APPENDIX G

WETLAND AND FLOODPLAIN

STATEMENT OF FINDINGS

SEPTEMBER 2021

U.S. Department
of Transportation

Federal Highway Administration

and

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Wetland and Floodplain Statement of Findings

Replacement and Widening of the American Legion Bridge, Phase 1 South, I-495 & I-270

Recommended:

_____ _____

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_____ _____

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1 INTRODUCTION

This Wetlands and Floodplains Statement of Findings (SOF) describes the alignment alternatives that were evaluated for the replacement and widening of the American Legion Bridge (ALB) for Alternative 9 – Phase 1 South of the I-495 & I-270 Managed Lanes Study (MLS); characterizes the National Park Service (NPS) wetland and floodplain resources that may be adversely impacted within NPS managed lands as a result of implementing the Preferred Alternative (Alternative 9 – Phase 1 South); describes adverse impacts that the MLS would likely have on these resources; and documents the steps that would be taken to avoid, minimize, and offset these impacts. All figures discussed in this document are also included in **Attachment A**.

1.1 Wetlands

Executive Order 11990, "Protection of Wetlands," issued 24 May 1977, directs all federal agencies to avoid to the maximum extent possible the long- and short-term adverse impacts associated with the occupancy, destruction, or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. In the absence of such alternatives, NPS must modify actions to preserve and enhance wetland values and minimize degradation. According to the Procedural Manual #77-1: Wetland Protection (NPS 2016), wetlands are defined as all shallow water habitats including riverine wetlands (streams) and palustrine wetlands. In this report, riverine wetlands may be referred to as "streams," palustrine wetlands may be referred to as simply "wetlands," and together they may be referred to as "NPS wetlands."

To comply with Executive Order 11990 within the context of the agency's mission, the NPS has developed a set of policies and procedures found in Director's Order 77-1: Wetland Protection (NPS 2002a) and Procedural Manual #77-1: Wetland Protection (NPS 2016). This policy and related procedures emphasize: 1) exploring all practical alternatives to building on, or otherwise adversely affecting, wetlands; 2) reducing impacts to wetlands whenever possible; and 3) providing direct compensation for any unavoidable wetland impacts by restoring degraded or destroyed wetlands on other NPS properties. If a Preferred Alternative would have adverse impacts on wetlands, a SOF must be prepared that documents the above steps and presents the rationale for choosing an alternative that would have adverse impacts on wetlands. This SOF includes wetlands within NPS park boundaries that would be affected by the proposed project.

1.2 Floodplains

Executive Order 11988, "Floodplain Management," issued 24 May 1977, US Department of Transportation (USDOT) Order 5650.2, "Floodplain Management and Protection", and the National Flood Insurance Act

of 1968 govern the construction and fill of floodplains to ensure proper consideration to the avoidance, minimization, and mitigation of floodplain development and associated adverse effects. In addition to enforcing floodplain regulations, the National Flood Insurance Act and its National Flood Insurance Program (NFIP) provide affordable flood insurance to property owners (FEMA, 2018).

Pursuant to Executive Order 11988 and the NPS *Procedural Manual 77-2: Floodplain Management* (NPS 2002b), the Maryland Department of Transportation State Highway Administration (MDOT SHA) has evaluated flooding hazards related to the proposed project. This SOF describes the Preferred Alternative, project site, floodplain determination, use of floodplain, investigation of alternatives, flood risks, and mitigation for the continued use of facilities within the floodplain.

2

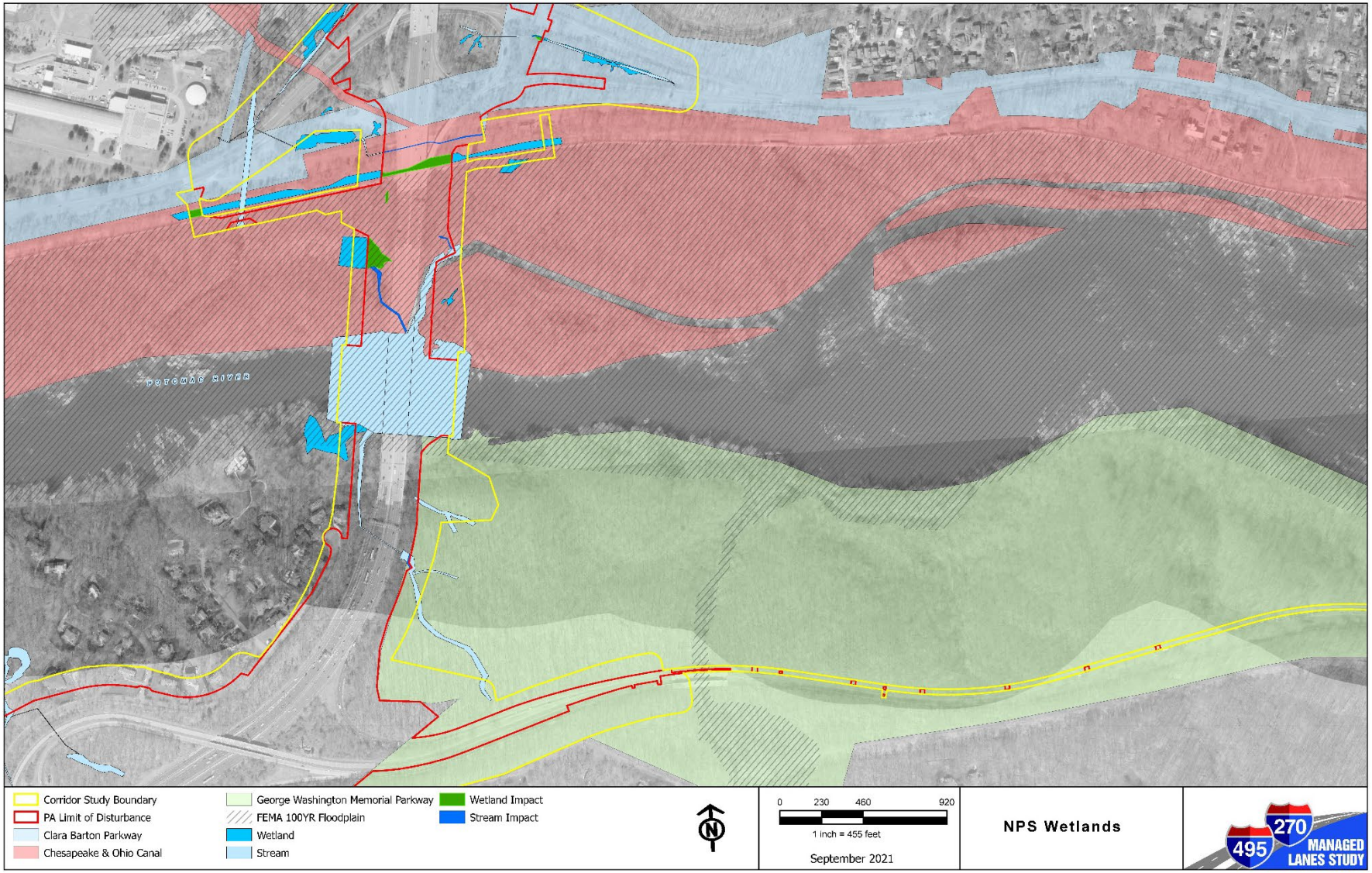
2 PROJECT SITE

I-495 and I-270 in Maryland are the two most heavily traveled freeways in the National Capital Region, each with an Average Annual Daily Traffic (AADT) volume of up to 260,000 vehicles per day in 2018. I-495 is the only circumferential route in the region that provides interregional connections to many radial routes, such as I-270, United States (US) 29 (Colesville Road), I-95, the Baltimore-Washington Parkway, US 50 (John Hanson Highway), and MD 5 (Branch Avenue). I-270 is the only freeway link between I-495 and the fast-growing northwest suburbs in northern Montgomery County and the suburban area in Frederick County. The purpose of the MLS is to develop a travel demand management solution(s) that addresses congestion and improves trip reliability on I-495 and I-270 within the MLS study limits and enhances existing and planned multimodal mobility and connectivity.

The Preferred Alternative crosses three units of the National Park System in Maryland and Virginia: George Washington Memorial Parkway (GWMP), Clara Barton Parkway (CBP), and the Chesapeake and Ohio Canal National Historic Park (CHOH) (**Figure 1**) in the vicinity of the ALB, which connects I-495 in Virginia with I-495 in Maryland, over the Potomac River.

The NPS focuses on impacts to NPS wetlands and floodplain within NPS park land; therefore, the wetlands within the study area outside of park-managed lands are not discussed in this SOF.

Figure 1: NPS Park Unit Boundaries and NPS Wetlands



2.1 George Washington Memorial Parkway

GWMP (**Figure 2**) is a publicly-owned park and National Register of Historic Places (NRHP)-listed historic district that extends along the Potomac River from I-495 to Mount Vernon in Virginia. The GWMP is a scenic roadway honoring the nation's first president that protects and preserves cultural and natural resources along the Potomac River below Great Falls to Mount Vernon. It is also a historic district listed in the NRHP for its association with twentieth-century parkway design, engineering, landscape architecture, park planning and conservation, and commemoration. Features within GWMP include the Potomac Heritage National Scenic Trail and Turkey Run Park conservation area. The park boundary of GWMP extends 38.3 miles and comprises approximately 7,300 acres.

2.2 Clara Barton Parkway

CBP (**Figure 3**) is a scenic NPS parkway in Maryland that extends 6.6 miles along the northern shore of the Potomac River between the Naval Surface Warfare Center at Carderock and the Washington, DC border with Maryland. CBP was designed for recreational driving; to link sites that commemorate important episodes in American history; and to preserve habitat for local wildlife.

2.3 Chesapeake and Ohio Canal National Historic Park

The CHOH (**Figure 3**) is an NRHP-listed historic district and publicly owned park and recreation area encompassing 19,575 acres. The CHOH stretches 184.5 miles along the Potomac River from Rock Creek at Georgetown in Washington, DC, to Cumberland, Maryland. Construction on the Chesapeake and Ohio (C&O) Canal began in 1828 and concluded in 1850. It served as a major transportation corridor, operating as a conduit for coal, lumber, and agricultural products to propel western development and satisfy demands from eastern US markets until 1924. The C&O Canal became a national monument in 1961 and CHOH was established as a National Historical Park in 1971. The purpose of the CHOH is to preserve and interpret the 19th century transportation canal and its associated scenic, natural, and cultural resources; and to provide opportunities for education and appropriate outdoor recreation. The CHOH is listed on the NRHP and contains more than 1,300 historic structures, including one of the largest collections of 19th century canal features and buildings in the National Park System.

Figure 2: George Washington Memorial Parkway and NPS Wetlands

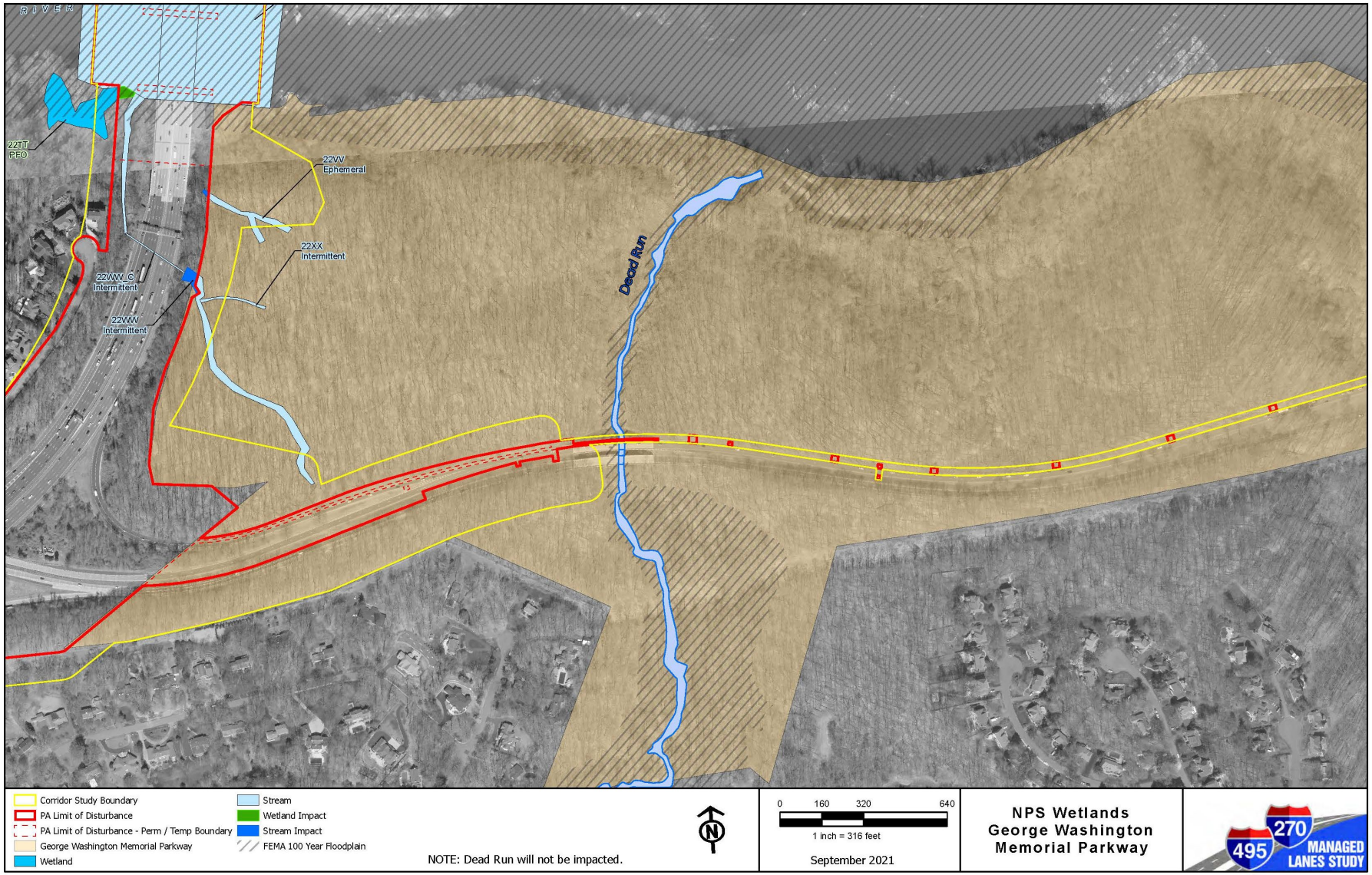
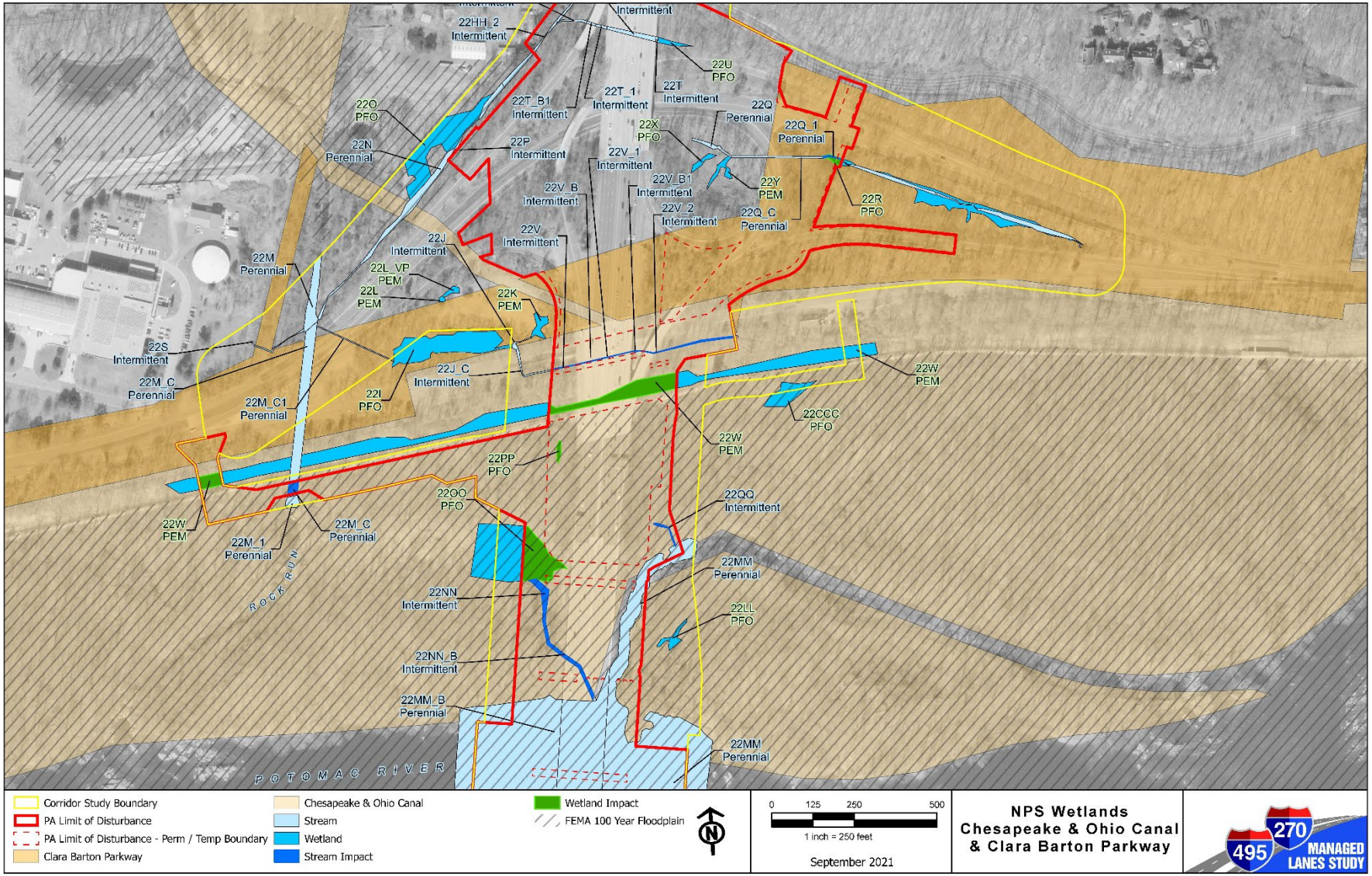


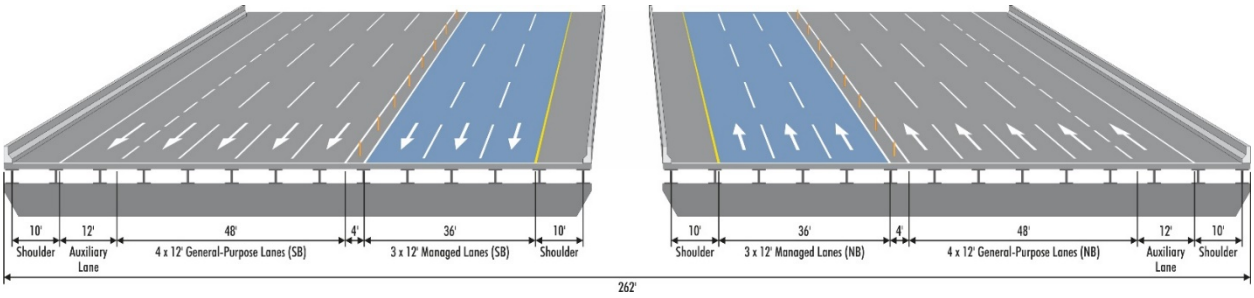
Figure 3: Clara Barton Parkway and Chesapeake and Ohio Canal National Park Boundaries and NPS Wetlands



3 ALTERNATIVES

The MLS Draft Environmental Impact Statement (DEIS) identified the No Build and seven Build Alternatives (8, 9, 9M, 10, 13B, and 13C). All DEIS Build Alternatives were identical in the vicinity of the ALB. The DEIS Build Alternatives proposed adding two managed lanes in each direction on I-495 from south of the GWMP to MD 5 and on I-270 from I-495 to I-370 and along the East and West I-270 Spurs and proposed adding two managed lanes plus a managed auxiliary lane in each direction on the ALB along with direct access ramps to/from the GWMP. Auxiliary lanes along the general purpose lanes would extend from GWMP to CBP in both directions, but would not provide access to the managed lanes. The ALB design lane arrangement remained the same between the DEIS Build Alternatives and the Preferred Alternative, which is identified in the Supplemental DEIS (SDEIS) as Alternative 9 - Phase 1 South. The Preferred Alternative will add two managed lanes in each direction on I-495 and the I-270 East and West Spurs within Phase 1 South, which extends along I-495 from south of the GWMP to MD 187 and up I-270 to I-370 and along the East and West I-270 Spurs to MD 187.

Figure 4: Proposed ALB Typical Section



The existing ALB structures, linking the Virginia and Maryland portions of I-495 over the Potomac River, were constructed in the early 1960s and must be replaced by 2030 due to age and condition. Replacing these bridge structures as part of the MLS would eliminate the need for a follow-up bridge replacement project for which the state does not have funding allocated. MDOT SHA has carefully considered various potential roadway alignments as well as various types of bridge structures to inform the limits of disturbance (LOD) in this area to accommodate roadway widening and bridge replacement across the Potomac River while limiting impact to NPS property and resources.

The Preferred Alternative includes numerous LOD modifications since the DEIS, one of the most significant of which is in the vicinity of the ALB to address comments and concerns received from the NPS regarding impacts to NPS lands and resources.

3.1 Alignments

Multiple alignments were considered when determining the LOD for the replacement of the ALB. Off-alignment bridge options were considered, but were not retained for further study in the DEIS, since they were not practicable. Tunnel and full-span suspension on-alignment alternatives were also considered, but were not retained for further study in the DEIS, because they would not allow for connection with the

CBP or GWMP and would be cost prohibitive. Alignment options that were investigated further include: an entirely offset alignment to either the east or west; a minimally offset alignment to either the east or west; and widening the structure on the existing alignment.

The ALB alignment determination required assessing impacts to wetlands, streams, forests, rare plant species, cultural resources, and adjacent properties such as the Naval Surface Warfare Center at Carderock in Maryland and a residential community along the Virginia shoreline of the Potomac River. Other factors considered when evaluating the proposed alignments included maintenance of traffic, constructability, construction access, and roadway engineering issues such as re-aligning the interchanges that lead to the ALB.

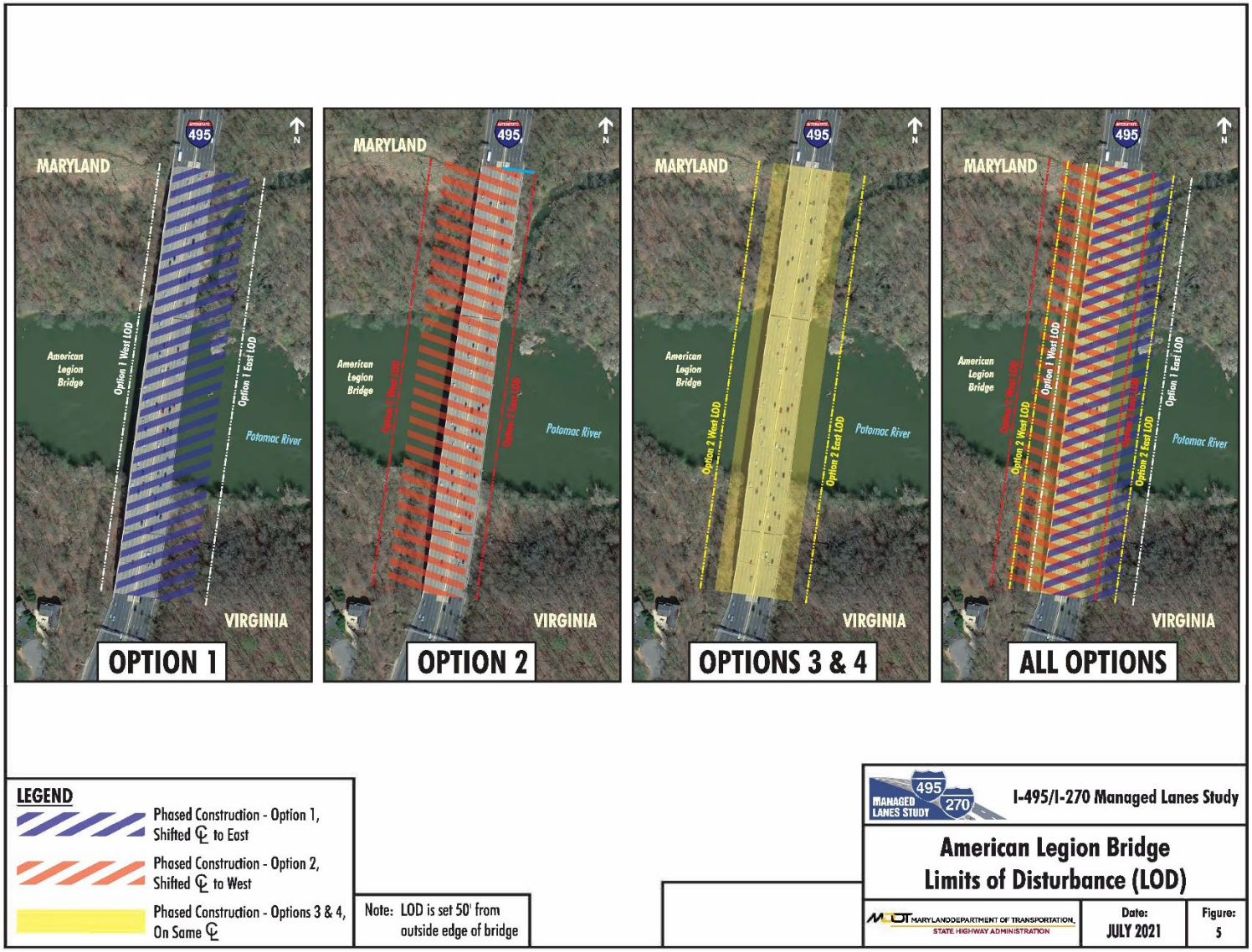
Building the replacement ALB on an entirely offset alignment to the east of the existing structure while traffic remains in its current configuration would result in unacceptable impacts to Plummers Island, an important biological and cultural resource within the CHOH, and impacts the two other NPS parks in the vicinity of the ALB. This approach would not be feasible on the west side of the existing ALB either, due to unacceptable impacts to the Naval Surface Warfare Center Carderock Division property located on the north side of the Potomac River, to a residential community on the south side of the Potomac River and to two NPS parks (CBP and CHOH).

A less impactful approach would be to construct a new structure on a minimally offset alignment, while placing traffic partly on the existing structure and partly on a new structure during construction. The minimally offset alignment to the east would still impact Plummers Island more than would be acceptable and this alignment is not feasible. The minimally offset alignment to the west would avoid impacts to Plummers Island, but would impact more NPS property and would require displacement of a residential property on the Virginia shoreline of the Potomac River. This “west shift” alignment was considered post-DEIS and is discussed further in **Section 3.1.1.D**.

Widening on the existing alignment would impact Plummers Island to some extent, but would avoid impacts to the residential property on the Virginia side of the ALB and would impact less NPS property than the “west shift” alignment option. This “on-center” widening alignment was considered post-DEIS and is discussed further in **Section 3.1.1.D**.

See **Figure 5** for a visualization of the minimally offset alignment to the east and west, the fully offset alignment to the east and west, and the potential impacts resulting from on-center widening.

Figure 5: American Legion Bridge Limits of Disturbance Alignment Options



3.1.1 Alternative Bridge Design Options

Alternative bridge design options were considered to inform the LOD in the vicinity of the ALB, to determine the extent to which the LOD could be minimized to limit impacts to NPS land and natural and cultural resources, while still providing enough space to accommodate bridge construction and maintenance.

A. Avoidance

Long-span Bridge:

The only avoidance option identified was replacement of the ALB with a long-span bridge. In order to avoid natural resources at the bridge location, permanent piers would need to be constructed completely beyond the limits of the resources. This would require a pier north of the Washington Aqueduct on the Maryland side and at, or south, of the existing south abutment in Virginia. The resulting clear span is at least 3,250 feet. A suspension bridge is the only feasible bridge type to span this distance and a bridge this long would be the 35th longest suspension bridge in the world, or the 5th longest in the U.S. Additional back-span dimensions for anchorage would be at least another 800-feet on each end for a total bridge length between cable anchorages of 4,850 feet. This length does not include a likely need for approach spans on either end to transition from the highway on grade to the suspended roadway. The total bridge length needed would make the interchanges at CBP and GWMP inaccessible. Replacing the ALB with a suspension bridge would not be practicable, since it would eliminate the interchanges with the parkways in Maryland and Virginia; would be cost-prohibitive; and would drastically alter the viewshed of the surrounding natural area.

B. Minimization

a. DEIS Minimization Options

Reconstruct Bridge without Widening:

One minimization option identified was reconstructing the ALB without widening. The existing bridge out-to-out width is approximately 138-feet and carries five lanes of traffic in each direction. To maintain 10 lanes of traffic during construction with minimal offsets to temporary barriers requires 119-feet of bridge width. Therefore, a maximum of 19-feet of the existing bridge is available for demolition and reconstruction in the first phase. This means that only one lane at a time could be reconstructed and shifted onto the new bridge. A minimum of nine phases of traffic control would be required to fully replace the bridge. This assumes that all the deck joints between phases are structurally feasible; the existing piers are stable in a partially loaded and/or demolished condition; and the new superstructure configuration could be made compatible with the temporary lane placement. The resulting superstructure would be inefficient, because uniform girder spacing would not be feasible while accommodating the required construction phasing. In addition, in the middle three phases of demolition and construction, work would have to occur between active lanes of traffic. In the same phases, traffic in the same direction would be divided with a construction zone in between the travel lanes. No work zone for construction vehicles and equipment would be available on the bridge, because all bridge deck that is in place, either existing or proposed, would be required to carry traffic. This approach to construction is very unsafe for motorists and construction staff. There would be no emergency pull off lanes for five lanes of traffic in each direction. Construction work would occur between and over open lanes of traffic. The duration of construction, number of traffic shifts, and inefficient structure configuration would result in a highly

undesirable and expensive approach to construction. This option is not practicable due to extreme safety issues, construction inefficiencies and challenges, and prohibitive cost and duration.

Double-Deck Existing Bridge:

A double-deck bridge was considered in hopes of reducing the extent of the construction footprint and minimizing impacts to NPS property and natural resources. The out-to-out superstructure width of one direction of travel in the proposed condition would be approximately 124-feet. Since this is less than existing superstructure width, constructing a second deck over the existing bridge superstructure would provide sufficient width for the proposed lane configuration. Previous analysis of the existing substructure units indicate that the piers are currently loaded to the point that there is no additional capacity. The additional dead load from the second deck and the live load from the vehicles could not be accommodated by the existing substructure. In order to support the second deck, new substructure units independent from the existing, would need to be constructed. These would consist of new pier caps spanning across the entire width of the existing bridge to newly constructed column elements supported on large, deep foundations located outside the existing bridge. To minimize the impact of the foundation elements, they would likely consist of large diameter drilled shafts. The associated pier cap would span a minimum of 155-feet, resulting in a significant concrete beam that would greatly increase the vertical profile of the top deck in order to provide sufficient vehicular under clearance to the lower deck. The approach roadway modifications necessary to transition from side-by-side to stacked roadways would extend well beyond the interchanges on each end of the bridge.

Proposed Double-Deck Bridge:

Building on the discussion above, it is clear that the out-to-out superstructure width of a completely new double-deck bridge would be 124-feet. To support both decks, the substructure would need to be wider than the superstructure. Again, assuming large, drilled shaft foundations and columns, the out-to-out of the entire bridge would be approximately 144-feet, which is wider than the existing bridge. Some minor additional impacts to the resources would be likely. To build an entirely new bridge, the construction phasing would ideally require the new bridge to be built off of the existing bridge alignment. This would allow conventional maintenance of traffic on the existing bridge while the new double-deck structure is completed. The approach roadway modifications required for the option to double-deck the existing bridge remain with this option. Construction of either double-deck bridge option is not practicable, since it would require a new substructure so far beyond the width of the existing structure that it would not reduce the construction footprint or minimize impacts to natural resources from a conventional construction method, but would be far more expensive than a conventionally constructed bridge.

