks and outdoor areas. All buildings and structures are evaluated for potential structural damage due to vibration from high-impact construction equipment such as impact pile driving. The thresholds for potential structural damage are greater than the thresholds for human annoyance. Train operations generally do not generate sufficient vibration to cause structural damage unless the trains are extremely close to sensitive buildings based on the FTA Generalized Ground Surface Vibration Curves. Historic properties are often more susceptible to vibration and have lower thresholds for increased risk of structural damage.

As described in **Section 12.0, Cultural Resources**, several historic districts and historic properties are located within the noise and vibration Local Study Area. The sensitivity of these cultural resources to noise and vibration are based on their human use and how they relate to the FTA Land Use Noise Categories. For example, a residence that is a historic property is a Category 2 receptor, and a historic museum is considered a Category 3 receptor. Potential noise and vibration effects related to human annoyance are assessed using the same criteria for historic properties and non-historic properties, unless a quiet environment is an essential aspect of the property and part of the character defining its historic or cultural significance, as is the case with Category 1 receptors. National Historic Landmarks with significant outdoor use, where serenity and quiet are significant attributes, are Category 1 receptors.

Noise-Sensitive Land Uses

Noise- and vibration-sensitive land uses in the Local Study Area were identified based on a review of aerial photography, DC Office of Zoning database information, and field investigations. Receptors were categorized according to their use as defined by the FTA and described in **Table 10-1** above.

10.2.2.3. Local Study Area

As shown in **Figure 10-3**, the Local Study Areas for noise and vibration include the physical limits of the proposed Project (the Project Area) and noise- and vibration-sensitive locations near the Project. The Local Study Areas for noise and vibration must extend sufficiently far from the Project limits to include all locations where substantial noise and vibration effects, potential impacts, and benefits from potential mitigation may occur.

To determine the Local Study Area extents, the FTA has screening distances that indicate where there is potential for noise or vibration impact to occur. If there are sensitive uses within these screening distances, then there is the potential for impact and further evaluation is necessary to verify whether there would be impact, the context and intensity of impact, and the need for mitigation.

The noise Local Study Area is 750 feet from the track alignment without intervening buildings and 375 feet with intervening buildings for mainline railroad operations. The vibration screening distance depends on the type of sensitive land use and the type of railroad project. The vibration screening distance is 200 feet for residential uses, 120 feet for institutional uses, and up to 600 feet for particularly sensitive receptors such as research facilities with vibration-sensitive equipment, theatres, and recording studios.

Noise and vibration are typically not assessed at a regional level for this project type, since noise and vibration effects occur more locally to the project footprint; therefore, no Regional Study Area has been developed.

10.2.2.1. Noise Impact Criteria

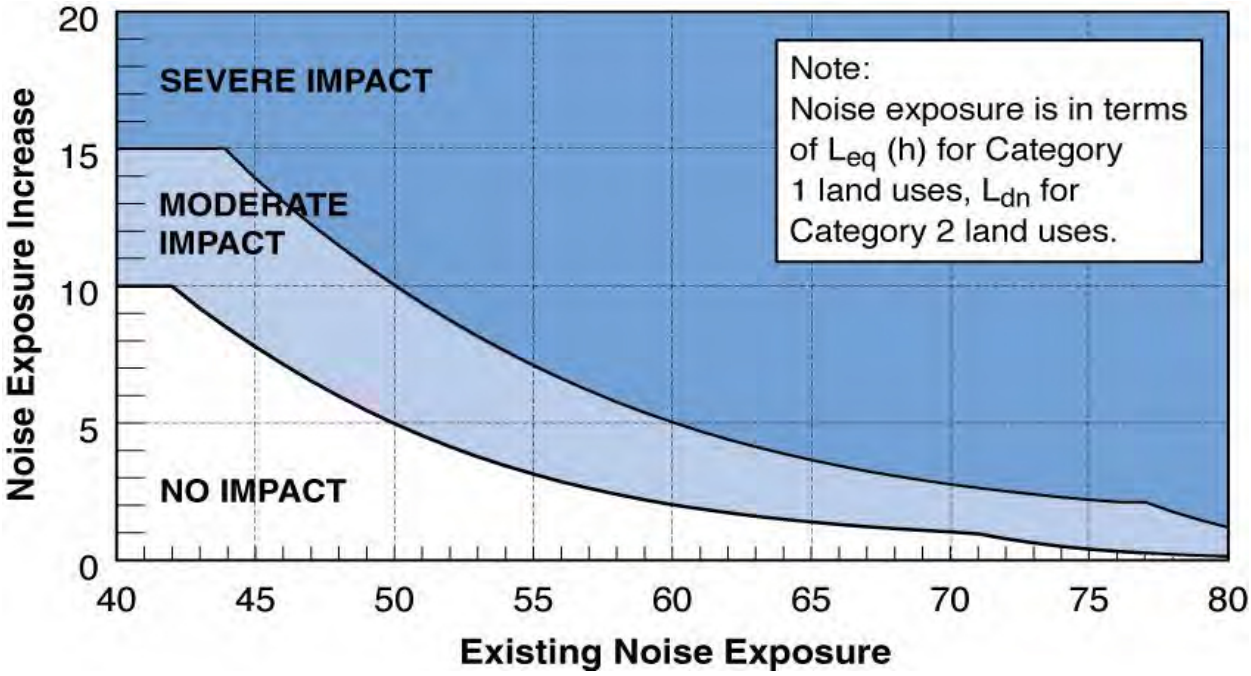
FTA noise impact criteria are what are known as "ambient-based" criteria, which evaluate the impact of a change in the noise environment due to the introduction of new noise sources and/or modification of existing sources. The noise impact criteria for human annoyance, presented in **Figure 10-4**, compare the existing outdoor Ldn for residential land use (Category 2) or peak transit hour Leq for institutional land use (Category 1 and 3) and the potential increase in future noise due to the proposed Project. The two levels of impact include severe impact and moderate impact. Severe impact is where a significant percentage of people would be highly annoyed by a project's noise. Moderate impact is where the change in the cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong, adverse reactions.

10.2.2.1. Vibration Impact Criteria

FTA vibration criteria are based on maximum levels for a single train pass-by event and depend on the type of land use and the frequency of events. More than one train may pass-by a given location at the same time; however, this is a relative infrequent occurrence and the incremental increase in vibration due to additional trains on tracks farther away from the nearest track is generally less than two decibels for receptors within 50 feet of the tracks according to the FTA generalized ground vibration curves. For projects in an existing railroad corridor the vibration impact assessment depends on existing vibration conditions in the Local Study Area.

Figure 10-3 | Local Study Area for Noise and Vibration

Figure 10-4 | FTA Noise Impact Criteria



Source: ***FTA, 2006.***

FTA has vibration impact criteria defined in the General Vibration Assessment methodology, which are based on overall vibration level and criteria defined in the Detailed Vibration Assessment method. The Detailed Assessment is based on the vibration level in one-third octave frequency bands. The FTA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment are shown in **Table 10-2**. FTA categorizes vibration receptors according to their use. These vibration criteria are defined in terms of human annoyance for different land-use categories such as high sensitivity (Category 1), residential (Category 2), and institutional (Category 3). In general, the threshold of human perceptibility of vibration is 65 vibration decibels (VdB). Vibration is not evaluated for human annoyance in parks or other outdoor locations because humans do not perceive vibration well outside buildings. Operational vibration impact is typically considered to be major as it relates to the NEPA.

All buildings and structures, including historic properties, are assessed for potential structural damage due to vibration during construction or for train operations within approximately 10 feet.

Table 10-2 | FTA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment[1]

Land Use Category	Ground-Borne Vibration Levels (VdB)[1]			Ground-Borne Noise Levels (dBA)[2]		
	Frequent Events[3]	Occasional Events[4]	Infrequent Events[5]	Frequent Events[3]	Occasional Event[4]	Infrequent Event[5]
Category 1: Buildings where low vibration is essential for interior operations.	65	65	65	N/A[6]	N/A[6]	N/A[6]
Category 2: Residences and buildings where people normally sleep.	72	75	80	35	38	43
Category 3: Institutional buildings with primarily daytime use.	75	78	83	40	43	48

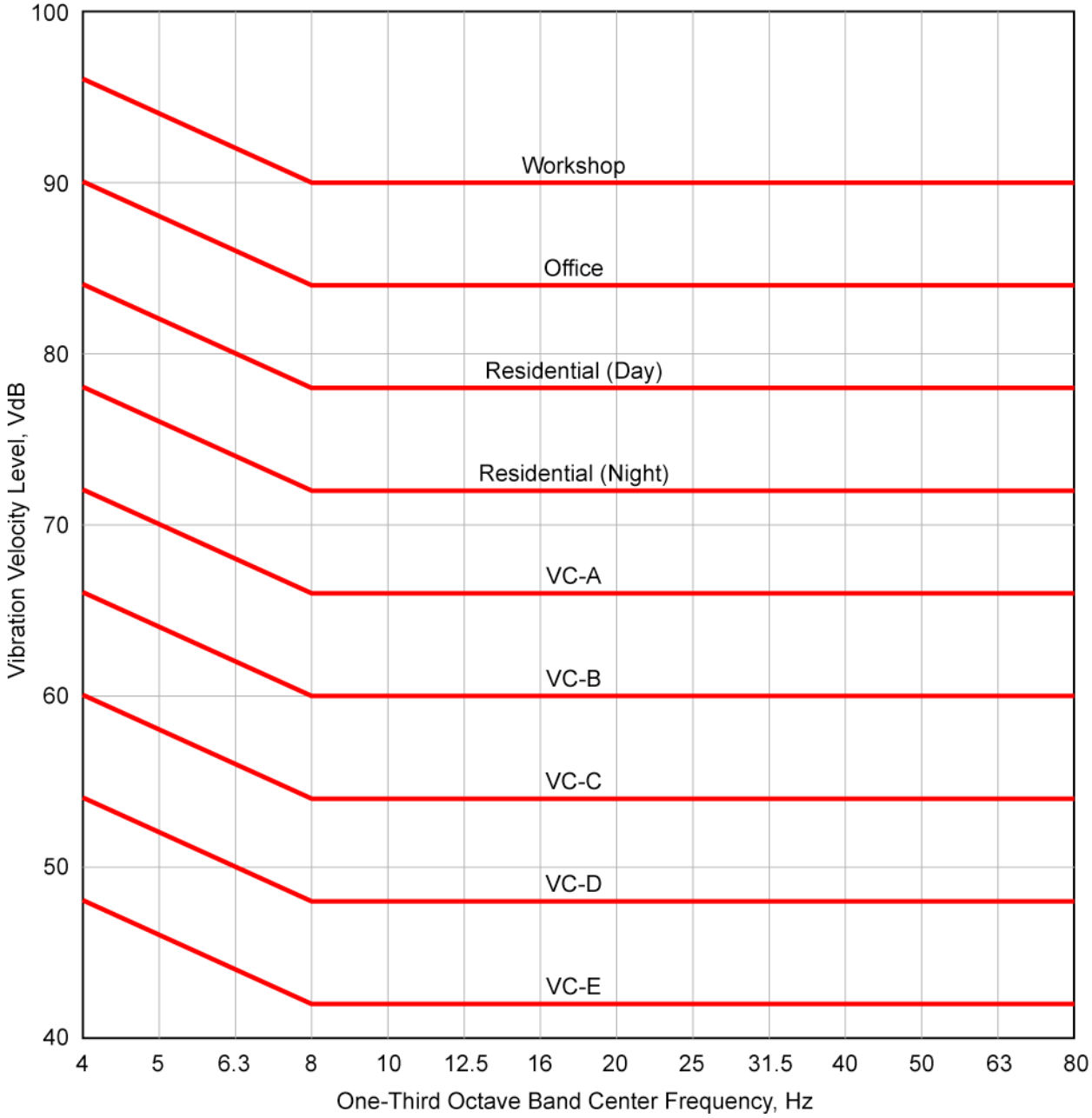
1. **Root Mean Square (RMS) vibration velocity levels are reported in VdB referenced to 1 micro inch per second (ips).**
2. **Ground-Borne noise levels are reported in dBA referenced to 20 micro Pascals.**
3. **"Frequent Events" is defined as more than 70 vibration events per day.**
4. **"Occasional Events" is defined as between 30 and 70 vibration events per day.**
5. **"Infrequent Events" is defined as less than 30 vibration events per day.**
6. **N/A means "not applicable." Vibration-sensitive equipment is not sensitive to ground-borne noise.**

Source: ***FTA, 2006.***

The FTA criteria for Detailed Vibration Analysis, as shown in **Figure 10-5**, similarly apply to residential uses, institutional uses, and vibration-sensitive equipment. If there are special-use buildings such as concert halls, recording studios, auditoriums, or theatres, then specific vibration and ground-borne noise criteria would apply.

The vibration criteria depend on existing conditions when there are existing sources of vibration. Since the Project is an in existing railroad corridor with more than 12 trains per day, a project would cause impact if vibration levels were to exceed the FTA criteria and the project were to significantly increase the number of vibration events (approximately doubling the number of events) or increase vibration levels by 3 VdB or more. If a project moves existing tracks, there would be impact only if the track relocation results in vibration levels exceeding the FTA criteria and increasing more than 3 VdB.

Figure 10-5 | FTA Detailed Ground-Borne Vibration Criteria



Source: ***FTA, 2006.***

10.2.2.2. Construction Assessment Methodology

The construction noise and vibration assessment evaluated typical equipment and methods used during different construction activities including track construction, pile driving over land in water, sheeting, pier work, and bridge superstructure. Construction noise and vibration has been predicted using the methods described in *Chapter 12* of the FTA manual and impact assessed by comparing to the applicable noise and vibration impact criteria described below. The FTA has guideline construction noise impact criteria; however, they are only used in locations where there are no local or state construction noise ordinances. Since there are local noise ordinances in the Local Study Area, FTA guideline criteria have not been used.

The District noise ordinance (Municipal Regulations Chapter 20-27) is intended to promote public health, safety, welfare, and the peace and quiet of the inhabitants of the District, and to facilitate the enjoyment of the natural attraction of the District. Sound generated by trains, other than WMATA railcars, is exempt from this ordinance. The local noise ordinance prohibits construction sound levels above 80 dBA (Leq) (except for pile driving) 25 feet from the outermost limits of the site between 7:00 AM and 7:00 PM unless a variance is granted. From 7:00 PM to 7:00 AM, construction activities may be limited to 65 dBA (Lmax) 25 feet from the outermost limits of the construction site for noise originating in an industrial zone. For projects, such as the Long Bridge project, where construction can cause major traffic impacts, it is often necessary for some level of construction to occur during the night.

Construction noise is regulated in the Arlington noise ordinance by the zoning of the receiving property. Any noise from construction activity which produces sound greater than the County limits shown in **Table 10-3** is permitted only during daytime hours (7:00 AM to 9:00 PM on weekdays and 10:00 AM to 9:00 PM on weekends and legal holidays). Nighttime noise limits apply to construction at all other periods of the day. The ordinance also requires that all feasible procedures and measures customarily used in the industry shall be implemented to minimize noise. At no time can construction noise exceed 90 dBA when measured at the curb of any property adjacent to a built street, a common area of any multi-unit structure, or an individual unit of any multi-unit structure, so long as the measurement is at least 50 feet from the noise source. Long Bridge Park is within the CM, P-S, and M-1 County zoning districts and the Mount Vernon Trail (MVT) is within a S-3A (special purpose) zoning district.

Since construction noise is typically addressed based on local or state noise ordinances and is temporary in nature, potential effects are less than major as it relates to the NEPA.

Construction noise has been predicted based on typical equipment that would be used and the amount of time, or usage factor, that the equipment would be used. **Table 10-4** presents the noise emissions from the equipment typically used during these construction activities.

Table 10-3 | Arlington County Maximum Permissible Noise Levels

Receiving Zoning District	Time of Day	Continuous Noise (dBA)	Impulsive Noise (dB)	Center Octave Frequency (Hz)	Center Octave dBA
CM M-1 P-S	All	70	120	31.5	85
				63	84
				125	79
				250	74
				500	68
				1,000	62
				2,000	57
				4,000	53
				8,000	50
S-3A	Daytime	60	95	31.5	75
				63	74
				125	69
				250	64
				500	58
				2,000	47
				4,000	43
				8,000	40
S-3A	Nighttime	55	90	31.5	70
				63	69
				125	64
				250	59
				500	53
				2,000	42
				4,000	38
				8,000	35

Source: ***Arlington County Code, Chapter 15***

Table 10-4 | Construction Equipment Noise Emissions

Equipment	Maximum Noise Level at 50 feet (dBA, Lmax)	Utilization Factor	Construction Activity
Compactor	80	20%	Access, backfill, retaining wall installation, track work
Compressor (Air)	80	40%	Track work
Concrete Mixer Truck	85	40%	Barrier crew, tremie pours
Concrete Pump Truck	82	20%	Tremie pours
Crane	85	16%	Cofferdam, deck construction, pier formwork, pile driving, rebar, Steel crew, track work
Dump Truck	84	40%	Access, backfill, demolition, excavation, retaining wall installation, traffic,
Excavator	85	40%	Demolition, excavation, backfill
Flat Bed Truck	84	40%	Deck construction, rebar, steel crew, track work
Front End Loader	80	40%	Access, cofferdam, deck construction, pier formwork, pile driving, rebar, retaining wall installation
Generator	82	50%	Barrier crew, cofferdam, deck construction, pier formwork, pile driving, rebar, track work, tremie pours
Impact Pile Driver	95	20%	Pile driving
Tamper	85	20%	Access, backfill, retaining wall installation
Pavement Scarifier	85	20%	Deck construction
Pickup Truck	55	40%	Access, backfill, barrier crew, cofferdam, deck construction, demolition, excavation, pier formwork, pile driving, rebar, retaining wall installation, track work, tremie pours
Tug Boat	87	50%	Backfill, cofferdam, deck construction, pier formwork, pile driving, steel crew, tremie pours
Vibratory Hopper	85	50%	Barrier crew
Vibratory Pile Driver	95	20 %	Cofferdam
Welder/Torch	73	40%	Deck construction, cofferdam, track work

Source: Federal Highway Administration (FHWA), 2006, FTA, 2006 and VHB, 2018.

Vibration generated by construction equipment has the potential to cause structural damage to buildings in very close proximity to construction activities and to annoy persons in nearby buildings. Certain construction activities have the potential for structural damage to nearby buildings. Structural damage is typically limited to impact-type construction equipment such as impact-pile driving used at very close distances to buildings (within 30 feet). The most fragile buildings susceptible to vibration damage (such as historic buildings) typically have a vibration threshold of 90VdB (0.12 inches per second peak particle velocity [PPV]) while buildings with reinforced concrete, steel, and timber may have a vibration threshold of 102 VdB (0.5 inches per second PPV). The appropriate vibration threshold for specific buildings is usually determined as part of a Construction Noise and Vibration Control Plan with input from the contractors and an assessment from a structural engineer. The potential for an increased risk of damage from vibration depends on the specific construction activity and how the existing building is constructed. FTA criteria for potential structural damage are shown in **Table 10-5** in both vibration level (VdB) and peak-particle velocity (PPV) measured in inches per second. The vibration thresholds for potential damage to structures other than buildings, such as the Jefferson Memorial Ashlar Seawall, are often substantially higher than the thresholds for potential effects to buildings. Since the effects have the potential to cause permanent damage to buildings, construction vibration impacts can be considered to be major as it relates to NEPA.

Table 10-5 | FTA Criteria for Potential Structural Damage

	Vibration Criteria for Potential Damage to Structures	
Building Category	**Vibration Level (VdB)**	**Peak-Particle Velocity (in/s)**
I. Reinforced-concrete, steel or timber	102	0.5
II. Engineered-concrete and masonry	98	0.3
III. Non-engineered timber and masonry	94	0.2
IV. Buildings extremely susceptible to vibration damage	90	0.12

Source: ***FTA, 2006.***

10.3. Permanent or Long-Term Effects

This section identifies the potential noise and vibration impacts that extend from the end of construction through the life of the Project.

10.3.1. Noise

As described in the *Affected Environment Report*, existing noise was measured at the following noise-sensitive receptor locations and shown in **Table 10-6**:

- Long Bridge Park (R1, R2, and R3) [within the George Washington Memorial Parkway (GWMP) Historic District] is primarily a park for active recreation including walking, cycling, and sports. It

does also have areas for passive recreation including benches on top of a retained earth section near the railroad corridor and is an FTA Category 3 land use;
- The Cuban Friendship Urn (R4) (within the East and West Potomac Parks and National Mall Historic Districts) is an area for passive recreation and is an FTA Category 3 land use;
- The Jefferson Memorial (R5) (within the East and West Potomac Parks and National Mall Historic Districts) is a historic landmark with significant outdoor use and is therefore considered to be an FTA Noise Category 1 land use;
- The Mandarin Oriental Hotel (R6) is an FTA Category 2 receptor since it is a building where people sleep; and
- The Portals V Residences (R7) is an FTA Category 2 noise-sensitive receptor since it is a residential building that is currently under construction.

The following locations within the Local Study Area are not considered to be sensitive to operational noise and are not receptors:

- MVT (within the Mount Vernon Memorial Highway Historic District), since it only has active recreational areas;
- Rock Creek Park Trails (within the East and West Potomac Parks Historic Districts), since it only has active recreational areas;
- Commercial and industrial properties such as the new Aquatics Center at Long Bridge Park, NPS headquarters, Bureau of Fiscal Service, U.S. Postal Service Credit Union, U.S. Immigration and Customs Building, Park America, and the U.S. Department of Defense (DOD) facility; and
- Central Heating Plant and USDA Cotton Annex (which are historic properties), since they are industrial land uses.
- The Bureau of Engraving and Printing (historic) is not considered sensitive to noise since it is primarily an industrial facility.

10.3.1.1. No Action Alternative

An increase in noise levels in the No Action Alternative because of increased train operations from 76 (Existing) trains to 114 (No Action) trains would result in a minor permanent direct adverse impact. The No Action Alternative includes several railroad capacity-enhancing projects on the approaches to the Long Bridge Corridor, including the addition of a fourth track from AF to RO Interlockings in Virginia,[7] the addition of a fourth track from L'Enfant (LE) to Virginia (VA) Interlockings in the District, the Virginia Railway Express (VRE) L'Enfant Station Improvements, and the Virginia Avenue Tunnel project.

Existing noise levels at each receptor were predicted based on the validated noise model and ranged from 65 to 83 dBA. The highest existing sound levels would be at the northwestern façade of the Mandarin Oriental Hotel which is approximately 40 feet from the near track centerline. Some of the existing trains in this area generate wheel squeal due to the curve of the tracks. Wheel squeal is a phenomenon that results in high-amplitude, high-frequency tones due to the interaction of the wheels with the rail surface.

[7] "AF" and "RO" are the proper names of the interlockings. They are not acronyms.

The most substantial change in noise with the No Action Alternative compared to the existing conditions would be the increase in train operations on the existing railroad corridor. Receptor locations are shown in **Figure 10-6**. **Table 10-6** compares the existing and No Action noise levels at sensitive receptors throughout the Local Study Area. Existing noise levels range from 65 to 83 dBA and the No Action Alternative noise levels would range from 67 to 86 dBA. The increase in train operations from 76 to 114 with the No Action Alternative would generally increase noise conditions by 2 to 4 dBA at receptors close to the railroad corridor. At locations farther from the railroad corridor, such as the Jefferson Memorial (R5) and Cuban Friendship Urn (R4), there would be very little change in noise with the No Action Alternative because train noise is only a portion of the overall noise environment which includes other sources such as traffic on I-395 and aircraft activity at Ronald Reagan Washington National Airport.

Table 10-6 | Existing and No Action Alternative Noise Conditions

			Noise Level (Ldn/Leq, dBA)[1]		
Receptor	**Location**	**LUC**	**Existing**	**No Action**	**Increase (dBA)**
R1	**Long Bridge Park South**	3	64.6	66.8	+2.2
R2	**Long Bridge Park Center**	3	67.7	69.3	+1.6
R3	**Long Bridge Park North**	3	65.3	67.1	+1.8
R4[2]	**Cuban Friendship Urn**	3	67.1	67.2	+0.1
R5[2]	**Jefferson Memorial**	1	64.2	64.3	+0.1
R6	**Mandarin Oriental Hotel**	2	82.5	86.4	+3.9
R7	**Portals V Residences**	2	72.3	76.2	+3.9

1 Land use category 2 receptors are evaluated based on the Ldn metric. Land use categories 1 and 3 are evaluated based on the Leq metric.
2 Modeled noise level includes measured ambient noise from non-rail noise contributions
LUC – Land Use Category; Ldn- Day Night Level; Leq – Peak Hour Equivalent Noise Level
Source: VHB, 2018.

10.3.1.2. Action Alternative A

An increase in noise levels in Action Alternative A compared to either the Existing Conditions or No Action Alternative may result in moderate to major permanent direct adverse impacts. As described in **Section 1.4.2, Action Alternatives**, Action Alternative A would include a new two-track bridge constructed west (upstream) of the existing bridge at the crossing of the Potomac River and the existing bridge would be retained to create a four-track crossing. This additional capacity would enable operators to run additional trains based on their long-range plans. As described in **Section 6.2.1.2, Railroad Infrastructure and Operations**, there would be a 71 percent increase in passenger train volumes compared to the No Action Alternative with the Project enabling Amtrak, VRE, and MARC to provide additional service between Virginia and the District. Action Alternative A assumes that railroad operations through the Long Bridge Corridor would increase from 114 trains (No Action Alternative) to 192 trains (Action Alternative) as a result of increased capacity.

Figure 10-6 | Noise Impact Assessment Results

As described in **Appendix B2, Basis of Design Report**, all mainline tracks would be designed to meet or exceed the maximum allowable speeds through the Project Area. Based on **Appendix B6, Conceptual Engineering Plans,** the maximum allowable speeds or design speeds range from 30 to 45 mph for passenger trains and between 25 and 40 mph for freight trains. Although a detailed railroad operations model and system safety plan may indicate that higher trains speeds may be possible, the noise and vibration assessment assumes that the existing train speeds would be maintained.

Noise impact was assessed based on the potential increase in railroad operations as a result of the increased capacity provided by Action Alternative A. The increase in noise was evaluated based on a comparison of both the Existing and No Action Alternative conditions as a baseline. The comparison of noise conditions between the Existing and Action Alternative A accounts for changes in future noise, such as additional train operations, that would occur regardless of the proposed project. The comparison of noise conditions between the No Action Alternative and Action Alternative A accounts for only the changes in noise due to the proposed project.

The noise impact assessment results for Action Alternative A are presented in **Table 10-7** and **Figure 10-6**. Action Alternative A noise levels with the Project would range from 67 to 86 dBA. At the Cuban Friendship Urn (R4) and the Jefferson Memorial (R5), there would be very little change in noise due to the contributions of other sources such as traffic on I-395 and aircraft activity at Ronald Reagan Washington National Airport and there would be no impact.

At Long Bridge Park, noise levels would increase by 6 to 9 dBA (Leq) relative to the Existing Condition and by 4 to 7 dBA (Leq) relative to the No Action Alternative. The introduction of new track turnouts and the increase in train operations would cause this increase in noise. Action Alternative A would cause a moderate noise impact away from the new track turnouts and severe noise impact near the new turnouts. Since Long Bridge Park is a public park, it is offered special protection under Section 4(f) of the United States Department of Transportation Act of 1966. Noise impacts can qualify as a "constructive use" under Section 4(f) if the change in noise would be "so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired."[8]

FHWA defines a potential constructive use, as it relates to noise, as a change in noise of more than 3 dBA (comparing the Action to the No Action condition) and exceeding the FHWA Noise Abatement Criteria. According to the FTA guidance manual, FTA moderate noise impacts are not considered to substantially impair the use of a Section 4(f) park and would generally not be a constructive use. Since there would be severe impact and noise levels would increase more than 3 dBA, this could be considered a noticeable change in noise and it could affect passive recreational activities such as talking, reading, or meditation. However, these noise impacts would not cause a constructive use. Long Bridge Park's design integrates the existing railroad corridor, and the esplanade allows visitors to view the trains. Serenity and quiet are not significant attributes of this section of the park, nor is this section intended for viewing wildlife or other activities that increased noise would disrupt. Therefore, increases in noise would not substantially interfere with the use and enjoyment of the park. Nevertheless, mitigation is warranted to reduce the increase in noise from the new track turnouts.

[8] 23 CFR 774.15(a)

Table 10-7 | Action Alternative A Noise Impact Assessment

			Noise Level (Ldn/Leq, dBA)[1]									
				Impact Criteria (Comparison of Action to Existing Condition)			Impact Criteria (Comparison of Action to No Action Condition)					
Receptor	Location	LUC	Existing	Moderate	Severe	No Action	Moderate	Severe	Action Alternative A	Increase (Action compared to Existing)	Increase (Action compared to No Action)	Impact Assessment
R1	**Long Bridge Park South**	3	64.6	68.1	71.9	66.8	69.8	73.3	71.4	6.8	4.6	Moderate[3]
R2	**Long Bridge Park Center**	3	67.7	70.6	74.0	69.3	72.0	75.2	76.6	8.9	7.3	Severe[4]
R3	**Long Bridge Park North**	3	65.3	68.7	72.3	67.1	70.2	73.6	71.2	5.8	4.0	Moderate[3]
R4	**Cuban Friendship Urn[2]**	3	67.1	70.2	73.6	67.2	70.2	73.6	67.3	0.2	0.1	None
R5	**Jefferson Memorial[2]**	1	64.2	65.6	68.0	64.3	65.7	68.0	64.4	0.2	0.1	None
R6	**Mandarin Oriental Hotel**	2	82.5	82.5	83.1	86.4	86.4	86.7	86.0	3.5	-0.4	Severe[4]
R7	**Portals V Residences**	2	72.3	73.0	74.7	76.2	76.5	78.3	78.7	6.4	2.5	Severe[5]

1 Land use category 2 receptors are evaluated based on the Ldn metric. Land use categories 1 and 3 are evaluated based on the Leq metric.
2 Includes contributions from non-railroad noise sources
3 Moderate impact based on comparison of Future noise with Existing condition and comparison of Future noise with No Action condition.
4 Severe impact based on comparison of Future noise with Existing condition and No Impact based on comparison of Future noise with No Action condition.
5 Severe impact based on comparison of Future noise with Existing condition and comparison of Future noise with The No Action condition.
LUC – Land Use Category; Ldn- Day Night Level; Leq – Peak Hour Equivalent Noise Level
Source: VHB, 2018.

Noise levels at the Mandarin Oriental Hotel (R6) would increase with Action Alternative A compared to existing conditions but would decrease slightly compared to the No Action Alternative. Action Alternative A would introduce two new tracks and would increase the number of train operations. These tracks move a portion of the train operations farther away from the Mandarin Oriental Hotel, resulting in a reduction in noise from those passbys. Cumulative noise exposure also depends on the number of train operations. These would increase 71 percent compared to the No Action Alternative and would increase 253 percent compared to existing conditions. Compared to the No Action Alternative, cumulative noise exposure would decrease slightly (less than 1 dBA) with Action Alternative A because the new tracks would offset the increase in train operations.

Compared to existing conditions, cumulative noise exposure with Action Alternative A would increase by 4 dBA (Ldn) because the additional train operations would not be offset by any new track. Therefore, Action Alternative A would result in a severe noise impact at the Mandarin Oriental Hotel (R6), which warrants an evaluation of potential mitigation.

At the Portals V Residences (R7), noise levels would increase by 3 dBA relative to the No Action Alternative and by 6 dBA relative to Existing Conditions due to the increase in train operations and the introduction of two new tracks closer to the building. Therefore, Action Alternative A would result in severe noise impact at the Portals V Residences, which warrants an evaluation of potential mitigation.

Further information on mitigation is presented in **Section 10.5, Avoidance, Minimization, and Mitigation**.

10.3.1.3. Action Alternative B

In Action Alternative B, a new two-track bridge would be constructed upstream of the existing bridge and the existing bridge would be replaced with a new two-track bridge, creating a four-track crossing. The replacement of the older steel bridge with a new bridge would not affect noise from the trains, but may reduce noise which is radiated by the structure. Bridges radiate noise due to it vibrating when trains pass over. Another difference with respect to the operational noise impact assessment with Action Alternative B is that the replacement bridge profile would be raised compared to the existing bridge. Neither the age of the bridge nor the bridge profile would have an appreciable effect on noise emissions, as all noise-sensitive receptors are on land and the small changes in noise would be over water. Therefore, the results of the noise impact assessment for Action Alternative B would be the same as those for Action Alternative A.

10.3.2. Vibration

10.3.2.1. No Action Alternative

The No Action Alternative would result in no permanent direct or indirect adverse vibration impacts. There would be no change in vibration level between the existing condition and the No Action Alternative as there would be no change in the railroad alignment and no change in the speed or train types. Vibration levels at each vibration-sensitive receptor have been predicted based on a regression of the exterior measurement results and adjustments for changes in track locations, special trackwork, and attenuation from the outside to the inside of buildings (building coupling loss). The overall vibration

velocity levels and the maximum vibration levels in any 1/3-octave band have been evaluated. Receptor locations are shown in **Figure 10-6**.

Table 10-8 presents the overall vibration level and the maximum vibration level in any 1/3-octave band for the Existing Condition and the No Action Alternative. As the maximum vibration velocity is a function of distance, vibration velocities are similar in the Existing and No Action Alternative as the distance from the closest track to the receptors do not change. Although the total number of train operations would increase between the Existing Condition and No Action Alternative, the vibration level generated by any individual train passby would remain the same because the same types of trains would operate at the same speeds under the same track conditions.

The highest vibration levels would be at the Mandarin Oriental Hotel (69 VdB overall; 63 VdB maximum in any 1/3-octave band). The overall vibration level and the maximum 1/3-octave band level would be below the FTA General Assessment vibration criterion (72 VdB) and the FTA Detailed Assessment vibration criteria at the Mandarin Oriental Hotel. Vibration levels at other receptors would be substantially lower since they are farther from the tracks. Vibration levels would be below the FTA impact criteria (see **Section 10.2.2.5, Vibration Impact Criteria**) at all receptor locations in the Existing Condition and No Action Alternative.

The potential increase in vibration with the No Action Alternative was evaluated against Existing Conditions to show the change in baseline conditions; however, mitigation is not considered for these changes as they are not Project impacts.

Table 10-8 | Existing Condition and No Action Alternative Vibration Conditions

Receptor	Location	LUC	Existing and No Action Overall Vibration Level (VdB)	Existing and No Action 1/3-Octave Band Vibration Level (VdB)
R5	**Jefferson Memorial**	1	39	37
R6	**Mandarin Oriental Hotel**	2	69	63
R7	**Portals V Residences**	2	57	52

LUC – Land Use Category; VdB – Vibration Decibels.
Source: VHB, 2018.

Similar to noise, any changes in vibration with the No Action Alternative would not be caused by the proposed Project. The potential increase in vibration with the No Action Alternative was evaluated against Existing Conditions to show the change in baseline conditions; however, mitigation is not considered for these changes as they are not Project impacts.

10.3.2.2. Action Alternative A

This section assesses the potential for operational vibration impacts for Action Alternative A. As described in **Section 10.2.2.5, Vibration Impact Criteria**, vibration impact is assessed in existing railroad corridors based on whether vibration levels would exceed the FTA criteria and whether there would be either a 3 VdB increase in vibration or a doubling or more of the number of train operations. The number of operations would more than double compared to existing conditions as a result of the added

capacity under Action Alternative A. Therefore, there would be vibration impact due to Action Alternative A if vibration levels would exceed the FTA vibration criteria.

Table 10-9 presents overall vibration level and the maximum vibration level in any 1/3-octave band for the existing and Action Alternative A. The proposed design would introduce two new tracks to the railroad corridor. North of the Potomac River, the proposed Track 1 would be on the south side of the railroad corridor and the proposed Track 4 would be on the north side of the railroad corridor.

The new Track 1 would be located within approximately 36 feet of the Mandarin Oriental Hotel (R6) where vibration levels would be 69 VdB (overall) and 63 VdB (max 1/3-octave band). The overall vibration level would not exceed the FTA General Vibration Assessment criterion and the vibration spectra would not exceed the FTA Detailed Vibration Assessment criteria. Therefore, there would not be vibration impact at the Mandarin Oriental Hotel. Vibration levels at The Portals V Residences would increase slightly relative to the No Action Alternative but would still be below the FTA vibration criteria. Vibration levels at the Jefferson Memorial would be well below the thresholds of perception and would not change with Action Alternative A. Therefore, there would not be vibration impact with Action Alternative A.

Table 10-9 | Action Alternative A Vibration Impact Assessment

			Existing		Action Alternative A			
Receptor	Location	LUC	Overall Level (VdB)	1/3-Octave Band Level (VdB)	Overall Level (VdB)	1/3-Octave Band Level (VdB)	Overall and 1/3-Octave Band Impact Criterion (VdB)	Vibration Impact
R5	Jefferson Memorial	1	39	37	39	37	65	No
R6	Mandarin Oriental Hotel	2	69	63	69	63	72	No
R7	Portals V Residences	2	57	52	61	56	72	No

LUC – Land Use Category; VdB – Vibration Decibels.
Source: VHB, 2018.

10.3.2.1. Action Alternative B

In Action Alternative B, a new two-track bridge would be constructed upstream of the existing bridge and the existing bridge would be replaced with a new two-track bridge, creating a four-track crossing. The only substantial difference with respect to the operational vibration impact assessment with Action Alternative B is that the replacement bridge profile would be raised compared to the existing bridge. However, this would not have an appreciable effect on vibration emissions, since the changes in bridge profile would be approximately 3 to 5 feet. Therefore, the results of the vibration impact assessment for Action Alternative B would be the same as those for Action Alternative A.

10.4. Temporary Effects

This section identifies the potential impacts to the resource that are intermittent, infrequent, or last only for the duration of the construction period.

Construction has the potential to increase noise and vibration in the Local Study Area and affect receptors at residential, commercial, and industrial land uses. **Section 1.5, Construction Overview**, details the construction methods and activities for the Action Alternatives, including information on construction sequence, duration, equipment used, and staging. Construction activities primarily include track work throughout the corridor, pile driving, sheeting, and decking, pier work, and superstructure work.

Unlike operational noise and vibration, which is evaluated at residential and institutional receptors based on FTA categories, construction noise is evaluated at all residential, commercial, and industrial receptors. Construction vibration has been computed at all nearby structures to assess the potential for structural damage.

As shown in **Table 10-4**, the maximum noise emissions at 50 feet of typical equipment used for construction activities range from 80 to 90 dBA. As shown in **Table 10-10**, the energy-average noise level (Leq) over a typical work period was computed at 50 feet based on all the equipment typically used during each construction activity and their respective utilization factors. This table shows that construction noise is generally 85 to 90 dBA (Leq) at 50 feet depending on activity.

Table 10-10 | Construction Activity Noise Emissions

Construction Activities	Construction Noise at 50 feet (dBA, Leq)
Track Work	84
Pile Driving. Sheeting and Decking (over Water)	89
Pile Driving, Sheeting, Decking (on Land)	90
Pier Work	84
Superstructure	89

Source: VHB, 2018.

Vibration generated by construction equipment has the potential to cause structural damage to buildings in very close proximity to the construction work area, and to cause human annoyance to persons inside nearby buildings. Equipment that generates vibration includes loaded trucks, drilling rigs, hoe rams, and impact pile drivers.

Table 10-11 Error! Reference source not found. presents the reference vibration level from typical construction equipment and the distance from the equipment where vibration levels would exceed the thresholds for potential structural damage (0.5, 0.3, 0.2, and 0.12 inches per second) depending on building type. For most equipment including loaded trucks, drilling rigs, hoe rams, and impact pile drivers, vibration levels would only exceed 0.5 inches per second within 29 feet. For fragile buildings that are particularly susceptible to structural damage, vibration levels exceed 0.12 inches per second within 73 feet of impact pile driving.

Table 10-11 | Typical Construction Vibration Source Levels and Distances

Equipment	PPV at 25 feet (in/sec)	Distance to exceeding FTA criterion (feet) Type I 0.5 in/s (102 VdB)	Type II 0.3 in/s (98 VdB)	Type III 0.2 in/s (94 VdB)	Type IV 0.12 in/s (90 VdB)
Loaded Truck	0.076	7	10	14	18
Drilling Rig	0.089	8	11	15	20
Hoe Ram	0.089	8	11	15	20
Impact Pile Driver	0.644	29	40	54	73

Source: ***FTA, 2006 and VHB, 2018.***

10.4.1. No Action Alternative

The No Action Alternative would result in construction noise and vibration associated with other projects, such as the addition of a fourth track from AF to RO Interlockings in Virginia, the addition of a fourth track from LE to VA Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project. The noise and vibration impacts related to the construction of these projects and any other large capital projects would be assessed within the context of each project.

10.4.2. Action Alternative A

Action Alternative A would have a potential moderate temporary direct adverse impact as it would exceed the District daytime noise limits at three receptors and would exceed the District and Arlington County nighttime noise limits at several other receptors. **Table 10-12** and **Figure 10-7**Error! Reference source not found. present the results of the construction noise assessment. The table shows that construction noise levels would generally range from 65 to 92 dBA (Leq) at all receptors. Construction noise levels would exceed the District daytime limit of 80 dBA (Leq) at three receptors including the Mandarin Oriental Hotel (R6), NPS Headquarters (R20) and Rock Creek Trail (R22). The construction noise would exceed daytime limits primarily due to construction activities such as trackwork, superstructure construction, and sheet pile driving in water.

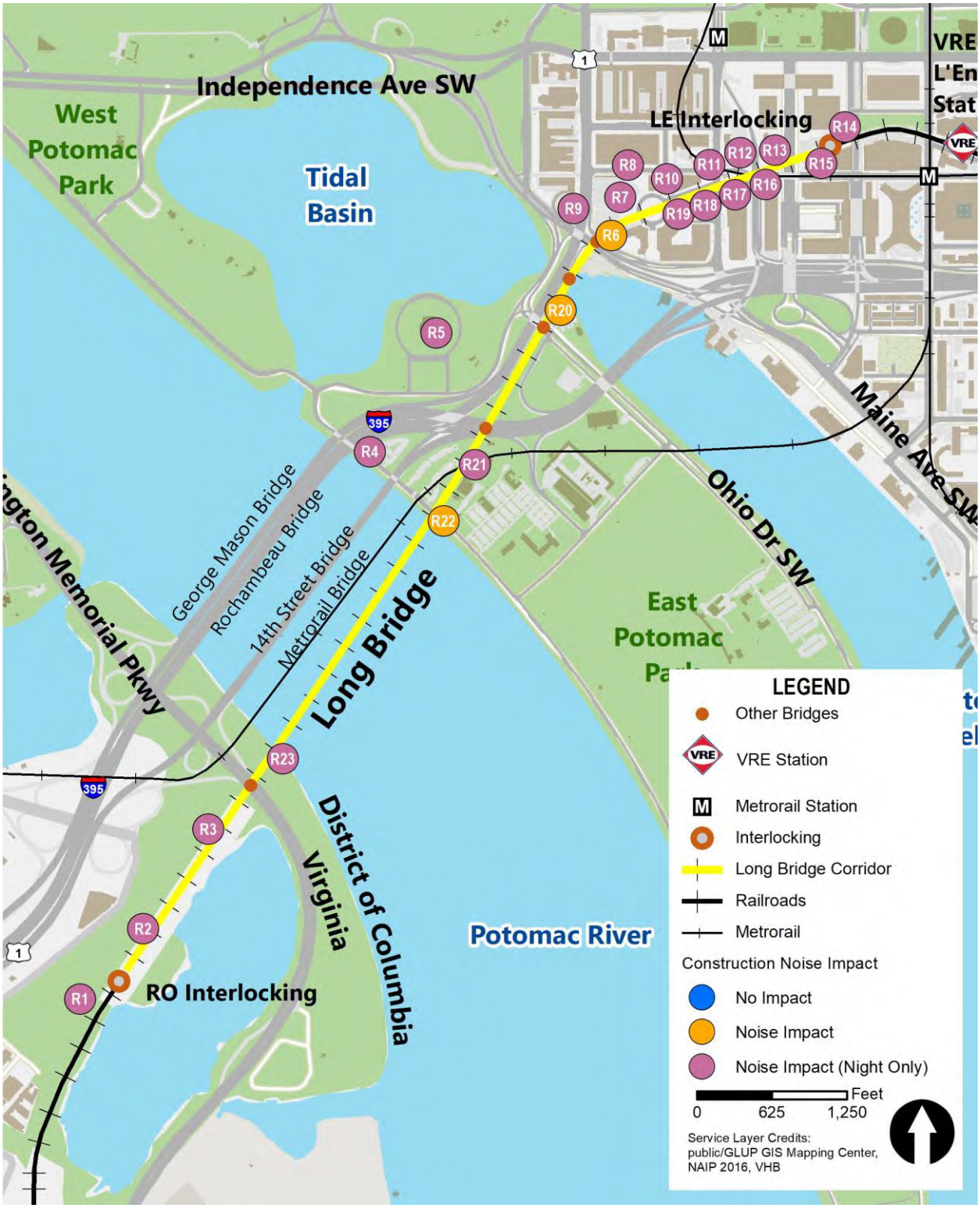
If construction were to occur at night, noise levels would exceed the District nighttime limit (65 dBA [Lmax]) at all locations within approximately 500 feet from construction activities and would exceed the Arlington County nighttime noise limits at Long Bridge Park (70 dBA [Leq] limit) and the MVT which is in a special-purpose zone S-3A (55 dBA [Leq] limit). Therefore, prior to mitigation, daytime construction noise levels would exceed the District noise ordinance and nighttime construction noise levels would exceed the District noise ordinance and the Arlington County noise ordinance and there would be a need to implement mitigation to reduce construction noise.

Table 10-12 | Action Alternative A Construction Noise Impact Assessment

Receptor	Location	Construction Activity	Construction Noise Level (Leq, dBA)	Construction Noise Impact Criteria (dBA)		Construction Noise Impact
				Day	Night	
R1	**Long Bridge Park West**	Track Work	73	N/A	70 (Leq)	Night Only
R2	**Long Bridge Park Center**	Track Work	83	N/A	70 (Leq)	Night Only
R3	**Long Bridge Park East**	Track Work	81	N/A	70 (Leq)	Night Only
R4	**Cuban Friendship Urn**	Pile Driving (Land)	67	80 (Leq)	65 (max)	Night Only
R5	**Jefferson Memorial**	Pile Driving (Land)	65	80 (Leq)	65 (max)	Night Only
R6	**Mandarin Oriental Hotel**	Track Work	86	80 (Leq)	65 (max)	Day and Night
R7	**Portals V Residences**	Superstructure	77	80 (Leq)	65 (max)	Night Only
R8	**U.S. Bureau of Engraving**	Superstructure	71	80 (Leq)	65 (max)	Night Only
R9	**Bureau of the Fiscal Service**	Pile Driving (Land)	73	80 (Leq)	65 (max)	Night Only
R10	**Portals III**	Track Work	72	80 (Leq)	65 (max)	Night Only
R11	**Fed Building – Parking**	Track Work	73	80 (Leq)	65 (max)	Night Only
R12	**Cotton Annex**	Track Work	72	80 (Leq)	65 (max)	Night Only
R13	**PenFed Credit Union**	Track Work	76	80 (Leq)	65 (max)	Night Only
R14	**U.S. Department of Education**	Track Work	77	80 (Leq)	65 (max)	Night Only
R15	**Park America**	Track Work	78	80 (Leq)	65 (max)	Night Only
R16	**U.S. Postal Service Credit Union**	Track Work	77	80 (Leq)	65 (max)	Night Only
R17	**U.S. Immigration and Customs**	Track Work	77	80 (Leq)	65 (max)	Night Only
R18	**American College of Obstetricians and Gynecologists (Administrative)**	Track Work	77	80 (Leq)	65 (max)	Night Only
R19	**U.S. Department of Agriculture**	Track Work	78	80 (Leq)	65 (max)	Night Only
R20	**NPS National Capital Region Headquarters**	Superstructure	92	80 (Leq)	65 (max)	Day and Night
R21	**Department of Defense Building**	Pile Driving (Land)	79	80 (Leq)	65 (max)	Night Only
R22	**Rock Creek Trail**	Sheeting (Water)	83	80 (Leq)	65 (max)	Day and Night
R23	**MVT (S-3A)**	Sheeting (Water)	84	N/A	55 (night)	Night Only

N/A There is no daytime construction noise limit in Arlington County.

Figure 10-7 | Construction Noise and Vibration Impact Assessment Results



Action Alternative A would have no construction vibration impact at nearby buildings and the Jefferson Memorial Ashlar Seawall due to the Project and there is no need for construction vibration mitigation. Construction vibration levels would be up to 0.066 inches per second (84 VdB) at the Mandarin Oriental Hotel. Construction vibration from all equipment and all activities would not exceed even the most stringent criterion for potential damage to fragile buildings (0.12 inches per second, 90 VdB). There is the potential for construction vibration to reach 0.9 inches per second (107 VdB) at the East Potomac Park seawall due to pile driving at approximately 20 feet. Since the sensitivity of the seawall to vibration is not known at this time, the seawall should be included in the contractor's Construction Noise and Vibration Control Plan.

Table 10-13 presents the results of the construction vibration assessment. Construction vibration from all equipment and all activities would not exceed even the most stringent criterion for potential damage to fragile buildings (0.12 inches per second). Therefore, there would be no construction vibration impact at buildings due to the Project and there is no need for construction vibration mitigation. There is the potential for construction vibration to reach 0.9 inches per second at the East Potomac Park seawall due to pile driving at approximately 20 feet. Since the sensitivity of the seawall to vibration is not known at this time, the seawall should be included in the contractor's Construction Noise and Vibration Control Plan.

10.4.3. Action Alternative B

Action Alternative B would have a potential moderate temporary direct adverse impact, as it would exceed the District daytime noise limits at three receptors and would exceed the District and Arlington County nighttime noise limits at several other receptors. The type of construction activities and equipment used for construction of Action Alternative B would generally be similar to that for Action Alternative A resulting in similar construction noise and vibration levels at all of the receptors. The overall duration of construction would be substantially longer (up to 8 years and 3 months compared to up 5 years for Action Alternative A); however, the construction duration is the same for both Action Alternatives in most portions of the Corridor where there are residences and businesses with the exception of the National Park Service National Mall and Memorial Parks Headquarters. The construction noise levels that result in potential daytime impact to the Mandarin Oriental Hotel (R6), National Park Service National Mall and Memorial Parks Headquarters (R20), and Rock Creek Trail (R22) and potential nighttime impact at Long Bridge Park and the Mount Vernon Trail would be the same in Action Alternative B as in Action Alternative A (**Figure 10-7**).

Table 10-13 | Action Alternative A Construction Vibration Impact Assessment

Receptor	Location	Construction Activity	Vibration-generating Equipment	Distance (feet)	Vibration Level (PPV, in/s)
R1	**Long Bridge Park West**	Track Work	Loaded Truck	180	0.004
R2	**Long Bridge Park Center**	Track Work	Loaded Truck	60	0.023
R3	**Long Bridge Park East**	Track Work	Loaded Truck	70	0.016
R4	**Cuban Friendship Urn**	Pile Driving (Land)	Pile Driver (Impact)	660	0.005
R5	**Jefferson Memorial and Jefferson Memorial Ashlar Seawall**	Pile Driving (Land)	Pile Driver (Impact)	800	0.003
R6	**Mandarin Oriental Hotel**	Pile Driving (Land)	Pile Driver (Impact)	110	0.066
R7	**Portals V Residences**	Pile Driving (Land)	Pile Driver (Impact)	400	0.010
R8	**U.S. Bureau of Engraving**	Pile Driving (Land)	Pile Driver (Impact)	670	0.005
R9	**Bureau of the Fiscal Service**	Pile Driving (Land)	Pile Driver (Impact)	320	0.014
R10	**Portals III**	Pile Driving (Land)	Pile Driver (Impact)	770	0.004
R11	**Fed Building - Parking**	Pier Work	Vibratory Compactor	180	0.011
R12	**Cotton Annex**	Pier Work	Vibratory Compactor	280	0.006
R13	**PenFed Credit Union**	Track Work	Loaded Truck	130	0.007
R14	**U.S. Department of Education**	Track Work	Loaded Truck	110	0.008
R15	**Park America**	Track Work	Loaded Truck	110	0.009
R16	**U.S. Postal Service Credit Union**	Track Work	Loaded Truck	120	0.008
R17	**U.S. Immigration and Customs**	Pier Work	Vibratory Compactor	120	0.019
R18	**American College of Obstetricians and Gynecologists (Administrative)**	Pier Work	Vibratory Compactor	210	0.009
R19	**U.S. Department of Agriculture**	Track Work	Loaded Truck	110	0.009
R20	**NPS National Capital Region Headquarters**	Pile Driving (Land)	Pile Driver (Impact)	130	0.053
R21	**Department of Defense Building**	Pile Driving (Land)	Pile Driver (Impact)	160	0.041
R22	**Rock Creek Trail and East Potomac Park Seawall**	Pile Driving (Land)	Pile Driver (Impact)	20	0.900
R23	**MVT (S-3A) Structures**	Pile Driving (Land)	Pile Driver (Impact)	100	0.079

Source: VHB, 2018.

