



RIVERRENEW

AN INFRASTRUCTURE INITIATIVE TO REMEDIATE ALEXANDRIA'S COMBINED SEWER SYSTEM



ENVIRONMENTAL ASSESSMENT
JUNE 2019

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Project Summary

Alexandria Renew Enterprises (AlexRenew), with support from the City of Alexandria is proposing to implement RiverRenew (proposed action). RiverRenew is a major infrastructure project designed to substantially reduce discharges of sewage mixed with rainwater from Alexandria, Virginia's combined sewer system to the Potomac River, Hooffs Run, and Hunting Creek. The project is needed to reduce combined sewer overflows (CSOs) that contribute to water quality impairment of the surrounding water bodies and ultimately the Chesapeake Bay; and to comply with the Commonwealth of Virginia's 2017 Legislation which requires that Alexandria's existing combined sewer outfalls be brought into compliance with Virginia law by July 1, 2025. Portions of the study area fall within Jones Point Park, George Washington Memorial Parkway and the bed of the Potomac River, which are administrative units of the National Park Service (NPS). AlexRenew, in cooperation with the NPS, has prepared this Environmental Assessment (EA) to describe the RiverRenew project (the proposed action) and the no-action alternative, and analyze the environmental consequences of implementing the alternatives on water quality, riverine wetlands, visitor/community use and experience, historic structures and districts, archeological resources, cultural landscapes, and human health and safety.

The proposed action involves the implementation of RiverRenew and supporting infrastructure to provide control for the four existing outfalls located within the City of Alexandria (Outfalls 001-004) that discharge a mixture of untreated sewage mixed with rainwater to the Potomac River (Outfall 001), Hunting Creek (Outfall 002), or Hooffs Run (Outfalls 003 and 004). The proposed controls are estimated to capture 98% of combined sewer flows and limit discharges to 4-6 times per year, based on the average climate period of 2000-2016. The project would include construction of diversion facilities to redirect flows from the existing combined sewer system into a tunnel or diversion sewer when the capacity of the existing sewer system is exceeded during storms. Once diverted to the tunnel or diversion sewer, excess flows would be conveyed by gravity to the AlexRenew Water Resource Recovery Facility (WRRF) to be treated before being discharged to Hunting Creek. Other supporting infrastructure, including an overflow structure, mining shaft and tunnel dewatering pump station would also be constructed.

Under the no-action alternative, AlexRenew would continue to operate and maintain the existing combined sewer system that discharges to the Potomac River (Outfall 001), Hunting Creek (Outfall 002), and Hooffs Run (Outfalls 003 and 004). Discharges of combined sewage would continue to occur at current levels resulting in a total discharge of approximately 140 million gallons into the local water bodies based on the average climate period of 2000-2016. The no-action alternative would result in failure to comply with the Commonwealth of Virginia's 2017 Law and AlexRenew's Virginia Pollutant Discharge Elimination System (VPDES) Permit.

This EA has been prepared to assess alternatives and their potential impacts on the environment in accordance with the National Environmental Policy Act of 1969 (NEPA); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508); NPS Director's Order #12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making* (NPS. 2011); and the NPS NEPA Handbook (NPS. 2015a.). Section 106 of the National Historic Preservation Act is a separate, but parallel, process with NEPA. An Assessment of Effects (AOE) by the NPS is ongoing at the time of this EA, as it relates to its federal action for the proposed undertaking within NPS lands.

Note to reviewers and respondents: If you wish to comment on the EA, you may submit comments electronically at the NPS Planning, Environment and Public Comment (PEPC) website at <https://parkplanning.nps.gov/alexrenew> or you may mail written comments by July 19, 2019.

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Before including personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Chapter 1. Purpose and Need

Purpose and Need of Action

Alexandria Renew Enterprises (AlexRenew), with support from the City of Alexandria is proposing to implement RiverRenew (proposed action). RiverRenew is a major infrastructure project designed to substantially reduce discharges of sewage mixed with rainwater from Alexandria, Virginia's combined sewer system to the Potomac River, Hooffs Run, and Hunting Creek. A portion of the study area, as shown in **Figure 1-1**, falls within Jones Point Park, George Washington Memorial Parkway and the bed of the Potomac River, which are administrative units of the National Park Service (NPS). Since portions of RiverRenew would be located within NPS property, AlexRenew must obtain Construction Right-of-Way and Special Use Permits for construction and operation of the structures required to comply with the 2017 Virginia Law¹. Therefore, AlexRenew, in cooperation with the NPS, has prepared this Environmental Assessment (EA) to assess alternatives and their potential impacts on the environment in accordance with the National Environmental Policy Act of 1969 (NEPA); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508); NPS Director's Order #12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making* (NPS. 2011); and the NPS NEPA Handbook (NPS. 2015a). Section 106 of the National Historic Preservation Act (Section 106) is a separate, but parallel, process with NEPA. An Assessment of Effects (AOE) by the NPS is ongoing at the time of this EA, as it relates to its federal action for the proposed undertaking within NPS lands.

On average, approximately 140 million gallons of combined sewage are discharged to Alexandria's waterways each year. These overflows, a mixture of untreated sewage and rainwater, impair water quality by increasing bacteria levels which contributes to low dissolved oxygen levels. Low dissolved oxygen levels adversely affect aquatic life and can increase the potential for fish stress or fish kills. Combined sewer discharges also pose health risks to the general public associated with exposure to untreated sewage and by littering our waterways and shorelines with trash, floatable matter and sediment. RiverRenew is needed to comply with the Commonwealth of Virginia's 2017 Legislation which requires that Alexandria's four existing combined sewer outfalls be brought into compliance with Virginia law by July 1, 2025.

AlexRenew and the City of Alexandria have jointly authored a Long Term Control Plan Update (LTCPU) which recommends control strategies to meet the legislative requirements established by the Virginia Department of Environmental Quality's (VDEQ) Bacteria Total Maximum Daily Loads (TMDL) for Hunting Creek and Hooffs Run, and the U.S. Environmental Protection Agency's (USEPA) Presumption Approach for combined sewer discharges to the Potomac River. In addition to combined sewer control strategies, the LTCPU also recommends an approach to eliminate sanitary sewer overflows (SSOs) and mitigate sewer flooding and basement backups along two main interceptors in the City of Alexandria as required by AlexRenew's Virginia Pollutant Discharge Elimination System (VPDES) Permit and Bacteria TMDLs for the Hunting Creek, Cameron Run, and Holmes Run Watersheds.

RiverRenew would include a combination of surface facilities, deep shafts, tunnels, diversion sewers and treatment facility upgrades to store, pump and treat flows from Outfalls 001-004 along two separate areas; one to capture both Outfalls 001 and 002 along the Potomac River and Hunting Creek, and the other to capture Outfalls 003 and 004 along Hooffs Run. The tunnel system would capture and redirect combined sewer discharges from the existing combined sewer system to a new storage and conveyance tunnel system when the capacity of the existing sewer system is exceeded during rain

¹ This legislation requires that Alexandria's four existing combined sewer outfalls be brought into compliance with Virginia law by July 1, 2025.

events. Captured combined sewer flows would be conveyed by gravity to the AlexRenew Water Resource Recovery Facility (WRRF) for treatment prior to discharge. Other infrastructure, including upgrades to the WRRF, wet weather treatment facility, pumping stations, ventilation control facilities, and residuals management systems would also be constructed in support of RiverRenew.

As illustrated in **Figure 1-1**, the RiverRenew study area is generally divided into two main areas based on the potential alignments of the tunnels. The study area for the Outfall 001/2 system is generally bounded to the east by a line approximately 100 feet east of the Commonwealth of Virginia border, to the west by South Royal Street, to the north by Oronoco Bay, and to the south by Interstate 95/495. The study area for the Outfall 003/4 system is generally bounded to the east by Payne Street, to the west by Hooffs Run Drive, to the north by Prince Street, and to the south by Interstate 95/495. The overall study area falls within the Waterfront, Old Town, and Southwest Quadrant neighborhoods of Alexandria.



Figure 1-1. RiverRenew Study Area

History of RiverRenew

Like many older cities in the United States, Alexandria, VA is served by two types of sewer systems, a separate sewer system and a combined sewer system. In separate systems, there are separate pipes for sewage and stormwater. In a combined sewer system, a single pipe carries both sewage and stormwater. Modern practice is to build separate sewers for sewage and stormwater. Alexandria's overall sewer system covers approximately 15.4 square miles, of which less than 6% (540 acres) is served by a combined sewer system, primarily in the Old Town neighborhood. Alexandria's combined sewer system was built in the late 1800s through the early 1900s. The two types of sewer systems and AlexRenew's service areas are depicted in **Figure 1-2**.

During dry weather and most rainfall conditions, the combined sewer system conveys sewage to the WRRF for treatment and discharge. During intense wet weather events, the capacity of the combined sewer system may be exceeded which results in discharges to Alexandria's waterways via four permitted outfalls. These outfalls, depicted in **Figure 1-1**, are operated in accordance with a discharge permit issued by VDEQ – VPDES Permit No. VA0087068.



Figure 1-2. Separate (left) and combined sewer (right) systems schematic

AlexRenew is a political subdivision of the Commonwealth of Virginia that was created in 1952 under the Virginia Water and Wastes Authority Act. AlexRenew owns and operates a WRRF that provides sanitary and combined sewage treatment services to the City of Alexandria and sanitary sewer treatment services to Fairfax County. **Figure 1-3** shows the overall service area. AlexRenew has a service agreement with Arlington County for conveyance and treatment of City flows from the service area in the northwest quadrant of the City to the Arlington Water Pollution Control Plant, as shown labeled in **Figure 1-3** as "To Arlington."

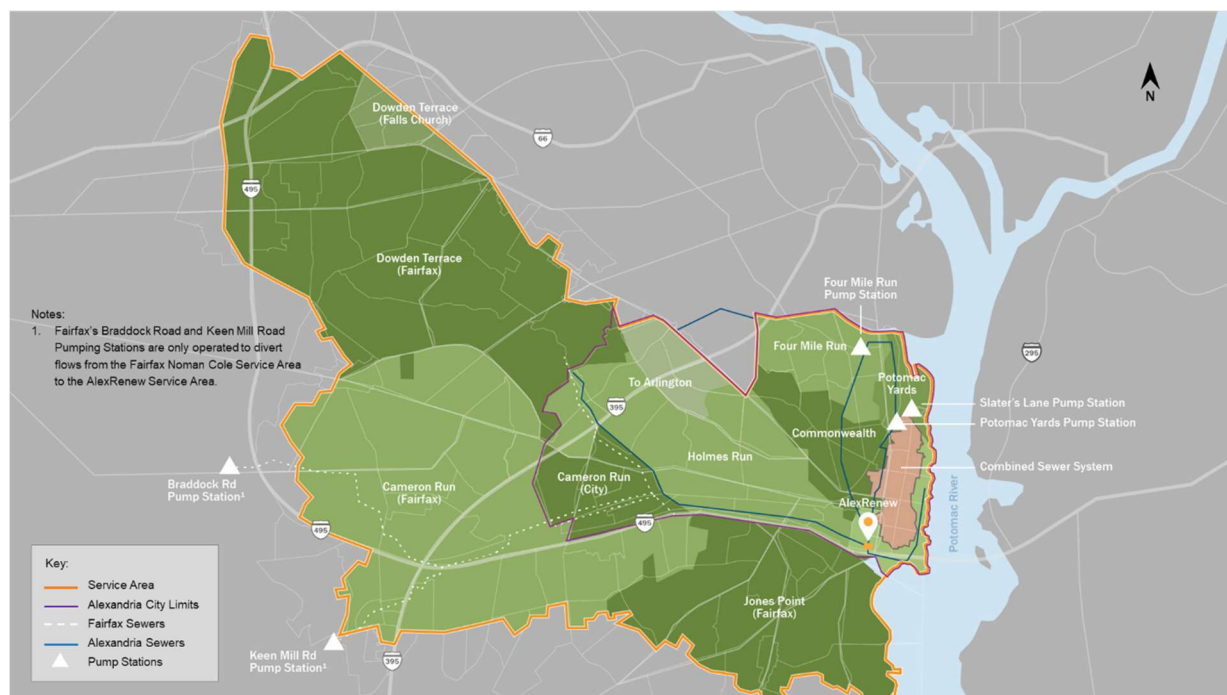


Figure 1-3. AlexRenew Service Areas

In 1999, the City of Alexandria developed a Long Term Control Plan (LTCP) consistent with the guidance provided in the USEPA Combined Sewer Overflow Control Policy. In 2010, VDEQ issued bacteria TMDL requirements for the Hunting Creek, Cameron Run, and Holmes Run Watersheds. The TMDL assigns bacteria loads, known as Waste Load Allocations (WLA), to all the sources introducing bacteria to Hunting Creek. The WLAs in the TMDL require increased reductions in bacteria from the combined sewer outfalls than called for in the previously approved LTCP. In addition, the TMDL requires significant bacteria reductions from other sources, including stormwater, septic, and wildlife to meet water quality standards. Among the four outfalls within the City of Alexandria, the Hunting Creek TMDL applies to Outfalls 002, 003, and 004. It should be noted that Outfall 001 is not included in the Hunting Creek TMDL because it discharges to Oronoco Bay, which is not part of the Hunting Creek watershed.

In order to maintain compliance with the VPDES discharge permit and meet the 2010 Hunting Creek TMDL bacteria reductions, the City of Alexandria submitted a LTCPU to VDEQ in August 2016. In April 2017, Virginia enacted a new law that resulted in a requirement to bring the outfalls located within the City of Alexandria into compliance by July 1, 2025 and required mitigation of discharges at Outfall 001.

A revised LTCPU, jointly prepared by AlexRenew and the City of Alexandria, was submitted to VDEQ in May 2018 and sets forth a publicly vetted alternative consisting of the following major elements:

- The expansion of the AlexRenew WRRF's primary treatment system from 108-116 million gallons per day (MGD);
- A tunnel system to provide for storage and conveyance of wet weather flows. One tunnel serving Outfalls 001/002 and the other serving Outfalls 003/004; and
- A 40 MGD wet weather treatment facility to provide primary treatment and disinfection of wet weather flows.

On June 29, 2018 VDEQ issued a letter approving the plan outlined in the 2018 LTCPU noting that the expected performance levels of the proposed controls will bring the outfalls into compliance with the

2017 Virginia Law. VDEQ also granted the City's request to transfer the ownership of the City's four combined sewer outfalls and accompanying VPDES permit (No. VA0087068) to AlexRenew. AlexRenew will lead the planning, design, and implementation of the approved LTCPU plan, now branded RiverRenew.

Scoping and Identifying Issues

The NPS and AlexRenew conducted a scoping meeting on September 25, 2018 to determine which issues and associated impact topics warranted further consideration. The scoping meeting was open to federal, state and local agencies, as well as non-governmental organizations, community associations and stakeholder groups, including the general public. Additional community outreach sessions were conducted with the general public prior to the scoping meeting and a full list of community and government meetings are included within **Appendix F**. The issues that warranted further consideration have been retained for detailed analysis within this EA. The issues that have been dismissed from further analysis are included within **Appendix A**.

Issues and Impact Topics Retained for Detailed Analysis

Issue: Implementation of RiverRenew would improve water quality by reducing combined sewer discharges. Under the no-action alternative, discharges of combined sewage would continue to degrade water quality in the Potomac River, Hunting Creek, and Hooffs Run by polluting these waterways with bacteria, nutrients, and other pollutants. However, improvements to water quality would occur from implementation of the proposed action through the capture and treatment of combined sewer discharges. These issues are analyzed in **Chapter 3** of this EA.

Issue: The proposed action could detract from visitor use and experience to Jones Point Park during construction and after supporting tunnel infrastructure has been installed. Construction of the Outfall 002 facilities and supporting infrastructure could disrupt Jones Point Park visitors use and detract from the visitor experience by temporarily eliminating the ability for park visitors to use certain areas of the park, and by temporarily obstructing scenic or historic views. Once construction is complete, permanent tunnel system structures would remain at or below grade. Additionally, an above-ground electrical cabinet would be necessary to support the ventilation control vault. These structures could potentially result in the loss of open space or the occasional disruption from routine maintenance activities. Construction fencing, vehicular congestion, and construction noise and construction light could impact the quality of life for the users of adjacent land-use facilities. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction could result in temporary disruptions to vehicle, bicycle, and pedestrian traffic. Temporary road and sidewalk closures, lane restrictions, and other disruptions to vehicle, bicycle, and pedestrian traffic would be necessary to construct the proposed facilities and supporting infrastructure. Construction may also result in increased vehicle congestion along designated haul routes or around construction areas. After the tunnel system is operational, occasional maintenance may require temporary traffic control measures to access supporting tunnel infrastructure. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction could disturb soils and temporarily contribute to water quality degradation. The construction of the tunnel system and supporting infrastructure could result in temporary erosive conditions that may deposit sediment into the local waterways. Ground disturbance would be required to construct the diversion facilities, sewers and pumping stations. These construction-related ground disturbances could result in erosion and the transport of sediment-laden water into the Potomac River, Hunting Creek, and Hooffs Run during storms that could temporarily degrade water quality. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction could result in disturbances to the Potomac River and Hooffs Run. Construction of the facilities and supporting infrastructure at Outfall 001, would result in disturbances in and along the west bank of the Potomac River, resulting in sediment entering the water column and being transported downstream. In addition, construction of the facilities associated with Outfalls 003/4 would result in disturbances along a portion of Hooffs Run. Construction-related disturbances within these areas could result in a loss of wetlands or other waters of the US and affect wetland functions, potentially requiring mitigation. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction could disturb known archeological resources and other areas of high archeological potential. Construction of the facilities at Outfall 001 may result in the disturbances to known archeological resources along the waterfront, while work at Outfall 002 has the potential to disturb resources in and along Jones Point Park. Construction of Outfall 003/4 facilities could result in disturbances in and along Hooffs Run, the Alexandria National Cemetery, Presbyterian Cemetery, Bethel Cemetery, and the African American Heritage Memorial Park. Construction related activities within these areas could result in disturbance to archeological resources. Subsurface excavation at these locations could potentially require the relocation of and reburial of human skeletal remains. Preliminary archeological investigations conducted in the proposed work area have determined a need for more detailed evaluations. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction could take place in proximity to historic structures that are listed, and others that are eligible for listing in the National Register of Historic Places and may add or modify elements within cultural landscapes. The tunnel system and supporting infrastructure would be constructed near historic structures that are listed, and others that could be eligible or potentially eligible for listing, in the National Register of Historic Places (NRHP). New non-contributing elements may be added within historic districts and cultural landscapes. Vibrations and ground movement caused by the tunnel construction and/or from construction of the surface facilities could also affect the integrity of historic structures. These issues are analyzed in **Chapter 3** of this EA.

Issue: Temporary noise could be generated at construction sites. Tunnel and shaft construction involve noise generating activities that can contribute to noise pollution that affects the quality of life for adjacent land uses. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction related activities may extend into evening and weekend hours. Construction activities may take place outside of typical municipal work hours. In this case, temporary lighting could be erected to illuminate the work sites, contributing to nighttime light pollution. All construction activities outside of the typical municipal work schedule would require authorization from the City of Alexandria per Chapter 5 of Title 11 of the City Code of Ordinances. These issues are analyzed in **Chapter 3** of this EA.

Issue: Construction activities could occur in areas with impacted soil and groundwater. Construction of the Outfall 001 Diversion Facility (all options) would be located in close proximity to a site with known contamination and may result in the excavation of contaminated soil and pumping of contaminated groundwater. This creates the potential for moving existing contaminants to areas that may have otherwise been uncontaminated. These issues are analyzed in **Chapter 3** of this EA.

Chapter 2. Alternatives

AlexRenew evaluated several different strategies to control the discharge of combined sewage to Alexandria, Virginia's waterways as part of its LTCPU. Ultimately, a tunnel system was approved by the VDEQ in June 2018. The tunnel system was subsequently branded as RiverRenew. The alternatives evaluated for this EA represent a continued refinement of RiverRenew and include: Alternative A, the no-action alternative; and Alternative B, the proposed action, intended to comply with the Commonwealth of Virginia's 2017 Law¹ and AlexRenew's VPDES Permit², which require the control of combined sewer discharges to Alexandria, Virginia's waterways.

The description of the proposed action (Alternative B) is separated by system components, which include the Outfall 001/2 System, Tunnel Dewatering Pumping Station, Outfall 003/4 System, and Wet Weather Treatment Facility. **Table 2-1** identifies the components and associated options for each work area that were identified for detailed evaluation. Note that the Outfall 001/2 System is the only component of RiverRenew that would directly impact NPS administrative units.

Table 2-1: RiverRenew System Components, Elements, and Options

Component	Element	Options
Outfall 001/2 System	Tunnel	6 Alignments
	Outfall 001 Diversion Facility	4 Locations
	Outfall 002 Diversion Facility	3 Locations
Tunnel Dewatering Pumping Station	Mining Shaft, Tunnel Dewatering Pumping Station, and Superstructure	1 Location
Outfall 003/4 System	Outfalls 003/4 Diversion Facility, Diversion Sewer or Tunnel, and Wet Weather Pumping Station	3 Alignments and Construction Methods
Wet Weather Treatment Facility	Wet Weather Treatment Facility	1 Location

Alternative A – No Action Alternative

Alternative A, the no-action alternative, represents continued operation and maintenance of the existing combined sewer system that discharges to the Potomac River (Outfall 001), Hunting Creek (Outfall 002), and Hooffs Run (Outfalls 003 and 004). Each of the four combined sewer outfalls, depicted on **Figure 1-1**, is controlled by a regulator structure that diverts dry weather flows to interceptor sewers for conveyance to the WRRF. During rain events that exceed the capacities of the downstream facilities, these structures allow combined sewer flows to be released directly to a waterbody, which contributes to pollution of the rivers and streams. **Table 2-2** provides the annual average overflow volume and events based on the climate period of 2000-2016.

Table 2-2: Average Overflow Events and Volume Per Year (2000-2016)

Outfall	Annual Average Overflow Events	Annual Average Overflow Volume (MG)
001	37	63
002	46	38
003	70	31
004	45	12

¹ Legislation requiring Alexandria's four existing combined sewer outfalls comply with Virginia law by July 1, 2025.

² VPDES Permit No. VA0087068, reissued August 29, 2018.

Under the no-action alternative, discharges of combined sewage would continue to occur at currently levels, resulting in failure to comply with the Commonwealth of Virginia's 2017 Law and AlexRenew's VPDES Permit. Therefore, Alternative A does not satisfy the purpose and need for RiverRenew.

Alternative B – Construct RiverRenew to Comply with 2017 Virginia Law

Alternative B, the proposed action, would involve the construction of a tunnel system and supporting infrastructure to provide control for the four existing combined sewer outfalls in Alexandria (Outfalls 001-004). It is anticipated that the proposed action would capture approximately 98% of combined sewer flows and limit discharges to 4-6 times per year, based on the average climate period of 2000-2016. The captured combined sewer flows would be conveyed to the WRRF for treatment. The proposed action would comply with the Commonwealth of Virginia's 2017 law and AlexRenew's VPDES Permit.

The study area for the proposed action, depicted on **Figure 1-1**, encompasses all possible locations for proposed RiverRenew system components. Surface disturbances outside of the AlexRenew WRRF would mainly be attributed to the construction of diversion facilities. Diversion facilities would be designed to divert flow from the existing combined sewer system to the tunnel during rain events. These facilities have been proposed to be located near the existing combined sewer outfalls to minimize disturbance within the community. A typical diversion facility includes a diversion chamber, approach channel, ventilation control vault, and drop shaft as illustrated in **Figure 2-1**.

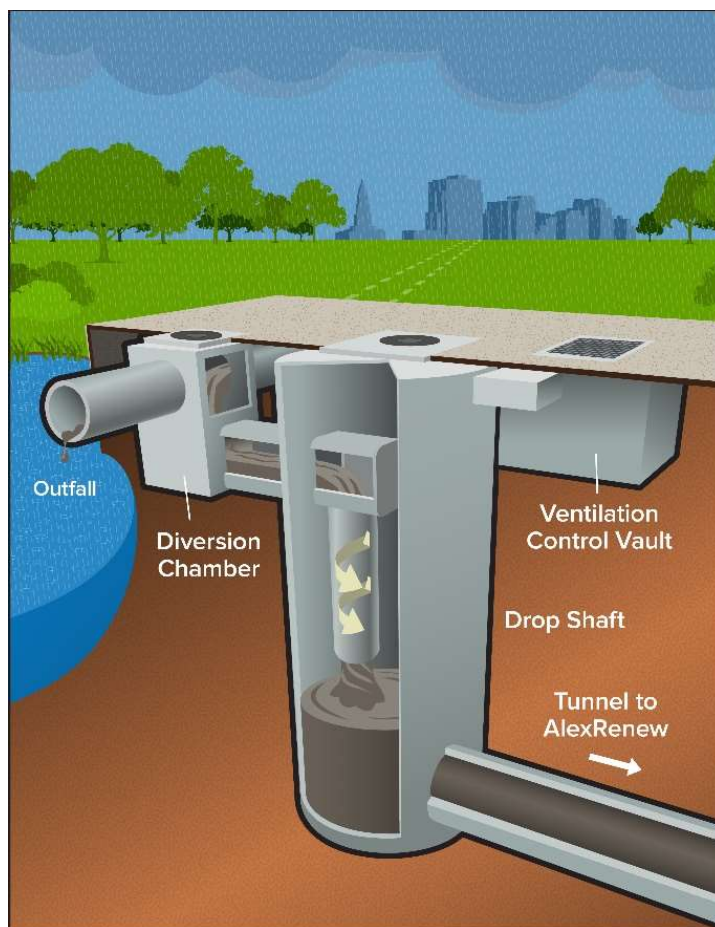


Figure 2-1. Typical Diversion Facility

In the preparation of this EA, the proposed system components have been developed to a conceptual level. Figures provided for each option are intended to represent the general construction scope and limits. Layouts and construction staging areas are based on best available data, but subject to change due to further design refinement, collection of additional site data (e.g. geotechnical borings), and/or coordination with third parties during the negotiation of permits, easements, and agreements. Detailed layouts and construction staging areas would be determined and refined in a subsequent final design phase.

The system component options outlined in **Table 2-1** that were selected for analysis are described in further detail below. Design options considered but dismissed from further consideration are addressed at the end of the chapter.

To advance the concepts defined in the LTPCU to the EA, the following guidelines were considered:

- Locate proposed system components within public land and rights-of-way whenever practicable.
- Minimize potential impacts to the environment, community, and existing structures.
- Ensure proposed system components are constructible and have sufficient construction staging areas.