Top-Down Construction:

Utilizing top-down construction techniques for the proposed bridge structure means that all construction equipment and access would be provided from the completed bridge deck. The contractor would begin construction at an abutment and the first pier working from the approach roadway behind the abutment. Next the superstructure would be constructed on the first span. All construction operations would then move onto the completed first span in order to construct the next pier and next span of superstructure. Construction would proceed in this manner along the entire length of the bridge until the full structure is complete. Two separate crews working from opposite ends of the bridge could each begin at opposite abutments and meet in the middle of the bridge. This technique would result in relatively short spans between pier locations due to limited equipment reach and capacity. The total footprint of pier elements

would be much larger than the footprint of a bridge with conventional span lengths. In addition, utilizing top-down construction does not address any of the issues with traffic phasing and work zones discussed in previous options. While this type of construction would still require a construction access road to remove materials and would be relatively more expensive to construct than the conventional method, it was determined to be a viable option.

b. Strike Team Minimization Options

MDOT SHA and Federal Highway Administration met with the NPS to discuss the LOD presented in the MLS DEIS on December 8, 2020. The NPS requested that MDOT SHA re-assess the LOD in the vicinity of the ALB to limit impacts to NPS land and its natural resources. MDOT SHA convened an 'ALB Strike Team' composed of national and local experts on bridge design, natural resources, and cultural resources who were charged with the following mission:

To develop and evaluate alternatives for the replacement of the ALB to avoid impacts, to the greatest extent practicable, and reduce overall acreage impacts to the C&O Canal National Historic Park (CHOH) and GWMP units of the NPS.

The ALB Strike Team conducted its intensive investigation in January 2021 to explore alternative design solutions, project phasing solutions, site access solutions, and the potential use of specialty construction techniques to limit the LOD. The ALB Strike Team presented its results to the NPS on February 8, 2021.

MDOT SHA established the Base LOD as the "Base Option," which includes a conventionally constructed bridge structure built in two phases on the existing bridge centerline with the assumption of temporary construction access over the Potomac River via trestles and causeways. This Base Option included minor LOD reductions from the DEIS LOD to minimize impacts to Plummers Island. The Base Option also started with construction access in all four quadrants and was minimized to remove the construction access in the southwest, southeast, and northeast quadrants, which significantly reduced impacts to NPS property.

The ALB Strike Team first reviewed the avoidance and minimization options developed by MDOT SHA to date, as described above, and the Strike Team agreed that these options were not practicable, except perhaps the top-down construction option, which they investigated in further detail. The Strike Team then reviewed the viability of the Base Option and confirmed that this on-center alignment with a conventional construction approach was a viable option. The ALB Strike Team also considered a "west shift" of the LOD to entirely avoid impacts to Plummers Island and determined that a conventional construction approach with a west shift was also a viable option.

The ALB Strike Team then considered other bridge construction approaches to determine if any of them could limit the LOD further than the Base Option could. The Strike Team conducted detailed investigation on a top-down segmental construction approach; a top-down cable stayed approach; and a slide-in place bridge construction approach.

<u>Top-Down Construction</u>

The first type of construction method assessed by the Strike Team was the top-down approach. The Strike Team investigated whether the existing bridge could be used as a work platform as part of the top-down construction method, but determined it could not, since the northbound and southbound lanes are at very different elevations, making it impossible to shift traffic across the bridge during construction. This

also means that the existing bridge cannot be used for construction and material deliveries, except during light traffic periods that would allow a lane closure. Top-down construction approaches investigated included: gantry, pre-cast segmental, cast-in-place segmental, and cable stayed. The Strike Team determined that the gantry method was not viable, because the ALB would require either spread footing foundations on rock or drilled piers, both of which would require ground access to the foundation locations for construction. Pre-cast segmental construction would also not be viable, because segments for the ALB would be too large and heavy to transport to the site.

Cast-In-Place Segmental

A cast-in-place segmental construction method was determined to be viable. A cast-in-place segmental bridge option would fit within the Base LOD, with impacts similar to the Base Option. The cost of this option is likely competitive with the Base Option and would likely be faster to construct.

Cable Stayed

The next top-down option reviewed by the Strike Team was the Cable Stayed Option, which would use a top-down cantilever method of construction. The primary advantage of this method is that it requires the fewest number of foundations of all options considered, minimizing the permanent ground displacement area. This option would also reduce the shade and shadow areas under the bridge, which is known to affect anadromous fish species. The cable stayed option would require a 200-foot tower and cables and would have a significant effect on the overall viewshed. This is the most expensive construction method considered.

Slide-In Place

A third type of bridge construction considered by the Strike Team for the ALB is the Slide-In Place Option. This option would construct the entire new superstructure on falsework situated west of the existing bridge and then slide it in place over a weekend. This option was found to be the most impactful strike team option and therefore not viable.

The Strike Team also reviewed constructability and construction access options and those are summarized in **Section 3.1.1.C** below. For more detail on the ALB Strike Team findings, please refer to the *American Legion Bridge Strike Team Report* (MDOT SHA 2021), completed on behalf of MDOT SHA's I-495 & I-270 Managed Lanes P3 Program.

C. Constructability Considerations

Construction equipment and personnel must be able to work below the bridge structures at river level to construct proposed piers and demolish the existing structure. Given the steep slopes on both shorelines of the Potomac River, limited access opportunities, and characteristics of the Potomac River channel, a site access plan is needed that requires additional LOD beyond the limits of the existing and proposed structures.

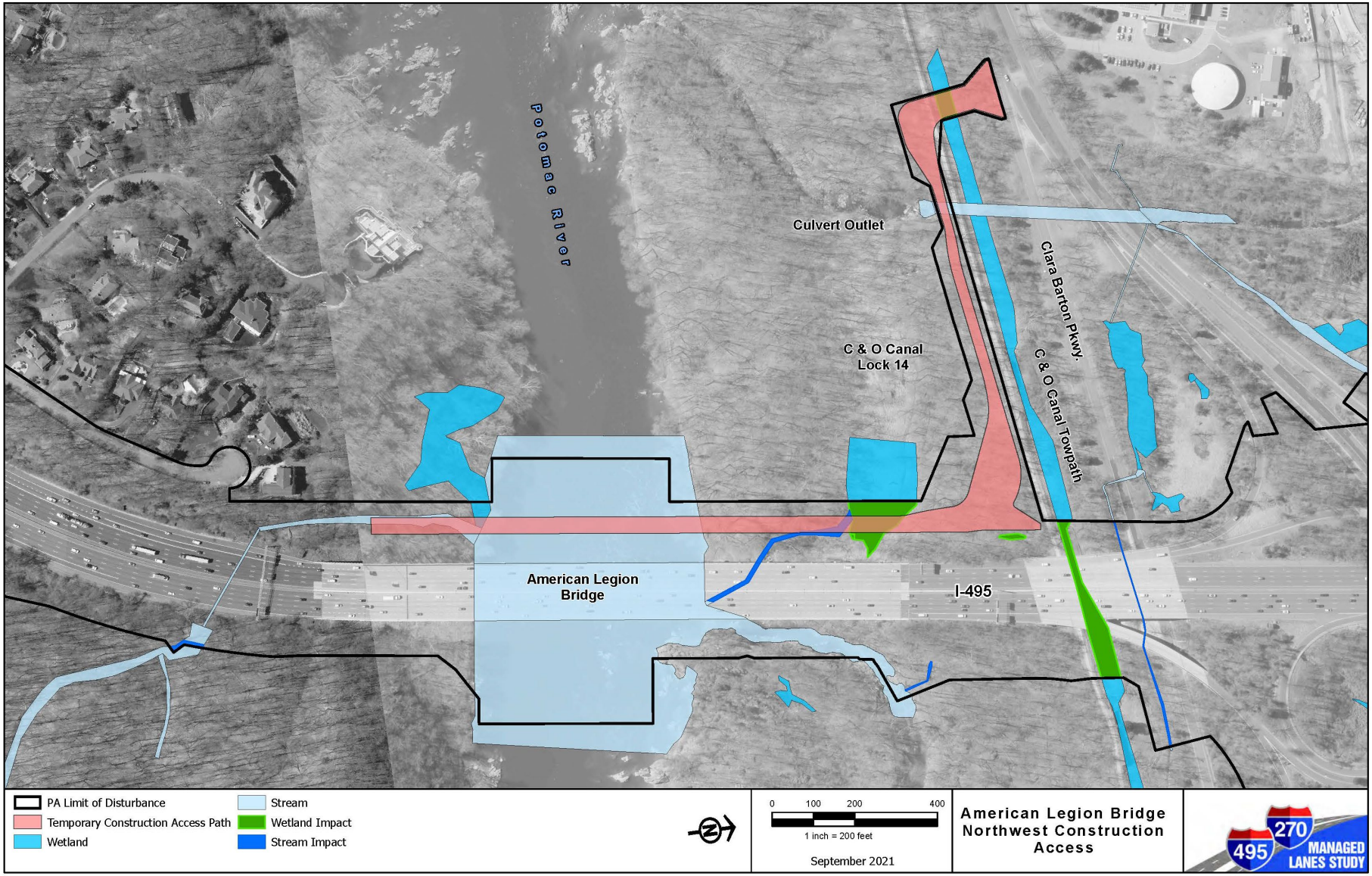
After field analysis and known information review, MDOT SHA and the ALB Strike Team determined that access to the site at river level can be consolidated to the north side of the river along CBP, eliminating the construction access from the other three quadrants around the bridge and significantly reducing impacts to NPS land. This would be achieved by constructing a temporary construction access road entrance off of CBP in the northwest quadrant and installing a temporary bridge over the C&O Canal and

a temporary haul road paralleling the towpath. Construction traffic could then turn south parallel to the existing structure and follow existing right-of-way to the area below the existing/proposed bridge. It is important to note that pedestrian traffic on the C&O Canal towpath must be maintained throughout construction. A barrier between the haul road and the towpath would need to be constructed to ensure public safety. The site access plan on the north side of the ALB would require an approximate travel way width of 40 feet beyond the extent of the proposed bridge to supply enough area for crane booms, pump trucks, man lifts, and other equipment needed to reach the proposed bridge deck from river level.

Access to the site at river level from the south side is more difficult. The existing residential neighborhood in the bridge's southwest quadrant constricts this area for site access. It is proposed that access to the south side of the river be via means of a temporary river causeway and temporary bridge, such as floating bridges and barges. River flooding would also need to be considered in the design of this temporary structure, which would require a contingency plan should water levels rise and would require the temporary structures and barges be built to withstand the 100-year flood or be removable prior to flood events.

The proposed construction access is shown in **Figure 6**. Storage of construction equipment, vehicles, and materials could be accommodated within the temporary LOD indicated in the SDEIS.

Figure 6: Proposed Construction Access for American Legion Bridge



D. Avoided and Minimized LOD in the Vicinity of the American Legion Bridge

MDOT SHA determined the LOD options for the ALB based on the results of the ALB Strike Team investigations. The bridge construction types with the smallest LOD footprint were the Base Option and the Cast-In-Place Segmental Option, both with a similar LOD requirement. Both construction types could be built with an on-center alignment or a west-shift alignment. MDOT SHA compared the NPS land impacts and those of the natural and cultural resources surrounding the ALB and determined that the on-center alignment would impact the least amount of total NPS Land; would not require re-configuration of the CBP interchange; and would not require residential displacement, as the west shift alignment would. For these reasons, the on-center alignment with the reduced LOD required by the Base Option or Cast-In-Place Segmental bridge types was incorporated into the Preferred Alternative LOD.

4 DESCRIPTION OF WETLANDS AND FLOODPLAINS WITHIN PROJECT AREA

4.1 NPS Wetlands

For the NPS, any area that is classified as a wetland according to the Federal Geographic Data Committee (FGDC) Wetlands Classification Standard (FGDC-STD-004-2013), a revision of the U.S. Fish and Wildlife Service's (USFWS) "Classification of Wetlands and Deepwater Habitats of the United States" (Report FWS/OBS-79/31) (FGDC 2013; Cowardin et al. 1979), is subject to NPS Director's Order 77-1: Wetland Protection (NPS 2002a). Deepwater habitats are not subject to Director's Order 77-1 since they are not considered wetlands under this definition. Under the Cowardin definition, a wetland must have one or more of the following three attributes:

- At least periodically, the land supports predominantly hydrophytes (wetland vegetation);
- The substrate is predominantly undrained hydric soil; or
- The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The Cowardin wetland definition encompasses more aquatic habitat types than the definition and delineation manual used by the Army Corps of Engineers for identifying wetlands subject to Section 404 of the Clean Water Act. The 1987 *Corps of Engineers Wetlands Delineation Manual* requires that *all three* of the parameters listed above (hydrophytic vegetation, hydric soil, wetland hydrology) be present in order for an area to be considered a wetland. The Cowardin wetland definition includes such wetlands, but also adds some areas that, though lacking vegetation and/or soils *due to natural physical or chemical factors* such as wave action or high salinity, are still saturated or shallow inundated environments that support aquatic life (e.g., unvegetated stream shallows, mudflats, rocky shores). The National Wetlands Inventory (NWI) produced by USFWS provides information on the characteristics, extent, and status of the nation's wetlands and deepwater habitats. The wetlands on the NWI maps are based upon the Cowardin wetland definition and classification system (Cowardin et al. 1979), so (subject to ground truthing) they are considered wetlands by the NPS.

The document will refer to all shallow water habitats subject to D.O. #77-1 according to definitions within the Procedural Manual for D.O. #77-1 and the FGDC Wetlands Classification Standard. Palustrine wetlands will generically be referred to as "wetlands" and riverine wetlands will generically be referred to as "streams." The term "NPS wetlands" will be used to generically refer to wetlands and streams on NPS land. Refer to **Figure 1** in **Section 1.1** for a depiction of NPS wetlands on NPS park land.

4.1.1 NPS Wetland Assessment Methodology

Field delineation and functional assessment of NPS wetlands within NPS park land within the MLS Corridor Study (CSB) Boundary was conducted from March 2018 through January 2021. All shallow water habitat features were delineated to satisfy both the 1987 USACE Manual and the FGDC Wetlands Classification Standard. Palustrine and riverine wetlands were identified within NPS park boundaries. Palustrine wetland boundaries were determined using the 1987 USACE Manual and Regional Supplements and riverine wetland boundaries were determined according to the FGDC Wetlands Classification Standard.

Environmental scientists completed data sheets for all shallow water habitat located on NPS land, including additional Cowardin classification information. All features were photographed and given a unique identifier containing the number of its associated field sub-segment. Data obtained from the field reconnaissance was collected with an iPad and boundary points were located using global positioning systems (GPS).

4.1.2 Evaluation of NPS Wetland Functions and Values

MDOT SHA conducted a qualitative functional assessment of palustrine NPS wetlands within NPS property and within the I-495 & I-270 MLS CSB in January 2021. The functions and values assessed include:

- Groundwater Recharge/Discharge,
- Floodflow Alteration,
- Fish and Shellfish Habitat,
- Sediment/Toxicant Retention,
- Nutrient Removal,
- Production Export,
- Sediment/Shoreline Stabilization,
- Wildlife Habitat,
- Recreation,
- Educational/Scientific value,
- Uniqueness/Heritage,
- Visual quality/Aesthetics, and
- Endangered Species Habitat

Functions:

- Ground water recharge/discharge—Recharge is the potential of a wetland to contribute water to an aquifer; discharge is the potential of a wetland to discharge groundwater to the surface. The wetland's ability to help maintain stream base flow has also been included in this variable.
- Flood alteration—The effectiveness of a wetland in reducing flood damage from prolonged periods of precipitation by storing and desynchronizing (i.e., gradually releasing at lower heights/velocities) floodwaters.
- Fish and shellfish habitat—The effectiveness of seasonal or permanent watercourses associated with a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of fish/shellfish and other aquatic organisms.
- Sediment/toxicant retention—The effectiveness of a wetland to reduce or prevent degradation of water quality by acting as a trap for sediments or toxic substances in runoff water that could adversely affect aquatic and terrestrial life.
- Nutrient removal—The effectiveness of a wetland to serve as a trap for nutrients carried by runoff from surrounding uplands or contiguous wetlands, and the wetland's ability to process these nutrients into other forms. The wetland also functions to prevent the adverse effects associated with excess nutrients entering aquifers or surface waters, including streams, rivers, lakes, ponds, or estuaries.
- Production export—The effectiveness of a wetland to produce food or other usable products for living organisms (including humans). Detrital export to downstream systems has been included in this variable.
- Sediment/shoreline stabilization—The effectiveness of a wetland to stabilize streambanks against shear stresses and/or protect shorelines against erosion by reducing forces caused from waves.

Other erosion and sediment control functions, such as reduction of water velocities and binding of the soil, have been included in this variable.

Values:

- Wildlife habitat—The effectiveness of a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of wildlife species typically associated with wetlands, their associated water bodies, and the wetland edge. This includes invertebrate species. Both resident and migratory species were considered.
- Recreation (consumptive/non-consumptive) and tourism—The suitability of a wetland and associated watercourses to provide active and/or passive recreational opportunities for both local and non-local populations. Consumptive use includes activities such as hunting and fishing that diminish the plants, animals, or other resources that are intrinsic to the wetland. Non-consumptive use includes activities such as hiking, birding, boating and canoeing, that do not diminish the resources of the wetland.
- Education/scientific value—The suitability of a wetland to serve as an "outdoor classroom," as a "reference site" for scientific study or research on ecosystems, or for interpretation.
- Uniqueness/heritage—The effectiveness of a wetland or its associated water bodies to provide certain wetland attributes or special functions and values related to aspects of public health, recreation, and habitat diversity. This may include the wetlands overall health and appearance, its role in the overall ecology of the area, or its relative importance as a typical wetland class for the geographic location.
- Visual quality/aesthetics (NPS/NE Method)—The effectiveness of a wetland in contributing to the visual or aesthetic quality or pleasing nature of the surrounding landscape.
- Endangered species habitat—The suitability of a wetland to support and/or provide the habitat requirements specific to rare, threatened, or endangered species.

Physical parameters, including wetland type, location in the landscape, flow/drainage, observed hydrology, microtopography, dominant vegetation, overall size, and soil composition were recorded and summarized. The wetland soil profile, landscape position, and hydrology were also assessed to determine the potential for groundwater infiltration within each wetland system. A visual assessment of any standing water was completed to provide an assessment of water quality. Based on the available hydrology and physical parameters of each wetland, an assessment of potential macroinvertebrate habitat was completed. Any available habitat features, including but not limited to standing water, vegetation, leaf packs, woody debris, and roots were noted. Available habitat was sampled using a D-net and a list of any observed macroinvertebrate species was compiled. During this assessment, any spring-fed groundwater seeps were noted and assessed for potential amphipod habitat. These field observations were summarized for each wetland feature and are included in the narratives below. As applicable, the narratives also include a summary of any listed rare, threatened, and endangered (RTE) plant species identified within or adjacent to the wetland systems during surveys previously completed in April through September 2020.

During the January 2021 NPS functional assessment, previously completed Functions and Values datasheets were verified in the field. A full assessment of the suitable and principal functions was

completed, and additional notes were added, as needed, to describe and characterize each wetland within NPS property.

Environmental scientists assessed the same functional parameters within riverine wetlands occurring on NPS property. Physical parameters, including stream class, location, hydrologic connectivity, substrate, bank stability, and adjacent vegetation were recorded and summarized. A visual assessment of water within the channel was completed to provide an assessment of water quality. Potential pollutants, trash abundance, and disturbances were noted. Each reach was assessed for potential fish habitat and macroinvertebrate habitat features, including, but not limited to, riffles, vegetation, leaf packs, woody debris, pools, and roots. All habitat features and any observed fish species were recorded. Available macroinvertebrate habitat was sampled using a D-net and a list of observed species was compiled.

Additionally, data collected during prior MLS field assessments was reviewed to inform the riverine wetland functional assessment on NPS park land. In February 2021, stream functional assessments were conducted for all NPS streams on NPS land within the MLS CSB using the EPA's RBP for Habitat Assessment (EPA, 1999). High and low gradient assessments were completed for streams over two percent in grade and below two percent in grade, respectively. The functions assessed between the two forms included:

- Substrate/Available Cover
- Embeddedness
- Pool Substrate Characterization
- Velocity/Depth Regime
- Pool Variability
- Sediment Deposition
- Channel Flow Status
- Channel Alteration
- Frequency of Riffles (or Bends)
- Channel Sinuosity
- Bank Stability
- Vegetative Protection, and
- Riparian Vegetative Zone Width

Scores from these assessments are presented in the table included in Appendix B of **Attachment B Qualitative Functional Assessment**. All functional assessment scores and additional field observations described above are summarized in the narratives for each NPS wetland below.

It is important to note that some of the NPS wetlands discussed in this SOF are located partially within an existing ROW for all alternatives and therefore have been previously disturbed. Historical disturbance has occurred because of vegetation removal activities during the initial highway construction and installation as well as during vegetation maintenance activities.

4.1.3 Results and Qualitative Functional Assessment of NPS Wetlands Impacted by the Preferred Alternative

The wetland delineation on NPS Land included palustrine riverine wetlands within the three NPS park units within the MLS CSB, as summarized in **Table 1** below and displayed on **Figure 2** and **Figure 3**.

Table 1: NPS Wetlands Impacted within Three National Park Service Units

Park Unit and Feature Name	Cowardin Classification
George Washington Memorial Parkway	
22WW	R4SB4
Clara Barton Parkway	
22Q_1	R3UB2H
22R	PFO1E
C&O Canal Historical Park	
22NN	R4SB4
22NN_B	R4SB4
22OO	PFO1B
22PP	PFO1A
22QQ	R4SB5
22V	R4SB3d
22V_1	R4SB3d
22V_2	R4SB3d
22V_B	R4SB3d
22V_B1	R4SB3d
22W	PEM1A/C

Each of the delineated and impacted NPS wetlands within the MLS CSB within GWMP, CBP, and CHOH park units were qualitatively assessed for wetland and stream function as described in the following sections. Note that impacts are not included for Feature 22MM, since the Potomac River and the Rock Run Culvert below the ordinary high-water mark are owned by the State of Maryland and are not under the jurisdiction of NPS. Features noted with "_C" in the name are culverts, are not considered NPS wetlands, and do not require mitigation.

A. George Washington Memorial Parkway

Stream 22WW: Stream 22WW is an unnamed tributary to the Potomac River. It is classified as an R4SB4 that flows southwest from GWMP and into a culvert on the east side of I-495. One small section of the stream within NPS property and near the existing culvert is within the CSB.

The stream is within a small valley likely receiving hydrology from both groundwater seeps and surface runoff. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22WW is suboptimal, with about 60 percent available habitat within the portion of stream just upstream of the culvert and within the CSB. Overall, the benthic macroinvertebrate habitat consists of small riffles, minor amounts of woody debris, roots, and small leaf packs. For fish, habitat is lacking, with only intermittent flows and downstream blockages. Riffle habitat is stable with some variety and flow diversity and is relatively frequent throughout Stream 22WW.

Substrate of the riffles consists of cobble, gravel and bedrock and is roughly 25 percent embedded. Pools are mostly shallow with gravel substrate, but some root mat habitat is available. Leaf packs observed were transient and unlikely to be suitable habitat. Shallow-fast and shallow-slow were the only two depth regimes present at Stream 22WW. Roughly 5 percent of the bottom of the streambed is affected by

sediment deposition, with slight deposition in pools. Water filled 50 to 75 percent of the channel during the time of the survey, with 25 to 50 percent of the channel substrate exposed. No evidence of channel alteration is present at Stream 22WW within the CSB on NPS property, however, downstream the stream flows west through a culvert under I-495.

Both banks are stable to moderately stable, with roughly 5 percent of both banks eroded; however, less than 50 percent of the streambank surfaces are covered by vegetation. Most of the bank stabilization and protection is from the bedrock, as well as some roots. Stream 22WW is surrounded by a mature high-quality mixed deciduous forest, giving both banks a riparian zone width of at least 18 meters. Very minimal human activity is impacting the riparian zones and approximately 90 percent of the stream is shaded by vegetation. The water within the stream appears clear with no noticeable odor present. Trash was only observed downstream outside of the NPS property at the input of the culvert running under I-495.

During a qualitative assessment of the aquatic community at Stream 22WW, aquatic worms (Subclass Oligochaeta), net-spinning caddisflies (Family Hydropsychidae), stoneflies (Order Plecoptera) and aquatic sowbugs (Family Asellidae) were collected in the stream. Aquatic worms and aquatic sowbugs are considered pollution-tolerant groups of organisms; net-spinning caddisflies are moderately pollution-sensitive; and stoneflies are pollutant-sensitive organisms. As Stream 22WW is a small intermittent channel, it is unlikely to be providing fish habitat, and none were observed during the time of the survey.

B. Clara Barton Parkway

Stream 22Q_1: Stream 22Q_1 is classified as R3UB2H and flows east from a culvert under I-495 and under CBP ramps and outside of the CSB.

Stream 22Q_1 is a manipulated natural channel receiving hydrology from headwater tributaries and surface runoff. Due to development, portions of the larger system upstream of the project area have been culverted or impacted by human activities in other ways. Stream 22Q_1 originates at a culvert within the CSB and flows into a culvert outside of the CSB. Based on the assessment of fish and macroinvertebrate habitat using the EPA Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at Stream 22Q_1 is poor, with less than 20 percent stable habitat and lack of substrate. Two of the four velocity/depth regimes are present at Stream 22Q_1.

The stream substrate is uniform and dominated by silts and sands, with more than 75 percent embeddedness. There is high sediment deposition in the stream reach and there is formation of islands and deposition in pools. Water fills 75 percent of the channel and a some of channel substrate is exposed. Some channel alteration is present in the sections of the reach near the culverts, although the construction was conducted over 20 years ago. Both banks are moderately stable, with 5 to 15 percent showing signs of erosion or instability. Vegetation protection is low on both banks, with less than 50 percent of the streambank surfaces covered by vegetation. The riparian zone consists of a mid-successional forest, giving both banks a riparian zone of at least 18 meters in width, with minimal human activity impacting the riparian zones. Stream 22Q_1 receives some sediment and pollution runoff from the upstream roadways.

Wetland 22R: Wetland 22R is a broad forested wetland situated within the floodplain of Stream 22Q in the eastern quadrant of the CBP/I-495 interchange. It is classified as a palustrine forested wetland with

broad-leaved deciduous vegetation and a seasonally flooded/saturated water regime (PFO1E). The broad wetland depression appears to be connected to downstream receiving streams outside the CSB.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from flooding along Stream 22Q. Observed wetland hydrologic indicators included surface water ponding up to four inches in depth, a high water table, and saturation. Secondary hydrologic indicators included geomorphic position.

Vegetation within the wetland included red maple (*Acer rubrum*), and American sycamore (*Platanus occidentalis*) in the canopy; common pawpaw (*Asimina triloba*) and black gum (*Nyssa sylvatica*) in the sapling stratum; and common pawpaw in the shrub layer. The herbaceous layer was dominated by invasive Japanese stilt grass with scattered deer-tongue grass (*Dichanthelium clandestinum*), sweet wood-reed, and frost aster (*Symphyotrichum pilosum*). The woody vine layer included horsebrier (*Smilax rotundifolia*) and Japanese honeysuckle.

Soils within the wetland met the redox dark surface hydric soil indicator. Soil samples had silty clay loam textures throughout.

Using the methodology described above, four principal functions/values were identified, including: groundwater recharge/discharge, sediment/toxicant retention, nutrient removal, and wildlife habitat. Evidence of deer use of the wetland and the presence of flowering plants provide opportunities for production export to occur.

The wetland was free of odors and trash and the shallow standing water appeared clear. Therefore, water quality within the wetland was likely high.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and limited habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of standing water within the lowest areas. Wetted vegetation, leaf packs, and wetted woody debris would be the primary substrates for such macroinvertebrates.

No federal or state listed threatened or endangered species are known to occur within Wetland 22R.

C. Chesapeake and Ohio Canal National Historic Park

Stream 22NN: "Stream 22NN" refers to features 22NN and 22NN_B. Stream 22NN is classified as an R4SB4 that flows southeast from Wetland 22OO on the west side of I-495 and flows into the Potomac River immediately under the North side of the ALB.

The stream is within a wide, eroded valley receiving hydrology from both the wetland upstream and surface runoff. As it flows under the bridge, the main channel begins to meander. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22NN is poor, with less than 20 percent available habitat. Overall, the benthic macroinvertebrate habitat consists of a few rocks, leaf packs and woody debris. For fish, habitat is lacking, with only intermittent flows and a lack of pools. Riffles are lacking with embeddedness at 100 percent, however, in the portion of stream under the I-495 bridge, placed riprap is

present providing some stabilization and possible habitat. The stream has little flow diversity, with shallow-slow as the only velocity/depth regime present.

In portions of the stream outside of the bridge cover substrate is dominated by fine sediment, sand, and small gravel, whereas the stream substrate in the portions under the bridge is dominated by mud with placed riprap present throughout. About 20 percent of the bottom of the streambed is affected by sediment deposition, with slightly more deposition in the portion of the stream flowing under the ALB. Very little water filled the channel during the time of the survey, with most of the channel substrate exposed, especially in the upstream portion that is not under the bridge. The portion of the stream channel that flows under the bridge had pools of stagnant mud. Some channel alteration is present, especially in the portions of the stream under the ALB where riprap has been placed.

The natural flow and location of the channel was also likely altered when I-495 was built. Both banks in the upstream portion that is not under the bridge are moderately stable, with 30 percent showing signs of erosion. The left bank under the bridge is unstable with many raw areas, while the right bank is moderately stable with roughly 30 percent erosion present. Apart from the portion of stream under I-495, 50 to 70 percent of the streambank surfaces are covered by woody roots and vegetation. No vegetation is present under the bridge. Since the stream runs parallel to I-495 upstream before flowing under the bridge, a riparian zone of about 12 meters is present on the left bank, with the right bank consisting of a riparian zone greater than 18 meters. Under the bridge, the riparian zones on both banks are less than 6 meters wide, with only sparse trees present. The upstream portion is partially shaded by vegetation, whereas the bridge provides 100 percent shade for the portion flowing underneath. Stream 22NN receives sediment and pollutant runoff from the adjacent roadway. No odor was present at the time of the survey, however iron floc, turbid water, suspended sediments, and some trash were observed in the stream.

During a qualitative assessment of the aquatic community at Stream 22NN, no fish were observed, but many pouch snails (Family Physidae) and aquatic worms (Subclass Oligochaeta) were collected. Pouch snails and aquatic worms are both considered pollution-tolerant organisms.

Wetland 22OO: Wetland 22OO is a broad emergent and forested wetland swale situated on the second terrace above the Potomac River, just upstream of the ALB and extending west to Rock Run. It is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a saturated water regime (PFO1B). Trees are scattered throughout the wetland and large areas are dominated by emergent vegetation. The wetland swale slowly drains southeast to an intermittent stream that discharges into Rock Run Culvert, just above the confluence with the Potomac River.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from seasonal groundwater seepage along the base of the upper terrace north of the wetland. Observed wetland hydrologic indicators included surface water ponding between one and two inches. Other primary hydrologic indicators included: a seasonally high groundwater table, soil saturation, iron staining, inundation observed on aerial imagery, and water-stained leaves. Secondary hydrologic indicators included: drainage patterns, geomorphic position, microtopographic relief, and FAC-neutral test.

Vegetation within the wetland included scattered ash-leaf maple and American sycamore in the canopy. The herbaceous layer was dominated by invasive reed canary grass (*Phalaris arundinacea*) with scattered

false-spike false nettle, lizard's-tail (*Saururus cernuus*), Asiatic tearthumb (*Persicaria perfoliata*), and pinkweed (*P. pensylvanica*).

Soils within the wetland were not sampled during the initial wetland delineation because the project did not have invasive access from the NPS. During the assessment in January 2021, soil samples met the depleted matrix hydric soil indicator within the upper 12 inches. Soils had clayey textures within the upper 1.5 feet and were a sandy loam texture below that depth. Soil textures likely allow slow groundwater infiltration and recharge during drier portions of the year.