10.5. Avoidance, Minimization, and Mitigation

10.5.1. Operational Noise Mitigation

As discussed in **Section 10.3, Permanent and Long-Term Effects**, there is the potential for permanent operational noise impact due to the increase in train operations resulting from additional capacity, addition of tracks closer to receptors, and introduction of special trackwork. As discussed in **Section 10.4, Temporary Effects**, there is the potential for construction noise to affect receptors near the corridor. Although construction would be relatively long term, taking approximately 5 to 8.25 years depending on the alternative, it would be temporary. The potential for operational and construction noise impact warrants an evaluation of avoidance, minimization and mitigation measures.

Noise mitigation is considered depending on the need, feasibility, reasonableness and effectiveness of potential options. As described in **Section 10.2.2, Methodology**, there are two levels of operations noise impact: moderate and severe. Severe impact is where a significant percentage of people would be highly annoyed by a project's noise. Moderate impact is where the change in cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong, adverse reactions. The level of noise impact is an important factor in determining the need for mitigation.

Severe noise impacts represent the most compelling need for mitigation and most railroad infrastructure projects would implement mitigation if it is safe, constructible, acoustically effective, and cost-effective. Mitigation must also be considered for moderate operational noise impacts; however, whether it is recommended depends on several factors such as where within the range of the moderate noise impact criteria receptors would be; whether there are safe, feasible, and acoustically effective mitigation options; the sensitivity of the impact receptors; and whether solutions are cost-effective.

Noise levels at the Long Bridge Park receptors exceed either the moderate or severe noise criteria for the Action Alternatives depending on proximity to the proposed special track work. Long Bridge Park has areas for passive recreation including benches on top of a retained earth section near the railroad corridor as shown in **Figure 10-8**. Noise at Long Bridge Park would increase by 4 to 7 dBA (Leq) relative to the No Action Condition and there would be Severe impact near the track turnout. The increase in noise is due to the gap in the rail running surface that is introduced with a turnout. The wheels travel over the gap and creates an impact noise. Turnouts are recommended that use either a spring-rail frog or moveable-point frog[9] to minimize the gap in the rail and would substantially reduce the impact noise and mitigate potential severe impact. Additional mitigation measures, such as a noise barrier, are not recommended at Long Bridge Park. Since noise-sensitive locations at Long Bridge Park are located on an existing retaining wall, retrofitting the wall to include a noise barrier would not be feasible from a constructability and safety perspective. Additionally, a barrier located on the retaining wall would not be reasonable without impeding the use of the pedestrian pathway and compromising the natural views from the park itself unless a transparent material was used. Based on these factors, a noise barrier is not recommended for Long Bridge Park.

[9] A frog is the part of a turnout where the tracks need to cross over each other.

Figure 10-8 | Long Bridge Park Receptor Locations

There would be severe noise impact at the Portals V Residences (R7) and at the Mandarin Oriental Hotel (R6) due to the introduction of new tracks and the increase in train operations. The most substantial source of noise at these receptors, however, is wheel squeal generated along the curve. Therefore, the most effective approach to reducing noise levels and mitigating potential impact would be to minimize wheel squeal from occurring. There are several approaches to minimizing wheel squeal, such as optimizing the wheel and rail profiles and using wayside top-of-rail friction modifier systems. The most effective means of reducing wheel squeal would be to implement a wayside top-of-rail friction modifier system and use gauge-face lubrication. Such a system would dispense a small amount of a material that optimizes the friction of the rail surface and minimizes the potential for wheel squeal. These systems have shown to substantially reduce the presence of wheel squeal. The Virginia Department of Rail and Public Transportation (DRPT), the project sponsor for final design and construction, would continue discussions with CSXT, Amtrak, and VRE as well as any potential future users (such as MARC or Norfolk Southern) to identify risk allocations due to any increased noise that may occur to nearby structures.

Table 10-14 presents the noise levels for the Action Alternatives prior to and with the recommended mitigation to reduce wheel squeal and impact noise from the new turnout at Long Bridge Park. This table shows that mitigation would reduce noise levels by 10 to 13 dBA (Ldn) at the Mandarin Oriental Hotel (R6) and the Portals V Residences (R7) and up to 5 dBA (Leq) at the Long Bridge Park.

Table 10-14 | Action Alternatives Prior To and With Noise Mitigation

			Noise Level (Ldn/Leq, dBA)[1]		
Receptor	**Location**	**LUC**	**Action Alternatives Prior to Mitigation**	**Action Alternatives with Mitigation**	**Noise Reduction**
R1	**Long Bridge Park South**	3	71.4	71.4	0
R2	**Long Bridge Park Center**	3	76.6	71.8	4.8
R3	**Long Bridge Park North**	3	71.2	70.0	1.2
R4[2]	**Cuban Friendship Urn**	3	67.3	67.3	0
R5[2]	**Jefferson Memorial**	1	64.4	64.4	0
R6	**Mandarin Oriental Hotel**	2	86.0	73.4	12.6
R7	**Portals V Residences**	2	78.7	68.8	9.9

1 Land use category 2 receptors are evaluated based on the Ldn metric. Land use categories 1 and 3 are evaluated based on Leq.
2 Modeled noise level includes measured ambient noise from non-railroad noise contributions
LUC – Land Use Category; Ldn- Day Night Level; Leq – Peak Hour Equivalent Noise Level
Source: VHB, 2018

10.5.2. Operational Vibration Mitigation

As described in **Section 10.3.2, Vibration**, overall vibration levels at the Mandarin Oriental Hotel (R6) would not exceed the FTA General Vibration Assessment criterion and maximum vibration levels in any 1/3-octave band would not exceed the FTA Detailed Vibration Assessment criteria. Therefore, there would not be vibration impact at the Mandarin Oriental Hotel or any other receptor in the Local Study Area. Should vibration mitigation be warranted based on further testing and analysis during final design, options to reduce vibration may include the use of ballast mats or resilient rail fasteners, or increasing the mass of track support foundations. Resilient rail fasteners dampen vibration as it propagates from the rail to the ties, ballast, and surrounding ground. Ballast mats dampen vibration as it propagates from the ballast to the surrounding ground.

10.5.3. Construction Noise and Vibration Mitigation

Since there would be daytime construction noise impact at three receptors in the District and potential nighttime construction noise impact at most receptors in the Local Study Area, there is a need for construction noise mitigation.

Given the long duration of construction activities and the relatively close proximity of sensitive receptors, the contractor would be required to prepare a Construction Noise and Vibration Control Plan prior to beginning construction. This plan would include detailed predictions of construction noise, requirements for conducting construction noise monitoring and, if necessary, detailed approaches that would be taken to mitigate potential construction-period noise impact.

The following are typical construction noise mitigation measures that are effective at minimizing construction noise:

- Assuring that equipment is functioning properly and is equipped with mufflers and other noise-reducing features.
- Locating especially noisy equipment as far from sensitive receptors as possible.
- Using quieter construction equipment and methods, as feasible.
- Using path noise control measures such as temporary noise barriers, portable enclosures for small equipment (such as, jackhammers and concrete saws).
- Replacing back up alarms with strobes, as allowed within Occupational Safety and Health Administration (OSHA) regulations, to eliminate the annoying impulsive sound.
- Conducting construction noise monitoring to alert the contractors of when noise limits are exceeded and when corrective measures would be warranted.
- Maintaining strong communication and public outreach with adjacent neighbors is a critical step in minimizing impact.

Best management practices should be used to minimize construction vibration as feasible and reasonable. The contractor would prepare a Construction Noise and Vibration Control Plan before beginning construction. This plan would include detailed predictions of vibration levels from the proposed construction equipment and detail specific methods to minimize potential vibration effects. The plan would set acceptable vibration limits and address the need to conduct pre-construction crack surveys, install crack detection monitors, and conduct vibration monitoring. It would define a process to alert the contractor of any limit exceedances and take corrective actions.

NPS has plans to relocate staff from the NAMA Headquarters. However, the timeline for this relocation is uncertain. If staff are still present when construction begins, DRPT would relocate remaining staff.

11.0 Aesthetic and Visual Resources

11.1. Overview

Visual and aesthetic resources include features of both the built and natural environment that together comprise the visual environment. Examples of these resources surrounding the Long Bridge Corridor include parks, natural areas, trails, parkways, scenic features, open vistas, terrain, and water bodies. Historic or urban core districts are also considered visual resources. These visual resources create visual and aesthetic qualities that define specific locations in the District of Columbia (the District) and Arlington County, Virginia.

The following terminology is used to describe visual resources, character, and quality:[1]

- **Viewers:** Neighbors who can see the proposed Long Bridge Project (the Project) and travelers who would use it.
    - **Neighbors:** Viewers who occupy, or will occupy, land adjacent or visible to the Project.
    - **Travelers:** Viewers who use the existing transportation infrastructure, or would use the transportation infrastructure resulting from the proposed Project.
- **Visual Resources:** Component of the natural, cultural, or Project environments that is capable of being seen. These include:
    - **Natural Visual Resources:** The land, geologic features, water, vegetation, and animals that compose the natural environment.
    - **Cultural Visual Resources:** The buildings, structures, objects, site, districts, and artifacts that compose the cultural environment.
    - **Project Visual Resources:** The geometrics, structures, and fixtures that compose the Project environment.
- **Visual Quality:** An assessment of what viewers like and dislike about visual resources that compose the visual character of a scene. Different viewers may evaluate specific visual resources differently based on their interests. Elements of visual quality include:
    - **Natural Harmony:** What a viewer likes and dislikes about the natural environment. The viewer labels the visual resources of the natural environment as being either harmonious or inharmonious.

[1] All definitions are adapted from FHWA's Guidelines for the Visual Impact Assessment of Highway Projects, unless otherwise noted. FHWA-HEP-15-029. Guidelines for the Visual Impact Assessment of Highway Projects. January 2015. Accessed from https://www.environment.fhwa.dot.gov/env_topics/other_topics/VIA_Guidelines_for_Highway_Projects.aspx. Accessed May 9. 2018.

  - **Cultural Order:** What a viewer likes and dislikes about the cultural environment. The viewer labels the visual resources of the cultural environment as being either harmonious or inharmonious.
  - **Project Coherence:** What the viewer likes and dislikes about the Project environment. The viewer labels the visual resources of the Project environment as being either coherent or incoherent.

- **Viewshed:** All surface area visible from a particular location or sequence of locations, such as a trail.
- **Area of Visual Effect (AVE):** The area in which views of the Project would be visible as influenced by the presence or absence of intervening topography, vegetation, and structures.
- **Key Viewpoint:** A location from which a viewer can see either iconic or representative landscapes.
- **Viewer Sensitivity:** The degree to which viewers are sensitive to changes in the visual character of visual resources. This is the consequence of two factors: viewer exposure and viewer awareness.
- **Viewer Exposure:** Viewer exposure is a measure of proximity (the distance between viewer and the visual resource being viewed), extent (the number of viewers viewing), and duration (the length of time visual resources are viewed). The greater the exposure, the more viewers will be concerned about visual impacts.
- **Viewer Awareness:** Viewer awareness is a measure of attention (level of observation based on routine and familiarity), focus (level of concentration), and protection (legal and social constraints on the use of visual resources). The greater the attention, the more viewers will be concerned about visual impacts.
- **Visual Character:** The description of the visible attributes of a scene or object typically using artistic terms such as form, line, color, and texture.
- **Compatibility of Impact:** Defined as the ability of environment to absorb the proposed project because of the project and the environment having compatible visual characters. The proposed project can be considered compatible or incompatible. By itself, compatibility of the impact should not be confused or conflated with the value of the impact. The Long Bridge structure will be considered compatible or incompatible based on its form.
- **Sensitivity to Impact:** Defined by the ability of viewers to see and care about a project's impacts. The sensitivity to impact is based on viewer sensitivity to changes in the visual character of visual resources. Viewers are either sensitive or insensitive to impacts. By itself, the sensitivity of the impact should not be confused or conflated with the value of the impact.
- **Degree of Impact:** Defined as either a beneficial, adverse, or neutral change to visual quality. A proposed project may benefit visual quality by either enhancing resources or by creating better views of those resources and improving the experience of visual quality by viewers. Similarly, a project may adversely affect visual quality by degrading visual resources or obstructing or altering desired views.

11.2. Regulatory Context and Methodology

This section describes the regulatory context for evaluation of impacts to aesthetics and visual resources, as well as the methodology used to evaluate current conditions and the probable consequences of the alternatives. The complete list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

11.2.1. Regulatory Context

The National Environmental Policy Act of 1969 offers guidelines to help ensure aesthetically pleasing surroundings for all Americans. In addition, numerous laws, regulations and Executive Orders under multiple federal agencies address aesthetics and visual resource considerations

For the purposes of this Environmental Impact Statement, the Federal Highway Administration (FHWA) *Guidelines for the Visual Impact Assessment of Highway Projects* (FHWA-HEP-15-029) establishes the general methodology used to assess impacts to aesthetics and visual resources.[2] While the FHWA is not a regulatory body for railroad projects, the agency is considered an expert resource regarding visual impact assessments, due to the FHWA's extensive documentation of visual resources, impacts, and mitigation measures.

Applicable state and local laws and regulations include the District of Columbia Municipal Regulations (DCMR) Zoning Regulations Special Purpose Zones, 11-K DCMR § 305; the Historic Landmark and Historic District Protection Act of 1978 (DC Law 2-144, as amended through October 1, 2016); and the Arlington County Zoning Ordinance (2017). Moreover, the Virginia Department of Historic Resources (VDHR) *Assessing Visual Effects on Historic Properties* provides relevant guidance for assessing visual impacts related to historic properties in the Commonwealth of Virginia. Also considered is the Height of Buildings Act of 1910 which limits the height of buildings in the District of Columbia to 90 feet along residential streets and up to a maximum of 130 feet along commercial corridors.[3]

Specific planning guidance regarding views and vistas within the Monumental Core is provided by the Urban Design Element of the National Capital Planning Commission (NCPC) *Federal Elements of the Comprehensive Plan* and by an associated technical addendum to the Urban Design Element. NCPC has review authority over the Project relative to visual and aesthetic impacts, as outlined in the National Capital Planning Act of 1952.[4] Other applicable federal planning guidance for federal land surrounding the Project Area includes the:

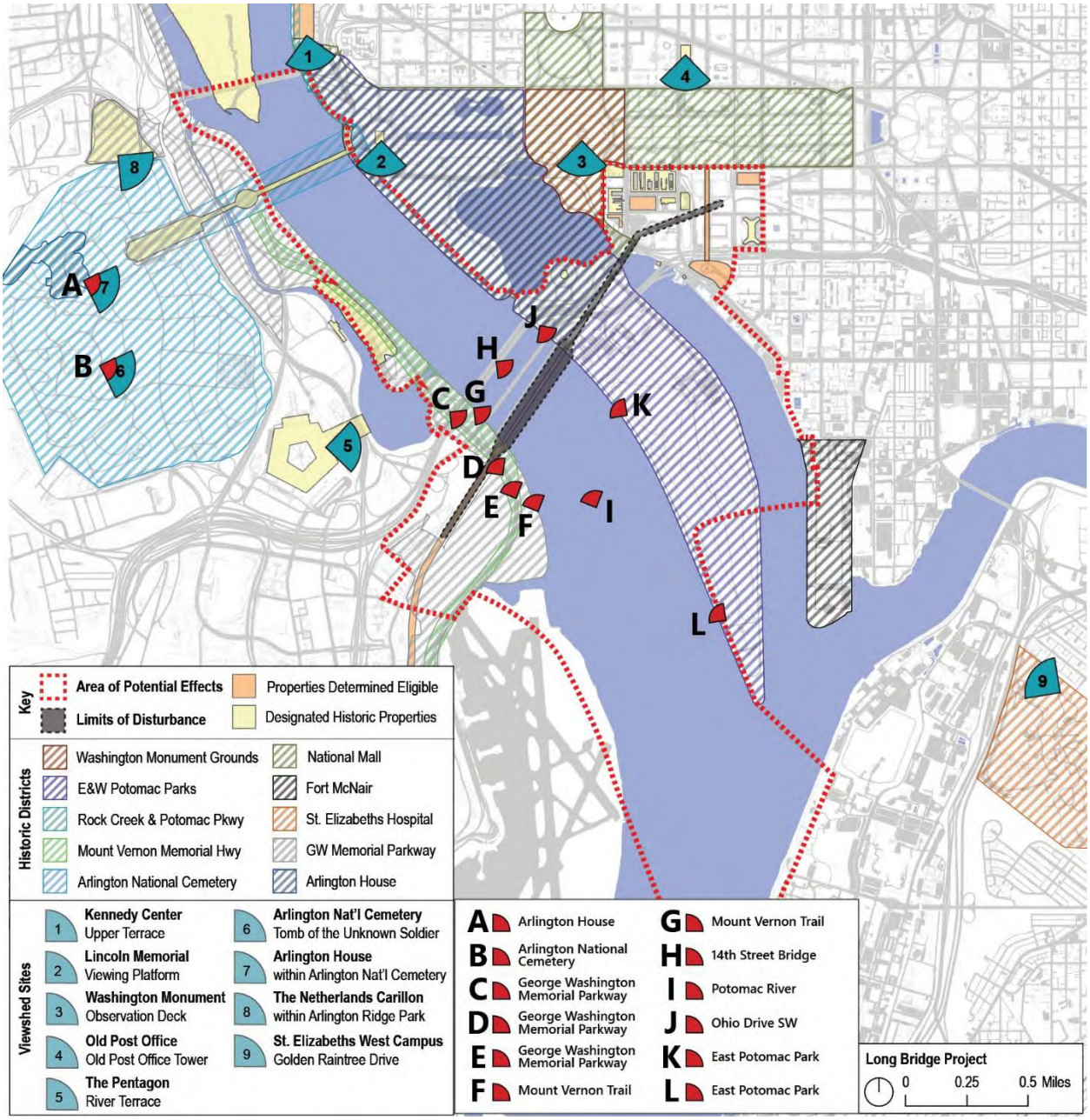
- NCPC SW Ecodistrict Plan (2013)
- NCPC Monumental Core Framework Plan (2009)
- National Park Service (NPS) National Mall Plan (2010)

[2] FHWA, 2015.
[3] Act of June 1, 1910, ch 263, Pub. L No. 61-196, 36 Stat. 452 (1910) codified at D.C. ST. 6-601.01-6-601.09. Accessed from https://code.dccouncil.us/us/congress/laws/public/61-2-ch263.html#%C2%A72. Accessed July 10, 2019.
[4] 40 USC 8701.

- NPS George Washington Memorial Parkway Foundation Document (2014)
- NCPC Memorials and Museums Master Plan (2001)

Additional local planning guidance addressing aesthetics and visual resource considerations include the Maryland Avenue SW Small Area Plan and the *District Elements of the Comprehensive Plan of the National Capital* (2006, amended 2011).

Figure 11-1 | Views and Viewsheds Selected for Analysis



11.2.2. Methodology

Based on field observations and consultation with reviewing agencies, the Project Team identified 12 representative views with the greatest potential to demonstrate impacts on aesthetics and visual resources. These views and viewshed locations, shown in **Figure 11-1**, were confirmed and refined following a Technical Advisory Committee meeting on August 16, 2018, that included NPS, NCPC, the District of Columbia State Historic Preservation Office, and VDHR.[5]

For each location, photo simulations of each Action Alternative were developed to quantitatively assess the visual and aesthetic impacts that would result from the Project under each Action Alternative. To produce the photo simulations, the Project Team constructed a three-dimensional digital massing model that was aligned with Existing Conditions photographs and superimposed over the photographs. Adobe Photoshop was also used to visualize the changes to the visual environment, including the addition and removal of certain visual elements. This analysis was supported by field visits, analysis of photographs, Google Earth mapping, and review of planning guidance to verify and qualitatively assess aesthetic and visual impacts.

11.3. Permanent or Long-Term Effects

This section considers the direct and indirect impacts of the Action Alternatives and No Action Alternative on aesthetics and visual resources. For the purpose of analyzing these impacts, this analysis considers conditions in the year 2040, by which time the Action Alternatives would be complete.

The photo simulations are presented in **Figures 11-2 through 11-25**, with summaries of the affected views and viewers and the anticipated impacts of each alternative, described in **Tables 11-1 through 11-2**. Detailed descriptions follow in **Section 11.3.3, Action Alternative A**, and **Section 11.3.4, Action Alternative B**.

11.3.1. No Action Alternative

The transportation projects included in the No Action Alternative are not expected to result in changes to the views within the Local and Regional Study Areas. The existing Long Bridge Corridor would remain in its current condition. However, development projects in Arlington and the District may affect panoramic views from the GWMP, the MVT, and East Potomac Park. Specifically, the second phase of the Wharf redevelopment will be visible to travelers and users of the GWMP and MVT within the panoramic view of the Monumental Core. From viewpoints along Ohio Drive SW in East Potomac Park, additional development in Pentagon City (including, potentially, the new Amazon HQ2 buildings) would be visible within the panoramic view of Virginia encompassing the United States Air Force Memorial and Ronald Reagan Washington National Airport.

[5] The U.S. Commission of Fine Arts was also invited to this Technical Advisory Committee meeting, but did not participate.

Table 11-1 | Visual Impacts of Action Alternative A

View	Impact Description	Impact
A	New bridge would blend into existing land uses and visual elements.	Negligible
B	New bridge would be largely hidden from view behind the tree canopy.	Negligible
C	New bridge would obscure portion of existing historic bridge and create loss of transparency in space between existing bridges. Additional bridge would increase tunnel effect caused by existing series of bridges.	Minor
D	Straight bottom of new bridge would be visible beneath arch of existing bridge and would be incompatible with arched form of other bridges in the series. Additional bridge would increase tunnel effect caused by existing series of bridges.	Moderate
E	New railroad bridge mostly obscured by existing bridge; loss of trees due to construction mostly obscured by remaining trees in foreground.	Minor
F	New railroad bridge mostly unnoticeable or not visible.	Negligible
G	New railroad bridge clearly visible; removing mature trees would reduce natural harmony and sense of enclosure.	Major
H	New railroad bridge clearly visible in the foreground; larger concentration of transportation infrastructure would contrast with and diminish the natural harmony of the river vista.	Minor
I	New railroad bridge partially visible above existing bridge's parapets; new piers visible below existing bridge's deck, reducing transparency beyond the existing bridge. Viewers less sensitive due to competing views of Arlington and the District. Pre-existing concentration of bridges would absorb and minimize new span's adverse impact.	Minor
J	New railroad bridge clearly visible; tree removal reducing natural harmony and sense of enclosure.	Major
K	New visual elements and changes to the visual environment largely obscured by existing built and natural elements and would be only slightly perceptible from a distance.	Negligible
L	New visual elements and changes to the visual environment largely obscured by existing build and natural elements and would be only slightly perceptible from a distance.	Negligible

11.3.2. Action Alternative A

11.3.2.1. Topographic Bowl and Potomac River

Action Alternative A would have negligible permanent direct adverse impacts to views of the topographic bowl and Potomac River from the surrounding ridgeline. The new bridge would blend in with its surroundings. Existing vegetation and the distance of the view would obscure the new bridge.

View A: Arlington House, the Robert E. Lee Memorial

The distant view from Arlington House, the Robert E. Lee Memorial, constitutes both a typical view of the topographic bowl and Potomac River from the surrounding ridgeline and a unique, historically significant view from the Arlington House Historic District. The Arlington House, the Robert E. Lee Memorial is a designated historic property with a view of Arlington National Cemetery in the foreground. Key elements of this view under existing conditions would remain under Action Alternative A: a panoramic view of the topographic bowl with the Potomac River and Anacostia ridgeline serving as a backdrop and the Long Bridge truss as the most visible portion of the bridge, rising above the tree line.

Impact to Visual Character

As the new bridge would be constructed parallel to and behind existing bridges, and would not have a truss, the new bridge would blend into existing land uses and visual elements. Action Alternative A would therefore result in a negligible adverse impact to visual character, as the new bridge would be only faintly discernible to the naked eye.

Impact to Viewers

Viewers from this vantage point would be primarily tourists and other visitors to Arlington House, the Robert E. Lee Memorial. Viewer sensitivity of this view would be minor overall, as the historic significance, visitors' relatively long viewing times, and a high level of focus on this view would be counterbalanced by the distant nature of the views.

Overall Visual Impact

The visual impact of Action Alternative A would be mitigated by the new bridge's high level of compatibility with its surroundings, due to the presence of numerous existing bridges within the viewshed and the lack of readily-apparent changes to the visual elements that comprise this view. As a result, overall adverse impacts to visual quality under Action Alternative A would be negligible. A photo simulation of this view under Action Alternative A is provided in **Figure 11-2**.[6]

View B: Arlington National Cemetery, Tomb of the Unknown Soldier

The distant view of the Long Bridge Corridor from Arlington National Cemetery is both a typical, representative view and a unique, historically-significant view. While this view is representative of other views of the topographic bowl and Potomac River from the surrounding ridgeline, it also constitutes a significant, panoramic view toward the National Capital's Monumental Core that is mentioned repeatedly in the Cemetery's nomination for the National Register for Historic Places (NHRP). From this vantage point, the Long Bridge Corridor is largely obscured from view by the surrounding tree line and adjacent manicured hedges. However, the truss of the existing bridge is just visible in the middle ground.

Impact to Visual Character

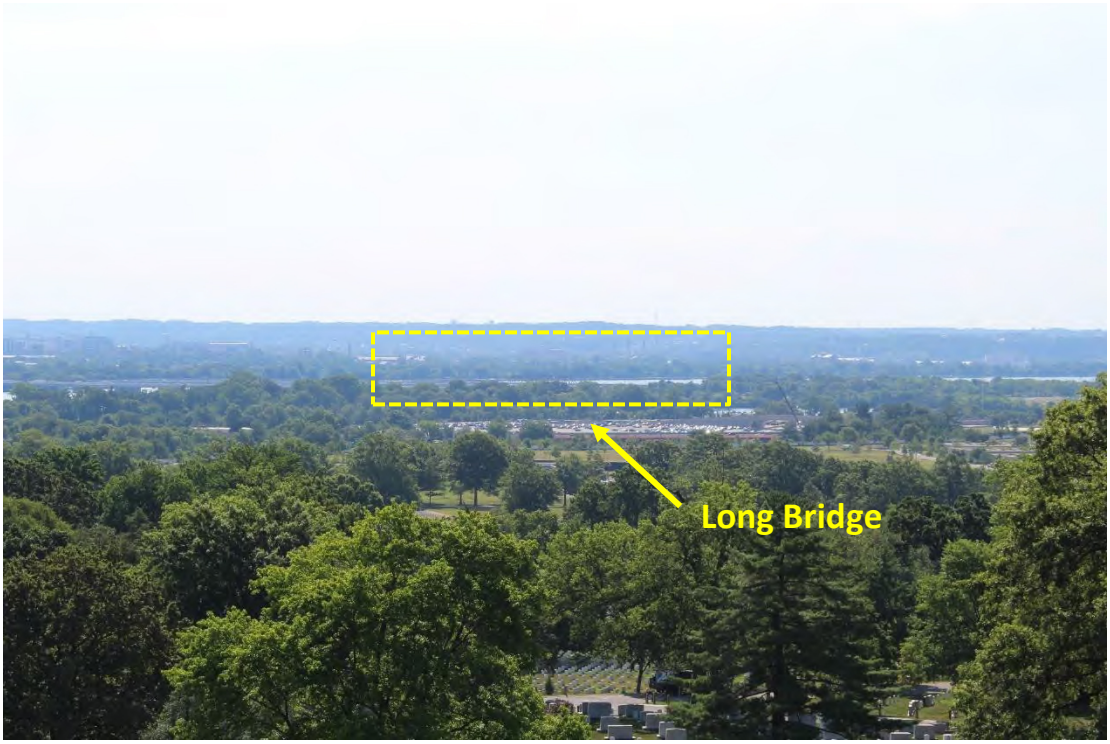
As the new bridge would be constructed parallel and at a similar height to the existing Long Bridge span and would not have a truss, the new bridge would be largely hidden from view behind the tree canopy. Action Alternative A would result in a negligible adverse impact to visual character.

Impact to Viewers

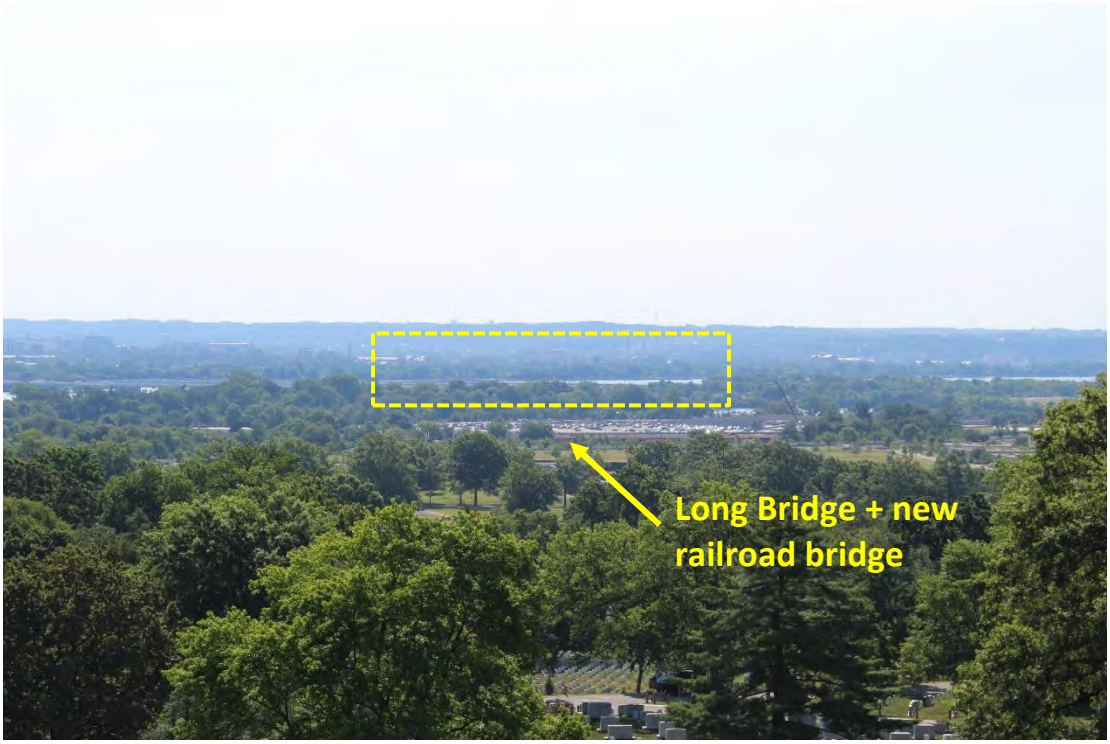
Viewers from this vantage point would be primarily tourists and other visitors to Arlington National Cemetery. Viewer sensitivity of this view would be minor overall, as the historic significance, visitors' relatively long viewing times, and the high level of focus on this view would be counterbalanced by the distant nature of the view.

[6] Note that leaves-off photographs were not taken for View A, because as of December 2018/January 2019, Arlington House was under repair and inaccessible to the public.

Figure 11-2 | View A: Action Alternative A (Leaves On)



View A, Existing Conditions



View A, Photo Simulation of Action Alternative A

Overall Visual Impact

The visual impact of Action Alternative A would be minimized by the fact that existing vegetation would obscure the new bridge, resulting in a high level of compatibility with its surroundings. As a result, overall adverse impacts to visual quality under Action Alternative A would be negligible. Photo simulations of this view under Action Alternative A with leaves on and leaves off the trees are provided in **Figures 11-3 and 11-4**.

11.3.2.2. George Washington Memorial Parkway

Action Alternative A would have minor to moderate permanent direct adverse impacts to views along the GWMP by adding an additional bridge crossing the roadway, altering the spacing between bridges, and thinning the vegetation and stands of trees included as part of the original GWMP design. In addition, the new bridge would negatively affect the cultural order by altering the spacing between bridges and contrasting with the typical arched form of bridges elsewhere along the GWMP.

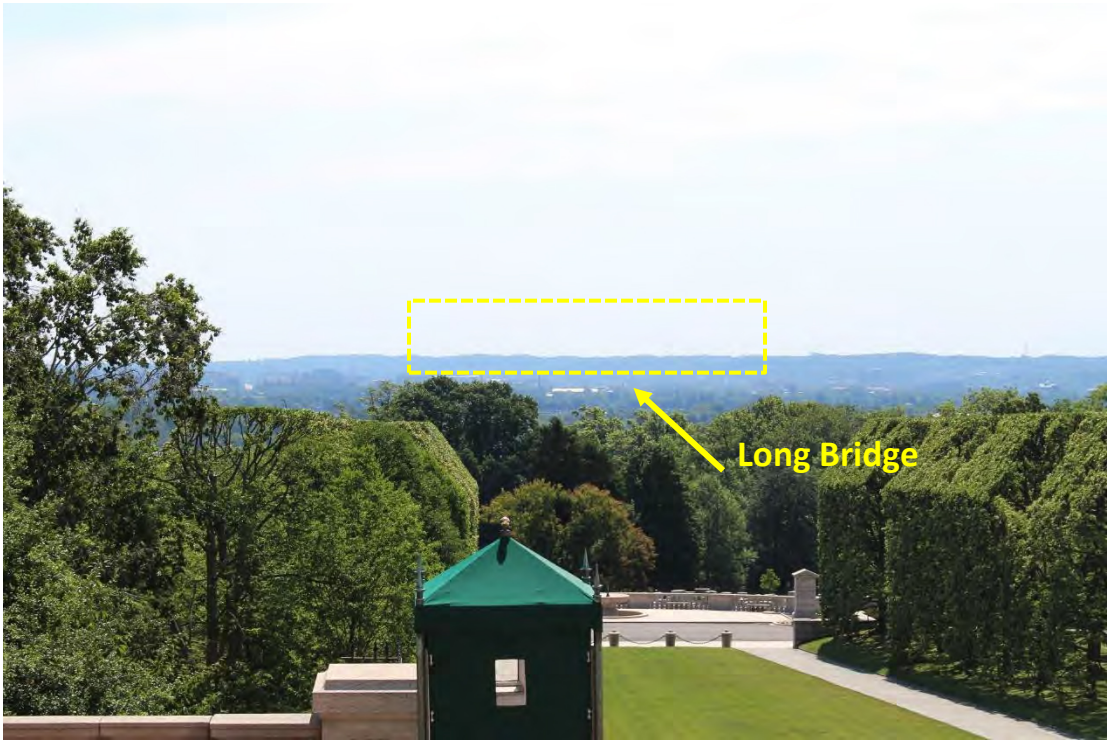
View C: George Washington Memorial Parkway Southbound, Approaching Metrorail Bridge

Approaching Long Bridge from the north on the GWMP, southbound views include a curving roadway framed by vegetation on both sides, a visible sequence of bridges spanning the GWMP, bridge piers occupying the central median, and signage indicating the ramp to I-395. The existing Long Bridge span over the GWMP is clearly visible beneath the Metrorail Bridge, while GWMP parkland, several mature trees, and the Potomac River are visible further in the distance above and beneath the arched railroad bridge. The existing railroad bridge is identified as a contributing resource to the GWMP Historic District.

Impact to Visual Character

Under Action Alternative A, the new railroad bridge over the GWMP would be partially visible underneath the Metrorail Bridge and would obstruct views of the top portion of the existing railroad bridge. Minor adverse impacts to visual character would result from the height difference between the existing Long Bridge span and the new bridge, as the three bridges would create a vertical layering effect and loss of transparency in the vertical space between the existing railroad bridge and the Metrorail Bridge. Moreover, while the design of the new bridge would be compatible with the existing railroad bridge, its straight bottom would contrast with the arched form of the existing bridge, which reflects the predominant bridge form along the GWMP and defines the gateway to the parkland beyond. The addition of a new bridge alongside the existing historic railroad bridge would alter historic views along the GWMP. Cumulatively, the three visible bridges, along with the additional stone masonry piers supporting the new railroad bridge, would exacerbate the existing tunneling and walling effect along an approximately 300-foot-long segment of the GWMP. The construction of Action Alternative A would also result in the loss of several mature trees and vegetation that were part of the original parkway design and intended to visually screen the railroad bridge. Removal of this vegetation would negatively affect the natural harmony of this part of the GWMP.

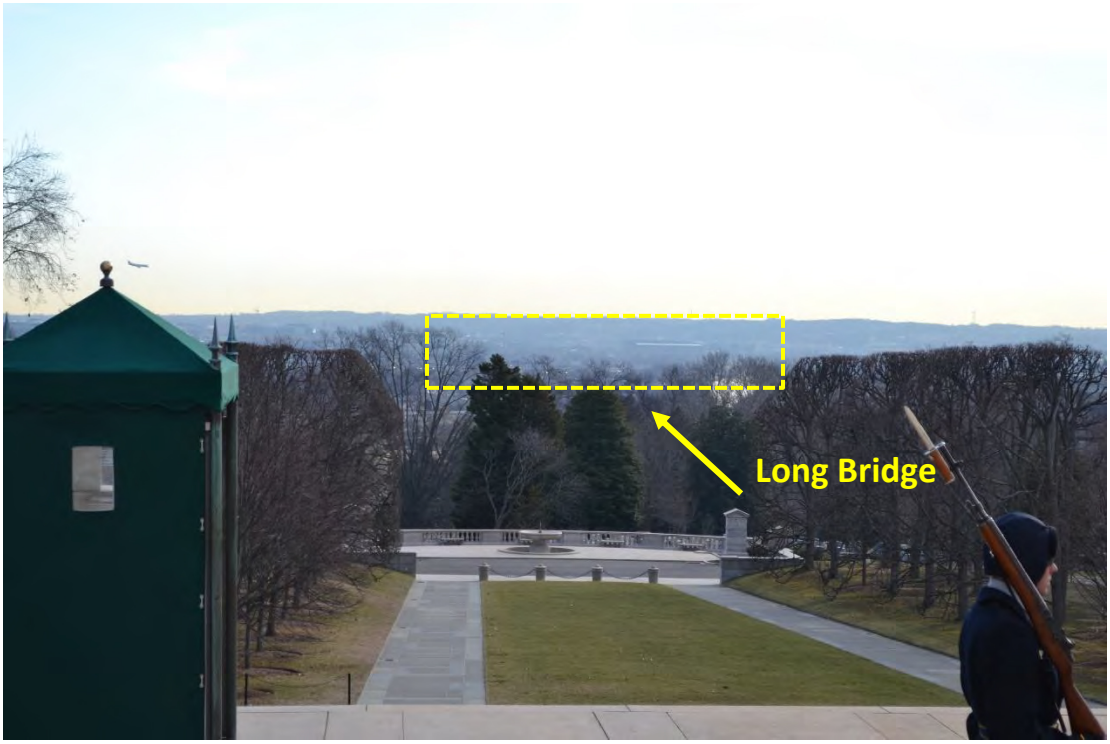
Figure 11-3 | View B: Action Alternative A (Leaves On)



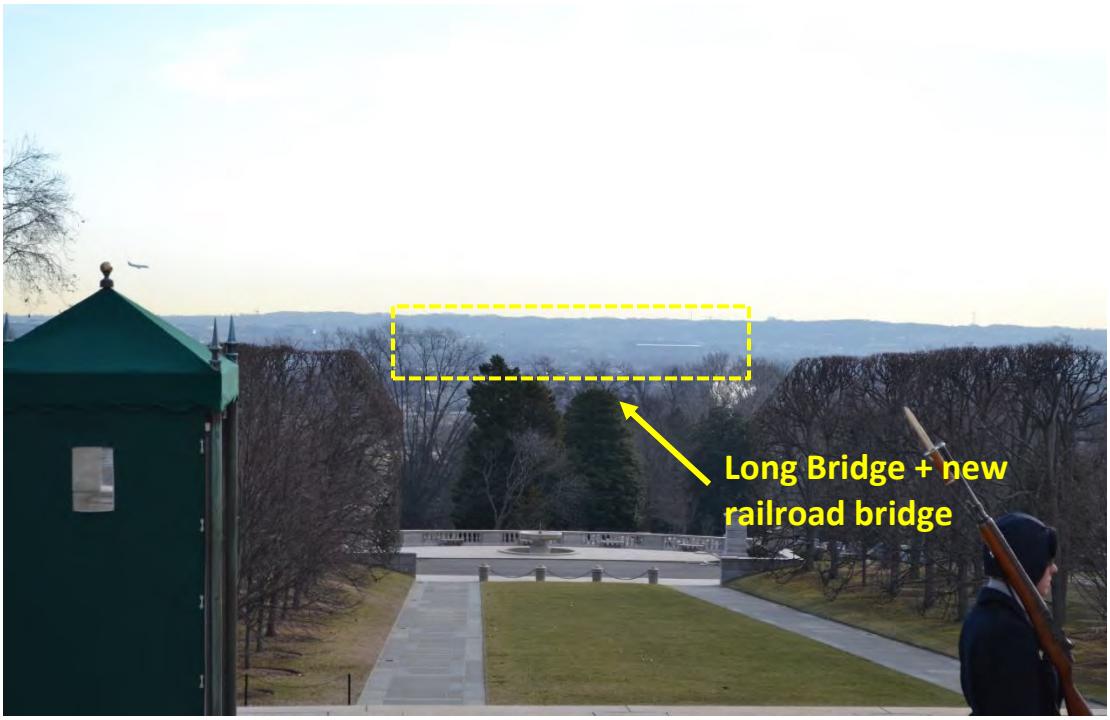
View B, Existing Conditions with Leaves On

View B, Photo Simulation of Action Alternative A with Leaves On

Figure 11-4 | View B: Action Alternative A (Leaves Off)



View B, Existing Conditions



View B, Photo Simulation of Action Alternative A

Impact to Viewers

Visitors and commuters traveling southbound by motor vehicle would be the primary viewers from this vantage point. The sensitivity of these viewers to changes in visual character would be moderate overall. The high number of daily viewers and the proximity of views would be counterbalanced by the relatively short duration of views for many viewers, thereby limiting viewer exposure to moderate levels, except during periods of traffic congestion, when exposure would be higher. Given the routine nature of many trips along the GWMP, viewer awareness of the new visual elements would be moderate; however, viewer awareness would be constrained since these visual elements would not likely be the primary focus of most viewers. Viewer sensitivity would also be limited by the ability of the visual environment to absorb the addition of a second railroad bridge. While noticeable, the new bridge would be moderately compatible with this segment of the GWMP, where multiple bridges already exist in close proximity. However, the form of the bridge would be incompatible with the arched form of the existing railroad bridge and other bridges along the GWMP, resulting in additional minor adverse impacts.

Overall Visual Impact

Overall, minor adverse impacts on visual quality would occur as a result of removal of vegetation in Action Alternative A. The view is already dominated by transportation infrastructure, and the addition of the new railroad bridge to this view does not affect the function or cultural order of the GWMP. Photo simulations of this view under Action Alternative A with leaves on and leaves off the trees are provided in **Figures 11-5 and 11-6**.

View D: GWMP Northbound Approaching Long Bridge with View of Metrorail and 14th Street Bridges

Approaching Long Bridge from the south on the GWMP, northbound views are of a curving roadway framed by vegetation, a sequence of four bridges spanning the GWMP, and signage for the ramp to I-395. The arching form of the existing Long Bridge span over the GWMP is clearly visible in the foreground, while the Metrorail Bridge and the continuation of two spans of the 14th Street Bridges are visible in the middle ground, with a curve in the roadway visible in the distance. The existing railroad bridge is identified as a contributing resource to the GWMP Historic District.

Figure 11-5 | View C: Action Alternative A (Leaves On)

View C, Existing Conditions

View C, Photo Simulation of Action Alternative A

Figure 11-6 | View C: Action Alternative A (Leaves Off)

View C, Existing Conditions

View C, Photo Simulation of Action Alternative A

Impact to Visual Character

Under Action Alternative A, the new railroad bridge over the GWMP would be partially visible underneath the arches of the existing railroad bridge. Though the new bridge would be compatible with the existing railroad bridge, its straight bottom would contrast with the arched form of the existing bridge, which reflects the predominant bridge form along the GWMP, a pattern continued and accentuated by the I-395 bridges beyond. The new bridge would alter historic views along the GWMP by adding a new visual element. As in View C, the addition of a new railroad bridge over the GWMP, along with new additional stone masonry piers, would add to the tunneling and walling effect along the GWMP. From this vantage point, the tunnel-like feel of the sequence of bridges along the GWMP would be more pronounced, due to the sequence of five bridges and associated piers and abutments in close proximity along an approximately 1,000-foot-long segment of the GWMP. The construction of Action Alternative A would also result in the loss of several mature trees and vegetation that were part of the original parkway design and intended to visually screen the railroad bridge. Removal of this vegetation would negatively affect the natural harmony of this part of the GWMP.

Impact to Viewers

Visitors and commuters traveling northbound by motor vehicle would serve as the primary viewers from this vantage point. The sensitivity of these viewers to the changes in visual character would be moderate overall. The high number of daily viewers and the proximity of views would be counterbalanced by the relatively short duration of views. Viewer exposure would be limited to moderate levels, except during periods of traffic congestion, when exposure would be higher. Given the routine nature of trips along the GWMP, viewer awareness of the new visual elements would be moderate but would be constrained by these visual elements not likely being the primary focus of most viewers.

Viewer sensitivity would be limited by the visual environment's ability to absorb the second railroad bridge. While noticeable, the new bridge would be moderately compatible with this segment of the GWMP, where multiple bridges already exist. However, the form of the new bridge would be incompatible with the arched form of the existing railroad bridge and other bridges along the GWMP, resulting in additional moderate adverse impacts.

Overall Visual Impact

Overall, moderate adverse impacts on visual quality would occur as a result of Action Alternative A. The new railroad bridge itself would pose a minor adverse impact on the overall visual experience of the GWMP, while the tunnel-like effect and contrast in bridge forms would further detract from the cultural order of the GWMP despite the existing concentration of transportation infrastructure along this segment of the GWMP. **Figures 11-7 and 11-8** provide photo simulations of this view under Action Alternative A with leaves on and leaves off the trees.

Figure 11-7 | View D: Action Alternative A (Leaves On)

View D, Existing Conditions

View D, Photo Simulation of Action Alternative A

Figure 11-8 | View D: Action Alternative A (Leaves Off)

View D, Existing Conditions

View D, Photo Simulation of Action Alternative A

View E: GWMP Northbound, Approaching Long Bridge

Traveling northbound and approaching the Long Bridge span over the GWMP, the view is characterized by a curving roadway framed by two stands of vegetation on both sides of the roadway. The existing railroad bridge is clearly visible at the curve in the roadway, with a ramp to I-395, the continuation of the GWMP, small portions of the Metrorail and 14th Street Bridges, and a stand of mature trees all visible beyond the railroad bridge. The existing railroad bridge is identified as a contributing resource to the GWMP Historic District.

Impact to Visual Character

Under Action Alternative A, the new railroad bridge over the GWMP would be mostly obscured by the existing bridge, except for portions of the bridge's piers that would be visible primarily along the roadway median and beyond the existing bridge's eastern abutment. The loss of trees as a result of constructing the new railroad bridge would be obscured by remaining mature trees in the foreground. From this vantage point, these changes would result in minor adverse impacts to visual character, due to the minor visual intrusion of additional bridge piers and the negligible to minor visual impact of tree loss in the vicinity of the new bridge.

Impact to Viewers

As in the case of other views along the GWMP, visitors and commuters traveling northbound by motor vehicle would serve as the primary viewers from this vantage point; however, limited portions of this view would also be visible to bicyclists and pedestrians traveling the Mount Vernon Trail (MVT). The sensitivity of these viewers to these changes in visual character would be moderate overall. The high number of daily viewers and the proximity of views would be counterbalanced by the short duration of views for many viewers, thereby limiting viewer exposure to moderate levels except during periods of traffic congestion, when exposure would be higher. Given the routine nature of many trips along the GWMP, viewer awareness of the new visual elements would be moderate; however, viewer awareness would be constrained since these visual elements would not likely be the primary focus of most viewers.

Viewer sensitivity would also be limited by the ability of the visual environment to absorb the addition of a second railroad bridge. While slightly noticeable, the new bridge would be moderately compatible with this segment of the GWMP, where multiple bridges already exist in close proximity. Unlike other views along the GWMP, the difference in form between the existing and new railroad bridges would not be discernible from this vantage point, given the extent to which the former visually obscures the latter.

Overall Visual Impact

Overall, minor adverse impacts on visual quality would occur as a result of Action Alternative A. The new railroad bridge and loss of trees would pose minor adverse impacts on the overall visual experience of the GWMP, as the visual impacts of the new bridge would be largely absorbed or obscured by the existing concentration of transportation infrastructure along this segment of the GWMP. **Figures 11-9 and 11-10** provide photo simulations of this view under Action Alternative A with leaves on and leaves off the trees.

Figure 11-9 | View E: Action Alternative A (Leaves On)

View E, Existing Conditions

View E, Photo Simulation of Action Alternative A

Figure 11-10 | View E: Action Alternative A (Leaves Off)

View E, Existing Conditions

View E, Photo Simulation of Action Alternative A

11.3.2.3. Mount Vernon Trail

Action Alternative A would have major permanent direct adverse impacts to visual quality along the MVT as it passes under the complex of bridges, as the removal of several mature trees would substantially reduce the natural harmony and sense of enclosure along that portion of the trail. Action Alternative A would have negligible adverse direct impacts to views from the MVT traveling north from Gravelly Point. The new bridge and changes to the visual environment would be either mostly unnoticeable or not visible.

View F: Mount Vernon Trail, Approaching Long Bridge from Gravelly Point

Northbound views along the MVT at Gravelly Point are of panoramic views of the Potomac River with the Monumental Core visible in the distance, above the bridge. The Long Bridge span over the Potomac River is partially obscured by a stand of mature trees lining Gravelly Point and by trees and scrub vegetation along the river's edge. The existing Long Bridge's truss is a defining element and landmark of this view, marking the entrance and crossing into the District. **Figures 11-11 and 11-12** provide photo simulations of this view under Action Alternative A with leaves on and leaves off the trees.

Impact to Visual Character

Under Action Alternative A, changes to visual character would be largely unnoticeable from this vantage point, since the new railroad bridge would be obscured by the existing Long Bridge span. The distant views, underneath the existing railroad bridge, of the piers supporting the Metrorail Bridge would be replaced by views of similarly sized and located piers of the new bridge. These changes would be absorbed by the surrounding context of bridges and bridge piers. The western portion of the new bridge would be obscured by the existing stand of trees. While not considered an historic view due, this view is one of numerous planned glimpses of the Potomac River and Monumental Core and beyond, envisioned as part of the GWMP design to provide a picturesque approach to the National Capital.[7] These changes would result in negligible adverse impacts to the visual character from this vantage point, since the new visual element and changes to the visual environment would be largely obscured by existing built and natural elements and would be absorbed by the already high concentration of bridges crossing this portion of the Potomac River.

[7] GWMP CLR

Figure 11-11 | View F: Action Alternative A (Leaves On)

View F, Existing Conditions

View F, Photo Simulation of Action Alternative A

Figure 11-12 | View F: Action Alternative A (Leaves Off)

View F, Existing Conditions

View F, Photo Simulation of Action Alternative A

Impact to Viewers

Viewers from this vantage point would consist primarily of MVT users and visitors to Gravelly Point Park. Viewer exposure would be moderate to high, depending on the speed at which viewers are traveling through the area and the level of traffic congestion, due to the proximity of the bridges, the amount of time available to notice the view on bicycle or on foot, and the high number of viewers that typically pass through this area on a daily basis. Viewer awareness would also be moderate, as high awareness of the scenic nature of the view and the routine nature of bicycle commuter travel along the trail would be counterbalanced by the fact that the view would not be the primary focus of many viewers. Overall viewer sensitivity would therefore range from moderate to high, depending on the individual viewer. At the same time, the compatibility of the changes with the concentration of transportation infrastructure that defines the visual environment would minimize overall adverse visual impacts.

Overall Visual Impact

Action Alternative A would result in negligible adverse impacts on visual quality from this vantage point, since the new bridge construction and associated changes to the visual environment would be either mostly unnoticeable or not visible.

View G: Southbound Mount Vernon Trail at Long Bridge

The existing southbound view is characterized by the linear vista along the MVT alignment and by the lush vegetation, including mature trees, that frames the view and provides a sense of enclosure for trail users. The existing Metrorail Bridge is partially visible overhead, while the existing Long Bridge span over the trail is visible in the distance. The lawn area surrounding the trail and spacing of the existing bridges contribute a sense of openness to the otherwise enclosed space. **Figures 11-13 and 11-14** provide photo simulations of this view under Action Alternative A with leaves on and leaves off the trees.

Impact to Visual Character

Under Action Alternative A, the addition of a second railroad bridge parallel to the existing bridge would be clearly visible as it passes over the trail in the middle ground of the view. Due to the slight height difference between the two bridges, a small portion of the existing bridge's lower edge would be slightly visible beneath the new bridge. Construction of the second bridge would require the removal of several mature trees along one side of the trail, which would have the effect of reducing the natural harmony and sense of enclosure provided by the tree canopy and the symmetry of the trees lining the trail. The presence of the two railroad bridges and associated piers in close succession, combined with the relatively low height of the bridges, would create a tunnel-like environment that alters the feel of the trail and the balance between natural and built elements.