Outfall 001/2 System

Outfall 001/2 Tunnel Alignment Options

A 12-foot inside diameter (with a maximum outside diameter of 19-feet) tunnel is proposed to provide the primary means of storage and conveyance of captured combined sewage from Outfalls 001 and 002. The proposed tunnel would be located approximately 100-feet to 140-feet below the ground surface and would be constructed using a tunnel boring machine (TBM) in the Potomac formation, which consists primarily of stiff clay that is favorable for tunneling. The TBM is designed to equalize ground pressure while excavating and constructing a permanent concrete tunnel lining. A rotating cutterhead at the front of the TBM would excavate soil as hydraulic cylinders push the machine forward. Openings in the cutterhead would control the rate of excavated material that would be conveyed to the surface for disposal.

Utilizing a TBM to construct the tunnel would minimize surface disruption between the WRRF and the diversion facilities located at Outfalls 001 and 002. It is anticipated that temporary surface disturbances along the tunnel alignment would be limited to installation of wells, ground monitoring arrays, seismographs, and other nonintrusive instrumentation to monitor the tunneling operations. Short-term access may be required at certain points along the alignment to perform ground improvement such as jet grouting, dewatering, or ground freezing to facilitate mining operations or maintenance and/or repair of the TBM.

Potential Outfall 001/2 tunnel alignments are illustrated in **Figure 2-2**. These alignments follow one of two east-west corridors and one of three north-south corridors. The east-west and north-south combinations result in six potential tunnel alignments. The options are labeled in accordance with the section of public right-of-way the tunnels are aligned in: Green Street, Church Street, Lee Street, Union Street, and the Potomac River. Tunnel lengths associated with the proposed options range from 10,100 to 11,500 feet.

Avoiding structures directly above the tunnel, and proximity to historic structures are major factors when evaluating tunnel alignments and diversion facility locations. Alignment evaluation must consider what structures could be affected by ground movements associated with tunnel and diversion

facility construction. Based on empirical methods and recent tunneling projects in similar geology, surface settlements induced by tunneling are expected to be fractions of an inch over the tunnel crown, and approach zero at a lateral distance of approximately 100 feet from the tunnel centerline. Therefore, for planning purposes, a 200-foot wide buffer centered on the tunnel is considered reasonable for identifying structures and utilities that could potentially be impacted by construction.

A significant proportion of the structures located in the vicinity of the proposed 001/2 Tunnel System alignments are historic masonry buildings, which typically have a lower capacity to resist stress and settlement than modern steel or wooden frames structures. A monitoring program would be implemented by the contractor to manage protection of structures risks. **Figure 2-2** depicts the boundary of Alexandria's Old Town Historic District where many masonry buildings are located.

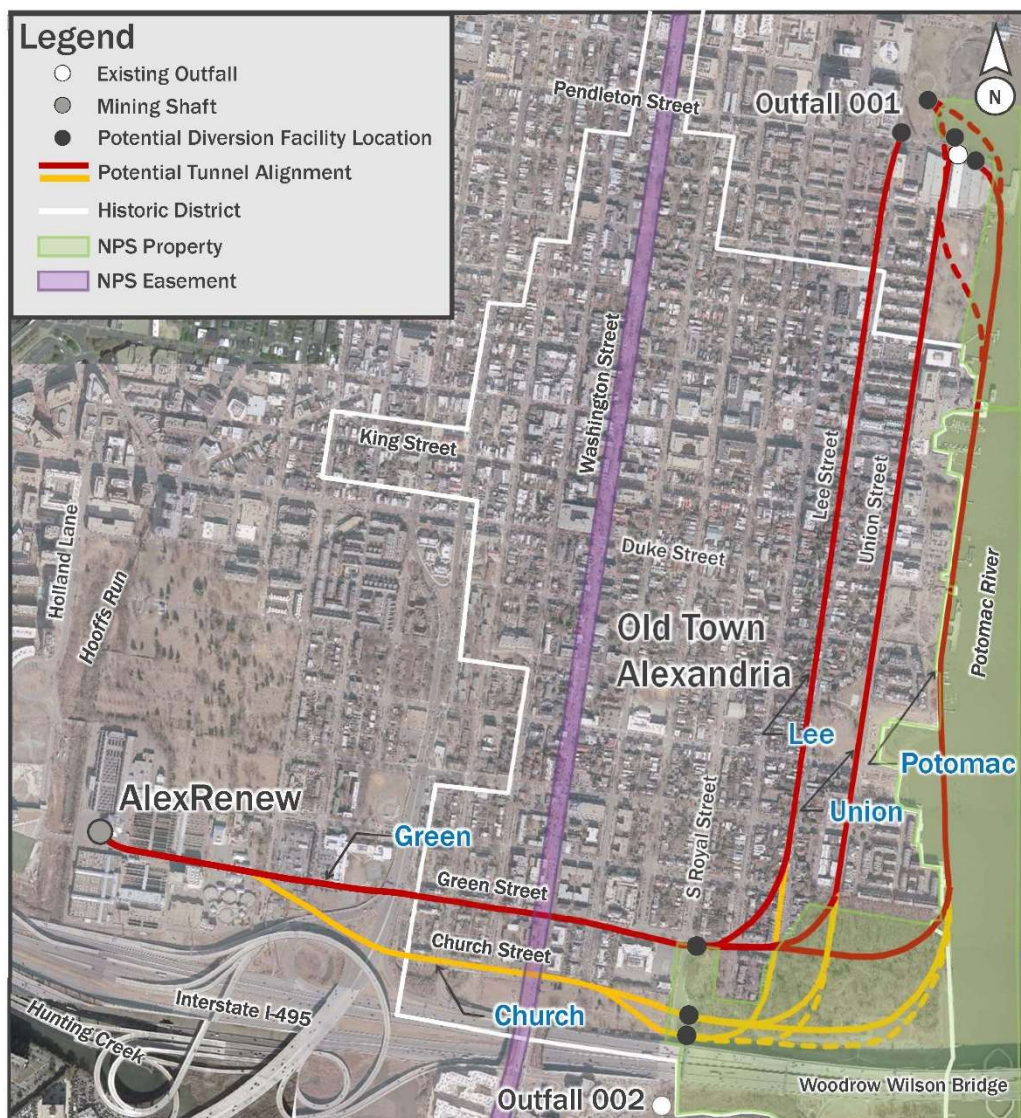


Figure 2-2. Outfall 001/2 Tunnel System Alignments

The total number of buildings and historic buildings³ within the buffer area for each tunnel alignment is summarized in **Table 2-3**. In general, the number of structures within the buffer area increases as the alignment moves westward of the Potomac River and northward of Church Street. The Potomac alignments generally carry significantly less risk to impacting existing structures.

Table 2-3: Tunnel Alignment Considerations

001/2 Tunnel Alignment	# of Historic Buildings in Tunnel Buffer Area	# of Total Buildings in Tunnel Buffer Area	Maximum Turning Radius
Potomac-Church	4	58	1,100 Feet
Potomac-Green	3	116	500 Feet
Union-Church	57	229	800 Feet
Union-Green	42	291	500 Feet
Lee-Church	85	406	500 Feet
Lee-Green	84	422	500 Feet

Another major factor to consider when identifying potential tunnel alignments is the turning radius limitations of the TBM. For initial screening purposes, alignments with turning radii of 500 feet and 800 feet were evaluated as these are the tightest turning radii that are still technically feasible. However, such radii would require greater specialization of the TBM and would likely result in higher construction costs and a longer construction schedule compared to an alignment with a larger turning radius.

Both the Lee-Green and Lee-Church alignments would require a 500-foot turning radius to construct. Additionally, the Lee-Green and Lee-Church⁴ alignments would require the tunnel to be located directly underneath ten (10) residential buildings where the tunnel turns north under Lee Street. The Potomac-Green and Union-Green alignments also have tight 500-foot turning radii in Jones Point Park, but would not be located under any residential buildings. The Potomac-Church and Union-Church alignment would allow turning radii of 1,100 feet and 800 feet, respectively, and would not be located under any residential buildings.

Constructing the tunnel underneath the Potomac River, rather than Union Street or Lee Street, would eliminate the concern of having any historic structures in the portion of the buffer area with the highest potential for surface settlement over the tunnel crown. In the unlikely event that a TBM fails in a manner that can't be repaired from within the tunnel, construction of a rescue shaft in Union Street or Lee Street would require a very lengthy road closure, and significant mitigation measures to control surface settlement at the adjacent existing structures. In comparison to the other alignment options, the Potomac-Church alignment would minimize community impacts within the City of Alexandria by locating the tunnel further away from historic and residential structures than the other alignment options.

Outfall 001 Diversion Facility Options

In the vicinity of Outfall 001, three potential diversion facility locations were identified within public property in Oronoco Bay Park, which include: Oronoco Bay Park East, Oronoco Bay Park West, and

³ Structures identified as historic in the Virginia Department of Historic Resources VCRIS database.

⁴ This is based on the Lee-Church alignment that follows the private road through St. Mary's Cemetery. The Lee-Church alignment routed slightly further south and under graves through St. Mary's Cemetery would require the tunnel to be located directly underneath one (1) residential structure.

Oronoco Bay Park North. Oronoco Bay Park is a public park owned by the City of Alexandria. A fourth option, Robinson Terminal North, would be located on the Robinson Terminal North (RTN) property, which is owned by a private developer and includes an abandoned warehouse.

The four potential Outfall 001 Diversion Facility options are depicted on **Figures 2-3** through **2-6**. The anticipated construction duration for each option is approximately 2.5 years. Options 1, 2 and 3 would require closing portions of Oronoco Bay Park, Pendleton Street and Union Street for the entire duration of construction activities. Each option would be located on land below the 100-year floodplain elevation, and would require disturbance to the bed of the Potomac River. In order to achieve operational requirements, provide resiliency, and plan for impacts associated with climate change, the ground surface associated with each alternative would be raised to elevation +14, approximately two (2) feet above the 100-year floodplain elevation. Additionally, the existing outfall location would be extended from the Oronoco Bay shoreline so that combined sewer flows are discharged to the main channel of the Potomac River.

Outfall 001 Diversion Facility Option 1 – Oronoco Bay Park East

The Oronoco Bay Park East Diversion Facility would be constructed in the southeast corner of Oronoco Bay Park (near the intersection of Pendleton and Union Streets) and within the Potomac River. The anticipated construction staging area would total approximately 2.0 acres, the majority of which would be in Oronoco Bay Park and public rights-of-way (**Figure 2.3**). The diversion facility would be constructed in the southern portion of the site near the existing sewer under Pendleton Street. The diversion chamber would be retrofitted to the existing 7-foot by 6-foot combined sewer to divert wet weather flow to the tunnel for storage. An approach channel would be constructed to convey flow from the diversion chamber to the drop shaft. Pending detailed design, a below-ground ventilation control vault would be constructed to mitigate fugitive emissions from the drop shaft. Access to the Mount Vernon Trail, located along the western edge of the site, would be maintained throughout construction. This option would result in permanent impact to approximately 0.29 acre of Potomac River bed.

Site restoration would include a public promenade above the diversion facility and would be restored in coordination with NPS, and in conformance with the City of Alexandria Waterfront Plan. Along the promenade, manholes, hatches and other structure access points would be flush with grade. The only anticipated above-grade component would be an electrical cabinet to serve the ventilation control vault equipment.

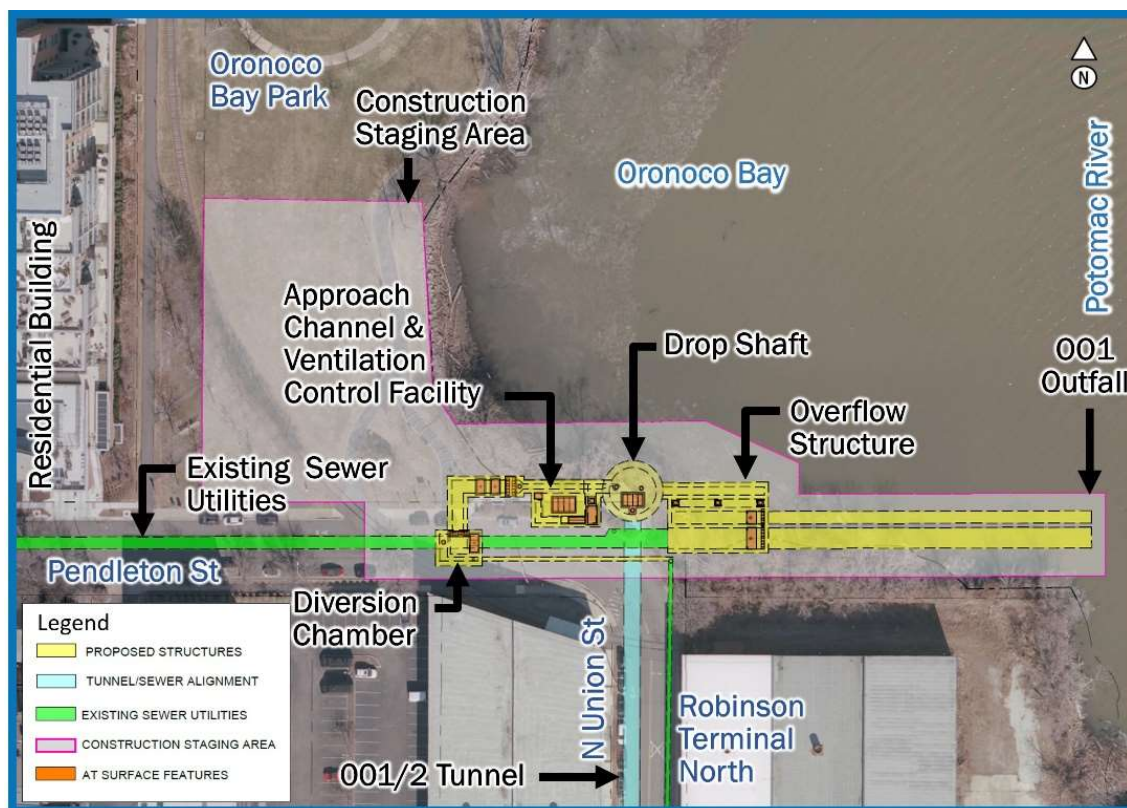


Figure 2-3 Oronoco Bay Park East Diversion Facility (pairs with Potomac River and Union Street Alignments)

Outfall 001 Diversion Facility Option 2 – Oronoco Bay Park West

The Oronoco Bay Park West Diversion Facility would be constructed along the entire southern boundary of Oronoco Bay Park (along Pendleton Street between Lee and Union Streets) and within the Potomac River. The anticipated construction staging area would total approximately 2.0 acres, the majority of which would be in Oronoco Bay Park and public rights-of-way (**Figure 2-4**). The Oronoco Bay Park West Diversion Facility would include the same structures as those outlined in the previous option, but would locate the drop shaft upstream of the diversion chamber. This configuration would require a longer overflow pipe to convey overflows to the outfall structure near the intersection of Pendleton and Union Streets. The location of the drop shaft would require excavation in close proximity to residential buildings and a temporary detour of the Mount Vernon Trail around the site throughout construction. This option would result in permanent impact to approximately 0.23 acre of Potomac River bed due to the overflow structure and outfall extension.

The site would be restored in coordination with NPS, and in conformance with the City of Alexandria Waterfront Plan; however, it would not include a public promenade along the Potomac River. At grade and above grade components would be the same as the previous option.

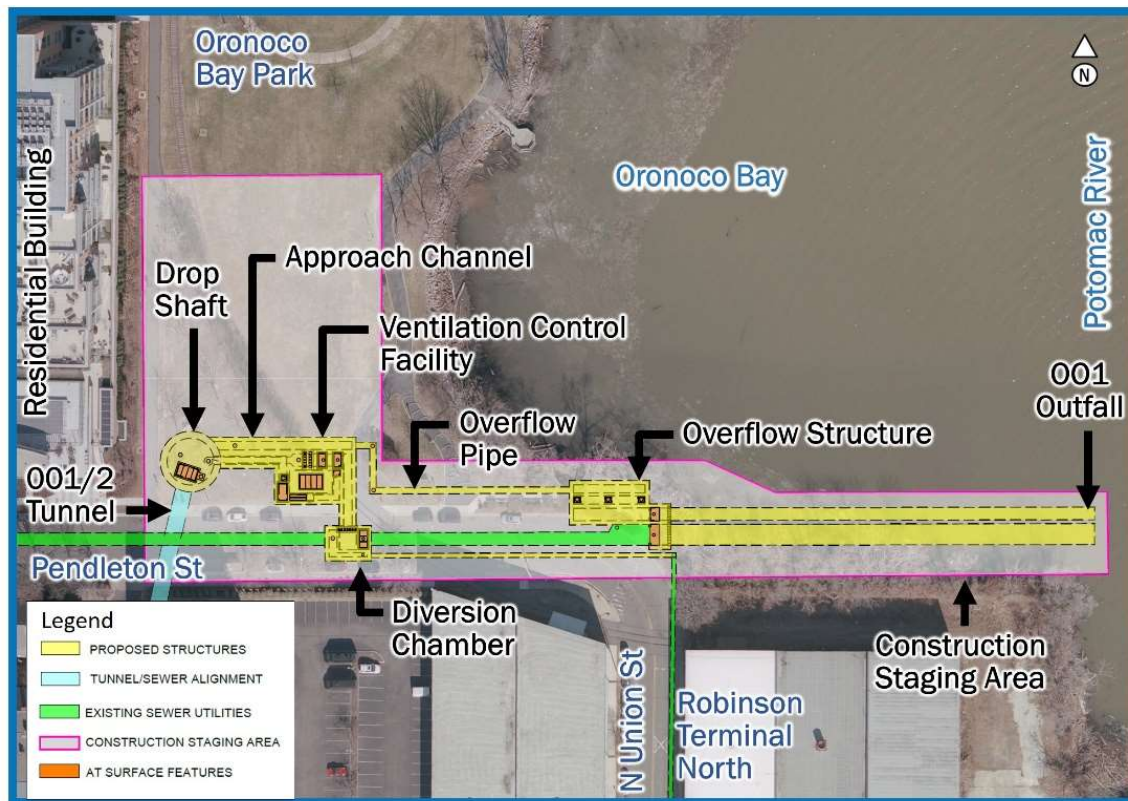


Figure 2-4. Oronoco Bay Park West Diversion Facility (pairs with Lee Street Alignment)

Outfall 001 Diversion Facility Option 3 – Oronoco Bay Park North

The Oronoco Bay Park North Diversion Facility would be constructed near the center of Oronoco Bay Park and within a portion of the Potomac River. The anticipated construction staging area would total approximately 2.5 acres, the majority of which would be in Oronoco Bay Park and public rights-of-way (**Figure 2-5**). The Oronoco Bay Park North Diversion Facility would include the same structures as those outlined in the previous options; but would locate the drop shaft a significant distance from the diversion chamber. This layout would require a longer approach channel and longer overflow pipe compared to the other options. It is not anticipated that this option would impact the Mount Vernon Trail. This option would result in permanent impact to approximately 0.23 acre of Potomac River bed due to the overflow structure and outfall extension.

The site would be restored in coordination with NPS, and in conformance with the City of Alexandria Waterfront Plan; however, it would not include a public promenade along the Potomac River. At grade and above grade components would be the same as the previous options.

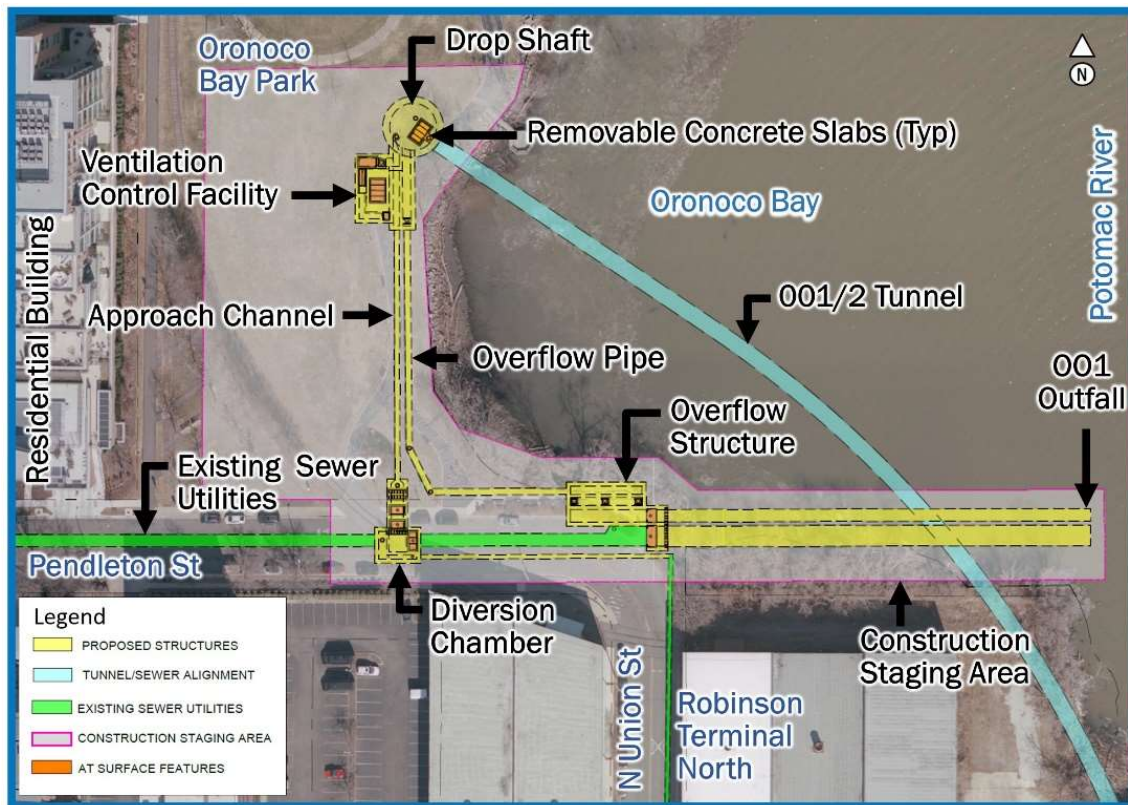


Figure 2-5. Oronoco Bay Park North Diversion Facility (pairs with Potomac River and Union Street Alignments)

Outfall 001 Diversion Facility Option 4 – Robinson Terminal North

The Robinson Terminal North Diversion Facility would be constructed just east of the intersection of Pendleton and Union Streets. The structures would be located on public property, private Robinson Terminal North (RTN) property and within the Potomac River bed. In 1983, the RTN property owner reached a settlement agreement with the NPS to resolve disputed ownership of previously submerged areas of the Potomac River that were filled to create more land along the Alexandria waterfront. As part of this settlement agreement, the RTN property was subdivided into separate parcels (Parcels A-D), each with varying restrictions on development and/or public access requirements. It should be noted that any proposed RiverRenew structures on the RTN property would be located within Parcel A, which is designated to remain as an open space public park area. Parcel A is located along the north and east of the site as outlined in **Figure 2-6**.

The anticipated construction staging area would total approximately 3.1 acres, the majority of which would be on private property (**Figure 2-6**). The Robinson Terminal North Diversion Facility would include the same structures as those outlined in the previous options, however, the outfall extension and overflow structure would be collocated.

This option would not require construction or staging within Oronoco Bay Park and would significantly reduce impacts to Pendleton and Union Streets when compared to the other options. Access to the Mount Vernon Trail would be maintained throughout construction. This option would result in permanent impact to approximately 0.28 acre of Potomac River bed.

The site would be restored in coordination with NPS, and in conformance with the City of Alexandria Waterfront Plan. It would also include a public promenade along the Potomac River. At grade and above grade components would be the same as the previous options. At the time of this EA, land

records are being evaluated and ownership of a future promenade has not yet been determined, but would be coordinated among NPS, the City of Alexandria, and AlexRenew, as appropriate.

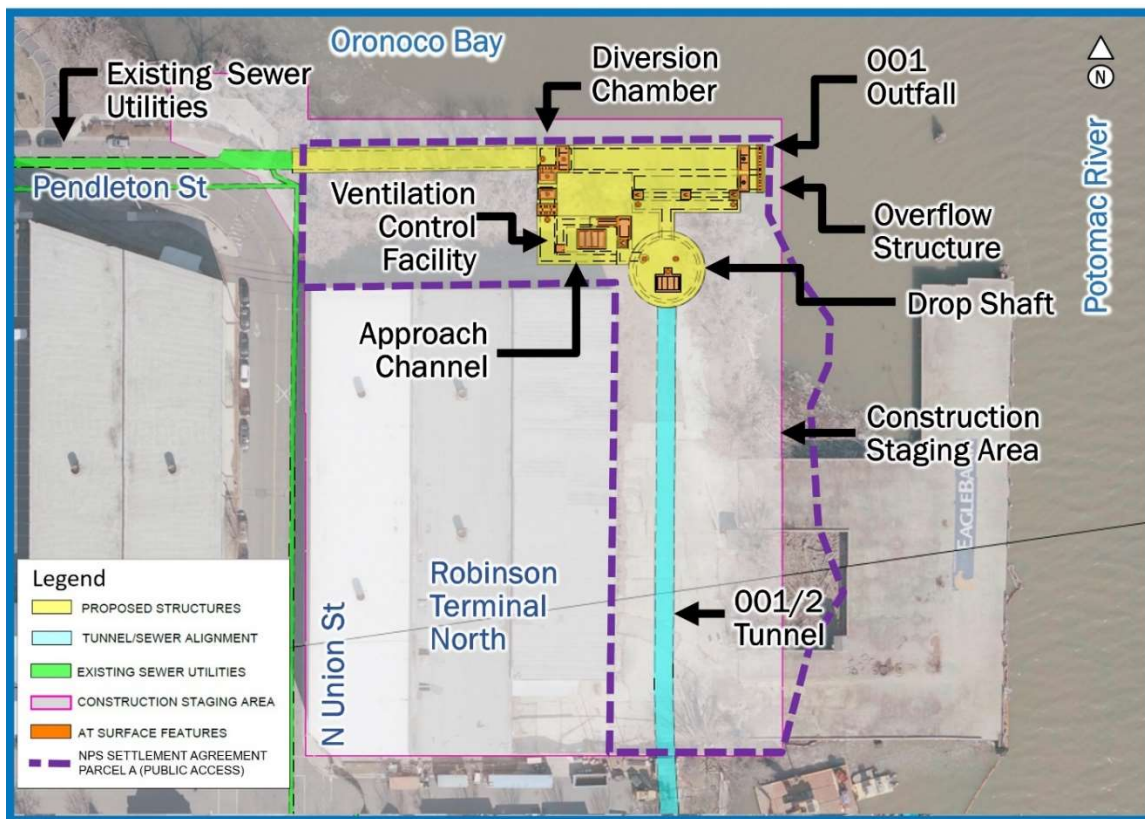


Figure 2-6. Robinson Terminal North Diversion Facility (pairs with Potomac River and Union Street Alignments)

In summary, impacts to the Potomac River are unavoidable by any of the Outfall 001 Diversion Facility options. Of the four (4) options, the Robinson Terminal North option would result in the second largest impact to the Potomac River bed, but this option significantly minimizes impacts to the community as outlined below.