Using the methodology described above, three principal functions/values were identified, including: nutrient removal, production export, and wildlife habitat.

Water quality within the wetland did not appear high, as iron flocculent was present where standing water was observed.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrates, including isopods and amphipods (scuds), were found within a shallow swale through the wetland that retained several inches of water during the early January sampling effort. Emergent vegetation was the primary substrate for these macroinvertebrates.

No federal or state listed threatened or endangered species are known to occur within Wetland 22OO. However, the state endangered buttercup scorpion-weed was mapped just outside the limits of the wetland and within the 25-foot wetland buffer to the north and south. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Wetland 22PP: Wetland 22PP is a narrow, isolated forested wetland swale situated on a shallow depression on the upper terrace slope just upstream of the ALB and downslope of the C&O Canal Towpath. It is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporarily flooded water regime (PFO1A). The wetland swale slowly drains south but dissipates where the slope increases, and water quickly diffuses in sheet and channel flow downslope toward Wetland 22OO.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from seasonal near-surface groundwater seepage along the slope of the upper terrace. Observed wetland hydrologic indicators included shallow surface water ponding in pockets to a quarter inch depth. Other primary hydrologic indicators included a seasonally high groundwater table and soil saturation. Secondary hydrologic indicators included drainage patterns, geomorphic position, and FAC-neutral test.

Vegetation within the wetland included scattered American elm in the canopy and amur honeysuckle in the shrub layer. The herbaceous layer was dominated by dotted smartweed with scattered creeping Japanese honeysuckle (*L. japonica*) vine, seedling green ash (*Fraxinus pennsylvanica*), and amur honeysuckle seedlings.

Soils within the wetland met the depleted matrix and redox dark surface hydric soil indicators. During the assessment in January 2021, soil samples had sandy loam to sandy clay loam textures within the upper

1.5 feet. Groundwater discharge occurs seasonally within the wetland and soil textures likely allow slow groundwater infiltration and recharge downslope of the wetland.

Using the methodology described above, two principal functions/values were identified, including groundwater recharge/discharge and production export.

Water quality within the wetland is low, as very little water is retained by the wetland and what is retained is typically sediment laden.

Based on the geomorphic position of this wetland and absence of standing water observed during the assessment, this wetland does not likely support a diverse fauna of macroinvertebrates. No macroinvertebrate habitat exists within the wetland and no macroinvertebrates were observed during the January 2021 assessment.

No federal or state listed threatened or endangered species are known to occur within Wetland 22PP. However, the state endangered buttercup scorpion-weed was mapped just outside the limits of the wetland to the north and south. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Stream 22QQ: Stream 22QQ is classified as an R4SB5 that flows southeast into Rock Run Culvert, Stream 22MM. The stream originates from a culvert that flows east under I-495. The entirety of the delineated stream is within the CSB.

Stream 22QQ is within a small gully, likely receiving hydrology from surface runoff. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22QQ is poor, with less than 10 percent available habitat. Overall, the benthic macroinvertebrate habitat consists of only some small areas of shallow, fast-moving water. For fish, habitat is lacking, with only intermittent flows. There are no well-defined riffles or pools providing habitat and there is very little flow diversity.

The stream bed substrate is lacking cobble/gravel, consisting mostly of fine sediment, and stream particles are over 75 percent embedded. Roughly 30 percent of the bottom of the streambed is affected by sediment deposition with slight deposition in pools. Very little water was present in the channel during the time of the survey, exposing most of the channel substrate. There is some channel alteration present, with riprap placed throughout the reach and with the upstream portion originating from a culvert.

The entire stream channel of 22QQ is incised with roughly 60 percent erosion on both banks, frequent areas of erosion, and head cutting. Less than 50 percent of the streambank surfaces are covered by native vegetation with many raw areas present. The riparian zone consists of a mature, high-quality forest, giving both banks a riparian zone at least 18 meters wide, with minimal to no human activity impacting the riparian zones. Approximately 90 percent of the stream is shaded and is bordered by a mixed-deciduous forest. Stream 22QQ receives sediment and pollution runoff from the adjacent roadway. Iron floc and trash are present within the stream channel, and oil sheen is present on the water's surface in areas of standing water.

During a qualitative assessment of the aquatic community at Stream 22QQ, no fish were observed, but aquatic worms (Subclass Oligochaeta) were collected. Aquatic worms are pollution-tolerant organisms.

Stream 22V: "Stream 22V" refers to all stream feature names that start with 22V, including: 22V, 22V_1, 22V_2, 22V_B, and 22V_B1. Stream 22V is classified as an R4SB3d that runs parallel to CBP and flows east under I-495. The stream flows east through the CSB.

Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for low gradient streams, the epifaunal substrate/available cover at 22V is poor, with less than 10 percent available habitat. Overall, the benthic macroinvertebrate habitat is deficient. For fish, there is no habitat present. Riffles are lacking with little variety and no flow diversity, while pools are mostly small-shallow with no root mat or submerged vegetation.

In portions of the stream outside of the bridge cover, substrate is dominated by gravel, sand, and silt, whereas the portions under the bridge are lined with riprap. Only about 30 percent of the bottom of the streambed is affected by sediment deposition, with slightly more deposition in the portion of the stream flowing under the I-495 bridge over CBP. Very little water filled the channel during the time of the survey, with only pockets of standing water present. Some channel alteration is present, especially in the portions of the stream under the I-495 bridge where it is lined with riprap. The channel was also likely formed or re-shaped when CBP was built more than 20 years ago, as it now acts as a roadside ditch. The channel of Stream 22V is very straight, likely having been channelized for many years.

Both banks are stable to moderately stable, with 5 percent or less of both banks showing signs of erosion. The portion of the stream west of I-495 does have minor amounts of erosion present on both banks, however, it is mostly healed over with some herbaceous vegetation present. The portion under the bridge has no bank instability as they are armored with riprap. Apart from the portion of stream under I-495, 50 to 70 percent of the streambank surfaces are covered by vegetation, with mowed grass present just west of the bridged portion and scattered trees and shrub hedge grove areas present in the remaining portions. No vegetation is present under the bridge. Since the stream runs parallel to a road on the left bank and is impacted by human activities associated with the C&O Canal on the right bank, both banks have riparian zones of less than 12 meters in width.

Vegetation is providing very little shade for the stream, as it is bordered by mowed grass and young regenerating woody species. The bridge provides 100 percent of shade for the portion flowing underneath. Stream 22V receives sediment and pollutant runoff from the adjacent roadways. No odor was present at the time of the survey, however cloudiness caused by fine sediments was present in the standing water and trash was observed along the banks.

During a qualitative assessment of the aquatic community at Stream 22V, no fish were observed, but many pouch snails (Family Physidae) and some aquatic sowbugs (Family Asellidae) were collected from the standing water. Pouch snails and aquatic sowbugs are both considered pollution-tolerant organisms.

Wetland 22W (C&O Canal): Wetland 22W is an emergent wetland delineated within the C&O Canal, spanning the entire width of the MLS CSB from east to west and beneath the I-495 bridge over CBP. It was classified as an excavated palustrine emergent wetland with persistent vegetation and a temporarily to seasonally flooded water regime (PEM1A/C). This excavated depression lies on an upland terrace high above the adjacent Potomac River, and has no surface water connection to downstream streams.

The wetland is hydrologically supported by surface water runoff that is retained by slowly drained clayey soils. Observed wetland hydrologic indicators included surface water ponding and a shallow water table perched over a dense clay. Other primary hydrologic indicators included sediment deposits, water marks, and water-stained leaves. Secondary hydrologic indicators included a positive FAC-Neutral test.

Vegetation within the wetland varied depending upon subtle differences in topography within the C&O Canal that leads to slight differences in the duration of surface water ponding or soil saturation, and on the availability of sunlight. Where surface water ponding is of longer duration, vegetation was comprised of both broad-leaf cat-tail (*Typha latifolia*) and narrow-leaf cat-tail (*Typha angustifolia*), duck-potato (*Sagittaria latifolia*), sedges (*Carex* spp.), lamp rush (*Juncus effusus*), rice cut grass (*Leersia oryzoides*), invasive common reed (*Phragmites australis*), and two species of hibiscus (*Hibiscu*s spp.). Within drier areas, invasive Japanese stilt grass (*Microstegium vimineum*) predominated along with Japanese bristle grass (*Setaria faberi*) and varieties of goldenrod (*Solidago* spp.). Beneath the existing I-495 bridge over CBP, little vegetation coverage existed because of shading effects.

Soils within the wetland were a silty clay texture and met the hydric soil criteria by exhibiting a depleted matrix (5Y4/1, 5Y3/1) throughout the 16-inch soil profile. These tight clay soils slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, three principal functions/values were identified, including: floodflow alteration, wildlife habitat, and uniqueness/heritage. The wetland provides floodflow alteration because of its position within the upper terraces of the Potomac River. Surface water runoff is trapped within the wetland as it drains downslope toward the river, thus allowing the excess runoff to slowly infiltrate, evaporate, or respire through the emergent vegetation within the wetland. The wetland also provides some sediment/toxicant retention and nutrient removal functions, but the opportunity for the presence of sediments, toxicants, and excess nutrients in the watershed above the wetland is relatively low. The wetland does contain numerous flowering and seed producing plants that attract a diversity of wildlife, including valuable pollinators and smaller and larger consumers. The wetland has a high uniqueness/heritage value because of its association with the CHOH. Remnants of a wooden lock occur within the wetland. The wetland exists because of the historical excavation of the canal. After the canal was abandoned as the primary means of transporting goods to Western Maryland, it eventually silted-in, resulting in the vegetated wetland condition of the canal today.

Since the wetland does not contain an outlet, water that collects within the wetland remains until it infiltrates or evaporates/respires. Therefore, water quality is likely not high. During field investigations some sediment was observed in areas with standing water.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and limited habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of standing water within the lowest areas. Emergent vegetation would be the primary substrate for such macroinvertebrates. During qualitative macroinvertebrate sampling in January 2021, a hellgrammite (Family Corydalidae) was observed, which is a pollution-sensitive organism. An aquatic worm (Subclass Oligochaeta) was also observed, which is a tolerant organism, as well as numerous scuds (Order Amphipoda), which are moderately-sensitive organisms. Scuds are common invertebrates found in

wetlands with surface water. There was no evidence of groundwater seeps or springs within the wetland that might contain rare subterranean amphipods.

No federal or state listed threatened or endangered species are known to occur within Wetland 22W. However, several halberd-leaf rose-mallow (*Hibiscus laevis*) plants were observed growing within a small area between Locks 11 and 12 during a targeted MLS Rare, Threatened and Endangered (RTE) Plant Survey in the summer of 2020. Halberd-leaf rose-mallow is a watch list species in Maryland, which means that it is at moderate risk of extinction or extirpation because of a restricted range; relatively few populations or occurrences; or recent and widespread declines, threats, or other factors.

4.2 Floodplains

Executive Order 11988, US Department of Transportation (USDOT) Order 5650.2, and the National Flood Insurance Act of 1968 govern the construction and fill of floodplains to ensure proper consideration to the avoidance, minimization, and mitigation of floodplain development and associated adverse effects. In addition to enforcing floodplain regulations, the National Flood Insurance Act and its National Flood Insurance Program (NFIP) provide affordable flood insurance to property owners (FEMA, 2018). Work within floodplains on NPS lands must adhere to NPS Floodplain Management D.O. #77-2 unless exempted. Floodplain approvals will be obtained by the appropriate jurisdiction.

Floodplains within the CSB and within NPS park land were identified using Maryland iMap and the Federal Emergency Management Agency (FEMA) Effective Floodplain GIS layer. The CSB crosses the FEMA 100-year floodplains of the Potomac River and Rock Run in Maryland and Dead Run in Virginia. The CSB overlaps the FEMA 100-year floodplains of these stream systems to varying degrees. **Table 2** describes the locations of these floodplains on NPS land within the Preferred Alternative.

Table 2: Streams and Associated Floodplains that Cross NPS Land

Name of Associated Stream	Location Where Floodplain Crosses Corridor Study Boundary
Potomac River	At the Maryland/Virginia border. Floodplain extends onto Maryland and Virginia shorelines.
Rock Run	Northwest of I-495/CBP interchange in Potomac, Maryland.
Dead Run	Crosses GWMP in Fairfax County, Virginia, east of I-495 and south of the Potomac River

5 PROPOSED IMPACTS TO WETLANDS, FLOODPLAIN, AND FLOOD RISK OF THE PROPOSED PROJECT AREA

5.1 Impacts to NPS Wetlands on NPS Land within the Preferred Alternative LOD

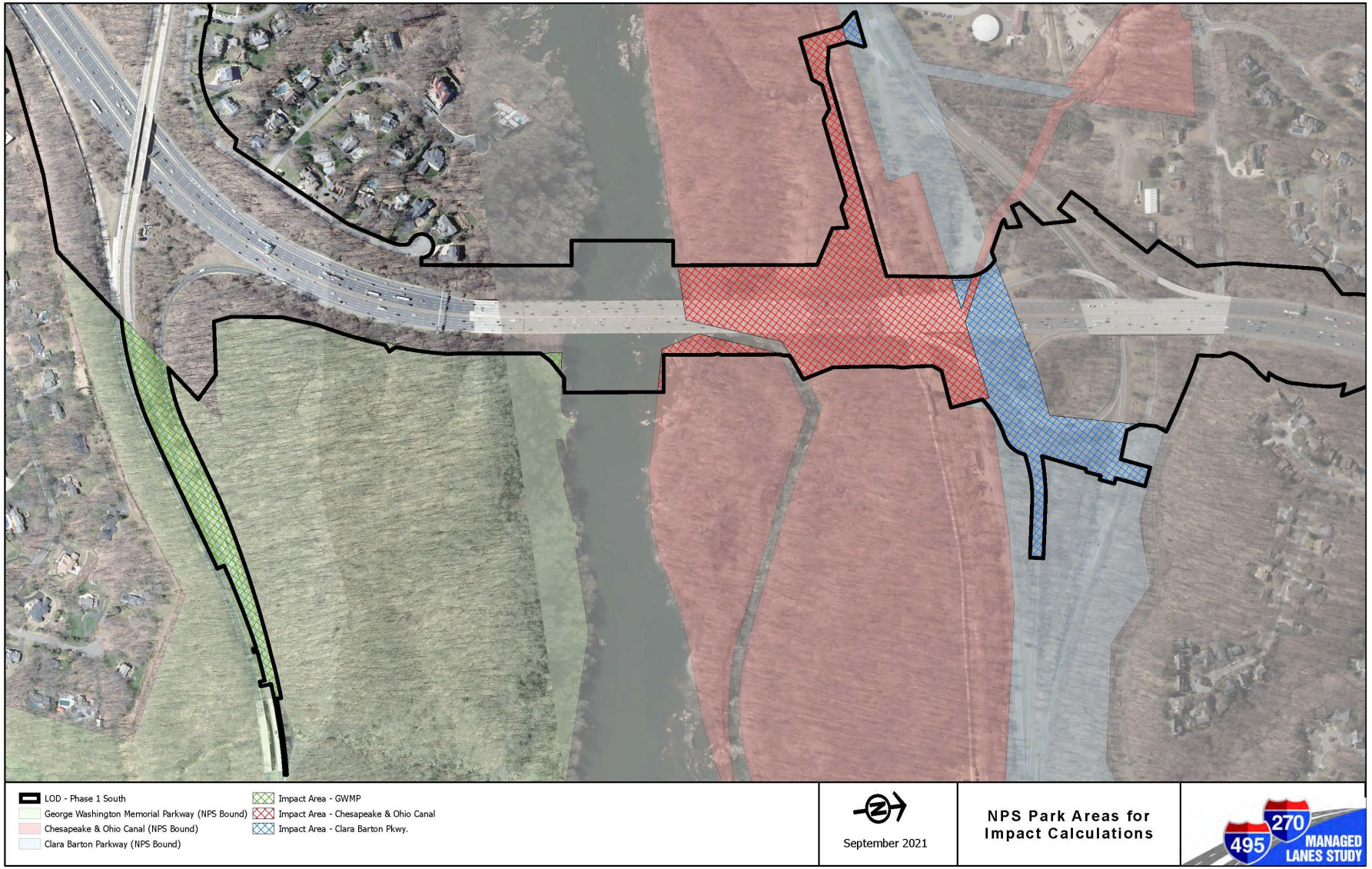
Impacts to shallow water habitat on NPS land were avoided and minimized to the greatest extent practicable and were an important factor in determining the ALB Preferred Alternative LOD. The impacts to NPS wetlands on NPS land that would result from the Preferred Alternative LOD are presented in **Table 3** below and depicted in **Figure 1**. The park area used to determine the limits of NPS lands for the purposes of impact calculation is depicted in **Figure 7**.

Table 3: Total Impacts to NPS Wetlands on NPS Park Land

Resource (unit)	MDOT SHA PA		
	Permanent	Temporary	Total
Natural Resources within Park Boundaries			
Riverine wetlands (square feet)	1,079	7,212	8,291
Riverine wetlands (linear feet)	125	1,115	1,241
Palustrine wetlands (acres)	0.06	0.60	0.66

Notes:
1. MDOT SHA PA includes the Centerline ALB Alignment from March 4, 2021 with additional refinements to the design and constructability assumptions.

Figure 7: NPS Park Areas for Calculating Impacts



Impacts to wetlands and streams by NPS park unit are presented in **Table 4** below and depicted in **Figure 2** and **Figure 3**:

Table 4: Impacts to NPS Wetlands on NPS Park Land by Park Unit

Park Unit and Resource (unit)	MDOT SHA PA		
	Permanent	Temporary	Total
George Washington Memorial Parkway			
Riverine wetlands (sq feet)	862	-	862
Riverine wetlands (linear feet)	69	-	69
Palustrine wetlands (acres)	-	-	-
C&O Canal Historical Park			
Riverine wetlands (sq feet)	14	7,164	7,178
Riverine wetlands (linear feet)	11	1,099	1,110
Palustrine wetlands (acres)	0.05	0.59	0.64
Clara Barton Parkway			
Riverine wetlands (sq feet)	203	48	251
Riverine wetlands (linear feet)	45	17	62
Palustrine wetlands (acres)	0.01	0.01	0.02

Notes:
1. MDOT SHA PA includes the Centerline ALB Alignment from March 4, 2021 with additional refinements to the design and constructability assumptions.

Impacts to individual wetlands and streams on NPS land within the Preferred Alternative LOD and their functional losses are presented in **Table 5** below and depicted in **Figure 2** and **Figure 3**.

Table 5: Impacts to NPS Wetlands on NPS Park Land by Park Unit and Feature

Park Unit and Feature Name	Cowardin Classification	Sq ft			Acres			Linear feet (Streams)			Functions and Values
		Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	
George Washington Memorial Parkway											
Riverine Wetlands											
22WW	R4SB4	862	-	862	0.02	-	0.02	69	-	69	Habitat; Flow Stability; Riparian Vegetation
Clara Barton Parkway											
Riverine Wetlands											
22Q_1	R3UB2H	203	48	251	<0.01	<0.01	0.01	45	17	62	Bank Stability; Channel Stability
Palustrine Wetlands											
22R	PFO1E	338	307	645	0.01	0.01	0.02	NA	NA	NA	Nutrient Removal; Wildlife Habitat
C&O Canal Historical Park											
Riverine Wetlands											
22NN	R4SB4	-	3,474	3,474	-	0.08	0.08	-	275	275	Minimal
22NN_B	R4SB4	10	1,465	1,475	<0.01	0.04	0.04	8	153	161	Minimal
22QQ	R4SB5	-	466	466	-	0.02	0.02	-	105	105	Minimal
22V	R4SB3d	-	190	190	-	<0.01	<0.01	-	76	76	Minimal
22V_1	R4SB3d	2	90	92	<0.01	<0.01	<0.01	1	40	41	Minimal
22V_2	R4SB3d	-	1,083	1,083	-	0.03	0.03	-	255	255	Minimal
22V_B	R4SB3d	-	331	331	-	0.01	0.01	-	168	168	Minimal
22V_B1	R4SB3d	2	66	68	<0.01	<0.01	<0.01	2	27	29	Minimal
Palustrine Wetlands											
22OO	PFO1B	1,708	10,429	12,137	0.04	0.24	0.28	NA	NA	NA	Nutrient Removal; Production Export; Habitat
22PP	PFO1A	490	-	490	0.01	-	0.01	NA	NA	NA	Groundwater Recharge; Production Export
22W	PEM1A/C	-	15,113	15,113	-	0.35	0.35	NA	NA	NA	Floodflow Alteration; Habitat; Uniqueness

Notes:
1. MDOT SHA PA includes the Centerline ALB Alignment from March 4, 2021 with additional refinements to the design and constructability assumptions.

5.2 Flood Risk within the Preferred Alternative

Avoidance and minimization of impacts to floodplains on NPS land within the MLS Preferred Alternative has been conducted to the maximum extent practicable, however there are unavoidable impacts to floodplains associated with this project. Floodplain impacts could not be avoided since alternatives that avoid all floodplain impacts do not meet the purpose and need. The 100-year floodplain impacts presented in **Table 6** represent the extent of the LOD associated with roadway widening and new ramps at the CBP/I-495 interchange and impacts from construction access areas associated with construction of the ALB. Actual analysis of potential project related changes to hydraulic function and elevation of floodplains will be determined using hydraulic and hydrologic floodplain modeling as part of the engineering process for each structure in final phases of design. Design efforts will focus on not increasing flooding, however if flood levels are increased, the project will mitigate the effects and comply with NFIP requirements. All structures and facilities will be designed to meet the standards and criteria of the NFIP (44 CFR Part 60).

Table 6: Impacts to FEMA 100-Year Floodplains that Cross NPS Land in Acres

Park Unit and Resource (unit)	MDOT SHA PA		
	Permanent	Temporary	Total
George Washington Memorial Parkway			
FEMA 100-Year Floodplain (sq feet)	1,098	2,603	3,701
FEMA 100-Year Floodplain (acres)	0.03	0.06	0.09
C&O Canal Historical Park			
FEMA 100-Year Floodplain (sq feet)	35,541	290,892	326,433
FEMA 100-Year Floodplain (acres)	0.82	6.68	7.49
Clara Barton Parkway			
FEMA 100-Year Floodplain (sq feet)	-	-	-
FEMA 100-Year Floodplain (acres)	-	-	-

Note: 1. MDOT SHA PA includes the Centerline ALB Alignment from March 4, 2021 with additional refinements to the design and constructability assumptions.
2. Note there is no impact to the floodplain of Dead Run, since all proposed impacts are on existing roadway.

The Potomac River is the fourth largest river along the East Coast of the US and has the potential for severe flood events. This flood hazard potential is a concern for the replacement of the bridge, with potential danger to infrastructure, people, wildlife, and surrounding natural resources if bridge elements were to wash-out during a flood event. For this reason, the ALB and its temporary construction elements (e.g. causeways and barges) will be constructed to withstand the 100-year storm. The flood risk is estimated by reviewing NOAA flood data associated with the Little Fall Gauge on the Potomac, which indicates that water levels in this portion of the Potomac increase to potentially dangerous high-water conditions on a fairly regular basis.

Fifty-one of the one-hundred recorded historic Potomac River floods (over 9.4 ft at Little Falls Gauge, National Oceanic and Atmospheric Administration data) were recorded since the first ALB structure was built in 1962 and thirty-three since the midsection of the bridge was filled in 1992. 1996 included two of the top 7 floods and 2018 included 4 historic floods. In 2019, the Plummers Island floodplain was inundated on and off for much of winter and spring. Mather Gorge (Cohn 2004) is much narrower at the ALB and Plummers Island than at Little Falls Gauge, so the high-water marks listed in **Table 7** from the Little Falls Gauge substantially underestimate the peak flows at the ALB and head of Plummers Island, but

give an idea of the high water conditions associated with flood events in the Potomac River in the general vicinity.

Table 7: High-Water Conditions Associated with Flood Events at Little Falls Gauge on the Potomac River (NOAA data)

Rank	Height (feet)	Date
5	19.29	1/21/1996
7	17.84	9/8/1996
31	12.82	3/15/2010
36	12.38	6/5/2018
37	12.35	3/6/1993
46	11.7	5/18/2014
47	11.68	4/18/2011
50	11.56	12/17/2018
54	11.44	9/21/2003
58	11.3	5/20/2011
61	11.17	1/27/2010
65	11.01	9/29/2018
66	10.88	3/12/2011
67	10.87	12/12/2003
68	10.85	9/11/2018
70	10.79	3/22/1998
77	10.55	4/18/1993

As indicated above, flood risk associated with the construction of the ALB is considerable and will be mitigated through careful construction measures. It is imperative that construction of the ALB be done in such a way as to avoid blow-outs of the temporary construction platforms and that people are kept out of the construction area during flood events to ensure that no one is harmed by potential flood debris.

6 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

Alternative 9 in Phase I South was identified as the Preferred Alternative for the I-495 & I-270 Managed Lanes Study in the SDEIS. MDOT SHA took into consideration the extensive comments of the cooperating agencies and the public when identifying a MLS Preferred Alternative, especially in the vicinity of the ALB. MDOT SHA coordinated closely with NPS to determine its concerns regarding the widening of I-495 and the replacement of the ALB within the C&O Canal Historical Park, CBP, and GWMP park units. MDOT addressed these concerns as much as possible in determining an LOD in these areas of the Preferred Alternative.

MDOT SHA responded to NPS' concerns related to the ALB LOD by assembling an ALB Strike Team of bridge construction and natural and cultural resource specialists to minimize the LOD as much as possible, with the least impact to the surrounding National Park Service land and natural and cultural resources.

MDOT SHA determined that the on-center alignment would result in the least impact to NPS land and would be the most practicable option. Although this alignment would have more impacts to streams and to Plummers Island than the West-Shift Alignment, it would have fewer impacts to wetlands and to NPS

land in general. The on-center alignment would also not require the Clara Barton interchange to be re-configured and would not cause residential displacements. The extent of the Preferred Alternative LOD was determined by considering several potential bridge construction types and selecting the smallest constructable LOD surrounding the ALB that would account for the additional lanes associated with this widening project. The Preferred Alternative is the NPS least damaging practicable construction alternative with respect to the requirements of D.O. #77-1 and #77-2.

7 MITIGATION MEASURES

7.1 Wetland Mitigation

7.1.1 Preferred Alternative Wetland Impact Avoidance and Minimization Practices

Throughout the development of the Preferred Alternative, MDOT SHA avoided and minimized adverse impacts to park resources to the greatest extent practicable by:

- Convening an ALB Strike Team to investigate potential design options, structure types, construction methods, and construction access routes to reduce the ALB LOD and therefore reduce overall impact to NPS land and to wetlands, streams, and floodplains.
- Reducing the number of access roads, which were originally proposed in all four quadrants of the ALB and were limited to a single proposed access road in the northwest quadrant, thereby reducing impact to wetlands and streams.
- Selecting the on-center alignment, which has fewest wetland impacts and lowest impact to NPS land, while also eliminating the need to re-configure the CBP interchange or cause residential displacement.

7.1.2 Wetland Compensatory Mitigation Requirements

As discussed above, efforts have been made throughout the MLS Phase I South planning process to avoid and minimize impacts to wetlands on NPS lands, while still achieving the goals of the project. Despite these efforts, impacts to NPS wetlands are unavoidable due to the extensive network of features that are located adjacent to and flow beneath the existing roadway. The project will result in unavoidable short and long-term impacts to NPS wetlands that are greater than 0.1 acres total and will therefore require wetland compensation in accordance with the policies and procedures of D.O. #77-1. The project will impact a total of 0.86 acres of NPS wetlands that will require mitigation, including 0.35 acres of palustrine emergent wetlands, 0.31 acres of palustrine forested wetlands, and 0.20 acres of streams. These unavoidable impacts are discussed in further detail in **Section 5.1** of this report.

Wetland compensation requirements were determined based on guidelines in Section 5.2.3 of the Procedural Manual #77-1: Wetland Protection (NPS 2016). The Procedural Manual states "*For the purpose of wetland compensation, wetland restoration proposals must, at a minimum provide one-for-one (1:1) wetland function replacement (i.e., focus on no net loss of wetland functions, not just wetland acreage).*" and that "*Final compensation ratios may need to be greater than 1:1 in cases where: (1) the functional values of the site being impacted are determined to be high and the restored wetlands will be of lower functional value; (2) it will take a number of years for the restored site to become fully functional (e.g., reestablishment of scrub-shrub or forested wetlands); or (3) the likelihood of full restoration success is unclear".*

Functional assessments were conducted for all NPS wetlands within the project study area and are discussed in further detail in **Section 4.1.2** of this report. These assessments, along with the proposed impact type, were used to determine the appropriate mitigation replacement ratios for the NPS wetland impacts. NPS wetland mitigation is not proposed for impacts to the Potomac River or the oxbow of the Potomac River, known as the Rock Run Culvert, (Feature 22MM) due to these impacts being located below the ordinary high-water mark of waters owned by the State of Maryland. The proposed impacts, functional loss, and mitigation replacement ratio for each NPS wetland are described below.

The Preferred Alternative will permanently impact Stream 22WW located in Virginia, just south of the ALB. The stream flows southwest through NPS parkland and into a culvert on the east side of I-495. Most of the stream east of I-495 is relatively stable and provides sub-optimal instream habitat, however the segment within the project LOD consists of a scour pool that was created by past construction/maintenance of the roadway culvert. Permanent impacts to the stream entail placing rip-rap in the channel for the proposed culvert extension. The reach being impacted provides limited hydrologic, geomorphic and in-stream habitat functions due to impacts from past roadway construction. The placement of rip-rap will improve the bed and bank stability of the channel. Following construction completion and seeding/planting the riparian area, the functions of the channel should fully recover and will likely improve over time. LODA mitigation replacement ratio of 1.1:1 was determined appropriate for permanent impacts due to the previously disturbed conditions of the channel.

Stream 22Q_1 will be impacted in the eastern quadrant of the CBP/I-495 interchange for access and alteration of an on-ramp to CBP. The impacted reach consists of a manipulated channel in a forest that flows east along the toe of the roadway embankment. The stream has moderately stable bed and banks, a streambed consisting of silts and sands, and shallow flows throughout most of the reach. Due to the small size and altered conditions, the feature provides limited hydrologic and geomorphic functions. Access and alteration of the on-ramp will require vegetation clearing along the channel that will have temporary impacts to these functions. Following construction completion and seeding/planting of the riparian area, the functions of the channel should fully recover over time. The on-ramp alteration will have minor permanent impacts to hydrologic and geomorphic functions due to the placement of rip-rap at the culvert outfall. The proposed rip-rap will improve the bed and bank stability of the channel. A mitigation replacement ratio of 1:1 was determined as necessary for temporary impacts to Stream 22Q_1 considering the channel and riparian buffer should fully recover over time. A mitigation replacement ratio of 1.1:1 was determined appropriate for permanent impacts due to the limited functions of the channel and minor impacts (<0.01 acres).

The Preferred Alternative will impact forested Wetland 22R located in the eastern quadrant of the CBP/I-495 interchange. The wetland is situated in the riparian zone of a stream (Feature 22Q_1) that flows east outside of the study area. Four principal functions/values were identified in the wetland including: groundwater recharge/discharge, sediment/toxicant retention, nutrient removal, and wildlife habitat. Access and alteration of the on-ramp will require vegetation clearing in the wetland that will have temporary impacts to these functions. Following construction completion, the wetland will be seeded/planted and the functions should fully recover over time. Permanent impacts to the wetland will be required for the placement of rip-rap at the culvert outfall that could limit the growth of native herbaceous plants that currently exist in the wetland. The proposed work will permanently impact the groundwater recharge/discharge, sediment/toxicant retention, nutrient removal, and wildlife habitat

functions. These permanent impacts are however relatively minor (0.01 acres). A mitigation replacement ratio of 1.5:1 was determined as necessary for the temporary impacts to Wetland 22R due to tree impacts. A replacement ratio of 2:1 was determined appropriate for permanent impacts due to the loss of trees and wetland hydrology.