Figure 11-13 | View G: Action Alternative A (Leaves On)

View G, Existing Conditions

View G, Photo Simulation of Action Alternative A

Figure 11-14 | View G: Action Alternative A (Leaves Off)

View G, Existing Conditions

View G, Photo Simulation of Action Alternative A

Impact to Viewers

Viewers from this vantage point would consist primarily of MVT users on bicycle and on foot. Viewer exposure would be moderate to high, depending on the speed viewers would be traveling through the area, due to the proximity of the bridges, the amount of time available to notice the view on bicycle or on foot, and the high number viewers that typically pass through this area daily. Viewer awareness would be moderate, as the scenic aspects of the view, the proximity of the view, and the routine nature of bicycle commuter travel along the trail would be counterbalanced by the fact that the view would not be primary focus of some viewers. Overall viewer sensitivity would therefore be moderate, depending on the individual viewer.

The construction of the new bridge would be moderately compatible with the existing visual environment due to the presence of two existing bridges. However, compatibility would be limited to some extent by the shifting balance between natural and built elements, as well as by the proximity of the new bridge to many viewers.

Overall Visual Impact

Action Alternative A would result in moderate adverse impacts on visual quality due to the contrast between the new bridge and its visual environment, the extent to which existing visual character would be altered by the removal of trees and the addition of a new bridge structure, and the potential sensitivity of some viewers to these changes. Adverse impacts would be limited by the fact that the new bridge would be compatible with the existing railroad bridge and would be constructed parallel to two existing bridges.

11.3.2.1. Bridges Spanning the Potomac River

Action Alternative A would have minor permanent direct adverse impacts to views from the bridges spanning the Potomac River. The new bridge would create a larger concentration of transportation infrastructure in the foreground of these views, contrasting with the natural harmony of the river vista. However, this section of the river is already dominated by bridges. Therefore, the additional bridge would not affect the cultural order of this view.

View H: Metrorail Bridge Looking South Toward Long Bridge

From Metrorail Yellow Line trains passing over the Potomac River, the existing Long Bridge is clearly visible from close up and from a vantage point slightly above the existing Long Bridge. The Potomac River and distant Anacostia ridgeline form the backdrop of this view, with a scattering of military, commercial, and industrial buildings interspersed with expanses of green tree canopy. The bridge's truss functions as a visual landmark above the river, while its transparency enables distant river and ridgeline vistas. From this close-up vantage point, the bridge's infrastructure and rusting exterior are clearly apparent. **Figure 11-15** provides a photo simulation of this view under Action Alternative A.

Figure 11-15 | View H: Action Alternative A

View H, Existing Conditions

View H, Photo Simulation of Action Alternative A

Impact to Visual Character

Under Action Alternative A, the new bridge, constructed parallel to the existing Long Bridge would be clearly visible in the foreground and from above. Additional portions of the new bridge's interior parapets and track infrastructure would be visible, and the improved aesthetics of its exterior relative to the condition of the existing Long Bridge would be notable.

Impact to Viewers

Viewers from this vantage point would be Metrorail Yellow Line passengers and operators, resulting in a high number of viewers and high viewer exposure as Metrorail train passes crosses the river. Viewer exposure would increase or decrease depending on the speed Metrorail trains would be traveling. Awareness of visual changes would also be high due to the routine nature of Metrorail travel through the corridor as well as the scenic aspects of the river vista. The new bridge would be compatible with the high concentration of transportation infrastructure along this segment of the Potomac River, although its spacing (in combination with the Metrorail Bridge) would be less compatible.

Overall Visual Impact

Collectively, these changes to the visual environment would result in minor adverse impacts to visual quality, as the additional bridge would create a larger concentration of transportation infrastructure that would contrast with, and diminish, the natural harmony of the river vista.

11.3.2.2. Potomac River

Action Alternative A would have minor permanent direct adverse impacts to views from the Potomac River. While the new railroad bridge would affect the overall visual experience of the Potomac River, viewers would be less sensitive to the new bridge's appearance due to competing views of Arlington and the District. Despite the slightly greater height of the new bridge span (approximately 5 feet higher at top of rail) and the increased density of bridge piers, the new bridge would be largely concealed behind existing bridges except for viewers within the complex of bridges. The existing concentration of transportation infrastructure along this segment of the Potomac River would absorb and minimize the new span's adverse impact on the cultural order of this view.

View I: Potomac River, South of Long Bridge

Approaching Long Bridge from the south on the Potomac River, northbound views are of a wide river horizon line with a partially visible vegetated shoreline behind a visible sequence of four bridges spanning the river. The Arlington ridgeline serves as a backdrop, with high-rise buildings in Arlington visible behind shoreline trees and other vegetation. The existing Long Bridge's unpainted and graffiti-covered truss, parapets, and piers are visible in the foreground. While the Metrorail Bridge and I-395 bridges' piers, roadway light posts, and traffic are visible in the middle ground, these bridges' decks are hidden by the existing Long Bridge. The view also coincides with the route of the Captain John Smith Chesapeake National Historic Trail, which passes beneath Long Bridge. **Figure 11-16** provides a photo simulation of this view under Action Alternative A.

Figure 11-16 | View I: Action Alternative A

View I, Existing Conditions

View I, Photo Simulation of Action Alternative A

Impact to Visual Character

Under Action Alternative A, the new railroad bridge span over the Potomac River would be largely concealed behind the existing bridge. The new bridge's piers would be visible below the existing railroad bridge's span, with a greater density of piers reducing the transparency of space beneath the two bridges. The design of the new bridge would be compatible with the existing railroad bridge, as both would have straight bottom edges. The new straight bottom span would reflect the predominant bridge forms along the Potomac River, a pattern continued and accentuated by the Metrorail and I-395 bridges beyond. The addition of a new railroad bridge over the Potomac River, along with the similarly sized and located piers supporting the new bridge below, would obscure views of the shoreline behind the bridge spans. Collectively, these changes would represent a minor adverse impact to visual character.

Impact to Viewers

The limited viewers from this vantage point would be occasional travelers in boats navigating the Potomac River. The sensitivity of these viewers to changes in visual character and quality would be moderate overall. The long duration of potential views, due to extended views at low speeds, would be counterbalanced by the limited number of viewers, thereby limiting viewer exposure to minor levels. However, viewer awareness of the new visual elements would likely be moderate as viewers would have a unique vantage point for viewing the sequence of bridges. While noticeable, the new bridge would be compatible with this segment of the Potomac River, where multiple bridges already exist in close proximity and are part of cultural order. While the slightly taller form of the new bridge would be slightly incompatible with the lower height of the existing railroad bridge and other bridges along the Potomac River, the new bridge would be largely compatible with its context, given the number bridge forms along this segment of the Potomac River.

Overall Visual Impact

Overall, minor adverse impacts on visual quality would occur as a result of Action Alternative A as the new railroad bridge itself would impact the overall visual experience of the Potomac River. Despite the slightly greater height of the new bridge span and the increased density of bridge piers, the new bridge would be largely concealed behind the existing bridges except for viewers within the complex of bridges. Moreover, the existing concentration of transportation infrastructure along this segment of the Potomac River would absorb and minimize the new span's adverse impact on the river's natural harmony.

11.3.2.3. East Potomac Park

In general, Action Alternative A would have negligible permanent direct adverse impacts to views from East Potomac Park, as changes would not be very noticeable due to the distance of the view and the existing built environment, which consists of a number of bridges. This sequence of bridge crossings provides a sense of cultural order to views upstream and downstream along the river. However, Action Alternative A would have major adverse effects to views immediately adjacent to the existing bridge along Ohio Drive SW. The removal of mature trees and the construction of a retaining wall to support the new tracks, replacing the existing vegetated embankment, would make the railroad infrastructure more prominent and substantially affect the natural harmony of the existing view.

View J: East Potomac Park, Ohio Drive SW at Long Bridge

The existing view to the southeast is characterized by the linear vista along Ohio Drive SW. The underside of the Metrorail Bridge is visible in the immediate foreground, while the existing railroad bridge is clearly visible in the middle ground. Vegetation, including a row of historic Japanese cherry blossom plantings along the western edge and a stand of trees along the east side, frames the view of the bridge, continuing as rows of trees along both sides of Ohio Drive SW into the distance. An existing retaining wall supporting the base of the elevated Long Bridge Corridor faces the roadway on the east side of Ohio Drive SW, while scattered street and wayfinding signs line the roadway. This view is situated within the East Potomac Park Historic District, for which the existing bridge serves as a contributing resource.

Impact to Visual Character

Under Action Alternative A, the addition of a second railroad bridge parallel to the existing bridge would be clearly visible as it crosses above Ohio Drive SW. Due to the slight height difference between the two bridges, a small portion of the existing bridge's lower edge would be visible beneath the new bridge. Construction of the new bridge would require removing trees immediately adjacent to the Long Bridge Corridor as it continues onward from the Ohio Drive SW bridges to the east. To the west of Ohio Drive SW, two stands of the historic Japanese cherry blossom plantings lining the river's edge would also require removal.

Impact to Viewers

In both instances, tree removal would have the effect of reducing the natural harmony and sense of enclosure along this segment of Ohio Drive SW while exposing more of the Long Bridge Corridor beyond the curbs of the roadway. The presence of the two railroad bridges and associated piers in close succession, combined with the relatively low height of the bridges, would create a tunnel-like atmosphere beneath the Long Bridge Corridor. When combined with the existing Metrorail Bridge, the sequence of bridges would alter the feel of the park and roadway, shifting the balance between natural and built elements. The new railroad bridge would be designed to be compatible with the aesthetics of the existing bridge, while—in this location—the archless forms of each bridge would also be compatible.

Viewers from this vantage point would be primarily East Potomac Park users and some commuters traveling on foot, in motor vehicles, and on bicycles. Viewer exposure would be moderate, depending on the speed viewers would be traveling through the area, due to the proximity of the bridges, the amount of time available to notice the view on bicycle or on foot, and the overall moderate number of viewers. Viewer awareness would also be moderate due to the scenic nature and proximity of the view. Overall viewer sensitivity would therefore be moderate, depending on the individual viewer.

The construction of the new bridge would be moderately compatible with the existing visual environment due to the presence of two existing bridges along an approximately 230-foot-long stretch of Ohio Drive SW. However, compatibility would be limited by the contrast between the new built element and the view's natural harmony, as well as by the proximity of the new bridge to the viewer.

Figure 11-17 | View J: Action Alternative A (Leaves On)

View J, Existing Conditions

View J, Photo Simulation of Action Alternative A

Figure 11-18 | View J: Action Alternative A (Leaves Off)

View J, Existing Conditions

View J, Photo Simulation of Action Alternative A

Overall Visual Impact

Resulting adverse impacts on visual quality would be major due to the contrast between the new bridge and its visual environment, the addition of a bridge as a prominent new visual element within an historic district, and the loss of vegetation that currently conceals a portion of the Long Bridge Corridor. **Figures 11-17 and 11-18** provide photo simulations of this view under Action Alternative A with leaves on and leaves off the trees.

View K: East Potomac Park, Near Buckeye Drive Looking Northwest Towards Long Bridge

Northwestern views from East Potomac Park are characterized by panoramic views of the Potomac River, with the Ronald Reagan Washington National Airport, Crystal City, and Pentagon City visible in the distance, next to Long Bridge. While some mature trees partially obscure views from Ohio Drive SW, at the Potomac River's edge, the existing bridge's form and exterior details are highly visible, including the prominent truss in the distance near the opposite shoreline. Long Bridge is a contributing element to the East and West Potomac Parks Historic District. Views along periphery of East Potomac Park and across the Potomac River contribute to the significance of the district, as noted in the NRHP nomination.

Impact to Visual Character

Under Action Alternative A, changes to visual character would be slightly noticeable to the viewer from this vantage point. The new railroad bridge span would be hidden by the existing Long Bridge's span, while the new bridge's piers would be partly visible while maintaining some transparency beneath the bridges. The distant views of the neighboring Metrorail and I-395 piers, underneath the existing railroad bridge, would be obscured by views of the similarly sized and located piers of the new bridge.

While slightly noticeable, these changes would be absorbed by the surrounding context of bridges and bridge piers. Collectively, these changes would result in negligible adverse impacts to visual character from this vantage point because the new visual element and changes to the visual environment would be largely obscured by existing built and natural elements and would be absorbed by the already high concentration of bridges crossing this portion of the Potomac River.

Impact to Viewers

Viewers from this vantage point would be primarily East Potomac Park visitors and travelers along Ohio Drive SW. Viewer exposure would be minor, as the distance of the bridges would counterbalance the relatively long durations of views for many visitors. Viewer awareness would be minor, as Long Bridge would fill much of the view, yet likely would not be the primary focus as compared to surrounding river vistas. Overall viewer sensitivity would be minor. Changes to the visual environment would be compatible with the surrounding context, as the concentration of transportation infrastructure that defines the visual environment would absorb and minimize overall visual impacts.

Figure 11-19 | View K: Action Alternative A

View K, Existing Conditions

View K, Photo Simulation of Action Alternative A

Overall Visual Impact

Action Alternative A would result in negligible adverse impacts to visual quality from this vantage point, as the new bridge would be largely concealed behind the existing bridge. The piers of the new bridge would slightly increase the visual density of the Potomac River bridge cluster beneath the bridges, and would further diminish the natural harmony of this portion of the river; however, these changes would be only slightly perceptible to the naked eye, due to the distance of the view and the extent to which the river vista is already obstructed by transportation infrastructure. This alternative would alter historic views from the East and West Potomac Parks Historic District, albeit modestly. These adverse impacts would be further limited by the relatively low viewer sensitivity to visual changes and the ability of these changes to be absorbed by the adjacent concentration of transportation infrastructure. **Figure 11-19** provides a photo simulation of this view under Action Alternative A.

View L: East Potomac Park at South End of Golf Course, Looking Northwest Towards Long Bridge

Northwestern views from East Potomac Park are characterized by panoramic views of the Potomac River, with the Arlington skyline and tree canopy visible in the distance beyond the existing Long Bridge. From this vantage point, the existing bridge and the distinctive geometry of its truss are clearly visible, while the piers and small portions of the Metrorail and I-395 bridges are partially visible above and below Long Bridge. The curving spires of the United States Air Force Memorial are faintly visible to the left of the truss. Long Bridge is a contributing element to the East and West Potomac Parks Historic District. Views along periphery of East Potomac Park and across the Potomac River contribute to the significance of the district, as noted in the NRHP nomination.

Impact to Visual Character

Under Action Alternative A, changes to visual character would be slightly noticeable to viewers from this vantage point. The new railroad bridge span would be hidden by the existing Long Bridge's span, while the new bridge's piers would be more pronounced. The distant views of the neighboring Metrorail and I-395 piers underneath the existing railroad bridge would be obscured by views of similarly sized and similarly located piers of the new bridge. While slightly noticeable, these changes would be absorbed by the surrounding context of bridges and bridge piers. Collectively, these changes would result in negligible adverse impacts to visual character from this vantage point, since the new visual element and changes to the visual environment would be largely obscured by existing built and natural elements. These changes would be absorbed by the high concentration of bridges crossing in this area.

Impact to Viewers

Viewers from this vantage point would be primarily East Potomac Park visitors and travelers along Ohio Drive SW. Viewer exposure would be minor, as the distance of the bridges would counterbalance the relatively long durations of views for many visitors. Viewer awareness would be minor, as Long Bridge fills much of this vantage point's view yet likely would not be the primary focus of viewers' attention as compared to surrounding river vistas. Overall viewer sensitivity would therefore be minor overall. At the same time, the changes to the visual environment would be largely compatible with the surrounding context, as the concentration of transportation infrastructure that defines the visual environment would absorb and minimize overall adverse visual impacts.

Figure 11-20 | View L: Action Alternative A

View L, Existing Conditions

View L, Photo Simulation of Action Alternative A

Overall Visual Impact

Action Alternative A would result in negligible adverse impacts to visual quality from this vantage point, as the new bridge would be largely concealed behind the existing bridge. The piers of the new bridge would slightly increase the visual density of the Potomac River bridge cluster beneath the bridges and would further diminish the natural harmony of this portion of the river. However, these changes would be only slightly perceptible to the naked eye, due to the distance of the view and the extent to which the new bridge concealed by the existing bridge. This alternative would alter historic views from the East and West Potomac Parks Historic District, albeit modestly. These adverse impacts would be further limited by the relatively low viewer sensitivity to visual changes and the ability of these changes to be absorbed by the adjacent concentration of transportation infrastructure. **Figure 11-20** provides a photo simulation of this view under Action Alternative A.

11.3.2.4. Continuous Views: GWMP

As described in the assessment of impacts for views C through F, Action Alternative A would alter the visual character of the GWMP by increasing the number of bridges along the GWMP by one, altering the spacing between bridges, and resulting in the thinning of vegetation in stands of trees included as part of the original GWMP design. Moreover, the additional bridge would contrast with the typical arched form of bridges elsewhere along the GWMP.

Under Action Alternative A, the GWMP would retain the visual quality and vividness created by the curving roadway, rolling topography, the vegetation framing the roadway, and the intermittent open spaces and vistas revealing the Potomac River and Monumental Core beyond. However, the rhythm and consistency of form created by the bridges along the GWMP would be diminished by the addition of a new railroad bridge that, while compatible with the design of the existing railroad bridge, would alter the spacing of the bridges and would not match the typical arched form of most GWMP bridges. Cumulatively, the sequence of five bridges (four existing and one new) along a short segment of the parkway—while compatible with the nearby concentration of transportation infrastructure along the affected segment of the GWMP—would exacerbate the existing tunnel-like effect along one segment of the GWMP. The loss of vegetation as a result of bridge construction would also adversely impact visual character and quality. Much of the vegetation in this area was intended to visually screen the railroad bridge and its loss would open up views of this infrastructure for GWMP users. Overall, these changes to the visual environment would also alter historic views within the GWMP Historic District.

As a result of these changes, minor adverse impacts to continuous views would result from Action Alternative A overall. Although the overall cultural harmony and intactness of the GWMP would remain, its continuous visual character and quality would be altered by the addition of new visual elements.

11.3.2.5. Other Views within the Study Area

A number of additional views within the Study Area were not selected for photo simulations due to factors such as the limited nature of existing views to and from the Long Bridge Corridor or the ability of the surrounding context to absorb changes in the visual environment. This section provides a summary of visual impacts resulting from Action Alternative A in other locations not directly captured by the photo simulations.

Long Bridge Park and Roaches Run

Between Long Bridge Park and Roaches Run, the Project would replace existing railroad tracks within the existing CSX Transportation (CSXT) right-of-way. While visible from the edges of Long Bridge Park and from a distance across Roaches Run from the GWMP, widening the railroad right-of-way would be highly compatible with existing conditions and viewers would have low sensitivity to these changes. As a result, under Action Alternative A, adverse impacts to visual quality would be negligible to minor in this area.

GWMP North, Lyndon Baines Johnson Memorial Grove, and Lady Bird Johnson Park

Views of Long Bridge are intermittent and fleeting along the northern segment of the GWMP within the Study Area. Views of the existing bridge are largely obscured behind the 14th Street and Metrorail Bridges, with only the bridge piers and truss visible above and below. Evergreen and deciduous trees along the river further obscure views of Long Bridge from the GWMP, except from vantage points where openings in vegetation provide brief glimpses of river vistas. Viewer sensitivity would be low overall due to the duration and distance of the view, while the location of new bridge construction behind an existing sequence of bridges would result in only minor adverse impacts on visual quality, as only the addition of bridge piers would be discernible.

Similarly, due to the distance of views, intervening vegetation, and other bridges obscuring views of the Long Bridge Corridor, negligible adverse impacts to visual quality would occur near the Lyndon Baines Johnson Memorial Grove and Lady Bird Johnson Park. In these locations, the only views of the Long Bridge Corridor would be partial views from the outer edges of Lady Bird Johnson Park, closest to the GWMP.

Arlington Memorial Bridge and Potomac River North

While Long Bridge is visible from the Arlington Memorial Bridge and points north on the Potomac River, views are limited by the distance from Long Bridge and the extent to which views are obstructed by other bridges along the river. For these reasons, and due to the compatibility of bridge construction with surrounding transportation infrastructure, adverse visual impacts would be negligible overall under Action Alternative A.

14th Street Bridges

The Long Bridge Corridor is visible from I-395 northbound, yet large portions of the bridge are obscured by both barriers along the roadway and by the Metrorail Bridge, leaving only the truss and piers visible above and below. New railroad bridge construction would likewise be mostly obscured from view. Given the obstructed nature of the views, the brief duration of views, and the compatibility of new construction with the visual environment from this vantage point, adverse impacts on visual quality would be minor under Action Alternative A.

East Potomac Park

An existing linear strip of mature trees along the Long Bridge Corridor between the existing tracks and the I-395 off-ramp would be removed as a result of corridor widening, opening up views of the Long Bridge Corridor where they were previously obscured by vegetation. While a noticeable loss of trees would occur, removing an existing visual buffer along the railroad tracks minimizes the adverse visual impacts for most viewers in this inaccessible location. The location between the existing surface parking

on one side of the corridor, and the NPS and United States Department of Defense (DOD) facilities on the other, and away from park amenities, would lower viewer sensitivity and adverse impacts on visitor experience. Under Action Alternative A, adverse impacts to visual quality, due to loss of natural harmony, would therefore be minor to moderate depending on the viewer's vantage point.

West Potomac Park

Existing views of Long Bridge from West Potomac Park are obstructed by the 14th Street and Metrorail Bridges. Except for views south of the 14th Street Bridges, the existing truss and piers are the primary visible elements. Impacts to views from West Potomac Park would be similar to those described and illustrated for East Potomac Park, with regard to the increased density of piers limiting views beneath the bridges. Otherwise, the majority of bridge construction would be obscured and absorbed by existing transportation infrastructure along this segment of the Potomac River.

I-395 Crossing

A single four-track railroad bridge would replace the existing two-track structure over the I-395 corridor. Due to the similar aesthetics of the replacement bridge and the highway aesthetics of the visual environment, the new bridge would be highly compatible with the existing bridge. In addition, the duration of views would be short under normal traffic conditions, due to the high speed of travel for most viewers, but longer during periods of traffic congestion. In addition, the bridge would not be a major focus of viewers' attention and would be absorbed by the highway visual environment. As a result, adverse visual impacts under Action Alternative A would be minor overall. Moreover, given the existing structure's unpainted and graffiti-covered exterior appearance, the addition of a new visual element along I-395 would be counterbalanced by the improved exterior appearance of a new bridge, resulting in minor beneficial impacts to visual quality.

Washington Channel and Maine Avenue

As shown in the *Affected Environment Report,*[8] the existing Long Bridge is visible at the western end of the Washington Channel and as it crosses Maine Avenue adjacent to the Route 1 overpass. A new four-track bridge would replace the existing two-track bridge in both locations and retaining walls would be added to retain embankment slopes. In addition, the existing Maine Avenue pedestrian ramp and connection would be replaced with a reconfigured version. None of these changes would constitute major changes to the visual environment, as they would be largely compatible with the existing concentration of transportation infrastructure, and the new bridge would have similar aesthetics to the existing bridge. Therefore, adverse visual impacts under Action Alternative A would be minor overall. Although the Washington Monument is clearly visible above and beyond the Washington Channel, bridge replacement would not noticeably alter Monument vistas, given the extent to which the bridge would be visually absorbed into surrounding built environment, which is defined by the concentration of transportation infrastructure. Minor adverse visual impacts could also occur for views from the Mandarin Oriental Hotel, as the bridge would be constructed closer to the hotel.

[8] VHB, 2018. Long Bridge Project Affected Environment Report.

Maryland Avenue SW

Along Maryland Avenue SW, the proposed action would be largely confined to the existing railroad right-of-way as the corridor transitions from below-ground to at-grade. Therefore, track expansion would not add new visual elements to the Maryland Avenue SW right-of-way. While new construction would not advance existing District and NCPC planning guidance advocating the opening up of historic views along Maryland Avenue, it would not adversely impact the existing viewshed.

Lincoln Memorial and St. Elizabeths West Campus

Both the Lincoln Memorial and St. Elizabeths West Campus offer distant views of Long Bridge, in which only the top of the existing bridge's truss is visible. Therefore, these views would not be impacted by new bridge construction, due to the lower bridge height.

11.3.2.6. Nighttime Conditions

The majority of the Project Area and southern portion of the Study Area are largely characterized by a limited number of light sources and overall low ambient light levels in the immediate vicinity of the Long Bridge Corridor. In these areas, the Long Bridge Corridor is mostly unlit. There is no lighting on the existing Long Bridge Corridor, except for a series of small red lights denoting, for navigational purposes, the underside of the bridge where it spans the Potomac River.

Action Alternative A would not cause adverse impacts to nighttime conditions. Action Alternative A would maintain the minimal lighting that currently exists along the Long Bridge Corridor. Given the negligible light emissions from the existing Long Bridge Corridor, no adverse impact is expected, due to the low potential for light spillage. Lighting would be incorporated as part of the new bridge for navigational purposes only.

11.3.3. Action Alternative B

The sections below described the anticipated visual impacts of Action Alternative B. The major visual difference between the two Action Alternatives is the removal of the existing center truss under Action Alternative B. Therefore, the impacts of Action Alternative B would be similar to Action Alternative A except as described below.

11.3.3.1. View A: Arlington House, the Robert E. Lee Memorial

Overall Visual Impact

The existing Long Bridge truss, currently the most visible portion of the bridge as it rises above the tree line, would be absent from this view due to the lack of a truss on the replacement bridge, resulting in a negligible adverse impact. While not readily apparent, the absence of the truss would be slightly noticeable in the distance from this vantage point. **Figure 11-21** provides a photo simulation of this view under Action Alternative B.

Figure 11-21 | View A: Action Alternative B

View A, Existing Conditions

View A, Photo Simulation of Action Alternative B

11.3.3.2. View B: Arlington National Cemetery, Tomb of the Unknown Soldier

Overall Visual Impact

From this viewpoint, the lack of a truss in the replacement bridge's structure would remove the existing bridge's most prominent visual element, which functions as a distant visual landmark and identifiable feature of the Potomac River corridor. This would constitute a negligible adverse impact. **Figures 11-22 and 11-23** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.3. View C: GWMP Southbound, Approaching Metrorail Bridge

Under Action Alternative B, the two new railroad bridges over the GWMP would be partially visible beneath the Metrorail Bridge. Due to the matching heights of the two bridges, the northern bridge would be obscured by the southern bridge, creating the visual perception of a single span above the GWMP.

Impact to Visual Character

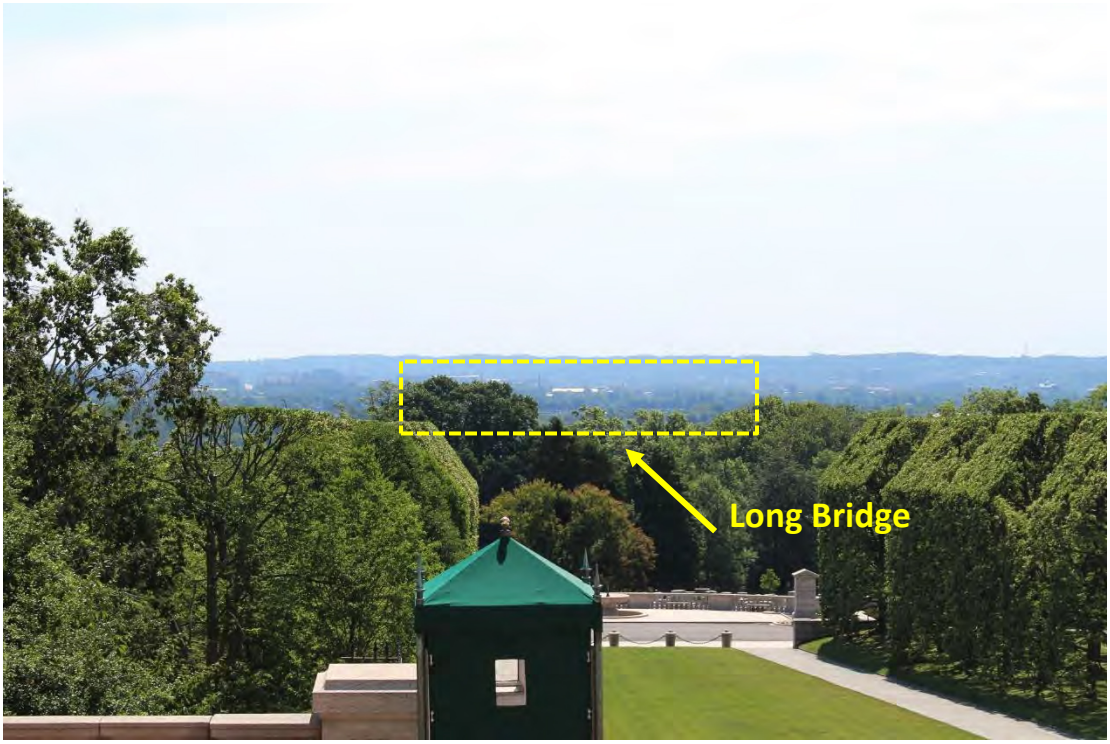
The higher elevation of the two bridges and matching heights would have the minor beneficial impact of opening the vista beyond the bridges crossing the roadway, revealing more of the GWMP parkland, trees, and Potomac River beyond. While the design of the new bridge would be compatible with the existing railroad bridge, the removal of the existing bridge and the construction of two new bridges would result in the loss of the historic arched bridge. This bridge currently defines the gateway to the parkland beyond and extends the arched form typical of other bridges along the GWMP. Collectively, these changes would result in moderate adverse impacts to visual character, due to the loss of the existing railroad bridge as a defining visual and historic element and the introduction of new visual elements to this portion of the GWMP.[9]

Impact to Viewers

While noticeable, the new bridges would be moderately compatible with this segment of the GWMP, where multiple bridges already exist in close proximity. However, the form of the bridges would be incompatible with the arched form of the existing railroad bridge and other bridges along the GWMP, resulting in additional minor adverse impacts.

[9] This bridge is more properly known as the Richmond, Fredericksburg & Potomac Railroad (RF&P RR) Underpass. It was designed in 1930 to move parkway traffic around the railroad. While the underpass contributes to the significance of the GWMP historic district from a transportation perspective, it was constructed by the railroad company and did not conform to the other bridges on the GWMP. As a result, planners and landscape architects used large trees and other vegetation to screen the industrial looking underpass bridge as much as possible from the roadway.

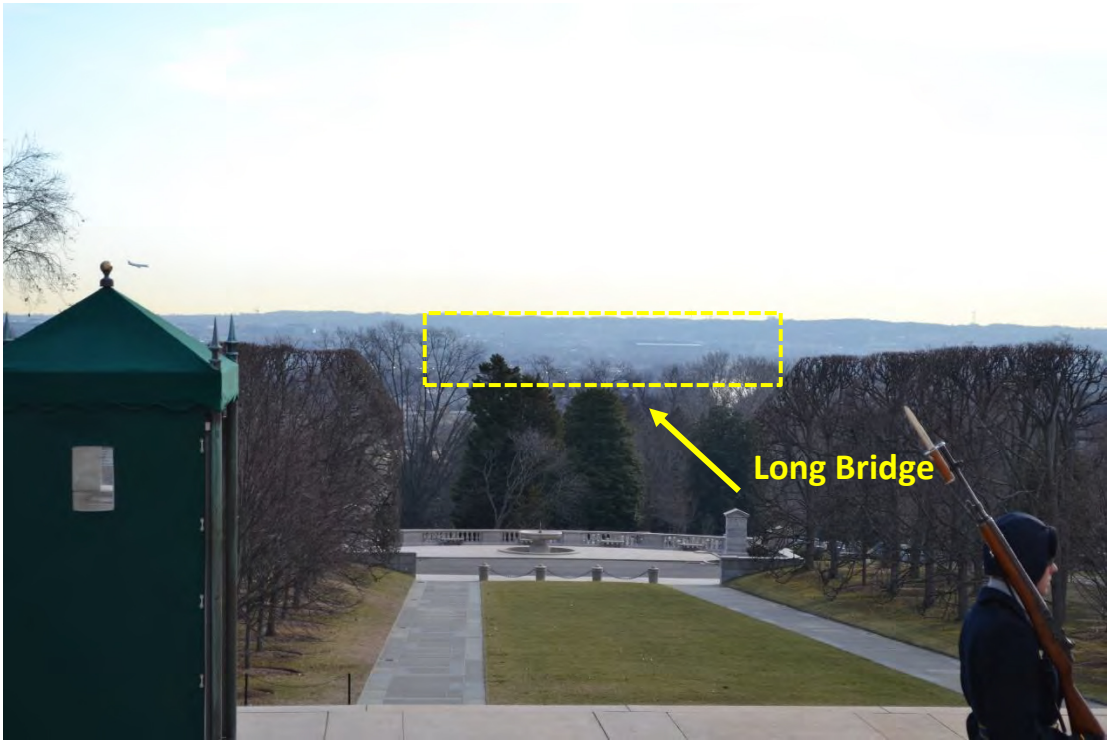
Figure 11-22 | View B: Action Alternative B (Leaves On)



View B, Existing Conditions

View B, Photo Simulation of Action Alternative B

Figure 11-23 | View B: Action Alternative B (Leaves Off)



View B, Existing Conditions

View B, Photo Simulation of Action Alternative B

Overall Visual Impact

The loss of an existing historic bridge, which reflects the prevailing arched form of bridges elsewhere along the GWMP, would affect cultural harmony a larger degree, resulting in moderate adverse impacts to visual quality. **Figures 11-24 and 11-25** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.4. View D: GWMP Northbound Approaching Long Bridge with View of Metrorail and 14th Street Bridges

Under Action Alternative B, the railroad bridge that would replace the existing Long Bridge span would be clearly visible in the foreground, similar to its predecessor, while a small portion of the second new bridge would be visible underneath the first bridge, obscuring the top edge of the Metrorail Bridge.

Impact to Visual Character

While the new bridges would be designed to be compatible with the existing railroad bridge, their straight bottoms would contrast with the arched form of the existing bridge, which reflects the predominant bridge form along the GWMP and is a pattern continued and accentuated by the I-395 bridges beyond. The addition of the two new bridges over the GWMP would also alter historic views along the GWMP by adding a new visual element.

Impact to Viewers

While noticeable, the new bridges would be moderately compatible with this segment of the GWMP where multiple bridges already exist in close proximity. However, the form of the two bridges would be incompatible with the arched form of the existing railroad bridge and other bridges along the GWMP, resulting in additional moderate adverse impacts given the notable contrast in bridge forms along this segment of the GWMP.

Overall Visual Impact

Overall, moderate adverse impacts on visual quality would occur as a result of Action Alternative B. The two new railroad bridges would pose a moderate adverse impact on the overall visual experience of the GWMP, due to the loss of an historic bridge and the addition of two new visual elements. **Figures 11-26 and 11-27** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

Figure 11-24 | View C: Action Alternative B (Leaves On)

View C, Existing Conditions

View C, Photo Simulation of Action Alternative B

Figure 11-25 | View C: Action Alternative B (Leaves Off)

View C, Existing Conditions

View C, Photo Simulation of Action Alternative B

Figure 11-26 | View D: Action Alternative B (Leaves On)

View D, Existing Conditions

View D, Photo Simulation of Action Alternative B

Figure 11-27 | View D: Action Alternative B (Leaves Off)

View D, Existing Conditions

View D, Photo Simulation of Action Alternative B

11.3.3.1. View E: GWMP Northbound, Approaching Long Bridge

Under Action Alternative B, the replacement of the existing railroad bridge would be clearly visible as it crosses the GWMP. Due to the matching heights of the two bridges, the northern bridge would be obscured by the southern bridge, creating the visual perception of a single span above the GWMP.

Impact to Visual Character

While the design of the new bridge would be compatible with the existing railroad bridge, the removal of the existing bridge and the construction of two new bridges would introduce new visual elements to this segment of the GWMP. At the same time, these actions would result in the loss of the existing historic arched bridge, representing an alteration of historic views along the GWMP. In addition, the existing bridge defines the gateway to adjacent segments of the GWMP and incorporates the arched form typical of other bridges along the GWMP. Moreover, the stands of trees framing the roadway would be visibly thinner on both sides, due to the loss of trees resulting from construction of the two bridges. Collectively, these changes would result in moderate adverse impacts to visual character, due to the loss of the existing railroad bridge as a defining visual and historic element, the introduction of new visual elements to this portion of the GWMP, and the visible thinning of the vegetation that frames the roadway.

Impact to Viewers

While noticeable, the new bridges would be moderately compatible with this segment of the GWMP, where multiple bridges already exist in close proximity. However, the form of the bridges would be incompatible with the arched form of the existing railroad bridge and other bridges along the GWMP, resulting in additional minor adverse impacts.

Overall Visual Impact

Overall, major adverse impacts on visual quality would occur as a result of Action Alternative B. The new railroad bridge would adversely impact the visual experience of the GWMP, but these impacts largely would not impact the cultural harmony of the GWMP due to the existing concentration of transportation infrastructure along this segment of the GWMP. However, the loss of an existing historic bridge, which reflects the prevailing arched form of bridges elsewhere along the GWMP, would affect cultural harmony to a larger degree, resulting in additional moderate adverse impacts to visual quality. The loss of mature vegetation framing the curved roadway would negatively affect the natural harmony of the GWMP. This vegetation currently screens existing transportation infrastructure from travelers on the roadway. **Figures 11-28 and 11-29** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.2. View F: Mount Vernon Trail, Approaching Long Bridge from Gravelly Point Park

The Long Bridge span over the Potomac River is partially obscured by a stand of mature trees lining Gravelly Point Park as well as by trees and scrub vegetation along the river's edge. The truss of the existing Long Bridge is a defining element of this view and functions as a visual landmark with a high degree of vividness, marking the entrance and crossing into the District.

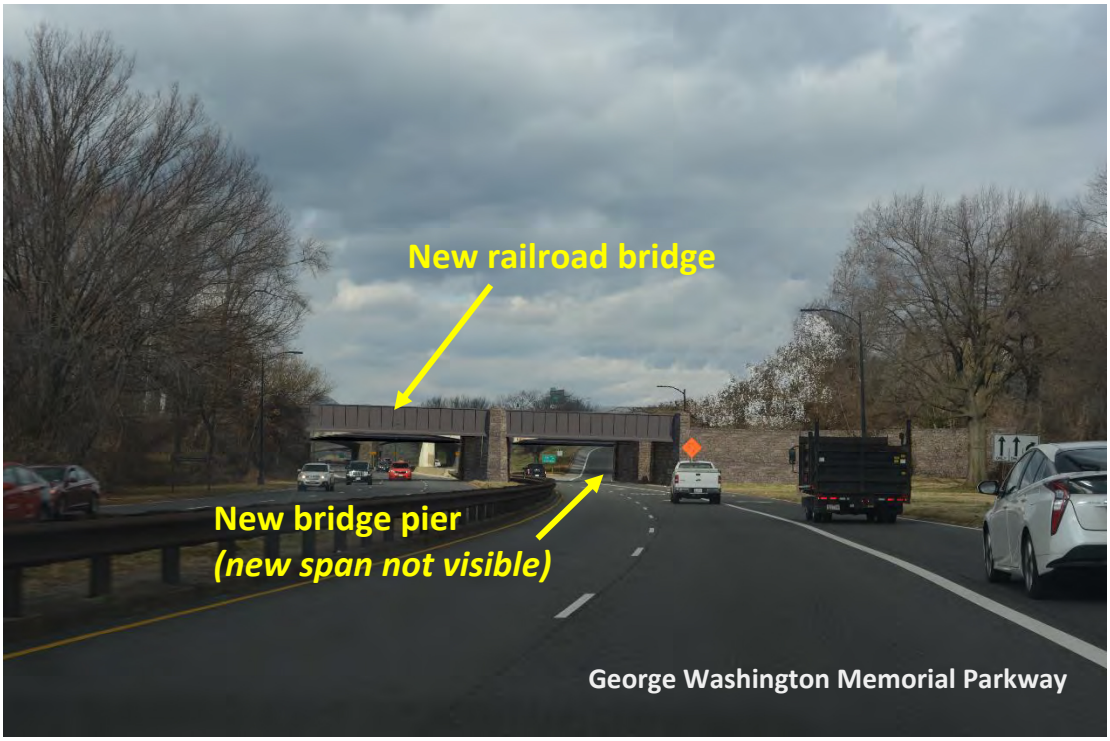
Figure 11-28 | View E: Action Alternative B (Leaves On)

View E, Existing Conditions

View E, Photo Simulation of Action Alternative B

Figure 11-29 | View E: Action Alternative B (Leaves Off)

View E, Existing Conditions



View E, Photo Simulation of Action Alternative B

Impact to Visual Character

Under Action Alternative B, changes to visual character would be visible and noticeable, due to the replacement of the existing railroad bridge with a new bridge. Most noticeably, the removal of the existing bridge's truss would adversely impact visual character by removing a visual element that functions as a landmark along this portion of the Potomac River. The remainder of the bridge and its piers would be designed to be aesthetically compatible with the existing bridge. While the new bridge would constitute a new visual element, its form and design would fit within the view in a similar manner.

Collectively, these changes would result in moderate adverse impacts to visual character from this vantage point. The replacement of the existing railroad bridge and truss would constitute a new visual element that would change the visual environment and affect the integrity of existing views. At the same time, the additional southern bridge would be largely obscured by existing built and natural elements and would be absorbed by the already high concentration of bridges crossing this portion of the Potomac River. The loss of trees to construct the two bridges would also adversely impact the visual character due to the visible thinning of the stand of trees—planned vegetation as part of the GWMP design—and increased visibility of the new bridge's form through the trees.

Impact to Viewers

Impact to viewers under Action Alternative B would be the same as under Action Alternative A.

Overall Visual Impact

Action Alternative B would result in moderate adverse impacts to visual quality from this vantage point, due to the addition of new visual elements, the loss of the existing bridge's truss as an identifiable landmark, and the loss of trees. These adverse impacts would be diminished somewhat by the compatibility of the new bridges with a surrounding context already defined by its concentration of transportation infrastructure.

While not offsetting the overall moderate adverse impact, visual quality would be improved by two minor beneficial impacts of Action Alternative B. First, the unpainted and graffiti-covered existing bridge would be replaced by a new bridge in good condition. Second, the removal of the truss would have the effect of further opening up the iconic views of the Monumental Core, currently partially obscured by the truss. **Figures 11-30 and 11-31** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.3. View G: Southbound Mount Vernon Trail at Long Bridge

Impact to Visual Character

Under Action Alternative B, the addition of a second railroad bridge parallel to the existing bridge would be clearly visible as it passes over the trail in the middle ground of the view. Due to the similar heights of the two bridges, one of the new railroad bridges would be mostly concealed behind the other until the viewer passes underneath them.

Impact to Viewers

Impact to viewers under Action Alternative B would be the same as under Action Alternative A.

Figure 11-30 | View F: Action Alternative B (Leaves On)

View F, Existing Conditions

View F, Photo Simulation of Action Alternative B

Figure 11-31 | View F: Action Alternative B (Leaves Off)

View F, Existing Conditions

View F, Photo Simulation of Action Alternative B

Overall Visual Impact

Resulting adverse impacts on visual quality would be moderate due to the contrast between the new bridges and their visual environment, and the extent to which existing visual character would be altered by the removal of trees and the construction of two new bridges, and the potential sensitivity of some viewers to these changes. Adverse impacts would be limited by the fact that the new bridges would be compatible with the existing railroad bridge and would be constructed parallel to, or in place of, two existing bridges. **Figures 11-32 and 11-33** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.1. View H: Metrorail Bridge, Looking Southeast Toward Long Bridge

Overall Visual Impact

The loss of the existing truss, while opening views to the river and ridgeline, would also remove a visual landmark from the river, representing both minor beneficial visual impacts and moderate adverse impacts, respectively. **Figure 11-34** provides a photo simulation of this view under Action Alternative B.

11.3.3.1. View I: Potomac River, South of Long Bridge

Impact to Visual Character

Under Action Alternative B, the replacement of the Long Bridge span over the Potomac River would have a complementary form and appearance to its predecessor, with the exception of the lack of truss on the replacement bridge, which would remove an identifiable landmark from this river view. Due to the similar forms and heights of the two bridges, the second railroad bridge would be only partially visible below the replacement railroad bridge's span in the form of a duplicate set of similarly-sized and located piers. Additional minor beneficial impacts would result from the improved appearance of the replacement bridge. Collectively, these changes would represent a minor to moderate adverse impact to cultural order due to the adverse impacts on views and natural harmony as well as the loss of the truss as a visual landmark.

Impact to Viewers

Impact to viewers under Action Alternative B would be the same as under Action Alternative A.

Overall Visual Impact

Overall, minor adverse impacts on visual quality would occur because of Action Alternative B. While the new railroad bridges would impact the overall visual experience of the Potomac River by removing the landmark truss and adding a new bridge structure as a visual element, the new bridges would be compatible with each other and with the preexisting bridge. The additional bridge would be largely concealed behind the existing bridge's replacement, except for the additional piers visible beneath the bridges. The pre-existing concentration of transportation infrastructure along this segment of the Potomac River would absorb and minimize the new spans' adverse impact on the natural harmony of the river's vista. **Figure 11-35** provides a photo simulation of this view under Action Alternative B.

Figure 11-32 | View G: Action Alternative B (Leaves On)

View G, Existing Conditions

View G, Photo Simulation of Action Alternative B

Figure 11-33 | View G: Action Alternative B (Leaves Off)

View G, Existing Conditions

View G, Photo Simulation of Action Alternative B

Figure 11-34 | View H: Action Alternative B

View H, Existing Conditions

View H, Photo Simulation of Action Alternative B

Figure 11-35 | View I: Action Alternative B

View I, Existing Conditions

View I, Photo Simulation of Action Alternative B

11.3.3.2. View J: East Potomac Park, Ohio Drive SW at Long Bridge

Overall Visual Impact

Resulting adverse impacts on visual quality would be major under Action Alternative B the same as Action Alternative A. **Figures 11-36 and 11-37** provide photo simulations of this view under Action Alternative B with leaves on and leaves off the trees.

11.3.3.3. View K: East Potomac Park, Near Buckeye Drive Looking Northwest Towards Long Bridge

Impact to Visual Character

Under Action Alternative B, changes to visual character would be noticeable to the viewer from this vantage point. The replacement Long Bridge would be clearly visible and would have a slightly reduced profile yet consistent in form and appearance with the existing bridge, while its new second span would be almost completely hidden by the first span due to the similar heights of the structures. These changes would be absorbed by the surrounding context of bridges and bridge piers. The removal of the landmark truss would represent an additional moderate adverse impact to visual character. Collectively, these changes would result in moderate adverse impacts to visual character from this vantage point.

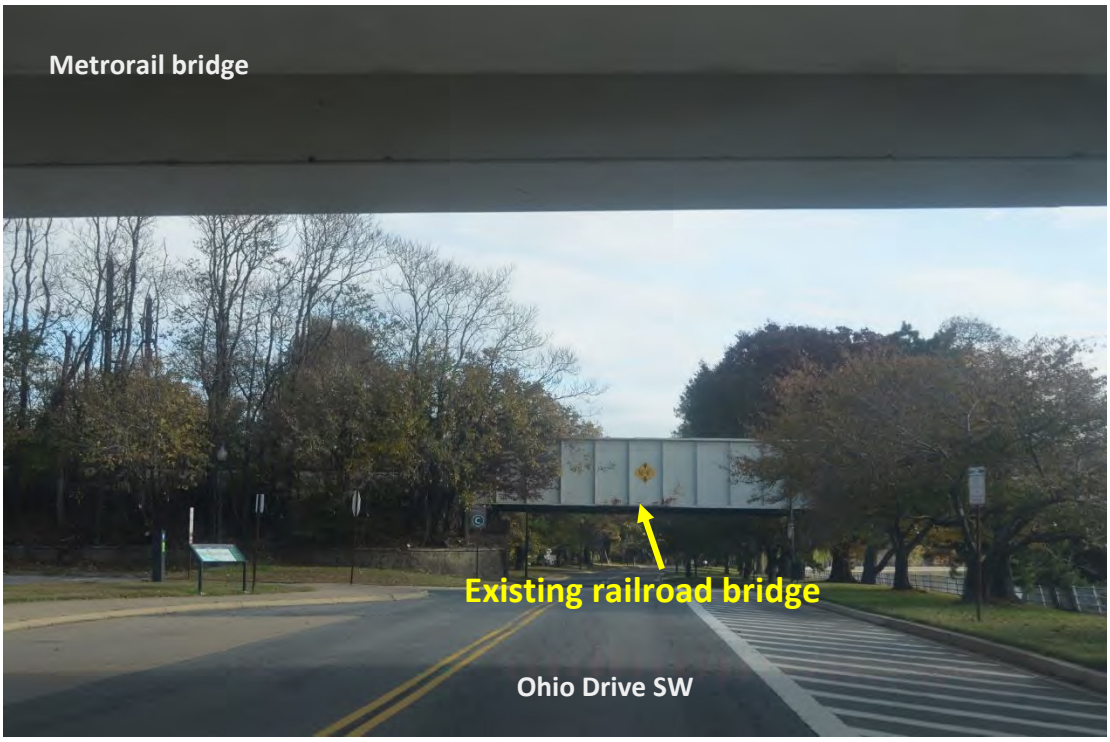
Impact to Viewers

Impact to viewers under Action Alternative B would be the same as under Action Alternative A.

Overall Visual Impact

Action Alternative B would be a moderate adverse impact to aesthetics and visual resources. It would alter historic views from the East and West Potomac Parks Historic District and remove the existing Long Bridge, a contributing historic resource, and its truss. The new bridge construction and associated changes would visually de-emphasize Long Bridge and refocus attention on the Arlington skyline. **Figure 11-38** provides a photo simulation of this view under Action Alternative B.

Figure 11-36 | View J: Action Alternative B (Leaves On)



View J, Existing Conditions

View J, Photo Simulation of Action Alternative B

Figure 11-37 | View J: Action Alternative B (Leaves Off)

View J, Existing Conditions

View J, Photo Simulation of Action Alternative B

Figure 11-38 | View K: Action Alternative B

View K, Existing Conditions

View K, Photo Simulation of Action Alternative B

11.3.3.1. View L: East Potomac Park at South End of Golf Course, Looking Northwest Towards Long Bridge

Impact to Visual Character

Under Action Alternative B, changes to visual character would be noticeable to the viewer from this vantage point. The replacement of the existing Long Bridge would be clearly visible at a distance. The loss of the existing bridge's truss would allow the replacement bridge to blend into its surroundings, making it less visually intrusive yet less distinctive given the truss is a visual landmark.

Impact to Viewers

Impact to viewers under Action Alternative B would be the same as under Action Alternative A.

Overall Visual Impact

Action Alternative B would result in moderate adverse impacts to aesthetics and visual resources from this vantage point, due to the addition of clearly-visible new visual element and removal of the existing bridge, a contributing historic resource, and its truss. In terms of the character and composition of these views, adverse impacts would be limited by the ability of the visual changes to be absorbed by the adjacent concentration of transportation infrastructure. Nevertheless, while the clearly-visible replacement bridge would blend into its surroundings, the removal of the existing bridge would alter historic views and would remove the truss, which from this vantage point functions as a visual landmark. **Figure 11-39** provides a photo simulation of this view under Action Alternative B.

Figure 11-39 | View L: Action Alternative B

View L, Existing Conditions

View L, Photo Simulation of Action Alternative B

Table 11-2 | Visual Impacts of Action Alternative B

View	Impact Description	Direct Impact
A	Removal of existing truss as a visual element would not be noticeable.	Negligible adverse
B	Removal of existing truss as a visual element would not be noticeable.	Negligible adverse
C	Loss of existing historic bridge, which reflects the prevailing arched form of bridges elsewhere along the GWMP, negatively affecting cultural order.	Moderate adverse
D	Loss of existing historic bridge, which reflects the prevailing arched form of bridges elsewhere along the GWMP, negatively affecting cultural order.	Moderate adverse
E	Loss of existing historic bridge, which reflects the prevailing arched form of bridges elsewhere along the GWMP, negatively affecting cultural order. Loss of mature trees would negatively affect natural harmony by reducing the sense of a curving roadway framed by vegetation.	Major adverse
F	Moderate adverse impact due to removal of existing truss as an identifiable landmark, negatively affecting cultural order; loss of trees negatively affecting natural harmony. Minor beneficial impact as removal of existing truss opens up views of the Monumental Core.	Moderate adverse & minor beneficial
G	Contrast between new bridges and natural environment; removing mature trees would substantially reduce natural harmony and sense of enclosure.	Major adverse
H	Moderate adverse impact as the larger concentration of transportation infrastructure would contrast with and diminish the natural harmony of the river vista. Loss of existing truss would remove a visual landmark, negatively affecting cultural order. Minor beneficial impact as removing existing truss would open up views to the river and ridgeline.	Moderate adverse & minor beneficial
I	Additional bridge would obstruct views and diminish natural harmony of river vista; loss of truss would remove a visual landmark, negatively affecting cultural order. Existing concentration of bridges would absorb and minimize new span's adverse impact.	Minor adverse
J	New railroad bridge clearly visible; tree removal would substantially reduce natural harmony and sense of enclosure.	Major adverse
K	Removing existing truss would alter historic views. New visual elements and changes to the visual environment largely obscured by existing built and natural elements.	Moderate adverse
L	Removing existing truss would alter historic views. New visual elements and changes to the visual environment largely obscured by existing built and natural elements.	Moderate adverse

11.3.3.2. Continuous Views: GWMP

As described in the assessment of impacts for views C through F, the new railroad bridges across the GWMP would contrast with the typical arched form of bridges elsewhere along the GWMP. Under this alternative, the rhythm and consistency of form created by the bridges along the GWMP would be diminished by the replacement of the existing bridge, a contributing historic resource.