- Consolidates the proposed structures into the smallest footprint.
- Limits construction activities within Oronoco Bay Park.
- Locates proposed structures at the greatest distance to existing residences.
- Significantly minimizes potential impacts to vehicular and pedestrian traffic.
- Avoids detouring the Mount Vernon Trail.
- Provides opportunity for enhanced community restoration and construction of a new promenade.

Outfall 002 Diversion Facility Options

In the vicinity of the existing Outfall 002 regulator along South Royal Street, three potential diversion facility locations were identified. These options are primarily located on NPS lands within Jones Point Park, with sewer connections within the public right-of-way as depicted on **Figures 2-7 through 2-9**. The anticipated construction duration for each option is approximately 2.5 years. Each of these options are located in areas below the 100-year floodplain elevation. Similar to Outfall 001, the ground surface at each Outfall 002 diversion facility location would be raised approximately two (2) feet above the 100-year floodplain elevation. At this elevation, the top of the diversion facility would be several feet above

the adjacent streets. Therefore, the options retained for detailed analysis depict the drop shaft outside of public rights-of-way to avoid the need to regrade streets and sidewalks. The final site layout and restoration would be coordinated with the NPS during the design and permitting processes. Note that none of these options would result in any modifications to the existing Outfall 002 structure located along the Hunting Creek shoreline.

Outfall 002 Diversion Facility Option 1 – Green Street

The Green Street Diversion Facility would be constructed in the northern section of Jones Point Park near the intersection of South Royal and Green Streets, adjacent to an existing community garden. The anticipated construction staging area would total approximately 1.2 acres, including approximately 0.55 acre within Jones Point Park (**Figure 2-7**). The diversion facility would be constructed just south of Green Street and east of the existing combined sewer under South Royal Street. The diversion chamber would be retrofitted to the existing 84-inch by 64-inch combined sewer to divert wet weather to the tunnel for storage. An approach channel would be constructed to convey flow from the diversion chamber to the drop shaft. Pending detailed design, a below-ground ventilation control vault would be constructed to mitigate fugitive emissions from the shaft.

During construction, South Royal Street would be closed south of Green Street to construct the diversion chamber on the existing combined sewer. A clearway through the construction site would be maintained to allow emergency vehicles to access underneath the Woodrow Wilson Bridge; however, the main entrance to Jones Point Park would be inaccessible during construction activities within South Royal Street. A temporary entrance to Jones Point Park, likely an extension of South Lee Street, would need to be constructed in advance of RiverRenew construction activities. This portion of South Royal Street is also utilized heavily by The Basilica School of Saint Mary (Basilica School) during morning drop off and afternoon pickup. It is estimated that approximately 400 vehicles per day use South Royal Street to access the Basilica School. Alternate arrangements for student drop off and pickup would need to be arranged with Basilica School and coordinated with the community if this option was selected.

This site would be located adjacent to community gardens and directly across the street from a residential neighborhood within the Alexandria Historic District. This option is not anticipated to impact any jurisdictional wetlands or other waters of the U.S. However, it is anticipated that this option would require the removal of approximately 80 trees within the construction staging area. Following construction, construction manholes, hatches and other structure access points would be flush with grade. The only anticipated above-grade component would be an electrical cabinet, approximately 8-foot wide, 4-foot tall, and 8 feet deep, to serve the ventilation control vault equipment. The site would be restored in coordination with the NPS.

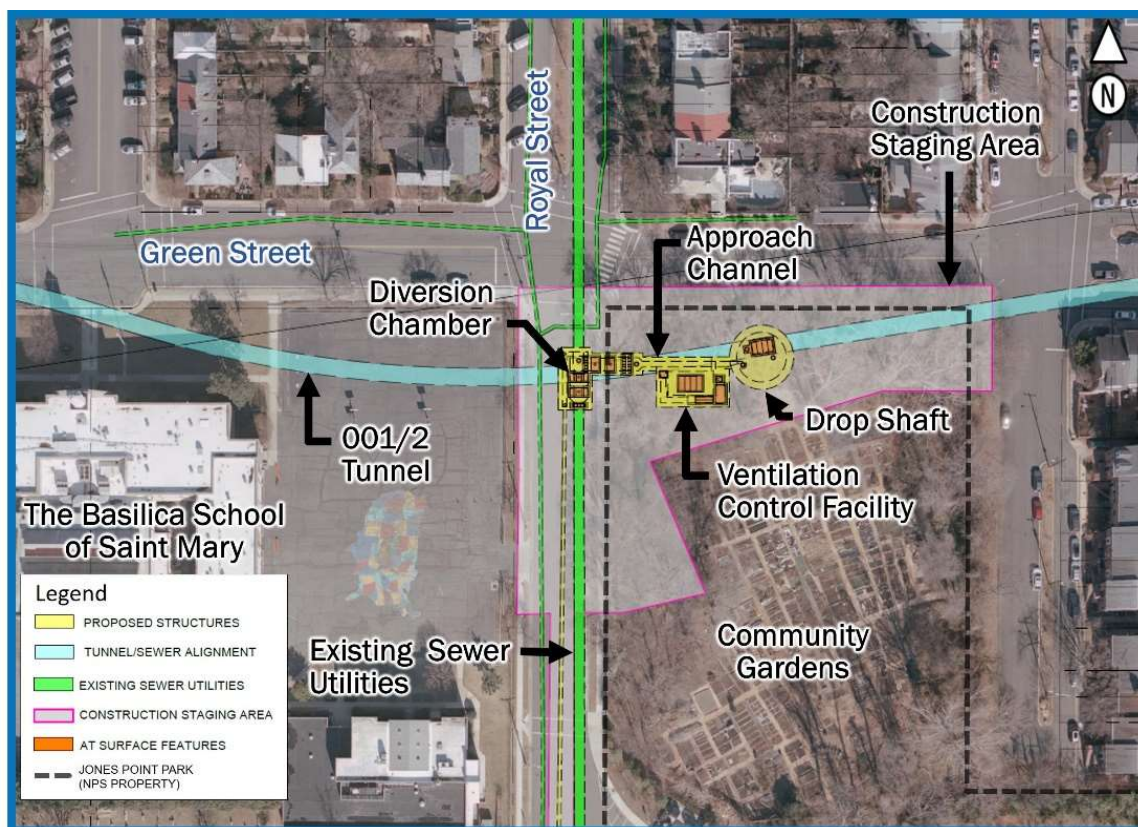


Figure 2-7. Green Street Diversion Facility (pairs with Green Street Alignment)

Outfall 002 Diversion Facility Option 2 – Royal Street North

The Royal Street North Diversion Facility would be constructed just south of Jones Point Drive, which serves as the entrance to Jones Point Park. The anticipated construction staging area would total approximately 1.0 acre, including approximately 0.77 acre within Jones Point Park (**Figure 2-8**). The components of Royal Street North Diversion Facility would be the same as the previous option; however, this configuration would require a longer approach channel to the drop shaft.

The gated portion of South Royal Street, south of Jones Point Drive, would be closed during construction; however, a clearway through the construction site would be maintained to allow emergency vehicles to access underneath the Woodrow Wilson Bridge. This option is not anticipated to impact Jones Point Park Drive or interrupt the traffic circulation procedures associated with the Basilica School.

This site would be located at a greater distance from residential areas and the community gardens than the previous option. This option would result in permanent impact to approximately 107 linear feet of intermittent stream channel due to construction activities. Additionally, it is anticipated that this option would require the removal of approximately 59 trees within the construction staging area. Following construction, manholes, hatches and other structure access points would be flush with grade. Anticipated above-grade components would include an approximately 3-foot tall retaining wall, new Jones Point Park entrance signage, and an electrical cabinet to serve the ventilation control vault equipment. Site restoration would be coordinated with the NPS.



Figure 2-8. Royal Street North Diversion Facility (pairs with Church Street Tunnel Alignment)

Outfall 002 Diversion Facility Option 3 – Royal Street South

The Royal Street South Diversion Facility would be constructed further south of Jones Point Drive and the South Royal Street cul-de-sac. The anticipated construction staging area would total approximately 1.2 acres, including approximately 0.86 acre within Jones Point Park (**Figure 2-9**). The components and layout of the Royal Street South Diversion Facility would be the same as the other options. Additionally, this option is anticipated to have the same street closure and traffic considerations as Option 2.

This option locates the proposed structures at the greatest distance from residential areas, the community gardens, and the Basilica School, but requires the tunnel to be routed under a large number of St. Mary's Cemetery graves to connect to the drop shaft. Construction activities associated with this option would result in the same amount of tree removal and permanent stream impacts as Option 2. At grade and above grade components and site restoration would be the same as Option 2.

In summary, the Royal Street options locate construction activities a greater distance from residential properties and community gardens than the Green Street option. Additionally, the Royal Street options maintain access to Jones Point Park and are not anticipated to interfere with the Basilica School traffic movements. The Royal Street North option would allow the tunnel to be routed under an existing road through St. Mary's Cemetery, whereas the Royal Street South option would require the tunnel to be routed under numerous graves.

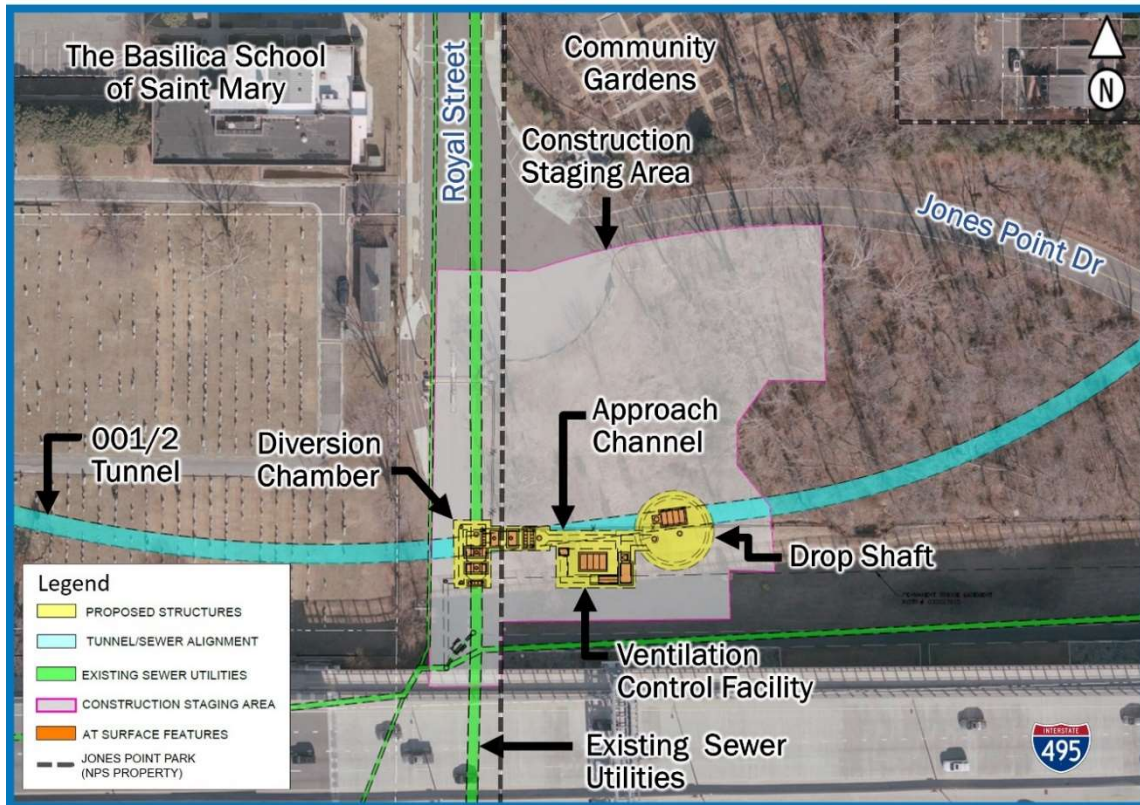


Figure 2-9. Royal Street South Diversion Facility (pairs with Church Street Alignment)

Ventilation and Odor Control

The tunnel and drop shafts would need to be vented to the atmosphere due to the large quantities of air displaced by combined sewer flows filling the tunnel. Since combined sewer system tunnels capture sewage diluted with rainwater, it is not typical or proposed to construct odor control facilities to treat the entire air exhausted from the tunnel during a filling event.

Potential tunnel system odorous air would be controlled primarily through a series of counter-balanced intake and exhaust dampers. During dry conditions, both sets of dampers would remain closed and prevent the exchange of tunnel air to the atmosphere. During filling events, the exhaust dampers would open to release air displaced by tunnel inflows, and subsequently close following the event. While the tunnel is dewatered, the intake dampers would open to allow fresh air to circulate into the tunnel.

In addition to the counter-balanced dampers, it is also proposed to install below-grade odor control equipment at the Outfall 001 and 002 diversion facilities to mitigate the potential for fugitive emissions of odorous air. This equipment would include radial flow activated carbon systems to provide treatment of air concentrated at the top of the drop shaft.

Tunnel Dewatering Pumping Station

The 001/2 Tunnel would be constructed from a 70-foot inside diameter Mining Shaft at AlexRenew's WRRF. The Mining Shaft would be utilized to lower and assemble the TBM, remove excavated materials, and deliver construction materials to the front of the TBM (e.g. concrete segments that would form the final tunnel liner). Approximately 3.5 acres of space would be occupied at the WRRF to

construct the Mining Shaft and conduct tunneling operations over approximately 4.5 years (**Figure 2-10**).

Prior to initiating construction of the mining shaft, AlexRenew would demolish its former administrative building, referred to as Building J, to provide a construction staging area sufficient to build the Mining Shaft and accommodate tunnel construction. Existing facilities within Building J would be relocated to other buildings on the WRRF campus. Additionally, Dominion Energy would extend a high-voltage electricity distribution line to the mining site to deliver power for construction activities.

Upon completion of tunnel construction, the Mining Shaft would be fit-out with a Tunnel Dewatering Pumping Station (TDPS) to dewater the 001/2 and 003/4 systems and manage residuals. The TDPS would include the following components: trench-style wet well, trash rack and rake, clamshell, overhead gantry crane, pumps, piping, electrical equipment, blowers, and other ancillary equipment. Stairs, an elevator, and access hatches would be provided to facilitate operation and maintenance of equipment.

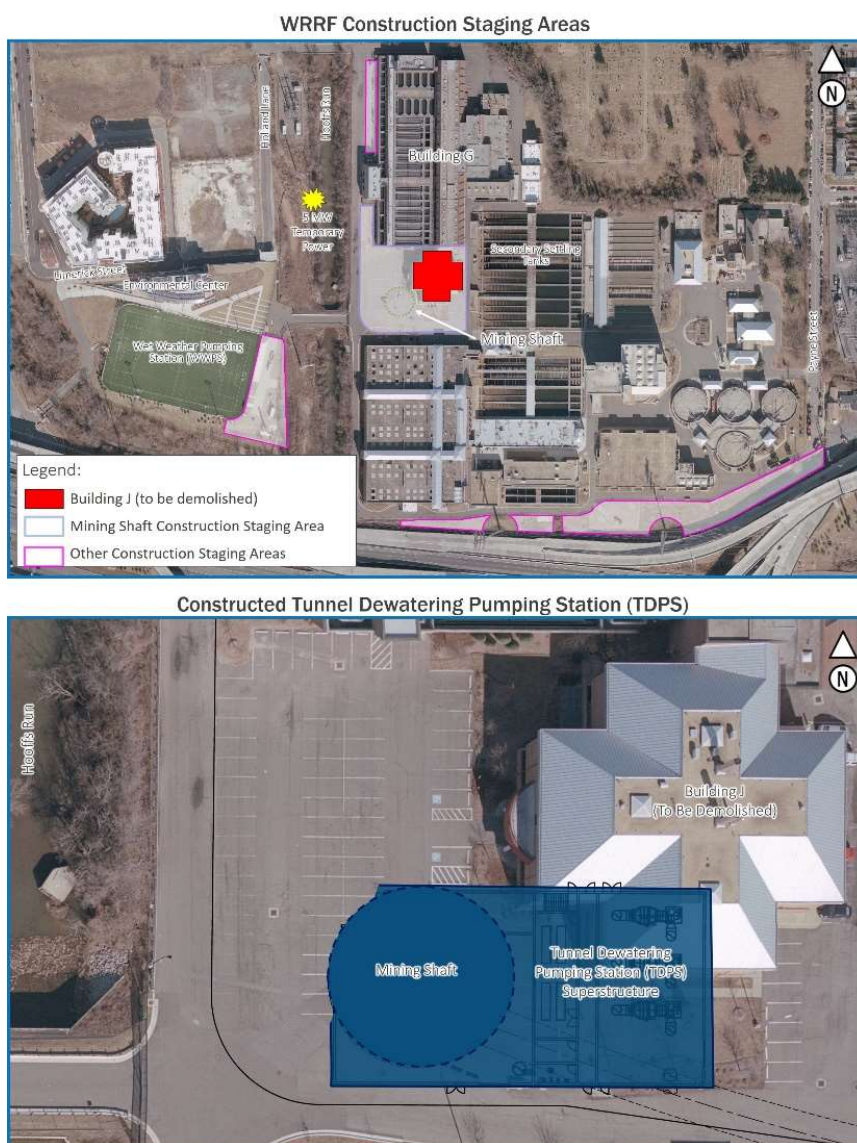


Figure 2-10. Tunnel Dewatering Pumping Station and Construction Staging Areas

Outfall 003/4 System

Three options have been identified for the Outfall 003/4 System, which include the Hooffs Run Diversion Sewer, Holland Lane Diversion Sewer, and Hooffs Run Deep Tunnel (**Figure 2-11**). Each option presents a different construction method and alignment to address combined sewage discharges from Outfalls 003/4. Each option would connect to the TDPS and the new Wet Weather Pumping Station (WWPS). The WWPS is necessary to lower the water level in the existing interceptor system to minimize upstream basement backups caused by extreme wet weather events.

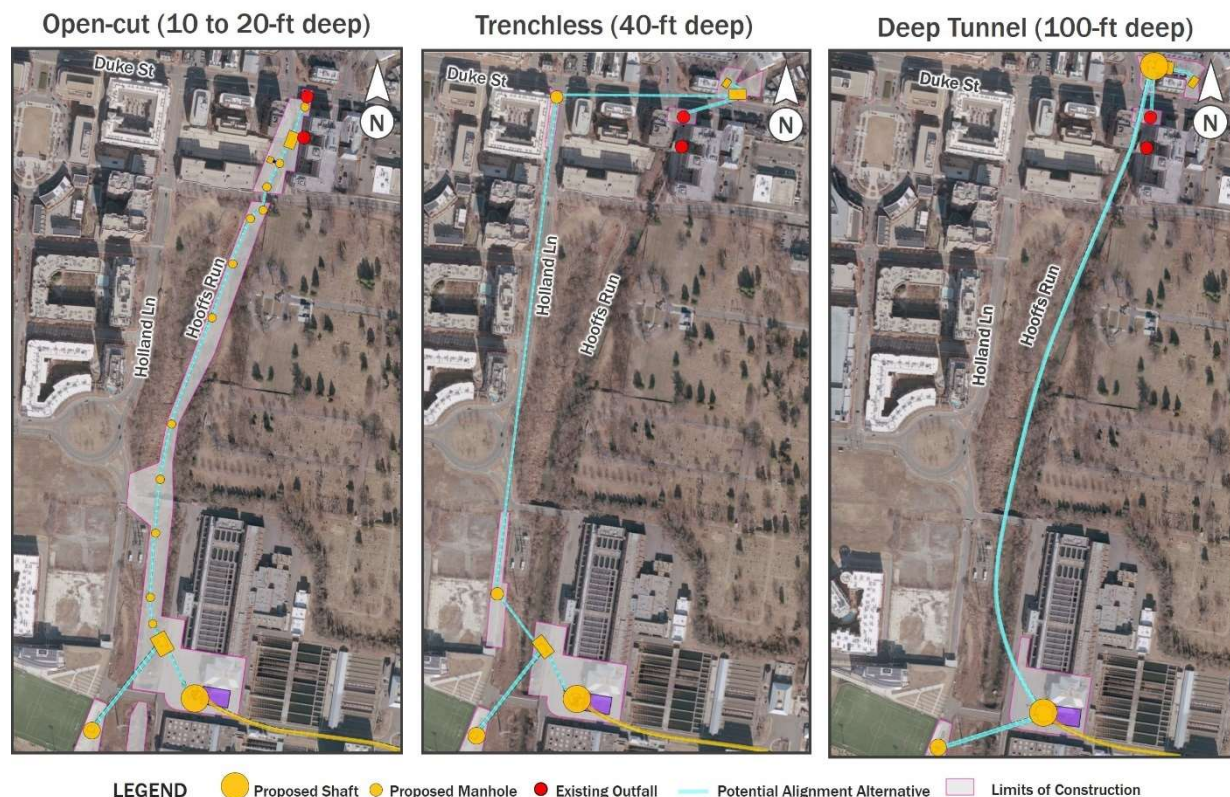


Figure 2-11. Outfall 003/4 System Options (from left to right: Hooffs Run Diversion Sewer, Holland Lane Diversion Sewer, Hooffs Run Deep Tunnel)

Wet Weather Pumping Station

The existing wet well for the WWPS is situated under the gallery of the existing Nutrient Management Facility on the west side of Hooffs Run. New pumps and piping up to a capacity of 130 mgd would be installed to prevent sewer surcharging and basement backups along the Holmes Run Trunk Sewer and Commonwealth Interceptor and maintain the conveyance capacity of the 003/4 diversion sewer or tunnel. The anticipated construction staging area would total approximately 0.75 acre at the WRRF and construction activities would span approximately 4.5 years (**Figure 2-12**). A WWPS conveyance sewer would be installed via trenchless methods under Hooffs Run to convey flows from the WWPS to the Hydraulic Grade Line (HGL) Control Structure.

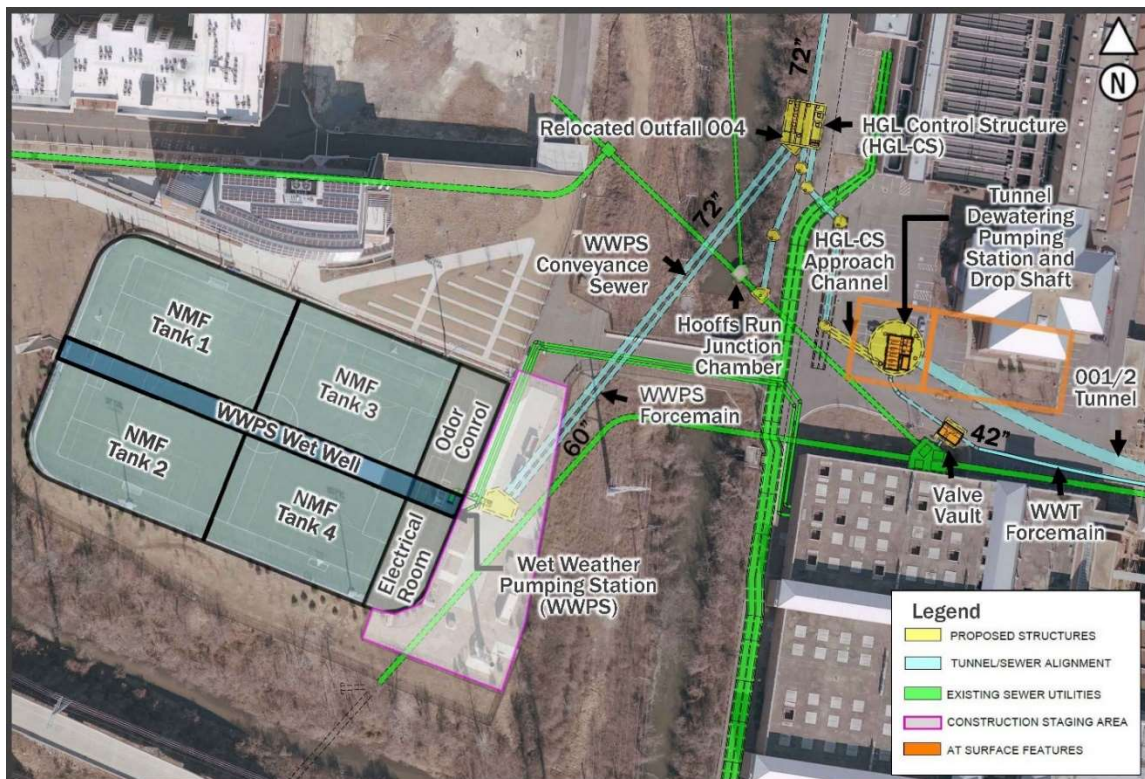


Figure 2-12. Wet Weather Pumping Station Construction Staging Area

Outfall 003/4 Option 1 – Hooffs Run Diversion Sewer

The Hooffs Run Diversion Sewer includes a 72-inch diameter pipe at a depth of 10 to 20 feet between Duke Street and the WRRF. The pipeline would be installed within the Hooffs Run floodplain using a combination of open-cut and trenchless methods. As part of restoration, the Hooffs Run riparian buffer within African American Heritage Park would be improved. **Figure 2-13** illustrates conceptual layouts for the Hooffs Run Diversion Sewer and associated structures near Duke Street.

Construction of the Hooffs Run Diversion Sewer would take approximately 2 years and include the Duke Street Diversion Chamber, a diversion manhole, and the Commonwealth Diversion Chamber. This option allows the existing siphons under Duke Street to be eliminated and abandoned. It is anticipated that the southernmost lane of Duke Street and adjacent sidewalk would be closed intermittently over the course of 1 year to connect to the existing sewer system.

The Hooffs Run Diversion Sewer would be installed via one of two alignments: 1) parallel to the existing Commonwealth Interceptor; or 2) directly replace the existing Commonwealth Interceptor. The parallel alignment would route the sewer beneath the Jamieson Avenue Bridge and route it thereafter in parallel to the existing Commonwealth Interceptor to the WRRF. The replacement alignment would remove and replace the existing Commonwealth Interceptor from just north of Jamieson Avenue to the WRRF. Both alternatives would include a junction structure at the WRRF to connect the diversion sewer to the TDPS and the WWPS.

This option would result in permanent impact to approximately 150 linear feet of perennial stream channel and 0.01 acre of palustrine forested wetland, as well as temporary impacts to approximately 1,550 linear feet of perennial stream channel and 0.45 acre of estuarine emergent wetland. Permanent impacts would result from filling and site grading activities. Temporary impacts would result

from installation of the diversion sewer and subsequent Hooffs Run bank stabilization activities associated with the riparian buffer restoration plan. The anticipated cumulative construction staging and restoration areas total approximately 11 acres, the majority of which is located within public property and the Hooffs Run floodplain.