Stream 22NN will be impacted north-west of the ALB. The channel consists of a deeply incised erosional feature that appears to be draining the groundwater hydrology from a degraded PFO wetland (Wetland 22OO) to the north. The feature has moderately unstable banks and a streambed consisting of silts, sands, and exposed bedrock. Surface water in the channel consists of shallow pools and surface flows, with several sections of the channel that are dry. The channel provides very limited hydrologic and geomorphic functions due to its small size, shallow flows, and incised conditions. Access and construction of the ALB expansion will require vegetation clearing and shading that will have temporary impacts to most of the channel. Following construction completion, channel stability should improve, and functions should recover over time. A new bridge pier will be constructed in the channel that will have permanent impacts to hydrologic and geomorphic functions. A mitigation replacement ratio of 1:1 was determined as necessary for temporary impacts to Stream 22NN and 22NN_B due to the limited functions of the channel and proposed stabilization improvements. A replacement ratio of 1.1:1 was determined appropriate for permanent impacts due to the degraded conditions and limited functions of the channel. The mitigation replacement ratios for Stream 22NN are based on roadway impacts; however, the channel is also included as part of the proposed mitigation site for the project that is discussed in **Section 7.1.3**.

Stream 22QQ is located north-east of the ALB and will be temporarily impacted for access and expansion of I-495 North. The channel consists of a deeply incised erosional feature that originates at a culvert outfall and drains south-east into Rock Run Culvert (Stream 22MM). The feature is deeply incised with severely eroded banks and a streambed consisting of silts and muck. Surface water in the channel consists of shallow pools and surface flows. The channel provides very limited hydrologic and geomorphic functions due to its small size, unstable conditions, and shallow flows. Vegetation clearing for access will have temporary impacts to these functions. Following construction completion and seeding/planting the riparian area, the functions of the channel should fully recover over time. A mitigation replacement ratio of 1:1 was determined as necessary for temporary impacts to Stream 22QQ due to the degraded conditions of the channel.

Stream 22V will be impacted just south of Clara Barton Parkway for expansion of the I-495 bridge and construction of a new off-ramp bridge to the east. The impacted reach consists of a man-made ditch in a forest that runs along the toe of the roadway embankment. The stream has moderately stable bed and banks, a streambed consisting of silts and sands, and shallow standing water throughout most of the reach. Due to the small size, lack of meanders, and intermittent nature of the channel, the feature provides limited hydrologic and geomorphic functions. Expansion of the existing bridge and construction of the new off-ramp bridge will require vegetation clearing along the channel that will have temporary impacts to these functions. Following construction completion and seeding/planting of the riparian area, the functions of the channel should recover over time. A new bridge pier will be constructed partially in the channel that will have minor permanent impacts to hydrologic and geomorphic functions. A mitigation replacement ratio of 1:1 was determined as necessary for temporary impacts to stream sections under existing bridges (22V_B and 22V_B1) considering the conditions of the channel will remain unchanged following construction. A 1:1 replacement ratio is also proposed for stream sections that are mostly

outside existing and proposed bridges (22V_2) where the riparian buffer should fully recover over time. A mitigation replacement ratio of 1.1:1 was determined appropriate for stream segments under new or expanded bridges (22V and 22V_1) due to the limited functions and minor impacts (<0.01 acres) to the overall hydrologic and geomorphic functions. A replacement ratio of 1.5:1 was determined appropriate for permanent impacts (22V_1 and 22V_B1) due to the limited functions of the channel.

The Preferred Alternative will impact forested Wetland 22OO located north-west of the ALB. The wetland is situated on a terrace above the Potomac River and drains south-east through a deeply incised channel (Stream 22NN) that connects to the Potomac. Three principal functions/values were identified in the wetland including: nutrient removal, production export, and wildlife habitat. Temporary and permanent impacts to the wetland will be required to access and construct the ALB expansion. All of the impacts will take place on the eastern side of the wetland that is dominated by invasive reed canary grass (*Phalaris arundinacea*) and mostly devoid of trees. Proposed access for the bridge expansion will require vegetation clearing and soil compaction that will have temporary impacts to wildlife habitat, nutrient removal and production export. Most of this temporary impact area is located within the NPS wetland restoration site (CHOH-13) that is proposed for the project and will be fully restored to a PFO wetland following construction completion. Further details on the proposed mitigation site are discussed in **Section 7.1.3**. The proposed bridge expansion over the wetland will have permanent impacts to production export, wildlife habitat, and nutrient removal functions of the wetland. A mitigation replacement ratio of 1:1 was determined as necessary for temporary impacts to Wetland 22OO due to the low quality of the existing wetland and proposed restoration that will improve the functions and values of the overall wetland. A replacement ratio of 1.1:1 was determined appropriate for permanent impacts due to the low-quality existing conditions and minimal loss (<0.01 acres) of production export, wildlife habitat, and nutrient removal to the overall wetland.

Wetland 22PP will be impacted just west of I-495 southbound. The wetland is situated in an isolated swale that drains along the toe of the roadway embankment. Two principal functions/values were identified in the wetland including: groundwater recharge/discharge and production export. Permanent impacts to the wetland will be required for expansion of I-495 to the west. Construction and access for the expansion will require filling-in the existing wetland and permanent impacts to groundwater recharge/discharge and production export functions. A mitigation replacement ratio of 2:1 was determined appropriate due to the removal of trees and permanent impacts to wetland functions.

The Preferred Alternative will temporarily impact emergent Wetland 22W located in the C&O Canal. This wetland spans the entire width of the canal and consists of an excavated depression that has no surface water connection to downstream waters. Three principal functions/values were identified in the wetland including: floodflow alteration, wildlife habitat, and uniqueness/heritage. The wetland contains a variety of native herbaceous plants that provide food and habitat for wildlife. Temporary impacts to the wetland will be required to access over the C&O Canal to the west of I-495, for the expansion of the I-495 bridge, and construction of a shifted off-ramp bridge to the east. Proposed access routes and temporary bridges will require vegetation clearing and shading that will have impacts to wildlife habitat. These areas are expected to fully recover following construction completion and removal of access routes and bridges. The proposed bridge expansion and new off-ramp will have impacts to wildlife habitat functions due to an increase in shading that could limit the growth of native herbaceous vegetation. These impacts are however relatively minor, with most of the impacts located under the existing I-495 bridge. A replacement

ratio of 2:1 was determined appropriate for temporary impacts based on the losses to wildlife habitat function due to bridge shading.

The Preferred Alternative will impact a total of 0.86 acres of NPS wetlands resulting in temporary functional impairments to wildlife habitat, nutrient removal, production export, hydrologic, geomorphic and in-stream habitat functions, and permanent functional impairments to wildlife habitat, nutrient removal, groundwater recharge, sediment/toxicant retention, production export, hydrologic and geomorphic functions. Replacement ratios for each NPS wetland were determined based on the impact type and functional loss of each feature. An impact replacement ratio of 1:1 was determined appropriate for most temporary impacts, with the exception of Stream 22V/22V_1 and Wetlands 22R and 22W. Replacement ratios for temporary impacts to Wetland 22R (1.5:1) and 22W (2:1) are greater due to tree and native herbaceous vegetation impacts. A 1.1:1 replacement ratio was determined appropriate for temporary impacts to Streams 22V and 22V_1 due to the proposed I-495 bridge expansion that will provide shade and likely prevent the growth of riparian vegetation. A 2:1 replacement ratio is proposed for permanent impacts to Wetlands 22R, 22W and 22PP based on proposed impacts to trees and native herbaceous vegetation. A 1.1:1 replacement ratio is proposed for permanent impacts to Wetland 22OO based on the degraded conditions of the existing wetland and the proposed minor impacts. A replacement ratio of 1.1:1 was determined necessary for permanent impacts to streams 22Q_1 and 22WW due to the minimal functions they provide. A 1.5:1 replacement ratio is proposed for permanent impacts to Stream 22V_1 due to the limited functions of the channel.

Based on the impact replacement ratios, a total of 1.24 acres of wetland mitigation is required to compensate for unavoidable impacts of the Preferred Alternative. Impacts and mitigation requirements for each NPS wetland are displayed in **Table 8** on the following page. Abbreviations for each wetland function are defined in a list below the table.

Table 8: NPS Wetland Impacts & Mitigation Requirements

Wetland Feature Name	Cowardin Classification	Impact Type	Impact Area (SF/AC)	Functions	Type of Loss	Impact Ratio	Required Mitigation (SF/AC)
22WW	R4SB4	Permanent	862 / 0.02	H, G, IH	Temporal, Reduced H, G	1.1:1	948 / 0.02
22Q_1	R3UB2H	Temporary	48 / <0.01	H, G	Temporal	1:1	48 / <0.01
		Permanent	203 / <0.01		Temporal, Reduced H, G	1.1:1	223 / <0.01
22R	PFO1E	Temporary	307 / 0.01	GR, SR, NR, WH	Temporal	1.5:1	461 / 0.02
		Permanent	338 / 0.01		Temporal, Reduced GR, SR, NR, WH	2:1	676 / 0.02
22NN	R4SB4	Temporary	3,474 / 0.08	H, G	Temporal	1:1	3,474 / 0.08
22NN_B	R4SB4	Temporary	1,465 / 0.04	H, G	Temporal	1:1	1,465 / 0.04
		Permanent	10 / <0.01		Temporal, Reduced H, G	1.1:1	11 / <0.01
22QQ	R4SB5	Temporary	466 / 0.02	H, G	Temporal	1:1	466 / 0.02
22V	R4SB3d	Temporary	190 / <0.01	H, G	Temporal	1.1:1	209 / <0.01
22V_1	R4SB3d	Temporary	90 / <0.01	H, G	Temporal	1.1:1	99 / <0.01
		Permanent	2 / <0.01	H, G	Temporal, Reduced H, G	1.5:1	3 / <0.01
22V_2	R4SB3d	Temporary	1,083 / 0.03	H, G	Temporal	1:1	1,083 / 0.03
22V_B	R4SB3d	Temporary	331 / 0.01	H, G	Temporal, Reduced H, G	1:1	331 / 0.01
22V_B1	R4SB3d	Temporary	66 / <0.01	H, G	Temporal	1:1	66 / <0.01
		Permanent	2 / <0.01		Temporal, Reduced H, G	1.1:1	2 / <0.01
22OO	PFO1B	Temporary	10,429 / 0.24	NR, PE, WH	Temporal	1:1	10,429 / 0.24
		Permanent	1,708 / 0.04		Temporal, Reduced NR, PE, WH	1.1:1	1,879 / 0.04
22PP	PFO1A	Permanent	490 / 0.01	GR, PE	Temporal, Reduced GR, PE	2:1	980 / 0.02
22W	PEM1A/C	Temporary	15,113 / 0.35	FA, WH, UH	Temporal	2:1	30,226 / 0.70
Total:			**36,677 / 0.86**				**53,079 / 1.24**

Function Abbreviations:

- G - Geomorphology
- H – Hydrology
- FA – Flood Flow Alteration
- GR – Groundwater Recharge
- IH – Instream Habitat
- NR – Nutrient Removal
- PE – Production Export
- SR – Sediment/Toxicant Retention
- UH – Uniqueness/Heritage
- WH – Wildlife Habitat

7.1.3 Proposed Wetland Compensatory Mitigation

MDOT SHA has identified the CHOH-13 site to meet the NPS wetland mitigation needs of the MLS Phase I South Project. The CHOH-13 site will provide approximately 1.49 acres of wetland mitigation that will meet the project wetland mitigation requirement of 1.24 acres. The site is included in the NPS *Environmental Assessment (EA) for the Wetland Restoration Action Plan (WRAP) for Catoctin Mountain Park, Chesapeake & Ohio Canal National Historical Park, Harpers Ferry National Historical Park, Monocacy National Battlefield, April 2017*. The WRAP provides a "*comprehensive approach to restoring, enhancing, and/or protecting wetlands, waterways, and riparian habitats (collectively referred to as 'wetlands') at four NCR parks when mitigation opportunities arise in the future.*" Section 5.2.3 of the *NPS Procedural Manual #77-1: Wetland Protection, Reissued June 21, 2016* states "*Wetland compensation sites must be on lands managed by the NPS, with the following recommended priority order: 1) within the same wetland system as the impacted wetland; 2) within the same watershed; or 3) in another watershed within the same NPS unit.*" The CHOH-13 site was selected due to its location on lands managed by the NPS and is considered the highest priority of all the potential NPS restoration sites due to its location within one of the NPS wetlands (Feature 22OO) being impacted by the project.

The CHOH-13 site is located in Montgomery County, Maryland within the CHOH, just north-west of the ALB. The site is situated on a terrace just north of the Potomac River that drains south-east through a deeply incised channel (Stream 22NN). The wetland is hydrologically supported by surface water runoff from upland forested slopes to the north and south, and from seasonal groundwater seepage along the base of the upper terrace north of the wetland. Most of the existing wetland is dominated by invasive reed canary grass (*Phalaris arundinacea*) with scattered American sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), and dead green ash (*Fraxinus pennsylvanica*) trees. Vegetation near the western perimeter of the wetland transitions from a reed canary grass monoculture into an area dominated by lizard tail (*Saururus cernuus*) with a mix of native and non-native species. A state-listed endangered sedge species (*Carex careyana*) was identified along an eroding bank of the deeply incised channel (Stream 22NN) in the south-eastern corner of the site. The channel appears to be tapping the wetland hydrology, resulting in a deeper groundwater table and drier soil conditions that promote the growth of invasive species. Old remnant drainage channels are evident within the wetland, indicating the site may have been historically drained. The soils within the site predominately consist of clay within the upper 2-3 feet of the

soil profile that is underlain by sandy soils and/or bedrock. The degraded conditions of the wetland along with its close proximity to the project impacts make the site an ideal candidate for wetland compensation.

A concept level design was developed for the CHOH-13 site that encompasses restoring approximately 1.49 acres of forested wetlands. The design entails restoring the terrace as a forested wetland by excavating a couple feet of the upper soil profile to restore the groundwater connection, promote hydric soil development, and remove the reed canary grass root zones from the upper soil profile. The concept includes filling the deeply incised intermittent channel that currently drains the wetland hydrology and installing a clay groundwater dam and micro-berm at the southeastern corner of the site to prevent future draining and restore groundwater hydrology throughout the site. Filling the channel will help prevent the state listed sedge species (*Carex careyana*) from being lost due to bank erosion and will also likely facilitate its growth within the filled channel over time. The limits-of-disturbance for future restoration design submittals will be set to avoid impacting the sedge during construction and an environmental monitor will be on-site to ensure direct or indirect impacts to the specimens are avoided. An outfall channel is proposed at the south-western end of the site to redirect surface and groundwater flows from the restored wetland to an existing sub-surface bedrock layer that drains west into Rock Run. Microtopography grading and woody debris placement from tree removals will be incorporated into the restored wetland to promote landscape diversity and create wildlife habitat. The site will be seeded with a native herbaceous seed mix and planted with native trees and shrubs to improve vegetation structure and diversity that will fully restore over time as a self-sustaining forested wetland system. As tree plantings mature, they will shade the wetland and help prevent reed canary grass from re-invading the site. Topsoil will be placed throughout the restored wetland to provide nutrients and organic materials necessary for plant growth. A concept plan for the CHOH-13 site is included in **Attachment C**.

Restoration of the CHOH-13 site will provide full replacement of NPS wetland functions and values that are lost due to the MLS Phase I South Project. Principal functions that will be replaced by the restoration site include production export, wildlife habitat, nutrient removal, sediment/toxicant retention, groundwater recharge, hydrologic, and geomorphic functions. Production export and wildlife habitat functions will be replaced by removing the reed canary grass, via excavation of the terrace, and replacing the monoculture with a diverse mix of native species. The restored wetland will be seeded and planted with native, endemic species including pollinator species, species that provide hard mast, berries and other wildlife food sources. The restored vegetation will provide food, shelter, and nesting for a wide variety of wildlife species. The diverse vegetation will also provide detritus for primary producers and consumers and improve soil conditions. Woody debris placement in the wetland will create structural habitat and help retain organic carbon sources (e.g., leaf litter, twigs, branches, logs) that will provide an abundant food source for microorganisms. Nutrient removal and sediment/toxicant retention functions will be provided by removing portions of the upper soil profile that consist of clay and reconnecting the terrace to the groundwater table to improve nutrient cycling. Improvements to the soil substrate through reconnection to the groundwater table and placement of topsoil will benefit necessary microbial communities, thus enhancing the ability for chemical and biological retention of toxicants and nutrients. Proposed planting and seeding will provide a dense vegetated root zone that will be highly connected to the groundwater table and further enhance microbial communities and food sources. The proposed wetland outlet channel will replace the minor loss of stream hydrologic and geomorphic functions by providing a shallow channel that is highly connected to the surrounding terrace. Hydrologic and geomorphic functions will be provided by seeding herbaceous vegetation and planting trees and shrubs

to promote dense vegetation growth in the riparian zone surrounding the channel. Flood flows will spread across the riparian zone where vegetative filtering, flood attenuation, and infiltration potential will be enhanced. Native streambed material and woody debris will be placed in the channel to provide instream habitat and grade control. Woody debris will help retain sources of organic carbon within the channel and provide instream habitat and food sources for macroinvertebrates.

Wetland restoration of the CHOH-13 site will provide one acre of mitigation credit for each acre restored. The proposed restoration will result in approximately 1.49 acres of wetland mitigation for the site, exceeding the project NPS wetland mitigation requirement of 1.24 acres.

A detailed wetland mitigation plan and appropriate state and federal permits will be required for the proposed wetland mitigation site. These documents will be prepared at a later date when design and survey efforts have been completed for the site. The funding source for the restoration project will be the applicant (MDOT SHA), which is consistent with the funding source restrictions listed in Procedural Manual #77-1 (NPS 2012a). Therefore, the NPS commitment for funding of the compensatory restoration will meet the requirements and restrictions of Section 5.2.3, paragraph 6 of Procedural Manual #77-1.

Long-term monitoring of the restored wetland will be required to ensure success of the mitigation site. Long-term monitoring plans (containing types of variables to be monitored, frequency and method of sampling, target conditions over time, performance bond values, and contingency actions based on what problems might occur in the particular restoration situation) will be created, implemented and funded by MDOT SHA. If it is determined that the design goals and performance standards of the project are not being met based on monitoring, an Adaptive Management Plan will be developed to assess the problem in further detail and develop remedial recommendations if necessary.

7.2 Floodplain Mitigation

Floodplain mitigation will not be required for the unavoidable impacts to floodplains on NPS land resulting from the Preferred Alternative. The I-495 & I-270 Managed Lanes Study will comply with the NIFP and will not increase flooding on NPS land.

8 SUMMARY

The I-495 & I-270 Managed Lanes Study is in compliance with NPS D.O. #77-1 and #77-2. The MLS has avoided and minimized impacts to wetlands and floodplains to the greatest extent practicable and has provided a Statement of Findings that presents the unavoidable impacts to wetlands and floodplains on NPS land resulting from the Preferred Alternative and a proposed compensatory mitigation plan that would result in No Net Loss of wetland functions and values on NPS Land.

9 REFERENCES

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List of Acronyms

AADT – Average Annual Daily Traffic

ALB – American Legion Bridge

C&O – Chesapeake and Ohio

CBP – Clara Barton Parkway

CFR – Code of Federal Regulations

CHOH – Chesapeake and Ohio Canal National Historic Park

CHOH – Chesapeake and Ohio Canal National Historic Park

COMAR – Code of Maryland Regulations

DEIS – Draft Environmental Impact Statement

EIS – Environmental Impact Statement

EPA – Environmental Protection Agency

FEMA – Federal Emergency Management Agency

FGDC – Federal Geographic Data Committee

GWMP – George Washington Memorial Parkway

LOD – Limits of Disturbance

MDOT SHA – Maryland Department of Transportation State Highway Administration

MLS – Managed Lanes Study

NFIP – National Flood Insurance Program

NOAA – National Oceanic and Atmospheric Administration

NPS – National Park Service

NRHP – National Register of Historic Places

PEM – Palustrine Emergent

PFO – Palustrine Forested

RTE – Rare, Threatened, and Endangered

SDEIS – Supplemental Draft Environmental Impact Statement

SOF – Statement of Findings

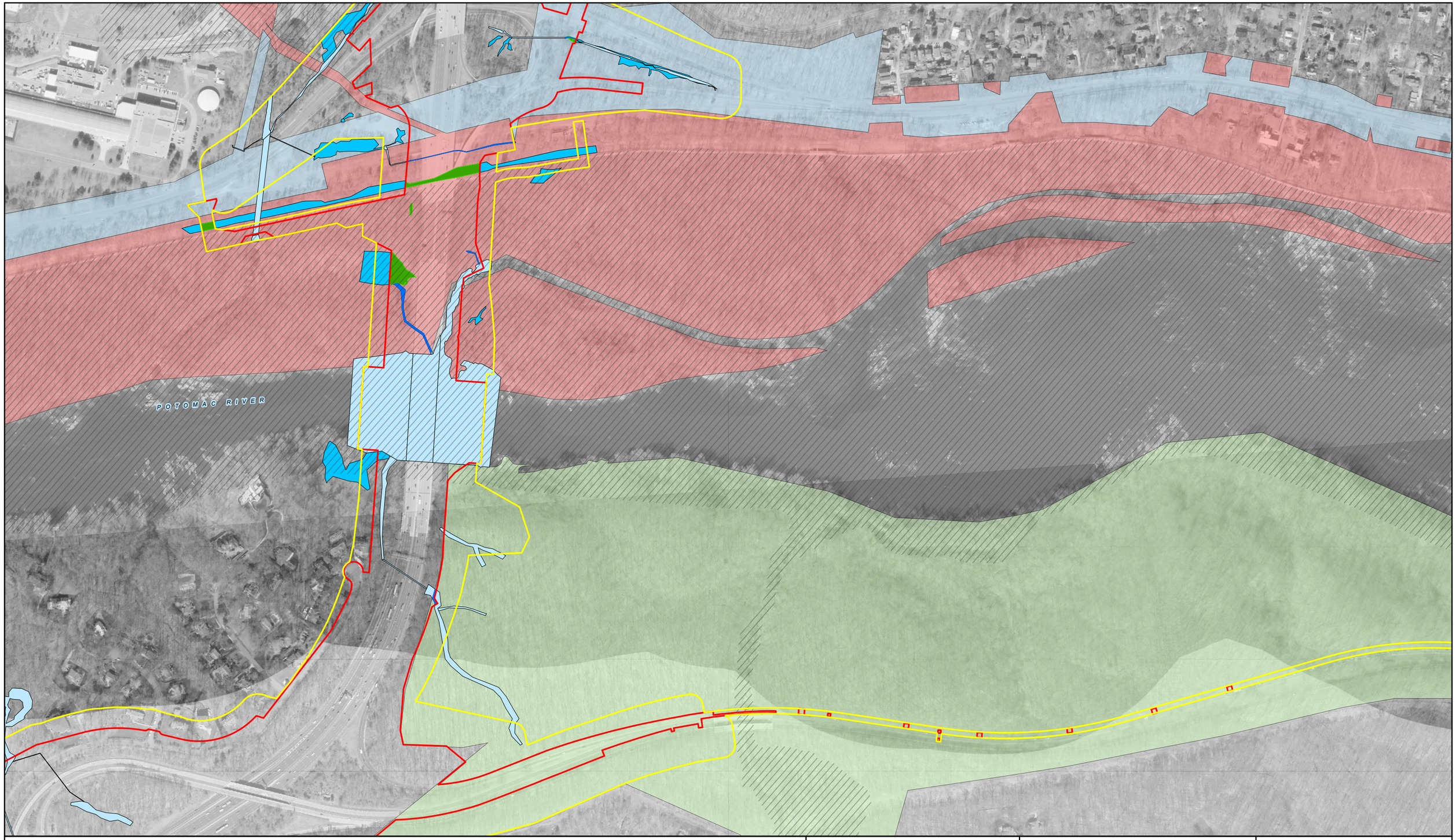
US – United States

USACE – United States Army Corps of Engineers

USDOT – United States Department of Transportation

USFWS – United States Fish and Wildlife Service

ATTACHMENT A: FIGURES



Corridor Study Boundary
PA Limit of Disturbance
Clara Barton Parkway
Chesapeake & Ohio Canal
George Washington Memorial Parkway
FEMA 100YR Floodplain
Wetland
Stream
Wetland Impact
Stream Impact

N

0 230 460 920

1 inch = 455 feet

September 2021

NPS Wetlands

270 495 MANAGED LANES STUDY

Corridor Study Boundary
PA Limit of Disturbance
PA Limit of Disturbance - Perm / Temp Boundary
George Washington Memorial Parkway
Wetland
Stream
Wetland Impact
Stream Impact
FEMA 100 Year Floodplain

NOTE: Dead Run will not be impacted.

N

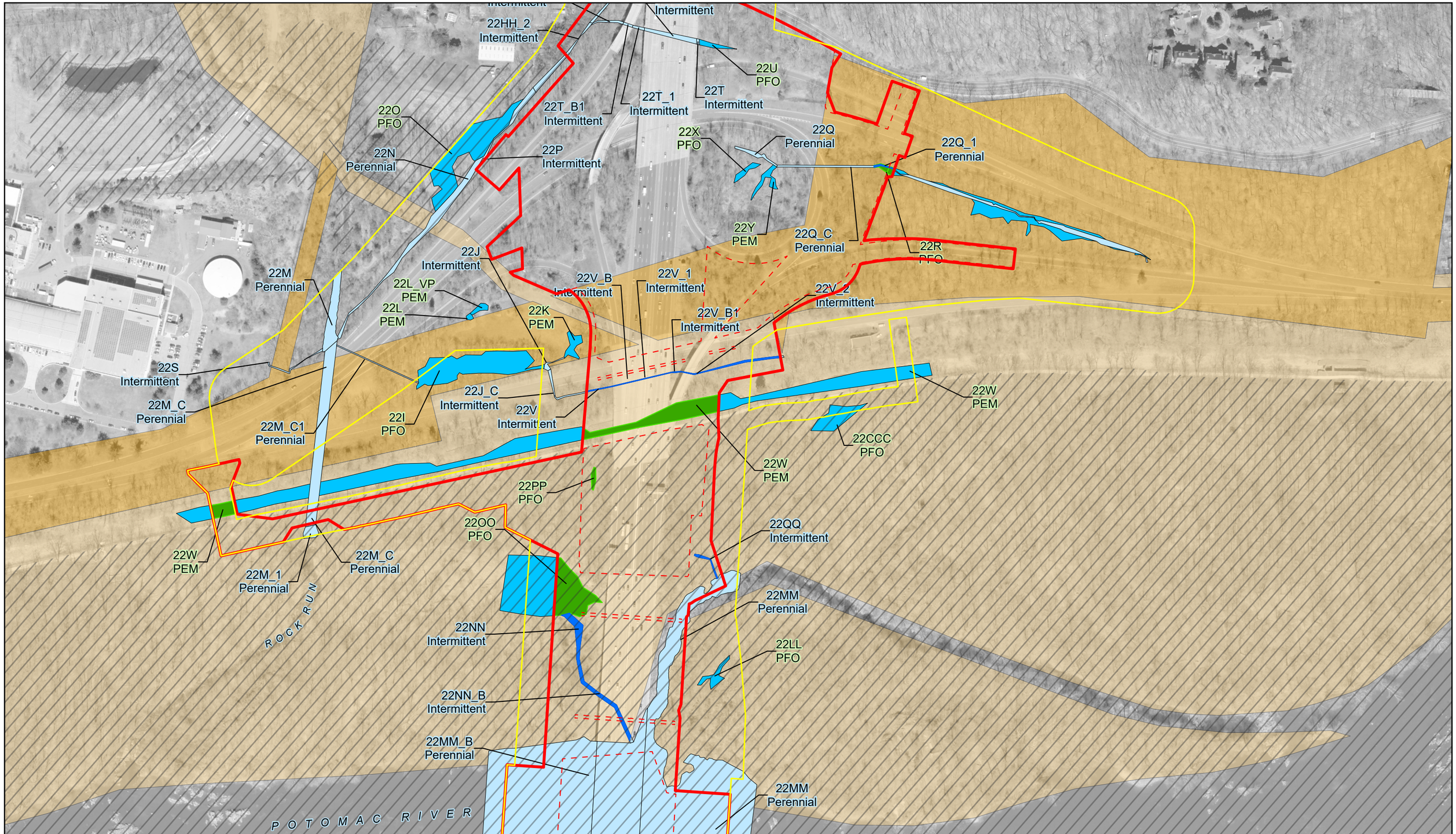
0 160 320 640

1 inch = 316 feet

September 2021

NPS Wetlands George Washington Memorial Parkway

495 270 MANAGED LANES STUDY



Corridor Study Boundary
PA Limit of Disturbance
PA Limit of Disturbance - Perm / Temp Boundary
Clara Barton Parkway

Chesapeake & Ohio Canal
Stream
Wetland
Stream Impact

Wetland Impact
FEMA 100 Year Floodplain

N

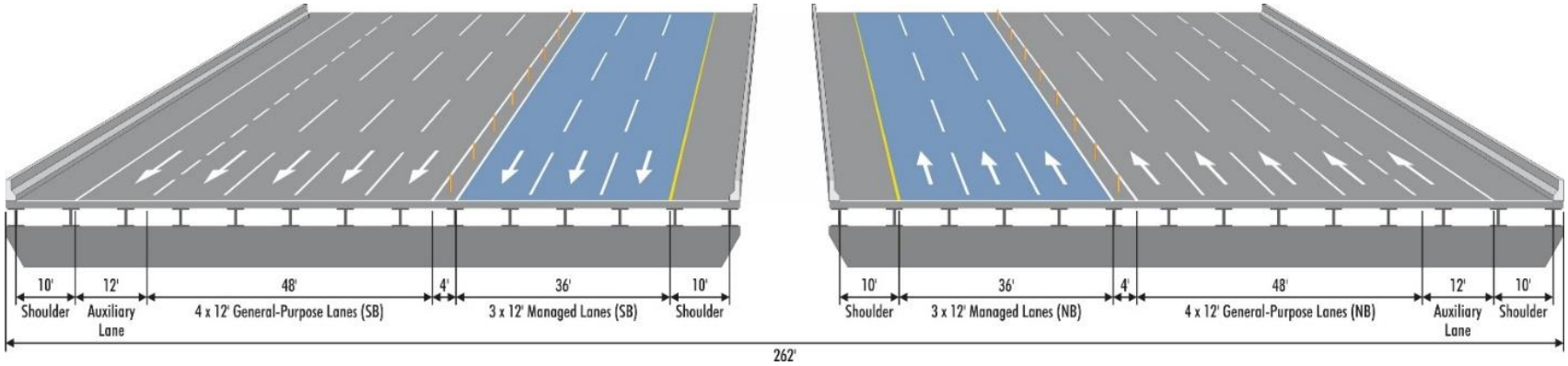
0 125 250 500
1 inch = 250 feet

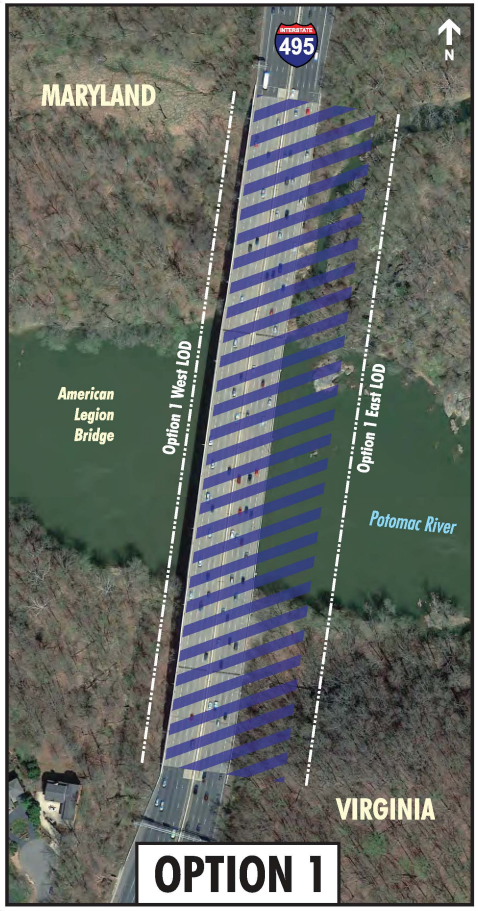
July 22nd, 2021

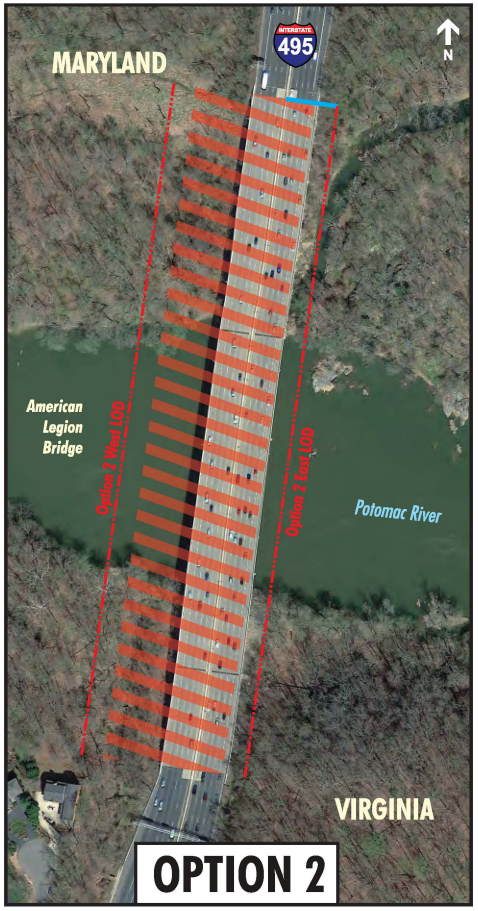
NPS Wetlands Chesapeake & Ohio Canal & Clara Barton Parkway