While compatible with the design of the existing railroad bridge, the two new bridges would not match the typical arched form of most GWMP bridges. The removal of the existing historic bridge would also

alter historic views along the GWMP. The removal of the existing historic Long Bridge's truss, moreover, would further alter views and remove a visual element that now functions as a visual landmark marking the entrance to the National Capital.

As a result of these changes, moderate adverse impacts to continuous views would result from Action Alternative B. Although the overall visual integrity and intactness of the GWMP would remain, its continuous visual character and quality would be altered by the addition of new visual elements as well as the removal and replacement of a historically-significant existing visual element. Overall, these changes to the visual environment would also alter historic views within the GWMP Historic District.

11.3.3.3. Other Views within the Study Area

Visual impacts associated with other views from throughout the Study Area would be the same as described under Action Alternative A, with the exception of the following:

- The removal of the existing truss in Action Alternative B would reduce or entirely eliminate visibility of Long Bridge in some locations, due to the lack of a vertical element visible above the tree line. For Potomac River views, as described for other views, truss removal would also constitute a minor to moderate adverse visual impact due to the truss's existing function as a visual landmark in the Potomac River.
- The replacement of the existing railroad bridge under Action Alternative B would be slightly and partially visible from some locations along the Potomac River, but would not affect the overall degree of visual impacts.

11.3.4. Nighttime Conditions

Impacts to visual resources and aesthetics during nighttime conditions would be the same as described under Action Alternative A.

11.4. Temporary Effects

11.4.1. No Action Alternative

The No Action Alternative may result in adverse direct or indirect temporary visual effects due to construction activities within the Local Study Area.

11.4.2. Action Alternative A

Construction activities under Action Alternative A would have an estimated overall duration of five years and would generate temporary moderate and major adverse impacts during that time, depending on the location, as described below. It should be noted that as the Project design advances, continued avoidance and minimization measures would be explored for impacts identified below. **Table 11-3** summarizes the temporary visual impacts

Table 11-3 | Action Alternative A Summary of Temporary Visual Impacts

Location	Impact Description	Direct Impact
Long Bridge Park	Construction fencing, vehicles, and structures may be visible to park users. Construction activities could disrupt the visual coherence of the park experience. Vegetation removal would cause disruptions to the natural harmony experienced by viewers.	Moderate adverse
George Washington Memorial Parkway and Mount Vernon Trail	Activities would be highly visible to pedestrian, bicycle, vehicular, watercraft, train, and Metrorail viewers. Vegetation removal would be noticeable and would yield a reduction in natural harmony experienced by viewers.	Major adverse
Potomac River and Washington Channel	Construction activities would be visible from both up and down river as well as from the nearby bridges and shores; views may be disrupted depending on heights and placement of construction elements. Vegetation removal could reduce natural harmony of river vistas.	Moderate adverse
East Potomac Park and Monumental Core	Activities would be highly visible, altering views both toward and away from the Monumental Core. Vegetation removal would alter natural harmony and temporarily disrupt the visual coherence of East Potomac Park.	Major adverse
L'Enfant Plaza and Southwest Waterfront	Construction activities would be highly visible, disrupting views from both lower elevations, such as the waterfront, as well as higher elevations, such as the elevated Maryland Avenue SW traffic circle. Several views would be altered and may be partially obstructed, reducing the cultural order.	Major adverse

11.4.2.1. Long Bridge Park

Action Alternative A would require a construction access area at the northern end of Long Bridge Park, between the aquatic facility and GWMP. The areas could include construction vehicles, material laydown and storage, staging, fencing, and equipment and would be needed for over 4 years.

The construction access would be in an area adjacent to Long Bridge Park facilities that is planned to remain undeveloped and vegetated in order to serve as a buffer and edge for park facilities currently under construction. The construction access would result in loss of trees and scrub vegetation, visibly thinning the vegetated buffer along the northern end of the park but would not impact the visual character of the park facilities.

Park users may see construction fencing, vehicles, and structures. Vegetation removal would cause disruptions to the natural harmony experienced by viewers, particularly along the loop trail planned just south of the impacted area. Overall, construction activities near Long Bridge Park would cause a temporary moderate adverse impact to visual quality.

11.4.2.2. George Washington Memorial Parkway and Mount Vernon Trail

Action Alternative A construction activities would require the temporary use of land along the GWMP and MVT. Activities could include construction vehicles, material laydown and storage, staging, fencing, and equipment. Construction staging and access areas would be located at the GWMP crossing in the median of the roadway as well as west and east of the crossing. An area north of the I-395 North Bridge would also be required. Construction would require temporary relocation of a portion of the MVT for public safety and to allow construction access and staging along the water. The construction areas would be needed for over 4 years, but relocation of the MVT would only be required for 2 years.

Construction activities would be highly visible to pedestrian, bicycle, vehicular, watercraft, train, and Metrorail viewers. Temporary relocation of the MVT would alter and disrupt the views experienced by users. Ground cover, scrub vegetation, and mature trees would be removed to accommodate construction activities, causing breaks in continuous vegetative views. Vegetation removal would be noticeable and would yield a reduction in natural harmony experienced by viewers. Construction activities near the GWMP and MVT would cause temporary major adverse impacts to visual quality.

11.4.2.3. Potomac River and Washington Channel

Action Alternative A construction activities would require temporary structures and staging areas in the Potomac River and Washington Channel. Construction areas could include barges, cranes, finger piers, staging, and materials storage, and would be required for over 4 years.

Construction activities would be visible from both up and down river as well as from the nearby bridges and shores; views may be disrupted depending on heights and placement of construction elements. Additionally, clearance of vegetation and lawn areas by construction activities and laydown areas could adversely impact river vistas by giving portions of the river banks a barren, instead of verdant, appearance thereby reducing the natural harmony experienced by viewers. Overall, construction activities in this area would cause temporary moderate adverse impacts to visual quality.

11.4.2.4. East Potomac Park and Monumental Core

Action Alternative A construction activities would require temporary use of, and access to, various areas of East Potomac Park, including NPS Parking Lots B and C. Vegetation including ground cover, landscape plantings, and Japanese cherry blossom plantings along Ohio Drive SW would be removed; limited vegetation removal would be required near NPS Parking Lots B and C. Construction activities would also occur in an area between Ohio Drive SW and I-395 North, a small access area adjacent to I-395 North on the Washington Channel southern bank, and in a larger section along that same southern bank. These construction activities, which may include equipment, storage, staging, fencing, and lay down uses, would have a duration of over 4 years.

Activities would be highly visible, altering views both toward and away from the Monumental Core. The cultural and natural elements in this area form a distinct visual experience which would be temporarily disrupted by activities. Vegetation removal would alter natural harmony and temporarily disrupt the visual coherence of East Potomac Park, particularly as experienced along Ohio Drive SW within closest proximity to the Japanese cherry blossom plantings and established plantings along the Potomac River.

Overall, construction activities would temporarily result in temporary major adverse impacts to visual quality.

11.4.2.5. L'Enfant Plaza and Southwest Waterfront

Action Alternative A construction activities would require use of the entire Washington Marina surface parking area the eastern side of Maine Avenue SW, a small area on the western side of Maine Avenue adjacent to the Mandarin Hotel, and an area west of the CSXT right-of-way in the Portals development. Some vegetation removal would be required and may include ground cover, landscape plantings, scrub vegetation, and trees. These construction activities, which may include vehicles, equipment, storage, fencing, and staging, would be in place for 3.5 years. Action Alternative A would also require temporary use of the western half of NPS Reservation 113 Hancock Park (adjacent to 9th Street SW) for construction transport and staging activities for 4 years.

Construction activities would be highly visible, disrupting views from both lower elevations, such as the waterfront, and higher elevations, such as Maryland Avenue SW. Several views would be altered and, potentially, partially obstructed, including views from both the Maryland and Maine Avenues SW toward the monuments, toward and from the Washington Marina, and toward the Portals development from 14th and D Streets NW. This would reduce the cultural order of the visual environment in this area. Construction activities in these areas would cause temporary major adverse impacts to visual quality but would preserve existing mature trees on the site.

11.4.3. Action Alternative B

Construction activities under Action Alternative B would have an estimated overall duration of 8 years and 3 months and would generate temporary moderate and major adverse impacts Construction staging and access locations would be the same as for Action Alternative A, resulting in no additional visual impact. However, the additional construction time would add to the disruption and inconvenience of the visual impacts.

11.5. Avoidance, Minimization, and Mitigation

Potential mitigation of visual and aesthetic impacts would be developed in accordance with Federal guidelines and evaluated based on their effectiveness in mitigating the impacts. As the Project design advances, continued avoidance and minimization measures would be explored for impacts identified above.

- Potential measures that would be employed to avoid, minimize, or mitigate long-term adverse impacts on aesthetics and visual resources include:
- Restoring any vegetation within areas of temporary impact, including landscape plantings, ground cover, and trees, following construction. Monitoring to ensure vegetation survival may also be required.
- Implementing final landscaping, including planting, plant selection and berms, in a manner that mitigates visual impacts on the GWMP, MVT, and East Potomac Park, and includes NPS as a participant in the design process. NPS will approve any plans prior to implementation. This mitigation may take place outside of the limits of disturbance, as identified by NPS.

- Possibly refining bridge structure design and materials in later design phases to mitigate impacts on visual resources and ensure aesthetic compatibility with built, natural, and cultural resources in the surrounding visual environment.

Potential measures that would be employed to avoid, minimize, or mitigate temporary adverse impacts on aesthetics and visual resources include:

- Developing a tree protection plan and implementing tree protection measures for trees within or immediately adjacent to the limits of disturbance.
- Making construction fencing and barriers as aesthetically pleasing as feasible and able to block potentially unattractive views into construction areas. Screening vegetation may also be used to minimize visual impacts of construction activities on viewers.
- Maintaining visitor use of parkland and trails in the vicinity of the Project Area to the maximum extent feasible during construction.
- Using signage for construction, traffic control, and MVT relocation that is clear, legible, attractive, and designed in consultation with NPS.
- Wherever possible, the Virginia Department of Rail and Public Transportation, the project sponsor for final design and construction, would avoid the use of the GWMP to transport construction equipment. Any use of the GWMP to transport construction equipment would require NPS approval for access.

12.0 Cultural Resources

12.1. Overview

This section defines the cultural resources pertinent to the Long Bridge Project (the Project) and provides the regulatory context and methodology for assessing impacts on cultural resources. For each Action Alternative and the No Action Alternative, this section also describes the potential short-term and long-term impacts on cultural resources. Proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project are provided.

For the purposes of the NEPA analysis, cultural and historic resources include all local, state, and federally designated or eligible historic sites, sacred sites, cultural landscapes, traditional cultural properties, and archaeological sites. The Environmental Consequences Report, which can be found in **Appendix D3, Environmental Consequences Report,** was prepared to inform the analysis of impacts to these resources under NEPA and considered different degrees of impacts (negligible, minor, moderate, or major) and types of impacts (adverse and beneficial) to cultural and historic resources. As outlined in **Section 1.3, Framework for Evaluating Impacts**, the degrees of impacts are defined as: negligible – may be adverse or beneficial but would occur at levels that are not measurable; minor – would be noticeable but would not affect the function or integrity of the resource; moderate – would be readily apparent and would influence the function or integrity of the resource; and, major – would be substantial and would result in severe adverse or exceptionally beneficial changes to the resource. Thus, using the above definitions for impact analysis, the NEPA analysis determined any impact intensity below moderate would not affect a resource's integrity.

Concurrent with the NEPA analysis, an assessment of effects on historic properties under the National Historic Preservation Act of 1966 (NHPA) and its implementing regulations (36 CFR 800) was also conducted. Section 106, as the process is most commonly referred to, requires Federal agencies to consider and consult on the effects of their actions on historic properties.[1] Section 106 defines historic properties as properties listed in or eligible for listing in the National Register of Historic Places (NRHP). This is notably different from NEPA, which, as previously stated, goes beyond considerations of Section 106 by also considering local, state, and federally designated or eligible resources. The Section 106 Assessment of Effects report, which can be found in **Appendix E3, Section 106 Assessment of Effects Report**, prepared in accordance with the NHPA, was prepared to determine if the Project would cause an adverse effect to historic properties. Differing from the above level of impacts used for the NEPA analysis, adverse effects under Section 106 are defined as any effect that diminishes the integrity of a historic property by altering any characteristics – location, design, setting, materials, workmanship, feeling, or association – that qualify the property from inclusion in the NRHP.

While both NEPA and Section 106 analyze and assess effects and impacts to historic and cultural resources, they assess those effects and impacts differently. As a result, the two processes can sometimes reach different conclusions on effects and impacts. For ease of understanding, both

[1] 36 CFR 800

conclusions have been stated in the following chapter. For the full analysis and conclusions under Section 106, please refer to **Appendix E3, Section 106 Assessment of Effects Report.**

12.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluation of impacts to cultural resources and summarizes the methodology used to evaluate current conditions and the probable consequences of the alternatives. This section also includes a description of the Study Area. The *Methodology Report* provides the complete list of laws, regulations, and other guidance considered and a full description of the analysis methodology followed for these.

12.2.1. Regulatory Context

Under NEPA, impacts are analyzed in several contexts, as was explained above, but the Section 106 process takes an additional step in the process by requiring consultation with identified stakeholders in the Project. This consultation, while not part of the NEPA process, was used to inform the impacts below. Consultation is the process of seeking, discussing, and considering the views of the Consulting Parties. The purpose of consultation is to identify and evaluate historic properties, assess impacts (adverse effects under Section 106), and resolve those impacts through avoidance, minimization, and mitigation strategies.

Consulting Parties for the Project were identified by the Federal Railroad Administration (FRA), the lead Federal agency, in consultation with the District of Columbia State Historic Preservation Officer (DC SHPO) and the Virginia Department of Historic Resources (VDHR). DC SHPO and VDHR–which serve as the respective SHPOs for their jurisdictions—are participating in consultation. Both agencies follow laws and guidelines specific to their respective jurisdictions, including the Virginia Antiquities Act of 1991;[2] *Guidelines for Conducting Historic Resources Survey in Virginia*;[3] the District of Columbia Historic Landmark and Historic District Protection Act of 1978;[4] and *Guidelines for Archaeological Investigations in the District of Columbia*.[5] A list of those FRA invited to participate in the consultation process is listed in **Table 12-1**.

12.2.2. Methodology

The Local Study Area for cultural resources is consistent with the Area of Potential Effect (APE) for NHPA Section 106 compliance.[6] Because the Project has no potential to adversely affect cultural resources beyond the APE, it was not necessary to define a Regional Study Area. The APE delineation identified and documented the areas from which the Project would cause ground disturbance or be reasonably

[2] Code of Virginia Chapter 23
[3] VDHR. September 2017. *Guidelines for Conducting Historic Resources Survey in Virginia*. Accessed from http://dhr.virginia.gov/pdf_files/SurveyManual_2017.pdf. Accessed June 4, 2018.
[4] DC Code 6-1101
[5] DC Preservation League et al. April 1998. *Guidelines for Archaeological Investigations in the District of Columbia*. Accessed from https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/DCArchaeologyGuidelines1998.pdf. Accessed June 4, 2018.
[6] Section 106 implementing regulations define the APE as "…the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." (36 CFR 800.16(d))

visible or audible. As shown in **Figure 12-1**, the APE and Limits of Disturbance (LOD) boundaries were mapped two dimensionally, although it was assumed that the boundaries encompass both above-ground and below-ground resources, including potential underwater and archaeological resources. The LOD is defined as the geographic area within which ground disturbance is anticipated to occur for the Project. It was developed to better understand the potential impacts to archaeological resources within the APE. FRA developed and refined the APE and LOD boundaries in consultation with DC SHPO, VDHR, and the Consulting Parties. By letters dated March 23, 2018, DC SHPO and VDHR concurred with the APE and LOD.

Table 12-1 | Agencies and Organizations Invited to Participate as Consulting Parties for the Long Bridge Project

Amtrak	National Mall Coalition[1]
Architect of the Capitol	National Park Service (NPS), Captain John Smith Trail[1]
Arlington County Historic Preservation Program	NPS, George Washington Memorial Parkway
Arlington County Manager[1]	NPS, National Capital Region
Arlington Historical Society[1]	NPS, National Mall and Memorial Parks
Arlington National Cemetery[1]	National Trust for Historic Preservation[1]
Catawba Indian Nation[1]	Pentagon Reservation (Department of Defense)
Committee of 100 on the Federal City[1]	Southwest Business Improvement District (BID)
Crystal City Civic Association	Trust for the National Mall[1]
CSX Transportation (CSXT)	U.S. Army Corps of Engineers, Baltimore District[1]
DC Preservation League	U.S. Army Corps of Engineers, Norfolk District[2]
Delaware Nation	U.S. Commission of Fine Arts
Delaware Tribe of Indians[1]	U.S. General Services Administration, National Capital Region
Federal Transit Administration	Virginia Department of Rail and Public Transportation
Mayor of the District of Columbia[1]	Virginia Railway Express
National Capital Planning Commission	Washington DC Chapter National Railway Historical Society[1]

[1] These organizations did not respond to the Consulting Party invitation or declined to participate as Consulting Parties.

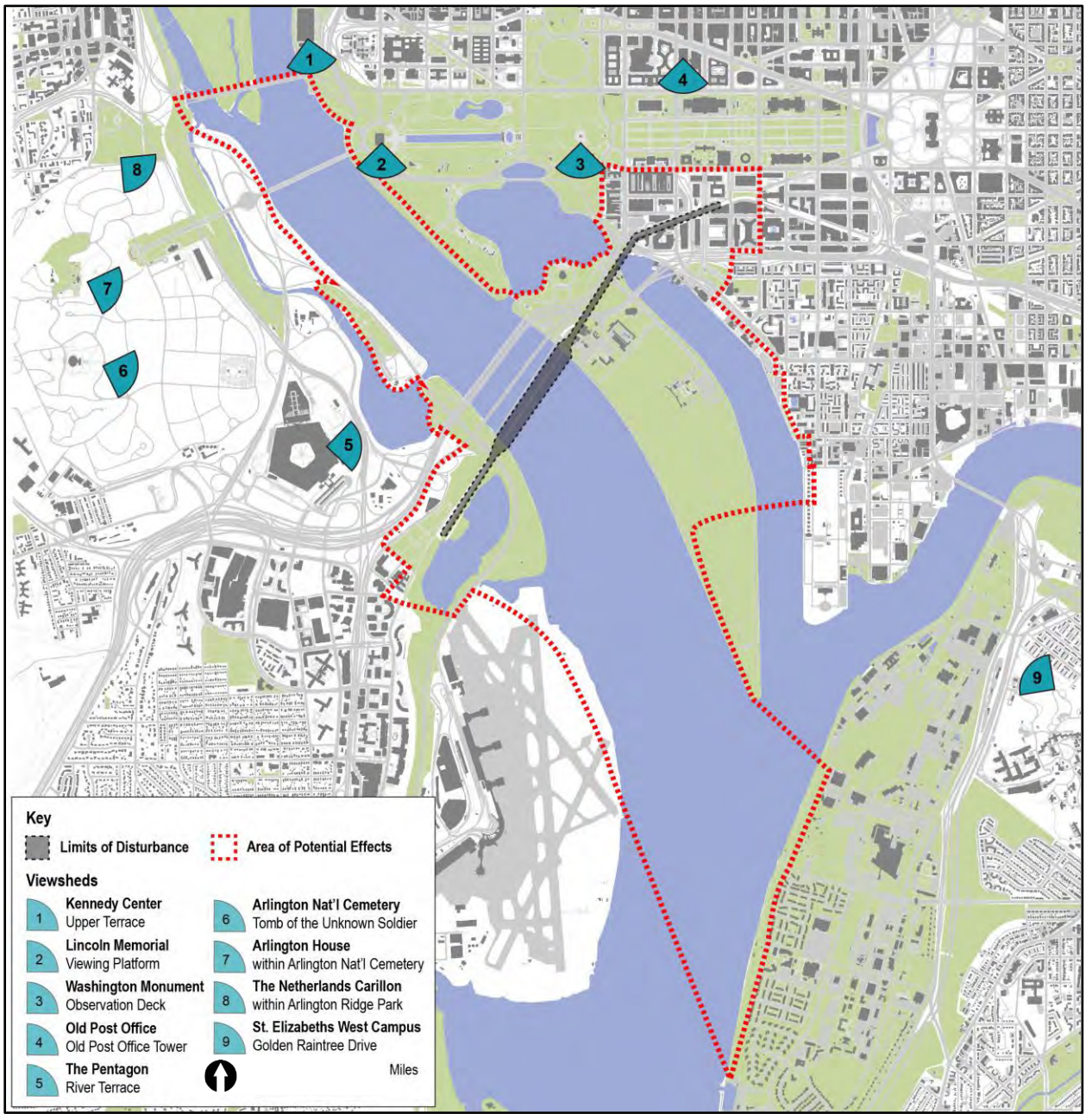
[2] During scoping, the Norfolk District designated FRA as the lead Federal agency for fulfilling its compliance obligations under Section 106. In November 2018, the Baltimore District designated FRA as the lead Federal agency for Section 106 compliance.

Following the dismissal of the bike-pedestrian crossing option downstream of the existing Long Bridge, FRA revised the LOD to remove the alignment of that crossing option and its associated access ramps and landings. The APE boundary remains unchanged.

Field survey to support the APE delineation process led to the identification of viewshed locations outside of the APE boundary. To compensate for this discrepancy, viewshed locations were identified from which the Long Bridge Corridor was clearly visible from a specific exterior vantage point or publicly accessible plaza or viewing platform. However, the view was sufficiently limited in these locations to not warrant expanding the APE to encompass the entirety of each site (for example, Long Bridge was visible from high points such as Arlington House, the Robert E. Lee Memorial and the Tomb of the Unknown Soldier, but not from the entirety of Arlington National Cemetery). More detailed information on the

cultural resources and viewshed analysis locations can be found in **Appendix E3, Section 106 Assessment of Effects Report**.

Figure 12-1 | Local Study Area and APE for Cultural Resources



FRA identified and mapped cultural resources within the APE using a variety of data sources, as described in the *Affected Environment Report*. The analysis in the *Affected Environment Report* identified all properties designated or eligible local and state resources, as well as all the resources that are listed

in, or are eligible for listing in, the NRHP that are located within the APE. The analysis also narratively described the historically significant characteristics of each resource and its specific historic designation and graphically illustrated the appearance and location of each resource.

The NEPA impact analysis, which was conducted concurrently, but separately from the Section 106 assessment, considered degrees of intensity, as described above and in **Section 1.3, Framework for Evaluating Impacts**. Impact intensity was identified as negligible, minor, moderate, or major.

As part of the consultation process, FRA and DDOT consulted with the Consulting Parties on the effects of the No Action and Action Alternatives on cultural resources. **Appendix E3, Section 106 Assessment of Effects Report**, provides a full description of the consultation and effects on cultural resources, and **Appendix E5, Draft Section 106 Programmatic Agreement (PA)**, provides a full description of the resolution to those effects. A PA is a flexible resolution document which outlines the avoidance, minimization, and mitigation measures of the identified adverse effects, as well as steps to be taken in the future when potential effects have yet to be identified. The public is welcome to comment on the PA through this DEIS.

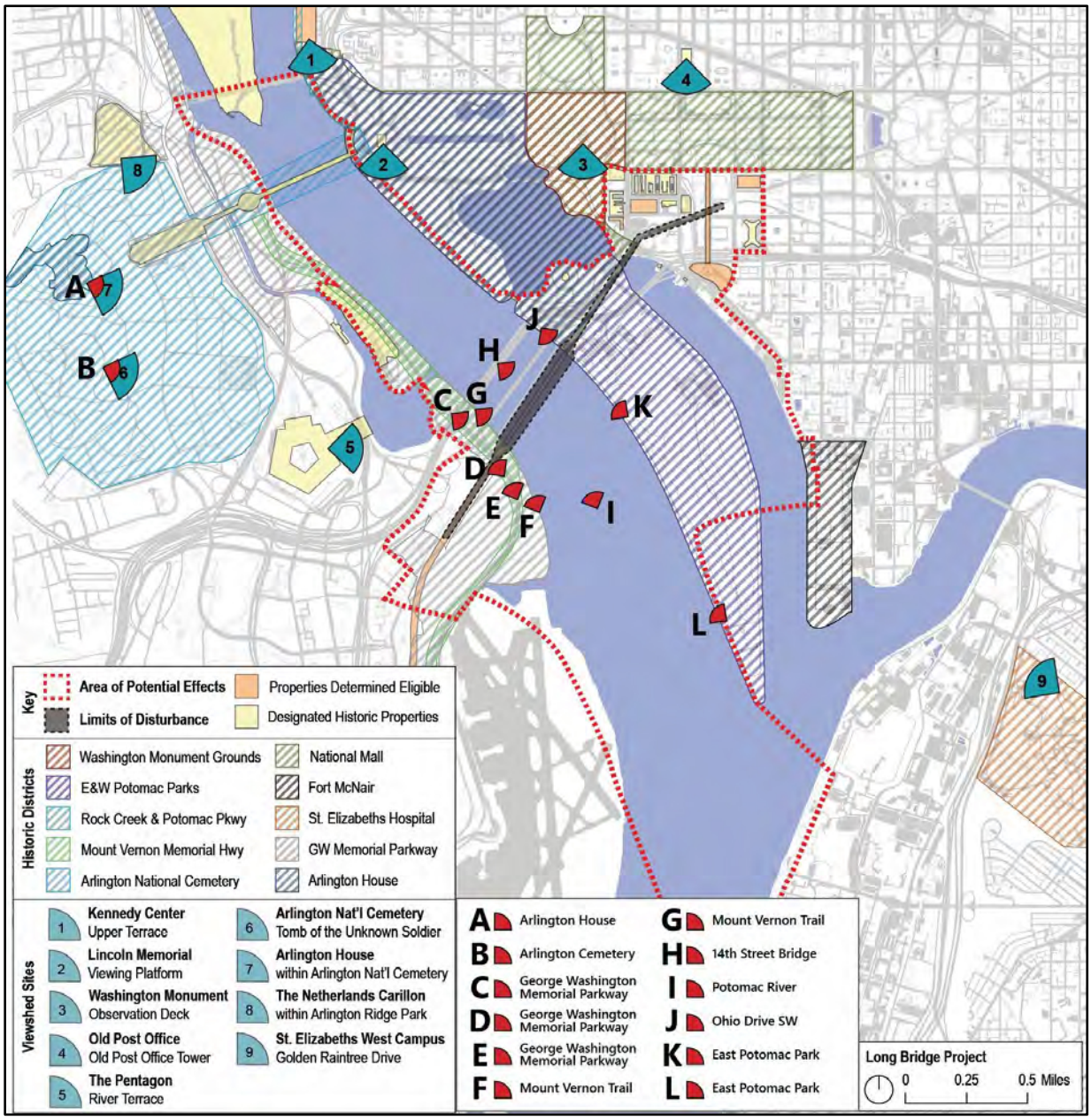
12.2.2.1. Viewshed Analysis

In order to better understand and evaluate the impacts of the proposed Action Alternatives, FRA and the District Department of Transportation (DDOT) prepared a series of photographic simulations that visualize the appearance of these alternatives as compared against existing conditions, which represent the No Action Alternative. The selected locations were sites that demonstrated a moderate or high potential for impacts resulting from either Action Alternative. Specific to cultural resources, moderate- or high-potential sites were those:

- With views or vistas that contribute demonstrably to the historic significance of a given cultural resource;
- Where the existing Long Bridge Corridor was currently clearly visible; and
- Where either Action Alternative had the potential to obstruct or alter historic views or vistas or diminish the integrity of a historic property.

The sites selected are listed in **Table 12-2** and depicted in Error! Reference source not found.. To create these views, FRA and DDOT conducted field survey to photograph existing conditions. Three-dimensional massing models of Action Alternatives A and B were aligned with the existing Long Bridge Corridor in these locations. The three-dimensional models were overlaid on existing conditions photographs and manipulated digitally to adjust for light and shadow, render materials, and approximate anticipated vegetation.

Figure 12-2 | Viewshed Locations (overlaid on APE)



These visualizations also support analysis of impacts on Visual Resources in **Section 11.0, Visual and Aesthetic Resources**. Views H and I are not cultural resources, and therefore are not evaluated in this section.

Table 12-2 | Viewshed Analysis Locations

#	Site/Property[1]	Location
A	**Arlington House, The Robert E. Lee Memorial**	View from Arlington House, The Robert E. Lee Memorial facing southeast
B	**Arlington National Cemetery**	View from Tomb of the Unknown Solder facing southeast
C	**George Washington Memorial Parkway (GWMP)**	View from southbound motorway approaching Metrorail Bridge
D	**GWMP**	View from northbound motorway approaching Metrorail and 14th Street bridges
E	**GWMP**	View from northbound motorway approaching GWMP railroad crossing
F	**GWMP, Mount Vernon Trail (MVT)**	View from Gravelly Point Park approaching Long Bridge facing north
G	**GWMP, MVT**	View from north of Long Bridge facing south
H	**I-395 Bridge**	View from center of bridge facing south
I	**Potomac River**	View from south of Long Bridge facing north
J	**East Potomac Park**	View from Ohio Drive SW facing southwest
K	**East Potomac Park**	View from Buckeye Drive vicinity facing northwest
L	**East Potomac Park**	View from end of Hains Point facing northwest

[1] ***Refer to*** *Error! Reference source not found.* ***for locations***

12.2.2.2. Archaeological Resources

Archaeological resources will be identified using a phased approach. FRA and the DDOT initiated the process by completing a Phase IA Archaeological Assessment in consultation with DC SHPO and VDHR. FRA and DDOT conducted the Phase IA Archaeological Assessment (Phase IA Assessment)in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation,[7] the *Guidelines for Archaeological Investigations in the District of Columbia* as adopted by the DC SHPO,[8] and the VDHR *Guidelines for Conducting Historic Resources Survey in Virginia*.[9] The Phase IA Assessment consisted of a desktop review of known archaeological sites and areas that exhibit high archaeological potential within the LOD. The Phase IA Assessment addressed all Action Alternatives and identified additional surveys that would likely be needed based on the selection of Action Alternative A as the Preferred Alternative. Because NPS has jurisdiction over a majority of the area within the LOD (including the bottom lands of the Potomac River), FRA and DDOT will continue to coordinate with NPS regarding potential impacts to archaeological resources, including potential underwater archaeological resources. For additional information, refer to **Appendix E4, Phase IA Archaeological Assessment Technical Report**. As the archaeological resources will be identified using a phased approach, the PA outlines the

[7] NPS. September 1983. *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*. Accessed from https://www.nps.gov/history/local-law/arch_stnds_0.htm. Accessed October 22, 2018.
[8] DC Preservation League et al. April 1998. *Guidelines for Archaeological Investigations in the District of Columbia*. https://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/DC%20Archaeology%20Guidelines%201998_1.pdf. Accessed May 18, 2018.
[9] VDHR. September 2017. *Guidelines for Conducting Historic Resources Survey in Virginia*. Accessed from http://dhr.virginia.gov/pdf_files/SurveyManual_2017.pdf. Accessed June 4, 2018.

future Section 106 responsibilities of the agencies and the Consulting Parties. The full PA can be found in **Appendix E5, Draft Section 106 Programmatic Agreement**, and public comments are welcome.

12.3. Permanent or Long-Term Effects

This section discusses the permanent or long-term impacts of the Action Alternatives and No Action Alternative on cultural resources within the Local Study Area under NEPA, taking NHPA determinations into account. A summary of impacts resulting from the No Action Alternative and both Action Alternatives is listed in **Table 12-3**. For resources where impacts were identified, these findings are described narratively by resource and alternative.

Table 12-3 | Permanent or Long-Term Impacts on Cultural Resources in the APE

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
National Mall Historic District	No impacts	Minor adverse impacts due to the expansion of the railroad corridor and removal of vegetation.	Minor adverse impacts due to the expansion of the railroad corridor and removal of vegetation.
Rock Creek and Potomac Parkway Historic District	No impacts	No impacts • located outside the limits of disturbance • no contributing views affected • located outside the noise and vibration study area	No impacts • located outside the limits of disturbance • no contributing views affected • located outside the noise and vibration study area
GWMP Historic District	No impacts	Moderate adverse impact due to the removal of contributing vegetation and minor adverse impact due to visual changes along the roadway and changes in operational noise.	Major adverse impact due to the removal of contributing GWMP railroad bridge and contributing vegetation and moderate adverse impact due to the removal of existing Long Bridge from the MVT viewshed. Negligible impact due to changes in operational noise.

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Mount Vernon Memorial Highway (MVMH) Historic District	No impacts	Moderate adverse impact due to the removal of contributing vegetation and minor adverse impact due to visual changes along the roadway and changes in operational noise.	Major adverse impact due to the removal of contributing MVMH railroad bridge and contributing vegetation and moderate adverse impact due to the removal of existing Long Bridge from the MVT viewshed. Negligible impact due to changes in operational noise.
Plan of the City of Washington	No impacts	Negligible adverse impact due to the increase in permanent operational noise	Negligible adverse impact due to the increase in permanent operational noise
East and West Potomac Parks Historic District	No impacts	Moderate adverse impact due to the removal of contributing vegetation and minor adverse impact due to viewshed changes along the perimeter of Hains Point, including the visual obstruction of the Long Bridge.	Major adverse impact due to the removal of the contributing Long Bridge and contributing vegetation and moderate adverse impact due to viewshed changes along the perimeter of Hains Point, including the removal of the Long Bridge.
Thomas Jefferson Memorial	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Central Heating Plant	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
U.S. Department of Agriculture (USDA) Cotton Annex	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
HUD Building (Robert C. Weaver Federal Building)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
USDA South Building	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Bureau of Engraving and Printing	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Auditor's Building Complex	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Arlington Memorial Bridge (and related features)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Fort Leslie J. McNair Historic District (The Old Arsenal)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Titanic Memorial	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Lunch Room Building and Oyster Shucking Shed	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Cuban Friendship Urn	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Theodore Roosevelt Island National Memorial (Analostan Island)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Lyndon B. Johnson Memorial Grove	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Lincoln Memorial (Statue of Lincoln)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Washington Monument and Grounds Historic District	No impacts	No impacts • no physical changes to this resource • new bridge would be minimally visible from the top of the Monument and would be located beyond the main focal points in the Monumental Core and would not obstruct these views • located outside the noise and vibration study area	No impacts • no physical changes to this resource • new bridges would be minimally visible from the top of the Monument and would be located beyond the main focal points in the Monumental Core and would not obstruct these views • located outside the noise and vibration study area
Arlington House Historic District	No impacts	No impacts • no physical changes to this resource • new bridge would be minimally visible within the panoramic view from the house and would not obstruct these views • located outside the noise and vibration study area	No impacts • no physical changes to this resource • new bridges would be minimally visible within the panoramic view from the house and would not obstruct these views • located outside the noise and vibration study area
Arlington National Cemetery Historic District[1]	No impacts	No impacts • no physical changes to this resource • new bridge would be minimally visible within the panoramic views of the District and would not obstruct these views • located outside the noise and vibration study area	No impacts • no physical changes to this resource • new bridges would be minimally visible within the panoramic views of the District and would not obstruct these views • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
St. Elizabeths Hospital Historic District	No impacts	No impacts • no physical changes to this resource • distance between sites means no potential to impede or alter panoramic views • located outside the noise and vibration study area	No impacts • no physical changes to this resource • distance between sites means no potential to impede or alter panoramic views • located outside the noise and vibration study area
Netherlands Carillon (within Arlington Ridge Park)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Old Post Office	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
The Pentagon	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Bureau of Engraving and Printing Annex	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Federal Office Building 10A (Orville Wright Building)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Benjamin Banneker Park/Overlook; Tenth Street Overlook	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
Richmond, Fredericksburg, and Potomac (RF&P) Railroad Historic District	No impacts	Negligible adverse impacts due to the expansion of the railroad corridor and negligible adverse impacts due to the increase in permanent operational noise	Negligible adverse impacts due to the expansion of the railroad corridor and negligible adverse impacts due to the increase in permanent operational noise

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Washington Marina Building	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
L'Enfant Promenade	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Lady Bird Johnson Park	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area
John F. Kennedy Center for the Performing Arts	No impacts	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area	No impacts • no physical changes to this resource • no contributing views affected • located outside the noise and vibration study area

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
Liberty Loan Federal Building	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Astral Building (North Building, L'Enfant Plaza)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Comsat Building (South Building, L'Enfant Plaza)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration
Loew's L'Enfant Plaza Hotel (East Building, L'Enfant Plaza)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration

Cultural Resource	No Action Alternative	Action Alternative A	Action Alternative B
United States Postal Service (USPS) Building (West Building, L'Enfant Plaza)	No impacts	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration	No impacts • no physical changes to this resource • no contributing views affected • no receptor locations in close proximity would experience exceedances of FTA thresholds for noise or vibration

12.3.1. No Action Alternative

In the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative presumes that Long Bridge remains in service, with continued maintenance as necessary. The No Action Alternative also presumes that DRPT and VRE complete the other planned railroad projects that would expand capacity to four tracks on either side of the Long Bridge Corridor. Because numerous cultural resources exist within the Local Study Area, projects in the No Action Alternative may affect one or more of these resources. However, the impacts of these projects and any other large capital projects would be assessed within the context of each project.

12.3.2. Action Alternative A

Action Alternative A would result in moderate permanent adverse impacts to the GWMP, MVMH, and East and West Potomac Parks Historic Districts due to the removal or alteration of contributing features.[10] The contributing features that may be removed or altered include contributing vegetation to the GWMP and MVMH, especially mature trees that date to the 1932 planting plan of the GWMP, which were intended to visually screen the railroad bridge from the motorway, as well as the removal of up to four contributing Japanese cherry blossom plantings along the perimeter of East Potomac Park, in addition to other mature vegetation. The Japanese cherry blossom plantings date from 1966 to 1968, when friends of President and Mrs. Lyndon B. Johnson planted approximately 1,800 Japanese cherry blossom plantings (and other flowering plantings) on both sides of Ohio Drive SW to honor the President and Mrs. Lyndon B. Johnson's role in the nationwide Beautification Program.

Action Alternative A would result in minor permanent adverse impacts to the National Mall Historic District and the RF&P Railroad Historic District. Impacts to the National Mall Historic District would be minor because, although the new bridge structures and expanded railroad trackage would be noticeable, no aspects of the contributing features within the historic district would be impacted. Impacts to the RF&P Railroad Historic District would be minor because, despite the addition of two

[10] A contributing feature is a building, site, structure, or object that adds to the historic significance of a property. This assessment is based on existing NRHP, NHL, DC Inventory of Historic Sites, Virginia Landmarks Register, determination of eligibility, cultural landscape, and other available documentation for each historic property.

tracks, the historic district would continue its uses as a railroad corridor and the primary components of its operation and design would remain intact.

Action Alternative A would also create minor permanent adverse impacts resulting from visual changes on the National Mall, GWMP, MVMH, and RF&P Railroad historic districts due to the addition of a new railroad bridge. While the introduction of a new railroad bridge structure above the Potomac River would alter views across the river, the findings of the viewshed analysis, when considered against the criteria of adverse effect, indicate that these changes are insufficient to diminish the integrity of these cultural resources. In the East and West Potomac Parks Historic District, the addition of a new bridge would obstruct views of the existing Long Bridge from the north, diminishing the visual integrity of this contributing structure and resulting in a moderate adverse impact.

12.3.2.1. National Mall Historic District

Alternative A's LOD includes approximately 6.92 acres within the National Mall Historic District. Despite this, there are no identified contributing features within the railroad corridor.[11] For this reason, although the new bridge structures and expanded railroad trackage would be noticeable, they would not diminish any aspect of integrity of contributing features within the historic district. Therefore, the resulting adverse impacts on the historic district would be minor.

12.3.2.2. George Washington Memorial Parkway

Alternative A's LOD includes approximately 0.92 acres of the GWMP. Construction of a new railroad bridge would necessitate removing contributing vegetation, especially mature trees that date to the 1932 planting plan of the GWMP, which were intended to visually screen the railroad bridge from the motorway. Loss of these trees would diminish the integrity of design, materials (specifically, the contributing vegetation), and feeling of GWMP, creating a moderate adverse impact.

The existing, non-contributing bridges along this portion of the GWMP have compromised its integrity of feeling, association, and setting. Although the addition of a new bridge would be visible, it would not diminish the integrity of the historic district and resulting adverse impacts would be minor. See **Figures 11-9 through 11-17**, **11-21**, **and 11-22** in **Section 11.0, Visual and Aesthetic Resources**, for illustrations of these changes. Although the introduction of a new railroad bridge structure above the Potomac River would alter views along the shoreline facing north toward the Monumental Core or south to Hains Point, the findings of the viewshed analysis indicate that these are insufficient to diminish any aspect of the integrity of the GWMP (**Figures 11-18 and 11-19** in **Section 11.0, Visual and Aesthetic Resources**).[12] The adverse impact would therefore be minor.

A portion of the GWMP is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no impacts resulting from increased operational vibration. Noise analysis has indicated that the increase in noise at some locations resulting from permanent operational changes would be moderate and adverse. However, several existing environmental factors mitigate this

[11] A contributing feature is a building, site, structure, or object that adds to the historic significance of a property. This assessment is based on existing NRHP, NHL, DC Inventory of Historic Sites, Virginia Landmarks Register, determination of eligibility, cultural landscape, and other available documentation for each historic property.
[12] The Monumental Core represents the central concentration of the Federal presence in the nation's capital. It is comprised of the National Mall, East and West Potomac Parks, the Federal Triangle, the Northwest Rectangle, and Southwest Federal Center.

perceived change. These include the high degree of ambient noise along the GWMP (generally resulting from automobile traffic along the GWMP and surrounding roads and regular overhead noise from airplane and helicopter traffic), the relatively infrequent occurrence of train traffic relative to automobile traffic, and the historic district's primary use for active recreation. For these reasons, the change in operational noise would not be sufficient to diminish the integrity of setting, feeling, and association of the historic district and the corresponding adverse impact would be negligible.

12.3.2.3. Mount Vernon Memorial Highway

Action Alternative A's impacts to the MVMH would be similar and additive to those described above affecting the GWMP. As described above, adverse impacts resulting from removing contributing vegetation would be moderate. Adverse impacts resulting to changes in views along the motorway would be minor. Adverse impacts resulting to changes to views along the shoreline facing north toward the Monumental Core or south to Hains Point would be negligible. Adverse impacts resulting from changes in operational noise would be negligible.

12.3.2.4. Plan of the City of Washington

A portion of the Plan of the City of Washington is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no potential for adverse impacts to contributing components of the Plan of the City of Washington resulting from increased operational vibration. Noise analysis has indicated that the increase in noise resulting from permanent operational changes would be moderate for portions of the Plan of the City of Washington along the Long Bridge Corridor. However, several existing environmental factors would mitigate this perceived change. These include the high degree of ambient noise within the SW Quadrant street grid and the lack of sensitive land uses (such as areas of passive recreation). For these reasons, the change in operational noise would not be sufficient to diminish the integrity of setting, feeling, and association of the historic district and the corresponding adverse impact would be negligible.

12.3.2.5. East and West Potomac Parks

Alternative A's LOD includes approximately 5.56 acres within East Potomac Park. A new railroad bridge would necessitate removing approximately four contributing Japanese cherry blossom plantings along the perimeter of East Potomac Park in addition to other mature vegetation. Loss of these features would diminish the integrity of design, materials (specifically, the trees themselves), and feeling of the park, creating a moderate adverse impact.

Addition of a new bridge structure would impact contributing views within the historic district, particularly those around the perimeter of East Potomac Park, including those facing toward the Monumental Core and views up and down the Potomac River toward Virginia and of the existing Long Bridge along the perimeter of East Potomac Park. Viewshed simulations show that the addition of a new upstream railroad bridge would obstruct views of the existing Long Bridge and create a moderate adverse impact. Otherwise, visual changes would be negligible. See **Figures 11-30, 11-31, 11-33, 11-34, 11-36, and 11-37** in **Section 11.0, Visual and Aesthetic Resources**, for illustrations of these changes.

12.3.2.6. Richmond, Fredericksburg, and Potomac Railroad

The Project proposes alterations to the RF&P Railroad at its eastern terminus to accommodate the additional two tracks and link these tracks to the new bridge proposed under each Action Alternative. Despite this change, the historic district would continue its uses as a railroad corridor and the primary components of its operation and design would remain intact. For these reasons, the property would retain its integrity of design, materials, feeling, location, workmanship, association, and setting and the corresponding adverse impact would be negligible.

This property is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no potential for adverse impacts from increased operational vibration. Noise analysis has indicated that the increase in noise resulting from permanent operational changes would be moderate for portions of the RF&P Railroad along the Long Bridge Corridor. Because the property's significance is directly related to its historic use as a railroad corridor, a moderate increase in operational noise would not diminish its integrity and the corresponding adverse impact would be negligible.

12.3.2.7. Archaeological Resources

A Phase IA Archaeological Assessment conducted for the Project (see **Appendix E4, Phase IA Archaeological Assessment Technical Report**) identified the following three terrestrial areas of high potential for archaeological resources and one submerged area of moderate potential within the Long Bridge Project limits of disturbance (LOD). FRA has not evaluated these sites for NRHP eligibility or their value for preservation in place.[13] As shown in **Figure 12-4,** the three terrestrial areas are:

- The eastern half of the area from the GWMP south to RO Interlocking, which has a high potential for prehistoric Native American archaeological features and artifact deposits;
- Areas east and west of the existing railroad Corridor at GWMP, which are the location of Jackson City (archaeological site 44AR0037); and,
- The area west of 12th Street SW, which has a high potential for prehistoric Native American and Historic period artifact and feature deposits.

The submerged area from the middle of the Potomac River to the shoreline of East Potomac Park has a moderate potential for piers associated with earlier bridges. This area was a terrestrial landform during the late Pleistocene/early Holocene epochs. While recent investigations at West Potomac Park concluded that river migration destroyed this landform, a Paleoindian projectile point was reported to DC SHPO from this approximate area. As such, the area from the middle of the Potomac River to the western shoreline of East Potomac Park has a moderate potential for prehistoric Native American artifact and feature deposits. All other terrestrial or submerged areas within the LOD have low or no potential for archaeological resources. FRA has not evaluated these sites for NRHP eligibility or their value for preservation in place.[14]

[13] When FRA, in consultation with the District of Columbia State Historic Preservation Office (DC SHPO) and Virginia Department of Historic Resources (VDHR), determines that the archaeological resource is important chiefly because of what can be learned by data recovery and has minimal value to preservation in place.

[14] When FRA, in consultation with the District of Columbia State Historic Preservation Office (DC SHPO) and Virginia Department of Historic Resources (VDHR), determines that the archeological resource is important chiefly because of what can be learned by data recovery and has minimal value to preservation in place.

Figure 12-3 | Results of the Phase IA Archaeological Assessment

The need for further investigations will be determined later using the phased approach and in consultation with the appropriate SHPO and Consulting Parties pursuant to the terms of the PA. Required investigations and evaluations will be conducted during Final Design once it is clearly understood where ground disturbing activities will take place.

12.3.3. Action Alternative B

Action Alternative B would have major permanent adverse impacts to the GWMP, MVMH, and East and West Potomac Parks Historic Districts as a result of the removal of the existing Long Bridge (a contributing resource to the East and West Potomac Parks Historic District) and a component railway bridge above the MVMH and the GWMP (a contributing resource to the GWMP). Action Alternative B would also remove the existing railroad bridge spanning above the GWMP roadway, which has been recommended by VDHR as a contributing resource to the GWMP. In addition, Action Alternative B would remove up to seven contributing Japanese cherry blossom plantings in East and West Potomac Parks Historic District. Other impacts resulting from Action Alternative B would be the same as for Action Alternative A.

Action Alternative B would also create moderate permanent adverse impacts resulting from visual changes on the GWMP, MVMH, and East and West Potomac Parks historic districts. Removing the existing railroad bridge above the GWMP roadway and replacing it with a modern bridge would diminish the integrity of setting and association of the historic district. Action Alternative B would remove the existing Long Bridge and its central through truss span, which form a significant visual component of the GWMP when traveling north and south along the MVT and of East and West Potomac Parks when traveling along the perimeter of East Potomac Park. Removing this visual element would diminish the integrity of setting and association of these historic districts. Other impacts resulting from Action Alternative B would be the same as for Action Alternative A.

12.3.3.1. National Mall Historic District

Action Alternative B's LOD includes approximately 7.11 acres within the National Mall Historic District. Despite this large area, there are no identified contributing features within the railroad corridor. For this reason, although the new bridges structures and expanded railroad trackage would be noticeable, they would not diminish any aspect of integrity of contributing features within the historic district. Therefore, the resulting adverse impacts on the historic district would be negligible.

12.3.3.2. George Washington Memorial Parkway

Action Alternative B's impacts would be similar to those described for Action Alternative A, although intensified in a result of a second new railroad bridge construction. Action Alternative B would also replace the existing railroad bridge spanning above the GWMP, which has been recommended by VDHR as a contributing resource to the GWMP. Replacing this contributing feature with a new, modern steel structure would result in a diminished integrity of design, materials, and workmanship of the property, creating a major adverse impact. See **Figures 11-9, 11-11, 11-12, 11-14, 11-15, and 11-17** in **Section 11.0, Visual and Aesthetic Resources**.

Action Alternative B's LOD includes approximately 1.6 acres of the GWMP. Construction of a new railroad bridge would necessitate removing contributing vegetation, especially mature trees that date to the 1932 planting plan of the GWMP, which were intended to visually screen the railroad bridge from

the motorway. Loss of these trees would diminish the integrity of design, materials (specifically, the contributing vegetation), and feeling of the GWMP, creating a moderate adverse impact.

The existing, non-contributing bridges along this portion of the GWMP have compromised its integrity of feeling, association, and setting. Although the addition of a new bridge would be visible, it would not diminish the integrity of the historic district and resulting adverse impacts would be negligible. See **Figures 11-9, 11-11, 11-12, 11-14, 11-21, and 11-23** in **Section 11.0, Visual and Aesthetic Resources**, for illustrations of these changes. In addition to the adverse impact resulting from changes to the motorway, Action Alternative B replaces the existing Long Bridge. This structure and its central through truss span form a significant visual component of the GWMP when traveling north and south along the MVT. Removing this visual element would diminish the integrity of setting and association of the historic district, resulting in a moderate adverse impact. See **Figures 11-18 and 11-20** in **Section 11.0, Visual and Aesthetic Resources**, for illustrations of these changes.

A portion of the GWMP is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no impacts resulting from increased operational vibration. Noise analysis has indicated that the increase in noise resulting from permanent operational changes would be moderate and adverse. However, several existing environmental factors mitigate this perceived change. These include the high degree of ambient noise along the GWMP (generally resulting from automobile traffic along the Parkway and surrounding roads and regular overhead noise from airplane and helicopter traffic), the relatively infrequent occurrence of train traffic relative to automobile traffic, and the historic district's primary use for active recreation. For these reasons, the change in operational noise would not be sufficient to diminish the integrity of setting, feeling, and association of the historic district and the corresponding adverse impact would be negligible.

12.3.3.3. Mount Vernon Memorial Highway

Action Alternative B's impacts to the MVMH would be similar and additive to those described above affecting the GWMP. As described above, adverse impacts resulting from removal of contributing vegetation would be moderate.[15] Adverse impacts resulting to changes in views along the motorway would be moderate. Adverse impacts resulting to changes to views along the shoreline facing north toward the Monumental Core or south to Hains Point would be minor. Adverse impacts resulting from changes in operational noise would be negligible.

12.3.3.4. Plan of the City of Washington

A portion of the Plan of the City of Washington is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no potential for adverse impacts to contributing components of the Plan of the City of Washington resulting from increased operational vibration. Noise analysis has indicated that the increase in noise resulting from permanent operational changes would be moderate for portions of the Plan of the City of Washington along the Long Bridge Corridor. However, several existing environmental factors would mitigate this perceived change. These include the high degree of ambient noise within the SW Quadrant street grid and the lack of sensitive land uses (such as areas of passive recreation). For these reasons, the change in operational noise would not be sufficient

[15] The railroad bridge spanning the Highway is described in the NRHP nomination for the MVMH, but it is unclear from this documentation if the structure is classified as a contributing resource.

to diminish the integrity of setting, feeling, and association of the historic district and the corresponding adverse impact would be negligible.