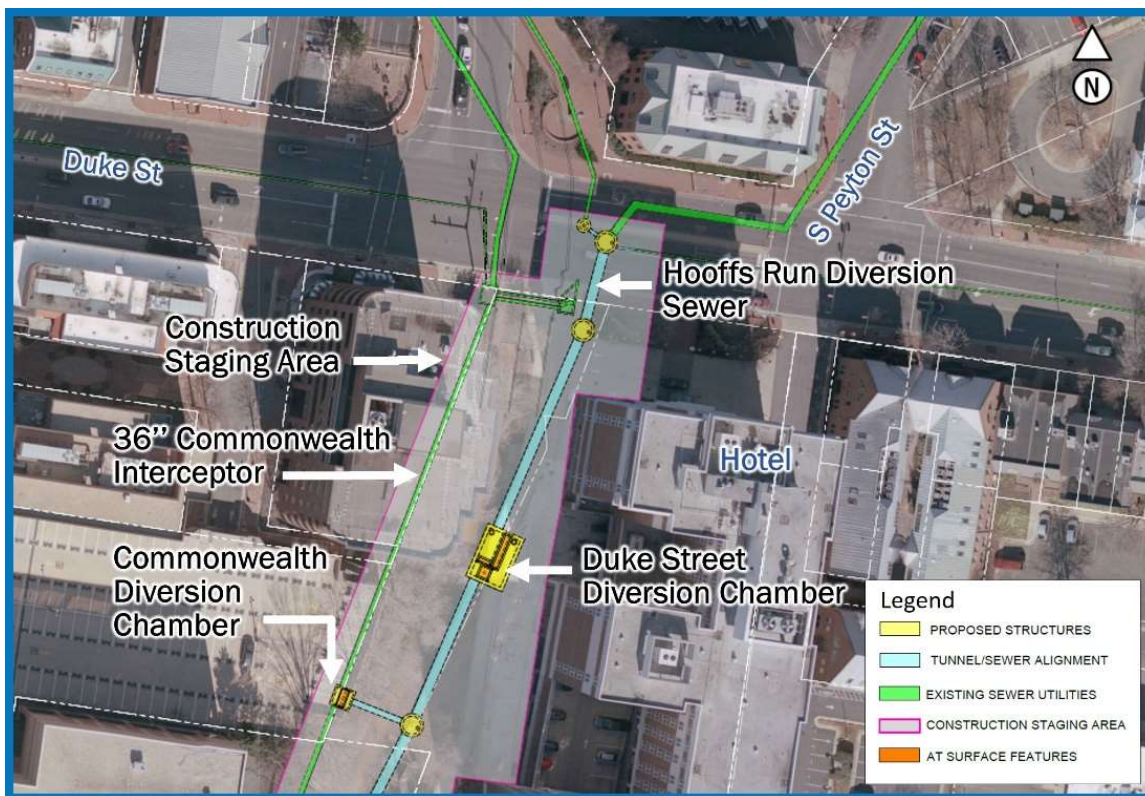


Figure 2-13. Hooffs Run Diversion Sewer and Structures near Duke Street

The Hooffs Run Diversion Sewer facilities and upgrades at the WRRF are depicted on **Figure 2-14**. The diversion sewer would connect to the HGL Control Structure, which would:

- control the depth of flow in the diversion sewer and Commonwealth Interceptor,
- direct and receive flows to/from the WWPS,
- direct flows to the TDPS, and
- serve as the relocated Outfall 004 discharge point.

Consolidating these features in a single structure would have the net benefits simplifying the layout of proposed structures and preserving space for future expansion.

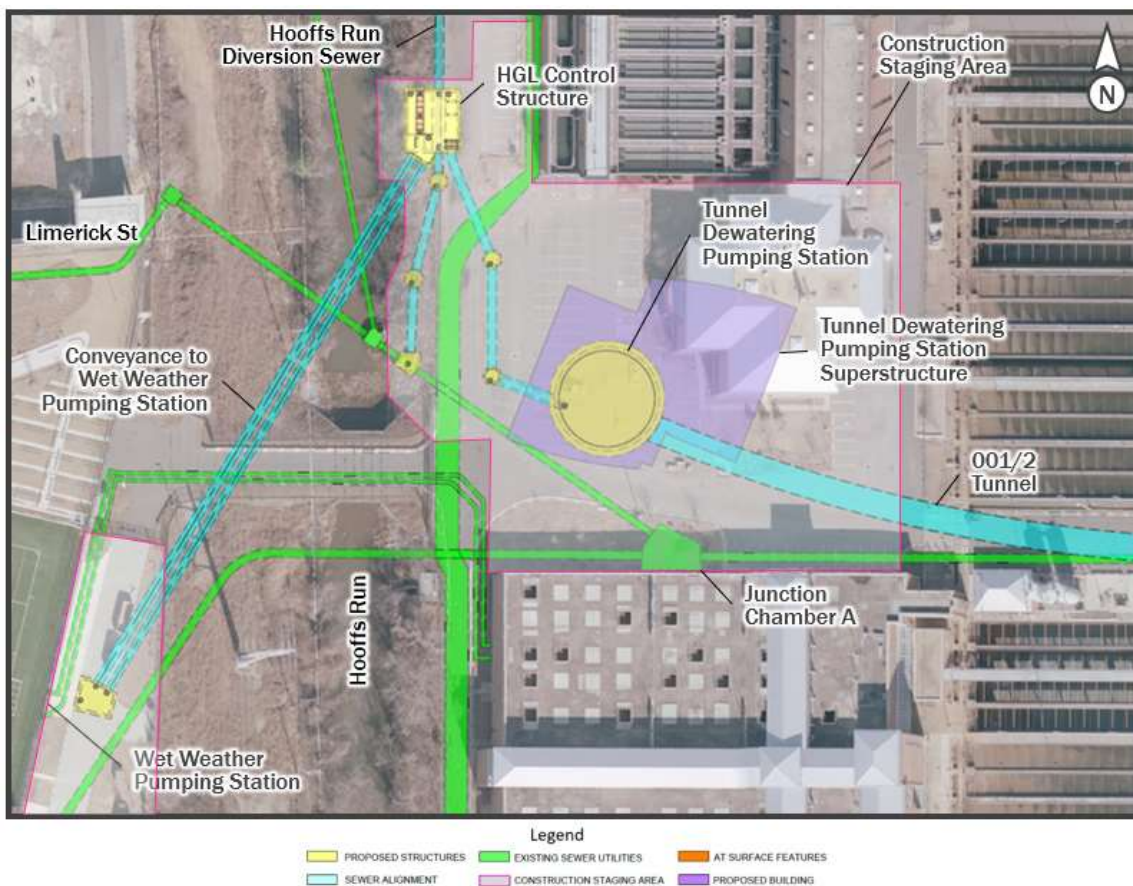


Figure 2-14. Hooffs Run Diversion Sewer Structures at the WRRF

Outfall 003/4 Option 2 – Holland Lane Diversion Sewer

The Holland Lane Diversion Sewer option includes a 72-inch diameter pipe at a depth of 20 to 40 feet that is constructed using primarily trenchless methods. **Figure 2-15** illustrates conceptual layouts of the Holland Lane Diversion Sewer and the associated Duke Street and Peyton Street Diversion Chambers to address discharges from Outfalls 003/4.

Construction of the Holland Lane Diversion Sewer would take approximately 2 years, with cumulative construction staging areas totaling approximately 4.8 acres. The primary construction area at the north end of the alignment is located within a highly visible and active public space, adjacent to heavily-travelled Duke Street, commercial buildings, and specialty day care centers. Construction activities would require the temporary occupation of the traffic circle at the southern end of Commerce Street, as well as the closure of South Peyton Street for the entire construction duration. Impacts to Duke Street would be the same as Option 1. This option is not anticipated to result in any impacts to jurisdictional wetlands or other waters of the U.S. After construction is complete, manholes, hatches and other structure access points would be flush with grade. The construction areas would be restored in coordination with the City of Alexandria.

The Holland Lane Diversion Sewer facilities at the WRRF are similar to those depicted in **Figure 2-14** and the downstream facilities would operate in the same manner as described in the previous option.

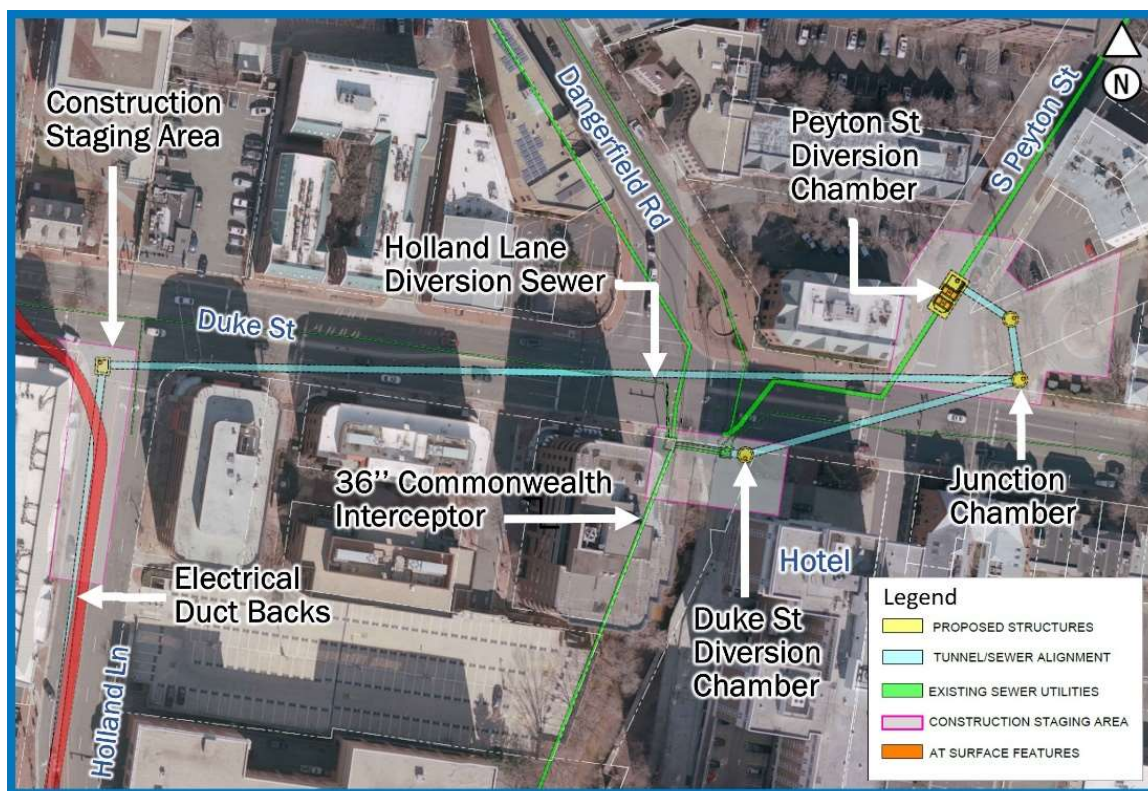


Figure 2-15. Holland Lane Diversion Sewer and Structures near Duke Street

Outfall 003/4 Option 3 – Hooffs Run Deep Tunnel

The Hooffs Run Deep Tunnel includes a 12-foot inside diameter (with a maximum outside diameter of 19-feet) tunnel at a depth of approximately 120 feet. The tunnel would be installed by TBM and excavated from the Mining Shaft at the WRRF. The tunnel would terminate at an approximately 40-foot inside-diameter drop shaft located within private property at 1501 Duke Street, near the intersection of Daingerfield Road and Duke Street. This construction technique would be similar to the method proposed for the Outfall 001/2 tunnel system and would require the construction of a diversion facility on private property (Figure 2-16).

Construction of the Hooffs Run Deep Tunnel would take approximately 2.5 years. The diversion facility and its construction staging area for this option would be located within private property, highly-utilized public space, adjacent to heavily-travelled streets, commercial buildings, and specialty day care centers. Construction activities would require the temporary use of a private parking lot at 1501 Duke Street and block the entrance to a parking garage at 207 South Peyton Street. Impacts to South Peyton Street and Duke Street would be the same as Option 2. The relatively restricted construction staging area would affect the means and methods for shaft construction. Furthermore, the excavation of the shaft would likely require significant mitigation measures to control settlement to the adjacent existing structures. This option is not anticipated to result in any impacts to jurisdictional wetlands or other waters of the U.S. After construction is complete, manholes, hatches and other structure access points would be flush with grade. The only anticipated above-grade component would be an electrical cabinet to serve the ventilation control equipment. The site would be restored in coordination with the City of Alexandria and private property owners.

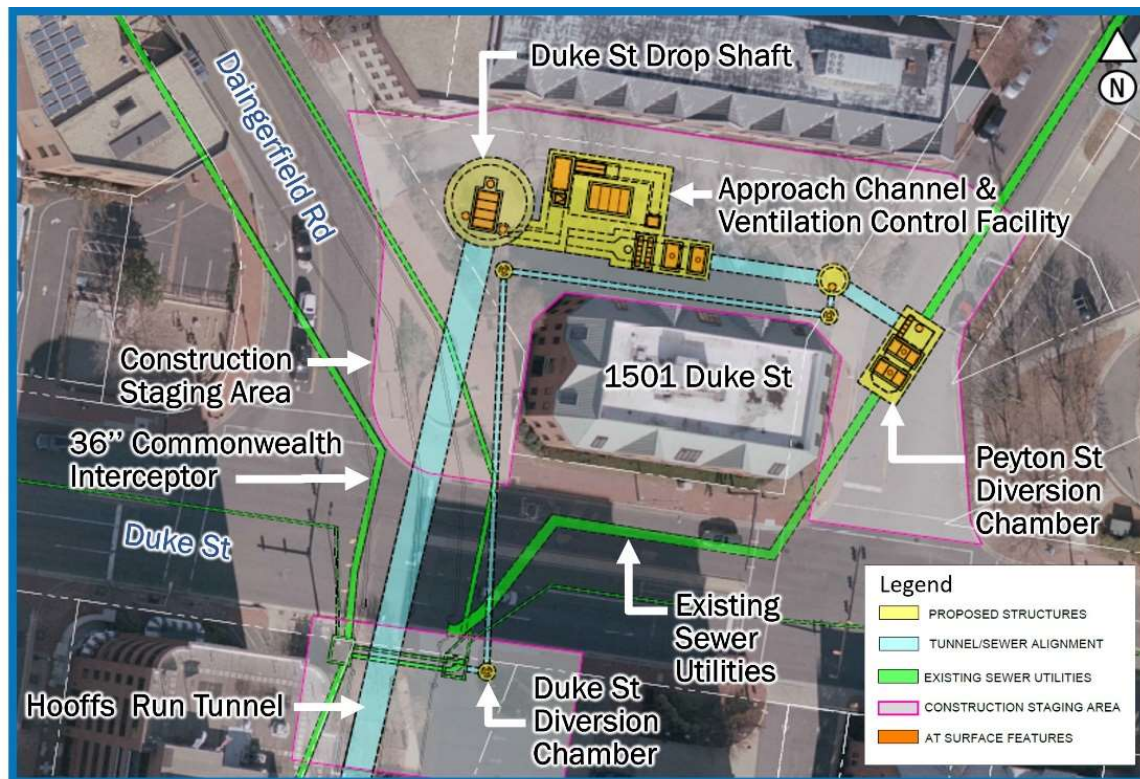


Figure 2-16. Hooffs Run Deep Tunnel and Diversion Facility near Duke Street

The Hooffs Run Deep Tunnel structures at the WRRF, depicted in **Figure 2-17**, include the following components: HGL Control Structure, flow splitting structure with associated piping, bifurcated shaft with separate pump stations and drop shafts for the Outfall 001/2 tunnel system and the Outfall 003/4 tunnel system, and relocated Outfall 004 with associated piping.

In summary, the Hooffs Run Deep Tunnel option would take the longest to construct and would severely impact businesses surrounding the diversion facility location. The Holland Lane Diversion Sewer and Hooffs Run Diversion Sewer have similar construction durations; however, the Holland Lane option would result in higher community impacts than the Hooffs Run option due to the additional construction activities within heavily traveled areas. While the Hooffs Run option has the lowest community impacts, it is the only Outfall 003/4 option that would result in impact to wetlands and streams. These impacts would be mitigated through a robust riparian restoration plan.

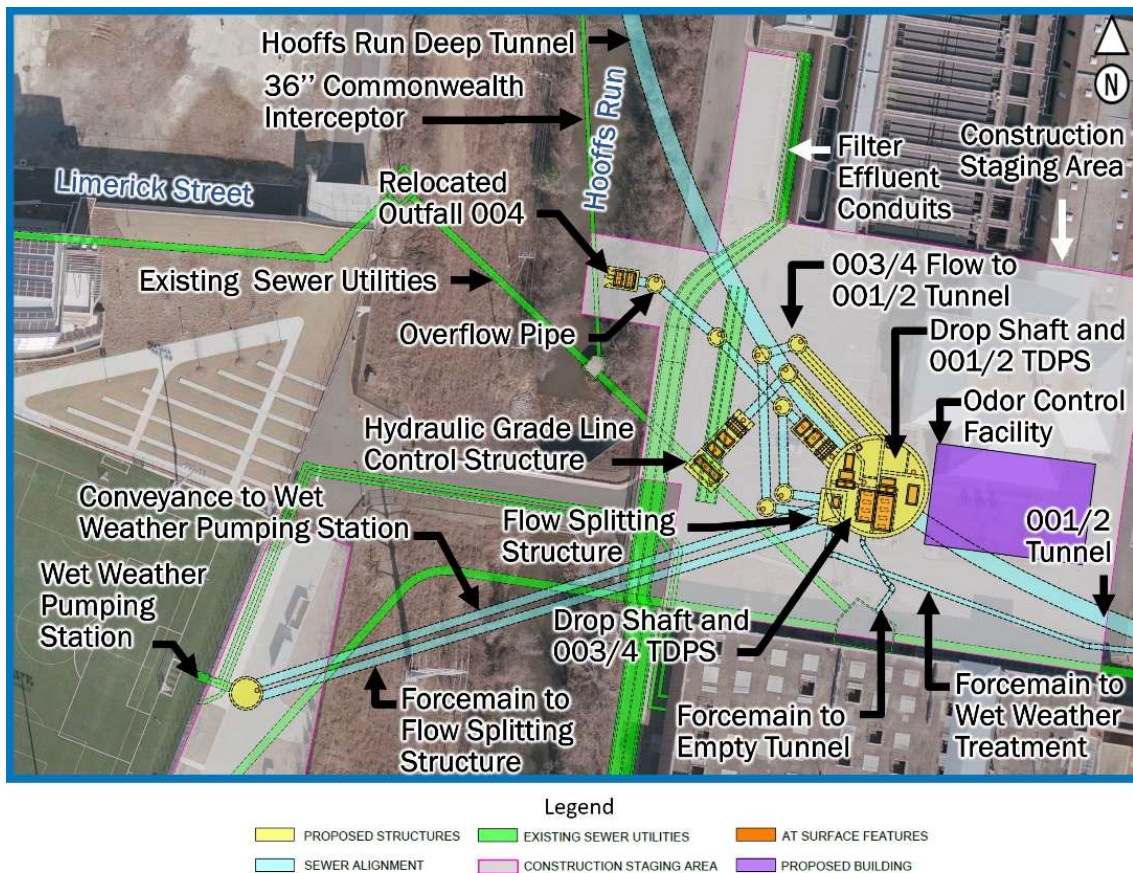


Figure 2-17. Hooffs Run Deep Tunnel Structures at the WRRF

Wet Weather Treatment Facility

The Wet Weather Treatment Facility (WWTF) would include repurposing a portion of AlexRenew's primary treatment processes to provide primary sedimentation and disinfection during wet weather events. The objective is to provide AlexRenew with the ability to retain primary settling for typical dry weather operations and convert tankage to wet weather mode to further reduce combined sewer flows. Following settling and disinfection, wet weather flows would be dechlorinated prior to discharge to Hunting Creek.

Disinfected wet weather flows would be conveyed to Hunting Creek via an unused existing flow channel that connects to an outfall downstream of AlexRenew's final effluent sampling location. It is intended to permit the Wet Weather Treatment Facility discharge separately from the WRRF's final treated effluent outfall and include provisions for separate sampling prior to conveyance to Hunting Creek.

The principal improvements would include: expanding the influent channel to remove flow restrictions, adding a chamber to mix the disinfectant (sodium hypochlorite) into the wet weather flow, adding isolation slide gates to maximize operational flexibility, modifying the effluent channel to connect to the proposed wet weather outfall, and adding chemical feed systems to disinfect and dechlorinate the wet weather flows.

If utilizing the existing primary tanks proves to be infeasible, either as a result of routing pipelines or adverse impacts to WRRF operations, it would be proposed to utilize AlexRenew's existing disinfection system or construct a new sedimentation and disinfection tank adjacent to the TDPS and its

associated superstructure. Utilizing AlexRenew's existing disinfection system would route treated flows through the existing WRRF outfall, which discharges to Hunting Creek. Treated flows from a new sedimentation and disinfection tank would be directed to relocated Outfall 004, which discharges to Hooffs Run.

Construction Haul Routes

Potential construction haul routes were evaluated to minimize impacts to NPS lands and the surrounding community. Consideration was given to traffic, road conditions, bridge capacities, and residential areas. In order to avoid hauling on the George Washington Memorial Parkway, U.S. Route 1 would serve as the primary north/south haul route. Haul routes associated with construction activities at Outfall 001, Outfall 003/4 and the WRRF are not anticipated to have any impact on NPS lands. The Outfall 002 diversion facilities are located along the eastern edge of Jones Point Park, and adjacent to S. Royal Street. As such, no construction hauling is anticipated to occur within Jones Point Park. Final selection of haul routes would be coordinated with the City of Alexandria and NPS. Proposed haul routes for each construction area are described in further detail, and presented on figures provided in **Appendix B**.

Preferred Alternative

Alternative B, which consists of the proposed action intended to comply with the Commonwealth of Virginia's 2017 Law and AlexRenew's VPDES Permit, is the preferred alternative. The preferred option for each project component element is listed in **Table 2-4**.

Second Preferred Options

As noted in **Table 2-4**, the Outfall 001/2 System tunnel and Outfall 001 diversion facility have first and second preferred options. As of the writing of this EA, AlexRenew is actively conducting subsurface geotechnical investigations, and compiling structural information (e.g. pile depths) for buildings and other structures along potential tunnel alignments. If subsequent investigations or information render the First Preferred Option (Potomac-Church Alignment) infeasible from a cost, schedule, engineering and/or constructability standpoint, the Second Preferred Option (Union-Church Alignment) would be advanced.

For the Outfall 001 diversion facility, the First Preferred Option (Robinson Terminal North) is located on private property and would require an agreement with the current property owner. If AlexRenew is unable to reach an agreement with the property owner, the Second Preferred Option (Oronoco Bay East) would be advanced.

Table 2-4: Component Options Comprising the Preferred Alternative

Component	Element	Preferred Option
Outfall 001/2 System	Tunnel	Potomac-Church Alignment As described in the Outfall 001/2 Tunnel System Alignment Options section and depicted on Figure 2-2 . (First Preferred Option)
		Union-Church Alignment As described in the Outfall 001/2 Tunnel System Alignment Options section and depicted on Figure 2-2 . (Second Preferred Option – See below)
	Outfall 001 Diversion Facility	Option 4 – Robinson Terminal North As described in the Outfall 001 Diversion Facility Options section and depicted on Figure 2-6 . (First Preferred Option)
		Option 1 – Oronoco Bay East As described in the Outfall 001 Diversion Facility Options section and depicted on Figure 2-3 . (Second Preferred Option)
	Outfall 002 Diversion Facility	Option 2 – Royal Street North As described in the Outfall 002 Diversion Facility Options section and depicted on Figure 2-8 .
Tunnel Dewatering Pumping Station	Mining Shaft, Tunnel Dewatering Pumping Station, and Superstructure	As described in the Tunnel Dewatering Pumping Station section and depicted on Figure 2-10 .
Outfall 003/4 System	Outfalls 003/4 Diversion Facility, Diversion Sewer or Tunnel, and Wet Weather Pumping Station	Option 1 – Hooffs Run Diversion Sewer As described in the Outfall 003/4 System section and depicted on Figures 2-13 and 2-14 .
Wet Weather Treatment Facility	Wet Weather Treatment Facility	As described in the Wet Weather Treatment Facility section.

Mitigation Measures of the Proposed Action

Mitigation measures would be implemented as part of the proposed action to offset adverse impacts to natural and cultural resources, community resources, and visitor experience. The exact mitigation measures would depend on the final design and plan approvals by the relevant agencies.

Component options Considered but Dismissed

Numerous CSO control methodologies and other alternatives were considered and dismissed as part of the public review processes associated with the Long Term Control Plan and LTCPU. The alternatives evaluated in this EA are based on the framework approved in the LTCPU by VDEQ on June 30, 2018. Multiple component options were considered during project planning and conceptual design for RiverRenew. The options included in **Appendix C** were dismissed due to one or more of the following reasons: unacceptable impacts or costs, or limitations in engineering design or constructability.

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes existing resources and environmental conditions that could be affected through the implementation of the proposed action, as well as the potential environmental impacts associated with the no action and proposed action alternatives. The RiverRenew study area primarily encompasses urban landscapes within the City of Alexandria but also includes Jones Point Park, the bed of the Potomac River, and George Washington Memorial Parkway (GWMP), which are administrative units of the NPS¹. Potential impacts to environmental and cultural resources within the study area are described under the environmental consequences section for each resource topic. These resource topics correspond to the issues described in **Chapter 1** of this EA.

Methodology for Analyzing Impacts

Environmental consequences were analyzed in accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.16) and include considerations of the potential direct, indirect, and cumulative impacts (CEQ. 1979a). The intensity of the impacts is considered in the context of the resource's purpose and significance (40 CFR 1508.27; CEQ. 1979b). The methods used to assess impacts vary depending on the resource being considered, but are generally based on a review of data research, public input and comment, information from NPS and City of Alexandria staff, and professional judgement.

RiverRenew includes two distinct tunnel systems that connect at the AlexRenew Water Resource Recovery Facility (WRRF). The eastern tunnel system connects Outfalls 001 and 002 to the WRRF, and the western tunnel system connects Outfalls 003 and 004 to the WRRF. The environmental consequences are focused on areas of surface impacts, such as diversion facilities, open cut utility installations and areas where potential impacts to cultural landscapes and viewsheds may occur from permanent structures².

Cumulative impacts, as defined in 40 CFR 1508.7 (CEQ. 1979c), are detailed in this EA by resource, and are considered for both the no-action alternative as well as the proposed action. Cumulative impacts include items such as proposed development plans, transportation projects, and other major infrastructure currently contemplated within the study area. **Table 3-1** provides a listing of plans and projects considered in the cumulative impact analysis.

¹ Note that the Outfall 001/2 System is the only component of RiverRenew that would directly impact NPS administrative units.

² Note that the only proposed above-ground structure would be located within the AlexRenew Water Resource Recovery Facility. With the exception of small electrical cabinets, all other permanent infrastructure would be located below ground or flush with the ground surface.