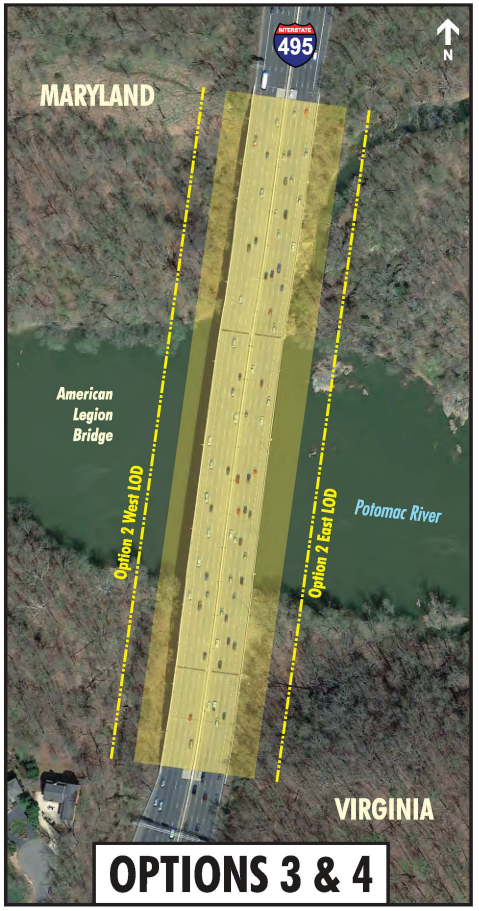
270 495 MANAGED LANES STUDY

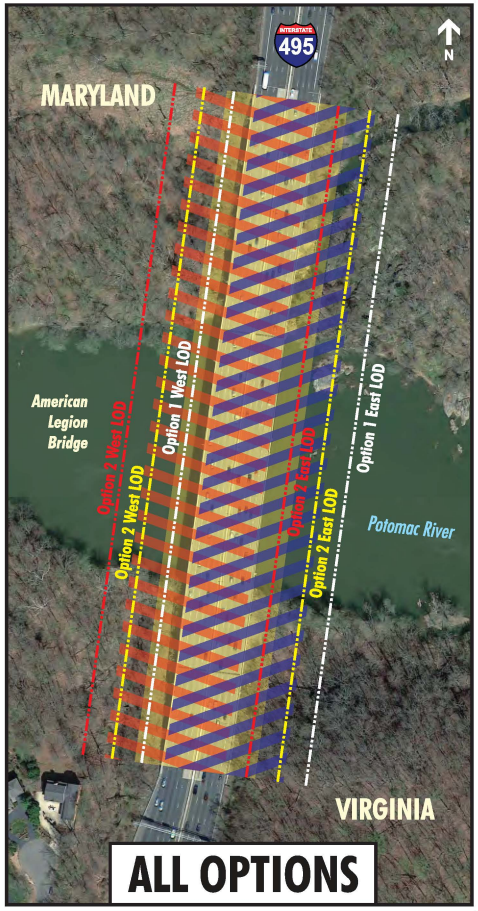
Figure 4: Proposed ALB Typical Section











LEGEND

- Phased Construction - Option 1, Shifted ℄ to East
- Phased Construction - Option 2, Shifted ℄ to West
- Phased Construction - Options 3 & 4, On Same ℄

Note: LOD is set 50' from outside edge of bridge

I-495/I-270 Managed Lanes Study

American Legion Bridge Limits of Disturbance (LOD)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION

Date: JULY 2021

Figure: 5

Potomac River

Culvert Outlet

C & O Canal
Lock 14

Clara Barton Pkwy.

C & O Canal Towpath

American Legion
Bridge

I-495

PA Limit of Disturbance

Temporary Construction Access Path

Wetland

Stream

Wetland Impact

Stream Impact

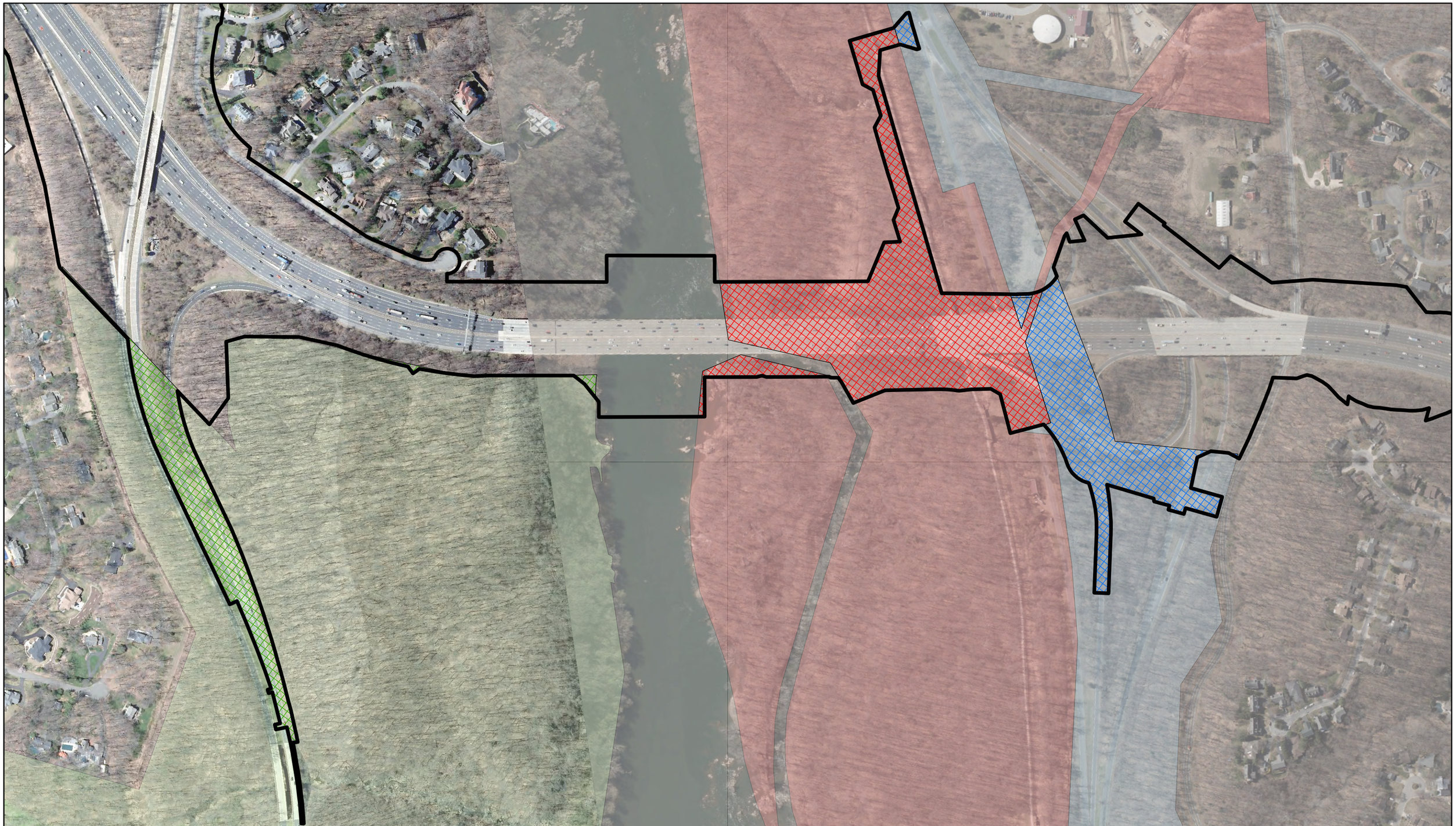
0 100 200 400

1 inch = 200 feet

September 2021

American Legion Bridge Northwest Construction Access

270 495 MANAGED LANES STUDY



LOD - Phase 1 South
George Washington Memorial Parkway (NPS Bound)
Chesapeake & Ohio Canal (NPS Bound)
Clara Barton Parkway (NPS Bound)

Impact Area - GWMP
Impact Area - Chesapeake & Ohio Canal
Impact Area - Clara Barton Pkwy.

September 2021

NPS Park Areas for Impact Calculations

270 495 MANAGED LANES STUDY

ATTACHMENT B: QUALITATIVE FUNCTIONAL ASSESSMENT

INTRODUCTION

MDOT SHA conducted a detailed functional assessment of all wetlands and streams within National Park Service (NPS) property along the I-495 & I-270 Managed Lanes Study (MLS) Corridor Study Boundary (CSB) in January 2021. A total of 13 nontidal wetlands and 18 streams occur within NPS park units along the corridor study boundary. The NPS park properties assessed included: George Washington Memorial Parkway, Clara Barton Parkway, C&O Canal National Historical Park, Baltimore Washington Parkway, Greenbelt Park, and Suitland Parkway.

Supplemental information supporting the wetland and streams functional assessment is included in Appendices A through C, as follows:

- Appendix A: Field Datasheets
- Appendix B: Rapid Bioassessment Protocol (RBP) Assessment Summary Table
- Appendix C: Photo Documentation

METHODS

Environmental scientists conducted a detailed qualitative biological and physical functional assessment of each wetland and stream within NPS property along the MLS corridor. The assessment included but was not limited to the following:

- Physical parameters
- Groundwater infiltration potential
- Water quality
- Fisheries habitat
- Macroinvertebrate habitat
- Groundwater invertebrates in seep wetlands
- Identification of listed Rare, Threatened or Endangered (RTE) species

These functional parameters were assessed in the field for each wetland system. Observations were recorded in a field notebook and each feature was photo documented (see **Appendix C**). Physical parameters, including wetland type, location in the landscape, flow/drainage, observed hydrology, microtopography, dominant vegetation, overall size, and soil composition were recorded and summarized. The wetland soil profile, landscape position, and hydrology were also assessed to determine the potential for groundwater infiltration within each wetland system. A visual assessment of any standing water was completed to provide an assessment of water quality. Based on the available hydrology and physical parameters of each wetland, an assessment of potential macroinvertebrate habitat was completed. Any available habitat features, including but not limited to standing water, vegetation, leaf packs, woody debris, and roots were noted. Available habitat was sampled using a D-net and a list of any observed macroinvertebrate species was compiled. During this assessment, any spring-fed groundwater seeps were noted and assessed for potential amphipod habitat. These field observations were summarized for each wetland feature and are included in the narratives below. As applicable, the narratives also include a summary of any listed rare, threatened, and endangered (RTE) plant species identified within or adjacent to the wetland systems during surveys previously completed in April through September 2020.

Additionally, data collected during the wetland delineation for the overall MLS was reviewed to inform the NPS wetland functional assessment. During the wetland delineation field assessment, wetland scientists completed a functions and values assessment for all wetlands using the USACE New England Method as presented in The Highway Methodology Workbook Supplement – Wetland Functions and Values; A Descriptive Approach (USACE, 1999). Alongside the best professional judgment of an experienced wetland scientist, this method uses the presence of certain physical characteristics broadly understood to indicate the presence of related functions. The assessed functions and values included:

- Groundwater Recharge/Discharge,
- Floodflow Alteration,
- Fish and Shellfish Habitat,
- Sediment/Toxicant Retention,
- Nutrient Removal,
- Production Export,
- Sediment/Shoreline Stabilization,
- Wildlife Habitat,
- Recreation,
- Educational/Scientific value,
- Uniqueness/Heritage,
- Visual Quality/Aesthetics, and
- Endangered Species Habitat.

During the January 2021 NPS functional assessment, previously completed Functions and Values datasheets were verified in the field. A full assessment of the suitable and principal functions was completed, and additional notes were added, as needed, to describe and characterize each wetland within NPS property. All Wetland Functions and Values datasheets are included in **Appendix A**.

Environmental scientists assessed the same functional parameters within streams occurring on NPS property. Physical parameters, including stream class, location, hydrologic connectivity, substrate, bank stability, and adjacent vegetation were recorded and summarized. A visual assessment of water within the channel was completed to provide an assessment of water quality. Potential pollutants, trash abundance, and disturbances were noted. Each reach was assessed for potential fish habitat and macroinvertebrate habitat features, including, but not limited to, riffles, vegetation, leaf packs, woody debris, pools, and roots. All habitat features and any observed fish species were recorded. Available macroinvertebrate habitat was sampled using a D-net and a list of observed species was compiled.

Additionally, data collected during prior MLS field assessments was reviewed to inform the NPS stream functional assessment. Between September and October of 2020, stream functional assessments were conducted for all perennial and intermittent streams within the MLS corridor study boundary using the EPA's RBP for Habitat Assessment (EPA, 1999). High and low gradient assessments were completed for streams over two percent in grade and below two percent in grade, respectively. The functions assessed between the two forms included:

- Substrate/Available Cover
- Embeddedness
- Pool Substrate Characterization
- Velocity/Depth Regime

- Pool Variability
- Sediment Deposition
- Channel Flow Status
- Channel Alteration
- Frequency of Riffles (or Bends)
- Channel Sinuosity
- Bank Stability
- Vegetative Protection, and
- Riparian Vegetative Zone Width.

Scores from these assessments are presented in the table included in **Appendix B**. A more detailed assessment, the USFWS Stream Function-based Rapid Assessment, was completed for Stream 22MM. This datasheet is included in **Appendix A**. All functional assessment scores and additional field observations described above are summarized in the narratives for each stream below.

RESULTS

Narrative summaries of the characteristics, function, and quality of each wetland and stream are included below and organized by NPS Park Unit.

C&O CANAL NPS UNIT

Wetland 22W

Wetland 22W is an emergent wetland delineated within the Chesapeake and Ohio Canal, spanning the entire width of the MLS Corridor Study Boundary (CSB) from east to west and beneath the I-495 bridge over Clara Barton Parkway. It was classified as an excavated palustrine emergent wetland with persistent vegetation and a temporarily to seasonally flooded water regime (PEM1A/C). This excavated depression lies on an upland terrace high above the adjacent Potomac River, and has no surface water connection to downstream waters.

The wetland is hydrologically supported by surface water runoff that is retained by slowly drained clayey soils. Observed wetland hydrologic indicators included surface water ponding and a shallow water table perched over a dense clay. Other primary hydrologic indicators included sediment deposits, water marks, and water-stained leaves. Secondary hydrologic indicators included a positive FAC-Neutral test.

Vegetation within the wetland varied depending upon subtle differences in topography within the C&O Canal that leads to slight differences in the duration of surface water ponding or soil saturation, and on the availability of sunlight. Where surface water ponding is of longer duration, vegetation was comprised of both broad-leaf cat-tail (*Typha latifolia*) and narrow-leaf cat-tail (*Typha angustifolia*), duck-potato (*Sagittaria latifolia*), sedges (*Carex* spp.), lamp rush (*Juncus effusus*), rice cut grass (*Leersia oryzoides*), invasive common reed (*Phragmites australis*), and two species of hibiscus (*Hibiscu*s spp.). Within drier areas, invasive Japanese stilt grass (*Microstegium vimineum*) predominated along with Japanese bristle grass (*Setaria faberi*) and varieties of goldenrod (*Solidago* spp.). Beneath the existing I-495 bridge over Clara Barton Parkway, little vegetation coverage existed because of shading effects.

Soils within the wetland were a silty clay texture and met the hydric soil criteria by exhibiting a depleted matrix (5Y4/1, 5Y3/1) throughout the 16-inch soil profile. These tight clay soils slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, three principal functions/values were identified, including: floodflow alteration, wildlife habitat, and uniqueness/heritage. The wetland provides floodflow alteration because of its position within the upper terraces of the Potomac River. Surface water runoff is trapped within the wetland as it drains downslope toward the river, thus allowing the excess runoff to slowly infiltrate, evaporate, or respire through the emergent vegetation within the wetland. The wetland also provides some sediment/toxicant retention and nutrient removal functions, but the opportunity for the presence of sediments, toxicants, and excess nutrients in the watershed above the wetland is relatively low. The wetland does contain numerous flowering and seed producing plants that attract a diversity of wildlife, including valuable pollinators and smaller and larger consumers. The wetland has a high uniqueness/heritage value because of its association with the Chesapeake and Ohio Canal National Historical Park. Remnants of a wooden lock occur within the wetland. The wetland exists because of the historical excavation of the canal. After the canal was abandoned as the primary means of transporting goods to Western Maryland, it eventually silted-in, resulting in the vegetated wetland condition of the canal today.

Since the wetland does not contain an outlet, water that collects within the wetland remains until it infiltrates or evaporates/respires. Therefore, water quality is likely not high. During field investigations some sediment was observed in areas with standing water.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and limited habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of standing water within the lowest areas. Emergent vegetation would be the primary substrate for such macroinvertebrates. During qualitative macroinvertebrate sampling in January 2021, a hellgrammite (Family Corydalidae) was observed, which is a pollution-sensitive organism. An aquatic worm (Subclass Oligochaeta) was also observed, which is a tolerant organism, as well as numerous scuds (Order Amphipoda), which are moderately-sensitive organisms. Scuds are common invertebrates found in wetlands with surface water. There was no evidence of groundwater seeps or springs within the wetland that might contain rare subterranean amphipods.

No federal or state listed threatened or endangered species are known to occur within Wetland 22W. However, several halberd-leaf rose-mallow (*Hibiscus laevis*) plants were observed growing within a small area between Locks 11 and 12 during a targeted MLS Rare, Threatened and Endangered (RTE) Plant Survey in the summer of 2020. Halberd-leaf rose-mallow is a watch list species in Maryland, which means that it is at moderate risk of extinction or extirpation because of a restricted range; relatively few populations or occurrences; or recent and widespread declines, threats, or other factors.

Wetland 22LL

Wetland 22LL is a small, isolated forested wetland situated in a shallow depression at the western end of Plummers Island. It is classified as a palustrine forested wetland with broad-leaved deciduous vegetation

and a seasonally flooded water regime (PFO1C). This depressional wetland lies on an upland terrace high above the Potomac River and Rock Run Culvert and does not appear to have a surface connection to either watercourse.

The wetland is hydrologically supported by surface water runoff that is likely retained by shallow soils perched over bedrock. Bedrock outcroppings occur just upslope of the wetland. Observed wetland hydrologic indicators included surface water ponding between one and 14 inches. Other primary hydrologic indicators included water marks and water-stained leaves. Secondary hydrologic indicators included sparsely vegetated concave surface and geomorphic position.

Vegetation within the wetland included ash-leaf maple (*Acer negundo*) and American elm (*Ulmus americana*) in the canopy, ash-leaf maple, northern spicebush (*Lindera benzoin*), and amur honeysuckle (*Lonicera maackii*) in the shrub layer, and creeping-jenny (*Lysimachia nummularia*), Japanese stilt grass, dotted smartweed (*Persicaria punctata*), Indian wood-oats (*Chasmanthium latifolium*), and false-spike false nettle (*Boehmeria cylindrica*) in the herb layer.

Soils within the wetland were a shallow sandy clay loam texture and met the hydric soil criteria by exhibiting a depleted matrix in the upper six inches of the profile. Rock was present below 10 inches, thus not providing ideal groundwater recharge potential.

Using the methodology described above, three principal functions/values were identified, including: wildlife habitat, educational/scientific value, and uniqueness/heritage. The wetland appears to retain sufficient water during winter and early spring to serve as a vernal pool habitat for obligate and facultative breeding amphibians. The wetland is also located on Plummers Island, which is one of the longest and most intensively studied islands in the United States. The flora and fauna of Plummers Island has been continuously studied since the early part of the twentieth century. The wetland also has a high uniqueness/heritage value because of its association with the Chesapeake and Ohio Canal National Historical Park.

Since the wetland does not contain an outlet, water that collects within the wetland remains until it infiltrates or evaporates/respires. Therefore, water quality is likely not high. During field investigations water was clear and had no odor.

Based on the geomorphic position of this wetland, limited amount of standing water observed during the assessment, and limited habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of standing water within the lowest areas. Emergent vegetation, woody debris, and leaf packs would be the primary substrate/habitat for such macroinvertebrates. During qualitative macroinvertebrate sampling in January 2021, no organisms were found.

No federal or state listed threatened or endangered species are known to occur within Wetland 22LL. However, buttercup scorpion-weed (*Phacelia covillei*), a state endangered spring ephemeral plant, was mapped just outside the limits of the wetland and within the 25-foot wetland buffer. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Wetland 22OO

Wetland 22OO is a broad emergent and forested wetland swale situated on the second terrace above the Potomac River, just upstream of the American Legion Bridge (ALB) and extending west to Rock Run. It is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a saturated water regime (PFO1B). Trees are scattered throughout the wetland and large areas are dominated by emergent vegetation. The wetland swale slowly drains southeast to an intermittent stream that discharges into Rock Run Culvert, just above the confluence with the Potomac River.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from seasonal groundwater seepage along the base of the upper terrace north of the wetland. Observed wetland hydrologic indicators included surface water ponding between one and two inches. Other primary hydrologic indicators included: a seasonally high groundwater table, soil saturation, iron staining, inundation observed on aerial imagery, and water-stained leaves. Secondary hydrologic indicators included: drainage patterns, geomorphic position, microtopographic relief, and FAC-neutral test.

Vegetation within the wetland included scattered ash-leaf maple and American sycamore (*Platanus occidentalis*) in the canopy. The herbaceous layer was dominated by invasive reed canary grass (*Phalaris arundinacea*) with scattered false-spike false nettle, lizard's-tail (*Saururus cernuus*), Asiatic tearthumb (*Persicaria perfoliata*), and pinkweed (*P. pensylvanica*).

Soils within the wetland were not sampled during the initial wetland delineation because the project did not have invasive access from the NPS. During the assessment in January 2021, soil samples met the depleted matrix hydric soil indicator within the upper 12 inches. Soils had clayey textures within the upper 1.5 feet and were a sandy loam texture below that depth. Soil textures likely allow slow groundwater infiltration and recharge during drier portions of the year.

Using the methodology described above, three principal functions/values were identified, including: nutrient removal, production export, and wildlife habitat.

Water quality within the wetland did not appear high, as iron flocculent was present where standing water was observed.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrates, including isopods and amphipods (scuds), were found within a shallow swale through the wetland that retained several inches of water during the early January sampling effort. Emergent vegetation was the primary substrate for these macroinvertebrates.

No federal or state listed threatened or endangered species are known to occur within Wetland 22OO. However, the state endangered buttercup scorpion-weed was mapped just outside the limits of the wetland and within the 25-foot wetland buffer to the north and south. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Wetland 22PP

Wetland 22PP is a narrow, isolated forested wetland swale situated on a shallow depression on the upper terrace slope just upstream of the ALB and downslope of the C&O Canal Towpath. It is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporarily flooded water regime (PFO1A). The wetland swale slowly drains south but dissipates where the slope increases, and water quickly diffuses in sheet and channel flow downslope toward Wetland 22OO.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from seasonal near-surface groundwater seepage along the slope of the upper terrace. Observed wetland hydrologic indicators included shallow surface water ponding in pockets to a quarter inch depth. Other primary hydrologic indicators included a seasonally high groundwater table and soil saturation. Secondary hydrologic indicators included drainage patterns, geomorphic position, and FAC-neutral test.

Vegetation within the wetland included scattered American elm in the canopy and amur honeysuckle in the shrub layer. The herbaceous layer was dominated by dotted smartweed with scattered creeping Japanese honeysuckle (*L. japonica*) vine, seedling green ash (*Fraxinus pennsylvanica*), and amur honeysuckle seedlings.

Soils within the wetland met the depleted matrix and redox dark surface hydric soil indicators. During the assessment in January 2021, soil samples had sandy loam to sandy clay loam textures within the upper 1.5 feet. Groundwater discharge occurs seasonally within the wetland and soil textures likely allow slow groundwater infiltration and recharge downslope of the wetland.

Using the methodology described above, two principal functions/values were identified, including groundwater recharge/discharge and production export.

Water quality within the wetland is low, as very little water is retained by the wetland and what is retained is typically sediment laden.

Based on the geomorphic position of this wetland and absence of standing water observed during the assessment, this wetland does not likely support a diverse fauna of macroinvertebrates. No macroinvertebrate habitat exists within the wetland and no macroinvertebrates were observed during the January 2021 assessment.

No federal or state listed threatened or endangered species are known to occur within Wetland 22PP. However, the state endangered buttercup scorpion-weed was mapped just outside the limits of the wetland to the north and south. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Wetland 22CCC

Wetland 22CCC is a broad forested wetland depression situated at the toe of slope of the C&O Canal Towpath east of I-495. It is classified as a palustrine forested wetland with broad-leaved deciduous

vegetation and a saturated water regime (PFO1B). The broad wetland depression appears to be isolated from downstream receiving waters.

The wetland is hydrologically supported by surface water runoff from the adjacent uplands and from seasonal groundwater seepage along the base of the C&O Canal Towpath. A clay lens about a foot below the ground surface acts to perch surface and near-surface groundwater. Observed wetland hydrologic indicators included surface water ponding up to one inch in depth. Other primary hydrologic indicators included a seasonally high groundwater table, water-stained leaves, and soil saturation. Secondary hydrologic indicators included geomorphic position and FAC-neutral test.

Vegetation within the wetland included red maple (*Acer rubrum*), green ash, and American elm in the canopy and ash-leaf maple, northern spicebush, common pawpaw (*Asimina triloba*), rambler rose (*Rosa multiflora*), and green ash in the shrub layer. The herbaceous layer was dominated by invasive Japanese stilt grass with scattered false-spike false nettle, sweet wood-reed (*Cinna arundinacea*), Japanese honeysuckle vine, and an unknown sedge. The woody vine layer included horsebrier (*Smilax rotundifolia*) and Japanese honeysuckle.

Soils within the wetland met the depleted matrix hydric soil indicator. During the assessment in January 2021, soil samples had silty loam to silty clay loam textures within the upper seven inches. Below ten inches, the soils become more of a silty clay texture, forming a confining layer. Groundwater discharge occurs seasonally within the wetland, but shallow clay soils restrict infiltration and any recharge opportunities.

Using the methodology described above, three principal functions/values were identified, including: production export, wildlife habitat, and uniqueness/heritage. Evidence of deer use of the wetland and the presence of flowering plants provide opportunities for production export to occur. Its uniqueness and heritage value lies in its position immediately adjacent to the C&O Canal Tow Path.

The wetland was free of odors and trash and the shallow standing water appeared clear. Therefore, water quality within the wetland was likely high.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and limited habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of standing water within the lowest areas. Wetted vegetation, leaf packs, and wetted woody debris would be the primary substrates for such macroinvertebrates. During qualitative macroinvertebrate sampling in January 2021, numerous isopods and amphipods (scuds) were observed. The scuds are moderately-sensitive organisms. While the wetland exhibited groundwater seepage along the base of the hillslope, there was no evidence of groundwater springs within the wetland that might contain rare subterranean amphipods.

No federal or state listed threatened or endangered species are known to occur within Wetland 22CCC. However, the state endangered buttercup scorpion-weed was mapped just outside the limits of the wetland and within the 25-foot wetland buffer to the east and west. This plant has a limited distribution in Maryland, occurring primarily within this portion of the Potomac River Gorge on upland river terraces. Where it occurs in this area, plant abundance is extremely high, with some areas containing up to 10,000 plants, as documented during a targeted MLS RTE Plant Survey in the early spring of 2020.

Stream 22M_1

Stream 22M_1 is Rock Run, a perennial stream that flows south through a culvert under Clara Barton Parkway and the C&O Canal into the Potomac River, just west of the ALB. A small portion of Rock Run, just as it flows from under the C&O Canal, is located within the CSB on parkland.

Stream 22M_1 is a natural channel flowing in a wide valley receiving hydrology from headwater tributaries and surface runoff. Due to development, portions of the larger system upstream of the project area have been culverted or impacted by human activities in other ways. Based on the assessment of fish and macroinvertebrate habitat using the Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at Stream 22M_1 is suboptimal, with 40 to 70 percent available habitat. Overall, the benthic macroinvertebrate habitat consists of gravel, cobble, and bedrock. For fish, habitat is present in large pools, however they are potentially inaccessible due to blockages. Riffles are very stable with both variety and flow diversity and are relatively frequent at Stream 22M_1. The portion of this stream that is within NPS property downstream of the culvert consists of two waterfalls and many riffles present over bedrock material. Pools are present between riffles and in eddies behind boulders providing decent habitat cover. Three of the 4 velocity/depth regimes are present at Stream 22M_1, including shallow-fast, shallow-slow, and slow-deep. The stream substrate is diverse and dominated by gravel, cobble, and bedrock, with less than 5 percent embeddedness. There is little to no sediment deposition in the stream reach and there is no formation of islands or point bars. Water reaches the base of both lower banks and a minimal amount of channel substrate is exposed, other than the larger boulders or bedrock sections. Some channel alteration is present in the section of the reach that exits the boxed culvert, although it was created over 20 years ago. Both banks are stable, with less than 5 percent showing signs of erosion or instability and little potential for future problems. Vegetation protection is low on both banks, with less than 50 percent of the streambank surfaces covered by vegetation, however, the presence of bedrock along both banks provides some protection. The riparian zone consists of a mature high-quality forest, giving both banks a riparian zone of at least 18 meters in width, with minimal to no human activity impacting the riparian zones. Stream 22M_1 receives some sediment and pollution runoff from the upstream roadways; however, no odor was observed, and the water was very clear. Some suds were observed in the pools and only minor amounts of trash were present along the banks.

During a qualitative assessment of the aquatic community at Stream 22M_1, no fish were observed and only a few net-spinning caddisflies (Family Hydropsychidae) were collected. Net-spinning caddisflies are considered moderately pollution-sensitive organisms. Although Stream 22M_1 is a high-quality stream overall, fish were likely not found due to up and downstream blockages. For macroinvertebrates, stable riffles were present, but most sampleable riffles were on bedrock without smaller pieces of rock that macroinvertebrates typically cling to.

Stream 22MM

Stream 22MM is Rock Run Culvert, a large oxbow perennial channel flowing northeast from the Potomac River then southeast around Plummers Island and back into the Potomac. The stream is located just east of the ALB. The section of the perennial channel running northeast parallel to I-495 is within the CSB.