12.3.3.5. East and West Potomac Parks

Action Alternative B would remove the existing Long Bridge and construct a new railroad bridge in its location. The Long Bridge (Potomac Railroad Bridge) is a contributing element of the historic district. Removing this contributing feature would diminish the integrity of design, feeling, association, materials, and feeling of the property, creating a major adverse impact.

Action Alternative B's LOD includes approximately 5.75 acres within East Potomac Park. Constructing a new railroad bridge would necessitate the removal of up to approximately seven contributing Japanese cherry blossom plantings along the perimeter of East Potomac Park, in addition to other mature vegetation. Loss of these features would diminish the integrity of design, materials (specifically, the trees themselves), and feeling of the park, creating a moderate adverse impact.

A new bridge structure would impact contributing views within the historic district, particularly those around the perimeter of East Potomac Park, including those facing toward the monumental core and views up and down the Potomac River toward Virginia and of the existing Long Bridge along the perimeter of East Potomac Park. Viewshed simulations show that the replacement of the existing Long Bridge and the addition of a new upstream railroad bridge would remove this contributing visual component and create a moderate adverse impact. Otherwise, visual changes would be negligible. See **Figures 11-30, 11-32, 11-33, 11-35, 11-36, and 11-38** in **Section 11.0, Visual and Aesthetic Resources**, for illustrations of these changes.

12.3.3.6. Richmond, Fredericksburg, and Potomac Railroad

The Project proposes alterations to the RF&P Railroad at its eastern terminus to accommodate the additional two tracks and link these tracks to the new bridge proposed under each Action Alternative. Despite this change, the historic district would continue its uses as a railroad corridor and the primary components of its operation and design would remain intact. For these reasons, the property would retain its integrity of design, materials, feeling, location, workmanship, association, and setting and the corresponding adverse impact would be negligible.

This property is located within the Noise and Vibration Study Area. Vibration analysis has indicated that there would be no potential for adverse impacts from increased operational vibration. Noise analysis has indicated that the increase in noise resulting from permanent operational changes would be moderate for portions of the RF&P Railroad along the Long Bridge Corridor. Because the property's significance is directly related to its historic use as a railroad corridor, a moderate increase in operational noise would not diminish its integrity and the corresponding adverse impact would be negligible.

12.3.3.7. Archaeological Resources

Action Alternative B would have the potential to affect the same archaeological resources described in **Section 12.3.2.7, Archaeological Resources.** See **Appendix E4, Phase IA Archaeological Assessment Technical Report** for a more detailed description of the findings of the Phase IA analysis. The need for further investigations would be determined later using the phased approach and in consultation with the appropriate SHPO and Consulting Parties pursuant to the terms of the PA. Required investigations

and evaluations would be conducted during Final Design once it is clearly understood where ground disturbing activities would take place.

12.4. Temporary Effects

This section considers the temporary impacts of the Action Alternatives and No Action Alternative on cultural resources within the APE. Properties where no temporary impacts were identified have been excluded.

12.4.1. No Action Alternative

Because numerous historic properties exist within the Local Study Area, the construction of projects in the No Action Alternative may affect one or more of these properties. However, the impacts of construction of these projects and any other large capital projects would be assessed within the context of each project.

12.4.2. Action Alternative A (Preferred Alternative)

Action Alternative A would have moderate temporary adverse impacts to the GWMP, MVMH, and East and West Potomac Parks historic districts. Use of portions of these historic districts for construction access and staging would temporarily diminish the integrity of setting, feeling, and association for these resources. Action Alternative A would also create a moderate temporary adverse impact to the National Mall Historic District and negligible adverse temporary impacts to the Plan of the City of Washington due to the location of construction access and staging areas within the historic districts.

Analysis compiled to support the noise and vibration chapter of the Environmental Impact Statement (EIS) found there would be no temporary adverse impacts on cultural resources resulting from vibration. There would be potential for moderate temporary adverse impacts on the GWMP, MVMH, and East and West Potomac Parks historic districts resulting from construction noise. Specific temporary impacts are described below, organized by cultural resource affected. Although no specific construction start date or schedule has been determined, it is projected that Action Alternative A construction would last approximately 60 months.

12.4.2.1. National Mall Historic District

Construction activities for Action Alternative A would require temporary use of, and access to, various areas of East Potomac Park that form a part of the National Mall Historic District. Both NPS Parking Lot B and NPS Parking Lot C would be closed during construction and used for construction staging and access. These surface parking areas are located within, but do not contribute to, the National Mall Historic District. Temporary construction access and staging areas would also be required for areas between the Department of Defense (DOD) Facility and I-395 North lanes, both east and west of the CSXT tracks.

Use of these areas for construction access and staging would temporarily diminish the integrity of setting, feeling, and association of the National Mall Historic District and would constitute a minor temporary adverse impact on this property.

12.4.2.2. George Washington Memorial Parkway

Construction of Action Alternative A would require the temporary use of land along the GWMP and MVT to support construction activities. Construction staging and access areas would be located at the GWMP crossing in the median of the roadway as well as west and east of the crossing. Construction would require temporary relocation of a portion of the MVT for public safety and to allow construction access and staging along the water. Analysis compiled to support the noise and vibration chapter of the EIS found there would be potential for construction noise to exceed Arlington County noise ordinance thresholds, creating a potential for moderate temporary impacts on the GWMP. These impacts could be minimized or avoided if appropriate construction management procedures are implemented as mitigation.

Temporary impacts in this area would last over 4 years and would result in moderate adverse impacts due to trail relocation and to the diminishment of integrity of feeling, association, and setting of the GWMP.

12.4.2.3. Mount Vernon Memorial Highway

Action Alternative A's impacts to the MVMH would be similar and additive to those described above affecting the GWMP. Temporary impacts in this area would last over 4 years and would result in moderate adverse impacts due to trail relocation and to the diminishment of integrity of feeling, association, and setting of the MVMH.

12.4.2.4. Plan of the City of Washington

Construction of Action Alternative A would require use of the western portion of NPS Reservation 113, also known as Hancock Park (adjacent to 9th Street SW and a contributing reservation to the Plan of the City of Washington) for construction staging and access for up to 3 years. Hancock Park is currently used for construction access and staging and its continued use in this capacity has a negligible potential to diminish the integrity of design, materials, workmanship, feeling, and association of this property. The corresponding adverse impacts would be negligible. See EIS **Chapter 24, Draft Section 4(f) Evaluation,** for more information on how Section 4(f) applies to Hancock Park.

12.4.2.5. East and West Potomac Parks

Construction activities for Action Alternative A would require temporary use of, and access to, various areas of East Potomac Park. Both NPS Parking Lot B and NPS Parking Lot C would be closed during construction and used for construction staging and access. These surface parking areas are located within, but do not contribute to, the historic district. The land at the intersection of Ohio Drive SW and Buckeye Drive has also been identified as a potential staging location. It is anticipated that one of these staging locations would be the site of a concrete plant during construction.

Temporary construction access and staging areas would also be required for areas between the DOD Facility and I-395 North lanes, both east and west of the CSXT tracks. Finally, access would be required in a section along the southern bank of the Washington Channel. Analysis compiled to support the noise and vibration chapter of the EIS found there would be potential for construction noise to exceed District noise ordinance thresholds, creating a potential for moderate temporary impacts on the East and West

Potomac Parks Historic District. These impacts could be minimized or avoided if appropriate construction management procedures are implemented as mitigation.

Temporary impacts in this area would last over 4 years and would result in moderate adverse impacts due to the diminishment of integrity of feeling, association, and setting of East Potomac Park. See EIS **Chapter 24, Draft Section 4(f) Evaluation,** for more information on how Section 4(f) applies to East and West Potomac Parks.

12.4.2.6. Archaeological Resources

Construction activities would have the potential to affect the same archaeological resources described in **Section 12.3.2.7, Archaeological Resources.** See **Appendix E4, Phase IA Archaeological Assessment Technical Report** for a more detailed description of the findings of the Phase IA analysis. The need for further investigations would be determined later using the phased approach and in consultation with the appropriate SHPO and Consulting Parties pursuant to the terms of the PA. Required investigations and evaluations would be conducted during Final Design once it is clearly understood where ground disturbing activities would take place.

12.4.3. Action Alternative B

Action Alternative B's temporary impacts would be similar to those described for Action Alternative A except that the estimated duration of construction would be longer due to the replacement of the existing Long Bridge and component railroad bridge that crosses the GWMP. Although no specific construction start date or schedule has been determined, it is projected that Action Alternative B construction would last approximately 99 months.

12.5. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the impacts to cultural resources. Throughout the Project planning process, FRA and DDOT, in consultation with DC SHPO, VDHR, and the Consulting Parties, have identified measures to avoid, minimize, or mitigate adverse impacts on cultural resources. These measures vary by alternative. The Section 106 consultation process is ongoing. FRA and DDOT will continue to consult with DC SHPO, VDHR, and the Consulting Parties to identify ways to avoid, minimize, and mitigate adverse impacts. The Section 106 agreement document, a PA, will describe these measures and stipulate that consultation would continue through the final design and construction processes. The draft PA is included as an appendix to the DEIS (**Appendix E5, Section 106 Draft Programmatic Agreement**).

12.5.1. Summary of Consultation

FRA and DDOT jointly conducted consultation through the Section 106 process and held five Consulting Party meetings to date between April 2017 and August 2019. A thirty-day comment period was provided for any additional comments after each Consulting Party meeting. The feedback received during the meetings, and subsequent comment periods, informed the development of the APE, the identification of historic properties, the assessment of effects and impacts on cultural resources, and appropriate resolution strategies. **Table 12-4** provides a summary of the topics and input received from the Consulting Parties. The Section 106 consultation process is further described in **Appendix E3, Section 106 Assessment of Effects Report**.

Through the Section 106 process and in consultation with DC SHPO, VHDR, NPS and other Consulting Parties, alternatives that considered the construction of a new railroad bridge and associated railroad infrastructure outside of the existing Long Bridge Corridor were dismissed from consideration. This avoids potential effects generated by expanding the scope and constructing the project within a significantly larger geographic area.

Table 12-4 | Section 106 Consulting Parties Meetings

Meeting Date	Topic(s)	Input from Consulting Parties
April 25, 2017 **1:00 PM to 3:00 PM**	• Project overview • Purpose and Need • Preliminary concepts and screening • Preliminary identification of historic properties	• Comments on concept screening • Comments on delineation of APE • Comments on identification of historic properties
November 15, 2017 **12:30 PM to 2:00 PM**	• Draft APE • Methodology Report • Field survey methodology • Refine identification of historic properties	• Comments on APE encompassing worst-case scenario • Input on important viewsheds to include in the APE • Additional areas/resources to be surveyed, including archaeology
May 30, 2018 **1:00 PM to 2:30 PM**	• Introduction of Phase IA Archaeological Assessment • Action Alternatives to be analyzed • Methodology for assessing effects to historic properties	• Comments on methodology • Comments on the identified historic resources within APE
October 24, 2018 **10:30 AM to 12:00 PM**	• Findings of Phase IA Archaeological Assessment • Determination of effects to historic properties • Introduction of strategies for avoidance, minimization, and mitigation	• Comments on Determination of effects to historic properties • Input on alternatives and suggestions for Preferred Alternative A • Input on strategies for avoidance, minimization, and mitigation
August 1, 2019 **1:00 PM to 2:30 PM**	• Strategies for avoidance, minimization, and mitigation as presented in the PA	• Comments on strategies for avoidance, minimization, and mitigation

Through the consultation process a preference for Action Alternative A was identified as having fewer adverse effects on historic properties than Action Alternative B. Most notably Action Alternative A would retain the existing Long Bridge and the railroad bridge over the GWMP, avoiding the adverse effects on East and West Potomac Parks Historic District, MVMH, and GWMP.

In comments following the fourth Consulting Parties meeting, Consulting Parties requested that the new bridge design be compatible with the existing Long Bridge. Further, they indicated a preference for a through-plate-girder bridge type to create a consistent aesthetic for the railroad bridges and distinguish them from the Metrorail bridge. Consulting Parties also suggested the installation of wayside signs on

the history and development of the Long Bridge corridor could mitigate the loss of views to and from the historic Long Bridge.

Consulting Parties requested that any new bridges or other structures introduced into NPS-administered properties be designed and aesthetically treated to be compatible with the existing character of these resources. This would minimize the adverse effect of introducing new features into historic districts. For example, within the GWMP and MVMH Historic Districts, new bridge piers could be clad with stone to match the piers of the existing railroad bridge. Also requested, was the development of a Viewshed Protection Plan that would ensure minimization and mitigation for potential interrupted or affected views throughout the Long Bridge corridor. Added to that suggestion, was the development of Cultural Landscape Inventories of MVMH and East and West Potomac Parks that would mitigate the insertion of contemporary features within the cultural landscapes.

12.5.2. Action Alternative A (Preferred Alternative)

To date, FRA and DDOT adopted the following measures for Action Alternative A in order to minimize and mitigate anticipated impacts:

- The new railroad bridge would be designed with a vertical clearance, structural system, and alignment that closely references that of the existing Long Bridge as well as of the adjacent 14th Street Bridge Complex. This design approach minimizes potential adverse visual impacts that could have been caused by a different type of structure, including a signature span bridge, by reducing the visual impact of a new structure.
- Aspects of the Project introducing new structures and elements in historic districts would go through design review consultation with DC SHPO, VDHR, NCPC, CFA, and NPS as engineering and designs are progressed, including final engineering and design documents. Design review could address, but would not be limited to, the following unresolved design elements: a) new railroad bridge design and engineering, including structure type, vertical clearance, visual appearance of the structural system, and alignment; b) aesthetic treatment of new component bridges or other structures introduced into NPS-administered properties; c) landscape design within the limits of disturbance of the Project; d) any additional signage or lighting necessitated by the Project; e) design of the bike-pedestrian crossing and any associated access ramps and trail connections; and f) construction staging and access procedures.
- To the extent possible, impacts to the trees and other vegetation would be minimized by preserving extant trees and vegetation in situ. A Tree Protection Plan would ensure protection of trees and vegetation construction.
- To the extent possible, trees and other vegetation would be introduced to partially mitigate the loss of mature vegetation and to visually screen new bridge structures in coordination with the replanting of vegetation described in Section 2.0, Natural Ecological Systems and Endangered Species and Section 11.0, Aesthetics and Visual Resources. In addition, the loss of trees and other vegetation would be mitigated with reintroduction of equal caliper trees and vegetation in other areas of the historic districts, through the development of execution of a Tree Restoration Plan.

- An Interpretation Plan would mitigate the loss of views to and from the historic Long Bridge. This could include the installation of wayside signs on the history and development of the Long Bridge corridor or a web-based media interpretive element.
- A Viewshed Protection Plan would be developed and executed to ensure minimization and mitigation for potential interrupted or affected views throughout the Long Bridge corridor.
- Cultural Landscape Inventories of MVMH and East and West Potomac Parks would mitigate the insertion of contemporary features within the cultural landscapes.
- Temporary impacts resulting from noise and vibration would be avoided or minimized using a variety of construction management techniques as detailed in **Section 10.0, Noise and Vibration**. Visual impacts would be minimized by providing appropriate screening between construction staging areas and cultural resources, limiting the size of construction staging areas, and locating them away from sensitive views and viewsheds.

For construction access and staging activities, potential impacts on archaeological resources would be minimized or avoided by locating these activities away from areas of high archaeological potential or within sites that are paved or have been previously disturbed.

12.5.3. Action Alternative B

With the exception of the retention of Long Bridge and the railroad bridge above the GWMP, all other avoidance and minimization measures described in Action Alternative A would be similar to Action Alternative B. The greater degree of permanent and temporary impacts resulting from Action Alternative B, including the replacement of the two existing railroad bridges and the mature, contributing vegetation within the GWMP, MVMH, and East and West Potomac Parks historic districts, would require additional mitigation measures.

13.0 Recreation and Parks

13.1. Introduction

This section defines the recreation areas and parks pertinent to the Long Bridge Project (the Project), and provides the regulatory context, methodology, and baseline for assessing impacts of the Action Alternatives and No Action Alternatives. For each Alternative and the No Action Alternative, this section describes the potential short-term and long-term impacts on recreation and parks. Proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project are also provided.

13.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluating impacts to recreation areas and parks, and summarizes the methodology used to evaluate current conditions and the probable consequences of the alternatives. This section also includes a description of the Study Area. The complete list of laws, regulations, and other guidance considered, and a full description of the methodology followed for analysis of these resources are available in the *Methodology Report*.

13.2.1. Regulatory Context

The National Environmental Policy Act of 1969 (NEPA) and the Federal Railroad Administration (FRA) *Procedures for Considering Environmental Impacts* require consideration of the potential effects of Federal actions on recreation areas and parks.[1] This evaluation of recreation areas and parks includes public parks, trails, paths, and areas open to the public and used for general recreation. **Chapter 24, Section 4(f) Evaluation**, provides a separate evaluation of parklands and related resources protected under Section 4(f) of the United States Department of Transportation Act of 1966, as amended.[2] There are no properties in the Local Study Area acquired or developed under Section 6(f) of the Land and Water Conservation Fund Act of 1965; therefore, a Section 6(f) Evaluation is not required.[3, 4]

Within the Local Study Area, most of the parkland is under the jurisdiction of the National Park Service (NPS). Activities on NPS property are governed by *NPS Management Policies 2006*,[5] NPS regulations,[6] and *NPS Director's Order 12, Conservation Planning, Environmental Impact Analysis, and Decision Making*.[7]

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[1] 64 FR 28545
[2] 49 USC 303
[3] 16 USC 4601-4
[4] The Land and Water Conservation Fund Act of 1965 (16 USC 460 I-4) was enacted to preserve, develop, and assure accessibility to outdoor recreation resources. Section 6(f) provides funds for authorizing federal assistance to states in planning, acquisition, and development of land and water areas and facilities; and provides funds for the federal acquisition and development of certain lands and other areas. Any project that proposes to convert property that was purchased or improved through 6(f) funding must receive approval from the National Park Service.
[5] NPS. *NPS Management Policies 2006.* Accessed from https://www.nps.gov/policy/MP_2006.pdf. Accessed June 21, 2018.
[6] 36 CFR 1-199
[7] NPS Director's Order 12

13.2.2. Methodology

As shown in **Figure 13-1**, the Local Study Area for recreation areas and parks includes the footprint of the Project Area and those immediately adjacent to the Project Area within approximately 0.25 miles of the existing bridge alignment. The Local Study Area includes all recreation areas and parks within a distance for which the Project may have potential direct or indirect effects. Because the Action Alternatives have the potential to create localized effects but not regional effects to parks, the analysis did not consider a Regional Study Area

For parklands located within the Study Area, the documentation of the Affected Environment included the name, location, ownership, and estimated total area (acres) within the Study Area. The intended purposes of the parkland (active or passive recreation) were also identified. The desktop analysis was supplemented by field observation to confirm typical park usage.

The Environmental Consequences analysis evaluated direct and indirect impacts to each recreation area and park by reviewing plans, maps, aerials and Geographic Information Systems (GIS) resources against the alternatives as well as cross referencing findings of other resources (such as water quality and noise), including:

- Whether all or a portion of the resource would overlap the with the permanent right-of-way;
- Whether impacts to a related resource (for example, water quality) would cause harm;
- Whether construction staging, or the permanent limits of the Project would require removal of trees or vegetation within the park or recreation area (street tree removal was not considered unless the street was specifically within a recreation area or park);
- Whether the alternatives would cause changes in public accessibility or connectivity;
- Whether the alternatives fragment any existing conservation lands or wildlife refuges; [8] and
- Whether the alternatives would cause noise and vibration impacts, changes in visual or aesthetic quality, or land cover conversion that would affect the use of the resource.

13.3. Permanent or Long-Term Effects

This section considers the direct and indirect impacts of the Action Alternatives and No Action Alternative, as described and illustrated in **Chapter 3, Alternatives**. This analysis identifies the potential impacts to the resource that are frequent, extend from the end of construction through the life of the Project, or cause a permanent change in the resource, and is consistent with the analysis framework and methodology established in **Chapter 4, Impact Analysis Framework**.

[8] Fragmentation occurs when a project isolates one area of conservation lands or wildlife refuges from other areas or breaks up an area into several smaller areas.

Figure 13-1 | Recreation Areas and Parks Within the Local Study Area

13.3.1. No Action Alternative

In the No Action Alternative, the Long Bridge Corridor would continue to operate with two tracks crossing the Potomac River. The No Action Alternative presumes that Long Bridge remains in service, with continued maintenance as necessary. The No Action Alternative also presumes that DRPT and VRE complete the other planned railroad projects that would expand capacity to four tracks on either side of the Long Bridge Corridor. These projects may have impacts to parks within the Local Study Area. Any park impacts related to these projects and any other large capital projects would be assessed within the context of each project.

13.3.2. Action Alternative A

Action Alternative A would have moderate permanent direct adverse impacts on parks and recreation areas, including vegetation resources. **Table 13-1** lists the parks that would be directly impacted by the Action Alternative A, the total acres of park land in the project area, the total acres of park land directly impacted by the alternative, and the percentage of park land in the project area that would be impacted by the alternative.

Table 13-1 | Acres of Recreation Areas and Parks in Action Alternative A Permanent Right-of-Way

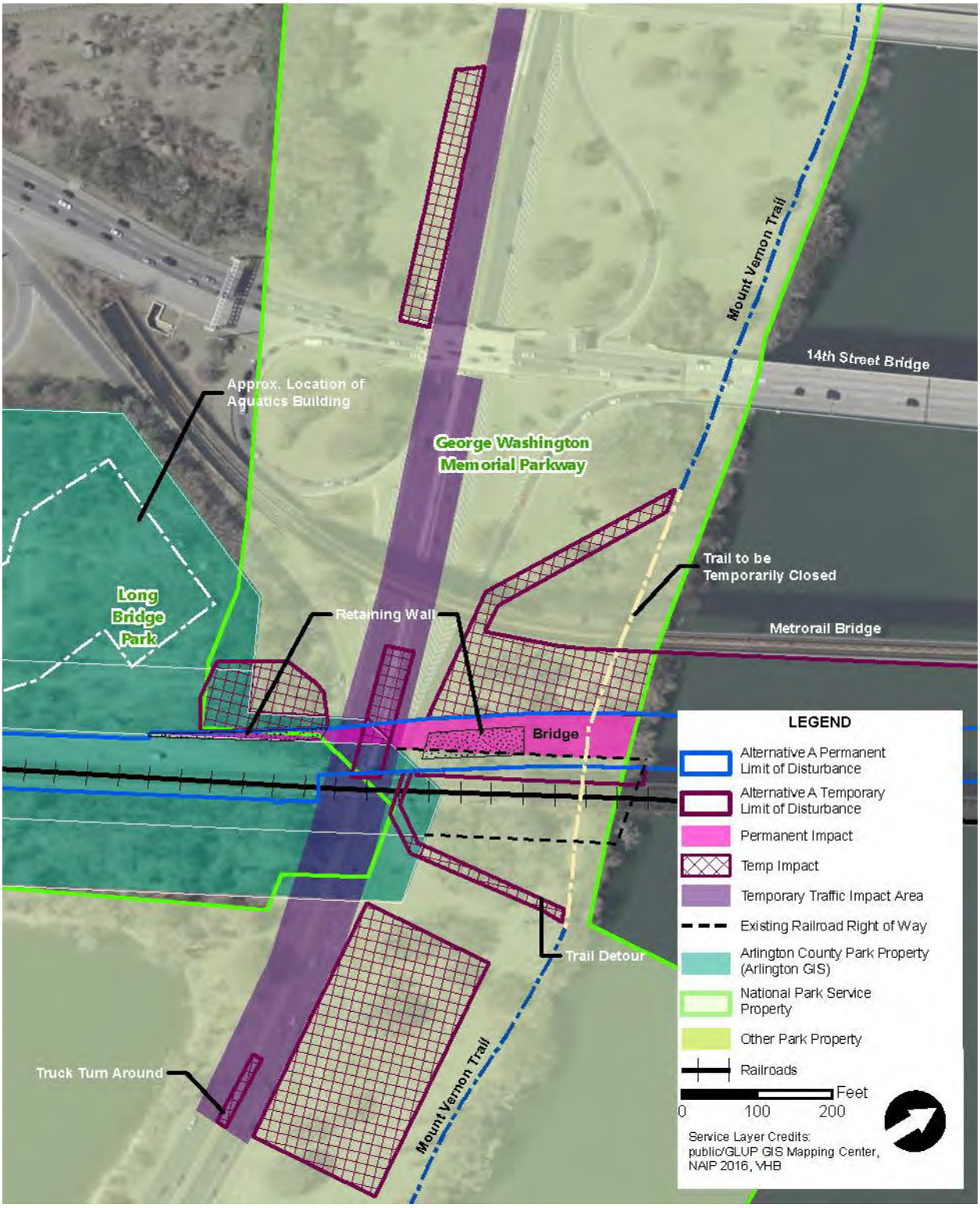
Name	Acres of Park in Local Study Area	Acres of Direct Permanent Impact	Percent Direct Permanent Impact
Long Bridge Park	30.0	0.04 or 0.14[1]	<1%
George Washington Memorial Parkway	7,146	0.4 or 0.5[1]	<1%
East Potomac Park	330	2.4	<1%

1. The range in impact areas for Long Bridge Park and the GWMP is due to the discrepancy in property records.

13.3.2.1. Physical Impacts to Park and Recreation Resources

Action Alternative A would have negligible permanent adverse direct impacts on 0.04 or 0.14 acres of land in Long Bridge Park for construction of the new railroad bridge. This area is located on the eastern end of the park, near the George Washington Memorial Parkway (GWMP; **Figure 13-2**). The railroad right-of-way would impact either approximately 0.04 or 0.14 acres of a wooded area that is currently unused by the public. The area of impact amounts to less than one percent of the total area of the park. This end of the park is currently is being developed for additional recreation facilities, including an aquatics center and a surrounding multi-use path. This portion of the park on the edge of the park property, near the new aquatics center and between the new path and the GWMP roadway, would be converted into railroad right-of-way. The piece of park property affected would be a vegetated area. Loss of this use would have a negligible impact on park users. Action Alternative A may require some minor reconfiguration of the multi-use path where it runs alongside the railroad right-of-way. In addition, Action Alternative A would build a new tie-in to RO interlocking as well as two new tracks within Long Bridge Park, from RO interlocking to the bridge; however, this construction would take place within the existing railroad right-of-way and there would be no impact to the park in this location.

Figure 13-2 | Impacts of Action Alternative A on Long Bridge Park and GWMP



Action Alternative A would have moderate permanent direct adverse impacts to the GWMP, impacting less than one percent of the total area of the park in an area currently dominated by transportation infrastructure (**Figure 13-2)**. The new railroad bridge would pass over the MVT and GWMP roadway and would permanently occupy a portion of the vegetated area between the trail and the roadway, occupying 0.4 or 0.5 acres of parkland on retained fill with 15-20-foot-high retaining walls. Construction of the new bridge would result in removal of approximately 70 trees, including three larger trees above 34-inches trunk diameter, resulting in a moderate impact. Approximately 50 trees, including the three larger trees above 34-inches trunk diameter, would be within the permanent limits of disturbance of the new railroad bridge and could not be replanted. Outside of the permanent limits of disturbance, replanted larger trees would take a long time to reach maturity and are therefore considered a permanent impact. Some of these trees date to the 1932 planting plan of the GWMP and were intended to visually screen the railroad bridge from the motorway **(see Section 12.0, Cultural Resources).**

Action Alternative A would have a minor direct impact to users of the MVT. Part of the GWMP, the MVT extends 18 miles through the region and is heavily used by bicyclists and pedestrians (**Figure 13-2**). The widened railroad corridor would cross the MVT. Views from the trail would be impacted by the addition of new overhead bridge structures and loss of vegetation surrounding the structures. For more information on visual impacts to park users, see **Section 11.0, Aesthetics and Visual Resources**.

Action Alternative A would have moderate permanent direct adverse impacts to the East Potomac Park, impacting less than one percent of the total area of the park in an area currently dominated by transportation infrastructure. Approximately 2.4 acres of NPS property to the west and east of the existing railroad corridor would be permanently impacted by the new railroad line (**Figures 13-3 and 13-4**). These impacts would include new structures to be built, such as retaining walls and a bridge over the WMATA tunnel portal. The impacts to East Potomac Park would include a permanent loss of 50 of the existing 67 parking spaces at the NPS Parking Lot C (of a total of 247 parking spaces in the three NPS surface parking areas at that location). This would impact visitors by reducing the number of available spaces, particularly in the spring, as this lot is used for visits to the monuments during the National Cherry Blossom Festival. Construction staging areas and widening of the embankment would require removal of approximately 170 trees, including eight larger trees above 34-inches trunk diameter and up to four Japanese cherry blossom plantings. The majority of the trees removed (150) would be small saplings under 12-inches trunk diameter that screen the railroad tracks. Approximately 160 trees, including two larger trees above 34-inches trunk diameter, would be within the permanent limits of disturbance of the new railroad infrastructure and could not be replanted. Outside of the permanent limits of disturbance, replanted larger trees would take a long time to reach maturity and are therefore considered a permanent impact.

Considering the direct impacts on public recreation lands, including vegetation resources, from new railroad structures as well as visual and noise impacts, Action Alternative A would have minor to moderate adverse impacts on recreation and park resources.

Figure 13-3 | Impacts of Action Alternative A on East Potomac Park

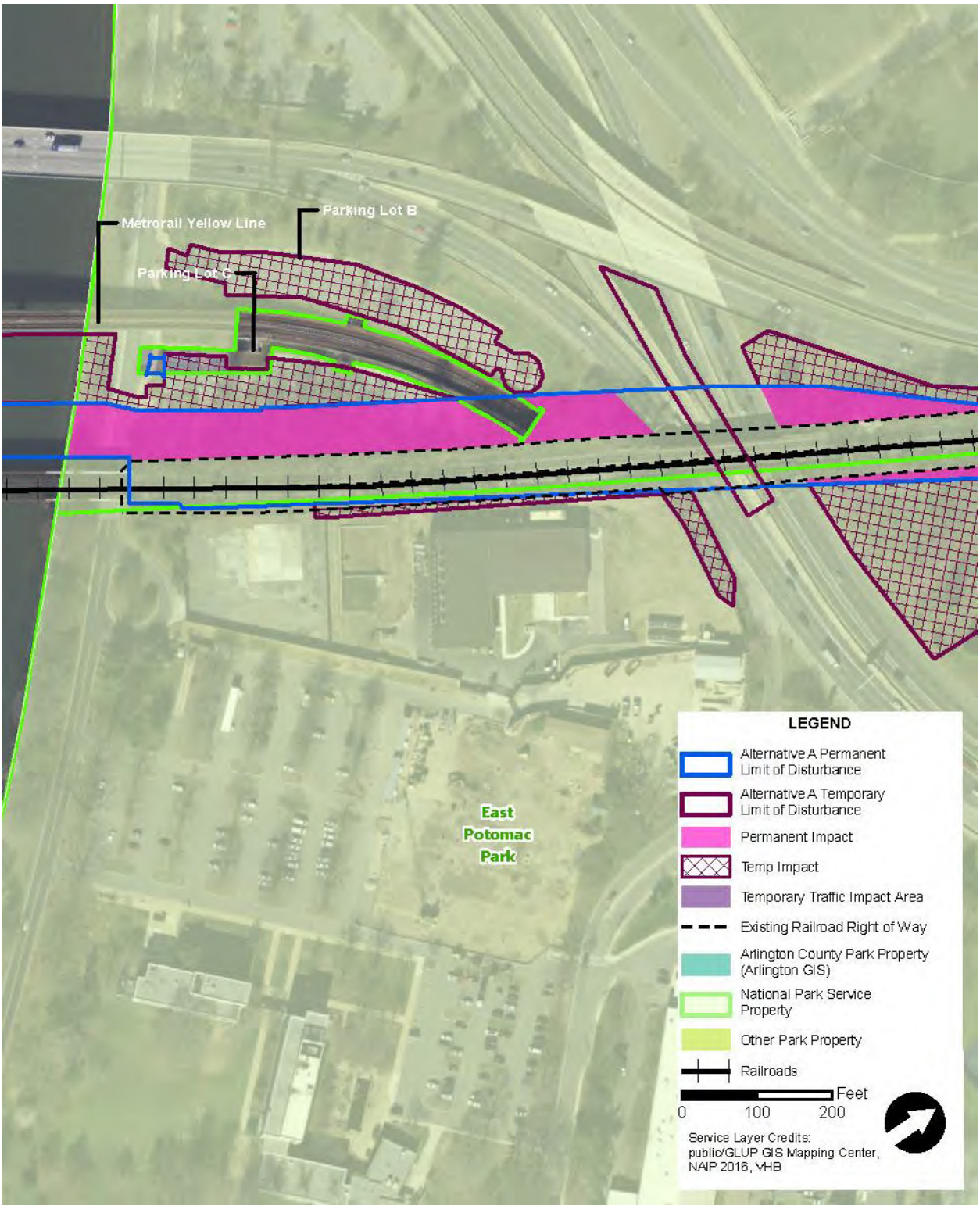
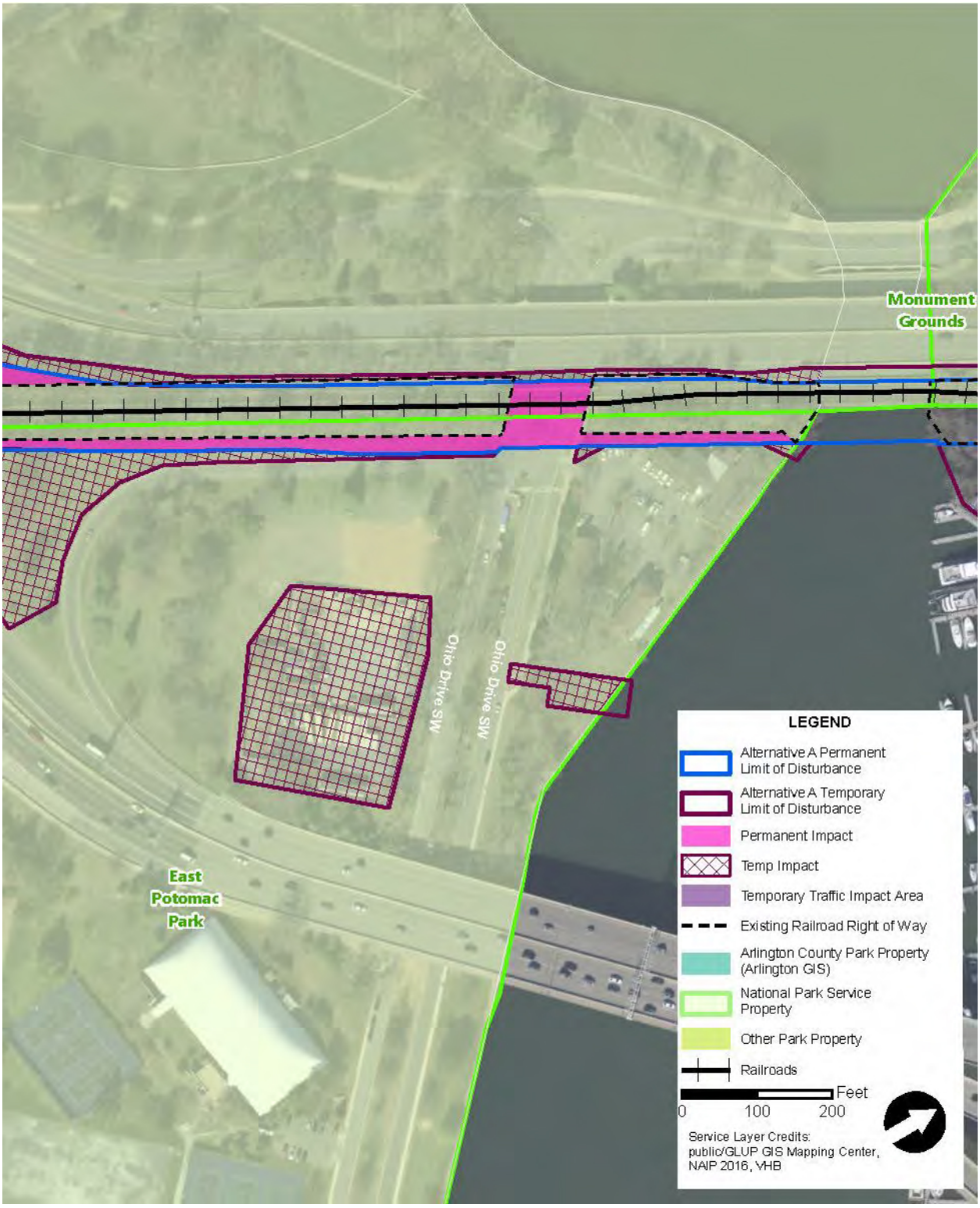


Figure 13-4 | Impacts of Action Alternative A on East Potomac Park



13.3.2.1. Visitor Use and Experience

Action Alternative A would have moderate to major indirect adverse impacts on visitors to Long Bridge Park due to noise, as the increased number of trains would increase the amount of noise experienced by park users. Action Alternative A would also have minor direct adverse impact on visitor use of the GWMP resulting from the conversion to railroad use, as this area is typically experienced by visitors passing through via motor vehicles, bicycles, and walking. Action Alternative A would also have minor to moderate permanent direct adverse visual impacts on GWMP visitor experience due to the increased number of bridges crossing the roadway and the removal of mature vegetation and trees as described above. The loss of 50 parking spaces at East Potomac Park would also have a minor permanent indirect adverse impact on visitor use by reducing the amount of available parking for users who drive to the park. The removal of mature trees screening East Potomac Park space from the railroad tracks could have a minor permanent direct adverse impact on park visitor experience by making the railroad corridor more visible.

Action Alternative A would also have moderate to major noise impacts on recreation and park resources. As discussed in **Section 10.0, Noise and Vibration**, Action Alternative A would have noise impacts on Long Bridge Park users, from increased train traffic and the introduction of new trackwork. Action Alternative A would increase noise levels by 6 to 9 decibels of equivalent continuous sound (dBA Leq) at Long Bridge Park due to new track turnouts and an increase in train operations. The area of Long Bridge Park that would receive the noise impacts would be along the railroad corridor, at a raised railroad viewing platform for visitors to watch trains. The recreation in this section of the park is passive.

Action Alternative A would have direct impacts on the visual and aesthetic value of some recreation and park resources in the Local Study Area. Action Alternative A would alter the visual character of the GWMP by changing the number and spacing of bridges as well as adding a bridge with a form that would contrast with the typical arched form of bridges elsewhere along the GWMP. In addition, Action Alternative A would have a direct visual impact on park resources by removing vegetation along the GWMP and in East Potomac Parkas described above. This would open views from within East Potomac Park of the Long Bridge Corridor where they were previously obscured. For further information see **Section 11.0, Aesthetics and Visual Resources**.

13.3.3. Action Alternative B

13.3.3.1. Physical Impacts to Park and Recreation Resources

The permanent limits of Action Alternative B would to be slightly larger in some park lands because new bridges would be constructed rather than retaining the existing structures, and the new bridge would require larger piers than the existing ones. This would result in an impact of 0.2 additional acres of East Potomac Park as compared to Action Alternative A. The additional impacts include one additional tree over 34-inches trunk diameter and 15 additional smaller trees removed in the GWMP green space, the removal of two to three additional Japanese cherry blossom plantings along Ohio Drive SW, one additional tree over 34-inches trunk diameter, and nine additional smaller trees removed from East Potomac Park. These differences in direct impacts on recreation and parks between the Action Alternatives are minimal; larger pier footprints than the existing piers would not have a noticeable impact on recreation use of park lands. Therefore, Action Alternative B would have moderate adverse impacts on recreation and park resources.

13.3.3.2. Visitor Use and Experience

Action Alternative B would have similar impacts on visitor use and experience as Action Alternative A. There are no differences in noise impacts to parks as compared to Action Alternative A; there are some minimal differences in the visual impacts on parks from Action Alternative B due to the replacement bridge profile being raised compared to the existing bridge.

13.4. Temporary Effects

This section identifies the potential impacts to the resource that are intermittent, infrequent, or last only for the duration of the construction period.

13.4.1. No Action Alternative

The No Action Alternative could result in temporary impacts to parks related to the construction of other projects such as the addition of a fourth track from AF to RO Interlockings in Virginia, the addition of a fourth track from L'Enfant (LE) to Virginia (VA) Interlockings in the District, the VRE L'Enfant Station Improvements, and the Virginia Avenue Tunnel project. In Long Bridge Park, Arlington County is currently undertaking Phase II of the Long Bridge Park Development Plan. This project will include construction of the 120,420-square-foot Aquatics and Fitness Center as well as the development of another 10.5 acres of park land, including the extension of the Esplanade, rain gardens, public gathering areas, parking, and support spaces. However, the impacts related to the construction of these projects and any other large capital projects would be assessed within the context of each project.

13.4.2. Action Alternative A

13.4.2.1. Physical Impacts to Park and Recreation Resources

Action Alternative A would temporarily impact some recreation and park resources in the Local Study Area for the duration of the construction period. **Table 13-2** lists the parks that would be temporarily impacted in Action Alternative A, the total acres of park land in the Project Area, the total acres of park land temporarily impacted, and the percentage of park land in the Project Area that would be impacted.

Table 13-2 | Action Alternative A Acres of Temporary Impact on Recreation Areas and Parks

Name	Acres of Park in Local Study Area	Acres of Temporary Impact	Percent Temporary Impact
Long Bridge Park	30.0	02 or 0.4[1]	up to 1.3%
George Washington Memorial Parkway	7,146	2.8 or 3.2[1]	<1%
East Potomac Park	330	4.7	1.4%
Hancock Park	1.3	0.09	7%

1. The range in impact areas for Long Bridge Park and the GWMP is due to the discrepancy in property records.

Construction in the Long Bridge Park section of the Local Study Area would take approximately 4 years, 2 months. During that time, Action Alternative A would impact less than 0.4 acres of park resources. These

impacts would be located primarily in the northeastern area of Long Bridge Park. A construction staging area would be created in Long Bridge Park, next to the GWMP roadway. During this time, use of this part of the park would be limited or completely unavailable to the public; use is currently passive to nonexistent in this section of the park. This area of the park is planned to be primarily green space (a meadow and wooded are) but does not include a loop trail that may need to be temporarily relocated during construction.

Constructing the new railroad bridge would also temporarily impact the GWMP over a period of approximately 3 years, 4 months, including roadway operations as well as park property. Construction would temporarily impact approximately 3.4 or 3.8 acres of GWMP lands. These impacts on the parkway would include traffic control measures, temporary lane closures, temporary lane shifts, and limited use of the parkway for construction vehicles. Impacts would also include laydown and staging areas next to both the northbound and southbound sides of the GWMP, as well as truck turnaround areas in the median. Construction at the GWMP would take place primarily at night.

Action Alternative A would have moderate direct impacts on East Potomac Park for approximately 4 years and 9 months during construction of the railroad bridge over the Potomac River. As shown in **Figures 13-3** and **13-4**, construction areas would use approximately 4.6 acres, or six percent of park land. Construction areas would use NPS Parking Lots B and C, as well as the green space between I-395 and the railroad corridor, one ballfield along Ohio Drive SW, and an area between Ohio Drive SW and the Washington Channel.

13.4.2.2. Visitor Use and Experience

Action Alternative A would have minor temporary direct adverse impacts to visitor use and experience of Long Bridge Park due to construction. The construction area at the northeastern end of the park may affect use of the planned loop trail. In addition, construction noise levels would exceed the Arlington County nighttime noise limit at Long Bridge Park (see **Section 10, Noise and Vibration**), causing a moderate direct adverse noise impact to user experience. Long Bridge Park is open until 11:00 PM.

Action Alternative A would temporarily impact visitors to the GWMP greenspace, including the MVT. This alternative would involve a temporary relocation of a portion of the MVT for public safety and to allow construction access and staging along the water. Users of the MVT would experience a different trail route, away from the river and towards the GWMP roadway; the trail would be temporarily relocated from its current path south along the GWMP. Less than 0.25 miles of the trail would be rerouted for approximately 2 years. In addition, construction noise levels would exceed the Arlington County nighttime noise limit at the MVT, which is in a special-purpose zone (see **Section 10.0, Noise and Vibration**), causing a moderate indirect adverse impact.

Action Alternative A would have moderate direct temporary impacts on visitor use and experience of East Potomac Park during construction. The majority of activities within East Potomac Park (golf course, biking, running, and walking, as well as picnics) take place south of Buckeye Drive SW, away from the construction areas. The tennis center is north of Buckeye Drive SW, but not proximate to the construction activities. Visitor access to the park would be maintained. During construction, the public would not be able to use NPS Parking Lots B and C, which would affect access to the park for visitors who drive and park. Parking Lots B and C would be completely closed to the public for staging for the railroad bridge construction and a temporary concrete plant (NPS Parking Lot B). This would impact park

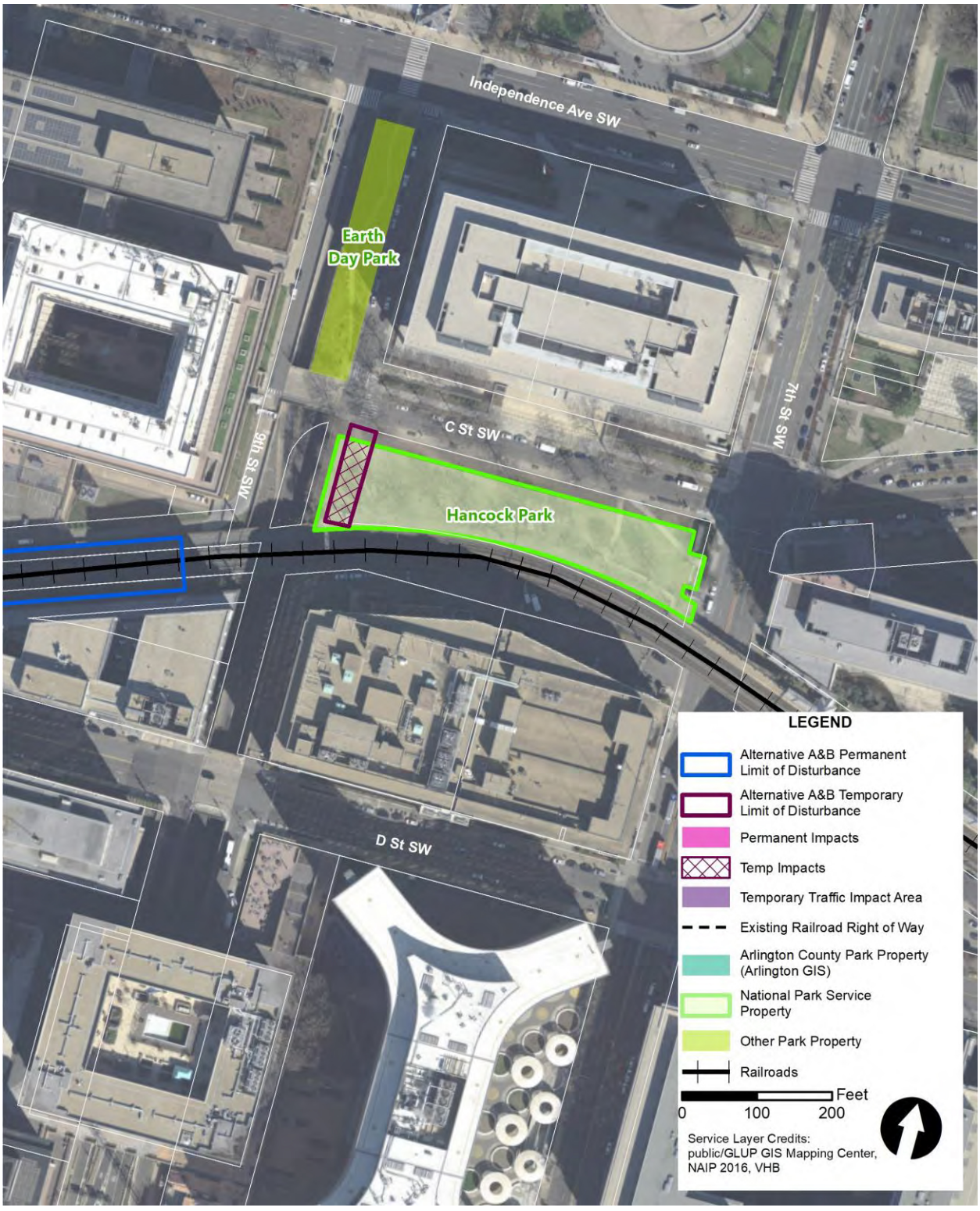
visitors, as the surface parking areas provide access to the Tidal Basin and Jefferson Memorial, and are heavily used in early spring during the National Cherry Blossom Festival. Park visitors would likely need to use NPS Parking Lot A during construction, which contains approximately 100 spaces. In addition to the impact on the use of the NPS parking lots, impacts on East Potomac Park would include creating temporary access and staging areas along the existing embankment along the I-395 South exit ramp and along Ohio Drive SW near the NPS-NAMA Headquarters. The staging area along Ohio Drive SW near the NPS-NAMA Headquarters would make use of an existing ballfield, which would not be available to park users during this time. The total acreage of this temporary impact in East Potomac Parks is 4.5 acres (**Figures 13-3** and **13-4**). However, there are multiple additional ballfields available nearby in West Potomac Park. Construction noise levels would exceed the District daytime limit at the National Park Service National Mall and Memorial Parks Headquarters (see **Section 10.0, Noise and Vibration**), causing a moderate indirect adverse impact for nearby park users and construction staging and equipment would be visible to park users traveling to and from the park, adversely affecting user experience. Visitor access to NPS-NAMA Headquarters would be maintained.

Action Alternative A would also impact approximately 0.09 acres of Hancock Park for 36 months. Hancock Park is in the northeastern part of the Project Area, near L'Enfant Plaza, in between the railroad corridor and the Federal Aviation Administration building (**Figure 13-5**). The western end of the park would be needed for staging railroad materials, equipment, and crews adjacent to the railroad corridor. This would impact park users by temporarily closing this section of the park to public use during the construction period. This section of the park currently provides access to the railroad right-of-way and is less heavily used than the eastern end of the park. While noticeable, construction impacts would not affect the function or integrity of the park.

13.4.3. Action Alternative B

Action Alternative B would temporarily impact some recreation and park resources in the Local Study Area for the duration of the construction period. Action Alternative B would include the same activities as Action Alternative A, with the addition of replacing the existing bridge over the GWMP and the existing Long Bridge. The temporary impacts of Action Alternative B, therefore, would be similar to Action Alternative A, with some exceptions. As the existing structures at both the GWMP and Long Bridge would require demolition to accommodate the new structures, Action Alternative B would add a construction staging area to access the Potomac River for demolition and replacement of the existing bridge. This would cause a minor increase in temporary impacts on the GWMP in Action Alternative B. In addition, the duration of temporary impacts from Action Alternative B would be longer than in Action Alternative A, due to the work required to demolish and remove the new bridge. The increased duration of construction impacts along the GWMP and MVT, and within East Potomac Park, would result in major adverse impacts. Construction impacts would last approximately 2 years, 6 months longer at Long Bridge Park, 3 years, 2 months longer along the GWMP, and 3 years, 4 months longer at East Potomac Park.

Figure 13-5 | Temporary Impacts of Action Alternative A on Hancock Park



13.5. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the resources based on the results of the impact assessment.

13.5.1. Action Alternative A

During the development of plans for construction, the Federal Railroad Administration and the District Department of Transportation met with NPS to discuss potential impacts to recreation areas and parks. DDOT also met with Arlington County to discuss impacts. Where practicable, construction-related impacts to Long Bridge Park, the GWMP, and East Potomac Park have been avoided through identification of staging areas and access routes that do not use park property.

Potential measures that would be employed to avoid, minimize, or mitigate the adverse impacts of the Action Alternative A on recreation and parks include:

- Minimizing impacts to trees and vegetated areas prior to construction through tree protection measures and preventing or limiting equipment access to adjacent forested areas through protective fencing.
- Mitigating loss of vegetation following construction to the extent practicable by restoring land and planting native woody shrubs and trees on NPS property within the GWMP and Long Bridge Park in coordination with Arlington County. Tree species may include various oaks (Quercus spp.), American sycamore (Platanus occidentalis), and tulip poplar (Liriodendron tulipifera). Maintain trees and vegetation for 3-5 years following planting.
- Restoring impacted ballfields following construction, and compensating NPS for revenue lost during construction.
- Coordinating with park owners, including Arlington County and NPS, regarding traffic control strategies to minimize traffic disruptions and maintain vehicular, pedestrian, and bicycle mobility on roadways in and around the Study Area.
- Maintaining visitor use of parkland and trails near the Project Area to the extent practicable during construction.
- Constructing a new bike-pedestrian bridge connecting Long Bridge Park, the George Washington Memorial Parkway, and East Potomac Park. The new connection would mitigate adverse impacts to the parks.
- Developing a construction access and staging plan pertinent to park property. Eliminating the 1.6-acre staging area in the center of Long Bridge Park; reducing the size of the GWMP staging area next to I-395 from 2.6 acres to approximately 1.2 acres; eliminating the use of the MVT for truck access; using a large floating barge near the shoreline of the East Potomac Park rather than the construction of a temporary pier; eliminating the staging area next to Ohio Drive SW near the Potomac River shoreline in East Potomac Park; relocating another staging area at East Potomac Park to an existing equipment storage yard rather than occupying an adjacent grassy open space; and reducing the size of the construction access area at Hancock Park.