Table 3-1 Cumulative Projects

Project	Description	Status
Waterfront Plan	The Waterfront Plan, approved by the City Council in January 2012, is a 20- to 30-year vision for the area extending from Third Street (Tidelock Park) on the north to Wolfe Street (Shipyard/Harborside Park) on the south (City of Alexandria DPZ. 2012). The Plan includes a combination of flood mitigation and open space and park projects along the Alexandria Potomac River waterfront to benefit the community. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes, Local Parks	Present and Future
Robinson Terminal North Development	Previously owned by The Washington Post, the Robinson Terminal North Warehouse site is now under private ownership. The City of Alexandria has approved plans for a mixed-use development that maintains public open space along the Potomac River waterfront. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes	Future
Old Dominion Boat Club	Construction of a new facility on the waterfront began in 2016 and was completed in late 2017. This facility includes a marina that extends into the Potomac River. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes	Past
Windmill Hill Park Shoreline Stabilization	Consistent with the Windmill Hill Park plan approved by the City Council in 2003 (City of Alexandria. 2003), the City recently completed a shoreline stabilization project that replaced an existing bulkhead with a natural shoreline along the Potomac River. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes	Past
Robinson Landing	Previously owned by The Washington Post, the Robinson Terminal South Warehouse site, now known as Robinson Landing, is now under private ownership and a residential development is currently under construction. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes, Historic Resources	Present
Reagan National Airport (DCA) Runway 15-33 Safety Project	Mandated safety improvement project that required fill in the Potomac River to extend runway 15-33. Affected Resources: Water Quality, Riverine Wetlands, Cultural Landscapes, Historic Resources	Past
Potomac Yard Metro Station	Construction of a new Metro subway station between the Braddock Road and National Airport Stations adjacent to the existing tracks and the Potomac Yard development. Affected Resources: Water Quality, NPS property, Non tidal Wetlands, Cultural Landscapes, Historic Resources,	Present and Future

Water Quality

Water Quality Affected Environment

Section 303(d) of the Clean Water Act (CWA) requires states to compile a list of waterbodies that do not meet USEPA-mandated water quality standards due to impairment by point and/or nonpoint sources of pollution discharge.

The study area includes portions of the Potomac River, Hooffs Run, and Hunting Creek (aka Cameron Run) embayment that are listed as being impaired by the VDEQ under the 2016 305(b)/303(d) Water Quality Assessment Integrated Report (DEQ. 2018) as noted in **Figure 3-1**. Hunting Creek's impaired listing results from *E. Coli*, low dissolved oxygen (DO) levels, polychlorinated biphenyls (PCB) in fish tissue, and PCBs in the water column. The Potomac River and Hooffs Run are listed as impaired for low DO levels, and PCBs in fish tissue. VDEQ lists the sources of impairment to be atmospheric deposition of nitrogen and toxics, CSO discharges, contaminated sediments, industrial point source discharges, nutrient recycling, riparian habitat loss, and wet weather municipal point sources. USEPA and VDEQ prepared a Total Maximum Daily Load (TMDL) for the Chesapeake Bay Watershed which covers all of these tributaries (USEPA. 2010; COV. 2010).

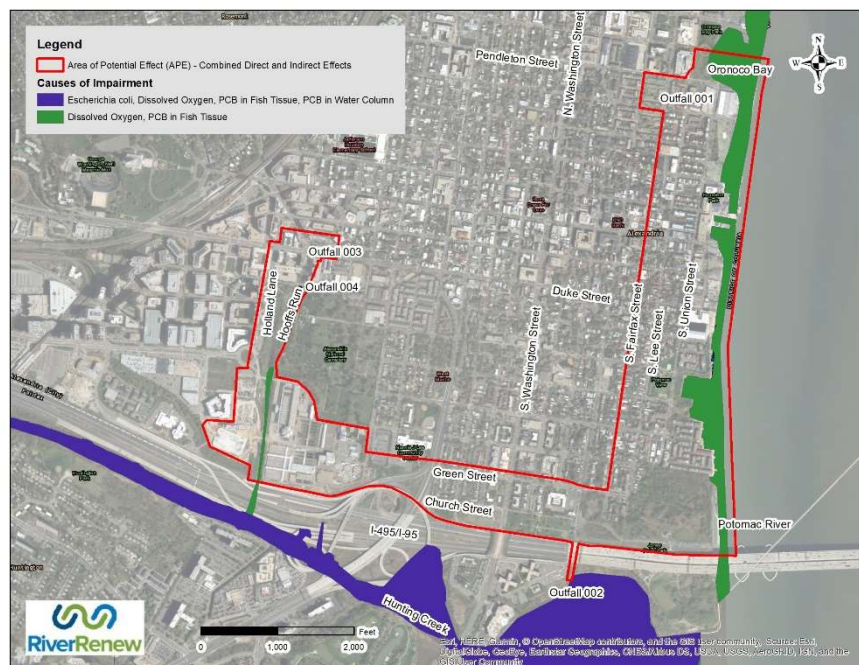


Figure 3-1. Impaired Waterways Within and Adjacent to the Study Area (USEPA. 2018)

The western bank of the Potomac River within the study area contains a mixture of riprap and bulkhead shoreline areas with few natural shorelines, with the exception of a newly constructed shoreline restoration with wetland benches along the shoreline at Windmill Hill Park.

Hooffs Run is lined with concrete from its outfall below Duke Street to just below Jamieson Avenue. The majority of the stream banks along Hooffs Run downstream of Jamieson Avenue are lined with stone riprap that has a fine layer of silt over it. The eastern bank contains a vertical steel bulkhead along the Alexandria National Cemetery. Hooffs Run south of this property is characterized by steep banks with areas of concrete rubble transitioning to riprap as the stream approaches the confluence with Hunting Creek. Hunting creek continues beneath the GWMP and discharges into the Potomac River.

Alexandria is an urbanized environment with approximately 4,273 acres of impervious surfaces, comprising approximately 43.5% of the city, served by a mixture of combined and separate sewer systems. There are four combined sewer outfalls within the City (Outfalls 001, 002, 003 and 004) that discharge a mixture of rainwater and untreated sewage into the Potomac River and its tributaries when storm events exceed the capacity of the combined sewer system. Combined sewer discharges contain a variety of pollutants, which contribute to the degradation of Hooffs Run, Hunting Creek and the

Potomac River. These pollutants include coliform bacteria, suspended solids, oil and grease, organics, and metals. The discharge of these pollutants contributes to low DO levels, which adversely impact the health of aquatic organisms, poses human health hazards, and can reduce the aesthetic quality of the surface waters of the rivers. Annually, there is an average of 70 combined wet weather event discharges from the four existing outfalls that total approximately 140 million gallons of sewage mixed with rainwater.

During high flow events, the Holmes Run Trunk Sewer and Commonwealth Interceptor Sewer can become overloaded, resulting in sewer backups into basements, and overflows into Hooffs Run through the Hooffs Run Junction Chamber (HRJC) located within Hooffs Run adjacent to the WRRF. These sanitary sewer overflows (SSO) can result in similar adverse impacts as the combined sewer discharges described above.

Water Quality Environmental Consequences

Water quality impacts were evaluated taking into consideration temporary construction disturbances, common erosion and sediment (E&S) control practices, and professional judgement. Long-term impacts to water quality were analyzed using anticipated reductions in discharges of sewage mixed with rainwater following the implementation of RiverRenew.

Impacts of Alternative A – No Action

Under the No Action alternative, there would be no new impacts to water quality; however, CSO and SSO discharges would continue to impair the Potomac River and its tributaries at their current frequency and magnitude. In a year of average rainfall, it is estimated that 140 million gallons of untreated discharges would occur. These discharges result in detrimental effects to aquatic life as well as human health and safety concerns as discussed above, and would continue to contribute to the impairments noted in the CWA Section 303(d)/305(b) report prepared by VDEQ for aquatic life, recreation, and fish consumption uses (VDEQ. 2018). The No Action alternative fails to comply with the 2017 Virginia legislative mandate or TMDL requirements, and would result in both short- and long-term adverse impacts to water quality.

Cumulative Impacts

There would be no new impacts to water quality under the No Action alternative; thus, there would be no cumulative impacts. However, CSO and SSO discharges would continue to occur at their current frequency and magnitude.

Conclusion

There would be no new impacts to water quality under the No Action alternative. However, approximately 140 million gallons of untreated sewage mixed with rainwater would continue to discharge to the Potomac River and its tributaries in a year of average rainfall and AlexRenew would not comply with the 2017 Virginia legislative mandate or TMDL requirements (VDEQ. 2018), and NPS properties would continue to be indirectly adversely impacted by the impaired waters.

Impacts of Alternative B – Proposed Action

The RiverRenew project includes the following system improvement items:

Outfall 001/2 System (NPS Administrative Unit Impacts: Potomac River Bed and Jones Point Park)

Construction of the Outfall 001 improvements includes tunneling operations, and a diversion facility, outfall extension, and emergency overflow structure. All alternatives for this outfall would require encroachments within the limits of the Potomac River, which is under jurisdiction of the NPS, U.S. Army Corps of Engineers (USACE) and VDEQ.

Construction of the Outfall 002 improvements include tunneling operations, a diversion facility and associated utility infrastructure. Surface impacts would include tree clearing, grading and piping a portion of a nontidal intermittent stream channel within Jones Point Park. This stream continues downslope of the proposed work area and ultimately connects to Hunting Creek and the Potomac River via a culvert.

Outfall 003/4 System

Construction of either the Outfall 003/4 System would require excavation within the limits of the Hooffs Run between Duke Street and Jamieson Avenue to install a diversion chamber and connect into the existing combined sewer system. The reach of Hooffs Run north of Jamieson Avenue Run where the diversion chamber is proposed is lined with concrete. A new or replacement run of sewer would then continue south down Hooffs Run either instream or along the banks where the existing Commonwealth Interceptor alignment is located to the WRRF plant area. The existing instream HRJC would be decommissioned and demolished. The entire disturbed reach of Hooffs Run would be restored and enhanced utilizing bio engineering techniques.

WRRF Upgrades

Construction activities associated with the Tunnel Dewatering Pumping Station (TDPS) and Wet Weather Treatment Facility would occur within the existing WRRF campus, which was constructed on fill. For the purposes of the environmental consequences analyses in this chapter, these activities are evaluated together as WRRF Upgrades. Proposed construction activities at the WRRF are located outside of jurisdictional wetlands or other waters of the U.S (WOTUS); however, given the highly developed and constrained project area, a small wetland area just south of the WRRF may be impacted to provide adequate contractor laydown and storage.

Water Quality Implications

Construction of the RiverRenew components, including tunnel mining operations, would require ground disturbance, temporary soil stockpiling, and dewatering practices to recover sediment-laden waters from underground work areas. These activities could result in temporary impacts to water quality; however, strict E&S control measures would be required in areas of ground disturbance to prevent construction-related water quality degradation, in accordance with the Code of Virginia § 62.1-44.15:52 (COV. 2017); Regulation Title 9, 9VAC25-840-40 (COV. 2016) as well as the Alexandria City Ordinance Title 5, Chapter 4, Section 5-4-1 to Section 5-4-19.1 (City of Alexandria. 2016). E&S controls may include, but are not limited to a combination of the following methods: silt fencing, cofferdams, hay bales, temporary stormwater basins, diversion channels, dewatering sediment bags, erosion control matting, stone stabilized construction entrances and stabilizing vegetation. Options to minimize sediment migration associated with activities within jurisdictional WOTUS include cofferdam installation behind full-depth turbidity curtains, or other manufactured barrier and cofferdam systems. Sediment-laden water associated with construction activities would be filtered through a state approved method of E&S treatment. All E&S controls would be approved by VDEQ prior to implementation.

The implementation of RiverRenew is anticipated to capture 98% of combined sewer flows, reduce the number of overflows to the Potomac River watershed from 60 to 4 in a year of average rainfall, and eliminate SSOs. By reducing CSO discharges and eliminating SSO discharges, pollutant loads of *E. coli* and PCBs would be significantly decreased, thereby providing considerable long-term benefits to the water quality of the Potomac River and the Chesapeake Bay.

Cumulative Impacts

As shown in **Table 3-1**, several other projects along Alexandria's waterfront are currently in construction, have been planned for construction or have been constructed recently and have the potential to contribute to the overall water quality. Newer construction projects are required to comply with current state and local stormwater regulations which regulate non-point source runoff that can adversely affect water quality. Provided the projects noted in **Table 3-1** are designed in accordance with state and local regulations, and best management practices are used, they are not anticipated to cumulatively adversely impact overall water quality in the Potomac River, Hunting Creek, or Hooffs Run.

Conclusion

Alternative B would result in significant long-term water quality improvements to the Potomac River watershed through the capture and treatment of an estimated 98% of combined sewer flows in an average year of rainfall. The implementation of E&S controls and approved dewatering methods would minimize short term adverse impacts to water quality that may occur during construction, including within the Potomac River bed and Jones Point Park. As this project would result in minimal adverse cumulative impacts, any adverse short-term cumulative impacts from construction would be outweighed by substantial long-term water quality improvements that would benefit active and passive recreation along the Potomac River, including within Jones Point Park.

Wetlands

Wetlands Affected Environment

The study area includes tidal and non-tidal jurisdictional wetlands and other WOTUS, as defined in accordance with the *1987 U.S. Army Corps of Engineers Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* (USACE. 1987; USACE. 2012). The study area also includes riverine wetlands defined in accordance with the Federal Geographic Data Committee (FGDC) Wetlands Classification Standard (FGDC-STD-004-2013; FGDC. 2013). The FGDC Wetlands Classification Standard defines riverine wetlands as the areas within a waterway of a depth of 2.5 meters (8.2 feet) or less at low water, or at the limits of emergent or woody vegetation extending beyond this depth (FGDC. 2013). Riverine wetlands were identified utilizing the National Oceanic and Atmospheric Administration (NOAA) predicted Mean High Water (MHW) at the Alexandria Station approximately 3.25 feet above Mean Low Water (MLW) Station ID 8634214.

Within the study area, the majority of tidal wetland areas hug the shorelines of the waters of the Potomac, Hooffs Run, and Hunting Creek from the MLW to just above the Mean High Tide Line. Non-tidal wetlands occur primarily within the undeveloped areas and drainage ditches of Jones Point, Oronoco Bay Park and African American Heritage Park. **Figure 3-2** below details the locations of wetlands in the study area.

In accordance with the *NPS Procedural Manual 77-1*, NPS requires the preparation of a Wetland Statement of Findings (SOF) for projects with unavoidable impacts to wetlands that exceed 0.10 acre. The SOF must also document compliance with NPS wetland protection procedures and describe the NPS proposal to compensate for the conversion, degradation or loss of wetland area and/or function (NPS. 2016). A SOF has been prepared for RiverRenew and is provided as **Appendix D**. Through the Section 401 and Section 404 of the CWA permitting processes, the USACE and/or VDEQ may also stipulate mitigation requirements.

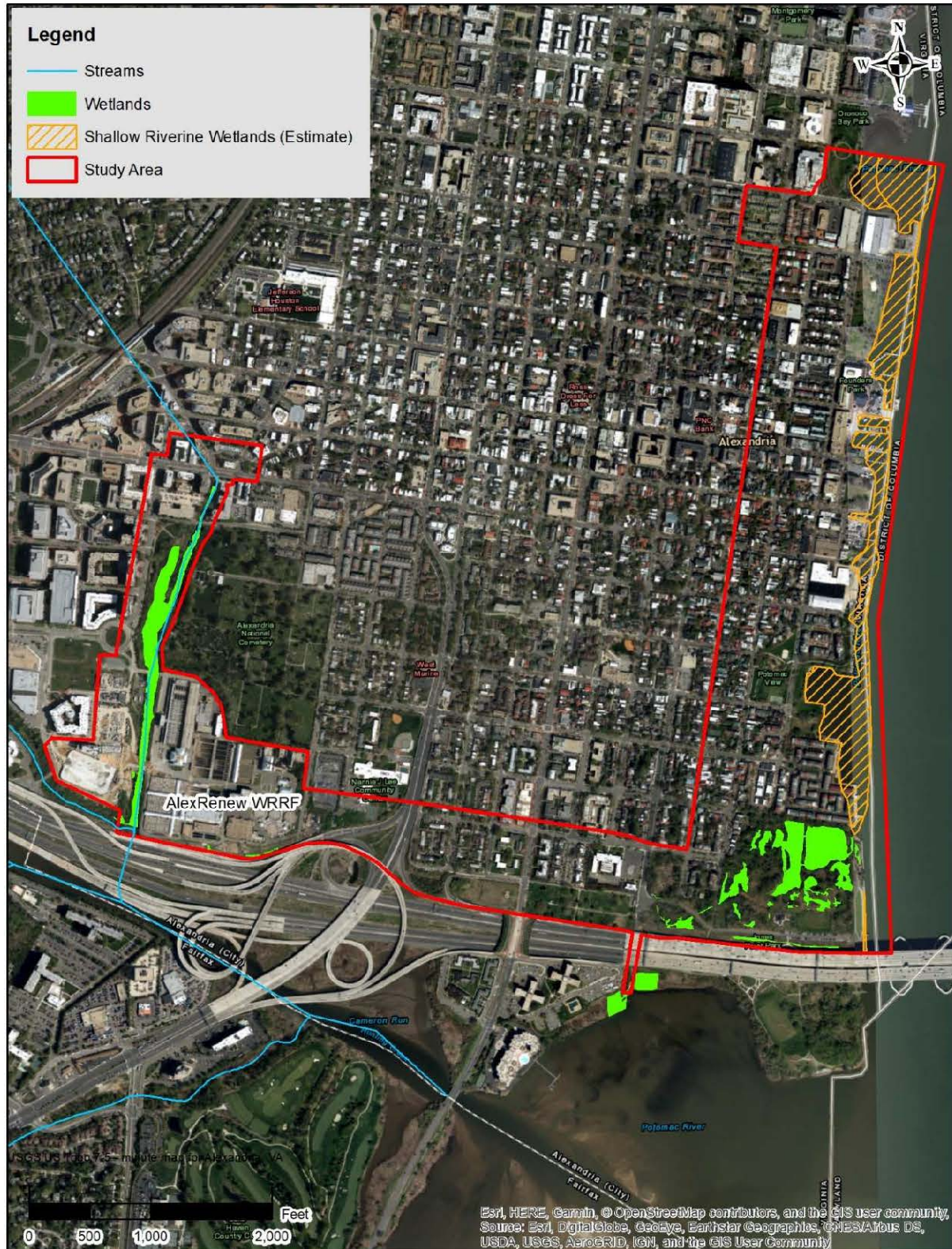


Figure 3-2. Wetlands Within the RiverRenew Study Area
(USACE Field Confirmation on 2/26/19)

Wetlands Environmental Consequences

To analyze impacts to wetlands, wetland delineations were conducted for the Outfall 003/4 System and WRRF Upgrades in April 2018, and for the Outfall 001/2 System in November 2018. A bathymetric survey, conducted in September 2018 and December 2018, was utilized to delineate the extent of riverine wetlands within proposed construction limits. Preliminary grading plans and limits of disturbance were used to calculate potential wetland impacts

Impacts of Alternative A – No Action

Under the No Action alternative, no new impacts to, or loss of or existing wetlands and WOTUS would occur. Untreated combined sewer discharges would continue to flow into the Potomac River, Hooffs Run and Hunting Creek, negatively impacting water quality and aquatic ecosystems, as described above. The presence of bacteria such as *E. coli*, PCBs and other pollutants associated with combined sewer overflows at current levels would continue to reduce the suitability of riverine and tidal wetland habitat for certain aquatic species and recreational uses.

Cumulative Impacts

Under the No Action alternative, untreated discharges would continue to occur to the Potomac River, contributing to the incremental increase of the adverse cumulative impacts of other projects. The Reagan National Airport Runway Safety Enhancements project previously impacted approximately 1.94 acres of tidal riverine wetlands.³ In addition, the Woodrow Wilson Bridge project previously impacted tidal and non-tidal wetlands within the study area, and specifically within Jones Point Park. Mitigation for the Woodrow Wilson Bridge impacts was provided through on-site and off-site wetland creation activities within Jones Point Park as well as several mitigation banks located within the Potomac River watershed. If approved by NPS, the Potomac Yard Metro Station project would result in approximately 3.57 acres of temporary and permanent non-tidal wetland impacts.⁴ Additionally, impacts to tidal and non-tidal wetlands have occurred in the City of Alexandria dating back to its charter; many of these historic impacts predated the CWA and other wetlands protections. See **Figures 3-9** and **3-10** for a display of historic Alexandria shorelines.

Conclusion

There would be no new impacts to wetlands under the No Action alternative. However, the continued discharge of untreated sewage mixed with rainwater would degrade the health of riverine wetlands and other WOTUS, including those on and along NPS property, the Potomac River and Jones Point Park Hunting Creek shoreline, which are impaired for recreation, aquatic habitat, and fish consumption uses noted under the CWA Sections 303(d)/305(b) Integrated Reports for the District of Columbia and Virginia (DC DOEE, 2016; VDEQ, 2018).

Impacts of Alternative B – Proposed Action

It is anticipated that the proposed action would capture 98% of combined sewer overflows and limit discharges to 4-6 times per year of average rainfall. SSOs along the Holmes Run Trunk Sewer would also be mitigated after implementation of the RiverRenew project. By reducing the harmful pollutants entering the waterbodies through combined sewer discharges and sanitary sewer overflows, aquatic habitat and recreation use impairments within the riverine wetland areas noted under the VDEQ and the District of Columbia 2016 305(b)/303(d) Water Quality Assessment Integrated Reports (DC DOEE, 2016; VDEQ, 2018) would be improved over the short and long term.

³ As reported in the March 2013 NPS Statement of Findings for Wetlands.

⁴ As reported in the April 5, 2019 USACE public notice.

Based on the definition of riverine wetlands (FGDC. 2013), only the Outfall 001 diversion facility (all options) is proposed in such an area. The Outfall 002 diversion facility (Royal Street options) and Outfall 003/4 System (all options) would result in some impacts to non-tidal and/or tidal wetlands and other WOTUS. Construction of the Deep Tunnel, Wet Weather Pumping Station and Tunnel Dewatering Pump Station are not anticipated to impact any wetlands or other WOTUS. **Tables 3-2** and **3-3** provide a summary of impacts to wetlands and other WOTUS that are anticipated with each option under the Outfall 001/2 System, as well as the Outfall 003/4 System and WRRF Upgrades, respectively.

Table 3-2. Anticipated Outfall 001/2 System Impacts to Wetlands and other WOTUS

Element (Option)	Riverine Wetlands (NPS Jurisdiction)		Waters of the U. S. (USACE Jurisdiction*)		Wetlands (USACE Jurisdiction*)		Total** Impacts
	Permanent Impacts	Temporary Impacts	Permanent Impacts	Temporary Impacts	Permanent Impacts	Temporary Impacts	
Outfall 001 Diversion Facility (Oronoco Bay East)	0.29 AC	0.73 AC	0.29 AC	0.73 AC	N/A	N/A	1.02 AC
Outfall 001 Diversion Facility (Oronoco Bay West)	0.23 AC	0.70 AC	0.23 AC	0.70 AC	N/A	N/A	0.93 AC
Outfall 001 Diversion Facility (Oronoco Bay North)	0.23 AC	0.70 AC	0.23 AC	0.70 AC	N/A	N/A	0.93 AC
Outfall 001 Diversion Facility (Robinson Terminal North)	0.28 AC	0.12 AC	0.28 AC	0.12 AC	N/A	N/A	0.40 AC
Outfall 002 Diversion Facility (Green Street)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Outfall 002 Diversion Facility (Royal Street North)	N/A	N/A	107 LF	N/A	N/A	N/A	107 LF
Outfall 002 Diversion Facility (Royal Street South)	N/A	N/A	107 LF	N/A	N/A	N/A	107 LF

*Numbers are approximate until final design. VDEQ and/or VMRC may also exert jurisdiction, NPS riverine jurisdiction overlaps USACE WOTUS jurisdiction. **Total Impacts do not double count for the overlapping NPS & USACE jurisdiction.
Note: AC = Acre, LF = Linear Feet, N/A = Not applicable

Table 3-3. Anticipated Outfall 003/4 System and WRRF Upgrades Impacts to Wetlands and other WOTUS

Element (Option)	Riverine Wetlands (NPS Jurisdiction)		Streams (USACE Jurisdiction*)		Wetlands (USACE Jurisdiction*)	
	Permanent Impacts	Temporary Impacts	Permanent Impacts	Temporary Impacts	Permanent Impacts	Temporary Impacts
Outfall 003/4 (Hooffs Run Diversion Sewer)	N/A	N/A	150 LF	1,550 LF	0.01 AC	0.45 AC
Outfall 003/4 (Holland Lane Diversion Sewer)	N/A	N/A	N/A	N/A	N/A	N/A
Outfall 003/4 (Hooffs Run Deep Tunnel)	N/A	N/A	N/A	N/A	0.13 AC	N/A
WRRF Upgrades	N/A	N/A	N/A	N/A	0.02 AC	N/A

*Numbers are approximate until final design. VDEQ and/or VMRC may also exert jurisdiction.

Note: AC = Acre, LF = Linear Feet, N/A = Not applicable

Outfall 001/2 System (NPS Administrative Unit Impacts: Potomac River Bed and Jones Point Park)

Construction of the Outfall 001 diversion facility, outfall extension, and overflow structure would extend into the Potomac River and are the only elements of RiverRenew located within riverine wetlands. The Robinson Terminal North option is anticipated to result in permanent and temporary impacts to approximately 0.28 acre and 0.12 acre respectively of riverine wetlands. The Oronoco Bay East option is anticipated to result in permanent and temporary impacts to approximately 0.29 acre and 0.73 acre respectively of riverine wetlands. For both options, unconsolidated soft bottom habitat within the Potomac River would be replaced by a hardened overflow structure. Currently over 680 acres of unconsolidated soft bottom habitat exists in the Potomac River between Madison Street and the Woodrow Wilson Bridge (USFWS. 2018a). As such, the amount of lost habitat would be very small compared to the total amount of soft bottom habitat within the Potomac River.

Construction of the Outfall 002 diversion facility is anticipated to result in permanent impacts to 107 linear feet of intermittent stream channel. Drainage from the existing culvert underneath Jones Point Drive would be conveyed through the disturbance area in a new culvert and discharge to a new riprap-lined outfall channel to maintain hydrology to the adjacent wetlands located downslope of the disturbed area.

Outfall 003/4 System

Construction of the Hooffs Run Diversion Sewer is anticipated to result in the permanent impact to approximately 150 linear feet of tidal/perennial (R1/R3) stream channel (Hooffs Run), the permanent conversion impact of 0.01 acre of PFO wetlands as well as the temporary impact of approximately 0.45 acre of estuarine emergent (EEM) wetlands and 1,550 linear feet of perennial stream channel (Hooffs Run). The permanent stream impact would result from the construction of a new diversion chamber at Outfall 004 and other sewer infrastructure along the western bank of Hooffs Run. The permanent conversion PFO wetland and temporary EEM wetland impacts would result from the installation of a new 72-inch diversion sewer. The temporary stream impacts would result from diversion sewer installation, the removal of the HRJC, construction of an HGL control structure at the WRRF, as well as the anticipated stream bed and bank restoration efforts proposed after the installation of the diversion sewer is complete.