Based on the assessment of fish and macroinvertebrate habitat using the stream function-based rapid assessment, 20 to 70 percent of mixed stable habitat suited for full colonization potential is present. During the time of assessment, water levels were high with little to no flow and a large woody debris jam was present across the channel. Overall, the benthic macroinvertebrate habitat consists of some submerged woody debris, boulders, and only one shallow sampleable riffle. For fish, habitat consist of deep pools, woody debris, roots, and boulder habitat. Although some pools with boulders and root/wood habitat cover are present, most of the channel is a run. The stream bed substrate consists of mostly sand and mud with some large boulders. Cobble and gravel were present at the shallow inlet of Rock Run Culvert providing some shallow riffle habitat. A good amount of the stream bottom is affected by sediment deposition, with fine sediment built up around the boulders. Evidence of flooding and changes in water level indicate varying available habitat conditions. No channel alteration is present at Stream 22MM and the stream has a normal pattern. The bank erosion rate potential on both banks is low, with some evidence of erosion present, but healed over. Both native vegetation cover and boulders are providing bank protection. The riparian zone consists of a mature high-quality forest, giving both banks a riparian zone of at least 18 meters in width, with minimal to no human activity impacting the riparian zones. Approximately 50 percent of the stream is shaded. Stream 22MM receives some sediment and pollution runoff from the adjacent roadway. The water is fairly turbid and there is an abundant amount of trash present in the debris jam.

During a qualitative assessment of the aquatic community at Stream 22MM, small minnow species of fish were observed and aquatic worms (Subclass Oligochaeta), scuds (Order Amphipoda), stoneflies (Order Plecoptera) and mayflies (Order Ephemeroptera) were collected. Aquatic worms are considered pollution-tolerant organisms, scuds are moderately pollution-sensitive, and stoneflies and mayflies are pollutant-sensitive organisms.

Stream 22NN

Stream 22NN is an intermittent stream that flows southeast from Wetland 22OO on the west side of I-495 and flows into the Potomac River immediately under the North side of the ALB.

The stream is within a wide, eroded valley receiving hydrology from both the wetland upstream and surface runoff. As it flows under the bridge, the main channel begins to meander. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22NN is poor, with less than 20 percent available habitat. Overall, the benthic macroinvertebrate habitat consists of a few rocks, leaf packs and woody debris. For fish, habitat is lacking, with only intermittent flows and a lack of pools. Riffles are lacking with embeddedness at 100 percent, however, in the portion of stream under the I-495 bridge, placed ripraprip rap is present providing some stabilization and possible habitat. The stream has little flow diversity, with shallow-slow as the only velocity/depth regime present. In portions of the stream outside of the bridge cover substrate is dominated by fine sediment, sand, and small gravel, whereas the stream substrate in the portions under the bridge is dominated by mud with placed ripraprip rap present throughout. About 20 percent of the bottom of the streambed is affected by sediment deposition, with slightly more deposition in the portion of the stream flowing under the ALB. Very little water filled the channel during the time of the survey, with most of the channel substrate exposed, especially in the upstream portion that is not under the bridge. The portion of the stream channel that flows under the

bridge had pools of stagnant mud. Some channel alteration is present, especially in the portions of the stream under the ALB where riprapriprap has been placed. The natural flow and location of the channel was also likely altered when I-495 was built. Both banks in the upstream portion that is not under the bridge are moderately stable, with 30 percent showing signs of erosion. The left bank under the bridge is unstable with many raw areas, while the right bank is moderately stable with roughly 30 percent erosion present. Apart from the portion of stream under I-495, 50 to 70 percent of the streambank surfaces are covered by woody roots and vegetation. No vegetation is present under the bridge. Since the stream runs parallel to I-495 upstream before flowing under the bridge, a riparian zone of about 12 meters is present on the left bank, with the right bank consisting of a riparian zone greater than 18 meters. Under the bridge, the riparian zones on both banks are less than 6 meters wide, with only sparse trees present. The upstream portion is partially shaded by vegetation, whereas the bridge provides 100 percent shade for the portion flowing underneath. Stream 22NN receives sediment and pollutant runoff from the adjacent roadway. No odor was present at the time of the survey, however iron floc, turbid water, suspended sediments, and some trash were observed in the stream.

During a qualitative assessment of the aquatic community at Stream 22NN, no fish were observed, but many pouch snails (Family Physidae) and aquatic worms (Subclass Oligochaeta) were collected. Pouch snails and aquatic worms are both considered pollution-tolerant organisms.

Stream 22QQ

Stream 22QQ is an intermittent unnamed tributary that flows southeast into Rock Run Culvert, Stream 22MM. The stream originates from a culvert that flows east under I-495. The entirety of the delineated stream is within the CSB.

Stream 22QQ is within a small gully, likely receiving hydrology from surface runoff. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22QQ is poor, with less than 10 percent available habitat. Overall, the benthic macroinvertebrate habitat consists of only some small areas of shallow, fast-moving water. For fish, habitat is lacking, with only intermittent flows. There are no well-defined riffles or pools providing habitat and there is very little flow diversity. The stream bed substrate is lacking cobble/gravel, consisting mostly of fine sediment, and stream particles are over 75 percent embedded. Roughly 30 percent of the bottom of the streambed is affected by sediment deposition with slight deposition in pools. Very little water was present in the channel during the time of the survey, exposing most of the channel substrate. There is some channel alteration present, with riprapriprap placed throughout the reach and with the upstream portion originating from a culvert. The entire stream channel of 22QQ is incised with roughly 60 percent erosion on both banks, frequent areas of erosion, and head cutting. Less than 50 percent of the streambank surfaces are covered by native vegetation with many raw areas present. The riparian zone consists of a mature, high-quality forest, giving both banks a riparian zone at least 18 meters wide, with minimal to no human activity impacting the riparian zones. Approximately 90 percent of the stream is shaded and is bordered by a mixed-deciduous forest. Stream 22QQ receives sediment and pollution runoff from the adjacent roadway. Iron floc and trash are present within the stream channel, and oil sheen is present on the water's surface in areas of standing water.

During a qualitative assessment of the aquatic community at Stream 22QQ, no fish were observed, but aquatic worms (Subclass Oligochaeta) were collected. Aquatic worms are pollution-tolerant organisms.

GEORGE WASHINGTON MEMORIAL PARKWAY NPS UNIT

Stream 22V

Stream 22V is an intermittent ditch that runs parallel to Clara Barton Parkway and flows east under I-495. The stream flows east through the CSB.

Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for low gradient streams, the epifaunal substrate/available cover at 22V is poor, with less than 10 percent available habitat. Overall, the benthic macroinvertebrate habitat is deficient. For fish, there is no habitat present. Riffles are lacking with little variety and no flow diversity, while pools are mostly small-shallow with no root mat or submerged vegetation. In portions of the stream outside of the bridge cover, substrate is dominated by gravel, sand, and silt, whereas the portions under the bridge are lined with riprap. Only about 30 percent of the bottom of the streambed is affected by sediment deposition, with slightly more deposition in the portion of the stream flowing under the I-495 bridge over Clara Barton Parkway. Very little water filled the channel during the time of the survey, with only pockets of standing water present. Some channel alteration is present, especially in the portions of the stream under the I-495 bridge where it is lined with riprap. The channel was also likely formed or re-shaped when Clara Barton Parkway was built more than 20 years ago, as it now acts as a roadside ditch. The channel of Stream 22V is very straight, likely having been channelized for many years. Both banks are stable to moderately stable, with 5 percent or less of both banks showing signs of erosion. The portion of the stream west of I-495 does have minor amounts of erosion present on both banks, however, it is mostly healed over with some herbaceous vegetation present. The portion under the bridge has no bank instability as they are armored with riprap. Apart from the portion of stream under I-495, 50 to 70 percent of the streambank surfaces are covered by vegetation, with mowed grass present just west of the bridged portion and scattered trees and shrub hedge grove areas present in the remaining portions. No vegetation is present under the bridge. Since the stream runs parallel to a road on the left bank and is impacted by human activities associated with the C&O Canal on the right bank, both banks have riparian zones of less than 12 meters in width. Vegetation is providing very little shade for the stream, as it is bordered by mowed grass and young regenerating woody species. The bridge provides 100 percent of shade for the portion flowing underneath. Stream 22V receives sediment and pollutant runoff from the adjacent roadways. No odor was present at the time of the survey, however cloudiness caused by fine sediments was present in the standing water and trash was observed along the banks.

During a qualitative assessment of the aquatic community at Stream 22V, no fish were observed, but many pouch snails (Family Physidae) and some aquatic sowbugs (Family Asellidae) were collected from the standing water. Pouch snails and aquatic sowbugs are both considered pollution-tolerant organisms.

Stream 22WW

Stream 22WW is an unnamed tributary to the Potomac River. It is an intermittent stream that flows southwest from George Washington Memorial Parkway and into a culvert on the east side of I-495. One small section of the stream within NPS property and near the existing culvert is within the CSB.

The stream is within a small valley likely receiving hydrology from both groundwater seeps and surface runoff. Based on the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover at 22WW is suboptimal, with about 60 percent available habitat within the portion of stream just upstream of the culvert and within the CSB. Overall, the benthic macroinvertebrate habitat consists of small riffles, minor amounts of woody debris, roots, and small leaf packs. For fish, habitat is lacking, with only intermittent flows and downstream blockages. Riffle habitat is stable with some variety and flow diversity and is relatively frequent throughout Stream 22WW. Substrate of the riffles consists of cobble, gravel and bedrock and is roughly 25 percent embedded. Pools are mostly shallow with gravel substrate, but some root mat habitat is available. Leaf packs observed were transient and unlikely to be suitable habitat. Shallow-fast and shallow-slow were the only two depth regimes present at Stream 22WW. Roughly 5 percent of the bottom of the streambed is affected by sediment deposition, with slight deposition in pools. Water filled 50 to 75 percent of the channel during the time of the survey, with 25 to 50 percent of the channel substrate exposed. No evidence of channel alteration is present at Stream 22WW within the CSB on NPS property, however, downstream the stream flows west through a culvert under I-495. Both banks are stable to moderately stable, with roughly 5 percent of both banks eroded; however, less than 50 percent of the streambank surfaces are covered by vegetation. Most of the bank stabilization and protection is from the bedrock, as well as some roots. Stream 22WW is surrounded by a mature high-quality mixed deciduous forest, giving both banks a riparian zone width of at least 18 meters. Very minimal human activity is impacting the riparian zones and approximately 90 percent of the stream is shaded by vegetation. The water within the stream appears clear with no noticeable odor present. Trash was only observed downstream outside of the NPS property at the input of the culvert running under I-495.

During a qualitative assessment of the aquatic community at Stream 22WW, aquatic worms (Subclass Oligochaeta), net-spinning caddisflies (Family Hydropsychidae), stoneflies (Order Plecoptera) and aquatic sowbugs (Family Asellidae) were collected in the stream. Aquatic worms and aquatic sowbugs are considered pollution-tolerant groups of organisms; net-spinning caddisflies are moderately pollution-sensitive; and stoneflies are pollutant-sensitive organisms. As Stream 22WW is a small intermittent channel, it is unlikely to be providing fish habitat, and none were observed during the time of the survey.

NATIONAL CAPITAL PARKS – EAST PARK UNIT- BALTIMORE WASHINGTON PARKWAY

Wetland 10P

Wetland 10P is a forested wetland delineated in the median of the Baltimore Washington Parkway, west of I-495. It is classified as a palustrine forested wetland with persistent vegetation and a saturated water regime (PFO1B). This seep wetland lies along a hillslope and abuts and drains to an intermittent stream (Stream 10F).

The wetland is hydrologically supported by a seasonally high groundwater table and surface water runoff from the surrounding uplands. Observed wetland hydrologic indicators included surface water ponding, a high water table, saturation, and water stained leaves.

Vegetation within the wetland is relatively sparse and is comprised of sweetgum (*Liquidambar styraciflua*), horsebrier, cinnamon fern (*Osmundastrum cinnamomeum*), and sensitive fern (*Onoclea*

sensiblis). Trees are rooted on the edge or just outside the wetland boundary but provide shading to the overall wetland.

Soils within the wetland were a silt loam over sandy loam texture and met the hydric soil criteria by exhibiting a depleted matrix (10YR6/1) throughout 12-inches of the soil profile. These loamy soils allow for infiltration of surface water, however the position of this wetland along an approximately 15% slope limits groundwater recharge potential since surface water drains to the stream downslope. The system provides more groundwater discharge than groundwater recharge potential, as water was observed seeping from the hillslope.

Using the methodology described above, two principal functions/values were identified, including groundwater recharge/discharge and sediment/toxicant retention. Groundwater was observed discharging along the hillslope within this wetland and seeping with light flow to the stream downslope. The wetland provides minor floodflow alteration, since surface water runoff is slowed within the wetland as it drains downslope toward the stream. Although vegetation within the wetland is not particularly dense, and long-term water retention does not occur due to its position along the slope, the wetland vegetation does still provide some sediment/toxicant retention and nutrient removal, since runoff from the adjacent roadways is likely a source of pollutants, sediments, and excess nutrients. Nutrients and organic material are exported from the wetland where it abuts the adjacent stream; therefore, the wetland is suitable to provide production export. The wetland occurs within forest parkland, but is located within a median, and therefore somewhat disconnected from adjacent wildlife habitat.

Since the water within the wetland was observed to be clear and predominantly groundwater, water quality within the wetland is relatively high. However, minor amounts of trash were observed, due to its proximity to the adjacent roadway.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of shallow standing water and leaf packs. During qualitative macroinvertebrate sampling in January 2021, no macroinvertebrates were observed.

Wetland 10GG

Wetland 10GG is a forested wetland delineated within the Baltimore Washington Parkway/Greenbelt Road interchange. It was classified as a palustrine forested wetland with persistent vegetation and a temporarily flooded water regime (PFO1A). This depression occurs downslope of an intermittent stream (Stream 10FF) within the interchange and extends to the toe-of-slope along the roadway.

The wetland is hydrologically supported by surface water runoff from the surrounding roadways, an intermittent stream that dissipates into the wetland, and a high groundwater table. Observed wetland hydrologic indicators included surface water ponding, a high water table, saturation, and water stained leaves. Secondary hydrologic indicators included drainage patterns and geomorphic position.

Vegetation within the wetland is comprised of red maple, sweetgum, tuliptree (*Liriodendron tulipifera*), horsebrier, and eastern poison ivy (*Toxicodendron radicans*).

Soils within the wetland were a sandy clay loam, sandy loam, and clay loam texture and met the hydric soil criteria by exhibiting a dark surface with redox (10YR3/1, 10YR3/2) within the upper 12-inches of the soil profile. These loamy soils allow for infiltration of surface water, thus providing groundwater recharge potential. However, the presence of tighter soils with more clay around 12 inches from the soil surface perches hydrology within the wetland and slows infiltration to some degree.

Using the methodology described above, two principal functions/values were identified, including floodflow alteration and sediment/toxicant retention. The wetland provides floodflow alteration because of its position in a flat, low lying depression within the median. Although the wetland is relatively small, surface water runoff and hydrology from the abutting stream is trapped within the wetland as it drains downslope. The excess runoff slowly infiltrates, evaporates, or respires through the wetland vegetation. The wetland also provides sediment/toxicant retention, as runoff from the adjacent roadways is a source of sediments and toxicants, which can be trapped by wetland vegetation and retained within standing water. The wetland vegetation also provides some nutrient removal, although the vegetative community is not particularly dense or diverse. The wetland occurs within forest parkland, but is located within a median and therefore disconnected from adjacent wildlife habitat.

Since the wetland does not contain an outlet, water that collects within the wetland remains until it infiltrates or evaporates/respires. Therefore, water quality is likely not high. Additionally, runoff containing sediments and toxicants from the roadways surrounding the wetland collects within the wetland. During field investigations, iron flocculent and trash was observed in areas with standing water.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to areas of shallow standing water and leaf packs. During qualitative macroinvertebrate sampling in January 2021, no macroinvertebrates were observed.

Stream 10F

Stream 10F is an unnamed tributary to Brier Ditch that abuts Wetland 10P. It is an intermittent stream that flows northwest to southeast within the median of Baltimore Washington Parkway.

The stream is within a small valley receiving hydrology from both groundwater and surface sources. Based on the habitat assessment using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover is mostly unstable at Stream 10F, with roughly 20 percent livable habitat available for fish and macroinvertebrates. Overall, the benthic macroinvertebrate habitat consists of a few small leaf packs, some woody debris, and shallow riffles comprised of gravel. For fish, no habitat is present, with only intermittent flows and one shallow pool, as well as step riprap causing a blockage. The substrate is comprised of mostly sand, gravel, and cobble and is embedded, with roughly 50 percent of stream particles surrounded by fine sediment. Shallow, slow-moving water is the dominant velocity/depth regime at Stream 10F, with some areas of fast-moving shallow water. Sediment deposition is moderate, with roughly 30 to 50 percent of the stream bottom changing frequently at Stream 10F. Water fills roughly 75 percent of the channel, with roughly 25 percent of the channel substrate exposed. Channelization is present, specifically where the stream flows into and out of two culverts under Baltimore Washington Parkway and riprap stabilization has been placed; however this channelization did not occur in the last 20 years. The riffle habitat at Stream 10F is relatively frequent, but poor overall, with only

shallow riffles present that are comprised of cobble. Both banks are moderately unstable with about 30 percent of the banks having areas of erosion and high erosion potential during floods. Roughly 50 to 70 percent of the surfaces of both streambanks are covered by native vegetation, although disruption is evident, and less than one-half of the potential plant stubble height is remaining. Stream 10F flows through narrow strips of early-mid successional forest and is 75 percent shaded. The riparian zone is over 18 meters on both banks, except for the right bank in the small downstream section that outlets from under the exit ramp, where the riparian zone is about 12 meters. Minimal human impacts are present in the riparian zones. Filamentous algae and iron floc were observed, and trash was present in the stream at the time of the survey. Stream 10F receives pollutants and runoff from adjacent roadways.

During a qualitative assessment of the aquatic community at Stream 10MM, no fish or benthic macroinvertebrates were observed.

Stream 10O

Stream 10O, a small ephemeral channel and tributary to Stream 10F and eventually Brier Ditch, is located entirely within the median of the Baltimore Washington Parkway and flows southwest.

The stream is within a small, shallow valley receiving hydrology from surface water sources. Although an assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols was not conducted, stream characteristics of Stream 10O were briefly evaluated. Stream 10O is a narrow channel that is roughly 2 to 3 feet wide and less than 1 foot deep. At the downstream section, the channel is subterranean for roughly 20 feet. Habitat for benthic macroinvertebrates is lacking and consists of some root mats and decaying leaf packs. Fish habitat is non-existent, as the stream has no flow and is comprised of mostly shallow, stagnant pools with no submerged vegetation and minimal woody debris. The substrate of Stream 10O is sand and silt with no cobble or gravel present, and there is some sediment deposition in pools. There is no evidence of channel alteration at Stream 10O and the stream has a normal, natural pattern. Both banks have little to no erosion, with minimal bare soil or evidence of bank failure. Stream 10O flows through a narrow corridor of early successional forest that shades roughly 80 percent of the channel. The riparian zone on each bank is roughly 12 to 18 meters wide and is minimally impacted by humans. There was no odor at Stream 10O at the time of the survey, but some iron floc was present. Minor amounts of trash were present in and around the channel. Located directly adjacent to the Baltimore Washington Parkway, Stream 10O likely receives runoff from the roadway.

During a qualitative assessment of the aquatic community at Stream 10O, no fish were observed, but riffle beetle larvae (Family Elmidae) were collected. Riffle beetles are moderately pollution-sensitive organisms.

Stream 10FF

Stream 10FF is an intermittent tributary that flows southeast and is located within the Baltimore Washington Parkway/Greenbelt Road interchange. The stream begins at a culvert and dissipates into Wetland 10GG.

The stream is within a low, wide valley receiving hydrology from ground and surface water sources. According to the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for high gradient streams, the lack of epifaunal substrate/available cover at Stream 10FF is apparent, with less than 20 percent available habitat. The existing macroinvertebrate habitat consists of

some leaf packs and woody debris, and no fish habitat is present. The substrate is mostly sand and mud with some gravel, and particles are more than 75 percent surrounded by fine sediment. Consisting of primarily shallow run with intermittent flow, the dominant velocity/depth regime is shallow, slow-moving water. There is little to no enlargement of islands or point bars at Stream 10FF and less than 5 percent of the stream bottom is affected by sediment deposition. For channel flow status, very little water is present, and the water that is present consists mostly of standing pools. Because Stream 10FF originates from a culvert, some channelization is present; however it did not occur in the last 20 years, and no other evidence of channelization was observed. No riffles are present at Stream 10FF. Both banks are stable, with minimal evidence of bank erosion or failure and little potential for future problems. Roughly 50 percent of each bank is protected by vegetation and has obvious disruption, with patches of bare soil or closely cropped vegetation present. Less than one half of the potential plant stubble height is remaining on each bank. The riparian zone on both banks is greater than 18 meters wide and is minimally impacted by humans. Stream 10FF is bordered by an early mid-successional forest that shades roughly 85 percent of the stream. No odor was present at the time of the survey and a small amount of trash was observed in or around the stream. Stream 10FF likely receives pollutants from roadway runoff due to its location, and filamentous algae and iron floc were observed.

During a qualitative assessment of the aquatic community at Stream 10FF, no fish or macroinvertebrates were collected.

Stream 10JJ

Stream 10JJ is an intermittent tributary to Brier Ditch that originates from a reinforced concrete pipe and runs parallel to the Baltimore Washington Parkway, flowing southwest to northeast.

The stream is within a small valley that receives hydrology from ground and surface water sources. The epifaunal substrate/available cover for fish and macroinvertebrates at Stream 10JJ is lacking, with less than 20 percent stable habitat and an obvious lack of substrate, based on the habitat assessment using EPA's Rapid Bioassessment Protocols for high gradient streams. Overall, the benthic macroinvertebrate habitat consists of riprap around the culvert and otherwise shallow riffle/run, while no livable habitat is present for fish due to a lack of pools, roots, and wood. The stream substrate consists of riprap, sand, silt, and gravel and is highly embedded with more than 75 percent of particles surrounded by fine sediment. Slow-shallow water is the only dominant velocity/depth regime at Stream 10JJ. Roughly 50 percent of the stream bottom is affected by sediment deposition, with some deposition of new gravel, sand, or fine sediment on old and new bars. There is very little flowing water at Stream 10JJ and the channel mostly consists of stagnant, standing pools and shallow riffles. Channelization is present at Stream 10JJ as the stream originates from a reinforced concrete pipe and has been straightened historically. Roughly 60 percent of the channel has been altered, and riprap is present on both banks as well as in the channel. Both banks of the stream are moderately stable, and roughly 30 percent of the reach has erosion. Roughly 50 percent of each bank's surfaces are covered by vegetation and disruption is apparent, with patches of bare soil or closely cropped vegetation common and less than one-half of the potential plant stubble height remaining. The riparian zone on the left bank is between 6 and 12 meters wide and has been greatly impacted by humans due to the stream's proximity to the Baltimore Washington Parkway. For the right bank, the riparian zone is greater than 18 meters wide and has not been impacted by humans. Stream 10JJ is bordered by an early mid-successional forest, shading roughly 55 percent of the stream.

Based on a qualitative assessment of the aquatic community at Stream 10JJ near the roadway culvert, no fish were observed, but one crane fly larva (Genus Tipula) was collected. Crane fly larvae are moderately pollution-sensitive organisms.

Stream 10KK

Stream 10KK is an intermittent stream that flows northeast to southwest into Stream 10MM and eventually to Brier Ditch. It is located to the south of Baltimore Washington Parkway and flows parallel to the roadway.

Stream 10KK is a shallow stream with intermittent flow, originating from a pipe that drains runoff from I-495. Based on the habitat assessment using EPA's Rapid Bioassessment Protocols for high gradient streams, less than 20 percent of the epifaunal substrate/available cover for fish and macroinvertebrates is stable, and lack of habitat is apparent. The benthic macroinvertebrate habitat is minimal and consists of mostly leaf packs, while no fish habitat is present. The substrate at Stream 10KK consists of only sand and gravel and is highly embedded, with more than 75 percent of stream particles surrounded by fine sediment. The dominant velocity/depth regime is shallow, slow-moving water, with very little flow and mostly standing pools at Stream 10KK. More than 50 percent of the stream bottom is changing frequently from heavy sediment deposits in the stream and on bars, and pools are absent due to substantial deposits of fine sediment. The channel of Stream 10KK is straight and has been channelized, with the stream flowing along the toe of slope of I-495. Riffle habitat is rated as poor because riffles are nonexistent at 10KK. The banks are moderately stable, and erosion is infrequent, with roughly 5 to 30 percent of each bank having areas of erosion. The vegetative protection on both banks is poor, with less than 50 percent vegetative cover on both banks. Disruption is very high, and vegetation has been removed to 5 centimeters or less in average stubble height. On the left bank, the riparian zone is over 18 meters wide, and human activities have made no impact. On the right bank, the riparian zone is roughly 6 to 12 meters wide due to the stream's proximity to I-495, and therefore human activities have impacted the riparian zone a great deal. Stream 10KK flows through a forested corridor comprised of mid-successional mixed deciduous vegetation, and roughly 70 percent of the stream is shaded. There was no odor at Stream 10KK at the time of the assessment, but iron floc was observed, and the water was cloudy.

During a qualitative assessment of the aquatic community at Stream 10KK, no fish were observed, but a predaceous diving beetle (Family Dytiscidae) larva was collected. Predaceous diving beetles are moderately pollution-sensitive organisms.

Stream 10MM

Stream 10MM, an intermittent stream and a tributary to Brier Ditch, begins north of Baltimore Washington Parkway and flows south through a culvert, turning southwest to parallel Baltimore Washington Parkway when it exits the culvert just south of the roadway.

The stream is within a narrow, incised valley receiving hydrology from both ground and surface water sources. Stream 10MM was assessed using EPA's Rapid Bioassessment Protocols for high gradient streams as well as the stream function-based rapid assessment. The epifaunal substrate/available cover is unstable at Stream 10MM, with less than 20 percent livable habitat available for fish and macroinvertebrates. Overall, the benthic macroinvertebrate habitat consists of a few small leaf packs, some roots, and shallow riffles comprised of sand and gravel. For fish, habitat is minimal, consisting of

some shallow pools with minimal roots that are lacking cover. The substrate is comprised of mostly sand and gravel with some cobble and is highly embedded, with more than 75 percent of stream particles surrounded by fine sediment. Shallow, slow-moving water is the only dominant velocity/depth regime at Stream 10MM, with very little flowing water present. More than 50 percent of the stream bottom is changing frequently from sediment deposition at Stream 10MM, and pools are almost absent due to substantial deposits of fine sediment. Channelization is present, specifically in the upstream section where the stream has been altered along an embankment before it flows into a culvert under I-495; however this channelization did not occur in the last 20 years. The riffle habitat at 10MM is poor, overall, with only a few riffles present that are comprised of sand and gravel. In the most downstream section of the stream reach, several head cuts are present, and banks are highly eroded. Above the head cuts, however, both banks are moderately stable, with five 5 to 30 percent of the banks having small areas of erosion that are mostly healed over. Roughly 70 to 90 percent of the surfaces of both streambanks are covered by native vegetation, although some disruption is evident. In the downstream section, Stream 10MM flows through a forested corridor of mid-successional mixed deciduous forest and is 85 percent shaded. In the upstream section, the stream is more exposed to sunlight with roughly 30 percent shading. The riparian zone is roughly 12 to 18 meters on both banks in the downstream section, with minimal impact by humans. In the upstream section, the left bank has a riparian zone that is less than 12 meters wide and has been impacted by humans due to maintenance from the roadway. There was no odor at Stream 10MM at the time of the assessment, but extensive iron floc was observed. Trash was also abundant within and around the channel, including large pieces of asphalt and concrete.

During a qualitative assessment of the aquatic community at Stream 10MM, no fish were observed, but aquatic worms (Subclass Oligochaeta), pouch snails (Family Physidae), and net-spinning caddisflies (Family Hydropsychidae) were collected. Aquatic worms and pouch snails are pollution-tolerant organisms, while net-spinning caddisflies are moderately pollution-sensitive.

Stream 10PP

Stream 10PP is an intermittent stream flowing from Wetland 10NN. The stream begins north of Baltimore Washington Parkway and flows south through a culvert, turning southwest to parallel the Baltimore Washington Parkway entrance ramp, eventually draining to Brier Ditch.

The stream is within a narrow valley receiving hydrology from ground and surface water sources. The epifaunal substrate/available cover for fish and macroinvertebrates at Stream 10PP is roughly 50 percent stable in the downstream section and roughly 20 percent stable in the upstream section, based on the habitat assessment using EPA's Rapid Bioassessment Protocols for high gradient streams. The benthic macroinvertebrate habitat consists of a few small leaf packs, some roots, and shallow riffles comprised of riprap, cobble, sand, and gravel. For fish, there are no pools or woody debris, although some root habitat is present. In the downstream section, the culvert that the stream flows from is perched and has created a blockage for fish, preventing them from traveling upstream. The substrate is highly embedded in the downstream section, with more than 50 percent of stream particles surrounded by fine sediment, and is less embedded in the upstream section, with less than 25 percent of stream particles surrounded by fine sediment. Shallow-fast and shallow-slow are the only 2 velocity/depth regimes present at Stream 10PP. Although there is minimal sediment deposition on the stream bottom, newly deposited sediment was observed along both banks in the downstream section. The channel is full at Stream 10PP, with water

reaching the base of both banks and little to no substrate exposed. Stream 10PP has been channelized, with riprap present along both banks and as substrate in the upstream section, as well as along the left bank in the downstream section. In both sections, the channel runs along the toe-of-slope of I-495 and has been straightened. Riffles are relatively frequent at Stream 10PP. For bank stability, both banks are stable and have minimal evidence of failure, with roughly 5 percent of bank surfaces affected by erosion. Roughly 50 percent of both banks are protected by bank vegetation, with apparent disruption, some of which is due to riprap placement. Patches of bare soil or closely cropped vegetation are common, and the vegetation that is present has been trimmed to less than one half of its potential height. The downstream section runs through a mid-successional forest corridor that shades roughly 70 percent of the stream, while the upstream section is more exposed due to its proximity to I-495 and is only 30 percent shaded. The left bank in the downstream section and the right bank in the upstream section both have riparian zones that are roughly 18 meters wide, with minimal human impact. The right bank in the downstream section has a riparian zone that is roughly 12 meters wide, while the left bank in the upstream section has a riparian zone that is roughly 6 meters wide, both of which have been greatly impacted by humans. Iron floc and trash were observed at Stream 10PP at the time of the assessment, and a petroleum odor was present when assessing the upstream section.

During a qualitative assessment of the aquatic community at Stream 10PP, no fish were observed, but pouch snails (Family Physidae) and damselfly larvae (Suborder Zygoptera) were collected. Pouch snails are pollution-tolerant organisms and damselfly larvae are moderately pollution-sensitive.

NATIONAL CAPITAL PARKS – EAST PARK UNIT- GREENBELT PARK

Wetland 10EE

Wetland 10EE is a forested wetland delineated in the median of the Baltimore Washington Parkway, west of I-495. It was classified as a palustrine forested wetland with persistent vegetation and a saturated water regime (PFO1B). This depression lies along the roadway toe-of-slope and drains to a culvert along Baltimore Washington Parkway.

The wetland is hydrologically supported by seasonally high groundwater and surface water runoff from the surrounding uplands. Observed wetland hydrologic indicators included surface water ponding, a high water table, saturation, sediment deposits, and water stained leaves.

Vegetation within the wetland is comprised of red maple, sweetgum, willow oak (*Quercus phellos*), horsebrier, an unknown grape species (*Vitis* sp.), Japanese honeysuckle, and eastern poison ivy.