Additional avoidance, minimization, and mitigation measures that would be employed to reduce the adverse impacts of the Action Alternatives on recreation and parks are discussed in **Section 2.0, Natural Ecological Systems, Section 9.0, Land Use and Property, Section 10.0, Noise and Vibration**, **Section 11.0, Aesthetics and Visual Resources**, **and Section 12.0, Cultural Resources**.

13.5.2. Action Alternative B

Potential measures that would be employed to avoid, minimize or mitigate the adverse impacts of Action Alternative B on recreation and parks are the same as those in Action Alternative A, as the two Action Alternatives have similar impacts.

14.0 Social and Economic Resources

14.1. Introduction

This chapter defines the social and economic resources pertinent to the Long Bridge Project (the Project), and provides the regulatory context, methodology, and baseline for the Affected Environment. For each Action Alternative and the No Action Alternative, this chapter also describes the potential short-term and long-term impacts on social and economic resources. This section also discusses proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project.

This chapter describes the social and economic resources related to demographics, jobs, current economic conditions, taxes, revenue, community facilities, local government services, and commercial activity. The social and economic impact assessment considered the Project's potential to impact the socioeconomic environment, including community disruption or cohesion, demographic shifts, impacts to existing commerce and new commercial activity, job creation, and tax revenues.

14.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluation of impacts to social and economic resources, and summarizes the methodology used to evaluate current conditions and the probable consequences of the alternatives. This section also includes a description of the Study Area. The complete list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

14.2.1. Regulatory Context

The Federal Railroad Administration *Procedures for Considering Environmental Impacts* require that the evaluation of impacts consider "impacts on the socioeconomic environment, including the number and kind of available jobs, the potential for community disruption and demographic shifts, the need for and availability of relocation housing, impacts on commerce, including existing business districts, metropolitan areas, and the immediate area of the alternative, and impacts on local government services and revenues."[1] Socioeconomic resources are also addressed in the District Department of Transportation *Environmental Manual*.[2]

14.2.2. Methodology

The Local Study Area includes the Project Area as well as 0.5 miles immediately adjacent to the Project Area. The U.S. 2010 Census block groups are the smallest geographic unit for which all the demographic data collected for this analysis are available; therefore, some analyses that rely on Census information capture data that extends beyond the Local Study Area. The Local Study Area can be divided into District and Arlington County block groups to capture any unique conditions between the two jurisdictions.

[1] 64 FR 28550

[2] District Department of Transportation. 2012. Environmental Manual, 2nd Edition. Chapter 24: Environmental Justice. Accessed from http://ddotsites.com/documents/environment/Files/Chapters/Chapter_25_-_Socioeconomic_Resources.pdf. Accessed August 2, 2018.

Figure 14-1 identifies the geographic boundary of the Local Study Area. A Regional Study Area was not designated for social impacts because these direct and indirect impacts of the Project are not expected to extend beyond the Local Study Area because social impacts typically relate to the potential for local community disruption or demographic shifts.

Two Regional Study Area was used for economic impacts, a Regional Study Area for Taxes, Public Revenue, and Local Government Services, and a Regional Study Area for Construction Employment. Given that tax receipts are measured on a City-wide basis in the District and a County-wide basis in Arlington, Virginia, the analysis of taxes and public revenue used the entirety of the District and Arlington County. Construction employment benefits are typically felt regionally; therefore, the analysis included the following jurisdictions in the Washington Metropolitan Area: the District; Frederick, Montgomery, Calvert, Charles, and Prince George's Counties in Maryland; Arlington, Clarke, Culpeper, Fairfax, Fauquier, Loudoun, Prince William, Rappahannock, Spotsylvania, Stafford, and Warren Counties, and Alexandria City, Fairfax City, Falls Church City, Fredericksburg City, Manassas City, and Manassas Park City in Virginia; and Jefferson County in West Virginia. The analysis estimated construction employment using IMPLAN, an economic impact assessment modeling system.

The impact analysis evaluated both the No Action and the Action Alternatives to determine whether the respective alternatives would result in direct and indirect, permanent and temporary impacts to each social and economic resource. The analysis included an evaluation of the potential for community disruption resulting from the Project and impacts on livability in the Local Study Area. In identifying potential impacts to communities, the communities and demographics analysis drew from the results of the analyses for air quality (**Section 7.0, Air Quality and Greenhouse Gas Emissions**), noise and vibration (**Section 10.0, Noise and Vibration**), visual impacts (**Section 11.0, Aesthetics and Visual Resources**), and traffic (**Section 6.0, Transportation and Navigation**). The analysis also determined potential physical impacts in the Local Study Area by comparing the proposed limits of disturbance and limits of construction to mapped community facilities.

The assessment of temporary impacts during the construction phase identified the limits of construction staging and likely phasing scenarios. Social and economic impacts during the construction phase were evaluated based on the following indicators: job creation, direct and indirect construction spending, potential disruptions to commercial activity, and potential disruptions to community cohesion and continuity. The analysis used IMPLAN software to estimate construction jobs and construction impacts.

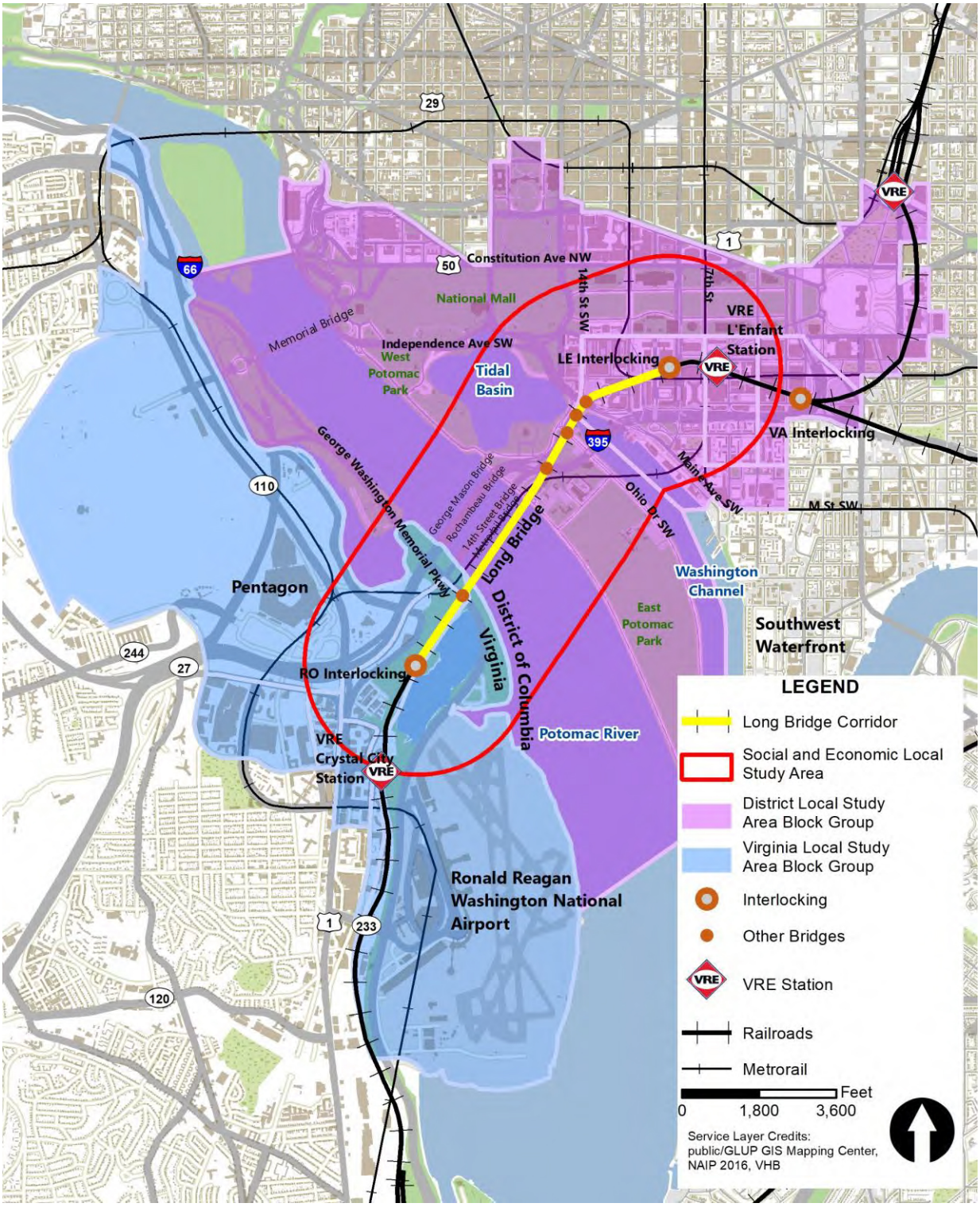
14.3. Permanent or Long-Term Effects

This section identifies the potential impacts to the socioeconomic environment that are frequent, extend from the end of construction through the life of the Project or cause a permanent change in the social or economic conditions.

14.3.1. Social

This section discusses potential permanent direct and indirect impacts to demographics, community facilities and local government services, property acquisition and displacement, and potential community disruption.

Figure 14-1 | Local Study Area for Social and Economic Resources



14.3.1.1. No Action Alternative

The No Action Alternative includes transportation projects in the Local Study Area that are likely to be implemented by 2040 including several railroad projects, and as described in **Section 1.4.1, No Action Alternative**. Some of these projects, including improvements to the Virginia Railway Express (VRE) L'Enfant Station would improve community cohesion by making public transportation easier to access and more efficient. The Boundary Channel Drive Interchange Project would also enhance community cohesion by improving safety and accommodating various modes of transportation including pedestrian and bicycle facilities. These projects would have a positive impact on community cohesion and community livability. Adverse social impacts are not anticipated due to these projects.

14.3.1.2. Action Alternative A

Demographics

Action Alternative A would have no direct or indirect impacts to demographics, including age, sex, race, and median income, in the Local Study Area because there would be no changes in population due to the Project. The Project would not induce development or create displacement.

Community Facilities and Local Government Services

While Action Alternative A would require the acquisition or transfer of lands with Long Bridge Park, the GWMP, and East Potomac Park, the acquisition or transfer of these lands is not expected to constitute a direct impact to social resources because the use of the parks would not change or be majorly impacted (see **Section 13.0, Recreation and Parks,** for further discussion). The Preferred Alternative would not affect other identified community facilities including schools, libraries, community centers, places of worship, emergency service centers, and childcare centers located within the Local Study Area.

Action Alternative A would not result in impacts to local government services because these services would not be impeded by the Project, nor would the Project create additional demand for services.

Property Acquisition and Displacement

Action Alternative A would not result in the displacement of residences or businesses, as described in **Section 9.0, Land Use and Property**.

Action Alternative A would require acquisition of between 0.14 and 0.35 acres of land in Long Bridge Park in Virginia for maintenance of the proposed right-of-way. The acquisition would not affect activities within the park. Also, approximately 3.59 acres of land in East Potomac Park in the District would need to be transferred. The acquisition or transfer of these lands is not expected to constitute a direct impact to social resources because the use of the parks would not change or be majorly impacted. See **Section 9.0, Land Use and Property**, for additional details regarding property acquisition.

Community Disruption

Action Alternative A would not directly or indirectly result in community disruption or adversely affect community cohesion. Community disruption is the combined effect of physical impacts on the local community including barriers to community cohesion and impacts to livability in the Local Study Area.

The resources considered for potential community disruption include air quality, noise and vibration, visual impacts, economic impacts, and traffic.

Permanent adverse impacts to the roadway network, traffic, or the bicycle and pedestrian network are not anticipated, nor are impacts expected due to vibration; therefore, these resources would not contribute to direct or indirect adverse impacts to communities. Action Alternative A would have permanent minor adverse direct effects to local and regional air quality, but these effects are not expected to adversely impact communities, either directly or indirectly, see **Section 7.0, Air Quality and Greenhouse Gases**. Action Alternative A would have indirect beneficial effects on social resources in the Local Study Area by enabling the expansion of train service to the local communities. For example, as stated in **Section 6.0, Transportation and Navigation**, it is assumed that Maryland Area Regional Commuter (MARC) would operate through service to Virginia with the additional capacity provided by Action Alternative A.

Action Alternative A would result in adverse impacts to the noise and the visual environment and a loss of parking in the Local Study Area. These impacts would affect a few specific locations but would not directly or indirectly affect livability or diminish overall quality of life in the existing communities in the Local Study Area. These impacts would not result in overall community disruption and they would not lessen community cohesion because they would not render buildings or community facilities unusable or uninhabitable. For additional information regarding adverse impacts to noise and visual conditions, see **Section 10.0, Noise and Vibration**, and **Section 11.0, Aesthetics and Visual Resources**.

14.3.1.3. Action Alternative B

Impacts to social resources due to Action Alternative B would be the same as impacts due to Action Alternative A.

14.3.2. Economic

This section discusses potential permanent direct and indirect impacts to jobs, the regional economy, tax/public revenue, and commercial activity.

14.3.2.1. No Action Alternative

The No Action Alternative would not cause any direct or indirect impacts to commercial activity in the Local Study Area. It would not cause direct or indirect impact to taxes or public revenues. Positive impacts from indirect job growth may occur.

In the No Action Alternative, train operators would increase train volumes in the Long Bridge Corridor from 76 trains per day to 112 trains per day. Additional trains would contribute to increased passenger trips, multimodal connectivity and freight activity in the region. The Long Bridge Corridor has insufficient capacity to effectively support the expected increase in train volume, which could lead to economic losses to the region due to the delayed movement of passengers and goods. The No Action Alternative would also not support the desired service levels for intercity passenger and commuter rail services. The No Action Alternative would not generate any new direct jobs, though indirect jobs may be created due to the increased train volume.

14.3.2.2. Action Alternative A

Jobs

Action Alternative A would have a negligible permanent indirect beneficial impact on employment in the region through indirect job creation.

No direct permanent jobs would be created by Action Alternative A. Once complete, Action Alternative A would result in greater capacity, enabling railroad operators (Amtrak, VRE, and MARC) to run additional trains between Virginia and the District. As described in **Section 6.0, Transportation and Navigation**, greater capacity would allow a 71 percent increase in passenger train volumes compared to the No Action Alternative. It is assumed that Action Alternative A would indirectly result in job creation by enabling expansion of railroad service, requiring railroad operators to hire more employees. Also, improved commuting would expand the labor pool for the economic centers located in the Local Study Area and would provide more access to employment opportunities for those who live in the Local Study Area.

Regional Economy

Action Alternative A would not directly impact the regional economy. Action Alternative A, however, would enable the expansion of railroad service, which would result in negligible indirect beneficial effects to the regional economy. The expanded railroad capacity would allow for more efficient movement of passengers, commuters and goods between Virginia and the District. With the additional capacity, it is also anticipated that MARC would operate through service to Virginia, allowing more efficient access from Maryland to employment centers and tourist destinations in Arlington and the District. The Project is anticipated to enable expanded economic activity and tourism within the Regional Study Area, generating a positive market response to the increased capacity.

Tax/Public Revenue

Action Alternative A would not directly impact taxes or public revenue in Virginia or the District because railroad infrastructure itself does not generate or impact tax or public revenue. Action Alternative A would be anticipated to have a moderate permanent indirect beneficial impact on tax revenue due to the increased economic activity described above. As noted in the Northern Virginia Transportation Commission's September 2017 report, *The Value of Metrorail and Virginia Railway Express to the Commonwealth of Virginia*, the presence of Metrorail and VRE currently supports an additional 85,000 households and 130,500 jobs in Northern Virginia, resulting in more than $600 million annually in sales and income tax revenue.[3]

Commercial Activity

Action Alternative A would result in moderate adverse direct impacts to Washington Marina and minor adverse direct impacts to the National Park Service (NPS) due to the loss of parking spaces. Impacts are assessed based on whether the loss of parking would be anticipated to financially affect the business or

[3] Northern Virginia Transportation Commission, *The Value of Metrorail and Virginia Railway Express to the Commonwealth of Virginia*. September 2017. Accessed from http://www.novatransit.org/uploads/studiesarchive/2017%20Economic%20Value%20of%20Transit.pdf. Accessed August 16, 2019.

entity. Action Alternative A would also indirectly benefit commercial activity in the region through increased ability to efficiently and reliably move commercial goods and commuters throughout the Regional Study Area. No other impacts to commercial activity in the Local Study Area are anticipated. While the Mandarin Oriental Hotel and Portals V development would experience noise impacts, these businesses were constructed long after the railroad bridge was built and have always experienced train noise. Operations of these businesses are not expected to be impacted by noise due to Alternative A.

Washington Marina, located adjacent to the existing tracks and Maine Avenue SW, would permanently lose approximately 20 parking spaces out of 88 existing spaces. The exact number of spaces to be removed, and the exact impacts to Washington Marina, would be determined as final design advances and through further coordination with Washington Marina. The loss of parking spaces would constitute a moderate direct adverse impact on Washington Marina without mitigation measures. It is anticipated that with mitigation measures, including reconfiguration of the existing surface parking area after the replacement pedestrian bridge is constructed, the net loss of parking spaces would be negligible.

NPS Parking Lot C, located in East Potomac Park, would permanently lose approximately 50 of the existing 247 metered parking spaces in NPS Parking Lots A, B, and C, which are close to each other. The exact number of spaces removed, and exact impact due to loss of revenue, would be determined as final design advances and through further coordination with NPS. It is anticipated that the loss of parking spaces would result in a minor adverse direct impact to NPS due to loss of revenue associated with loss of metered parking spaces, with or without mitigation measures. Mitigation would include reconfiguration of the surface parking area after construction to maximize the number of metered spaces. The surface parking area is currently lightly used, except during special events such as the annual blooming of the Japanese cherry blossom plantings; therefore, loss of parking is not anticipated to affect normal operations of the park. Minor adverse impact is anticipated because NPS would lose some revenue from loss of metered spaces during peak usage. NPS parking lots in East Potomac Park became metered in 2017; parking in these areas was free prior to 2017. Parking Lots B and C combined contain 143 parking spaces that raise approximately $30,000 annually in revenue. Therefore, the permanent loss of 50 parking spaces would correlate to a loss of $10,490 in revenue per year, if parking could not be accommodated in other NPS parking lots.

14.3.2.3. Action Alternative B

Impacts to economic resources due to Action Alternative B would be the same as impacts due to Action Alternative A.

14.4. Temporary Effects

14.4.1. Social

14.4.1.1. No Action Alternative

Construction of the No Action Alternative projects could have temporary adverse impacts to the transportation network, noise conditions, visual resources, and air quality in the Local Study Area, as described in **Section 6.0, Transportation and Navigation; Section 7.0, Air Quality and Greenhouse Gases; Section 10.0, Noise and Vibration; and Section 11.0 Aesthetics and Visual Resources**. These

impacts could result in adverse direct impact to communities in the Local Study Area but would be temporary and would cease upon project completion.

14.4.1.2. Action Alternative A

Action Alternative A would not result in temporary direct or indirect impacts to community demographics, community facilities, or local government services. No temporary displacement or property acquisition of residences, businesses or community facilities, other than parks would occur. Moderate temporary direct adverse impacts, due to construction to GWMP and East Potomac Park are described in **Section 9.0, Land Use and Property and Section 13.0, Recreation and Parks**. Use of the parks for construction would not constitute a direct impact to community facilities because the community would still have access to the full range of recreational opportunities within the parks.

Community disruption refers to a population's ability to navigate their way around their community. Temporary moderate adverse impacts due to community disruption would occur at varying locations and for varying durations during the construction period. Community disruption would be due to temporary impacts to traffic and pedestrian and bicycle facilities during construction. These impacts are further described in **Section 6.0, Transportation and Navigation**. These impacts would disrupt community cohesion and wayfinding by creating longer travel times and rerouting travel patterns. These effects, however, would be temporary , and would cease upon project completion. Most impacts would not last the full duration of the 5-year construction period because construction locations would shift.

14.4.1.3. Action Alternative B

Despite the longer overall construction duration of Action Alternative B (up to 99 months versus up to 60 months in Action Alternative A), the construction duration would be similar at the locations with greater impacts to community disruption; therefore, Action Alternative B has similar temporary impacts as Action Alternative A.

14.4.2. Economic

14.4.2.1. No Action Alternative

Construction jobs and regional benefits associated with construction could have a temporary beneficial direct impact due to construction of the transportation projects included in the No Action Alternative. These impacts would be beneficial because these projects would support employment and business spending in the construction industry. The benefits would be commensurate with construction costs. Any adverse impacts to economic conditions due to construction are likely to be temporary.

14.4.2.2. Action Alternative A

Jobs and Regional Economy

Action Alternative A would cause minor temporary direct and indirect beneficial impacts to employment and the regional economy. Construction jobs and regional benefits associated with construction would occur for the estimated 5-year construction period. Construction employment benefits are typically felt regionally, especially in a metropolitan area where construction workers often live outside of the city and construction materials and business-to-business transactions also may take place outside of the city.

Further, significant infrastructure projects, such as this Project, require specialized labor and equipment which would require a regional approach. The analysis of construction employment benefits used IMPLAN, a regional input-output model software system, and includes the following jurisdictions in the Washington metro area: the District; Frederick, Montgomery, Calvert, Charles, and Prince George's Counties in Maryland; Arlington, Clarke, Culpeper, Fairfax, Fauquier, Loudoun, Prince William, Rappahannock, Spotsylvania, Stafford, and Warren Counties, and Alexandria City, Fairfax City, Falls Church City, Fredericksburg City, Manassas City, and Manassas Park City in Virginia; and Jefferson County in West Virginia.[4]

The projection of construction employment, wages, and economic output is based on estimated construction costs, including both hard and soft construction costs. Action Alternative A is estimated to cost approximately $1.9 billion (in 2019 dollars) over a construction period of 5 years.

Jobs are defined as full- and part-time annual average jobs for both employees and self-employed workers, including seasonal workers. Construction jobs shown in **Table 14-1** are estimated annually and categorized as direct jobs (the number of construction jobs), indirect jobs (jobs supported by business-to-business transactions), and induced jobs (jobs supported by the household spending of direct wages). It is estimated that the Project would support an average of approximately 1,822 direct jobs annually and 1,239 indirect and induced jobs annually, for a total of 3,061 jobs annually. Direct jobs would occur primarily within the construction and architectural, engineering, and related services industries while the indirect and induced jobs would occur in industries such as wholesale trade; restaurants; real estate; hospitals; retail; and services to buildings. These jobs are calculated based on multipliers and datasets for various industries identified in IMPLAN and reflect typical spending patterns by these industries and workers.

Project construction would produce an estimated $226 million in annual labor income (employee compensation and proprietor income). Annual value added—the combination of labor income, other property type income, and indirect business taxes—would be approximately $306 million. Annual total output, or the value of production, would be approximately $501 million. These economic outputs would spread benefits throughout the Washington Metropolitan Region.

Table 14-1 | Annual Construction Employment, Action Alternative A

	Annual Jobs	Annual Labor Income	Annual Value Added	Annual Total Output
Direct Effect	1,822	$146,391,519	$177,651,493	$299,229,546
Indirect Effect	441	$34,838,259	$50,329,256	$78,567,865
Induced Effect	799	$44,424,818	$78,135,238	$123,281,734
Total Effect	3,061	$225,654,596	$306,135,988	$501,079,145

Source: IMPLAN

[4] These jurisdictions are used because they comprise the Washington-Arlington-Alexandria, DC-VA-MD-WV, metropolitan statistical area as defined by the United States Office of Management and Budget and used by the U.S. Census Bureau.

Tax/Public Revenues

Temporary direct or indirect impacts to taxes and other public revenues are not anticipated.

Commercial Activity

Construction of Action Alternative A would cause major temporary adverse impacts to the Washington Marina without mitigation, and, minor temporary impacts to NPS due to loss of revenue from NPS Parking Lots B and C.

Action Alternative A would require demolishing the pedestrian bridge across Maine Avenue SW near the Mandarin Oriental Hotel that provides access to the Washington Marina and other waterfront locations. The pedestrian bridge would be replaced with a comparable permanent structure. Prior to the replacement of the pedestrian bridge, pedestrians would be rerouted using existing sidewalks so there would still be access between the Mandarin Oriental Hotel and Washington Marina.

In addition to the permanent loss of parking at the Washington Marina and NPS Parking Lot C in East Potomac Park, temporary loss of additional parking spaces is expected to occur at both locations for purposes of construction staging, and may last for the duration of construction. This would include temporary closure of most of the surface parking at the Washington Marina and would also include temporary closure of all parking at NPS Parking Lot B and Parking Lot C. Loss of parking at NPS Parking Lots B and C would result in a temporary loss of revenue for NPS from the metered parking spaces, constituting a temporary direct, minor adverse economic impact.

Temporary parking for Washington Marina would be established offsite for the duration of construction (the location of temporary parking for the marina will be identified later in the planning process as final design progresses and in coordination with the marina). Construction would have a potentially major direct impact to Washington Marina considering both the temporary loss of parking and the inconvenience of the temporary removal of the pedestrian bridge for approximately 5 years. These impacts would be inconvenient for Washington Marina and its patrons and could result in the loss of patrons. However, with mitigation measures in place, such as temporarily relocated parking and pedestrian access, temporary adverse impacts, such as a loss of patrons, to Washington Marina would be considered minor.

14.4.2.3. Action Alternative B

Major temporary direct adverse impacts to the Washington Marina due to construction of Action Alternative B would be the same as those due to Action Alternative A. The minor impacts anticipated to NPS due to loss of revenue from the closure of NPS Parking Lots B and C would be felt for an additional 3 years because Action Alternative B has an 8-year construction period. The higher cost and longer construction period for Action Alternative B would result in additional construction employment and economic benefit as discussed below.

Jobs and Regional Economy

Minor beneficial direct and indirect effects to employment and the regional economy would occur with Action Alternative B. Action Alternative B is estimated to cost approximately $2.8 billion over a construction period of 8 years and 3 months.

Jobs are defined as full- and part-time annual average jobs for both employees and self-employed workers, including seasonal workers. Construction jobs in **Table 14-2** below are estimated annually and categorized as direct jobs (the number of construction jobs), indirect jobs (jobs supported by business-to-business transactions), and induced jobs (jobs supported by the household spending of direct wages). It is estimated that the Project would support an average of approximately 1,683 direct jobs annually and 1,145 indirect and induced jobs annually, for a total of 2,829 jobs annually. Direct jobs would occur primarily within the construction industry while the indirect and induced jobs would occur in industries such as wholesale trade; restaurants; real estate; architectural, engineering and related services; hospitals; retail; and services to buildings. These jobs are calculated based on multipliers and datasets for various industries identified in IMPLAN and reflect typical spending patterns by these industries and workers.

Project construction would produce an estimated $209 million in annual labor income (employee compensation and proprietor income). Annual value added—the combination of labor income, other property type income and indirect business taxes—would be approximately $283 million. Annual total output, or the value of production, would be approximately $463 million. These economic outputs would spread benefits throughout the Washington Metropolitan Region.

Table 14-2 | Annual Construction Employment, Action Alternative B

	Annual Jobs	Annual Labor Income	Annual Value Added	Annual Total Output
Direct Effect	1,683	$135,312,946	$164,120,086	$276,479,729
Indirect Effect	407	$32,202,304	$46,526,598	$72,588,564
Induced Effect	738	$41,063,000	$72,222,394	$113,952,472
Total Effect	2,829	$208,578,250	$282,869,078	$463,020,765

Source: IMPLAN

14.5. Avoidance, Minimization, and Mitigation

14.5.1. Social

The Project would result in impacts to parks but no other community facilities. Mitigation measures for impacts to parks are discussed in **Section 13.0, Recreation and Parks**. Action Alternative A would not result in other impacts to social resources; therefore, no mitigation measures are proposed.

14.5.2. Economic

The Project would result in impacts to specific businesses, including Washington Marina, NPS Parking Lots B and C, the Mandarin Oriental Hotel, and the Portals V development. These impacts are due to a loss of parking, change in access, and noise. Mitigation measures for these impacts are discussed in **Section 6.0, Transportation and Navigation**; **Section 9.0 Land Use and Property**; **Section 10.0, Noise and Vibration**; and **Section 13.0 Recreation and Parks**. Impacts to Mandarin Oriental Hotel and the Portals V development are not discussed further in this chapter because the impacts are not anticipated to financially affect either business. The Virginia Department of Rail and Public Transportation, the

project sponsor for final design and construction, would continue to coordinate with the Washington Marina and NPS to develop appropriate mitigation for adverse temporary and permanent impacts, including potential loss of revenue and patrons due to the temporary and permanent removal of parking, to these establishments due to the Project.

15.0 Safety and Security

15.1. Introduction

This section defines the safety and security resources pertinent to the Long Bridge Project (the Project), provides the regulatory context for the study of these resources, and describes the methodology for assessing these resources. For each Action Alternative and the No Action Alternative, this section describes potential construction and permanent or long-term impacts on safety and security. This chapter also discusses proposed avoidance, minimization, and mitigation measures to reduce adverse impacts of the Project.

15.2. Regulatory Context and Methodology

This section describes the regulatory context for evaluation of impacts to safety and security resources, as well as the methodology used to evaluate current conditions and the probable consequences of the alternatives. The complete list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report*.

15.2.1. Regulatory Context

The Federal Railroad Administration (FRA) is the key agency with regulatory jurisdiction on intercity passenger and freight railroad safety. FRA has jurisdiction over all aspects of the physical railroad system including railroad infrastructure (for example, tracks, bridges, and tunnels), equipment (for example, locomotives and railcars), freight, and passengers.[1] The Virginia State Corporation Commission – Commonwealth of Virginia (SCC) is tasked with rail safety oversight in Virginia in cooperation with FRA. Other key agencies in the safety and security of railroad infrastructure, material transport, and passenger safety are the United States Department of Homeland Security (DHS), and the Transportation Security Agency (TSA), an agency within DHS.

FRA is responsible for the administration of the Rail Safety Improvement Act of 2008 and the High-Speed Passenger Rail Safety Strategy.[2,3] The DHS and TSA play a role in monitoring and securing freight across the country, this includes the transport of hazardous materials, as well as mass transit and passenger rail security and preparedness.[4,5] USDOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) also plays an oversight role in the transportation of hazardous materials by rail. The National Fire Protection Association (NFPA), a trade organization, is also responsible for publishing guidance, codes and standards intended to eliminate death, injury, property and economic loss due to fire and related

[1] 49 USC 201
[2] Public Law 110-432
[3] USDOT, FRA. 2009. High-Speed Passenger Rail Safety Strategy. Accessed from https://www.fra.dot.gov/eLib/Details/L03624. Accessed June 7, 2017.
[4] 49 CFR 1580
[5] DHS, Office of the Inspector General. 2010. TSA's Preparedness for Mass Transit and Passenger Rail Emergencies. Accessed from https://www.oig.dhs.gov/assets/Mgmt/OIG_10-68_Mar10.pdf. Accessed June 7, 2017.

hazards. The United States Coast Guard (USCG) has overall responsibility for safety and security on all waterways including those in the Local and Regional Study Areas.

The District and Arlington County, Virginia, enforce safety and security through local code requirements, laws, ordinances, and regulations within their jurisdictional boundaries. The Project Area is serviced in the District by the District Fire and Emergency Medical Services Department (DC FEMS), Metropolitan Police Department (MPD), and Homeland Security and Emergency Management Agency (HSEMA). In Virginia, Arlington County Police, Arlington County Sheriff's Office, and Arlington County Fire Department are the local agencies responsible for safety, security, and emergency response. Details regarding public safety and emergency response will vary depending on location.

15.2.2. Methodology

As shown in **Figure 15-1**, the Local Study Area for safety and security resources includes the footprint of the Project Area and the areas immediately adjacent to the Project Area within approximately 0.5 miles. The Local Study Area includes the tracks, interlockings, bridges, and related railroad infrastructure being modified by the Project.

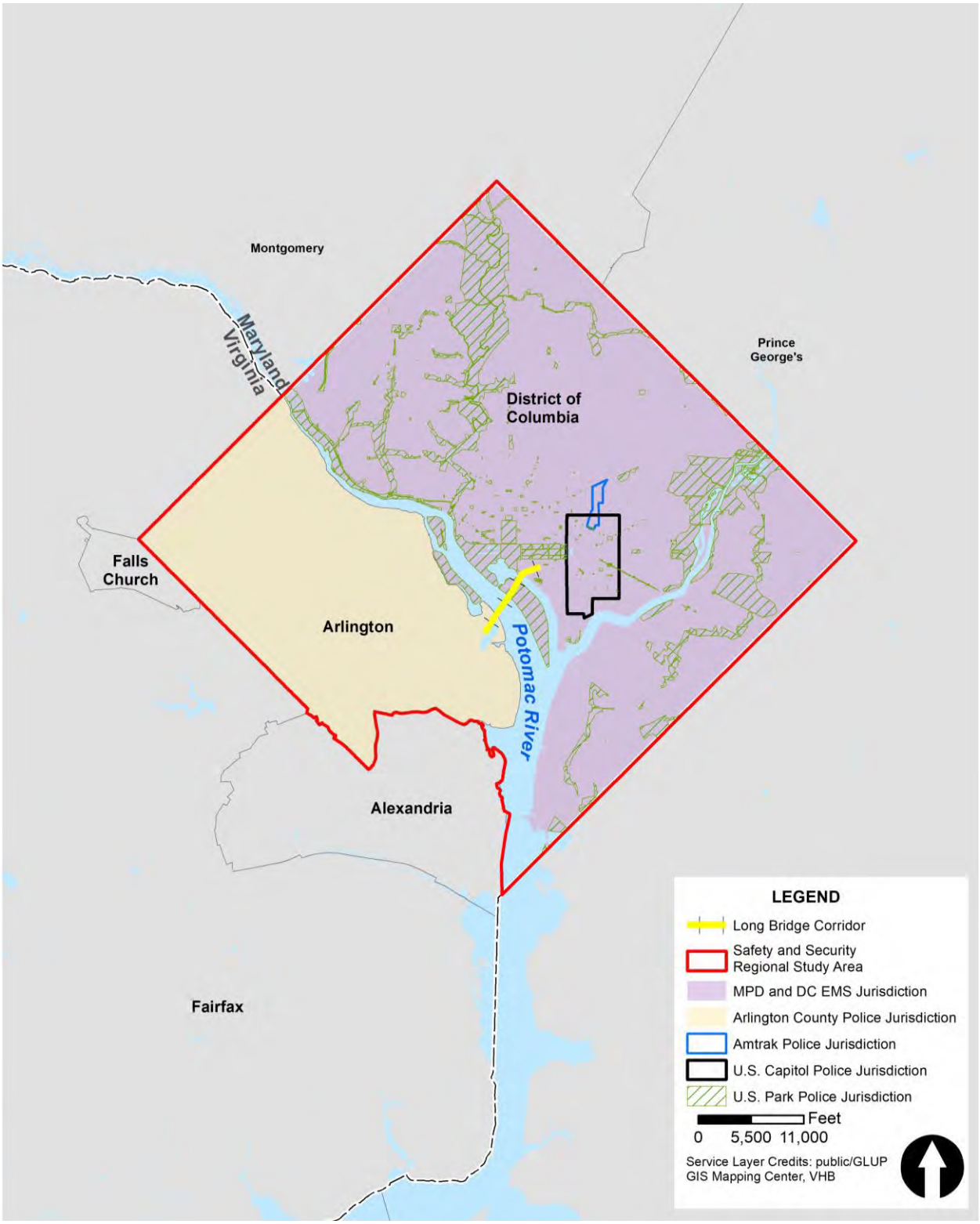
The Regional Study Area for safety and security encompasses the District and Arlington County, Virginia. The service boundaries for fire, law enforcement, and emergency services in the District and Arlington County, as well as service boundaries of specific forces in the area including Amtrak Police, Metropolitan Police, Arlington Police, Metro Transit Police, United States Park Police, and United States Capitol Police are shown in **Figure 15-2**.

The evaluation of potential impacts to safety identified potential impacts (beneficial or adverse) to access for emergency services and first responders, including any changes in access to public safety facilities. The analysis also evaluated safety impacts to residences, schools, and other sensitive facilities, as well as the potential for dangerous conditions around the railroad facilities that could lead to an increase in vehicle, pedestrian, or cyclist accidents. In addition, the analysis evaluated the potential for workers or passengers to be exposed to hazards resulting from the alternatives. Schools are considered in this safety analysis because children are a highly vulnerable population and may be at-risk from railroad operations, including incursion onto the tracks in the Local Project Area.

The evaluation of potential impacts to security resources identified any direct impacts due to project elements requiring the permanent or temporary physical use of property occupied by security facilities. The analysis also assessed hazards that could affect future operations; potential vulnerabilities related to terrorist acts and criminal activity; and the potential for increased hazards to people or structures as a result of new features. In addition, the analysis identified potential changes to security practices in the Local Study Area as a result of the Project.

Figure 15-1 | Local Study Area for Safety and Security

Figure 15-2 | Regional Study Area for Safety and Security



15.3. Permanent or Long-Term Effects

This section identifies the potential impacts to the resource that are frequent, extend from the end of construction through the life of the Project, or cause a permanent change in the resource that would last beyond the life of the Project even if the actions that caused the impacts were to cease. For discussions on the impacts associated with the transport and use of hazardous materials on public safety and transportation see **Section 5, Solid Waste Disposal and Hazardous Materials**.

15.3.1. Railroad Safety

15.3.1.1. No Action Alternative

The No Action Alternative would have beneficial direct impacts due to the implementation of Positive Train Control (PTC). PTC is an automatic collision avoidance system that stops or slows a train in case of operator error or incapacitation, and prior to the violation of a speed or signal restriction. Beyond the implementation of PTC, current operators CSX Transportation (CSXT), Virginia Railway Express (VRE), and Amtrak would continue their existing safety management practices under the No Action Alternative.

15.3.1.2. Action Alternative A

Action Alternative A would have minor permanent direct beneficial impacts to railroad safety, and no indirect impacts. Action Alternative A would have a standard two-track bridge design and would pose no unique design or operational challenges to the host railroad or any of the third-party operators. Thus, it can be assumed there would be no additional risk to railroad safety. The design of Alternative A would meet all current and related NFPA, American Railway Engineering and Maintenance-of-Way Association, and FRA design standards. The right-of-way would be secured with fencing within the full project limits, so no additional threats of right-of-way incursion is expected.

In addition to the above outlined design standards, other operational safety measures that would be included or operational by completion of this project include:

- PTC: All Amtrak, VRE, and CSXT trains operating across Long Bridge would have operable PTC.
- 49 CFR Part 270 - System Safety Program: FRA mandates all commuter rail (VRE) and intercity passenger rail (Amtrak) operators develop a System Safety Program to determine and mitigate existing and potential hazards associated with railroad operations—including bridge crossings.

Action Alternative A would have a minor permanent direct beneficial impact to railroad safety. The existing track configuration throughout the 1.8-mile-long Corridor maintains 13-foot track spacing with 8.5 feet of lateral clearance, which would be upgraded to meet the current CSXT design criteria of 15-foot track spacing with 9 feet or greater lateral clearance through the majority of the Corridor. As explained in **Section 15.3.1, Maryland Avenue SW to L'Enfant Interlocking**, the existing conditions at the Maryland Avenue SW overbuild, 12th Street SW bridge, 12th Street Expressway bridge, and surrounding retaining walls between Maine Avenue SW and the L'Enfant (LE) Interlocking present challenges to meeting the current design criteria. The infrastructure through this section of the Corridor would require extensive structural modifications to obtain the same 15-foot track spacing and 9-feet lateral clearance, resulting in major impacts to local roads, businesses, and private properties. Through discussions with CSXT and railroad operators (Amtrak, VRE, and DRPT), FRA and DDOT selected a

configuration of 14-foot track spacing with a minimum of 7.5 feet of lateral clearance as the preferred option. With the additional mitigation identified in **Section 15.5.1, Railroad Safety**, this option would meet the operational and safety requirements of the railroad.

As noted in the *Affected Environment Report, Section 17.5.1, Railroad Safety*, there have been only two derailments on CSXT-owned track in the District since 2012. Based on the overall lack of reportable incidences in the District, it is reasonable to assume there would be either no increase or a negligible increase in risk to railroad operational safety from adding more tracks. Any increased operational risk due to increased rail traffic system-wide is under the purview of the FRA and is addressed in each operator's System Safety Program as outline in 49 CFR Part 270.

15.3.1.3. Action Alternative B

Permanent impacts to railroad safety resulting from Action Alternative B would be the same as the impacts described for Action Alternative A.

15.3.2. Public Safety

15.3.2.1. No Action Alternative

The No Action Alternative would not have permanent or long-term effects on emergency response or emergency services in the Local Study Area. The Local Study Area would continue to be serviced by public and private emergency response services, dependent on jurisdiction (the District or Arlington), would continue to serve the Local Study Area.

CSXT would continue existing practices to secure its right-of-way from the risk of the public accessing the tracks. There are no grade-crossings and limited access points in the Local Study Area.

15.3.2.2. Action Alternative A

Action Alternative A would have no direct or indirect impacts to public safety, including effects on emergency response, emergency services, crime, or other components of public safety in the Local Study Area. The Local Study Area would still be served by public and private emergency response services, depending on the jurisdiction (the District or Arlington). The new two-track system would not create additional impacts. While more trains would be traveling through the corridor (as a result of added capacity), emergency situations cannot be predicted. Currently there are no at-grade crossings and Action Alternative A would not add any; therefore, the increase in train traffic would not affect emergency response times.

There is one emergency shelter within the Local Study Area at Jefferson Middle School in the District (801 7th Street SW). Action Alternative A would not add railroad infrastructure outside the current right-of-way or change the distance between Action Alternative A and Jefferson Middle School. Therefore, Action Alternative A would result in no permanent impacts to access to the emergency shelter.

Action Alternative A would not include any new stations or platforms in the Long Bridge Corridor where potential increases in crime would occur. Therefore, Action Alternative A is not anticipated to result in increased crime per capita.

No grade crossings would be added with Action Alternative A, and it is assumed that CSXT would continue existing practices to secure its right-of-way from the risk of the public accessing the tracks. The entire existing right-of-way is within a grade-separated corridor. Therefore, Action Alternative A is not expected to affect public safety impacts from incursions onto the tracks.

15.3.2.3. Action Alternative B

Permanent impacts to public safety resulting from Action Alternative B would be the same as the impacts described for Action Alternative A.

15.3.3. Security

15.3.3.1. No Action Alternative

The No Action Alternative would have no permanent or long-term effects on security in the Local Study Area. There would be no change to security when compared to existing conditions. Existing security practices and plans would continue to be in effect.

15.3.3.2. Action Alternative A

Action Alternative A would have negligible permanent direct adverse impacts to security and negligible indirect impacts. Several of the roadways within the Local Study Area are classified as regional evacuation routes by the District HSEMA including I-395/Route 1, George Washington Memorial Parkway (GWMP), and 9th Street SW. However, no permanent impacts to roadways are anticipated, as no at-grade crossings are included in the Project.

Action Alternative A would abut several areas where incursions are plausible; however, new tracks and associated infrastructure would be grade-separated from roadways (either above or below existing grade) and proper measures would be taken upon project completion to control access points. No permanent security impacts or risks are expected to result from trespassing or incursions. Currently, the barriers between the right-of-way and public areas include high barriers, fencing, or vegetative zones. The same measures would be used upon Project completion to maintain separation between railroad infrastructure and potential access areas.

Construction of the new bridge would create another piece of critical infrastructure that could be the target of criminal or terrorist activity. Local, regional, and Federal agencies would need to update transportation infrastructure safety, security, and emergency management plans to encompass the new bridge. As these plans are updated regularly, the anticipated impacts are negligible. It is anticipated that the additional infrastructure would not overburden the applicable safety and security agencies.

15.3.3.3. Action Alternative B

The permanent impacts resulting from Action Alternative B would be the same as the impacts described for Action Alternative A.

15.4. Temporary Effects

This section identifies the potential impacts to the resource that are intermittent, infrequent, or last only for the duration of the construction period.

15.4.1. Railroad Safety

15.4.1.1. No Action Alternative

The No Action Alternative may have temporary direct adverse impacts to railroad safety due to construction near the active tracks, resulting in the potential for impacts to railroad worker safety during construction.

15.4.1.2. Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts to railroad safety. Action Alternative A would require construction in the vicinity of active tracks, resulting in the potential for impacts to railroad worker safety during construction. Construction of Action Alternative A would require the implementation of safety measures as described in **Section 15.5.1, Railroad Safety**.

15.4.1.3. Action Alternative B

The temporary impacts resulting from Action Alternative B would be similar to the impacts described for Action Alternative A, except that the potential for temporary impacts resulting Action Alternative B would last longer than Action Alterative A. The estimated duration of construction for Action Alternative B is approximately 1.5 times Action Alternative A (8 years and 3 months versus 5 years, respectively), resulting in additional months and years of potential impacts to railroad safety during which safety measures would be required.

15.4.2. Public Safety

15.4.2.1. No Action Alternative

The No Action Alternative may have temporary direct adverse impacts to public safety due to the location of construction sites within heavily urbanized areas. Members of the public, including children, could enter unsecured staging areas or railroad right-of-way during the construction.

15.4.2.2. Action Alternative A

Action Alternative A would have moderate temporary direct impacts to public safety due to lane closures on Maine Avenue SW, which could inhibit or cause delays for police, fire, and emergency services. The contractor would be required to coordinate with emergency services to minimize impacts to emergency response.

Constructing Action Alternative A would require temporary relocation of portions of the Mount Vernon Trail (MVT), a pedestrian walking and bike path. The relocated trail would be adjacent to the GWMP and the I-395 North ramp. Under the proposed Action Alterative A temporary impact durations, the MVT would be relocated for approximately 24 months. Measures would be put in place and appropriate distance maintained between pedestrians, bicyclists, and automobiles to ensure the safety of trail users.

Several Project construction sites would be located within heavily urbanized areas and thus could introduce risk to public safety. Members of the public, including children, could enter unsecured staging areas or railroad right-of-way. Therefore, all staging areas would be secured and fenced.

15.4.2.3. Action Alternative B

The temporary impacts resulting from Action Alternative B would be similar to the impacts described for Action Alternative A, although the potential for temporary impacts resulting from Action Alternative B would last longer than Action Alterative A. The estimated duration of construction for Action Alternative B is approximately 1.5 times Action Alternative A (8 years and 3 months versus 5 years, respectively), resulting in additional months and years of potential impacts to public safety.

15.4.3. Security

15.4.3.1. No Action Alternative

The No Action Alternative could have temporary direct adverse impacts to security resources due to the addition of construction staging areas and access points close to public rights-of-way. Construction staging areas or access points present additional opportunity for incursions onto the railroad right-of-way.

15.4.3.2. Action Alternative A

Action Alternative A would have minor temporary adverse direct impacts to security resources. Action Alternative A would temporarily add security risk due to the addition of several construction staging areas, access points and the proximity of these areas to public areas. Unsecured construction staging areas or access points present additional opportunity for incursions onto the railroad right-of-way. With Action Alternative A, these areas could be present for as long as 60 months. As noted in **Section 15.4.2, Public Safety**, all construction sites would be secured through using fencing or other passive security measures (such as lighting) in addition to active security measures (such as cameras or intrusion detection), security personnel, monitoring of various activities, and adherence to strict protocols for entrance of construction workers to construction sites. The inspection of materials would also be employed at the construction sites.

15.4.3.3. Action Alternative B

The temporary impacts resulting from Action Alternative B would be similar to the impacts described for Action Alternative A, except that the potential for temporary impacts under Action Alternative B will be longer than Action Alterative A. The estimated duration of construction for Action Alternative B is approximately 1.5 times Action Alternative A (8 years and 3 months versus 5 years, respectively), resulting in additional months and years of potential impacts to security.

15.5. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the resources based on the results of the impact assessment.

15.5.1. Railroad Safety

The Project would not cause permanent adverse impacts to railroad safety. Therefore, no avoidance, minimization, or mitigation measures are proposed for permanent impacts.

The Project would involve construction in the vicinity of active tracks, requiring a range of measures to ensure the safety of railroad workers. Measures would include:

- The Virginia Department of Rail and Public Transportation (DRPT), the project sponsor for final design and construction, and the SCC would require construction contractors to meet all applicable safety and security requirements, including those specified by CSXT, Amtrak, VRE, and state and Federal agencies, including DDOT, the Virginia Department of Rail and Public Transportation, FRA, TSA, USCG, the United States Environmental Protection Agency, and the Occupational Safety and Health Administration (OSHA).
- CSXT would require that the contractors use flagmen as needed and ensure that the required railroad safety training has been completed by all workers that would be in the vicinity of the active tracks during construction.
- Before beginning work, CSXT would require contractors to develop a Safety and Security Plan for review and approval. Safety and security would be coordinated with Federal, state, and local law enforcement and safety agencies.

Because of the proposed reduced track spacing and lateral clearance between Maine Avenue SW and LE Interlocking, DRPT would be required to implement several mitigation measures:

- To accommodate the track configuration, DRPT would implement infrastructure upgrades to the crashwalls, as well as provide clearance detectors, security lighting, enhanced security fencing, and track friction modifiers.
- DRPT would modify crashwalls in the reduced clearance areas to meet the design criteria.
- DRPT would also add electrical and communication connections to enable the addition of security measures.
- DRPT would continue to evaluate opportunities for further structural improvements in the overbuild area during final design to potentially increase lateral clearance.
- DRPT would continue discussions that FRA and DDOT conducted with CSXT, Amtrak, and VRE to identify and mitigate operational impacts of the reduced track spacing and lateral clearance.

15.5.2. Public Safety

The Project would not cause permanent adverse impacts to public safety. Therefore, no avoidance, minimization, or mitigation measures are proposed for permanent impacts.

Construction zone impacts from the Project can be mitigated by following standard construction safety procedures as outlined by OSHA and industry best practices for highway, railway, and pedestrian way overbuilds. Choosing a contractor with a proven safety record and a successful work history on railway/highway projects can help to keep risk at an acceptable level. During construction, safety and security would be coordinated with Federal, state, and local first responders to ensure access and minimize delays for emergency response. Safety and security measures would be developed to address natural events (such as severe storms, flooding, earthquakes), or emergencies caused by human error, mechanical failure, or intentional human intervention.

Construction staging areas can be targets of theft or vandalism, with materials and construction equipment stored on site for extended periods of time. Throughout the construction period, DRPT would employ proper measures to prohibit trespassing, such as barriers, fences, or barricades. Entrances and exits to construction sites would be locked and areas would be well lit and equipped with automatic protective lighting systems.

15.5.3. Security

DRPT would implement measures to inhibit trespassing, incursions, and potential terrorist acts on railroad infrastructure through coordination with Federal, state, and local law enforcement. Measures would include fencing, barriers, and dense vegetation.

DRPT would secure all construction sites through using fencing or other passive security measures (such as lighting), as well as active security measures (such as cameras or intrusion detection), security personnel, monitoring of various activities, and adherence to strict protocols for entrance of construction workers to construction sites. The inspection of materials would also be employed at the construction sites.

16.0 Public Health, Elderly, and Persons with Disabilities

16.1. Introduction

This section describes the analysis of the No Action Alternative and each Action Alternative and their potential construction and permanent or long-term impacts on public health, elderly, and persons with disabilities. This section also defines the public health, elderly, and persons with disabilities resources pertinent to the Long Bridge Project (the Project), provides the regulatory context and describes the methodology for assessing these resources. It also provides proposed avoidance, minimization, and mitigation measures to reduce potential adverse impacts of the Project to public health, elderly, and persons with disabilities.

Assessments of **public health** for the purposes of this analysis include the resources and crucial issues or concerns relating to human health and welfare. This chapter also considers the impacts of the alternatives on the elderly and people with disabilities.

16.2. Regulatory Context and Methodology

This section describes the regulatory context and the methodology used to evaluate the Action Alternatives and No Action Alternative impacts to public health, elderly, and persons with disabilities. The complete list of laws, regulations, and other guidance considered, and a full description of the analysis methodology followed for these resources are available in the *Methodology Report***.**

16.2.1. Regulatory Context

The National Environmental Policy Act of 1969 requires consideration of the potential effects of Federal actions on public health, elderly, and persons with disabilities.[1] The Federal Railroad Administration's *Procedures for Considering Environmental Impacts* state that the "Environmental Impact Statement shall assess impacts of the alternatives on the transportation and general mobility of the elderly and handicapped."[2]

Many of the laws and regulations protecting public health are resource-specific, for example, the Clean Air Act of 1970 and its amendments of 1990,[3] and the National Ambient Air Quality Standards.[4] However, it is important to consider these laws and the impacts from resources regards to overall public health concerns. The Occupational Safety and Health Administration is responsible for governing public health conditions at places of employment nationwide.

The protection of more vulnerable populations is another consideration under public health. Vulnerable populations include children, the elderly, and persons with disabilities. The Department of Health and Human Services is the lead agency for connecting elderly persons to care, resources, and information.