Construction of the Holland Lane Diversion Sewer and Hooffs Run Deep Tunnel options are not anticipated to result in impacts to jurisdictional wetlands or other WOTUS.

WRRF Upgrades

Construction activities associated with the WRRF Upgrades are not anticipated to result in any impacts to jurisdictional wetlands or WOTUS. However, wetlands may be impacted if the area is used for temporary construction laydown, which would result in permanent impact to approximately 0.02 acre of palustrine emergent (PEM) wetlands.

Mitigation

In accordance with *Procedural Manual 77-1*, NPS requires mitigation to compensate for conversion, degradation, or loss of wetland area and/or function (NPS. 2016). Through the CWA Section 401 and Section 404 permitting processes, the USACE and/or VDEQ may also stipulate mitigation requirements. An SOF has been prepared for the project and is provided within **Appendix D**. The SOF provides details regarding mitigation that is proposed to compensate for wetland impacts resulting from implementation of RiverRenew. Due to the small amounts of impacts to riverine wetlands and other WOTUS, and the mitigation that would be implemented to compensate for the impacts, the short-term adverse impacts to wetlands would be negligible under Alternative B. Over the long-term, the reduction of untreated combined sewer discharges to the Potomac River would result in a net benefit to wetlands by improving water quality and the suitability of riverine and estuarine wetlands habitat for aquatic species, and other riparian uses.

Cumulative Impacts

The Projects listed in **Table 3-1** require construction within the Potomac River that may result in temporary water quality impacts and an associated reduction in the suitability of riverine wetlands habitat. It is assumed that strict E&S controls, as required by VDEQ, would be employed during construction of all these projects, resulting in minimal adverse cumulative impacts in the short- and long-term. Under Alternative B, temporary and permanent impacts to riverine wetlands, as well as other tidal and non-tidal jurisdictional wetlands and other WOTUS, would contribute a small adverse increment to short-term cumulative impacts that would be mitigated through permitting processes. Over the long-term, implementation of Alternative B would significantly reduce combined sewer discharges to the Potomac River, Hunting Creek and Hooffs Run that would improve water quality and the suitability of riverine and other wetland habitat for aquatic species.

Conclusion

Any of the Outfall 001 Diversion Facility options would result in temporary and permanent impacts to NPS Potomac River property including riverine wetlands. If selected for implementation, the Outfall 002 Royal Street Diversion Facility Options and the Outfall 003/4 Hooffs Run Diversion Sewer option would result in temporary and permanent impacts to tidal and non-tidal jurisdictional wetlands and other WOTUS. Short- and long-term adverse impacts are anticipated to be minimal based on the proposed permanent impacts and with the implementation of acceptable mitigation measures that would be determined through the NPS and CWA permit review processes. Reducing combined sewer discharges would improve water quality and habitat for aquatic species in the long-term, which aligns with the goals of CWA 303(d).

Visitor Use and Experience

Visitor Use and Experience Affected Environment

The City of Alexandria provides many opportunities to residents and tourists for recreation and interpretation within a variety of federal, regional and local parklands (**Table 3-4**).

Table 3-4. Park Properties within Study Area

Property Jurisdiction and Name	Sum of Acreage (Acres)	Number of Park Properties
National Park Service	42.1	2
George Washington Memorial Parkway, including Jones Point Park and Mount Vernon Trail	33.4	1
Potomac Riverbed	8.7	1
Local & Regional Parks	32.3	21
Historic Regional Park (Carlyle House)	1.9	1
City Historic and Destination Parks	20.9	17
Neighborhood Park (African American Heritage Memorial Park)	6.4	1
Shared Use (Nannie J. Lee Recreation Center)	1.8	1
Natural Area (Holland Lane)	1.3	1

National Park Service Administrative Units

Within the study area, the NPS manages the GWMP, which includes Jones Point Park and the Mount Vernon Trail, as well as the bed of the Potomac River along the City of Alexandria waterfront. Note that the NPS lands within the RiverRenew study area are intersected by only the Outfall 001/2 System elements. The other RiverRenew components are located outside of NPS lands.

Jones Point Park

The RiverRenew study area includes only the portion of Jones Point Park located north of the Woodrow Wilson Bridge and around existing Outfall 002. This portion of the park is approximately 33.4 acres and includes large forested areas, wetlands, two garden plots, a multi-use field, a tot lot, a fishing pier, a portion of the Mount Vernon Trail, and a parking lot for 95 vehicles. There is also a canoe launch that allows visitors to access the Potomac River for canoeing and kayaking.

Figure 3-5 details the 2017 NPS planned park uses and facilities within Jones Point Park. There are approximately 1.3 acres of community gardens within the study area, which include both the Lee Street and Royal Street gardens. Garden plots are leased by the NPS. There are also approximately 23 acres of forest within the Jones Point Park study area. According to the NPS event calendar, Jones Point Park hosts approximately 30 public events per year.

Mount Vernon Trail

The Mount Vernon Trail is an 18-mile paved multi-use trail that connects George Washington's Mount Vernon Estate to Theodore Roosevelt Island. The Mount Vernon Trail traverses from north of the study area along the Potomac River on a separate path to Pendleton Street where it then joins the roadway along Union Street and follows until it then separates again at South Union Street just north of Jones Point Park. Within Jones Point Park, the trail follows the northern and eastern perimeter of the park, then turns west under the Woodrow Wilson Bridge to continue along the GWMP.

According to bikearlington.com, the northern end of the Mount Vernon Trail had approximately 152,819 bicycle users and over one million pedestrians in a six-month period from January to June 2017.⁵ Use numbers appear to decrease slightly for the section of Mount Vernon Trail south of the Woodrow Wilson Bridge. Data provided from the NPS noted the Mount Vernon trail use just south of Jones Point Park and north of the Hunting Creek Bridge during 2017 and 2018 ranges from 13,762 to 49,031 pedestrians and bicyclists per month. The lowest use numbers were typically recorded in

⁵ Counts were taken just south of Marina Drive (Bike Arlington. 2019.).

December and January, and the highest use during July and August. All numbers may include both north and southbound users and may count the same users more than once.



Figure 3-5. 2017 Jones Point Park Planned Uses & Facilities (NPS. 2017)

Potomac River Bed

The Potomac River offers many opportunities for residents and visitors to enjoy water-based activities. The study area includes approximately 8.7 acres of Potomac River bed along the Alexandria waterfront bounded to the north by Oronoco Bay, to the south by the Woodrow Wilson Bridge, and extends approximately 100 feet east of the Commonwealth of Virginia boundary. There are numerous parks and marinas along the Alexandria waterfront that provide opportunities for boating, water taxis, and sightseeing.

Local and Regional Parks

The study area contains portions of 21 publicly-owned Alexandria City Parks. These parks include smaller landmarks such as historic alleyways as well as larger waterfront recreational parks and range from 0.02 acre to 6.3 acres. Overall there are approximately 32.3 acres of local and regional parks within the study area (**Table 3-4**).

Oronoco Bay Park is the only local waterfront park within the study area that contains proposed surface impacts. The park encompasses approximately 2.5 acres between Pendleton Street and Madison Street and provides opportunities for biking, picnicking, walking and jogging. Visitors can also enjoy views of the Potomac River, Washington D.C. and Maryland. The park hosts the City's annual birthday celebration with orchestral and band performances along with a fireworks display.

The African American Heritage Park is located in the Carlyle area of Alexandria between Holland lane and Hooffs Run. This park is approximately 7.6 acres, including a 1-acre, 19th century African American cemetery. The park also contains sculptures, wetland areas, and a walking path with boardwalk through wetland areas.

The City of Alexandria's 2012 Waterfront Plan, referenced in **Table 3-2**, is intended to serve as a guide for redevelopment of the Alexandria waterfront from Third Street to Wolfe Street. The redevelopment includes parks and plans for public recreational access, as well as the implementation of a flood mitigation system.

Noise

The study area is located within the City of Alexandria, which is an urban setting that experiences higher than typical ambient noise generated by airplanes, vehicle traffic, construction and other noise generating activities. Noise-sensitive receptors within the study area include federal, local and regional parks, as well as residences, schools, cemeteries and businesses. The NPS administrative units and City parks are located adjacent to or within the Reagan National Airport flight path, but outside of the 2004 Noise Contours for 65 decibels day-night average sound level (DNL). Vehicular noise is generated by local traffic along the secondary streets, City Bus and Trolley routes, tour bus use, interstate traffic, and commuter use particularly along I-495, Duke Street, Eisenhower Avenue, and GWMP/Washington Avenue. All of these existing uses involve the generation of noise and vibration at higher levels than a rural setting. **Table 3-5** details typical baseline range of noise levels of average uses within the study area.

Table 3-5. Typical Range of Sound

Typical Range of Sound		
Common Outdoor Activities	Noise Level dBA	Common Indoor Activities
Jet Fly-over at 300 m (1000 ft)	110	Rock Band
Gas Lawn Mower at 1 m (3 ft)	100	
Diesel Truck at 15 m (50 ft), at 80 km/hr (50 mph)	90	Food Blender at 1 m (3 ft)
Noisy Urban Area, Daytime	80	Garbage Disposal at 1 m (3 ft)
Gas Lawn Mower at 30 m (100 ft)	70	Vacuum Cleaner at 3 m (10 ft)
Commercial Area	60	Normal Speech at 1 m (3 ft)
Heavy Traffic at 90 m (300 ft)	50	Large Business Office Dishwasher, Next room
Quiet Urban Daytime	40	Theater, Large Conference Room (Background)
Quiet Urban Nighttime	30	Library
Quiet Suburban Nighttime	20	Bedroom at Night, Concert Hall (Background)
Quiet Rural Nighttime	10	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

AlexRenew commissioned ambient acoustical surveys to document existing background noise levels in the vicinity of proposed RiverRenew construction staging areas. To represent background sound levels, the surveys utilized the L90 metric in the A-weighted decibel scale⁶. The L90 represents the sound levels which are exceeded for 90% of the time and it is often used to describe background levels from non-specific sources. For the purposes of the study, daytime is defined by the City of Alexandria construction hours presented in **Table 3-6**. All other times are considered nighttime, and work is generally prohibited. Daytime readings were typically between 55 and 65 dBA and nighttime values dropped to as low as 42 dBA (AlexRenew. 2019).

The City of Alexandria's Office of Environmental Quality (OEQ) is responsible for enforcing Noise Control in the City of Alexandria. The Noise Control Code (NCC) can be found in Section 11-5 in the Alexandria City Code (City of Alexandria. 2017). The code restricts certain noise producing activities between the hours noted in the **Table 3-6**. Noise producing activities associated with construction can exceed approved levels, or occur during the prohibited hours if a variance has been issued by the City Manager in the case of urgent necessity in the interest of public health. Section 11-5-7 of the City Noise Code describes the process required to apply for a noise variance. Note that if a variance is approved and construction extends into the evening hours, temporary lighting could be erected to illuminate the construction staging areas, contributing to elevated nighttime noise levels and light pollution.

⁶ The A-weighted decibel scale is a common frequency weighting that effectively cuts of the lower and higher frequencies that the average person cannot hear.

Table 3-6. City of Alexandria Construction Hours

Construction Hours - The use of Construction Devices and Power Equipment (Sec. 11-5-4 (b)15) is permitted during the following hours:	
Monday - Friday: 7:00 a.m. to 6:00 p.m.; Saturday: 9:00 a.m. to 6:00 p.m.; Sunday: Prohibited	
Pile Driver use (Sec. 11-5-4 (b)19) is permitted during the following hours and days of the week:	
Monday - Friday: 9:00 a.m. to 6:00 p.m.; Saturday: 10:00 a.m. to 4:00 p.m.	
All construction is prohibited on the following holidays (Sec. 11-5-5(a)(5)a):	
New Year's Day (first day of January)	Labor Day (first Monday in September)
Memorial Day (last Monday in May)	Thanksgiving Day (fourth Thursday in November)
Independence Day (July 4)	Christmas Day (December 25)

Traffic and Transit

AlexRenew conducted a traffic analysis in early 2019 to document levels of service (LOS) for various intersections within the study area. A LOS analysis is utilized to assess the overall operating conditions of intersections and to characterize them based on travel times and number of vehicles (**Table 3-7**).

Table 3-7. Level of Service Designations*

Level of Service	Definition
LOS A	Free-flow traffic with individual users virtually unaffected by the presence of others in the traffic stream.
LOS B	Stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users.
LOS C	Restricted flow that remains stable but with significant interactions with others in the traffic stream. The general level of comfort and convenience declines noticeably at this level.
LOS D	High-density flow in which speed and freedom to maneuver are severely restricted and comfort and convenience have declined even though flow remains stable.
LOS E	Unstable flow at or near capacity levels with poor levels of comfort and convenience.
LOS F	Forced traffic flow in which the amount of traffic approaching a point exceeds the amount that can be served. LOS F is characterized by stop-and-go waves, poor travel times, low comfort and convenience, and increased accident exposure.

*As defined by the Virginia Department of Transportation (VDOT. 2019)

The LOS was predicted for the year 2025, assuming a growth rate of 1% per year to identify a baseline condition during the period of construction. The LOS analysis included roads within the study area near proposed construction areas and haul routes (**Table 3-8**). Conceptual maintenance of traffic (MOT) plans for each project component and option were taken into account to analyze the LOS during active construction.

Table 3-8. Roads Included in Level of Service Analysis

Element	Analyzed Road
Outfall 001 Diversion Facility	N. Union St and Pendleton St between Oronoco St and Fairfax St
	Oronoco St between N. Fairfax St and N. Union St
	N. Fairfax St between Oronoco St and Pendleton St
Outfall 002 Diversion Facility	S. Royal St, south of Green St
Outfall 003/4 Diversion Facility	Duke Street in vicinity of Daingerfield Rd and S. Peyton St
	Daingerfield Rd near Duke St
	S. Peyton St near Duke St
Outfall 003/4 Diversion Sewer	Jamieson Ave between Holland Ln and S. West St
TDPS and WWTF Elements	Holland Ln between Jamieson Ave and WRRF

Public transportation is widely available in the City. The King Street Trolley operates year-round and runs from the King Street Metro Station to the Potomac River. Additionally, Metro and DASH bus routes run primarily north and south along Fairfax Street in the northeastern portion of the study area, shifting over to Royal Street after King Street, then turning west up Franklin Street. There are bus stops located at the intersection of Washington Street and Church Street and Washington Street and Green Street. The western section of the study area contains two bus stops along Duke Street.

Visitor Use and Experience Environmental Consequences

Qualitative evaluation was used to analyze the impacts of each alternative on park visitors and surrounding communities. Disruptions to the park settings, recreational activities, and the community, including construction related noise and traffic, were considered. The analysis of potential impacts was completed using data provided by NPS staff, technical experts, professional judgement, public comments and experience with similar past projects.

Impacts of Alternative A – No Action

There would be no new impacts to visitor use or experience under the No Action alternative. However, untreated combined sewer discharges would continue to flow into the Potomac River, Hunting Creek, and Hooffs Run during rain events resulting in degraded water quality. Riparian visitor use activities and experience along the Potomac River, including boating and other water-based recreational activities, would remain diminished by the presence of untreated sewage and debris discharged during and after storm events. Combined sewer discharges would still pose health and safety hazards related to direct contact with the water, and can also detract from the overall outdoor riparian experience due to odors. Standards for safe swimming in Hooffs Run, Hunting Creek, and the Potomac River would remain unattainable during and immediately after combined sewer discharges.

Cumulative Impacts

The future implementation of all or portions of the City's Waterfront Plan would increase visitor use by providing more opportunities for access along and to the Potomac River. It is anticipated the Waterfront plan or portions of it would continue to be implemented, therefore, cumulative impacts associated with the No Action alternative are consistent with existing City plans.

Conclusion

New impacts to visitor use under the No Action alternative in the City of Alexandria, including NPS properties, would be limited to those identified in the Waterfront Plan and other planned development along the Alexandria waterfront. Discharges of untreated sewage mixed with rainwater would continue to diminish the experience for visitors of surrounding recreational areas limiting water-based activities after large rain events, through the prohibition of water-based recreational uses at and around the outfalls.

Impacts of Alternative B – Proposed Action

Construction of RiverRenew components and associated infrastructure is scheduled to start in November 2020 and must be completed and operational by July 1, 2025 to comply with the Virginia legislative mandate. Tunnel mining operations at the WRRF are expected to occur for approximately 3 years. The Outfall 001/2 System diversion facilities and Outfall 003/4 System options would each take approximately 2 to 2.5 years to construct. The WRRF Upgrades would take approximately 1 to 2 years to construct. The approximate limits of construction areas are depicted on **Figures 2-4 through 2-17** in **Chapter 2** of the EA. These construction limits represent the anticipated total area needed for construction, including ground disturbance and staging, and would be off limits to the public during construction. It should be noted that AlexRenew would coordinate with NPS, City of Alexandria, and other stakeholders to determine an approach for construction phasing that would allow for efficient construction operations while attempting to reduce impacts to traffic or community resources, as well as avoiding conflicts with other projects in the vicinity.

National Park Service Administrative Units

Jones Point Park

Construction of the Outfall 002 Diversion Facility Option 1 (Green Street) would be disruptive to park visitors and the community gardens. In order to construct this option, S. Royal Street (south of Green Street) would be closed for an extended period of time which would require a temporary alternative entrance to Jones Point Park. Additionally, construction would occur immediately adjacent to the community gardens and require closure of the garden access off Green Street. AlexRenew would coordinate with NPS to identify an alternative Park entrance, as well as to ensure garden access is maintained throughout construction. Following construction, S. Royal Street and the garden access road off Green Street would be restored and reopened.

Construction of the Outfall 002 Diversion Facility Option 2 or 3 (Royal Street North or South) would be minimally disruptive to park visitors. In order to construct either option, a portion of S. Royal Street would be closed for an extended period of time; however, the closure would occur south of the entrance to Jones Point Park. Access to the community recycling center and daily use by the Basilica School for student drop off and pickup would be maintained in the S. Royal Street cul-de-sac throughout construction. Additionally, construction operations would occur further from the community gardens and would not impede garden access. However, noise from the construction site would be audible in the community gardens, and the adjacent park and trail areas just north of the Woodrow Wilson Bridge. These diversion facility options are located in an area of the park that contains heavy undergrowth vegetation with no formal or informal trails. It is primarily utilized for passive recreation and also acts as natural buffer from the Woodrow Wilson Bridge and other urban encroachments. Following construction, S. Royal Street would be reopened and the limits of construction would be restored in accordance with a plan approved by AlexRenew and NPS. Bicycle and pedestrian access would be maintained along S. Royal Street throughout construction, resulting in no long-term impacts to bicycle and pedestrian circulation.

Construction of the Outfall 002 Diversion Facility Option 2 or 3 is anticipated to impact approximately 0.05 acre of maintained areas and 0.95 of vegetated or forested area, including approximately 59 trees. These impacts could affect the visitor use experience through the reduction of the natural buffer and setting for uses like bird watching, and biological studies. These impacts would be mitigated through an approved restoration and mitigation plan.

Mount Vernon Trail

The portion of Mount Vernon Trail near Oronoco Bay Park is not anticipated to be affected by three of the four options for the Outfall 001 Diversion Facility. The Oronoco Bay West option, however, would

require the trail to be detoured along City streets for approximately 2.5 years during construction. The portion of Mount Vernon Trail within Jones Point Park would not be affected by the proposed action. However, in order to provide safe passage during construction, periodic detours may be necessary for those riders who utilize the existing and planned Royal Street Neighborhood Bikeway to connect to Mt. Vernon Trail. Permanent impacts to existing bike and pedestrian routes are not anticipated. The proposed action would accommodate roadway, bike lane and pedestrian detours during construction as necessary and would include a variety of communication measures to advertise upcoming trail and roadway detours or closures. Anticipated detours are not expected to be more than two city blocks.

Potomac River

Construction of the Outfall 001 Diversion Facility would be disruptive towards events and recreational activities within the Potomac River as well as along the shoreline and southern portion of Oronoco Bay Park. The areas to be disturbed for the outfall and diversion facility are currently overgrown bank with broken concrete bulkhead and riprapped shoreline, as well as some soft sediment areas from the outfall to the limits of the new extension. Construction for the RiverRenew project would also impact landscaped portions of the affected properties.

Local and Regional Parks

Impacts to recreational uses for local park visitors related to the implementation of RiverRenew would be concentrated around proposed areas of surface disturbance near the existing Outfall 001 in Oronoco Bay Park (all Outfall 001 diversion facility options), as well as downstream of Outfalls 003 and 004 within the African American Heritage Park (Hooffs Run Diversion Sewer option). Impacts to park aesthetics such as landscaping, forested and natural areas, and viewsheds are anticipated with all options. Accessibility within these parks could be temporarily impacted, and noise levels are anticipated to be elevated temporarily during construction.

Construction of the Outfall 001 Diversion Facility would be disruptive toward recreational activities and City of Alexandria-sponsored events within Oronoco Bay Park, with the exception of the Robinson Terminal North option. To avoid potential conflicts or inconsistencies with the City of Alexandria's Waterfront Plan, the final surface treatments at the Outfall 001 Diversion Facility would be coordinated closely with the City of Alexandria and NPS during the planning and design processes to incorporate aspects of the plan where feasible, and to assure the project does not preclude the City's overall vision of the Waterfront Plan.

Construction of the Hooffs Run Diversion Sewer option is not anticipated to impact federal parklands and/or cemeteries; however, construction activities would temporarily disrupt recreational activities within the African American Heritage Park. Replacing the existing Commonwealth Interceptor Sewer in its current alignment through the African American Heritage Park would require temporary closure of a portion of the trail along Hooffs Run as well as grassy areas near Jamieson Avenue. Based on preliminary plans, this option would impact approximately 2.52 acres of forested area and 0.64 acre of landscaped impacts, the majority of which are located within the park.

Construction would likely involve significant temporary impacts on park uses as visitors would have limited access within the park, and would be subjected to construction noise. This park is frequently used for a variety of passive outdoor recreation activities including dog walking, picnics and wildlife observation. To mitigate the temporary construction impacts, AlexRenew would coordinate with the City and local stakeholders to develop a restoration plan that would improve the visitor experience by enhancing Hooffs Run and adjacent riparian corridor.

Noise

Under Alternative B, noise-generating construction equipment would be required, and could include dump trucks, cranes, excavators, portable generators and diesel-powered light sources. Heavy

equipment, site preparation, and other construction-related activities would temporarily elevate noise levels during operations at all construction sites. Noise levels generated by construction equipment typically range from 75 to 100 dBA at a distance of 50 feet from the source of the noise (USDOT, 2006.). If multiple machines operate concurrently, noise levels can be relatively high within several hundred feet of the active construction site. Noise sensitive receptors are sites or buildings located adjacent to the proposed surface construction sites that could experience temporarily elevated noise levels during construction operations. Noise sensitive receptors in the study area include but are not limited to the following:

- Outfall 001 Diversion Facility: Oronoco Bay Park, Mount Vernon Trail, Founders Park, and nearby residential buildings east of N. Fairfax Street
- Outfall 002 Diversion Facility: Jones Point Park (including community gardens), Mount Vernon Trail, St. Mary's (school, church and cemetery), and nearby residences
- Outfall 003/4 System: African American Heritage Park, Alexandria National Cemetery, Baptist Cemetery, Presbyterian Cemetery, Methodist Protestant Cemetery, Trinity United Methodist Cemetery, Agudas Achim Cemetery, adjacent residences, and hotels

Above-ground construction activities would comply with the City of Alexandria noise ordinance, or in accordance with any granted variances regarding noise levels, construction hours or lighting. It is anticipated that construction operations at the tunnel mining site would be conducted 24 hours a day and seven days a week; however, hauling of the mined material would be limited to approved hauling hours. Temporary noise barriers could be installed around construction staging areas to provide noise reductions of up to 10 dBA for equipment less than 15 feet in height. Other mitigation measures that could be used to reduce noise levels during construction include: specifying quiet equipment models and proper equipment maintenance, limiting the number and duration of idling equipment, minimizing the use of backup alarms, monitoring construction noise levels, and providing a noise complaint hotline. It is anticipated that with the use of noise barriers and/or other mitigation measures, construction noise would be reduced to permissible levels.

As part of the procurement process, AlexRenew would specify noise mitigation measures to be implemented by contractors. Upon project completion, the study area would return to ambient background noise levels. The permanent tunnel infrastructure would not generate noise above ambient conditions; therefore, there would be no long-term noise impacts.

Traffic and Transit

Construction of RiverRenew and supporting infrastructure would result in increased traffic congestion within the City of Alexandria due to temporary road or lane closures, sidewalk or trail detours, or hauling activities. A LOS analysis was conducted for various roads in the vicinity of proposed work areas. Potential impacts on pedestrians and cyclists were also evaluated where sidewalk and trail closures are anticipated. Detours and maintenance of traffic plans would be coordinated with multiple stakeholders, including the NPS, and implemented as necessary during construction. Tunnel mining operations at the WRRF and associated hauling are anticipated to be the highest traffic generating activities. The LOS analysis is ongoing at the time of this EA.

Construction of the Outfall 001 Diversion Facility options within Oronoco Bay Park would require the full closure of the portion of Pendleton Street from approximately one block west of Union Street to its intersection with Union Street for the duration of construction activities. The Robinson Terminal North option would require the closure of one lane at the intersection of Pendleton Street and Union Street for the duration of construction. There are no existing bus stops within the potential Outfall 001 work areas, and the intersection of Pendleton Street and Union Street has a low utilization rate (<3

cars/minute). The traffic analyses conducted noted the proposed detours would have minimal impact on surrounding roadway level of service and performance.

Construction of the Outfall 002 Diversion Facility (Royal Street North option) would require the closure of the southern-most portion of S. Royal Street for the duration of construction activities. The road closure would occur south of Jones Point Drive and therefore is not anticipated to adversely affect access to Jones Point Park. Additionally, this design would not preclude the use of the cul-de-sac area for the Basilica School student drop off or pick up process, which regularly exceeds 600 vehicles twice a day during the school year. Emergency vehicle access would be maintained through the construction area in S. Royal Street through the entire duration of construction. There are no bus stops along this portion of S. Royal Street; however, it is used frequently by bicyclists (>30 users/hour during peak periods). A temporary detour around the construction area would be provided for pedestrians and cyclists.

Outfalls 003 and 004 are currently located within Hooffs Run between Jamieson Avenue and Duke Street. The section of Duke Street between Holland Lane and S. Peyton Street is heavily traveled and would be impacted by each of the three options. The construction of the Hooffs Run Diversion Sewer option would require the southernmost lane of Duke Street and adjacent sidewalk to be closed intermittently over the course of 1 year to connect to the existing sewer system. The Holland Lane Diversion Sewer option construction activities would require the temporary occupation of the traffic circle at the southern end of Commerce Street, and a closure of South Peyton Street for the construction duration. Impacts to Duke Street would be the same as Option 1; however, this option would require the intermittent closures of the two southbound lanes of Holland Avenue between Duke Street and Jamieson Avenue. Bus stops located within the potential work areas would be temporarily shifted as necessary during construction. Construction activities associated with the Hooffs Run Deep Tunnel option would require the temporary use of a private parking lot at 1501 Duke Street and block the entrance to a parking garage at 207 South Peyton Street. Impacts to South Peyton Street and Duke Street would be the same as the Holland Lane Diversion Sewer option.