Soils within the wetland were a silty or sandy clay loam texture over clay and met the hydric soil criteria by exhibiting a depleted matrix (10YR4/2) within the upper 6 inches of the soil profile. These tight clay soils slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, two principal functions/values were identified, including floodflow alteration and sediment/toxicant retention. The wetland provides floodflow alteration due to its position in a flat, low lying depression along the roadside. Although the wetland is relatively small, some surface water runoff is trapped within the wetland as it drains downslope toward the culvert, which outfalls to wetlands and streams visible on aerial imagery north of Baltimore Washington Parkway. The

excess runoff slowly infiltrates, evaporates, or respires through the wetland vegetation. The wetland also provides sediment/toxicant retention, as runoff from the highway is a source of sediments and toxicants, which can be trapped and retained by wetland vegetation and standing water. The wetland vegetation also provides some nutrient removal, although the vegetative community is not particularly dense or diverse. The wetland occurs within forest parkland, but is located within a median, and therefore disconnected from adjacent wildlife habitat.

Since the wetland is located directly along the roadway and water appears to collect within the wetland and remain until it infiltrates or drains slowly to the culvert, water quality is likely not high. During field investigations, some sediment was observed in areas with standing water. Iron flocculent, algae, and abundant trash was also observed.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to areas of standing water and habitat features included leaf packs, woody debris, and root wads. During qualitative macroinvertebrate sampling in January 2021, the only macroinvertebrates observed were midges (Family Chironomidae), which are a pollution-tolerant group of organisms.

Stream 10A

Stream 10A, a small ephemeral channel and tributary to Brier Ditch, is located west of Baltimore Washington Parkway southbound and flows west into Greenbelt Park, just south of I-495.

The portion of the stream within the CSB at the culvert outfall is incised and receives hydrology from surface sources. Although an assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols was not conducted, because this is an ephemeral channel, stream characteristics of Stream 10A were briefly evaluated. Stream 10A originates at a culvert and a severe head cut occurs approximately 30 feet from the roadway. The habitat for benthic macroinvertebrates is very poor, with some woody debris, roots, sandy gravel, and little to no flow. Fish habitat is non-existent, as the stream has low flow and no pools. The substrate of Stream 10A consists of silt and sandy gravel with heavy sediment deposition present at the culvert. Channel alteration is present as upstream is culverted; however, this channelization did not occur in the last 20 years. Moderate erosion is present overall, with some exposed banks and roots. Stream 10A is at the edge of a mid-successional forest that shades roughly 75 percent of the channel. The riparian zone is 18 meters wide and is minimally impacted by humans. The water is cloudy with suspended sediments and abundant trash present. Located directly adjacent to the Baltimore Washington Parkway, Water10A likely receives runoff from the roadway.

During a qualitative assessment of the aquatic community at Stream 10A, no fish were observed, but pouch snails (Family Physidae) were collected. Pouch snails are pollution tolerant organisms.

Stream 10AAA

Stream 10AAA is an intermittent stream that flows into Wetland 10XX, which connects to a main unnamed tributary to Brier Ditch. Stream 10AAA flows west from under the Baltimore Washington Parkway southbound into Greenbelt Park, just south of I-495.

The portion of the stream, where it originates within the CSB and before it abuts Wetland 10XX, is a small, scoured out section that receives hydrology from surface sources. Based on the habitat assessment using EPA's Rapid Bioassessment Protocols for high gradient streams, the epifaunal substrate/available cover is lacking at Stream 10AAA, with less than 20 percent livable habitat available for fish and macroinvertebrates. The benthic macroinvertebrate habitat consists of some gravel and cobble. For fish, no habitat is available, as there are only intermittent flows. The stream originates at a 3-to-4-foot head cut at the end of a riprap channel. Substrate just downstream of the headcut is comprised of mostly clay, cobble, and gravel with about 25 percent embeddedness. Shallow, slow-moving water is the only dominant velocity/depth regime at Stream 10AAA. Between 5 to 30 percent of the stream bottom is impacted by sediment deposition and there is slight deposition in pools. Water fills roughly 50 percent of the available channel, with riffle substrates mostly exposed. Channelization is present through most of this section of the stream reach, with the stream flowing from a culvert and riprap placed for stabilization at the outlet, however this channelization did not occur in the last 20 years. Riffles at Stream 10AAA are relatively frequent, but poor quality overall, with only shallow riffles present that are comprised of gravel and cobble. Both banks are unstable where the stream originates, with obvious bank sloughing and severely eroded, raw areas. Downstream, banks are stable with minor erosion and the stream becomes more naturalized as it flows into Wetland 10XX. Roughly 50 to 70 percent of the surfaces of both streambanks are covered by native vegetation, although disruption is evident, and less than one-half of the potential plant stubble height is remaining. Stream 10AAA flows through a mid-successional mixed deciduous forest and is roughly 75 percent shaded. The riparian zone is over 18 meters wide on both banks, with minimal human impacts present. Trash is present, particularly at the head cut, and filamentous algae is present just downstream of the eroded headcut portion of stream within the CSB. Stream 10AAA receives pollutants and runoff from adjacent roadways.

During a qualitative assessment of the aquatic community at Stream 10AAA where it originates upstream of Wetland 10XX, no fish or benthic macroinvertebrates were observed.

NATIONAL CAPITAL PARKS – EAST PARK UNIT- SUITLAND PARKWAY

Wetland 3KKK

Wetland 3KKK is a scrub-shrub wetland delineated along the north side of Suitland Parkway, west of the I-495 overpass. It was classified as a palustrine scrub-shrub wetland with persistent vegetation and a saturated water regime (PSS1B). This shallow depression lies within the floodplain of Henson Creek (Stream 3L) and drains to Henson Creek via an abutting ephemeral channel (Stream 3LLL).

The wetland is hydrologically supported by surface water runoff from Suitland Parkway that is retained by slowly drained clayey soils. Observed wetland hydrologic indicators included surface water ponding and saturation perched over rock and clay. Secondary hydrologic indicators included geomorphic position and a positive FAC-Neutral test.

Vegetation within the wetland is comprised of deer-tongue rosette grass (*Dichanthelium clandestinum*), sweetgum, lamp rush, groundseltree (*Baccharis halimifolia*), and an unknown goldenrod (*Solidago* sp.).

Soils within the wetland were a sandy clay texture and met the hydric soil criteria by exhibiting a depleted matrix (10YR4/2) throughout the 10-inch soil profile. A confining rock layer occurs at a depth of

approximately 10 inches from the soil surface. These tight clay soils over rock slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, production export was the only identified principal function/value provided by the wetland. The wetland provides production export value since wildlife food sources grow within the wetland, which are utilized and exported by wildlife. Additionally, organic plant material is exported to the adjacent perennial stream via an ephemeral channel. The wetland provides some floodflow alteration because of its depressional position within the terraced floodplain of Henson Creek. Surface water runoff is trapped and retained within the wetland as it drains from Suitland Parkway toward the adjacent stream, thus allowing the excess runoff to slowly infiltrate, evaporate, or respire through the emergent and shrub vegetation within the wetland. Surface water within the wetland provides some minor groundwater recharge potential, but this is limited by clay soils and a confining rock layer. The wetland also provides some sediment/toxicant retention and nutrient removal functions, as runoff from the adjacent roadways is likely a source of all three, and dense vegetation within the wetland provides trapping and utilization potential. Dense vegetation within this wetland also provides some stabilization of the adjacent stream bank against minor flood events. Due to its location within a forested stream corridor on parkland, this wetland also provides some suitability for wildlife habitat.

Since the wetland is located along the roadway embankment and receives hydrology from a pipe outfall that drains the roadway, water quality is likely not high. However, during field investigations, surface water observed within the wetland was relatively clear and minor amounts of trash were observed near, but not within, the wetland.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of shallow standing water. Emergent vegetation would be the primary substrate for such macroinvertebrates. No macroinvertebrates were observed during qualitative sampling in January 2021.

Wetland 3M

Wetland 3M is an emergent wetland delineated along both banks of perennial Stream 3L (Henson Creek), north of Suitland Parkway and east of I-495. It was classified as a palustrine emergent wetland with persistent vegetation and a saturated water regime (PEM1B). This wetland occurs within a low-lying bench in the floodplain of Henson Creek.

The wetland is hydrologically supported by out of bank flow from the adjacent stream and a seasonally high groundwater table. Observed wetland hydrologic indicators included surface water, saturation, a high groundwater table, and sediment deposits. Other primary hydrologic indicators included oxidized rhizospheres along living roots. Secondary hydrologic indicators included drainage patterns and a positive FAC-Neutral test.

Vegetation within the wetland includes invasive Japanese stilt grass, deer-tongue rosette grass, sweetgum, and an unknown aster species (*Symphyotrichum* sp.).

Soils within the wetland were a sandy loam and sandy clay loam texture and met the hydric soil criteria by exhibiting a depleted matrix (10YR4/1) from 5-12 inches within the soil profile. These sandy loam and clay loam soils contribute to a high level of infiltration of surface water and interaction with the groundwater table.

Using the methodology described above, two principal functions/values were identified, including floodflow alteration and sediment/shoreline stabilization. The wetland provides floodflow alteration because of its low-lying position within a floodplain bench along Henson Creek (Stream 3L), where it can detain excessive flood flows from the adjacent channel. Although the wetland is not large, some surface water runoff is trapped within the wetland as it drains downslope toward Henson Creek from Suitland parkway, thus allowing the excess runoff to infiltrate or respire through the emergent vegetation within the wetland. The wetland also provides some sediment/toxicant retention and nutrient removal functions, as there is potential for the presence of sediments, toxicants, and excess nutrients in the Streamhed above the wetland. However, vegetation within the wetland is not particularly diverse, and open water/long-duration water retention is not present within the wetland. Wetland 3M does contain some wildlife food sources and is located within a forested stream corridor. Therefore, it has some suitability to provide production export and wildlife habitat. The wetland provides sediment/shoreline stabilization along Henson Creek, as herbaceous plants and scattered shrub/saplings are providing stabilization of the stream bank against minor flood events.

During field investigations, only a small amount of surface water was observed. Some sediment and cloudiness were observed in areas with standing water; therefore, water quality is likely not high. Additionally, cloudy water and extensive iron flocculent were observed within the adjacent stream channel.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely very limited since minimal standing water was observed and the potential habitat, which consists of a few small leaf packs, is very poor and lacks structure. During qualitative macroinvertebrate sampling in December 2020, no macroinvertebrates were observed.

Wetland 3O

Wetland 3O is a forested wetland located north of Henson Creek and Suitland Parkway and east of I-495. It was classified as palustrine forested wetland with persistent vegetation and a seasonally flooded/saturated water regime (PFO1E). This wetland occurs within a broad depression and drains to Henson Creek (Stream 3L) through a narrow swale where it parallels I-495 and overlaps parkland.

The wetland is hydrologically supported by a seasonally high groundwater table and surface water from one ephemeral and one perennial channel that both dissipate into the wetland. Observed wetland hydrologic indicators within the swale portion of the wetland included surface water and drainage patterns.

Vegetation within the swale portion of Wetland 3O along the highway is relatively sparse and includes deer-tongue rosette grass, horsebrier, Japanese honeysuckle, and an unknown aster species.

Soils within the wetland were a sandy loam and sandy clay loam texture and met the hydric soil criteria by exhibiting a depleted matrix (2.5Y5/2) from 1-10 inches within the soil profile. These sandy loam and clay loam soils with gravel contribute to a relatively high level of infiltration of surface water. However, hydrology within the swale drains quickly to Henson Creek and therefore is not likely to infiltrate and provide groundwater recharge.

Using the methodology described above, four suitable functions/values were identified, including sediment/toxicant retention, nutrient removal, production export, and wildlife habitat. The wetland receives hydrology from roadway runoff draining from I-495, which is a source of toxicants, sediments, and excess nutrients. Although water moves relatively quickly through the wetland swale and vegetation is not particularly dense, herbaceous vegetation within the wetland swale and trees rooted along the edge can trap these sediments and utilize a portion of excess nutrients before they reach Henson Creek downslope. The wetland contains plant species that serve as wildlife food sources and is located within a forested stream corridor. Therefore, this wetland has suitability to provide production export and wildlife habitat.

During field investigations, shallow surface water was observed within the swale. Overall, the water appeared relatively clear, but trash was observed along the adjacent slope and within the overall wetland depression.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited. Potential habitat features consist of shallow standing water, gravel, and small leaf packs. During qualitative macroinvertebrate sampling in January 2021, one aquatic sowbug (Family Asellidae) was observed, which is a pollution-tolerant organism.

Wetland 3T

Wetland 3T is a forested wetland delineated north of Suitland Parkway and Henson Creek and west of the I-495 overpass. It was classified as a palustrine forested wetland with persistent vegetation and a temporarily flooded water regime (PEM1A). This micro depression/hillslope lies within the floodplain of the perennial headwaters of Henson Creek (Stream 3L and 3S). A small portion of Wetland 3T is located within parkland. This portion of the wetland shows evidence of prior disturbance in the vicinity of an existing sewer line manhole.

The wetland is hydrologically supported by overflows from the adjacent stream channels. Wetland hydrologic indicators were lacking within the small portion of wetland on parkland during the January 2021 field assessment. However, during the wetland delineation primary hydrologic indicators, including saturation and a high water table, were observed within the wetland. Secondary hydrologic indicators included the presence of crayfish burrows.

Vegetation within the wetland is comprised of deer-tongue rosette grass, Japanese honeysuckle, green ash, an unknown aster species, an unknown grass species, Japanese stilt grass, and Virginia wildrye (*Elymus virginicus*).

Soils within the wetland were a sandy clay loam and sandy clay texture and met the hydric soil criteria by exhibiting a depleted matrix (2.5Y5/2, 2.5Y4/2, and 2.5Y4/1) within 10 inches of the soil profile. A

confining rock/restrictive layer was observed within the wetland on parkland. These tight clay soils above the rock layer slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, five suitable functions/values were identified, including: sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, and wildlife habitat. The wetland provides sediment/toxicant retention and nutrient removal because of its position along the roadway toe-of-slope, between I-495 and two perennial streams. The presence of dense emergent vegetation and woody stems provide an opportunity to trap sediments and utilize excess nutrients present in surface water runoff. The wetland contains flowering and seed producing plants that could attract smaller and larger wildlife consumers and is located within a forested stream corridor. Therefore, this wetland has some suitability to provide production export and wildlife habitat.

Since no surface water was observed within the wetland, water quality was not assessed during the January 2021 field visit. Based on the geomorphic position of this wetland, absence of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Additionally, no macroinvertebrate habitat was observed within the wetland on parkland.

Wetland 3V

Wetland 3V is a forested wetland delineated along the north side of Suitland Parkway, west of the I-495 overpass. It was classified as a palustrine forested wetland with persistent vegetation and a seasonally flooded water regime (PFO1C). This swale wetland originates at a culvert along Suitland Parkway and drains north through the floodplain into Henson Creek (Stream 3L).

The wetland is hydrologically supported by surface water runoff from Suitland Parkway that is retained by slowly drained clayey soils. Observed wetland hydrologic indicators included surface water ponding and saturation perched over rock and clay. Water-stained leaves and drainage patterns are also present within the wetland.

Vegetation within the wetland is comprised of Japanese stilt grass, an unknown aster species, and sweet wood-reed. Tree and other woody species including sweetgum, red maple, black gum, eastern poison ivy, and Japanese honeysuckle are present within the majority of the wetland, but only within MDOT SHA right-of-way.

Soils within the wetland were a sandy clay texture and met the hydric soil criteria by exhibiting a depleted matrix (10YR4/1, 2.5Y4/2) throughout the profile. A confining rock layer occurs at a depth of approximately 20 inches from the soil surface. These tight clay soils over rock slowly infiltrate surface water, thus not providing ideal groundwater recharge potential.

Using the methodology described above, three principal functions/values, including sediment/toxicant retention, nutrient removal, and production export were identified. Due to the excess sediment, pollutants, and nutrients in the surface water runoff from the adjacent roadways, the wetland provides sediment/toxicant retention and nutrient removal functions, and dense vegetation within the wetland provides trapping and utilization potential. The wetland provides production export value since wildlife food sources grow within the wetland, which are utilized and exported by wildlife. Additionally, organic plant material is exported to the adjacent perennial stream where the swale abuts the stream. The wetland provides some floodflow alteration because of its depressional position within the terraced

floodplain of Henson Creek. Surface water runoff is trapped and retained within the wetland as it drains from Suitland Parkway toward the adjacent stream, thus allowing the excess runoff to slowly infiltrate, evaporate, or respire through the emergent and woody vegetation within the wetland. Dense vegetation within this wetland also provides some stabilization of the adjacent stream bank against minor flood events. Due to its location within a forested stream corridor on parkland, this wetland also provides some suitability for wildlife habitat.

Since the wetland is located along the roadway embankment and receives hydrology from a pipe outfall that drains the roadway, water quality is likely not high. During field investigations, surface water observed within the wetland was somewhat cloudy and minor amounts of trash were observed near, but not within, the wetland.

Based on the geomorphic position of this wetland, small amount of standing water observed during the assessment, and lack of habitat structure, this wetland likely does not support a diverse fauna of macroinvertebrates. Macroinvertebrate use of the wetland is likely limited to periods of shallow standing water and wetted leaves. No macroinvertebrates were observed during qualitative sampling in January 2021.

Stream 3L

Stream 3L is a perennial headwater of Henson Creek that flows east to west under I-495 and parallel to Suitland Parkway. Wetland 3M abuts both banks of Stream 3L east of I-495, and Wetlands 3V, 3T, and 3KKK are adjacent to the stream west of I-495.

The stream is located within a moderately wide valley receiving hydrology from both ground and surface water sources. According to the assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols for low gradient streams, the epifaunal substrate/available cover at Stream 3L is lacking, with less than 15 percent available habitat within the portion of stream in the CSB. Overall, the benthic macroinvertebrate habitat consists of some woody debris and some leaf packs. For fish, available habitat consists of some riffles in the upstream portion of the stream within the CSB and one shallow pool with roots and snags. Riffles are shallow and have little flow diversity, with substrate consisting mostly of gravel and sand with some cobble. Pools are mostly shallow with all mud substrate, no submerged vegetation, and little root mat habitat. However, some leaf packs and woody debris were noted. Roughly 50 percent of the bottom of the streambed is affected by sediment deposition, with slight deposition in pools in the section upstream of I-495 and moderate deposition in pools in the section downstream of I-495. Water filled 50 to 75 percent of the channel during the time of the survey, with 25 to 50 percent of the channel substrate exposed. Some evidence of channel alteration is present, specifically in the section downstream of I-495 where the stream bottom and banks have been stabilized with concrete more than 20 years ago. The channel of Stream 3L is relatively straight. Both banks are stable to moderately stable, with less than 30 percent of both banks showing signs of erosion, and with infrequent, small areas of erosion that are mostly healed over with vegetation. Roughly 70 percent of the streambank surfaces are covered by native vegetation, with roughly one half of the potential plant stubble height remaining due to evident disruption. Although the stream runs parallel to Suitland Parkway on the left bank, both banks have riparian zones of at least 18 meters in width, with minimal to no human activity impacting the riparian zones. Approximately 40 percent of the stream is shaded and is bordered by regenerating woody species, herbs, and young mixed-deciduous forest. There was also evidence of beaver activity. No odor

was present at the time of the survey and no trash was observed in or around the stream, but iron floc was abundant, and the water was cloudy in appearance.

During a qualitative assessment of the aquatic community at Stream 3L, no fish were observed, but aquatic worms (Subclass Oligochaeta), crayfish (Order Decapoda), and scuds (Order Amphipoda) were collected in the stream. Aquatic worms are considered a pollution-tolerant group of organisms, while crayfish and scuds are moderately pollution-sensitive.

Stream 3LLL

Stream 3LLL is a small ephemeral channel that receives drainage from abutting Wetland 3KKK and collects stormwater runoff from Suitland Parkway and I-495, ultimately flowing into Henson Creek. Stream 3LLL is located to the west of I-495 and flows south to north.

The stream is within a flat riparian area receiving hydrology from both ground and surface water sources. Although an assessment of fish and macroinvertebrate habitat using EPA's Rapid Bioassessment Protocols was not conducted, since this is an ephemeral channel, stream characteristics of Stream 3LLL were briefly evaluated. At roughly 1-foot wide and a few inches in depth, Stream 3LLL is lacking habitat for fish and benthic macroinvertebrates. Very little flowing water is present, with substrate consisting of clay and sand. For macroinvertebrates, the only available habitat is dead herbaceous vegetation that has fallen over from the banks and into the channel, as well as a few decaying leaves. With no pools, woody debris, or riffles, there is no fish habitat at Stream 3LLL. Although Stream 3LLL drains the roadway and the channel is straight with no bends, there are no signs of channelization present and the channel seems to have formed naturally. There is a highly eroding head cut at the confluence of Stream 3LLL and Henson Creek, indicating that stormwater runoff flows can be significant. Above the head cut, both banks are stable with little to no erosion or bare soils, with minimal evidence of bank failure. Both streambank surfaces are protected by vegetation, although plant diversity is lacking, and no trees are present. The riparian zone consists of herbaceous vegetative and regenerating woody species and is greater than 18 meters on both banks. There was no odor at Stream 3LLL at the time of the survey, but some iron floc was present. Trash was also present within the channel.

During a qualitative assessment of the aquatic community at Stream 3LLL, no fish or macroinvertebrates were collected.

Stream 3S

Stream 3S is a perennial headwater of Henson Creek located to the west of I-495, flowing northeast to southwest and running parallel to I-495.

The stream is within a moderately wide valley receiving hydrology from both ground and surface water sources. The small portion of Stream 3S located on parkland at the confluence with Stream 3SS within the CSB has been channelized into a 2-foot trapezoidal wetted concrete channel, with no natural habitat features available for fish and macroinvertebrates. Based on the habitat assessment using EPA's Rapid Bioassessment Protocols for low gradient streams, the epifaunal substrate/available cover is unstable and lacking, with less than 10 percent livable habitat at Stream 3S. Although there are no pools present in this portion of Water 3S on NPS property within the CSB, shallow pools are present immediately upstream where the stream is not concrete-lined. Substrate in pools consists of a mixture of materials including gravel and firm sand, and root mats are common. There is moderate sediment deposition at Stream 3S,

with 50 to 80 percent of the stream bottom affected by deposits of new gravel, sand, or fine sediment. Sediment deposits are also present on old and new bars within the stream and along the banks. At roughly 1 to 2 inches deep, the channel is full of fast-moving water, with minimal substrate exposed. Overall, the stream is straight with no bends due to channelization. The concrete channel has greatly altered the natural conditions of Stream 3S by removing instream habitat as well as altering both banks. Because the banks are concrete, they are stabilized and have little potential for future erosional problems, showing no evidence of existing erosion or bank failure. However, the edge of the concrete as its downstream end appears to be deteriorating along the bottom of the stream. Roughly 50 to 70 percent of the surfaces of both banks are covered by vegetation and disruption is apparent, with less than one-half of the potential plant stubble height remaining. Roughly 30 percent of the stream is shaded, and the vegetation that is present consists of regenerating woody species as well as many invasive species. On the left bank, the riparian zone is roughly 6 to 12 meters wide and has been significantly impacted by humans. On the right bank, the riparian zone is 12 to 18 meters wide and human impact has been minimal. There was no odor present at Stream 3S at the time of the survey, but extensive iron floc was observed. Trash was also abundant within and around the channel.

During a qualitative assessment of the aquatic community at Stream 3S, no fish were observed. The only macroinvertebrates observed were midges (Family Chironomidae), which are a pollution-tolerant group of organisms.

DRS, MN, LN
1/11/21

Wetland Function-Value Evaluation Form

Total area of wetland >0.60 Ac Human made? Yes Is wetland part of a wildlife corridor? YES or a "habitat island"? _____

Adjacent land use forest, tow path Distance to nearest roadway or other development 0-150 Ft

Dominant wetland systems present PEM Contiguous undeveloped buffer zone present yes

Is the wetland a separate hydraulic system? no If not, where does the wetland lie in the drainage basin? middle

How many tributaries contribute to the wetland? several * Wildlife & vegetation diversity/abundance (see attached list)

* outside study area

Wetland I.D. 22W - C+O canal

Latitude 38.772411 Longitude -77.178513

Prepared by: MMS Date 10/31/11

Wetland Impact: Type PEM Area >0.60Ac

Evaluation based on: Office _____ Field ✓

Corps manual wetland delineation completed? Y ✓ N _____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		2, 7, 15, 8, 13		
Floodflow Alteration	✓		3, 4, 5, 6, 7, 8, 9, 10, 13, 15	✓	
Fish and Shellfish Habitat		✓	4, 7		
Sediment/Toxicant Retention	✓		1, 2, 3, 4, 5, 8,		
Nutrient Removal	✓		3, 4, 5, 6, 7, 8, 9, 12, 11		
Production Export	✓		1, 2, 4, 7, 5, 8, 9, 12, 14		
Sediment/Shoreline Stabilization		✓	3, 15		
Wildlife Habitat	✓		3, 4, 5, 6, 7, 8, 9, 13, 14, 19, 20, 21,	✓	
Recreation	✓		1, 4, 6, 9, 12		
Educational/Scientific Value		✓	5		
Uniqueness/Heritage	✓		12, 13, 16, 17, 19, 21, 22, 23, 25	✓	C+O canal
Visual Quality/Aesthetics		✓	2, 3, 5, 7, 8, 9, 12		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

DKS, MN, LN 1/11/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.05Ac Human made?_____ Is wetland part of a wildlife corridor? Yes or a "habitat island"?_____

Adjacent land use Forest + Bedrock Distance to nearest roadway or other development 140 ft

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present Yes

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Middle

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 22LL

Latitude 38.970275 Longitude -77.178429

Prepared by: MRN Date 10/31/18

Wetland Impact: Type PFO Area 0.05Ac

Evaluation based on: Office_____ Field ✓

Corps manual wetland delineation completed? Y ✓ N_____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	2, 6, 15		wetland is small, perched pool of water on bedrock island
Floodflow Alteration		✓	3, 5, 6, 8,		
Fish and Shellfish Habitat		✓	1,		
Sediment/Toxicant Retention		✓	3, 4,		
Nutrient Removal		✓	3, 5, 7,		
Production Export		✓	1, 2,		
Sediment/Shoreline Stabilization		✓	5,		
Wildlife Habitat	✓		1, 3, 4, 5, 7, 8, 10, 18	✓	minor function as open water pool on bedrock island during portions of the year; Potential Vernal Pool habitat.
Recreation		✓	1, 5, 7,		
Educational/Scientific Value	✓	✗	2, 4, 5, 6, 11, 13, 16	✓	National Park property. Wetland on Plummers I.S. that has been studied by Washington Biological Field Club 2 times.
Uniqueness/Heritage	✓	✗	10, 11, 12, 16, 17, 19, 22, 25,	✓	
Visual Quality/Aesthetics		✓	2, 5, 6, 7, 8,		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

DRS, MN, LN 1/11/21

Wetland Function-Value Evaluation Form

Total area of wetland >0.5Ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"?

Adjacent land use forest Distance to nearest roadway or other development 50 ft

Dominant wetland systems present PEM/PFO Contiguous undeveloped buffer zone present Yes

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? middle

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 2200

Latitude 38.971063 Longitude -77.180070

Prepared by: MRS Date 10/31/18

Wetland Impact:
Type PFO Area >0.5 Ac

Evaluation based on:
Office ____ Field ✓

Corps manual wetland delineation completed? Y ✓ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	13		
Floodflow Alteration		✓	5,6,9,15		
Fish and Shellfish Habitat		✓	1		
Sediment/Toxicant Retention		✓	4,5,8,		
Nutrient Removal	✓		1,3,5,7,8,9,10,11	✓	Dense vegetation, but watershed is primarily small and forested → low sediment load
Production Export	✓		1,2,4,5,7,8,12, M	✓	
Sediment/Shoreline Stabilization		✓	2,3,		
Wildlife Habitat	✓		3,4,8,13,15,M,21,	✓	
Recreation		✓	1,5,12		
Educational/Scientific Value		✓	5,6,		
Uniqueness/Heritage		✓	16,17,19		
Visual Quality/Aesthetics		✓	4,5,8.		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

DRS, MN, LW 1/11/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.01 Ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"?

Adjacent land use Forest, roadway Distance to nearest roadway or other development 50 ft

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present Yes

Is the wetland a separate hydraulic system? Yes If not, where does the wetland lie in the drainage basin?