[1] 42 USC 4321
[2] 64 CFR 28545
[3] 42 USC 7401
[4] 40 CFR 50

The Americans with Disabilities Act of 1990 (ADA) ensures persons with disabilities are not discriminated against or disproportionately impacted in transportation, employment, access, and public places.[5] Many agencies play a part in guiding policies and projects to improve and safeguard these policies. Federal agencies' responsibility lies with the sector they oversee. The United States Department of Transportation enforces regulations governing transit, which includes the accessibility of Federal, state, and local roadways and pedestrian facilities (for example, bus, subway, and rail stations).

16.2.2. Methodology

The Local Study Area (**Figure 16-1**) includes the Project Area and 0.5 miles immediately adjacent to the Project Area. It includes the tracks, interlockings, bridges, and related railroad infrastructure that would be modified by the Project.

Impacts related to elderly and disabled persons at a regional scale are considered unlikely because of the scope of this Project and are therefore considered not applicable. Impacts to these populations, if any, are expected to be localized and limited to the Local Study Area.

The Environmental Consequences analysis evaluated direct and indirect impacts for both construction and long-term or permanent impacts to public health, the elderly, and persons with disabilities. The analysis included a qualitative description of how the Project could affect health, followed by a discussion of avoidance and minimization measures if needed. Regarding the elderly and people with disabilities, the analysis identified impacts and benefits to accessibility, if any, associated with the proposed Project elements. Impacts were considered for both passenger and commuter rail users and people within the Study Areas as appropriate. Impacts may also be beneficial if the Project design includes accessibility improvements.

16.1. Permanent or Long-Term Effects

This section identifies the potential direct and indirect impacts to the resources that are frequent, extend from the end of construction through the life of the Project, or cause a permanent change in the resource that would last beyond the life of the Project even if the actions that caused the impacts were to cease.

16.1.1. Public Health

16.1.1.1. No Action Alternative

Under the No Action Alternative, railroad conditions related to public health are expected to remain the same as existing and there would be no impacts. Resource specific impacts are discussed in the resource-specific sections of this report (**Section 3.0, Water Quality**; **Section 5.0, Solid Waste Disposal and Hazardous Materials**; **Section 7.0, Air Quality and Greenhouse Gases**; **Section 10.0, Noise and Vibration**; and **Section 15.0, Safety and Security**).

[5] 42 USC 126

Figure 16-1 | Local Study Area for Public Health, Elderly, and Persons with Disabilities

16.1.1.2 Action Alternative A

Overall Action Alternative A would have negligible permanent direct adverse impacts on public health due to negligible impacts on solid waste disposal and hazardous materials, which would not equal measurable public health effects, see **Section 5.0, Solid Waste and Hazardous Materials**. Action Alternative A would have negligible permanent indirect adverse impacts to public health due to air quality effects from the emissions from the additional trains using the corridor. However, the slight increase in emissions would have negligible public health effects (see **Section 7.0, Air Quality**).

Specific populations, such as elderly persons and children, can be more vulnerable or sensitive to changes in adjacent resources such as air quality, water quality, and noise and vibration. No nursing homes were identified in the Local Study Area and no concentrations of elderly populations are located in the Local Study Area, and therefore no permanent impacts to the elderly are anticipated. There are four child care facilities or schools located within the Study Area: Sparkles! Child Care Centers in Crystal City, Apple Tree Early Learning Public Charter School at 7th Street SW, Washington Global Public Charter School at 525 School Street SW, and Jefferson Middle School. However, public health impacts on school-aged children are expected to be negligible due to distance since the impacts would occur localized to the Project. Additionally, no healthcare facilities were identified in the Local Study Area; therefore, no permanent impacts to healthcare facilities or impacts to access are expected.

While Action Alternative A would cause moderate to major impacts on sensitive noise receptors within the Long Bridge Corridor, none of these locations are near schools, child care facilities, healthcare facilities, and nursing homes. Noise Receptors at the Mandarin Oriental Hotel and Portals V Residences currently in construction adjacent to the Long Bridge Corridor showed severe noise impacts as a result of train operations, specifically wheel squeal as a result of curve in track infrastructure. However, mitigation measures would reduce the noise levels at or below those of Existing Conditions. Therefore, Action Alternative A would not cause direct or indirect impacts to public health due to noise. For more information on noise impacts and mitigation measures, please see **Section 10, Noise and Vibration**.

16.1.1.3 Action Alternative B

The permanent impacts under Action Alternative B would be the same as the impacts under Action Alternative A.

16.1.2. Elderly Persons

16.1.2.1. No Action Alternative

With the No Action Alternative, railroad conditions related to elderly persons in the Local Study Area would remain the same as existing and there would be no impacts.

16.1.2.2. Action Alternative A

Action Alternative A would have no impact on elderly persons. The increase in daily train operations would cause future noise levels along the Long Bridge Corridor to range from 56 to 92 dBA, as described in **Section 10.0, Noise and Vibration**. Elderly persons are more susceptible to changes in ambient environmental conditions including changes in noise. However, data show no nursing homes or

concentrations of elderly persons in the Local Study Area and noise impacts would not be disproportionate to elderly persons in residential areas.

There would be no permanent direct and indirect effects of air quality to the elderly. Action Alternative A would have local concentrations of air pollutant emissions below the *de minimis* thresholds (see **Section 7.0, Air Quality and Greenhouse Gases**). Solid waste or freight trips carrying hazardous materials as a result of increased operations would be appropriately handled and managed as required by regulations (see **Section 5.0, Solid Waste Disposal and Hazardous Materials**). Therefore, no additional public health impacts to elderly persons are expected.

16.1.2.3. Action Alternative B

The permanent impacts under Action Alternative B would be the same as the impacts under Action Alternative A.

16.1.3. Persons with Disabilities

16.1.3.1. No Action Alternative

With the No Action Alternative, there would be no permanent direct or indirect impacts to persons with disabilities. There are no at-grade crossings of the railroad with the public right-of-way that might affect access for persons with disabilities. Projects in the No Action Alternative that might affect access (the L'Enfant and Crystal City VRE Station projects) would be completed in compliance with the Americans with Disabilities Act (ADA).

16.1.3.2. Action Alternative A

There would be no permanent direct or indirect adverse impacts to persons with disabilities because of Action Alternative A. Action Alternative A would not include any new grade crossings in Arlington or the District that would affect accessibility. Action Alternative A would not change access points to stations or platforms for persons with disabilities.

Action Alternative A would cause minor permanent direct beneficial impacts on persons with disabilities by replacing the existing pedestrian crossing of Maine Avenue. This crossing is not accessible to persons with disabilities because of a broken elevator, which inhibits safe access over Maine Avenue. The new pedestrian crossing would have a fully ADA-compliant ramp. Action Alternative A does not add at-grade crossings, stations, or platforms that require accessibility or adversely impact persons with disabilities.

16.1.3.3. Action Alternative B

The permanent impacts under Action Alternative B would be the same as the impacts under Action Alternative A.

16.2. Temporary Effects

This section identifies the potential impacts to public health, elderly persons, or persons with disabilities that are intermittent, infrequent, or last only for the duration of the construction period.

16.2.1. Public Health

16.2.1.1. No Action Alternative

The No Action Alternative may have temporary direct and indirect adverse impacts on public health as it relates to air quality, noise and vibration, and hazardous materials. Temporary construction activities of other projects may increase emissions and cause noise and vibration that would adversely affect public health. These impacts would be assessed and mitigated within the context of each project. Temporary construction activities for railroad projects included in the No Action Alternative could potentially encounter hazardous soils and require proper removal. The No Action Alternative would not have temporary direct and indirect adverse impacts on public health as it relates to water because temporary construction activities of other projects are not anticipated to extend into the water table.

16.2.1.2. Action Alternative A

Action Alternative A would have minor temporary direct adverse impacts on public health due to construction activities. Temporary public health impacts from construction activities could result from solid waste disposal and hazardous materials, air quality, and noise and vibration effects. **Section 1.5, Construction Methods**, describes the construction methods and activities for the Action Alternative A, including information on construction sequence, duration, equipment use, and staging.

During construction of Action Alternative A, potentially hazardous materials would be stored on-site and used which can pose a risk to public and construction worker health. Proper measures would be used to ensure public and worker safety during construction, including the implementation of spill prevention plans, use of personal protective equipment, and conducting safety trainings. Temporary effects on solid waste and hazardous materials are discussed in more detail in **Section 5.0, Solid Waste Disposal and Hazardous Materials**.

Pollutant emissions with potential to impact public health would occur during construction from on-site diesel equipment, increased truck traffic to and from the construction sites, and fugitive dust. However, it is unlikely that construction activities would cause the *de minimis* thresholds for air quality to be exceeded. As a result, there would be no measurable public health effects from construction activities. Temporary effects on air quality are discussed in more detail in **Section 7.0, Air Quality and Greenhouse Gases**.

Temporary noise and vibration effects from construction activities include, increased truck traffic, light and heavy machinery, construction equipment vibration impacts and increased ambient noise levels. The maximum noise emissions at 50 feet of typical equipment used for construction activities range from 80 to 90 dBA. Construction noise levels would exceed the daytime noise level and nighttime construction noise levels resulting in minor public health effects. Construction activities would not exceed minor annoyance or disruption. Temporary effects from noise and vibration are discussed in more detail in **Section 10.0, Noise and Vibration**.

There are no drinking water sources in or near the Local Study Area. Action Alternative A would not result in temporary impact to drinking water quality or quantity. Temporary effects on water resources are outlined in more detail in **Section 3.0, Water Quality**.

16.2.1.3. Action Alternative B

The temporary impacts under Action Alternative B would be similar to impacts described under Action Alternative A. However, the potential for temporary impacts under Action Alternative B would be longer than Action Alterative A. The estimated duration of construction for Action Alternative B is approximately nearly double Action Alternative A (99 and 60 months, respectively), resulting in additional months in which construction may potentially affect public health.

16.2.2. Elderly Persons

16.2.2.1. No Action Alternative

The No Action Alternative would not cause temporary impacts related to elderly persons as none of the projects are expected to affect accessibility. These impacts would also apply to elderly persons.

16.2.2.2. Action Alternative A

Temporary impacts on elderly persons because of construction under Action Alternative A would be minor. Although the Project is in an urban area, there are no concentrations of elderly persons and no nursing homes or assisted living facilities in the 0.5-mile buffer. Construction activities could increase ambient environmental conditions of noise and vibration and air quality in the Local Study Area. Construction activities would exceed the daytime and nighttime construction noise levels, and elderly persons in the Local Study Area may experience temporary noise and vibration impacts. However, these impacts would be negligible due to the temporary nature of construction activities and there are no concentrations of elderly nor residential areas. Temporary effects from noise and vibration are discussed in more detail in **Section 10.0, Noise and Vibration**.

Minor impacts would result from the diversion of pedestrian sidewalks and bicycle trails that may impact elderly persons who frequent these trails. Temporary impacts on parks and recreational activities are discussed in more detail in **Section 13.0, Recreation and Parks**.

16.2.2.3. Action Alternative B

The temporary impacts under Action Alternative B would be similar to the impacts described under Action Alternative A. However, the potential for temporary impacts under Action Alternative B would be longer than Action Alterative A. The estimated duration of construction for Action Alternative B is nearly double that of Action Alternative A (8 years and 3 months versus 5 years, respectively).

16.2.3. Persons with Disabilities

16.2.3.1. No Action Alternative

The No Action Alternative may have temporary adverse impacts to access for persons with disabilities, depending on the location of construction areas and whether construction will require any sidewalk closures that may require detours that would increase the travel distance required to reach certain destinations.

16.2.3.2. Action Alternative A

Temporary impacts on persons with disabilities because of construction under Action Alternative A would be minor. Proper measures would be used to ensure public and worker safety during construction, including the development of spill prevention plans, personal protective equipment, and safety trainings. Temporary effects on solid waste and hazardous materials are discussed in more detail in **Section 5.0, Solid Waste Disposal and Hazardous Materials**.

Pollutant emissions during construction would occur from on-site diesel equipment, increased truck traffic to and from the construction sites, and fugitive dust, which could impact public health. However, it is unlikely the *de minimis* thresholds would be exceeded causing any measurable impacts to persons with disabilities from construction activities. Temporary effects on air quality are discussed in more detail in **Section 7.0, Air Quality**.

Construction of Action Alternative A would result in adverse impacts to persons with disabilities from changes in pedestrian walkways and sidewalks, if temporary replacement facilities are not fully accessible. Where feasible, curb cuts or curb ramps would be used to enable ADA accessibility when construction activities inhibit or divert sidewalks. All temporary walkways would be required to be ADA-compliant when possible.

16.2.3.3. Action Alternative B

The temporary impacts under Action Alternative B would be similar to impacts described under Action Alternative A. However, the potential for temporary impacts under Action Alternative B will be longer than Action Alterative A. The estimated duration of construction for Action Alternative B is nearly double that of Action Alternative A (99 and 60 months, respectively), resulting in additional years of potential impacts to persons with disabilities.

16.3. Avoidance, Minimization, and Mitigation

This section describes proposed mitigation for the impacts to public health, elderly, and persons with disabilities resources.

Avoidance, minimization, and mitigation measures that would be employed to reduce the adverse impacts of both Action Alternatives on public health, elderly persons, and persons with disabilities are discussed in other resource chapters, including **Chapter 6, Water Quality**; **Chapter 8, Solid Waste Disposal and Hazardous Materials**; **Chapter 10, Air Quality and Greenhouse Gases**; **Chapter 13, Noise and Vibration**; and **Chapter 18, Safety and Security**. The measures the Virginia Department of Rail and Public Transportation, the project sponsor for final design and construction, would consider include:

- Reducing wheel squeal by implementing a wayside top-of-rail friction modifier system and using gauge-face lubrication.
- Developing spill prevention plans, personal protective equipment, Construction Noise and Vibration Control Plan, and safety trainings to ensure public and worker safety during construction. These measures include requiring all temporarily relocated sidewalks to be accessible to persons with disabilities, to the extent practicable.

- Mitigating construction noise. Due to the daytime construction noise impacts at three receptors in the District and potential nighttime construction noise impacts at most receptors in the Local Study Area, there is a need for construction noise mitigation. Given the duration of construction activities and the relatively close proximity of sensitive receptors, the contractor would prepare a Construction Noise and Vibration Control Plan prior to beginning construction to reduce noise impacts on public health, the elderly, and persons with disabilities.

17.0 Environmental Justice

17.1. Introduction

This section defines the potential for impacts on environmental justice populations from the Long Bridge Project (the Project), provides the regulatory context for the study of these impacts, and describes the methodology for assessing these impacts. For each Action Alternative and the No Action Alternative, this section summarizes potential construction and permanent or long-term impacts on environmental justice populations. This section also discusses proposed avoidance, minimization, and mitigation measures to reduce potential adverse impacts of the Project on environmental justice populations.

Environmental justice (EJ) is defined by Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. EO 12898 requires that Federal agencies identify and address disproportionately high and adverse impacts resulting from Federal projects on minority and low-income communities. The United States Department of Transportation (USDOT) and the Federal Railroad Administration (FRA) is committed to the principles of EJ, which include:

- Avoiding, minimizing, or mitigating disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- Ensuring the full and fair participation by all potentially affected communities in the transportation decision-making process; and
- Preventing the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

This section evaluates the potential of the Project to cause disproportionately high and adverse impacts on EJ populations. If applicable, measures to avoid, minimize, or mitigate potential disproportionate adverse impacts are identified, along with permitting and regulatory compliance requirements.

17.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluation of impacts to EJ communities, and summarizes the methodology used to evaluate current conditions and the probable consequences of the alternatives. This section also includes a description of the Study Area. The *Methodology Report* provides the complete list of laws, regulations, and other guidance considered and a full description of the analysis methodology followed for this resource.

17.2.1. Regulatory Context

EO 12898 of February 11, 1994: *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* directs Federal agencies to take appropriate and necessary steps to

identify and address disproportionately high and adverse environmental effects of Federal agency actions (including transportation projects) on minority and low-income populations.[1]

The USDOT *Order to Address Environmental Justice in Minority Populations and Low-Income Populations* sets forth the USDOT policy to consider EJ principles in all USDOT programs, policies, and activities.[2] It describes how the objectives of EJ are integrated into planning and programming, rulemaking, and policy formulation. This EO also requires that any activities that will have a disproportionately high and adverse effect on populations protected by Title VI ("protected populations") will only be carried out if:

1) A substantial need for the activity exists, based on the overall public interest; and
2) Alternatives that would have less adverse effects on protected populations (and that still satisfy the need identified in item 1 above), either
    a) Would have other adverse social, economic, environmental or human health impacts that are severe; or
    b) Would involve increased costs of extraordinary magnitude

Because FTA is a Cooperating Agency, the EJ analysis for the Project is also consistent with FTA guidance. FTA Circular 4703.1, *Environmental Justice Policy Guidance for FTA Recipients*, provides guidance for incorporating EJ principles into plans, projects, and activities subject to adoption of or approval by FTA.[3]

17.2.2. Methodology

As shown in **Figure 17-1**, the Local Study Area for the EJ analysis accounts for effects that may be felt outside the area of direct impacts, such as changes in air quality, noise, vibration, and land uses that may adversely or disproportionately affect low-income or minority communities. The Local Study Area includes the Project Area, which spans from the L'Enfant (LE) Interlocking in the District to the RO Interlocking in Arlington County, Virginia, as well as a 0.5-mile buffer surrounding the Project Area. The U.S. Census blocks and block groups are the smallest geographic units for which the demographic data collected for this analysis are available; therefore, some analyses that rely on U.S. Census information capture data that extends beyond the Local Study Area. The 0.5-mile radius captures the extent of indirect impacts that may be noticeable. This Local Study Area is designated in such a way as to capture all relevant impacts. The Project alternatives have no potential to disproportionately affect EJ populations at the regional level. Therefore, no Regional Study Area is considered.

[1] EO 12898
[2] USDOT Order 5610.2(a)
[3] FTA Circular 4703.1

Figure 17-1 | Local Study Area for Environmental Justice

The documentation of the Affected Environment included determining the characteristics of the general population and describing the characteristics of the potentially impacted population within the Local Study Area. The analysis used the U.S. 2010 Census as the data source for the identification of minority populations. The analysis quantified minority populations at the block level, which is the smallest geographic unit for which race and ethnicity data are available. The analysis used the American Community Survey 5-year average data for 2011–2015 as the data source for the identification of low-income populations. The analysis quantified low-income populations at the block group level, which is the smallest geographic unit for which low-income population data are available.

The analysis used additional data sources to provide more recent indications of low-income populations within the Local Study Area. The District's Geographic Information Systems data on affordable housing production and preservation projects (updated November 20, 2017, and checked again September 12, 2018) was used to identify affordable housing in the portion of the Study Area within the District. For the portion of the Study Area within Virginia, the list of apartment complexes offering affordable housing was geocoded from Arlington County's Affordable Housing website. Where minority or low-income populations were present in the Local Study Area, outreach was conducted to solicit feedback from those populations as described in **Section 17.6, Coordination with Environmental Justice Communities**.

The EJ environmental consequences analysis evaluated both the No Action and the Action Alternatives to determine whether the respective alternatives would result in disproportionately high and adverse direct and indirect impacts to minority and low-income populations. Based on FTA guidance, the evaluation considered the following criteria in determining whether the activity would result in a "disproportionately high and adverse effect on human health or the environment":[4]

- Would the alternative's adverse impacts be predominantly borne by minority or low-income populations? This will be determined by identifying whether adverse impacts are concentrated in minority or low-income communities.
- Would adverse impacts to minority or low-income populations be appreciably more severe or greater in magnitude than those suffered by non-minority or low-income populations?
- Does the Project affect a resource that is especially important to an EJ population? For example, does the Project affect a resource that serves an especially important social, religious, or cultural function for an EJ population?
- What would be the effect of the alternative's offsetting benefits when considering these impacts?
- What would be the effect of mitigation measures that would be incorporated into the alternative and any other enhancements or betterments that would be provided in lieu of mitigation when considering these impacts?

The analysis evaluated EJ primarily by considering the geographical distribution of the potentially adverse impacts and whether they would be concentrated in areas with a high proportion of minority or low-income persons (based on the demographic data presented in the Affected Environment sections); fall mostly on facilities or activities of cultural or economic importance to such populations; or otherwise

[4] FTA Circular 4703.1

affect minority or low-income persons more than the general population. This approach was used to review direct and indirect impacts from the operation of Long Bridge after the completion of the Project and impacts from the construction of the Project, as presented in **Table 17-1** in **Section 17.3, Permanent or Long-Term Effects**, and **Table 17-2** in **Section 17.4, Temporary Effects**.

The analysis also considered mitigation measures that could be incorporated into the alternatives, if and as needed, as well as any beneficial impacts that may offset disproportionate adverse effects on EJ populations.

17.3. Permanent or Long-Term Effects

This section identifies the potential impacts that are frequent, extend from the end of construction through the life of the Project, or cause a permanent change in a resource.

As noted in **Section 17.2.2, Methodology**, all resource topics analyzed in this Environment Impact Statement (EIS) were reviewed to confirm whether adverse effects were identified. **Table 17-1** summarizes the intensities of permanent adverse impacts for each resource. The screening for the potential for disproportionately high adverse effects on EJ populations involved the following steps:

- If the EIS identified no potential adverse effects, the analysis determined there was no potential for disproportionately high adverse effects on EJ populations.
- If the EIS identified adverse effects, the analysis reviewed the locations of the effects to determine if that area overlaps with the areas identified as areas of EJ concern.
    - If no overlap would occur, the analysis determined there was no potential for disproportionately high adverse effects on EJ populations.
- If the analysis identified an overlap between adverse effects and areas of EJ concern, the effects were further examined to determine if adverse effects would be concentrated upon EJ populations or resources of importance to those populations.
    - If the answer to this question was "No," there was no need to further analyze the potential for disproportionately high adverse effects on EJ populations. In these cases, while adverse effects may take place in areas of EJ concern, they would be felt by all populations living in or using the area, regardless of race, ethnicity, or socioeconomic status.

For the majority of resource areas, there would be no overlap between potential effects and areas of EJ concern. The sections below describe the analysis when potential effects would overlap areas of EJ concern. The last column in the table captures this determination.

17.3.1. No Action Alternative

The No Action Alternative would not cause disproportionately high permanent adverse effects on EJ populations because the Project would not be constructed. This section also considers the potential for changes due to planned and funded transportation projects likely to be implemented by 2040, and maintenance projects necessary to keep the existing bridge and corridor in service. These other potential projects are not expected to cause disproportionately high permanent adverse effects on EJ populations.

Table 17-1 | Potential for Permanent Disproportionately High Adverse Effects on EJ Populations

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
Natural Ecological Systems (Section 2.4.1)						
Forests	None	None	Direct Minor	No	No	No
Early Succession Field	None	Direct Minor		No	No	No
Maintained Lawn/ Landscaping	None	Direct Minor		No	No	No
Wetland Vegetation	None	None		No	No	No
Submerged Aquatic Vegetation	None	None		No	No	No
Wildlife Habitat	None	Direct Negligible and Minor		No	No	No
Aquatic Biota	None	Direct Minor		No	No	No
Rare, Threatened, and Endangered (RTE) Species (Section 2.4.2)						
RTE Species	None	Direct Minor		No	No	No
Water Resources and Water Quality (Section 3.4)						
Water Quality	None	Direct Negligible to Minor		No	No	No
Wetlands and Waters of the United States	None	Direct Minor		No	No	No
Floodplains	None	Direct Negligible		No	No	No

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
Chesapeake Bay Preservation Areas	None	Direct Minor		No	No	No
Geologic Resources (Section 4.0)						
Geologic Resources	None	Direct Minor		No	No	No
Soils	None	Direct Minor		No	No	No
Solid Waste and Hazardous Materials (Section 5.0)						
Solid Waste	Direct Negligible	Direct Negligible; Indirect Minor		No	No	No
Hazardous Materials	Direct Negligible	Direct Negligible; Indirect Minor		No	No	No
Transportation (Section 6.0)						
Railroads	None	None	None	No	No	No
Transit	None	None	None	N/A	N/A	No
Pedestrian and Bicycle Network	None	None	None	N/A	N/A	No
Roadway Network	None	None	None	N/A	No	No
Parking	None	Direct Moderate		No	No	No
Aviation	None	None	None	N/A	N/A	No
Navigation	None	None	None	N/A	N/A	No
Air Quality and Greenhouse Gas (GHG) Emissions (Section 7.0)						

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
Local Air Quality	Direct Minor	Direct Minor		No	No	No
Regional Air Quality/ General Conformity	Direct Minor	Direct Minor		No	No	No
GHG Emissions	Direct Minor	Direct Minor		No	No	No
Energy (Section 8.0)						
Energy consumed by railroad infrastructure	None	Direct Minor		No	No	No
Availability of diesel fuel	Direct Minor	Direct Minor		No	No	No
Land Use and Property (Section 9.0)						
Land Use	None	Direct Minor and Moderate		No	No	No
Property	None	Direct Minor	Direct Minor	No	No	No
Consistency with Local Plans	Direct Minor	None		No	No	No
Noise and Vibration (Section 10.0)						
Noise	Direct Minor	Direct Moderate and Major		No	No	No
Vibration	None	None	None	N/A	N/A	No

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
Aesthetics and Visual Resources (11.0)						
George Washington Memorial Parkway (GWMP)	None	Direct Minor to Moderate	Direct Moderate	No	No	No
Mount Vernon Trail	None	Direct Moderate	Direct Moderate	No	No	No
East and West Potomac Parks	None	Direct Negligible and Minor		Yes	No	No
Nighttime Conditions	None	None		No	No	No
Cultural Resources (Section 12.0)						
Richmond, Fredericksburg and Potomac Railroad Historic District	None	Direct and Indirect Negligible		No	No	No
GWMP	None	Direct Moderate; Indirect Negligible	Direct Major; Indirect Moderate	No	No	No
Mount Vernon Memorial Highway (MVMH)	None	Direct Moderate; Indirect Negligible	Direct Major; Indirect Moderate	No	No	No

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
East and West Potomac Parks Historic District	None	Direct Moderate; Indirect Negligible	Direct Major; Indirect Negligible	Yes	No	No
National Mall Historic District	None	Direct and Indirect Negligible		Yes	No	No
Recreation and Parks (Section 13.0)						
Long Bridge Park	None	Direct Negligible; Indirect Moderate to Major	Direct Negligible; Indirect Moderate to Major	No	No	No
GWMP	None	Direct Negligible; Indirect Minor to Moderate		No	No	No
East and West Potomac Parks	None	Direct Minor; Indirect Minor to Moderate	Direct Minor; Indirect Minor to Moderate	No	No	No
Social and Economic Resources (Section 14.0)						
Social	None	None		N/A	N/A	No
Economic	None	Direct Minor		No	No	No
Safety and Security (Section 15.0)						
Railroad Safety	None	None	None	N/A	N/A	No
Public Safety	None	None	None	N/A	N/A	No

	Permanent Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action Alternative	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?	Analyze potential for disproportionately high adverse effects on EJ populations?
Security	None	Direct Negligible		No	No	No
Public Health, Elderly, and Persons with Disabilities (Section 16.0)						
Public Health	None	Direct Negligible		No	No	No
Elderly Persons	None	Direct Negligible		No	No	No
Persons with Disabilities	None	None	None	N/A	N/A	No

*Areas of EJ concern are those that are at least 50 percent minority or 27 percent below 150 percent of the poverty line.

17.3.2. Action Alternative A

Action Alternative A would not result in disproportionately high and adverse permanent impacts on EJ populations. EJ populations would not be denied benefits from Action Alternative A. None of the environmental impacts of Action Alternative A would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Completion of the Action Alternative A would not displace any persons.

Resource topics under which there exists the potential for permanent adverse effects are natural ecological systems; rare, threatened, and endangered species; water resources and water quality; geologic resources; solid waste and hazardous materials; transportation; air quality and greenhouse gas emissions; energy; land use and property; noise; aesthetic and visual resources; cultural resources; recreation and parks; social and economic resources; safety and security; and public health, elderly, and persons with disabilities. However, nearly all of these impacts are not within areas that meet the thresholds used to identify areas of EJ concern.

The only adverse effects that would overlap with a possible EJ population are the negligible direct impacts on the National Mall Historic District (discussed in **Section 12.3.2, Cultural Resources Permanent or Long-Term Effects, Action Alternative A**). These impacts take place adjacent to a couple census blocks identified as 100 percent minority (Blocks 1021 and 1022 of Census Tract 62.02).[5] Any impacts to the integrity of the National Mall Historic District would also be experienced by the general population within study area, regardless of race, ethnicity, or socioeconomic status.

Action Alternative A would also affect approximately 2.4 acres of East Potomac Park. As noted in **Section 17.3.1, Minority Populations**, local District residents including EJ populations who live nearby use East Potomac Park for activities such as cycling along Ohio Drive, walking on trails, and picnicking along the waterfront. However, the effects would not alter the recreational opportunities available to local residents because the majority of these activities take place south of Buckeye Drive, away from the location of impacts to the park. Therefore, there are no disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

17.3.3. Action Alternative B

The potential for impacts on EJ populations resulting from Action Alternative B would be the same as Action Alternative A, with 0.2 additional acres of East Potomac Park affected. Action Alternative B would not result in disproportionately high and adverse permanent impacts on EJ populations. EJ populations would not be denied benefits from Action Alternative B. None of the environmental impacts of Action Alternative B would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Completion of the Action Alternative B would not displace any persons.

17.4. Temporary Effects

This section identifies the potential impacts to the resource that are intermittent, infrequent, or last only for the duration of the construction period.

[5] No housing exists in this area; therefore, the 11 total individuals counted in these two blocks may be homeless individuals.

As noted in the methodology for this section, all resource topics discussed in this document were reviewed to confirm whether adverse effects were identified. **Table 17-2** summarizes the intensities of temporary adverse impacts for each resource. Where there are no adverse effects, further screening for effects on EJ populations are no longer applicable (noted as "N/A" in screening portion of the table). Where adverse effects are identified, the area subject to those effects was reviewed in tandem with the areas identified as areas of EJ concern in the Affected Environment section, and if these areas overlap, it is noted in the table as a "Yes." If there is the potential for overlap, the effects were further examined to determine if adverse effects would be concentrated upon EJ populations or resources of importance to those populations. If the answer to this second question is "No," there is no need to further analyze the potential for disproportionately high adverse effects on EJ populations. In these cases, where adverse impacts may take place in areas of EJ concern, adverse effects would be felt by all populations living in or using the study area, regardless of race, ethnicity, or socioeconomic status. The last column in the table captures this determination.

17.4.1. No Action Alternative

The No Action Alternative would not cause disproportionately high adverse temporary effects on EJ populations because the Project would not be constructed. This section also considers the potential for temporary impacts due to planned and funded transportation projects likely to be implemented by 2040, and maintenance projects necessary to keep the existing bridge and corridor in service. Anticipated effects include noise, vibration, dust, and traffic due to construction activity. Within the Local Study Area, construction for these other potential projects would not occur proximate to EJ populations and therefore are not anticipated to cause disproportionately high temporary adverse effects on EJ populations.

17.4.1. Action Alternative A

Construction of Action Alternative A would not cause any disproportionately high temporary adverse effects on EJ populations. None of the environmental impacts of Action Alternative A would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Construction of Action Alternative A would last approximately 5 years and would not displace any persons. For most resources, any adverse impacts would not overlap with areas of EJ concern.

Resource topics under which exists the potential for temporary adverse effects are natural ecological systems; rare, threatened, and endangered species; water resources and water quality; geologic resources; solid waste and hazardous materials; transportation; air quality and greenhouse gas emissions; energy; land use and property; noise; aesthetic and visual resources; cultural resources; recreation and parks; social and economic resources; safety and security; and public health, elderly, and persons with disabilities. However, nearly all of these impacts are not within areas that meet the thresholds used to identify areas of EJ concern. See the following paragraphs for additional discussion for the resources where adverse impacts would overlap areas of EJ concern.

Transportation: The cluster of four minority census blocks located in the vicinity of the Southwest Waterfront may use some of the bus lines and roadways that construction on the I-395 bridge would affect. However, all users regardless of race, ethnicity, or socioeconomic status would experience impacts on transit service and traffic. Therefore, Action Alternative A would not cause disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

Air Quality: Pollutant emissions during construction would occur from emissions from on-site diesel equipment, increased truck traffic to and from the construction site, and fugitive dust. These emissions are likely to be most concentrated adjacent to the railroad corridor and construction areas, which do not include areas of EJ concern. The general population within the Local Study Area regardless of race, ethnicity, or socioeconomic status would experience these temporary impacts. Therefore, Action Alternative A would not cause disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

Noise: Prior to mitigation, daytime construction noise levels would exceed the District noise ordinance at two receptors in East Potomac Park adjacent to the railroad corridor. As noted above, residents of nearby communities, including minority and low-income residents, use East Potomac Park for activities such as cycling along Ohio Drive, walking on trails, and picnicking along the waterfront. However, the bulk of these activities take place south of Buckeye Drive SW in areas that would not be adversely affected by construction noise. Noise impacts would generally be noticed by trail users on foot or on bicycle passing near the railroad corridor. All users regardless of race, ethnicity, or socioeconomic status would experience these impacts. Therefore, Action Alternative A would not cause disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

Cultural Resources: The negligible impacts from construction on the National Mall Historic District (discussed in **Section 12, Cultural Resources**) would overlap with a possible EJ population. These impacts take place adjacent to the same minority census blocks mentioned in **Section 17.3.2, Action Alternative A**. The general population within the Local Study Area, regardless of race, ethnicity, or socioeconomic status would experience any impacts to the integrity of the National Mall Historic District. Therefore, there are no disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

Recreation and Parks: Temporary impacts to East Potomac Park include use of NPS Parking Lots B and C and the ballfields along Ohio Drive SW near the National Mall and Memorial Parks (NAMA) Headquarters for construction staging. The surface parking areas are heavily used during events such as the National Cherry Blossom Festival, but lightly used most of the rest of the year. As noted above, the bulk of activities in East Potomac Park take place south of Buckeye Drive SW in areas that would not be adversely affected by construction. All users regardless of race, ethnicity, or socioeconomic status would experience the temporary impacts north of Buckeye Drive SW. Therefore, Action Alternative A would not cause disproportionately high adverse effects on EJ populations, and no further analysis was conducted.

Table 17-2 | Potential for Temporary Disproportionately High Adverse Effects on EJ Populations

	Temporary Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action	**Action Alternative A**	**Action Alternative B**	**Impacts overlap with areas of EJ concern?***	**Impacts concentrated in areas of EJ concern? Resources important to EJ populations?***	**Analyze potential for disproportionately high adverse effects on EJ populations?**
Natural Ecological Systems (Section 2.4.1)						
Forests	None	None	None	No	No	No
Early Succession Field	None	Direct Minor		No	No	No
Maintained Lawn/ Landscaping	None	Direct Minor		No	No	No
Wetland Vegetation	None	None	None	No	No	No
Submerged Aquatic Vegetation	None	None	None	No	No	No
Wildlife Habitat	None	Direct Minor		No	No	No
Aquatic Biota	None	Direct Negligible and Minor		No	No	No
RTE Species (Section 2.4.2)						
RTE Species	None	Direct Negligible and Minor		No	No	No
Water Resources and Water Quality (Section 3.4)						
Water Quality	None	None	None	No	No	No
Wetlands and Other Waters of the United States	None	Direct Minor		No	No	No
Flood Hazards and Floodplain Management	None	Direct Negligible		No	No	No

	Temporary Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?*	Analyze potential for disproportionately high adverse effects on EJ populations?
Chesapeake Bay Preservation Areas	None	Direct Minor		No	No	No
Geologic Resources (Section 4.0)						
Geologic Resources	None	Direct Minor		No	No	No
Soils	None	Direct Minor		No	No	No
Solid Waste and Hazardous Materials (Section 5.0)						
Solid Waste	None	Direct Minor		No	No	No
Hazardous Materials	None	Direct Minor		No	No	No
Transportation (Section 6.0)						
Railroads	Direct Minor	Direct Moderate		No	No	No
Transit: Virginia Railway Express	Direct Minor	Direct Minor		No	No	No
Transit: Washington Metropolitan Area Transit Authority	None	Direct Minor		No	No	No
Transit: Local and Commuter Bus	Direct Minor	Direct Moderate and Major		Nearby	No	No
Pedestrian and Bicycle Network	Direct Minor	Direct Moderate	Direct Major	No	No	No
Roadway Network	Direct Minor	Direct Negligible to Major		No	No	No

	Temporary Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?*	Analyze potential for disproportionately high adverse effects on EJ populations?
Parking	None	Minor to Major		No	No	No
Aviation	None	None	None	No	No	No
Navigation	None	Direct Minor	Direct Minor	No	No	No
Air Quality and GHG Emissions (Section 7.0)						
Impacts to Air Quality and GHG	None	Direct Minor		No	No	No
Energy (Section 8.0)						
Energy Consumed by Vehicles and Equipment	None	Direct Minor		No	No	No
Land Use and Property (Section 9.0)						
Land Use	None	Direct Moderate	Direct Major	No	No	No
Property	None	Direct Major		No	No	No
Noise and Vibration (Section 10.0)						
Noise	None	Direct Moderate	Direct Major	No	No	No
Vibration	None	None	None	No	No	No
Aesthetics and Visual Resources (Section 11.0)						
Long Bridge Park	None	Direct Minor		No	No	No
GWMP	None	Direct Moderate		No	No	No

	Temporary Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?*	Analyze potential for disproportionately high adverse effects on EJ populations?
Potomac River and Washington Channel	None	Direct Minor		No	No	No
East Potomac Park and Monumental Core	None	Direct Moderate		No	No	No
L'Enfant Plaza and Southwest Waterfront	None	Direct Moderate		No	No	No
Cultural Resources (Section 12.0)						
GWMP	None	Direct and Indirect Moderate		No	No	No
MVMH	None	Direct and Indirect Moderate		No	No	No
East and West Potomac Parks Historic District	None	Direct and Indirect Moderate		No	No	No
National Mall Historic District	None	Direct and Indirect Minor		Yes	No	No
Plan of the City of Washington	None	Direct and Indirect Negligible		No	No	No
Recreation and Parks (Section 13.0)						
Long Bridge Park	None	Direct Minor		No	No	No
GWMP	None	Direct Moderate	Direct Major	No	No	No
East and West Potomac Parks	None	Direct Moderate	Direct Major	No	No	No
Hancock Park	None	Direct Minor		No	No	No

	Temporary Adverse Effect Intensity			Screening for Adverse Effects on EJ Populations		
	No Action	Action Alternative A	Action Alternative B	Impacts overlap with areas of EJ concern?*	Impacts concentrated in areas of EJ concern? Resources important to EJ populations?*	Analyze potential for disproportionately high adverse effects on EJ populations?
Social and Economic Resources (Section 14.0)						
Social	Direct Minor	Direct Minor		No	No	No
Economic	None	Direct Minor or Major		No	No	No
Safety and Security (Section 15.0)						
Railroad Safety	None	Direct Minor		No	No	No
Public Safety	None	Direct Minor		No	No	No
Security	None	Direct Minor		No	No	No
Public Health, Elderly, and Persons with Disabilities (Section 16.0)						
Public Health	None	Direct Minor		No	No	No
Elderly Persons	None	Direct Negligible		No	No	No
Persons with Disabilities	None	Direct Negligible		No	No	No

*Areas of EJ concern are those that are at least 50 percent minority or 27 percent below 150 percent of the poverty line.

17.4.2. Action Alternative B

Action Alternative B would have similar temporary impacts to those described under Action Alternative A. The only differences in the potential for impacts than those described in **Section 17.4.1, Action Alternative A**, are:

- A small change in the precise locations of impacts, and
- The effects would last approximately 3 years longer than Action Alternative A.

For the same reasons described in **Section 17.4.1, Action Alternative A**, construction of Action Alternative B would not cause any disproportionately high temporary adverse effects on EJ populations. None of the environmental impacts of Action Alternative B would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Construction of the Action Alternative B would not displace any persons.

17.5. Avoidance, Minimization, and Mitigation

The Project would not cause disproportionately high adverse effects on EJ populations. Therefore, no avoidance, minimization, nor mitigation measures are warranted beyond those already described for other resources where direct and indirect effects on those resources are described (including **Section 6.0, Transportation; Section 7.0, Air Quality and Greenhouse Gases;** and **Section 9.0, Land Use**).

17.6. Coordination with Environmental Justice Communities

One of the guiding principles of EJ is ensuring full and fair access to meaningful involvement by minority and low-income populations in project planning and development. Therefore, a robust, sustained, and transparent engagement process is essential through the life of the Project.

FRA and the District Department of Transportation (DDOT) have provided and will continue to provide opportunities for public involvement prior to and throughout the National Environmental Policy Act of 1969 (NEPA) process through the Project website, contact list, public information meetings, and public comment periods. FRA and DDOT implemented an Agency and Public Coordination Plan in accordance with the requirements of 23 USC 139.

The goals for public involvement in the Project are:

- To provide an opportunity and a mechanism for public participants to engage in the development of the EIS and give relevant input to the Project.
- To focus public input in a structured manner that will allow decisions to be made with the maximum benefit from public involvement.
- To ensure that elected officials, agencies, stakeholders, and the general public are adequately informed about the Project and its implications for their communities, and to identify potential issues so that they can be addressed and resolved before the completion of the EIS process.

The following principles have been adopted to support involvement of local EJ communities in the Study Area:

- Documents, notices, and meetings will be made concise, understandable, and readily accessible to the public;
- Informational material will be made available through a variety of outlets;

- All public events will be scheduled at convenient and accessible locations and times;
- Title VI forms will be provided at meetings; and
- Various community leaders and groups will be contacted to increase public participation of constituent communities.

The Project website, newspaper advertisements (*Washington Post Express, El Tiempo Latino*), press releases, email blasts, local distribution of meeting flyers (nearby public facilities, community groups), and social media (FRA and DDOT Facebook and Twitter) have been and will continue to be used to publicize all public meetings. Advertisements have been published in Spanish, and translation services have been available to public meeting attendees, and American Sign Language interpreters have been available at meetings. Meeting announcements have included information on how to request special accommodations and language assistance services (translation or interpretation).

DDOT is committed to providing all citizens, regardless of race, color, age, gender, or national origin, the opportunity to participate in and respond to transportation plans, programs, and activities that may affect their community. To help ensure DDOT reaches this goal and maintains compliance with Title VI of the Civil Rights Act of 1964 and all relevant Federal and local nondiscrimination laws, DDOT asked participants at each meeting to voluntarily complete a Title VI public involvement questionnaire.

Public outreach for the Project was initiated in 2012, prior to the initiation of the NEPA process, with the Phase I Study and development of the Project website (www.longbridgeproject.com). The Phase I Study included three public meetings conducted in an open-house format between November 2012 and December 2013. Meetings were announced through advertisements in the *Washington Post*, postcards distributed at Metrorail stations during morning commute hours, and email distribution to the Project mailing list.

Following the initiation of the Phase II Study, FRA and DDOT held a public meeting on February 10, 2016, to update the public on the Project status and schedule. This meeting was announced through an advertisement in the *Washington Post Express*, website notification, and email distribution to the Project mailing list.

FRA and DDOT held a public scoping open house meeting on September 14, 2016. Materials presented at the meeting, included displays, a Fact Sheet, and the Draft Purpose and Need, are available on the project website. Stakeholders, elected officials, and the public were notified of the meeting through issuance of the NOI and email notification. Flyers were also mailed to adjacent property owners. Advertisements were published in the *Washington Post* and the *Washington Post Express*.

Following Scoping, FRA and DDOT held three public meetings to provide information about the project and solicit feedback at key milestones. These meetings were held on May 16 and December 14, 2017, and on November 29, 2018. Materials presented at the meetings, including displays and the presentation, are available on the project website. The project website also provides summaries of the December 14, 2017, and November 29, 2018, meetings. FRA and DDOT publicized each meeting by:

- Posting information on the Project website, www.longbridgeproject.com, beginning three weeks prior to the meeting.
- Publishing advertisements in two newspapers—*Washington Post Express* (English) and *El Tiempo Latino* (Spanish)— to inform both the English-speaking public and the Spanish-speaking public of the meeting.

- Distributing an e-blast notification to the Project electronic mailing list three weeks prior to the meeting and a reminder notification three days prior to the meeting.
- Announcing the meeting through a DDOT-issued press release.
- Publicizing the meeting via social media, including the DDOT Twitter account and the FRA Facebook account.

Following publication of the Draft EIS, FRA and DDOT will hold a public hearing. The public hearing will include an opportunity for oral testimony, to be recorded by a stenographer. Comments and testimony provided at the public hearing will be addressed in the Final Environmental Impact Statement. Spanish-language translators will be available at the public hearing.

18.0 Cumulative Impacts

18.1. Introduction

The Long Bridge Project would result in direct or indirect adverse or beneficial effects to a range of resources, as described in prior sections. Some of the Long Bridge Project's impacts, whether minor or major, when combined with the effects of other past, present, or reasonably foreseeable future actions, may result in substantive effects to environmental or social (human) resources. These combined impacts are referred to as **cumulative impacts**.

Because this section evaluates the cumulative impacts for multiple resources, the structure of this section differs somewhat from previous sections that focused on the impacts on a single resource category. Rather than documenting the affected environment, this chapter (in **Section 18.2.2, Methodology**) provides an overview of the resources evaluated, the geographic time span considered, and the past, present, and future actions included in the cumulative analysis. This chapter discusses permanent or long-term cumulative effects for each relevant resource and then summarizes temporary cumulative effects by the category of cumulative action.

18.2. Regulatory Context and Methodology

This section describes the most pertinent regulatory context for evaluating cumulative impacts, and summarizes the methodology used to evaluate those impacts. The *Methodology Report* provides a complete list of laws, regulations, and other guidance considered and a full description of the analysis methodology followed for these resources.

18.2.1. Regulatory Context

The analysis in this section evaluates direct and indirect changes to the environment resulting from the Long Bridge Project and from past and reasonably foreseeable future actions, consistent with Council on Environmental Quality and other agency guidance documents:

- Considering Cumulative Effects Under the National Environmental Policy Act (NEPA);[1]
- Guidance on the Consideration of Past Actions in Cumulative Effects Analysis;[2]
- Secondary and Cumulative Impact Assessment in the Highway Project Development Process;[3]

[1] Council on Environmental Quality Executive Office of the President. 1997. *Considering Cumulative Effects Under the National Environmental Policy Act.* Accessed from https://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf. Accessed August 2, 2017.

[2] Council on Environmental Quality Executive Office of the President. 2005. *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*. Accessed from https://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-PastActsCumulEffects.pdf. Accessed August 2, 2017.

[3] Federal Highway Administration. 1992. *Secondary and Cumulative Impact Assessment in the Highway Project Development Process*. Position Paper. Accessed from https://www.environment.fhwa.dot.gov/guidebook/content/Secondary_Cumulative_Impact_Assessmt.asp. Accessed June 7, 2017.

- Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process;[4]
- National Cooperative Highway Research Program (NCHRP) 25-25 Task 11: Indirect and Cumulative Impact Analysis;[5] and
- NCHRP Report 423A: Land Use Impacts of Transportation: A Guidebook. [6]

18.2.2. Methodology

18.2.2.1. Resources Evaluated

For each resource area, impacts of other past, present, and reasonably foreseeable future projects (without the Long Bridge Project) are summarized, and the cumulative impacts (including the Long Bridge Project) are assessed. The analysis considers how impacts in one category (for example, traffic changes) might affect other categories (for example, air quality). Some resources are expected to be negligibly affected by any of the Long Bridge Project alternatives, while most resources are expected to have minor or moderate impacts.

18.2.2.2. Geographic Area and Time Span

The cumulative impacts analysis defines a time frame and geographic range for the evaluation and takes into account changes from other projects within this time frame that contribute to cumulative effects on the resources.

For most resources, prior changes are evaluated for the period from 2007 to 2017. This period captures the end of the previous development boom and the post-recession development in the area. The last 10 years is generally considered a reasonable temporal boundary for past actions. The cumulative impact assessment of past actions is not assessed on an individual basis, but considers the aggregate effects of relevant past actions.[7] For each resource, future impacts will be considered in the timeframe of the Planning Year (2040).

Spatial boundaries for the analysis vary by resource, according to the specific characteristics of the resource, regulatory jurisdictions, and the availability of meaningful data. In general, the Study Area for cumulative impacts includes a broad study area to encompass actions in which effects could incrementally add to the impacts of the Proposed Action. The analysis used readily available data sources for past and future changes.

For each resource, the analysis took into consideration past changes to the selected resources that resulted from development trends or major projects within the Local Study Area defined for each resource area. These resource-specific Study Areas may differ from each other based on resource-specific concerns, and conversely, some resource-specific Study Areas are the same. The cumulative

[4] Federal Highway Administration. 2003. *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*. Accessed from https://www.environment.fhwa.dot.gov/guidebook/qaimpact.asp. Accessed June 7, 2017.
[5] Transportation Research Board. 2006. *NCHRP 25-25 Task 11: Indirect and Cumulative Impact Analysis*. Accessed from http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(11)_FR.pdf. Accessed August 8, 2017.
[6] Transportation Research Board. 1999. *NCHRP Report 423A: Land Use Impacts of Transportation: A Guidebook.*
[7] Transportation Research Board. 2006. *NCHRP 25-25 Task 11: Indirect and Cumulative Impact Analysis.* Accessed from http://onlinepubs.trb.org/onlinepubs/archive/NotesDocs/25-25(11)_FR.pdf. Accessed August 8, 2017.

analysis considers the extent of the area covered for each resource area. Future changes to the selected resources are based on historic or recent trends, or specific projects, including all reasonably foreseeable projects and that are programmed for construction.

The projects that may or have affected the same resources affected by the Long Bridge Project belong to three categories: transportation, private development, and park planning and development. **Figure 18-1 shows** the resource-specific Local Study Areas used to identify these projects**. Section 18.2.3, Past, Present, and Reasonably Foreseeable Actions** briefly describes each of these projects. The Local Study Areas are:

- **Transportation (see Section 6.0, Transportation and Navigation)**: within 0.25 miles of the Long Bridge Corridor
- **Private Development Projects (see Section 9.0, Land Use and Property)**: within 0.5 miles of the Long Bridge Corridor
- **Parks (see Section 13.0, Recreation and Parks)**: within 0.25 miles of the Long Bridge Corridor

The cumulative impacts analysis did not identify a Regional Study Area because cumulative effects are focused on those areas where the impacts of the Long Bridge Project overlap with impacts of other past, present, and reasonably foreseeable future projects, and these impacts are captured within the Local Study Area.

Because most of the reasonably foreseeable projects identified as part of the cumulative scenario are in early planning stages and are at the conceptual design stage, effects to environmental resources have largely not been quantified. The cumulative impacts of these projects are therefore assessed qualitatively based on the assumed level of impact. If impacts have been identified in a NEPA document, that information has been incorporated into the description.

18.2.3. Past, Present, and Reasonably Foreseeable Actions

The analysis of cumulative impacts includes projects within the relevant Study Areas that are reasonably foreseeable—in other words, projects that are planned or programmed for construction within the time frame of this analysis or which are likely to occur.

Projects identified below have been assessed to determine if they meet the following criteria for inclusion in the cumulative scenario:

- Actions are inside the geographic boundaries and time frame established for the cumulative effects analysis.
- Actions that would affect resources that are the subject of the cumulative effects analysis.

18.2.3.1. Transportation and Infrastructure Projects

The cumulative scenario includes the existing transportation network, plus all proposed transportation and infrastructure projects by the planning year of 2040 within the transportation Local Study Area (0.25 miles from the existing Long Bridge Corridor). These projects are described in detail in **Section 1.4.1, No Action Alternative** and they are listed in **Table 18-1** below.

Figure 18-1 | Local Study Areas Used to Identify Cumulative Actions

Table 18-1 | Transportation Projects Included in the No Action Alternative

Project	Location	Description	Year Complete	Reference
RAILROAD PROJECTS				
Fourth Track from AF to RO Interlocking[1]	Arlington and Alexandria, VA	Add a fourth track from the AF to RO Interlocking, with associated improvements to RO Interlocking, as part of corridor-wide upgrades to support higher operating speeds.	2025	DC to Richmond Southeast High Speed Rail (DC2RVA) FEIS and Record of Decision (ROD)
VRE L'Enfant Station Improvements	VRE L'Enfant Station (DC)	Create an island platform and allow for simultaneous boarding of two tracks at L'Enfant Station, and extend and widen platform to accommodate eight-car trains and a future fourth track.	2024	VRE Capital Improvement Plan (CIP)
L'Enfant North and South Storage Tracks	VRE L'Enfant Station (DC)	Convert existing side tracks at VRE L'Enfant Station to storage tracks while permanent Midday Storage Facility is under construction.	2019	VRE CIP
Fourth Track LE to Virginia (VA) Interlocking	12th Street Expressway to 3rd Street SW (DC)	Provide additional main track between the VA and LE Interlocking in DC.	2023	VRE CIP
Virginia Avenue Tunnel [2]	Under Virginia Avenue between 2nd Street SE and 11th Street SE (DC)	Replace existing tunnel with two new tunnels capable of accommodating double-stack intermodal freight trains.	2018	Virginia Avenue Tunnel FEIS and ROD
ROADWAY PROJECTS				
Boundary Channel Drive Interchange	Boundary Channel Drive/I-395 Interchange in Arlington, VA	Redesign and reconstruction of Long Bridge Park Drive interchange with I-395 and Boundary Channel Drive to increase safety and better accommodate multimodal transportation.	2021	Arlington County CIP

[1] "AF" and "RO" are the proper names of the interlockings. They are not acronyms.