Anticipated lane closures along Duke Street and Holland Lane are expected to have minimal impacts during peak travel periods. The use of off-peak construction hours, steel plates or other measures to maintain traffic during peak times would be investigated.

AlexRenew plans to provide opportunities to reduce traffic-related impacts at all proposed construction areas. Increased traffic congestion is likely to occur during construction; however, it is anticipated that maintenance of traffic plans developed in accordance with the City Transportation Department, VDOT and other stakeholders would minimize impacts to residents, local businesses, commuters and visitors, and would not limit accessibility to park amenities. After construction, traffic would return to LOS consistent with the projected 2025 conditions as none of the proposed facilities would permanently eliminate travel lanes. Therefore, there would be no long-term impacts to traffic from implementing RiverRenew.

Cumulative Impacts

No long-term impacts to the NPS resulting from changes to traffic or transit are anticipated as a result of the project. Visitor use and experience is largely unaffected by other projects being developed within the Study Area. The implementation of all or portions of the City's Alexandria Waterfront Plan which includes improvements and alterations to Oronoco Bay Park, as well as to bulkheads along the Potomac River could cause increases in visitor use and associated congestion along City streets (City of Alexandria DPZ. 2012). Ways to address these items are included in the City plan. Cumulative impacts from Waterfront Plan construction activities could occur if they coincide with construction-related impacts associated with Alternative B and are anticipated to be minimal. Alternative B would contribute a to long-term adverse cumulative impacts related to proposed tree removal within Jones

Point Park. Cumulative impacts to visitor use and experience would be beneficial over the long-term by the implementation of this project given increased accessibility from the Waterfront Plan and improved water quality from the reduction of combined sewer discharges.

Conclusion

Construction of RiverRenew and supporting infrastructure under Alternative B would be disruptive to visitors, residents, and businesses near the areas of proposed surface disturbance. AlexRenew would coordinate closely with NPS, the City of Alexandria, and other stakeholders to identify strategies to minimize construction-related impacts to visitor use and experience. In the vicinity of Jones Point Park, it is anticipated that traffic impacts would be variable, and directly correlated to hauling activities, with moderate impacts to pedestrian and bicycle travel from temporary detours. Once construction is complete, the disturbed areas would be largely restored to existing conditions and/or in accordance with approved restoration plans. Minimal at- or above-grade infrastructure would be visible. Alternative B would contribute a small amount of long-term adverse cumulative impacts from tree removal within Jones Point Park. However, implementation of RiverRenew would result in long-term benefits from the reduction of combined sewer discharges and the corresponding water quality improvements that would enhance water-based recreation.

Historic Structures and Districts

Historic Structures and Districts Affected Environment

The City of Alexandria was founded in 1749 and has a rich history. Many of the City's original structures remain today and are contributing elements to several nationally and locally recognized historic districts. To identify potentially impacted historic properties for the NEPA analysis, AlexRenew used the Area of Potential Effects (APE) for RiverRenew that was developed in accordance with Section 106 of the National Historic Preservation Act as part of a separate, but parallel regulatory process. The APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16[d]; US Advisory Council on Historic Preservation. 2004).

For the purposes of this project, two types of APEs were established; one for indirect impacts and one for direct impacts. Indirect impacts include potential visual and vibration impacts associated with RiverRenew infrastructure and tunneling activities. Indirect impacts include potential visual and vibration impacts associated with RiverRenew infrastructure and tunneling activities. Direct impacts include those associated with ground disturbance and structure demolition. A Documentary Study was conducted for RiverRenew and that focused on proposed surface disturbance areas in three study areas: Oronoco Bay, Jones Point Park, and Hooffs Run. The three study areas and direct impact APEs are depicted in **Figure 3-6**. While this Documentary Study was coordinated with the City of Alexandria and other consulting parties such as Alexandria Archaeology, the findings noted below refer to documented available information located at the Virginia Department of Historic Resources (VDHR) and the City of Alexandria's Planning and Zoning Department (VDHR. 2013; City of Alexandria DPZ. 2019).

The RiverRenew indirect impact APE is depicted in **Figure 3-7**, along with the boundaries of National Register of Historic Places (NRHP) listed and locally recognized and regulated historic districts, which intersect the APE. These districts, which are located primarily east of Washington Street and extend to and into the Potomac River, include the George Washington Memorial Parkway Historic District (GWMPHD), the Alexandria National Historic Landmark District (VDHR #100-0121), the Alexandria National Register Historic District (VDHR #100-0121), and the Old & Historic Alexandria Historic District, which is locally regulated. Jones Point Park was added to the GWMPHD as a notable parcel of land in an updated 2017 NRHP nomination (draft) because of its role in conserving the Potomac River shoreline and the scenic qualities of the GWMP. The Alexandria historic districts also contain individual properties that are recognized as National Historic Landmarks or listed individually in the NRHP, the Virginia Landmarks Register (VLR), or are included in the City of Alexandria's list of 100-Year-Old Buildings. Many of the buildings and structures located within these districts, are considered contributing elements of the historic district and may or may not be individually eligible for listing, as they have yet to be evaluated. Resources are considered contributing to a historic district if they date to the period of significance and contribute to the character of the district through their historical associations and/or architecture.



Figure 3-6. Area of Potential Effects – Direct Effects

Figure 3-8 details the locations of the ten architectural resources within, or immediately adjacent to the APE. These are individually listed in the NRHP and the VLR, as well as one resource, the Gunston Hall Apartments, that has been determined to be potentially eligible for listing by the VASHPO, but has yet to be listed in the NRHP. None of the listed architectural resources are located on lands administered by the NPS. While Jones Point Park contains the historic Jones Point lighthouse which is listed in the NRHP and is a contributing element to the Alexandria Historic District, areas south of the Woodrow Wilson Bridge are not included in the project APE.

While the western portion of the study area does not contain historic districts, it does contain two historic sites, the Orange & Alexandria Railroad Hooffs Run Bridge (VDHR #100-0149), and the Alexandria National Cemetery (VDHR #100-0138), which are both listed in the NRHP and the VLR. In addition to NRHP and VLR recognition, the Hooffs Run Stone Bridge is also on the City of Alexandria's List of 100-Year-Old Buildings, which it regulates under local code.

Historic Structures and Districts Environmental Consequences

Potential impacts to previously recorded City of Alexandria- and NRHP-listed or eligible resources were analyzed in accordance with the provisions in 36 CFR Part 800 (US Advisory Council on Historic Preservation, 2004), regulations implementing Section 106 of the NHPA. The analysis focused on whether the proposed undertaking would "...alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR 800.5(a)(1)).

Impacts of Alternative A – No Action

The No Action alternative represents continued operation and maintenance of the existing combined sewer system. As there would be no construction involved with this alternative, the character-defining features of historic structures or districts would not be altered, and the overall integrity of these resources would not be compromised in any way. Continued discharges of combined sewer flows are not anticipated to have noticeable effects on historic structures or districts. Thus, there would be no direct, indirect, or cumulative impacts under the no-action alternative.

Cumulative Impacts

There would be no new impacts to historic structures or districts under the No Action alternative; thus, there would be no cumulative impacts.

Conclusion

There would be no construction that would alter character-defining features or compromise the overall integrity of historic structures or districts. As a result, there would be no impacts under the No Action alternative.



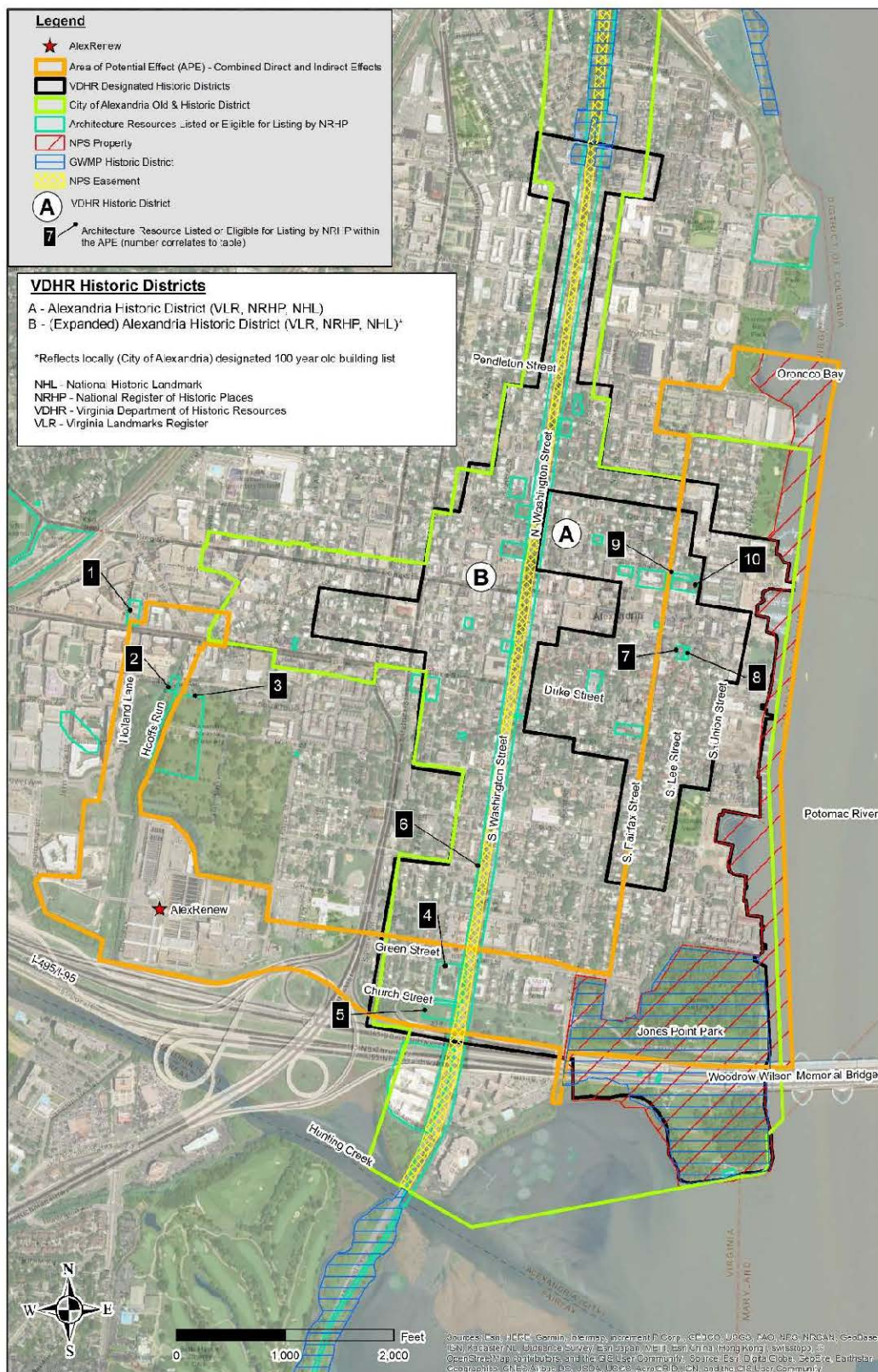


Figure 3-8. NRHP-Listed Architectural Resources Within APE (Data acquired from VDHR database (Source: VCRIS July 2018); Table of Listed Architectural Resources Provided in Appendix E (Table E-1)

Impacts of Alternative B – Proposed Action

Construction of RiverRenew components could result in ground movements that have the potential to result in damage to historic structures located within the tunnel buffer area (a 200-ft. buffer surrounding each tunnel alignment, as defined in **Chapter 2** of this EA). The primary approach to minimizing potential impacts to historic structures and districts would be to route the tunnel sufficiently far from historic properties such that they are outside the tunnel buffer area. To minimize potential damage to historic and other non-historic properties that cannot be avoided, AlexRenew would conduct preconstruction surveys, implement a thorough monitoring plan, implement structural protections (if needed), and identify other construction means and methods to minimize the potential effects of vibration and settlement. Monitoring and structural protections implemented during construction would be anticipated to prevent any long-term impacts from vibration. The historic properties and districts within the APE are shown in **Figure 3-7** and **Figure 3-8** and listed in **Appendix E**.

To date, AlexRenew has completed a Documentary Study of the three potential surface disturbance zones within the overall study area: Oronoco Bay Disturbance Zone (Outfall 001 Diversion Facility), Jones Point Park Disturbance Zone (Outfall 002 Diversion Facility), and Hooffs Run Disturbance Zone (Outfall 003/4 System and WRRF Upgrades) (**Figure 3-6**). The conclusions of this study are incomplete pending final review by the NPS, VA SHPO, and Alexandria Archaeology.

Outfall 001/2 System (NPS Administrative Unit Impacts: Potomac River Bed and Jones Point Park)

Historic properties within the tunnel buffer area include: Saint Mary's Cemetery, Freedmen's Cemetery and Gunston Hall Apartments. Historic properties outside of the tunnel buffer area are not anticipated to be impacted by vibration or settlement. The tunnel is anticipated to be constructed approximately 100-feet to 140-feet deep. No structures or properties lie within the proposed footprint of the preferred diversion facility options.

There are no previously recorded historic structures within the area of the Outfall 001 diversion facility. The Outfall is located adjacent to the Robinson Terminal Warehouse complex which was constructed between 1964 and 1975. A now defunct historic rail spur extends south from Oronoco Bay Park, and across Pendleton and North Union streets to the warehouse. All of the Outfall 001 diversion facility options would require some tree clearing around the existing outfall. Additionally, the Oronoco Bay East and Robinson Terminal North options would include the construction of an elevated public promenade along the Outfall 001 extension, with a surface elevation of approximately 14 feet North American Vertical Datum of 1988 (NAVD 88).

Though located within the NPS owned Jones Point Park, there are no recorded historic structures within the area of the Outfall 002 diversion facility. The Outfall 002 diversion facility options would also require tree clearing and would be graded up to approximately elevation 14 feet NAVD 88. Views to and from historic properties are not anticipated to be impacted by construction barriers, however construction equipment may be visible depending on height.

Upon completion of construction, preconstruction conditions would be restored at each diversion facility location. With the exception of a small electrical cabinet, the diversion facilities would be located below ground with at-grade access points. AlexRenew, in consultation with NPS, VA SHPO, the City of Alexandria, and others as appropriate, would develop site restoration plans to ensure visible infrastructure is located and designed in an appropriate manner for the site. Additionally, trees of the same or similar species would be planted to replace trees removed during construction. Impacts to views within Jones Point Park and along the Potomac River would be minimal due to the small scale of visible infrastructure.

Outfall 003/4 System and WRRF Upgrades

The Outfall 003/4 System elements and WRRF Upgrades are located outside of all historic districts and NPS administration units. Of the three potential Outfall 003/4 System alignments, only the Hooffs Run Diversion Sewer option is located adjacent to historic properties, including the Alexandria National Cemetery (VDHR #100-0138) and the Orange & Alexandria Railroad Hooffs Run Bridge (VDHR #100-0149). Construction of the Hooffs Run Diversion Sewer would involve the open cut installation of a 72-inch pipeline along the Hooffs Run floodplain. Following construction, only a new diversion chamber and manholes would be visible at grade. Views to and from historic properties would be temporarily impacted by construction barriers and equipment. AlexRenew, in consultation with NPS, VA SHPO, the City of Alexandria, and others as appropriate, would develop site restoration plans to ensure visible infrastructure is located and designed in an appropriate manner for the site. Additionally, trees of the same or similar species would be planted to replace trees removed during construction.

Cumulative Impacts

The current and future projects identified on **Table 3-1** could result in construction-related impacts to the character-defining features of historic properties by temporarily altering the features or affecting the viewshed of the resources. These projects could also have long-term impacts on historic properties or districts from permanent changes to views and vistas along the Potomac River. Through design and consultation coordination, AlexRenew is collaborating with the NPS, VA SHPO, City of Alexandria and other appropriate stakeholders to minimize any adverse cumulative impacts under Alternative B. Therefore, although the extent of impacts is not fully known, it is anticipated that Alternative B would add an incremental increase to the overall adverse cumulative impacts.

Conclusion

Impacts to views within Jones Point Park and along the Potomac River would be minimal due to the small scale of visible infrastructure. Upon completion of construction, AlexRenew would coordinate with NPS, VA SHPO, the City of Alexandria, other impacted landowners and stakeholders, as appropriate, to reestablish the functions and facilities of the impacted park areas, restore vehicle, pedestrian, and bicycle circulation, reestablish trees and other vegetation, and ensure that the character-defining features and overall integrity of impacted historic properties are restored. Negligible impacts are anticipated to views to and from surrounding historic properties.

Construction of the Outfall 001/2 tunnel system and supporting infrastructure have the potential to cause ground movements that could result in impacts to historic structures. The tunnel is anticipated to be constructed approximately 100-feet to 140-feet below the ground surface. Any surface settlement resulting from construction of the tunnel is anticipated to be fractions of an inch over the tunnel crown, and approach zero at a lateral distance of approximately 100 feet from the tunnel centerline. As a result of best management practices and permit conditions, implementation of the proposed action is not anticipated to have significant adverse effects to historic structures or districts on NPS lands. Additional consultation under Section 106 of the National Historic Preservation Act would occur for project areas outside of NPS lands as part of the CWA permitting process.⁷

⁷ The USACE would be the lead agency.

Archeological Resources

Archeological Resources Affected Environment

This section describes the results of the initial desktop analysis and identifies construction areas where archeological resources have been previously identified, or other areas of archeological potential. Given the City of Alexandria's history, archeological resources are known to exist within the study area. Information on recorded archeological sites that are currently listed on or eligible for listing in the NRHP was obtained from the VDHR - Virginia Cultural Resource Information System (VCRIS; VDHR, 2013). Additional information on areas that may contain important archeological resources was obtained from archeological survey reports, historic maps, utility maps, and soil boring data. A list of previously recorded archeological resources within the APE can be found in **Appendix E**. Note that the location of these resources has been withheld from all figures to protect the archeological site.

While archeological surveys have been conducted within portions of the study area, there are still resources being discovered, particularly within areas that were part of the original Alexandria waterfront dating back to about 1749. This area was filled and expanded over time to the present shoreline. **Figure 3-9** and **Figure 3-10** depict the approximate boundaries of the original shoreline within the APE interpreted from historic maps from 1749, 1798, 1894 and 1907.



Figure 3-9 Historic Shoreline Near Outfall 001 (Historic Wharves Map, City of Alexandria 2009), (1798 Map of Alexandria, Library of Congress, accessed November 2018)

The results of the documentary study identified areas with the potential to contain intact significant archeological deposits within disturbance zones and therefore may warrant further consideration during future project planning. The need for additional archeological investigations would be determined in consultation with the NPS, VDHR, City, and other interested parties.



Figure 3-10 Historic Shoreline Near Outfall 002⁸

There are no previously recorded archaeological sites located within the currently defined Oronoco Bay study area or direct impact APE (see **Figure 3-6**), which includes the Outfall 001 Diversion Facility. In 1985, Gordon P. Watts, Jr. conducted acoustic and magnetic remote sensing within Oronoco Bay (*Acoustic and Magnetic Remote Sensing and Site Identification Survey Along the Alexandria, Virginia Waterfront Between Oronoco and Franklin Streets and Oronoco Bay*) which confirmed the use of modern debris in filling Oronoco Bay. According to this survey, the debris included sheet pile bulkheads, steel piers, and abandoned pump station pipelines which masked the natural magnetic background in the area making the identification of historically significant remains virtually impossible. The Jones Point Park study area, which includes the Outfall 002 Diversion Facility, includes one previously recorded archeological site (Site 44AX0185); however, this prehistoric site is located outside and to the east of the direct impact APE. A Phase III data recovery at Site 44AX0185 was previously completed (by others) as part of the Woodrow Wilson Bridge improvement project (Barse et. al. 2006). There are also five previously recorded sites in the Hooffs Run study area, which includes the Outfall 003/4 System and WRRF Upgrades. Two of these sites, the Orange & Alexandria Hooffs Run Bridge (VDHR #44AX0148) and the Duke Street Tannery (VDHR # 44AX0188) are located in the vicinity of the direct impact APE.

⁸ This shoreline is interpreted from “The vicinity of Washington D.C.” historical map (Hopkins. 1894) and other historical maps (Gilpin et al. 1798; Harrison et al. 1863; Sanborn Map Company. 1907).

Archeological Resources Environmental Consequences

The NPS defines archeological resources as the remains of past human activity. These remains typically take the form of artifacts (e.g. ceramic or tool fragments), features (e.g., remnants of walls, cooking hearths, or trash middens), and ecological evidence (e.g., pollens remaining from plants that were in the area when the activities occurred), and may be “prehistoric” (pre-European contact), “historic” (post-European contact), or contain artifacts from both periods (Little et al. 2000).

The analysis of impacts to archeological resources particularly in an urban environment is typically conducted utilizing a phased approach that conforms to the standards and guidelines of the NPS and the City of Alexandria. The initial phase is a documentary study conducted by reviewing databases of known archeological sites, reports of archeological investigations, historical maps, and surface disturbance to predict the potential for the presence of archeological resources within a construction area. The second phase consists of field surveys (Phase I) and systematic surface testing to help locate archeological resources. If present, the resources are evaluated for listing in the National Register (Phase II). If a site is determined to be NRHP eligible and cannot be avoided by construction activities, Phase III data recovery would be implemented to mitigate the adverse effects. To date, the initial documentary study has been completed for the potential areas of surface disturbance within the overall study area.

Impacts of Alternative A – No Action

As there would be no construction-related ground disturbance under the No Action alternative, there would be no direct impacts to archeological resources.

Cumulative Impacts

There would be no new impacts to archeological resources under the No Action alternative; thus, there would be no cumulative impacts.

Conclusion

There would be no impacts to archeological resources.

Impacts of Alternative B – Proposed Action

Outfall 001/2 System (NPS Administrative Unit Impacts: Potomac River Bed and Jones Point Park)

Land within and around Oronoco Bay was made throughout the development of the City of Alexandria and historic maps indicate that the area of the proposed Outfall 001 Diversion Facility may have been underwater until the twentieth century. Twentieth century construction along the shoreline and wharf improvements are expected to have impacted soils and contextual integrity in the immediate area of improvements, as have previous disturbance of stormwater and sewer infrastructure. Documentation indicates fill soils in the Outfall 001 System disturbance zone possibly up to ± 15 feet in depth. Given its location and the presence of made land, ship hulls or other maritime vessels may be present in the fill material. While near surface disturbances (i.e. < 2 feet) associated with construction staging and material storage areas are not expected to impact intact archaeological deposits, construction of the Outfall 001 Diversion Facility would result in subsurface impacts to depths greater than documented fill soils in areas of the drop shaft and deep tunnel. Portions of the drop shaft area below the fill may have the potential to contain intact archaeological deposits; however, no archeological deposits are anticipated at tunnel depth. The 1985 Watts survey recommended that disturbance of the river bottom be monitored based on the conclusion that, at this location, only physical examination of the sub-bottom environment would be likely to produce evidence of submerged cultural material (Watts. 1985).

Historic mapping indicates that the area of Outfall 002 Diversion Facility was underwater or marshland through much of its history. The shorelines, marshes, and tidal flats adjacent to the Potomac River would have been desirable locations for procurement of natural resources and marine wildlife by prehistoric populations and a prehistoric site (VDHR #44AX0185) was discovered within the area of Outfall 002 prior to improvements made to I-495/95 and the Woodrow Wilson Bridge. This was a Middle and Late Woodland period site below ± 5 feet of fill material. Also, east of Outfall 002, outside of the proposed study area, is a site likely associated with the ropewalk that had historically been located on Jones Point (VDHR #44AX0165) (Barse et al. 2006). The area of the proposed Outfall 002 Diversion Facility remained largely void of structural development from the seventeenth century up through the present day due to the presence of marshland and a ditch that drained tanyard waste into Hunting Creek, which suggests that the presence of historical archeological features is unlikely. Geotechnical borings in the vicinity of the proposed Outfall 002 Diversion Facility revealed the presence of natural soils at depths of 5-6 feet below the present surface west of the proposed drop shaft feature and extending towards South Royal Street. The presence of prehistoric site 44AX0185 east of the proposed disturbance zone on buried natural soils suggests that there is a potential for similar type resources to be present west of the proposed drop shaft. While near surface disturbances (i.e. <2 feet) associated with construction staging and material storage areas are not expected to impact intact archaeological deposits, construction of the Outfall 002 Diversion Facility would result in subsurface impacts to depths greater than documented fill soils over natural soils in areas of the drop shaft and approach channel, which have the potential to contain intact archaeological deposits.

To address these potential impacts, archeological resource identification efforts would continue prior to construction, and an archeological monitoring program would be implemented during construction of the proposed Outfall 001/2 System. The resource identification efforts and monitoring program would be developed in accordance with the NPS, VA SHPO, and Alexandria Archaeology, as appropriate. If unexpected intact significant archeological deposits are encountered during exploratory testing or construction activities, resource recordation and excavation would occur in accordance with an agreed upon protocol outlined in the monitoring program.

Outfall 003/004 System and WRRF Upgrades

Outfall 003/004 System and WRRF Upgrades are located in the vicinity of Hooffs Run, south of Duke Street. Given the presence of a waterway, and marshland around Hunting Creek, it may have been a desirable area for prehistoric procurement of natural resources and wildlife. Hooffs Run roughly divided the early historical developments of Spring Garden to the east and West End to the west before being incorporated into the City of Alexandria. Documentary and cartographic sources suggest that the potential for archeological deposits from the eighteenth and nineteenth centuries to be present is moderate to high. There are two previously recorded archeological sites within the Hooffs Run study area: at the Orange & Alexandria Hooffs Run Bridge (VDHR #44AX0148), and the Duke Street Tannery (VDHR #44AX0188). In 1990, Alexandria Archaeology completed an on-site examination of the bridge site; however no subsurface testing was completed. The Duke Street Tannery site has not been previously evaluated. Historic cemeteries flank Hooffs Run on the east and west. The location of the cemeteries and human burials have been mapped and documented by others; therefore, the potential for undocumented burials to be present within the direct impact APE is considered moderate to low. Additionally, there was a Civil War era encampment to the west of Hooffs Run. However, twentieth century disturbances associated with stormwater and sewer infrastructure lower the potential for an archeological record to be present and intact.

Similar to the Outfall 001/2 System, an archeological testing and monitoring program would be implemented prior to, and during construction of the proposed Outfall 003/4 System. Because the WRRF was constructed on a prior landfill, no additional archeological testing or monitoring is anticipated for the WRRF Upgrades. The Outfall 003/4 System testing and monitoring program would

be developed in accordance with the USACE, VA SHPO, and Alexandria Archaeology, as appropriate. If unexpected intact significant archeological deposits are encountered during exploratory testing or construction activities, resource recordation and excavation would occur in accordance with an agreed upon protocol outlined in the monitoring program.