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 22PP

Latitude 38.9719 Longitude -77.179505

Prepared by: MRS Date 10/31/18

Wetland Impact:
Type PFO Area 0.01 Ac

Evaluation based on:
Office ____ Field ✓

Corps manual wetland delineation completed? Y ✓ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		0, 4, 5, 13, 15	✓	Water seeping out of slope; no spring may receive GW seepage from highway embankment
Floodflow Alteration		✓	2, 3, 7, 9,		very limited drainage area
Fish and Shellfish Habitat		✓	1		
Sediment/Toxicant Retention		✓	–		
Nutrient Removal		✓	–		
Production Export	✓	✓	1, 4, 5, 10, 12, 13	✓	Deer use area, flowering shrubs attract pollinators
Sediment/Shoreline Stabilization		✓	2, 5,		
Wildlife Habitat		✓	3, 5, 7, 8, 17		Deer tracks/feces
Recreation		✓	1, 4,		
Educational/Scientific Value		✓	10,		
Uniqueness/Heritage		✓			
Visual Quality/Aesthetics		✓			
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland ~0.15ac Human made? N Is wetland part of a wildlife corridor? yes or a "habitat island"? _____

Adjacent land use Forest Distance to nearest roadway or other development ~15'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? yes. If not, where does the wetland lie in the drainage basin? _____

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 22CCC

Latitude 38.972134 Longitude -77.176950

Prepared by: HN, DKS Date 1/11/21

Wetland Impact:
Type PFO Area —

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N _____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	2, 6, 15		Perched hydrology
Floodflow Alteration	✓		2, 3, 5, 6, 9, 18		Isolated system
Fish and Shellfish Habitat		✓	1		
Sediment/Toxicant Retention			3, 4, 7, 9		
Nutrient Removal			3, 5, 7, 8, 9, 10, 11		not likely to be an abundance of excess nutrients in runoff
Production Export	✓		1, 2, 4, 5, 7, 8, 13	✓	Evidence of deer within wetland
Sediment/Shoreline Stabilization		✓	2, 5		
Wildlife Habitat	✓		1, 3, 4, 5, 7, 8, 9, 13, 15, 17	✓	Evidence of wildlife, feces - tracks
Recreation		✓	1, 4, 5, 12		
Educational/Scientific Value		✓	2, 4, 5, 6, 10, 13		
Uniqueness/Heritage	✓		10, 16, 17, 19, 28	✓	Part of Potomac Gorge, along C&O Canal tow path
Visual Quality/Aesthetics		✓	2, 5, 6, 7, 8, 9		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

EXISTING and PROPOSED REACH LEVEL STREAM FUNCTION-BASED RAPID ASSESSMENT FIELD DATA SHEET

Watershed: Potomac River/Rock Run
Stream: 22MM (Trib)
Reach Length:
Photo(s):
Reach ID:

Rater(s): LT/AB/AN
Date: December 3, 2020
Latitude: 38.970705
Longitude: -77.178789

Reach Score/Reach Total Ex. ___/170 Prop.: ___/170 Quality: Ex: ___ Prop:___

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Runoff	**Stream Function Pyramid Level 1 Hydrology**			
	1. Concentrated Flow	No potential for concentrated flow/impairments from adjacent land use	Some potential for concentrated flow/impairments to reach restoration site, however, measures are in place to protect resources	Potential for concentrated flow/impairments to reach restoration site and no treatments are in place
	Existing Condition	10 9 8	7 6 5 4	(3) 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	2. Flashiness	Non-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover less than 6%	Semi-flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover 7 - 15%	Flashy flow regime as a result of rainfall patterns, geology, and soils, impervious cover greater than 15%
	Existing Condition	10 9 8	(7) 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	Stream Function Pyramid Level 1 Hydrology Overall EXISTING Condition	**F (FAR) NF**	**Score:** 10	
	Stream Function Pyramid Level 1 Hydrology Overall PROPOSED Condition	**F FAR NF**	**Score:**	
Floodplain Connectivity (Vertical Stability)	**Stream Function Pyramid Level 2 Hydraulics**			
	3. Bank Height Ratio (BHR)	<1.20	1.21 - 1.50	>1.50
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	4a. Entrenchment (Meandering streams in alluvial valleys or Rosgen C, E, DA Streams)	>2.2	2.1 - 1.4	<1.4
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	4b. Entrenchment (Non meandering streams in colluvial valleys or Rosgen B Streams)	>1.4	1.3 - 1.1	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	5. Floodplain Drainage	no concentrated flow; runoff is primarily sheet flow; hillslopes < 10%; hillslopes >200 ft from stream; ponding or wetland areas and litter or debris jams are well represented	runoff is equally sheet and concentrated flow (minor gully and rill erosion occurring); hillslopes 10 - 40%; hillslopes 50 - 200 ft from stream; ponding or wetland areas and litter or debris jams are minimally represented	concentrated flows present (extensive gully and rill erosion); hillslopes >40%; hillslopes <50 ft from stream; ponding or wetland areas and litter or debris jams are not well represented or absent
	Existing Condition	10 9 8	7 6 (5) 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	6. Vertical Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 (9) 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	Stream Function Pyramid Level 2 Hydraulics Overall EXISTING Condition	**F (FAR) NF**	**Score:** 14	
	Stream Function Pyramid Level 2 Hydraulics Overall PROPOSED Condition	**F FAR NF**	**Score:**	

Reach ID:		Reach Score/Reach Total Ex. ___/170 Prop.: ___/170	Quality: Ex: ___ Prop:____

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning
Stream Function Pyramid Level 3 Geomorphology				
Riparian Vegetation (Score = Average of Left and Right bank, max score of 10)	7. Riparian Vegetation Zone (EPA, 1999, modified)	Riparian zone extends to a width of >100 feet; good vegetation community diversity and density; human activities do not impact zone; invasive species not present or sparse	Riparian zone extends to a width of 25-100 feet; species composition is dominated by 2 or 3 species; human activities greatly impact zone; invasive species well represented and alter the community	Riparian zone extends to a width of <25 feet; little or no riparian vegetation due to human activities; majority of vegetation is invasive
	Left Bank Existing	10 9 8	7 6 5 **4**	3 2 1
	Left Bank Proposed	10 9 8	7 6 5 4	3 2 1
	Right Bank Existing	10 9 8	7 **6** 5 4	3 2 1
	Right Bank Proposed	10 9 8	7 6 5 4	3 2 1
Lateral Stability (Score =Average of Left and right bank, max score of 10)	8. Dominant Bank Erosion Rate Potential	Dominate bank erosion rate potential is low or BEHI/NBS Rating: L/VL, L/L, L/M, L/H, L/VH, M/VL	Dominate bank erosion rate potential is moderate or BEHI/NBS Rating: M/L, M/M, M/H, L/Ex, H/L, M/VH, M/Ex, H/L, H/M, VH/VL, Ex/VL	Dominate bank erosion rate potential is high or BEHI/NBS Rating: H/H, H/Ex, VH/H, Ex/M, Ex/H, Ex/VH, VH/VH, Ex/Ex
	Existing Condition (Right bank)	10 9 **8**	7 6 5 4	3 2 1
	Proposed Condition (Right Bank)	10 9 8	7 6 5 4	3 2 1
	Existing Condition (Left bank)	10 9 **8**	7 6 5 4	3 2 1
	Proposed Condition (Left Bank)	10 9 8	7 6 5 4	3 2 1
	9. Lateral Stability Extent	Stable	Localized Instability	Widespread Instability
	Existing Condition	10 9 8	7 **6** 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
Bedform Diversity (Do not complete if stream is ephemeral)	10. Shelter for Fish and Macroinvertebrates (EPA 1999)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, rubble, gravel, cobble and large rocks, or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	20-70% mix of stable habitat; suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale)	Less than 20% mix of stable habitat; lack of habitat availability less than desirables obvious; substrate unstable or lacking
	Existing Condition	10 9 8	7 6 **5** 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	11a. Pool-to-Pool Spacing Ratio (Watersheds < 10 mi^2)	4.0 - 5.0	3.0 - 4.0 ***or*** 5.0 - 7.0	< 3.0 ***or*** >7.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	11b. Pool-to-Pool Spacing Ratio (Watersheds > 10 mi^2)	5.0 - 7.0	3.5 - 5.0 ***or*** 7.0 - 8.0	<3.5 ***or*** >8.0
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12a. Pool Max Depth Ratio/Depth Variability (Gravel Bed Streams)	>1.5	1.2 - 1.5	<1.2
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1
	12b. Pool Max Depth Ratio/Depth Variability (Sand Bed Streams)	>1.2	1.1 - 1.2	<1.1
	Existing Condition	10 9 8	7 6 5 4	3 2 1
	Proposed Condition	10 9 8	7 6 5 4	3 2 1

Reach ID:		Reach Score/Reach Total Ex. ___/170 Prop.: ___/170	Quality: Ex: ___ Prop:___

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category: Functioning	Functioning-at-Risk	Not Functioning

Bedform Diversity (Do not complete if stream is ephemeral)

Moderate Gradient Perennial Streams in Colluvial Valleys

Measurement Method	Functioning			Functioning-at-Risk				Not Functioning		
11. Pool-to-Pool Spacing Ratio (3-5% Slope)	2.0 - 4.0			4.0 - 6.0				>6.0		
Existing Condition	10	9	8	7	6	5	4	3	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1
12. Pool Max Depth Ratio/Depth Variability	>1.5			1.2 - 1.5				<1.2		
Existing Condition	10	9	8	7	6	5	4	3	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1

Stream Function Pyramid Level 3 Geomorphology Overall EXISTING Condition F (FAR) NF **Score:** 42

Stream Function Pyramid Level 3 Geomorphology Overall PROPOSED Condition F FAR NF **Score:**

Stream Function Pyramid Level 4 Physicochemical

Water Quality and Nutrients (Do not complete if stream is ephemeral)

Measurement Method	Functioning			Functioning-at-Risk				Not Functioning		
13. Water Appearance and Nutrient Enrichment (USDA 1999)	Very clear, or clear but tea-colored; objects visible at depth 3 to 6 ft (less if slightly colored); no oil sheen on surface; no noticeable film on submerged objects or rocks. Clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes; little algal growth present			Frequent cloudiness especially after storm events; objects visible to depth 0.5 to 3.0 ft; may have slight green color; no oil sheen on water surface. Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrate				Very turbid or muddy appearance most of the time; objects visible at depth< 0.5 ft; slow moving water maybe bright green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface; or strong odor of chemicals, oil, sewage, or other pollutants. Pea-green, gray, or brown water along entire reach; dense stands of macrophytes clogging stream; severe algal blooms creating thick algal mats in stream		
Existing Condition	10	9	8	7	6	5	(4)	3	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1
14. Detritus (Petersen, 1992)	Mainly consisting of leaves and wood without sediment covering it			Leaves and wood scarce; fine organic debris without sediment				Fine organic sediment - black in color and foul odor (anaerobic) or detritus absent		
Existing Condition	10	9	8	7	6	5	(4)	3	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1

Stream Function Pyramid Level 4 Physicochemical Overall EXISTING Condition F FAR NF **Score:**

Stream Function Pyramid Level 4 Physicochemical Overall PROPOSED Condition F FAR NF **Score:**

Stream Function Pyramid Level 5 Biology

Biology (Do not complete if stream is ephemeral)

Measurement Method	Functioning			Functioning-at-Risk				Not Functioning		
15. Macroinvertebrate	Abundant			Rare				Not present		
Existing Condition	10	9	8	7	6	5	4	(3)	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1
16. Macroinvertebrate Tolerance	Abundant intolerant species			Limited intolerant species				Only tolerant species		
Existing Condition	10	9	8	7	6	5	4	(3)	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1
17. Fish Presence	Abundant			Rare				Not present		
Existing Condition	10	9	8	7	6	5	4	(3)	2	1
Proposed Condition	10	9	8	7	6	5	4	3	2	1
If existing biology is FAR or NF, provide description of cause(s)	Too large to assess. No pools/riffles. No root mats or woody debris. Scarce vegetation.									

Stream Function Pyramid Level 5 Biology Overall EXISTING Condition F FAR NF **Score:**

Stream Function Pyramid Level 5 Biology Overall PROPOSED Condition F FAR NF **Score:**

Reach ID:		Reach Score/Reach Total Ex. ___/170 Prop.: ___/170	Quality: Ex: ___ Prop:____

Function-based Rapid Reach Level Stream Assessment

Assessment Parameter	Measurement Method	Category		
		Functioning	Functioning-at-Risk	Not Functioning

Bankfull Determination and Rosgen Stream Classification

Rosgen Stream Type (Observation)	B2				
Regional Curve (circle one):	Piedmont	Coastal Plain	Allegheny Plateau/Ridge and Valley	Urban	Karst
DA (sqmi)					
BF Width (ft)			BF Area (sqft)		
BF Depth (ft)			Percent Impervious (%)		

Field Measurements

Parameter	Measurements and Ratios			
Water surface to geomorphic feature elevation difference				
Riffle Mean Depth at Bankfull Stage (dbkf)				
Riffle Width at Bankfull Stage (Wbkf)				
Riffle XS Area at Bankfull Stage (Abkf = dbkf*Wbkf)				
Floodprone Area Width (Wfpa) (Wfpa=Width at elevation determined by 2xDmax)				
Entrenchment Ratio (ER) (ER=Wfpa/Wbkf)				
Low Bank Height (LBH)				
Riffle Maximum Depth at Bankfull Stage (Dmax)				
Bank Height Ratio (BHR) (BHR=LBH/Dmax)				
BEHI/NBS Ratings and Lengths				
Pool to Pool Spacing (P-P)				
Pool to Pool Spacing Ratio (P-P Ratio) (P-P Ratio=P-P/Wbkf)				
Pool Maximum Depth at Bankfull Stage (Dmbkfp)				
Pool Depth Ratio (Dmbkfp Ratio) (Dmbkfp Ratio=Dmbkfp/dbkf)				
Macroinvertebrate Taxa Observed				

1/19/21 NPS Func. Assessment
MN, LE, KS

Wetland Function-Value Evaluation Form

Total area of wetland 4 Ac Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? Yes

Adjacent land use Forest Distance to nearest roadway or other development ~50'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present Yes

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 10P

Latitude 38.990027 Longitude -76.888065

Prepared by: MPS Date 5/29/18

Wetland Impact:
Type PFO Area < 0.1Ac

Evaluation based on:
Office ____ Field ✓

Corps manual wetland delineation completed? Y ✓ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		2,4,5,7,10,13,15,14	✓	Water observed seeping from hillslope
Floodflow Alteration	✓	✓	2,3,4,5,7,13		
Fish and Shellfish Habitat		✓	1,15		
Sediment/Toxicant Retention	✓	✓	1,2,3,4,9,10,13,14	✓	Directly downslope from roadway
Nutrient Removal	✓	✓	3,4,5,7,10,12,14		Vegetation sparse and no long duration water retention
Production Export	✓		1,2,10,11,13		
Sediment/Shoreline Stabilization		✓	2,3,4,5		
Wildlife Habitat		✓	3,6,7,8		
Recreation		✓	1		
Educational/Scientific Value		✓			
Uniqueness/Heritage		✓	17		
Visual Quality/Aesthetics		✓			
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

1/19/24 NRS functions Assessment

MM, LE, KS

Wetland Function-Value Evaluation Form

Total area of wetland 0.1A Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? No

Adjacent land use Roadway Distance to nearest roadway or other development 20'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Upper

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. LOGG

Latitude 38.99476 Longitude -76.87709

Prepared by: SH Date 11/16/18

Wetland Impact:
Type N/A Area N/A

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	Yes	4, 5, 7, 8, 9, 15		
Floodflow Alteration	Yes	2, 3, 4, 5, 6, 7, 8, 9, 10, 13	✓	Wetland can retain hydrology from intermittent channel upslope + overland sheet flow
Fish and Shellfish Habitat	No	1, 17		
Sediment/Toxicant Retention	Yes	1, 2, 5, 7, 9, 10, 11, 13, 15	✓	Sed/tox in roadway runoff, veg + standing water present to trap + retain
Nutrient Removal	Yes	3, 4, 5, 10, 13		potential for some nutrient attenuation - veg. not particularly diverse - wetland remains saturated + ponded water is present
Production Export	No	1, 2		No real signs of export.
Sediment/Shoreline Stabilization	No	3, 4, 14		
Wildlife Habitat	No	7, 8, 11		Within NPS property but disconnected from adj forested hab. due to presence within interchange.
Recreation	No	1		
Educational/Scientific Value	No			
Uniqueness/Heritage	No	1, 5		
Visual Quality/Aesthetics	No			
ES Endangered Species Habitat	No			
Other				

Notes:

* Refer to backup list of numbered considerations.

1/19/24 NPS Functional Assessment
MM LE, KS

Wetland Function-Value Evaluation Form

Total area of wetland 0.1 Ac Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? No

Adjacent land use Roadway Distance to nearest roadway or other development 30'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Middle

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 10FE

Latitude 38.98665 Longitude -76.89141

Prepared by: SH Date 11/16/18

Wetland Impact: Type N/A Area N/A

Evaluation based on: Office ✓ Field ✓

Corps manual wetland delineation completed? Y ___ N ___

Function/Value	Suitability Y / N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	Yes	2,4,5,15		
Floodflow Alteration	Yes	2,3,4,5,6,7,9,15	✓	Holds standing water
Fish and Shellfish Habitat	No	1		
Sediment/Toxicant Retention	Yes	1,2,3,5,7,9	✓	observed suspended sediments in standing water
Nutrient Removal	Yes	2,3,4,5,10		Ponded water
Production Export	No	1,2,11,13		
Sediment/Shoreline Stabilization	No	3		
Wildlife Habitat	No	3,7,8,11		
Recreation	No	1		
Educational/Scientific Value	No			
Uniqueness/Heritage	No	17		
Visual Quality/Aesthetics	No			
ES Endangered Species Habitat	No			
Other				

Notes:

* Refer to backup list of numbered considerations.

MN, LE, SS - 1/13/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.08ac Human made? NO Is wetland part of a wildlife corridor? NO or a "habitat island"? NO

Adjacent land use Forest + roadway Distance to nearest roadway or other development ~50'

Dominant wetland systems present PSS Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? high

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 3KKK

Latitude 38.831043 Longitude -76.874216

Prepared by: MN, SL, SK Date 5/17/2018

Wetland Impact:
Type _____ Area _____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N _____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		2,4,6,13,15	N	
Floodflow Alteration	✓		4,5,6,7,9,13,18	N	
Fish and Shellfish Habitat		✓		N	Not associated w/ intermittent or perennial watercourse.
Sediment/Toxicant Retention	✓		1,2,3,7	N	Not associated w/ intermittent or perennial watercourse
Nutrient Removal	✓		3,4,8,9,10,11	N	Not associated w/ intermittent or perennial watercourse
Production Export	✓		1,2,4,5,7,10,11,13,	Y	
Sediment/Shoreline Stabilization	✓		1,3,9,13,14,15	N	
Wildlife Habitat	✓		3,6,7,8,12,13,17,18,21	N	
Recreation		✓	1,2,4	N	
Educational/Scientific Value		✓	11	N	
Uniqueness/Heritage		✓	1,5,7,13,19,22,14,17	N	Although this wetland has numerous qualities, it is not a unique wetland for this region.
Visual Quality/Aesthetics		✓	2.	N	
ES Endangered Species Habitat		✓		N	
Other					

Notes: Wetland situated on both sides of 3LL. Also abuts 3V and adjacent to 3L.

*Refer to backup list of numbered considerations.

MN, SS, LE 1/13/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.02 ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forest Distance to nearest roadway or other development ~100'

Dominant wetland systems present PEM Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? high

How many tributaries contribute to the wetland? 1* Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 3M

Latitude 38.830782 Longitude -76.872558

Prepared by: HT, EM Date 4/9/18

Wetland Impact:
Type _____ Area _____

Evaluation based on:
Office _____ Field ✓

Corps manual wetland delineation completed? Y ✓ N _____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	2,4,5,7,15	N	
Floodflow Alteration	✓		4,5,6,7,8,9,10,11,13,18	Y	
Fish and Shellfish Habitat		✓	1,4,8,14,15,16,17	N	may only provide fish habitat during flood stage or wet season. Only area with standing water is downstream of wetland.
Sediment/Toxicant Retention	✓		1,2,9,10,13,16	N	
Nutrient Removal	✓		3,4,8,9,10	N	
Production Export	✓		1,2,4,5,7,10,13	N	
Sediment/Shoreline Stabilization	✓		1,3,4,6,9,12,13,15	Y	
Wildlife Habitat	✓		3,5,6,7,8,13,18,21,	N	
Recreation		✓	1,2,4	N	
Educational/Scientific Value		✓	11	N	
Uniqueness/Heritage		✓	1,5,7,13,14,17,19,22	N	Although this wetland has numerous qualities, it is not a unique wetland for this region.
Visual Quality/Aesthetics		✓	2	N	
ES Endangered Species Habitat		✓		N	
Other					

Notes: Wetland bench abutting perennial stream, receives hydrology from stream

* Refer to backup list of numbered considerations.

MN, LE, SS 1/13/21

Wetland Function-Value Evaluation Form

Total area of wetland 1.9ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use forest Distance to nearest roadway or other development ~100'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? high

How many tributaries contribute to the wetland? 2 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 30

Latitude 38.83107 Longitude -76.87200

Prepared by: TTEM Date 4/9/18

Wetland Impact:
Type ____ Area ____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	2,5,7, ~~9~~	N	~~Floodplain wetland begins at terminus of perennial stream~~ Wetland swale w/in impacted area. No evidence of GW R/D.
Floodflow Alteration		✓	~~1~~, 4, 5, ~~8~~, 13, ~~14~~, ~~16~~, ~~18~~ 18	N	~~Wetland begins at terminus of perennial channel~~ Wetland swale w/in impacted area not providing Floodflow alteration, but upslope wetland is.
Fish and Shellfish Habitat		✓	~~3~~, 4, 8, ~~9~~, ~~16~~	N	Watercourse is dammed upstream of wetland, rip-rap prevalent, not much habitat within water course Not provided w/in impact area.
Sediment/Toxicant Retention	✓		1, 2, ~~6~~, ~~7~~, ~~9~~, 10, 11, ~~12~~, 14, 15, 16	~~N~~	~~Retention swale pond and dammed stream upstream of wetland, excessive amount of iron floc present~~ Not a principal function w/in impact area
Nutrient Removal	✓		~~5~~, ~~8~~ 4, 8, 9, 10	N	~~Wetland collects sediment and nutrients from surrounding roads and commercial lots~~
Production Export	✓		1, 2, 4, ~~6~~, 7, 10	N	~~Evidence of deer and other mammals present in wetland~~
Sediment/Shoreline Stabilization		✓	1, ~~3~~, ~~9~~, 15	N	
Wildlife Habitat	✓		~~3~~ 4, 7, 8, 15, 17, 18, ~~19~~, ~~20~~	N	~~Evidence of deer and other mammals~~ present Most of habitat outside of impact area in broader depression
Recreation		✓	1, 2, 4	N	
Educational/Scientific Value		✓	11	N	
Uniqueness/Heritage		✓	1, 5, 7, 13, 14, 17, 19, 22	N	Although this wetland has numerous qualities, it is not a unique wetland for this region.
Visual Quality/Aesthetics		✓	2	N	
ES Endangered Species Habitat		✓		N	
Other					

Notes:

*Refer to backup list of numbered considerations.

MN, LE, S5 - 1/13/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.1ac Human made? No Is wetland part of a wildlife corridor? No or a "habitat island"? Yes

Adjacent land use forest, stream Distance to nearest roadway or other development ~50'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? high

How many tributaries contribute to the wetland? 2 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 3T

Latitude 38.83165 Longitude -76.8733

Prepared by: TT, EM Date 4/9/18

Wetland Impact:
Type _____ Area _____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N _____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		✓	2,4,6,10,	N	Impact area does not appear to show signs of GW/R/D. due to its small size + weak hydrology.
Floodflow Alteration		✓	3,4,5,9,18	N	portion of wetland w/in impact area does not provide floodflow alteration
Fish and Shellfish Habitat		✓	1	N	
Sediment/Toxicant Retention	✓		1,2,7,9,	N	
Nutrient Removal	✓		3,4,8,9	N	
Production Export	✓		1,2,5,7,	N	
Sediment/Shoreline Stabilization	✓		2,3,6,7,12,13,14,15	N	Although multiple qualifiers apply to this wetland, due to its small size and location outside of the active floodplain, S/SS is not a principal function
Wildlife Habitat	✓		3,6,7,8,12,13,17,18,21		
Recreation		✓	1,2,4		
Educational/Scientific Value		✓	11		
Uniqueness/Heritage		✓	1,5,7,13,19,22,14,17		Although this wetland has numerous qualifiers, it is not unique for this region.
Visual Quality/Aesthetics		✓	2		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

MN, LE, SS - 1/13/21

Wetland Function-Value Evaluation Form

Total area of wetland 0.02ac Human made? Yes (ditched from culvert) Is wetland part of a wildlife corridor? No or a "habitat island"? Yes

Adjacent land use Forest, Roadway Distance to nearest roadway or other development ~25'

Dominant wetland systems present PFO Contiguous undeveloped buffer zone present no

Is the wetland a separate hydraulic system? no If not, where does the wetland lie in the drainage basin? high

How many tributaries contribute to the wetland? 0 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. 3V

Latitude 38.87404 Longitude -76.873946

Prepared by: HT, EM Date 4/9/18

Wetland Impact:
Type ____ Area ____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ✓ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		2,4,6,13,15	N	
Floodflow Alteration	✓		4,5,6,7,9,13,18	N	
Fish and Shellfish Habitat		✓	8,14,16,17	N	
Sediment/Toxicant Retention	✓		1,2,3,7,10,13,14,15,16	Y	
Nutrient Removal	✓		3,4,8,9,10,11,12,13,14	Y	
Production Export	✓		1,2,4,5,7,10,11,13	Y	
Sediment/Shoreline Stabilization	✓		1,3,9,13,14,15	N	
Wildlife Habitat	✓		3,6,7,8,12,13,17,18,21	N	
Recreation		✓	1,2,4	N	
Educational/Scientific Value		✓	11	N	
Uniqueness/Heritage		✓	1,5,7,13,19,22,14,17	N	
Visual Quality/Aesthetics		✓	2	N	
ES Endangered Species Habitat		✓		N	
Other					

Notes:

* Refer to backup list of numbered considerations.

RBP ASSESSMENT SUMMARY TABLE

FEATURE ID	CLASSIFICATION	HIGH GRADIENT RBP HABITAT PARAMETERS													TOTAL SCORE
		SUBSTRATE/ AVAILABLE COVER	EMBEDDEDNESS	VELOCITY/ DEPTH REGIME	SEDIMENT DEPOSITION	CHANNEL FLOW STATUS	CHANNEL ALTERATION	FREQUENCY OF RIFFLES (OR BENDS)	BANK STABILITY		VEGETATIVE PROTECTION		RIPARIAN VEGETATIVE ZONE WIDTH		
									LB	RB	LB	RB	LB	RB	
C & O CANAL NPS UNIT															
22M_1	Perennial	12	19	15	20	18	15	18	10	9	3	3	10	10	162
22NN	Intermittent	3	0	3	14	3	16	3	6	6	4	5	6	10	79
22QQ	Intermittent	2	0	2	11	2	14	0	2	2	1	1	10	10	57
GEORGE WASHINGTON PARKWAY NPS UNIT															
22V	Intermittent	2	8	2	13	3	11	1	8	8	3	3	4	5	71
22WW	Intermittent	14	16	10	15	10	20	16	9	8	1	2	10	10	141
NATIONAL CAPITAL PARKS - EAST PARK UNIT - BALTIMORE WASHINGTON PARKWAY															
10F.S1	Intermittent	7	11	8	10	11	13	16	5	5	5	4	9	9	113
10O	Ephemeral	EPHEMERAL, NO RBP ASSESSMENT													
10FF	Intermittent	3	0	2	19	2	14	0	9	9	3	3	10	9	83
10JJ	Intermittent	4	1	4	6	4	8	0	5	5	3	4	4	10	58
10KK	Intermittent	2	2	2	5	3	8	0	6	6	2	2	10	4	52
10MM	Intermittent	2	1	2	2	2	14	0	8	8	6	6	7	10	68
10PP	Intermittent	6	18	8	19	19	6	17	9	9	3	2	3	8	127
10PP_1	Intermittent	13	8	10	19	19	11	19	9	8	3	3	8	5	135
NATIONAL CAPITAL PARKS - EAST PARK UNIT - GREENBELT PARK															
10A	Ephemeral	EPHEMERAL, NO RBP ASSESSMENT													
10AAA	Intermittent	3	15	3	12	7	11	16	2	3	4	5	9	9	99
NATIONAL CAPITAL PARKS - EAST PARK UNIT - SUITLAND PARKWAY															
3LLL	Ephemeral	EPHEMERAL, NO RBP ASSESSMENT													

RBP ASSESSMENT SUMMARY TABLE

FEATURE ID	CLASSIFICATION	LOW GRADIENT RBP HABITAT PARAMETERS													TOTAL SCORE
		SUBSTRATE/ AVAILABLE COVER	POOL SUBSTRATE CHARACTERIZATION	POOL VARIABILITY	SEDIMENT DEPOSITION	CHANNEL FLOW STATUS	CHANNEL ALTERATION	CHANNEL SINUOSITY	BANK STABILITY		VEGETATIVE PROTECTION		RIPARIAN VEGETATIVE ZONE WIDTH		
									LB	RB	LB	RB	LB	RB	
NATIONAL CAPITAL PARKS - EAST PARK UNIT - SUITLAND PARKWAY															
3L	Perennial	6	10	5	14	15	15	2	8	9	8	7	10	10	119
3S.S4	Perennial	2	16	1	8	16	1	1	10	10	4	4	5	8	86

C & O CANAL NPS UNIT

Wetland 22W – PEM

Wetland 22LL – PFO

Wetland 22OO – PFO

Wetland 22PP – PFO

Wetland 22CCC – PFO

Waters 22M_1 – Perennial

Waters 22MM – Perennial

Waters 22MM – Perennial

Waters 22NN – Intermittent

Waters 22NN – Intermittent

Waters 22QQ – Intermittent

Waters 22QQ – Intermittent

GEORGE WASHINGTON PARKWAY NPS UNIT

Waters 22V – Intermittent

Waters 22V – Intermittent

Waters 22WW – Intermittent

Waters 22WW – Intermittent

NACE - BALTIMORE WASHINGTON PARKWAY

Wetland 10P – PFO

Wetland 10GG – PFO

Waters 10F – Intermittent

Waters 10F – Intermittent

Waters 10O – Ephemeral

Waters 10O – Ephemeral

Waters 10FF – Intermittent

Waters 10FF – Intermittent

Waters 10JJ – Intermittent

Waters 10KK – Intermittent

Waters 10KK – Intermittent

Waters 10MM – Intermittent

Waters 10MM – Intermittent

Waters 10PP – Intermittent

Waters 10PP_1 – Intermittent

NACE - GREENBELT PARK

Wetland 10EE – PFO

Waters 10A – Ephemeral

Waters 10A – Ephemeral

Waters 10AAA – Intermittent

Waters 10AAA – Intermittent

NACE - SUITLAND PARKWAY

Wetland 3KKK – PSS

Wetland 3M – PEM

Wetland 3O – PFO

Wetland 3T – PFO

Wetland 3V – PFO

Waters 3L – Perennial

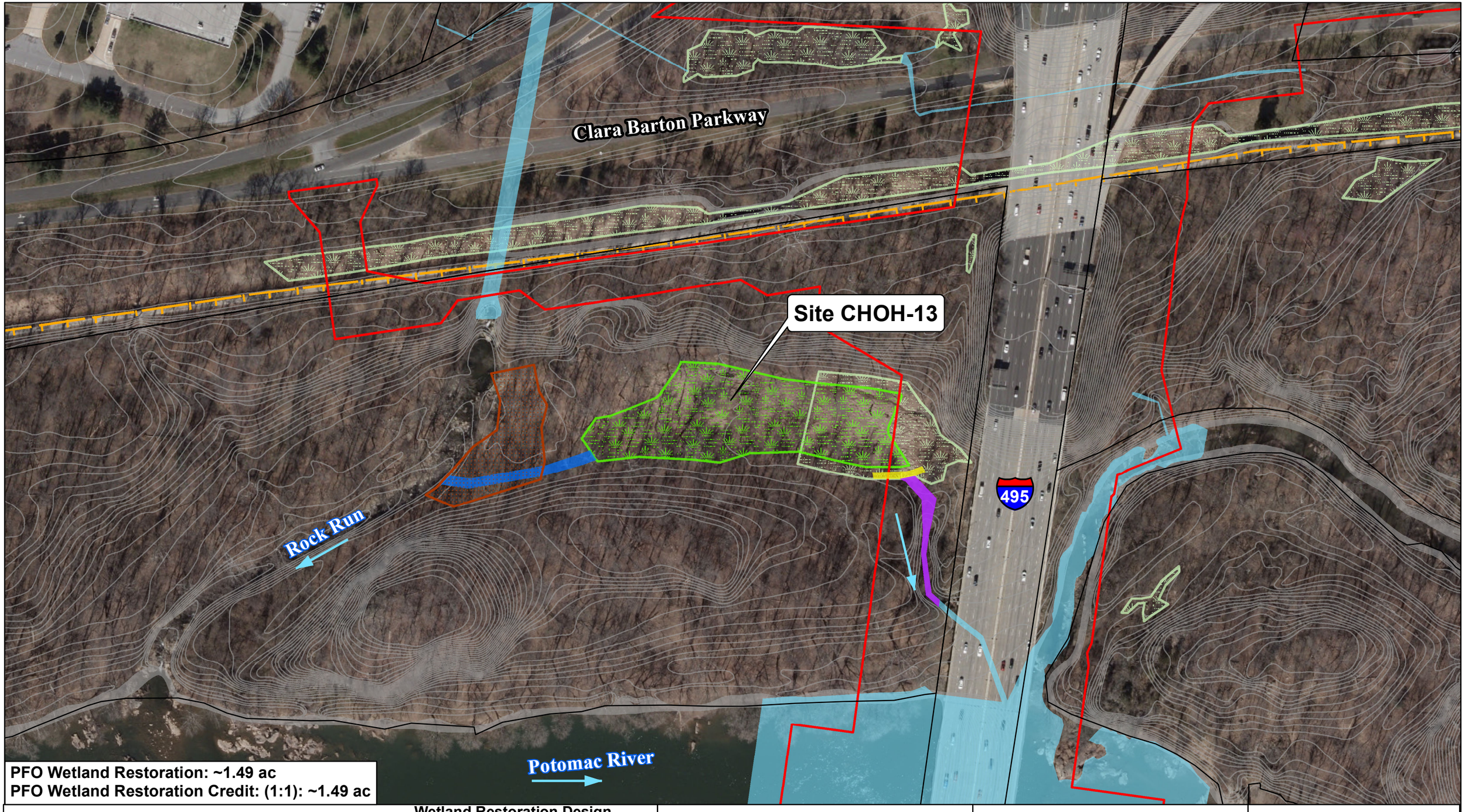
Waters 3L – Perennial

Waters 3LLL – Ephemeral

Waters 3LLL – Ephemeral

Waters 3S – Perennial

ATTACHMENT C: CHOH 13 CONCEPT PLAN



Wetland Restoration Design

- Parcel Boundaries
- Phase 1 South LOD
- 100 Year FEMA Floodplain
- 2' Contours
- Delineated Streams
- Delineated Wetlands
- Sub-Surface Bedrock
- PFO Wetland Restoration
- Channel Fill
- Groundwater Dam & Micro-berm
- Outlet Channel

N W E S

0 75 150 225 300 Feet

1 inch = 150 feet

I-495 & I-270 Managed Lanes Study
NPS Wetland Mitigation
Concept Design Plan
Site CHOH-13

495 270 MANAGED LANES STUDY