[2] The Virginia Avenue Tunnel is not within the Study Area, but directly relates to the operations and infrastructure of the corridor and therefore was included as part of the No Action Alternative Infrastructure.

In addition to the transportation projects included in **Table 18-1**, the cumulative impacts analysis includes the following projects that lie just outside the 0.25-mile study area:

- The **Washington, DC Optimization the Airspace and Procedures in the Metroplex (DC OAPM)** project involved implementation of optimized air traffic control procedures that standardize aircraft routing to and from airports in the Washington Metropolitan Region, including Ronald Reagan Washington National Airport.[8] Planes traveling to and from the airport cross the Local Study Area and contribute to cumulative impacts on soundscapes.
- The **Potomac River Tunnel** project will include construction of a tunnel and supporting infrastructure to provide control for seven combined sewage overflow (CSO) outfalls along the Potomac River. With this project, instead of being discharged directly to the river, the captured combined sewage would be stored and conveyed to a treatment facility.[9]
- The **Potomac Yard Metrorail Station** project will construct a new Metrorail station at Potomac Yard, including tracks, a new platform, and pedestrian bridges. This project is located just south of the study area in Alexandria and will have visual and property impacts to the GWMP.[10]
- The **VRE Crystal City Station Improvements** project will construct a longer platform at the VRE Crystal City station, to be served by two tracks (currently the station is served by a single track). If construction of this project were to occur concurrently with the Long Bridge Project, coordination would be required.[11]

18.2.3.2. Private Development Projects

In a few portions of the Local Study Area for Land Use and Property, private development has dominated the landscape, and redevelopment projects are underway and planned for the near future. One of these areas of development occurs south and west of Long Bridge Park in Arlington County and includes predominantly privately-owned properties at the northern end of Crystal City and a portion of Pentagon City to the west.

In the District, land use is characterized by a growing area of residential and commercial land uses in the southwestern portion of the Local Study Area. While this area and its vicinity consist largely of single-use buildings, it also includes emerging pockets of mixed-use development, typically with ground-floor retail uses and office or residential uses on the upper floors.

Due to the rapidly evolving nature of land use within the Local Study Area, assessing potential land use impacts requires a baseline understanding of anticipated land use changes by the Long Bridge Project's 2040 opening date. This understanding of future land use is informed by local planning guidance in the District and Arlington County, as well as by ongoing and future development projects currently under

[8] Federal Aviation Administration. 2013. *Draft Environmental Assessment for Washington, D.C. Optimization of Airspace and Procedures in the Metroplex*. Accessed from http://www.metroplexenvironmental.com/dc_metroplex/dc_docs.html. Accessed October 24, 2018.
[9] National Park Service. 2018. *DC Clean Rivers Project, Potomac River Tunnel Environmental Assessment*. Accessed from https://parkplanning.nps.gov/documentsList.cfm?projectID=50548. Accessed May 15, 2019.
[10] City of Alexandria. 2019. *Potomac Yard Metrorail Station Project*. Website. Accessed from https://www.alexandriava.gov/PotomacYardMetro. Accessed July 23, 2019.
[11] Virginia Railway Express. 2018. *Crystal City Station Improvements*. Website. Accessed from https://www.vre.org/development/station-improvements/crystal-city-station-improvements/. Accessed July 23, 2019.

construction or in the planning stages. Planned future land use in Arlington County and the District is shown in **Figure 10-5**, in **Section 9, Land Use and Property**, in the *Affected Environment Report* (June 2018).

Table 18-2 summarizes 16 recently completed and reasonably foreseeable development projects within the Study Area for land use as of October 2018. Several projects are in early planning stages and the exact land use and size of the development is still to be determined.[12]

This table is not an exhaustive list of private development taking place within the Local Study Area for land use (0.5 miles of the existing Long Bridge Corridor); however, it provides context for the large-scale redevelopment taking place as part of the cumulative scenario for the Long Bridge Project. Because these projects are taking place in a heavily developed urban environment and can often be classified as redevelopment, the analysis of cumulative impacts below assumes the following: (1) these developments will not cause any noticeable increase in impervious surface, (2) they would take place in a way consistent with existing plans, and (3) they would not cause any other substantial impacts on natural and cultural resources beyond those described in **Section 18.3, Permanent or Long-Term Effects**.

In November 2018, Amazon announced they had selected National Landing in Arlington as the site of one of its new East Coast headquarters.[13] The headquarters will eventually bring more than 25,000 jobs to Crystal City and Pentagon City. The new headquarters will not change future land use plans in the Local Study Area. As stated in the proposal for the new headquarters, "all buildings, existing or proposed, are fully master plan approved, with all zoning in place."[14]

[12] Information on the near-term development activity was compiled and sourced from the following agencies: DC Office of Planning, the DC Department of Consumer and Regulatory Affairs, the DC Office of Zoning, the DC Zoning Commission, the DC Board of Zoning Adjustment, the District Office of the Deputy Mayor for Planning and Economic Development, the Southwest Business Improvement District, Arlington County, and the local Advisory Neighborhood Commissions.
[13] Arlington County. "Northern Virginia's National Landing Selected for Major New Amazon Headquarters." November 13, 2018. Accessed from https://www.arlingtoneconomicdevelopment.com/resources/news/news-releases/northern-virginias-national-landing-selected-for-major-new-amazon-headquarters/. Accessed December 20, 2018.
[14] *Innovation Lives Here: Northern Virginia Amazon HQ2 Submission,* p. 208. 2017. Accessed from https://hqnova.com/downloads.html. Accessed December 20, 2018.

Table 18-2 | Reasonably Foreseeable Development Projects in Local Study Area

Project Name	Location	Project Status	Land Use/Size
1770 Crystal Drive Expansion	Arlington County	Planning	Office: 11,642 square feet (sf)
The Altaire	Arlington County	In Construction	Residential: 453 units
Boeing Site (Phase II)	Arlington County	Planning	Office: 131,338 sf
Potomac Yard – Land Bay C (National Gateway 3-4-5-6)	Arlington County	Planning	Office: 1,064,298 sf Retail: 4,1325 sf
Amazon's HQ2	Arlington County	Planning	TBD
Waterfront Station West/East Residential Towers	Washington, DC	Completed 2014	Residential: 424 units
400 E Street SW (Parcel 69)	Washington, DC	Completed 2015	Retail: 1,200 sf Hotel: 143,800 sf Municipal: 17,750 sf
450 6th Street SW (Old Engine Co 13)	Washington, DC	In Construction	Retail: 13,000 sf Residential: 160 units Hotel: 95,000 sf
The Wharf (SW Waterfront) Phase I	Washington, DC	Completed 2015	Office: 465,000 sf Retail: 205,000 sf Residential: 841 units Hotel: 441,500 sf Municipal: 140,000 sf
The Wharf (SW Waterfront) Phase II	Washington, DC	Planning	Office: 531,590 sf Retail: 88,613 sf Residential: 486,502 sf Hotel: 82,516 sf
Waterfront Station – Eliot on 4th	Washington, DC	In Construction	Retail: 5,000 sf Residential: 365 units
Waterfront Station II	Washington, DC	Planning	Retail: 30,000 sf Residential: 443 sf
500 L'Enfant Plaza	Washington, DC	In Construction	Office and Conference Center: 20,000 sf Green space: 70,000 sf
The Portals Residential Tower (Portals V)	Washington, DC	In Construction	Residential: 373 units
Riverside Baptist Church Redevelopment	Washington, DC	Planning	Retail: 9,100 sf Residential: 170 units Church space: TBD
Spy Museum at L'Enfant Plaza Complex	Washington, DC	In Construction	Museum space: 140,000 sf

18.2.3.3. Park Planning and Development

Park lands of various ownership comprise a substantial portion of the land surrounding the Long Bridge Corridor. Several park improvement projects, both federal and non-federal, have the potential to contribute impacts to the cumulative scenario. These past, present, and reasonably foreseeable future actions related to park planning and development that are located both in Arlington County and the District, and are described below.

Long Bridge Park Development

Long Bridge Park, located on the north end of Crystal City in Arlington County, consists of 30 acres of recreation and open space. Formerly known as the North Tract Project, this park was created from a former brownfield site. Phase I was completed in 2011 and included environmental remediation, utilities installation, and construction of three full-sized athletic fields, the first section of the Esplanade, picnic groves, rain gardens, and walkways. Phase I also included construction of park facilities such as restrooms, staff offices, and vending services. Phase II is currently underway and will include construction of the 120,420-square-foot aquatics and fitness center, which will feature indoor pools and health and fitness spaces. Also included in this phase will be the development of another 10.5 acres of park land, including the extension of the Esplanade, rain gardens, public gathering areas, parking, and support spaces.

Dwight D. Eisenhower Memorial

The Dwight D. Eisenhower Memorial is under construction along Independence Avenue SW at its intersection with Maryland Avenue SW. Designed by architect Frank Gehry, this memorial will be a 4-acre urban park off the National Mall. It will feature a one-of-a-kind stainless-steel tapestry, bronze sculptures, and stone bas-reliefs representing President Eisenhower's achievements. The memorial will also feature landscaped lawn and ornamental trees to create a park atmosphere. From the memorial site, visitors will experience dramatic views of the United States Capitol down Maryland Avenue as well as views of the National Air and Space Museum, the Federal Aviation Administration building, the United States Department of Education building, the Voice of America building, and the United States Department of Health and Human Services building. The memorial is anticipated to be completed and dedicated in 2020.

Benjamin Banneker Park Connection

In 2017, the National Park Service (NPS), in cooperation with the National Capital Planning Commission, and in collaboration with the District and Hoffman-Madison Waterfront, constructed a temporary connection at Benjamin Banneker Park that includes a stairway and Architectural Barriers Act Accessibility Standard (ABAAS)-compliant ramp to provide universal accessibility between 10th Street SW and Maine Avenue SW, along the Southwest Waterfront.

NPS National Capital Region Campus Renovation Project and Park Police District 1 Substation

NPS is undertaking a project to renovate the existing National Capital Region (NCR) buildings and construct a new US Park Police (USPP) building on the NCR campus within East Potomac Park. This project will include renovating the existing NCR building, which will be reused as a shared building for both NCR and USPP. The existing temporary trailers will be removed. The existing USPP building will be renovated and reused for the National Mall and Memorial Parks headquarters. A new 13,000-square-

foot facility for the USPP District 1 police station will be constructed within the footprint of the existing surface parking, which will be reconfigured to include secure parking for police cruisers. Construction for the NCR campus renovation has not yet started, but the USPP District 1 police station is currently under construction.

Arlington County and Vicinity Boathouse

NPS is undertaking a project to create a public rowing and paddling facility along the Virginia shoreline of the Potomac River. Part of this project would include a soft launch point for paddlecraft at Roaches Run. A short, floating dock would be installed, and existing riprap would be removed. An existing road would be used for pedestrian access and would connect to an existing parking area to minimize disturbance.

18.3. Permanent or Long-Term Effects

The following sections define the impacts of other past, present, and reasonably foreseeable future actions and describe the contribution of the Long Bridge Project to the overall cumulative effect. If the Long Bridge Project does not have the potential to have a direct or indirect impact on a resource, there does not exist the potential for cumulative impacts on that resource.

18.3.1. Natural Ecological Systems and Endangered Species

18.3.1.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 2.0, Natural Ecological Systems and Endangered Species**, Action Alternative A would result in direct minor adverse impacts on vegetation and wildlife habitat due to removal of some early succession scrub-shrub areas (0.1 acres), removal of maintained lawn and landscaping (3.6 acres), removal of several mature hardwood trees, and minor encroachments to brushy and narrow strips of trees and small forested habitat. There would also be direct minor adverse impacts on aquatic biota due to the disturbance of soft substrate on river bottoms of the Potomac River (0.2 acres) and the Washington Channel (<0.1 acres). The addition of bridge piers in the Potomac River would permanently disturb bottom substrate, reducing available foraging habitat of the shortnose sturgeon and Atlantic sturgeon by 0.2 acres, resulting in a direct minor adverse impact. There would be no indirect permanent impacts on natural ecological systems or endangered species under Action Alternative A.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to result in permanent impacts on natural ecological systems and endangered species include transportation projects, private development, and park planning and development. All three types of actions have the potential for similar impacts on natural ecological systems and endangered species. While much of this area is already developed, some limited vegetation removal may need to take place for modified footprints or new development. Vegetation removal has secondary impacts on wildlife habitat. Given the developed nature of the area, these other past, present, and reasonably foreseeable future projects would have minor adverse impacts on natural ecosystems and endangered species.

Cumulative Impact: The permanent impacts of the Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an

overall minor adverse cumulative impact on natural ecosystems and endangered species. This is because, given the already developed nature of the Local Study Area, the cumulative impacts would not affect the function or integrity of wildlife habitat.

18.3.1.2. Action Alternative B

The permanent impacts of Action Alternative B would be the same as described under Action Alternative A, as discussed in **Section 2.0, Natural Ecological Systems and Endangered Species**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.2. Water Resources and Water Quality

18.3.2.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 3.0, Water Resources and Water Quality**, Action Alternative A would result in negligible to minor adverse impacts on groundwater recharge, peak runoff rates, or total runoff volume due to relatively small increases in impervious area in three area watersheds: the Potomac River (1.9 acres), Roaches Run (<0.1 acres), and District MS4 (0.8 acres). The increase would allow for buildup and wash-off of pollutants, which would cause a minor adverse impact on water quality in the Potomac River, Roaches Run, and the District MS4 watershed. Action Alternative A would also result in minor adverse impacts to the following wetlands and waters of the United States: the Potomac River (0.5 acres) and the Washington Channel (<0.1 acres). The decking of the new bridge would create additional impervious surface, causing a permanent impact to 0.2 acres of Chesapeake Bay Preservation Areas through increased pollutant loading to waterbodies and loss of vegetation underneath bridge areas. There would be no indirect permanent impacts on water resources and water quality under Action Alternative A.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect water resources and water quality include the railroad projects outlined in **Table 18-2** and the development of the Long Bridge Park Aquatics Center.

The Fourth Track Virginia (VA) to L'Enfant (LE) Interlocking and the L'Enfant South Storage Track projects, both located in the northeastern portion of the Local Study Area for this resource, and the Fourth Track RO to Alexandria-Franconia (AF) Interlocking project, located at the southeastern extent of the Local Study Area, would likely result in a slight increase in impervious area or conversion of a small area from previously disturbed vegetated area to rail ballast.

While existing ground cover in this area consists almost entirely of impervious cover that inhibits groundwater recharge, the other transportation developments and development of the Long Bridge Park Aquatics Center would result in an increase in impervious area within the Local Study Area. As a result, other actions would have negligible long-term adverse impacts on groundwater quantity through the reduction in groundwater recharge. This reduction in groundwater recharge could be mitigated through implementation of stormwater best management practices (BMPs). If designed in accordance with the District Department of Energy and Environment *Stormwater Management Guidebook* or the

Arlington County *Stormwater Manual*,[15] these BMPs would provide the prescribed recharge volume to mitigate any long-term adverse impacts to groundwater quantity. Similarly, overland surface water quality would be maintained through implementation of BMPs.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on water resources and water quality. This is because the cumulative impacts would not affect the function or integrity of water resources or water quality.

18.3.2.2. Action Alternative B

Impact from Long Bridge Project: As described in **Section 3.0, Water Resources and Water Quality**, Action Alternative B would have the same impacts on wetlands and waters of the United States as described under Action Alternative A. Action Alternative B would have similar permanent impacts on water quality as Action Alternative A, but there would be an increase in the amount of impervious surface in the Potomac River at 3.8 acres, which would be a minor adverse impact. Similarly, there would be an increase in permanent minor adverse impacts over Alternative A on the Chesapeake Bay Preservation Areas at 0.3 acres. There would be no indirect permanent impacts on natural ecological systems or endangered species under Action Alternative B.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect water resources and water quality include the railroad projects outlined in **Table 18-2** and the development of the Long Bridge Park Aquatics Center. These impacts are described under Action Alternative A above.

Cumulative Impact: The permanent impacts of Action Alternative B when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on water resources and water quality.

18.3.3. Geologic Resources

18.3.3.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 4.0, Geologic Resources**, Action Alternative A would result in permanent minor adverse impacts on geologic resources due to earthwork and foundations required for the new structures as well as due to the potential soil loss following construction. There would be no indirect permanent impacts on geologic resources under Action Alternative A.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect geologic resources include transportation improvements, private development, and park planning and development. All of these actions have the potential for some earthwork, and some may require foundation installation. These actions would likely result in negligible to minor adverse impacts on geologic resources.

[15] Arlington County Department of Environmental Services. *Stormwater Manual: A Guide to Stormwater Requirements for Land Disturbing Activities in Arlington County*. January 2015. Accessed from http://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/21/2014/06/DES-Stormwater-Management-Ordinance-Guidance-Manual.pdf. Accessed January 12, 2018.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on geologic resources.

18.3.3.2. Action Alternative B

Impact from Long Bridge Project: As described in **Section 4.0, Geologic Resources**, the permanent impacts of Action Alternative B would be similar to those described under Action Alternative A, but would be greater due to the additional earthwork and foundations required for the additional new bridge. These permanent impacts would be minor and adverse. There would be no indirect permanent impacts on geologic resources under Action Alternative B.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect geologic resources include transportation improvements, private development, and park planning and development. Impacts of these actions are described under Action Alternative A above. These actions would likely result in negligible to minor adverse impacts on geologic resources.

Cumulative Impact: The permanent impacts of Action Alternative B when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on geologic resources.

18.3.4. Solid Waste Disposal and Hazardous Materials

18.3.4.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 5.0, Solid Waste Disposal and Hazardous Materials**, Action Alternative A would result in permanent negligible adverse impacts on solid waste disposal due to a marginal increase in solid waste generation during routine maintenance. Action Alternative A would also continue to result in negligible adverse impacts to the environment from hazardous materials due to the ongoing use of herbicides for vegetation management and due to releases of oil or hazardous materials from trains. Additionally, indirect, negligible adverse impacts would result from the generation of approximately 26,000 cubic yards of soil during construction that would require off-site disposal, along with any contaminated materials that could not be reused.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect solid waste disposal and hazardous materials include transportation improvements, private development, and park planning and development. All these actions have the potential for considerable amounts of solid waste generation during construction (and long-term operation for private developments), and railroad developments are likely to require disposal of potentially contaminated soils. For example, the Fourth Track RO to AF Interlocking project would cross two known petroleum release sites in the vicinity of the Long Bridge Project Local Study Area.[16] These areas have the potential for uncovering contaminated soil during construction. Over all, these actions would likely result in negligible to minor adverse impacts on waste disposal and hazardous materials.

[16] Federal Railroad Administration. 2017.

In contrast, development of Long Bridge Park was a beneficial impact on hazardous material due to the associated remediation of the brownfield site on which it is located.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on solid waste disposal and hazardous materials.

18.3.4.2. Action Alternative B

Impact from Long Bridge Project: As described in **Section 5.0, Solid Waste Disposal and Hazardous Materials**, Action Alternative B would result in the same direct, permanent impacts on solid waste disposal and hazardous materials as described under Action Alternative A above. The indirect permanent impacts under Alternative B would be similar to Alternative A but would result in a larger amount of soil and contaminated materials that would require off-site disposal generated during construction.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect solid waste disposal and hazardous materials include transportation improvements, private development, and park planning and development. The impacts are discussed under Action Alternative A above. These actions would likely result in negligible to minor adverse impacts on waste disposal and hazardous materials.

Cumulative Impact: The permanent impacts of Action Alternative B when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on solid waste disposal and hazardous materials.

18.3.5. Transportation and Navigation

18.3.5.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 6.0, Transportation and Navigation**, Action Alternative A would result in a range of permanent impacts on a variety of transportation-related resources. Action Alternative A would result in major beneficial impacts due to increased capacity for railroad operations, including railroad-based transit service, over what would be provided by other planned transportation projects as noted below. Major, permanent, indirect beneficial impacts would also result from the increased frequency of intercity passenger trains, Virginia Railway Express (VRE) trains, and the introduction of Maryland Area Regional Commuter (MARC) service to Virginia. Other minor beneficial impacts would include improvements to the pedestrian and bicycle network in the vicinity of Maine Avenue SW and the 14th Street Bridge ramp. Action Alternative A would also result in moderate adverse impacts related to removal of 50 public parking spaces at NPS Parking Lot C and approximately one-third of the parking spaces at the Washington Marina surface parking area. Alternative A would result in no permanent impacts on navigation because the new bridge structure would maintain the existing span and vertical clearance, which would continue to accommodate current and future navigation needs of the area.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to result in permanent impacts on transportation and navigation include transportation projects, private development, the NPS NCR

Campus Renovation Project and USPP District 1 Substation, and the Benjamin Banneker Park connection.

The railroad projects described in **Section 1.4.1, No Action Alternative**, would increase capacity for railroad and Metrorail operations (including railroad-based transit service), which would be a moderate beneficial direct impact. This would result in an estimated 112 additional trains per day that could be accommodated once these improvements are completed (see **Table 6-1** in **Section 6.0, Transportation and Navigation**, for more detail). These volumes assume that, without additional capacity in the corridor, CSX Transportation (CSXT) would not renegotiate its existing operation agreements with the railroad operators, but that each operator would fully utilize the slots allocated. This assumption is based on CSXT's need to maintain adequate capacity to allow for the operation of its present and future freight network demands.

The roadway and multimodal projects described in **Section 1.4.1, No Action Alternative**, would have moderate beneficial impacts on the pedestrian and bicycle network within the Local Study Area due to the enhanced pedestrian and bicycle connections. The Benjamin Banneker Park connection provides improved connections (including an ABAAS-compliant ramp) between the southwest waterfront and the National Mall. The Boundary Channel Drive project is expected to improve roadway safety.

The renovation project at the NPS NCR headquarters has the potential to result in negligible adverse impacts on parking due to the reconfiguration of the existing surface parking area, which may reduce the overall number of parking spaces available. Private development in the area may increase both the availability of and demand for parking within the Local Study Area. It is uncertain how this may affect the cumulative transportation scenario; however, it is possible that some of the new developments may provide parking that could offset some of the parking lost during construction of the proposed action. Private development also has the potential to cause construction-related detours of pedestrian, bicycle, and roadway networks.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall moderate beneficial cumulative impact on transportation and navigation.

18.3.5.2. Action Alternative B

Action Alternative B would cause the same permanent impacts as Action Alternative A, as discussed in **Section 6.0, Transportation and Navigation**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.6. Air Quality and Greenhouse Gases

18.3.6.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 7.0, Air Quality and Greenhouse Gas Emissions**, Action Alternative A would result in minor adverse impacts on air quality and greenhouse gas (GHG) emissions due to the short durations of pollutant exposure associated with moving locomotives. Action Alternative A would have no permanent indirect impacts on air quality or GHG emissions.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to result in permanent impacts on air

quality and GHG emissions include railroad projects described in **Section 1.4.1, No Action Alternative**. These projects have the potential to result in an increase in railroad operations and frequency of trains travelling through the Local Study Area. This would result in minor adverse impacts on air quality and GHG emissions due to the pollutant exposure associated with moving locomotives.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor adverse cumulative impact on air quality and GHG emissions.

18.3.6.2. Action Alternative B

The permanent impacts of Action Alternative B would be the same as described under Action Alternative A, as discussed in **Section 7.0, Air Quality and Greenhouse Gas Emissions**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.7. Energy

18.3.7.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 8.0, Energy**, Action Alternative A would result in permanent, minor adverse impacts on energy consumption due to powering bridge lighting, signals, sensors, and communication equipment; fueling vehicles and equipment used for ongoing maintenance; and fueling the trains operating in the corridor. However, the additional energy consumed by Action Alternative A would be a small fraction of the regional and national energy consumption. The additional fuel consumed by trains would regionally increase demand for fuel, but would not affect the national supply. There would be no indirect permanent impacts resulting from Action Alternative A.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to result in permanent impacts on energy include transportation projects, private development projects, and park planning and development. Transportation projects have the potential to result in negligible adverse impacts on energy consumption due to the increased railroad operations. Although additional trains traveling through the corridor would require additional fuel, the amount of fuel consumed by these trains would be a negligible amount when compared to the amount of fuel consumed annually nationwide. Other private development projects and park planning and development projects would have the potential to result in moderate adverse impacts on energy use due to the energy needs of new recreational facilities, residential buildings, office buildings, hotels, and other buildings. Specific impacts would depend on size of each development and use of energy-efficient building practices.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor cumulative impact on energy.

18.3.7.2. Action Alternative B

The permanent impacts of Action Alternative B would be the same as described under Action Alternative A, as discussed in **Section 8.0, Energy**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.8. Land Use and Property

18.3.8.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 9.0, Land Use and Property**, Action Alternative A would result in minor permanent adverse impacts on land use and property due to conversion of portions of NPS, Arlington County, District, and private property into railroad right-of-way; and alterations to NPS and marina parking lots. Under Action Alternative A, 4.48 acres of park property and 0.36 acres of private property would be permanently impacted. Noise impacts associated with train operations would result in an indirect, moderate adverse impact on passive uses in Long Bridge Park. Overall, the actions under Action Alternative A would be consistent or not inconsistent with local plans.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect land use and property include transportation projects, private development projects, and park planning and development. Past park projects at Long Bridge Park have changed land use of the area from a brownfield into a public recreational park. Reasonably foreseeable projects have the potential to result in similar adverse impacts if land acquisition is required for changes to the railroad right-of-way or there is a change in land use that is inconsistent with local plans. Specific impacts would depend on the design of the individual developments. These actions have the potential to result in negligible to minor impacts on land use.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor cumulative impact.

18.3.8.2. Action Alternative B

As discussed in **Section 9.0, Land Use and Property**, Action Alternative B would result in similar permanent impacts as described under Action Alternative A, but would impact an additional 0.1 acres of park property. This would still be a minor direct adverse impact. All other permanent impacts would be the same as under Action Alternative A. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.9. Noise and Vibration

18.3.9.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 10.0, Noise and Vibration**, Action Alternative A would result in moderate to major direct adverse impacts due to the close proximity of proposed railroad tracks to receptor locations and due to the expected increase in train operations through the corridor from 76 daily trains to 114 daily trains. This increase in railroad operation would result in general noise increases of 2 to 4 dBA. The increased noise level would exceed the Federal Transit Administration (FTA) moderate noise criteria at two locations and would exceed the FTA severe noise criteria at three locations. There would be no permanent, indirect impacts on noise resulting from Action Alternative A. There would be no vibration impacts resulting from Action Alternative A because the overall vibration levels would not exceed the FTA General Vibration Assessment criteria and the

vibration spectra would not exceed the FTA Detailed Vibration Assessment criteria, as discussed in **Section 10.3.2.2**; therefore, there would be no cumulative impact related to vibration.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect noise include the DC OAPM project. The DC OAPM project has resulted in altered flight paths to and from Ronald Reagan Washington National Airport, which has increased noise levels related to air traffic within the Local Study Area.[17]

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall moderate to major adverse cumulative impact on noise. This is because of the cumulative increase in noise from Action Alternative A and the DC OAPM project. There would be no cumulative impact related to vibration.

18.3.9.2. Action Alternative B

The permanent impacts of Action Alternative B would be the same as described under Action Alternative A, as discussed in **Section 10.0, Noise and Vibration**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.10. Aesthetics and Visual Resources

18.3.10.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 11.0, Aesthetics and Visual Resources**, Action Alternative A would result in negligible to moderate adverse impacts on aesthetics and visual resources due to the addition of a new bridge and the removal of trees and mature vegetation within the viewshed. The negligible to minor impacts would occur in areas where Long Bridge is viewed from a distance or where it is screened by vegetation or other structures. The moderate impacts would occur in areas where Long Bridge is closer in distance or where it is highly visible. There would be no impacts on nighttime conditions because the light emissions from the new bridge would be negligible.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect aesthetics and visual resources include transportation projects, private development projects, and park planning and development. All of these actions have the potential to introduce new structures into the viewshed of the Long Bridge Project. In particular, the Long Bridge Park Development project would introduce a new large building into what was previously an open area. The Potomac Yard Metrorail Station would introduce new visual elements and remove vegetation, which would alter the views from GWMP. Similarly, the Potomac River Tunnel project would introduce new visual elements to East and West Potomac Parks. Additionally, the Wharf (Southwest Waterfront) Phase I and Phase II projects have introduced and will introduce new multi-story buildings along the Southwest Waterfront, which is within the viewshed of the Local Study Area. Specific impacts of other projects would depend on the design and location of specific

[17] Federal Aviation Administration. 2013. Draft Environmental Assessment for Washington, D.C. Optimization of Airspace and Procedures in the Metroplex. Accessed from http://www.metroplexenvironmental.com/dc_metroplex/dc_docs.html. Accessed October 24, 2018.

developments. Given the highly developed nature of the area, the introduction of new structures within the viewshed would result in negligible to minor adverse impacts on aesthetics and visual resources.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor cumulative impact, given the highly developed nature of the area.

18.3.10.2. Action Alternative B

Impact from Long Bridge Project: As discussed in **Section 11.0, Aesthetics and Visual Resources**, Action Alternative B would result in similar impacts related to the new bridge as described under Action Alternative A. However, Action Alternative B would result in additional impacts from the removal of the existing Long Bridge and its replacement with a bridge of a different appearance. These changes in the viewshed would result in moderate adverse impacts because a historic bridge, which is also a visual landmark, would be removed and replaced with a bridge lacking the truss and arched substructure of the existing bridge. However, the removal of the exiting truss would open up views to the Monumental Core, which would be a minor beneficial impact on those views.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect aesthetics and visual resources include transportation projects, private development projects, and park planning and development. All of these actions have the potential to introduce new structures into the viewshed of the Long Bridge project. Given the highly developed nature of the area, the introduction of new structures within the viewshed would result in negligible to minor adverse impacts on aesthetics and visual resources.

Cumulative Impact: The permanent impacts of Action Alternative B when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall moderate cumulative impact, given the highly developed nature of the area.

18.3.11. Cultural Resources

18.3.11.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 12.0, Cultural Resources**, Action Alternative A would result in negligible to moderate permanent impacts on cultural resources due to the alteration of historic character and views from the addition of a new bridge structure and the removal of contributing vegetation. Negligible adverse impacts would occur on the Richmond, Fredericksburg and Potomac (RF&P) Railroad Historic District and the National Mall Historic District. Moderate adverse impacts would occur on the George Washington Memorial Parkway (GWMP), the Mount Vernon Memorial Highway (MVMH), and the East and West Potomac Parks Historic District due to the removal of contributing vegetation and introduction of new railroad infrastructure within the boundaries of the historic district. There would be indirect, negligible adverse impacts on cultural resources because the new bridge structures would be visible but would not diminish the integrity of contributing resources.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect recreation and parks include transportation projects, private development projects, and park planning and development projects. These projects all have the potential to result in changes to the historic setting and viewsheds of cultural

resources within the Area of Potential Effect for cultural resources due to the introduction of new structures, removal of vegetation, or other alterations to features in the vicinity of these resources. The Potomac Yard Metrorail Station would introduce non-historic visual elements and remove vegetation within the historic viewshed of the GWMP Historic District. These new non-historic elements would impact the integrity of the designed historic landscape and degrade the scenic quality and contemplative experience for travelers in this area. The Potomac River Tunnel project would introduce non-historic elements into the East and West Potomac Parks Historic District cultural landscape. The Wharf (Southwest Waterfront) Phase I and Phase II projects have and will introduce new buildings along the Southwest Waterfront, which would somewhat alter the historic viewshed of East Potomac Park. The Benjamin Banneker Park Connection project resulted in the addition of a new stairway and pathway as well as the removal of a section of Japanese yew vegetation, which is partially visible from the Local Study Area. Specific impacts of other reasonably foreseeable future projects would depend on the design and location of these projects. Given the highly developed nature of the area, these actions are likely to result in negligible to minor impacts on cultural resources.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor cumulative impact, given the highly developed nature of the area.

18.3.11.2. Action Alternative B

Impact from Long Bridge Project: As discussed in **Section 12.0, Cultural Resources**, Action Alternative B would result in the same permanent impacts on the RF&P Railroad Historic District and the National Mall Historic District as under Action Alternative A. However, Action Alternative B would result in major adverse impacts on the GWMP, the MVMH, and East and West Potomac Parks Historic District due to the removal of the existing Long Bridge, which is considered a contributing resource, and the removal of additional contributing vegetation. Indirect adverse impacts would be the same as under Action Alternative A for the RF&P Railroad Historic District; East and West Potomac Parks; and the National Mall Historic District. However, there would be indirect, moderate adverse impacts on the GWMP and MVMH because the removal of the existing Long Bridge and truss would diminish the integrity of setting and association of these cultural resources.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect recreation and parks include transportation projects, private development projects, and park planning and development projects. These impacts are discussed under Action Alternative A above. Specific impacts would depend on the design and location of these projects; however, given the highly developed nature of the area, these actions are likely to result in negligible to minor impacts on cultural resources.

Cumulative Impact: The permanent impacts of Action Alternative B when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall moderate cumulative impact, given the highly developed nature of the area.

18.3.12. Recreation and Parks

18.3.12.1. Action Alternative A

The Long Bridge Project would result in no permanent impacts on most of the park and recreation resources within the Local Study Area, as discussed in **Section 13.0, Recreation and Parks**. Therefore, there would be no permanent cumulative impacts on those resources. The park and recreation resources on which the Long Bridge Project would result in permanent impacts include Long Bridge Park, the GWMP, the MVT, and East Potomac Park. These four resources are discussed below.

Long Bridge Park

As discussed in **Section 13.0, Recreation and Parks**, Action Alternative A would result in permanent negligible adverse impacts on small portions of park land in Long Bridge Park for the railroad right-of-way (0.1 acres). However, the area that would be affected is a wooded area that is unused by the public. Although the Long Bridge Park Development project would occur within the Local Study Area, the footprint would not overlap with the Long Bridge Project footprint and would not impact the same park and recreation resources. Therefore, there would be no cumulative impacts on Long Bridge Park.

George Washington Memorial Parkway

As discussed in **Section 13.0, Recreation and Parks**, Action Alternative A would result in permanent moderate adverse impacts on small portions of land within the GWMP for the railroad right-of-way (0.5 acres) and removal of vegetation. Moderate adverse impacts would occur where the new bridge crosses over GWMP, which would alter the views and feeling of the park in that area as the loss of trees that would make the railroad more visually prominent. The Potomac Yard Metrorail Station Project, approximately 2.8 miles to the south, would also impact a portion of the GWMP. However, given the relatively small area impacted by each project and the distance between them, there would be no cumulative impacts on the GWMP. Additional discussion of the cumulative impacts to the visual and cultural resource of the GWMP is in **Section 18.3.10, Aesthetics and Visual Resources**.

Mount Vernon Trail

As discussed in **Section 13.0, Recreation and Parks**, Action Alternative A would result in permanent moderate to major adverse impacts where the new bridge crosses over the MVT, which would alter the views and feeling of the trail in that area as the loss of trees that would make the railroad more visually prominent. However, no other past, present, or reasonably foreseeable actions were identified that would result in impacts on the MVT. Therefore, there would be no cumulative impacts on the MVT.

East Potomac Park

As discussed in **Section 13.0, Recreation and Parks**, Action Alternative A would result in permanent minor to moderate adverse impacts on small portions of land within East Potomac Park for the railroad right-of-way (2.3 acres), removal of vegetation, and the loss of public parking spaces at NPS Parking Lot C. Although the NPS National Capital Region Campus Renovation is taking place within East Potomac Park, its footprint is confined to the existing campus and surface parking areas and does not overlap with any recreational resources. No other past, present, or reasonably foreseeable actions were identified that would result in impacts on the same elements of East Potomac Park that would be

affected by the Long Bridge Project. Therefore, there would be no cumulative impacts on East Potomac Park.

18.3.12.2. Action Alternative B

As discussed in **Section 13.0, Recreation and Parks**, Action Alternative B would result in similar permanent impacts as described under Action Alternative A, but would impact an additional 0.2 acres of Long Bridge Park and an additional 0.2 acres of East Potomac Park. This would still be a minor direct adverse impact. All other permanent impacts would be the same as under Action Alternative A. Therefore, there would be no cumulative impact under Action Alternative B.

18.3.13. Social and Economic Resources

18.3.13.1. Action Alternative A

Impact from Long Bridge Project: As discussed in **Section 14.0, Social and Economic Resources**, Action Alternative A would result in permanent, minor beneficial impacts on social resources due to enabling the expansion of train service to local communities and the region. This would also result in indirect, negligible beneficial impacts on economic resources because the expanded train service would create new jobs, provide more access to employment opportunities, and allow more efficient movement of people and goods. There would also be minor adverse impacts on economic resources due to the loss of parking spaces at the Washington Marina and East Potomac Park.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect social and economic resources include transportation projects, private development projects, and park planning and development projects. These projects would improve community cohesion and the transportation projects would make public transportation easier to access and more efficient. The Boundary Channel Drive Interchange Project would also improve safety and accommodate various modes of transportation including pedestrian and bicycle facilities. These projects are anticipated to have a minor to moderate beneficial impacts on social and economic resources.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in an overall minor beneficial cumulative impact.

18.3.13.2. Action Alternative B

The permanent impacts of Action Alternative B would be the same as described under Action Alternative A, as discussed in **Section 14.0, Social and Economic Resources**. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.14. Safety and Security

18.3.14.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 15.0, Safety and Security**, Action Alternative A would result in permanent, moderate beneficial impacts on railroad operational safety due to the

redundancy provided by the new tracks. Although a new bridge would add a new piece of critical infrastructure that would require local, regional, and Federal agencies to update safety, security, and emergency management plans, these adverse impacts are considered negligible.

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to affect safety and security include other railroad projects. The fourth track from AF to RO Interlocking, the fourth track from LE to VA Interlocking, and the Virginia Avenue tunnel all provide redundancy in railroad infrastructure, a major benefit to railroad operations within the Local Study Area.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in a moderate beneficial cumulative impact on safety and security.

18.3.14.2. Action Alternative B

As discussed in **Section 14.0, Social and Economic Resources**, Action Alternative B would result in the same permanent impacts as described under Action Alternative A. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.15. Public Health, Elderly, and Persons with Disabilities

18.3.15.1. Action Alternative A

Impact from Long Bridge Project: As described in **Section 16.0, Public Health, Elderly, and Persons with Disabilities**, Action Alternative A would result in negligible adverse impacts on public health due to emissions from the increase in train operations through the area, as discussed in **Section 7.0, Air Quality**. However, impacts on resources that result in public health impacts such as noise and vibration as well as solid waste disposal and hazardous materials would not result in measurable impacts on human health. Action Alternative A would also result in beneficial impacts for persons with disabilities due to the new pedestrian bridge at Maine Avenue SW being fully accessible (the existing elevator is currently inoperable).

Impacts from Past, Present, and Reasonably Foreseeable Future Actions: Other past, present, and reasonably foreseeable future actions that have the potential to result in permanent impacts on public health, elderly, and persons with disabilities include private development and the Benjamin Banneker Park Connection. New private development would meet current accessibility standards, which may result in beneficial impacts on persons with disabilities, particularly if it improves access over the existing infrastructure. The Benjamin Banneker Park Connection resulted in beneficial impacts due to the ABAAS-compliant ramp that provides universal accessibility between 10th Street SW and Maine Avenue SW.

Cumulative Impact: The permanent impacts of Action Alternative A when combined with the permanent impacts of other past, present, and reasonably foreseeable future projects would result in a negligible adverse cumulative impact on public health as well as a minor beneficial impact on persons with disabilities.

18.3.15.2. Action Alternative B

As discussed in **16.0, Public Health, Elderly, and Persons with Disabilities**, Action Alternative B would result in the same permanent impacts as described under Action Alternative A. Therefore, the cumulative impact would be the same as discussed under Action Alternative A.

18.3.16. Environmental Justice

18.3.16.1. Action Alternative A

As described in **Section 17.0, Environmental Justice**, Action Alternative A would not result in disproportionately high and adverse permanent impacts on environmental justice (EJ) populations. EJ populations would not be denied benefits from Action Alternative A. None of the environmental impacts of Action Alternative A would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Completion of Action Alternative A would not displace any persons. Therefore, there would be no cumulative impact associated with EJ.

18.3.16.2. Action Alternative B

As described in **Section 17.0, Environmental Justice**, Action Alternative B would not result in disproportionately high and adverse permanent impacts on EJ populations. EJ populations would not be denied benefits from Action Alternative B. None of the permanent environmental impacts of Action Alternative B would be disproportionately borne by minority or low-income persons, or disproportionately affect facilities or service of importance to such persons. Completion of Action Alternative B would not displace any persons. Therefore, there would be no cumulative impact associated with environmental justice.

18.4. Temporary Effects

This section defines the cumulative construction impacts and describes the contribution of the Long Bridge Project to the overall temporary cumulative effect. The duration of construction under Action Alternative B would be approximately 3 years and 3 months longer than under Action Alternative A. Although this would extend the duration of construction impacts, it would not change the intensity of the cumulative impact. Therefore, the temporary cumulative impacts would be the same for both Action Alternatives A and B.

As outlined above in **Section 18.2.3.1, Transportation Projects**, several other major railroad infrastructure projects to the north and south of the Long Bridge Corridor are in the planning phase. While the timing of construction depends on numerous factors including funding, these projects may advance to construction around the same time as the Long Bridge Project. Because this and other major railroad infrastructure projects in the planning phase are yet to be funded, it is unknown if concurrent construction would be possible. The Long Bridge Project may be constructed at separate times from these other projects. To the extent that construction timing for these projects overlaps, coordination between projects would be essential to best manage operational outages and construction staging.

Construction of other development and infrastructure projects, as well as roadway maintenance such as repaving projects, may occur at the same time as the Long Bridge Project. It is likely that construction for

The Wharf Phase II would be completed before construction for the Long Bridge Project begins. For the NPS NCR Campus Renovation Project, the timeline for the start of construction is unclear at this time. Thus, renovation of the NPS NCR Campus could overlap with construction of the Long Bridge Project. For the other reasonably foreseeable projects, construction staging and access would not occur near the major staging and access areas for the Long Bridge Project.

18.4.1. Resources with No Cumulative Temporary Effects

If construction were to occur concurrently with construction of the projects described above, either Action Alternative would result in no potential cumulative effects for the resources described below.

- **Recreation and Parks:** Four reasonably foreseeable future actions (the Long Bridge Park Aquatics and Fitness Facility and Park Expansion, the Potomac Yard Metrorail Station, the NPS NCR Campus Renovation, and the VRE L'Enfant Station Improvements) would likely have temporary impacts in parks that would also be affected by construction of the Long Bridge Project. However, no cumulative effects to park resources are anticipated for the reasons described below.
    - **Long Bridge Park:** The Action Alternatives would require a construction access and staging area within Long Bridge Park, near the construction of the Long Bridge Park Aquatics and Fitness Facility. Because the facility has started construction, it is unlikely that construction timelines would be concurrent. In addition, the overlap in construction areas would occur in an area of the park that is currently undeveloped and unused by park visitors. Therefore, there would be no cumulative impacts on Long Bridge Park.
    - **GWMP:** The Potomac Yard Metrorail Station would make use of 0.25 to 0.42 acres of the GWMP and 2.86 to 3.09 acres of the Greens Scenic Area Easement for construction staging and laydown areas associated with construction. Construction vehicles would not use the GWMP for access. A design-build contract has been awarded for station construction; therefore, it is likely that construction timelines would be concurrent. In addition, given the relatively small area impacted by each project and the distance between them, there would be no cumulative impacts on the GWMP.
    - **East Potomac Park:** Although the NPS NCR Campus Renovation is taking place within East Potomac Park, its footprint is confined to the existing campus and surface parking areas and does not overlap with any recreational resources. No other past, present, or reasonably foreseeable actions were identified that would result in impacts on the same recreational resources of East Potomac Park that would be affected by construction of the Long Bridge Project. Therefore, there would be no cumulative impacts on East Potomac Park.
    - **Hancock Park:** The VRE L'Enfant Station Improvements will require access to the railroad right-of-way and therefore may make use of the same access point from Hancock Park as planned for the Action Alternatives. However, even if construction of the two projects were to overlap, equipment would make use of the same access point and would not be expected to require additional areas of the park.
- **Environmental Justice:** Minority or low-income persons would not disproportionately bear the temporary environmental impacts of Action Alternative A or B, nor would the Action Alternatives disproportionately affect facilities or service of importance to such persons.

Construction of Action Alternative A and Action Alternative B would not displace any persons. Therefore, there would be no cumulative temporary impact associated with Environmental Justice.

18.4.2. Resources with Negligible to Minor Cumulative Temporary Effects

If construction were to occur concurrently with construction of the projects described above, either Action Alternative could result in the potential negligible to minor cumulative effects described below.

- **Natural Ecological Systems and Endangered Species**: The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on natural ecosystems and endangered species due to limited vegetation removal that may be required for construction access and staging.
- **Water Resources and Water Quality:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on water resources and water quality due to impacts on Chesapeake Bay Preservation Areas, a small loss of flood storage within the floodplain, increased sedimentation, and increased stormwater runoff caused by land disturbance.
- **Geologic Resources:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on geologic resources due to temporary disturbance of existing vegetation during earthwork activities and potential for soil erosion during construction activities.
- **Solid Waste Disposal and Hazardous Materials:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on solid waste disposal and hazardous materials due to the generation of solid waste during construction and disposal of potentially contaminated materials.
- **Air Quality and Greenhouse Gases:** Construction activities have the potential to cause increases in emissions from on-site diesel equipment, increased truck traffic to and from the construction site on local roadways, and fugitive dust. When combined, the construction activities from either Action Alternative and other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on air quality and greenhouse gas emissions.
- **Energy:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on energy consumption due to the additional energy and fuel needed to operate construction equipment and vehicles.
- **Land Use and Property:** Construction of either Action Alternative and other past, present, and reasonably foreseeable future projects may require construction staging and access in the same area. To the extent that construction of these projects occurs concurrently, multiple properties could be affected, resulting in minor cumulative impacts to land use and property. If construction occurs sequentially, the projects may be able to use some areas already disturbed by a previous project for construction staging. While this would reduce the potential for

cumulative impacts from multiple staging areas, it would also increase the amount of time any one parcel is in use for construction, potentially creating a minor cumulative impact.

- **Noise and Vibration:** Noise and vibration due to construction of most of the other reasonably foreseeable future projects would impact different receptors than those affected by either Action Alternative and would therefore have no potential for cumulative impacts. For receptors that could be affected by the Action Alternatives and other projects, the potential for cumulative impacts is described below.
    - **Long Bridge Park:** Either Action Alternative would have noise impacts for park users at the northern end of Long Bridge Park. While this area could also be affected by noise from construction of the Long Bridge Park Aquatics and Fitness Center, park users would not make use of that portion of the park until the aquatics center project is complete. Therefore, there is no potential for cumulative noise impacts.
    - **East Potomac Park:** Either Action Alternative would have noise impacts for park users in East Potomac Park, as well as for office workers at the NPS NAMA Headquarters building. Combined with noise impacts due to construction activities for the renovation of the NPS NCR Campus, the Action Alternatives could have minor cumulative noise impacts to these receptors.
    - **Buildings between Maine Avenue SW and Hancock Park:** Either Action Alternative would have noise impacts to people in the buildings along the railroad corridor between Maine Avenue SW and Hancock Park. Combined with noise impacts due to construction activities for the VRE L'Enfant Station Improvements, the Action Alternatives could have minor cumulative noise impacts to receptors between Hancock Park and LE Interlocking.
- **Aesthetics and Visual Resources:** Either Action Alternative would cause disruptions to visual coherence from fencing, vehicles, and structures within the Local Study Area. In park and landscaped areas, such as Long Bridge Park and GWMP, there would be a disruption to the natural harmony of these areas due to the removal of vegetation for construction. Some views within the Local Study Area would be altered and possibly partially obscured due to construction activities. Construction activities for reasonably foreseeable future actions also have the potential to alter or possibly obscure views within the Local Study Area. To the extent that construction activities for either Action Alternative and these other projects would occur within the same viewshed, they would likely result in minor cumulative impacts on aesthetics and visual resources given the highly developed nature of the area.
- **Cultural Resources:** Either Action Alternative would cause moderate adverse impacts on the GWMP, MVMH, East and West Potomac Parks, and National Mall historic districts because construction staging and access would be visible within these resources and would diminish the integrity of setting. No cumulative impacts would be expected to the GWMP and MVMH historic districts because the construction activities for the Long Bridge Project and the Potomac Yard Metrorail Station are not expected to overlap.. The NPS NCR Campus Renovation would also locate construction staging and access within the East and West Potomac Parks and National Mall historic districts. If constructed at the same time, these activities would likely result in minor cumulative impacts on cultural resources.
- **Social and Economic Resources:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future

projects would result in an overall minor to moderate beneficial cumulative impact due to the creation of new jobs, assuming several construction projects would overlap within the same communities.

- **Safety and Security:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on safety and security due to construction activities in close proximity to active railroad tracks for multiple projects.
- **Public Health, the Elderly, and Persons with Disabilities:** The temporary impacts of either Action Alternative when combined with the temporary impacts of other past, present, and reasonably foreseeable future projects could result in an overall minor adverse cumulative impact on public health, elderly, and persons with disabilities due to potential exceedances of noise limits that could result in annoyance and activity disruption negatively affecting the welfare and public health of people within or near the corridor. On-site diesel equipment during construction, increased truck traffic to and from the construction sites, and fugitive dust would cause pollutant emissions. Construction activities may also require the excavation and transportation of contaminated soils or sediments, and risk potential spills from construction-related equipment. Sidewalk closures and detours may increase walking distance for the elderly and persons with disabilities. To the extent that construction timing for these projects overlaps, coordination between projects would be essential to best manage sidewalk closures and detours.

18.4.3. Resources with Moderate Cumulative Temporary Effects

Transportation is the only resources for which construction activities have the potential to cause moderate cumulative temporary effects as described in the following paragraphs. Cumulative impacts to railroad operations could be beneficial as well as negative, given the potential to coordinate track outages across multiple projects. Construction of both railroad and non-railroad projects have the potential to contribute additional vehicular traffic on roadways in the Local Study Area.

As the owner of the Long Bridge Corridor, CSXT has the final say over any activities that might affect railroad operations within its right-of-way. CSXT has the authority to approve schedules and the timing and duration of track outages. Through CSXT, track outages would be coordinated across multiple projects to minimize overall impact on railroad operators. Contractors for the multiple projects including the Long Bridge Project would also be required to coordinate with projects outside of CSXT's right-of-way, such as Washington Union Station. This could result in a moderate beneficial cumulative effect due to the opportunity to conduct track work requiring track outages concurrently thereby reducing cumulative track outage time. However, this coordination could result in negative impacts to individual project schedules. There also may be times when it is not possible to coordinate track outages, resulting in negative cumulative effects to railroad operations.

If construction occurs in separate timeframes, there could be greater adverse effects to railroad service due to track outages of a longer duration than if construction takes place concurrently. Further coordination would be undertaken as these projects move forward and as funding becomes available to minimize adverse effects to the extent possible.

Additionally, construction of the Long Bridge Project would contribute additional vehicular traffic in the Local Study Area, which already experiences heavy traffic volumes. The other railroad projects north and

south of the Long Bridge Corridor would also contribute additional vehicular traffic near access points and construction areas. However, the projects would occur along a linear corridor, resulting in little potential overlap among these areas. Concurrent construction would therefore have the potential to result in minor, temporary, adverse cumulative impacts on transportation.

If timed sequentially, the projects may be able to use some areas already disturbed by a previous project for construction staging, reducing the potential for cumulative impacts from multiple staging areas. If construction timing overlaps, implementation of operational plans for both normal and emergency operations would minimize any adverse effects to service to the maximum extent possible.

Construction of any reasonably foreseeable project has the potential to require road closures and detours during construction, which could interrupt local and commuter bus routes, the pedestrian and bicycle network, and the roadway network. The Wharf Phase II would result in road closures and detours along Maine Avenue SW, which would also be affected by construction of the Long Bridge Project, as described in **Section 6.0, Transportation and Navigation**. However, it is likely that construction for The Wharf Phase II would be completed before construction for the Long Bridge Project begins. For the NPS NCR Campus Renovation Project, the timeline for the start of construction is unclear at this time. Thus, renovation of the NPS NCR Campus could overlap with construction of the Long Bridge Project. If renovation and construction timelines overlap, the schedules would be coordinated to minimize closures of public areas or other disruptions to public services.

18.5. Avoidance, Minimization, and Mitigation

The Action Alternatives would include measures to avoid, minimize, and mitigate direct and indirect impacts, which will serve to avoid, minimize, and mitigate cumulative effects. **Sections 2** through **17** describe these measures for each resource area.