Cumulative Impacts

Current and future projects and actions identified in **Table 3-1** are located along waterfront of the Potomac River. Present and future work at the Robinson Terminal North and Robinson Landing sites have the potential to impact archeological resources. However, the presence of made land at Outfall 001 in the vicinity of the Robinson Terminal North site would likely lessen cumulative archeological impacts. Adverse impact to archeological resources through RiverRenew would be minimized and/or mitigated under Alternative B. No additional future projects are planned for the Jones Point Park or Hooffs Run disturbance zones.

Conclusion

A Documentary Study of RiverRenew study areas and direct impact APEs has identified areas of potential archeological resources. The potential for intact substantial archeological deposits is moderate to high within the Oronoco Bay study area. Given the proximity to the historic shoreline, the possibility of wharf remains as well as scuttled ship hulls sealed under later episodes of fill and shoreline repair are possible. The Jones Point study area is located near the historic shoreline, marshes, and tidal flats that may have been desirable to prehistoric populations and therefore has potential for prehistoric archeological remains under later fill. There is, however, no indication of heavy use within the direct impact APE from the seventeenth century to the present. The Hooffs Run study area is located in an area of varied archeological potential. Documentary and cartographic sources suggest that the potential for archeological deposits from the eighteenth and nineteenth century to be high in areas around Duke Street. This potential decreases further south in the study area.

The preferred alternative is not anticipated to adversely impact identified archeological resources, but the potential exists to impact yet unidentified archeological resources. Prior to any construction activities, a Section 106 Programmatic Agreement, along with an archeological testing and monitoring program, would be reviewed and approved by the NPS, VA SHPO, Alexandria Archaeology, and the USACE, as appropriate, to minimize the potential for any adverse impacts to archeological resources resulting from the implementation of Alternative B. The testing and monitoring program would also establish a protocol to address and document any unexpected intact significant archeological resources encountered during construction.

Cultural Landscapes

Cultural Landscapes Affected Environment

The NPS defines a cultural landscape as a geographic area, both cultural and natural, associated with a historic event, activity, or persons exhibiting other cultural or aesthetic values (Page et al. 1998.). There are four general types of cultural landscapes, defined below by the Cultural Landscape Foundation:

- Historic Sites: those cultural landscapes that are “significant for their association with a historic event, activity, or person;”
- Designed Landscapes: those that were “consciously designed or laid out by a landscape architect, master gardener, architect, or horticulturist to design principles, or by an amateur gardener working in a recognized style or tradition;”

- Vernacular Landscapes: those that have “evolved through use by the people whose activities or occupancy shaped those landscapes. Through social or cultural attitudes of an individual, family, or community, the landscapes reflect the physical, biological, and cultural character of those everyday lives;” and
- Ethnographic Landscapes: those that contain a “variety of natural and cultural resources that the associated people define as heritage resources.” (Cultural Landscape Foundation, 2016)

Identification of a site as a cultural landscape has no legal historic designation and therefore, cultural landscapes are addressed separately from historic structures, districts and archeological resources in this EA.

The NPS–GWMP considers Jones Point Park to be a cultural landscape, as it is located within a historic district and it is under the jurisdiction of the NPS. A cultural landscape inventory (CLI) has not yet been completed for Jones Point Park. The Outfall 002 Diversion Facility would be located on the western edge of the park, near the park entrance at the intersection of Jones Point Drive and South Royal Street. To the north of Jones Point Drive is a cluster of recycling containers. To the south of Jones Point Drive, planted trees line the South Royal Street cul-de-sac, shielding the park entrance from I-95/I-495. More natural vegetation is situated between this line of trees and the highway. This area also includes the Jones Point Park entrance sign, and a VDHR historical highway marker. S. Royal Street continues south along the western end of the proposed construction staging area and leads to a restricted parking area and pedestrian/bike path that parallels the highway. Once inside the park gate, Jones Point Drive is bordered by natural vegetation consisting of mixed hardwoods with a dense undergrowth. and small patches of grass.

Outside of NPS lands, it is possible that the Alexandria National Cemetery may be considered a cultural landscape as a reminder to those lost in the Civil War. Additionally, though modern, the Alexandria African American Heritage Park may be considered a cultural landscape as a designed landscape associated with the Black Baptist Cemetery. A brief description of the general boundaries, background, and significance are provided in **Appendix E**.

Cultural Landscapes Environmental Consequences

Potential direct and indirect impacts to cultural landscapes within the APE were analyzed in relation to regulations outlined in Section 106 of the National Historic Preservation Act and guidelines stated within The Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes (NPS. 1996). Evaluated features relating to the cultural landscapes present included, but are not limited to: land use, spatial organization, circulation, vegetation, buildings and structures, natural systems, views and vistas, archeology, and small-scale features.

Impacts of Alternative A – No Action

Under the No Action alternative, there would be no construction or land disturbance. Therefore, there would be no new impacts because existing landscape features would not be altered and no new elements would be added within the cultural landscapes identified in the study area.

Cumulative Impacts

There would be no new impacts to cultural landscapes under the No Action alternative; therefore, there would be no cumulative impacts. No planned future changes in or around Jones Point park are proposed, including the current proposed study area.

Conclusion

There would be no new impacts to the cultural landscapes on NPS properties under the No Action alternative because no construction would occur and existing landscape features would not be modified by the addition of new elements. There would also be no cumulative impacts under the No Action alternative.

Impacts of Alternative B – Proposed Action

Under Alternative B, there would be no impacts to cultural landscapes from the construction of the Outfall 001 Diversion Facility or WRRF Upgrades. All options of the Outfall 002 Diversion Facility would require tree clearing and site grading, resulting in modifications to features of the Jones Point Park cultural landscape, including forested areas and the park entrance. The significance of Jones Point Park to the GWMP Historic District (and the associated cultural landscape) is related to land conservation as well as the preservation of the scenic qualities of the GWMP along the Potomac River. Views to and from Jones Point Park, the Mount Vernon Trail, as well as the Basilica School campus and cemetery, would be temporarily impacted by construction fencing and equipment. The existing entrance to Jones Point Park is impacted by several modern visual intrusions directly adjacent to the park, which include recycling dumpsters, a modern traffic gate, overhead utilities, modern street lighting, and the Woodrow Wilson Bridge (see **Appendix E**). Following implementation of Alternative B, access points to the diversion facility would be visible at grade. The only infrastructure visible above-ground would be an electrical cabinet, measuring approximately 8-feet long by 4-feet wide by 6-feet tall, and potentially a small (likely < 4 feet tall) retaining wall along a portion of Jones Point Drive. To mitigate the potential for adverse impacts, AlexRenew would locate and design visible infrastructure to be appropriate for the site, and consult with NPS to develop a site restoration plan, including, but not limited to planting trees of the same or similar species to replace trees removed during construction. Note that trees would not be planted within ten (10) feet of the proposed structures, access points, or in areas of steep slopes; however, these areas could be planted with native grasses and shrubs. Permanent impacts to the historic character and landscape of the immediate vicinity are not anticipated to be significantly more than those from existing constructed infrastructure.

Construction activities necessary to connect to the existing Outfall 003 and Outfall 004 is located in a commercial area north of Jamieson Avenue, are outside of existing cultural landscapes. South of Jamieson Avenue and the Orange & Alexandria Railroad Hooffs Run Bridge, views to and from the natural/cultural areas adjacent to Hooffs Run (including the African American Heritage Park and Alexandria National Cemetery) may be temporarily impacted by above-ground construction activities associated with the Hooffs Run Diversion Sewer alternative; however, no permanent above-ground impacts are anticipated.

Cumulative Impacts

Several current and future projects within the study area have the potential to impact cultural landscapes. The Waterfront Plan and Robinson Landing development are located within the Alexandria Historic District and would potentially impact the views to and from Jones Point Park. Through Settlement Agreements with the riparian property owners, the NPS must be consulted regarding designs and plans to minimize modifications to important landscape features and visual intrusions. Additionally, the intended result of this project is to reduce combined sewer discharges into the Potomac River, which would benefit the natural landscape of the many waterfront parks located adjacent to the study area.

Conclusion

Under Alternative B, construction of RiverRenew would modify landscape features and add new surface elements within NPS property at Jones Point Park which is located within the Alexandria

Historic District. AlexRenew would consult and coordinate with NPS, VA SHPO, the City of Alexandria, and other stakeholders, as appropriate, to minimize adverse impacts and develop context-sensitive designs. Alternative B is not anticipated to result in permanent changes to land use, circulation, spatial organization or natural systems at Jones Point Park. Overall, Alternative B would result in both adverse and beneficial impacts to the cultural landscapes within NPS properties. The overall benefit of improved water quality on and along NPS properties should outweigh the impacts particularly with the implementation of proposed mitigation.

Human Health and Safety

Human Health and Safety Affected Environment

The project area has a history of infill and prior industrial uses with documented impacts to soil and groundwater. Excavation, grading, and/or dewatering activities are anticipated to encounter impacted soil and groundwater. Current and historic data were reviewed to identify potential environmental concerns (PECs) regarding soils and groundwater within the proposed construction sites. Additionally, environmental sampling associated with the RiverRenew Geotechnical Exploration Program is ongoing to characterize soil and groundwater at the proposed construction sites.

PECs related to historic operations were identified during review of historic Sanborn maps, the VDEQ – Virginia Environmental Geographic Information System (VEGIS), historic reports prepared by other consultants, and other available data. Environmental data and historic site information was obtained by reviewing publicly available environmental reports, including but not limited to the following:

- Corrective Action Plan, Former Robinson Terminal North, ICOR, 2019;
- Risk Assessment Report, Former Robinson Terminal North, ICOR, 2018;
- Post Site Characterization Monitoring Report & Second Post Site Characterization Monitoring Report, Former Robinson Terminal North, ICOR, 2018;
- Final Site Characterization Report, Former Robinson Terminal North, ICOR, 2017; and
- CSO-001 Contaminated Soils Study, Greeley and Hansen, 2017.

Outfall 001 Diversion Facility

Historic operations in the vicinity of the proposed Outfall 001 Diversion Facility included manufactured gas plants, a chemical manufacturing and fertilizer facility, and coal and gravel yards. The proposed Outfall 001 Diversion Facility (all options) would be located within the vicinity of three (3) voluntary remediation program (VRP) sites (VDEQ. 2019): the former Robinson Terminal North (RTN) Site (VRP00673)⁹, the former Alexandria Town Gas (ATG) Site (VRP00241), and 601 North Fairfax Street (VRP00594). PECs associated with these sites include: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), petroleum compounds, coal tar, pesticides and herbicides, arsenic, and a variety of metals. Arsenic concentrations are consistent with naturally occurring background levels.

Outfall 002 Diversion Facility

The proposed Outfall 002 Diversion Facility would be located in the vicinity of the former Virginia Shipbuilding Company within Jones Point Park, former Standard Oil site, historic tannery ditch, and former Trent Amalgam Coal Fuel Oil Company. PECs associated with the Outfall 002 Diversion Facility include: petroleum compounds and arsenic. Arsenic concentrations are consistent with naturally occurring background levels in this area.

Preliminary Findings at Outfalls 001 and 002

As part of the Phase A Exploration Program for RiverRenew, a total of 20 environmental soil samples were collected from 10 soil borings within the Outfall 001/2 System study area. Twelve of these samples were subsequently compared to VDEQ standards due to their proximity to areas proposed for surface disturbance. Three (3) samples in the vicinity of the Outfall 001 Diversion Facility and one sample in the vicinity of the Outfall 002 Diversion Facility exceeded the VDEQ Tier II residential standard for total petroleum hydrocarbons – diesel range organics (TPH-DRO). Additionally, one (1) soil sample in the vicinity of the Outfall 001 Diversion Facility exceeded the established background concentration for arsenic and exceeded the VDEQ Tier III industrial standard for arsenic. Note that the remainder of the arsenic concentrations at the outfall locations are consistent with naturally occurring background levels.

Impacted soils (TPH-DRO and arsenic) were encountered in the borings from 8 to 40 feet below ground surface (bgs). Although the concentrations of these analytes are reported above VDEQ standards, the soil is characterized as non-hazardous and can be transported and disposed off-site at a landfill. Construction workers would be required to wear personal protective equipment (PPE) similar to other construction sites (i.e. steel toe boots, vests, hard hats, safety glasses). Additional levels of PPE are not required at these outfalls based on the reported soil concentrations.

Outfall 003/4 System

Historic operations in the vicinity of the Outfall 003/4 System consisted primarily of railroads, associated with a former Southern Railway railyard (VDEQ ID: VAD988203550), as well as landfills, and former dry cleaners. Common contaminants associated with railyards include VOCs, SVOCs, metals, and to lesser extent, chlorinated solvents. In addition to the railyard use, a total of 10 VRP sites were noted in the study area with potential additional PECs including PCBs, and methane gas. A majority of the southern portion of the study area was previously a waterbody filled to create land in support of development. Urban fill material typically contains low levels of contaminants such as heavy metals, PAHs and petroleum compounds.

As part of the Phase A Exploration Program for RiverRenew, a total of 23 environmental soil samples from 13 soil borings were analyzed within the Outfall 003/4 System study area. Eleven of the 23 soil samples were subsequently compared to VDEQ standards due to their proximity to areas proposed for surface disturbance. Seven (7) of these soil samples exceeded the VDEQ Tier II residential standard for TPH-DRO and one (1) sample also exceeded the established background concentration for arsenic. Note that the remainder of the arsenic concentrations at the outfall locations are consistent with naturally occurring background levels.

Impacted soils (TPH-DRO and arsenic) were encountered in the borings from approximately 18 to 140 feet bgs. Although the concentrations of these analytes are reported above VDEQ standards, the soil is characterized as non-hazardous and can be transported and disposed off-site at a landfill. PPE requirements for the Outfall 003/4 system would be consistent with the Outfall 001/2 system.

Human Health and Safety Environmental Consequences

Federal and Virginia state regulations, including the Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA), generally regulate contamination issues, and typically refer to human health and safety as it relates to potential exposure pathways. This is typically done utilizing a risk-based overview, and a focus on minimizing exposure pathways to the contaminated materials for workers and the public.

Potential risks to human health and safety were evaluated taking into consideration PECs within areas of proposed surface construction disturbances, including excavation for near surface structures and deep shaft construction, as well as other areas based on professional judgement.

Impacts of Alternative A – No Action

Under the No Action alternative, there would be no construction or land disturbance. Therefore, no new impacts to human health and safety are anticipated as a result of the No Action alternative.

Cumulative Impacts

Remedial efforts by the City and other property owners would continue, potentially benefitting human health and safety over the long term. Planned development efforts noted in **Table 3-1** would be implemented, likely resulting in additional remedial efforts not currently identified. No planned future changes in or around Jones Point Park are proposed. Residual contamination in the soils and groundwater would likely continue to degrade through natural physical and biological processes over a long period of time rendering improvements to human health and safety over the long term.

Conclusion

There would be no new impacts to the soils on NPS administrative units under the No Action alternative because no construction would occur and existing soils would not be modified. Cumulative impacts would include minor long-term improvements from natural biodegradation under the No Action alternative.

Impacts of Alternative B – Proposed Action

The Proposed Action includes the following activities that could result in potential impacts to human health and safety:

Outfall 001 Diversion Facility (NPS administrative unit impact - Potomac River)

All options for the Outfall 001 Diversion Facility would require soil grading, dewatering, excavation, and encroachments within the limits of the Potomac River, which is an NPS administrative unit.

Outfall 002 Diversion Facility (NPS administrative unit impact – Jones Point Park)

All options for the Outfall 002 Diversion Facility would require soil grading, excavation, dewatering and encroachments within the limits of Jones Point Park, which is an NPS administrative unit.

Outfall 003/4 System (No NPS administrative unit impact)

All Options for the Outfall 003/4 System would require grading, excavation, and dewatering.

WRRF Upgrades (No NPS administrative unit impact)

Construction activities associated with the TDPS and WWTF would occur within the existing WRRF campus, which was constructed on fill. These activities include excavation of a deep mining shaft and additional shallow excavation to accommodate the installation or relocation of utility lines.

Investigation, Treatment, and Mitigation Actions

In advance of construction, a Phase B Exploration Program would be conducted to further identify and analyze the concentration and location of PECs, including impacted soil and groundwater in the areas of proposed ground disturbance. When working in areas with impacted soils and groundwater, exposure pathways to workers and the public would be minimized utilizing best management practices (BMPs) and other methods approved by the VDEQ, including those outlined in the January 2019 Corrective Action Plan for the Former Robinson Terminal North site. These BMPs could include, but are not limited to the following:

- Soil would be live loaded into trucks or stockpiled and transported and disposed of off-site to a landfill, or facility approved to accept impacted soils. The duration that soil is stockpiled on site is likely to be limited during construction;

- Soils with concentrations less than the VDEQ Tier II residential standards may be used as backfill on-site (i.e. beneficial reuse);
- All construction areas would be fenced, with no trespassing signs and fencing cloth to deter bystanders and reduce migration of dust from the site. Regular watering of the site may be conducted to minimize the potential for dust. Most of the soils proposed to be excavated would be below the water table (therefore saturated) and not produce fugitive dust;
- Trucks transporting soil would be tightly covered and would pass through a wheel wash station prior to leaving the construction area to eliminate migration of soil media;
- On-site oversight professionals would inspect trucks before they leave the construction area;
- Regular street sweeping would be conducted along haul routes and within the vicinity of construction areas;
- Excavation dewatering would be followed by water treatment, sampling and discharge in compliance with the terms of the permitted discharge (i.e. a Virginia Pollutant Discharge Elimination System Permit or discharge at the WRRF). The contractor would provide on-site treatment (i.e. granulated activated carbon, bag filters, or equivalent), sampling and metering;
- Site restoration would include backfilling excavated areas with clean fill material.

Cumulative Impacts

Impacted soils and groundwater encountered during construction would be handled in accordance with federal, state and local regulations and would result in a positive effect through the removal of contamination from the existing environment. In conjunction with ongoing VRP projects and other potential remedial efforts from Projects noted in **Table 3-1**, an overall positive cumulative impact on human health and safety is anticipated within the NPS administrative units and the City of Alexandria.

As previously discussed, BMPs would be implemented to mitigate the potential for impacted soil and groundwater from impacting the community. Excavated soil would either be live loaded or stockpiled on-site for a short duration of time. Any stockpiled soil would be placed on a polyethylene ground cover with perimeter berms to prevent stormwater run-on or run-off. Trucks transporting potentially impacted soils would be covered with a tarp and would enter a decontamination wheel wash station prior to leaving the construction area. To prevent fugitive dust migration, a wind screen barrier would be installed on the fencing surrounding the construction area. Potentially impacted groundwater produced during construction would be treated on-site and discharged to either the AlexRenew WRRF or to a location via a VPDES Permit.

Conclusion

Construction activities associated with the Outfall 001 and Outfall 002 diversion facilities may disturb PECs and impacted soils or groundwater within or adjacent to the Potomac River and Jones Point Park, respectively. Construction activities associated with the Outfall 003/4 System and WRRF Upgrades may disturb PECs within or adjacent to Hooffs Run and WRRF campus, respectively. If soil and/or groundwater impacts are found to exceed regulations at any of these locations, they would be treated in accordance with existing federal, state and local regulations, NPS permit conditions and the BMPs outlined above. Soil and groundwater samples collected to date from within areas of potential ground disturbance indicate that soil and groundwater are classified as non-hazardous waste. It is anticipated that soil would be transported and disposed off-site at a landfill and groundwater would be treated and discharged via a VPDES Permit to an off-site location or the AlexRenew WRRF.

Site specific health and safety plans, including PPE requirements for construction workers, would be developed prior to construction to address risks to human health and safety posed by the presence of impacted soil and groundwater, or other PECs, as appropriate.

Chapter 4. Consultation and Coordination

AlexRenew, with support from the City of Alexandria and NPS, encouraged public involvement and solicited comments to identify potential community concerns on the proposed action. Consultation and coordination were conducted with federal and state agencies and other consulting parties to determine potential natural and historical resource impacts. This section summarizes the public involvement and agency consultation that occurred during the planning stages of design and preparation of this EA.

Public Involvement

As part of the NEPA process, and to comply with the requirements of Section 106 of the National Historic Preservation Act, AlexRenew conducted three (3) community listening sessions in September 2018 located near Outfalls 001, 002, and 003/4, respectively, and one (1) NPS public scoping meeting held on September 25, 2018 at the Alexandria Renew Enterprises Environmental Center. The community and scoping meetings were held to provide interested members of the public opportunities to learn about RiverRenew, identify areas of concern regarding the proposed project, share their knowledge of important environmental and cultural issues that should be considered during planning, and to provide feedback to help inform the development of project alternatives. The public, agencies, stakeholders, and other interested parties were invited to submit comments on the project during each of the scoping meetings. In addition, a public comment period was open from September 10, 2018 – October 25, 2018 in order to solicit increased public involvement in the project planning.

AlexRenew used the following strategies to inform the local communities about the Program and public meetings, as well as to encourage public participation and solicit community comments:

- Announced the September 2018 community listening sessions on the City of Alexandria eNews service;
- Issued press releases to local publications, generating news articles online and in print;
- Placed community listening session dates and locations on Community Calendar listings in four publications;
- Developed dedicated pages on the RiverRenew website which included background information and the introduction to the RiverRenew brand, as well as ways for the public to connect with questions or comments by email or phone;
- Circulated press ads for the September 2018 community listening sessions in the September issue of The Zebra, the Alexandria Times on the September 6, 2018 and September 13, 2018, and the Alexandria Gazette on September 6, 2018 and September 13, 2018;
- Produced 180 bus billboards to appear in 90 City (DASH) buses;
- Distributed hundreds of postcards and flyers announcing the Listening Sessions in public areas and at events up to six weeks prior;
- Sent out three e-announcements to 220-plus homeowner's associations, community influencers and email followers, to include: Save the Date, Reminder, and Final Reminder.

Additionally, the NPS posted project information and announced the September 25, 2018 Scoping Meeting on the NPS Planning, Environment and Public Comment (PEPC) website. A comprehensive list of the public outreach and community organization coordination activities can be found in **Appendix F**. During the public scoping period, 132 public comments were submitted through the PEPC website. An additional 29 public comments were submitted to AlexRenew via handwritten comments at listening sessions, letter, or the RiverRenew website.

Agency Consultation and Coordination

Section 106 of the National Historic Preservation Act and Tribal Consultation

In accordance with Section 106 of the National Historic Preservation Act of 1966 (36 CFR §800.2(a)(4)), NPS and AlexRenew initiated consultation with the VDHR on July 26, 2018 for the portion of the RiverRenew program that falls within NPS administrative units. Note that AlexRenew will also coordinate with the USACE and other related federal agencies to initiate a separate Section 106 Consultation for the entire RiverRenew study area as part of RiverRenew's CWA permitting process. Information regarding the Section 106 Consultation process was provided during the September 25, 2018 scoping meeting and public comments were solicited. NPS and AlexRenew subsequently held an informational meeting with representatives from VDHR and the City of Alexandria on November 30, 2018 to further discuss Section 106 Consultation roles and responsibilities as they relate to the RiverRenew EA. The NPS determined there are no Tribal lands located within NPS administrative units included in the study area and therefore no Tribal coordination is proposed at this time. Section 106 consultation is ongoing at the time of this EA. The NPS does not anticipate any significant adverse effects to identified cultural resources will occur within NPS administrative units as a result of the Proposed Action; however, the potential exists for impact to yet unidentified archeological resources. A Section 106 programmatic agreement would be developed to establish a protocol in the event that unanticipated archeological resources are discovered during construction.

Section 7 of the Endangered Species Act

AlexRenew conducted a review of the USFWS and NMFS databases to assess the potential for the RiverRenew project area to contain protected populations of threatened and endangered species. The USFWS Information for Planning and Construction (IPaC) database review, conducted July 26, 2018, noted the project area does not contain species Federally Listed as Threatened, Candidate or Endangered under USFWS jurisdiction¹ (USFWS. 2018b). It also noted there are no documented critical habitats for any species within the project area.

A search of the Center for Conservation Biology (included in USFWS database review) noted one documented bald eagle nest within 660 feet of the project area, near Cameron Run/Hunting Creek (USFWS. 2018c; CCB. 2018). This nest is located on a power pole adjacent to the WRRF and the Interstate 495/U.S. Route 1 interchange. Given the close proximity of the documented nest to the WRRF and the proposed types of noise generating activities associated with RiverRenew, the USFWS determined that an incidental take permit would be necessary to account for the potential for nest abandonment by the eagles during construction activities. While protection measures would be implemented to minimize impacts to the nest, AlexRenew has applied for an incidental take permit from the USFWS.

A review of the NMFS database and habitat maps noted the project area contains critical habitat for the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), and documented occurrences of the Shortnose Sturgeon (*Acipenser brevirostrum*) in the Potomac River and just downstream of the project in Hunting Creek/Cameron Run. These species are listed as Endangered and protected under the Endangered Species Act. The NMFS also documents environmentally sensitive habitats within the project area. The majority of sensitive habitats within the project area include the eagle nest near the AlexRenew property, and the submerged aquatic vegetation (SAV) along the Potomac Shoreline.

¹ IPaC does not display listed species or critical habitats under the sole jurisdiction of NMFS.

Section 7 consultation is ongoing at the time of this EA. AlexRenew and NPS are in the process of coordinating with NMFS and will develop mitigation measures as necessary to ensure that the proposed action will not result in any adverse effects to any federally listed threatened or endangered species.

Clean Water Act and Rivers and Harbors Act

In accordance with Sections 404 and 401 of the CWA (33 USC 1344 and 33 USC 1341, respectively), as well as Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403), AlexRenew is seeking authorization from the USACE and VDEQ for regulated activities proposed within jurisdictional wetlands and other waters of the U.S. located within the study area.² Coordination regarding these authorizations is ongoing at the time of this EA. As part of the permit review processes, potential impacts to jurisdictional wetlands and other waters of the US would be avoided or minimized to the maximum extent practicable. AlexRenew will coordinate with USACE and VDEQ to determine appropriate mitigation measures for any unavoidable impacts.

Coastal Zone Management Act

In accordance with the Coastal Zone Management Act (CZMA) of 1972, as amended and pursuant to the Virginia CZM Program approved by the National Oceanic and Atmospheric Administration (NOAA), AlexRenew is currently seeking a federal consistency determination from VDEQ. This certification is required for federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone, which must be consistent with the enforceable policies of the state's approved coastal management program.

This consistency determination is required for the project as it must obtain a *Federal license or permit* (15 CFR part 930, subpart D) for the work, and the work will be performed by a non-federal entity requiring federal permits. This project will require federal permits from the NPS for the tunnel and diversion facilities as well as Clean Water Act permits from the USACE for encroachments into waters of the US, including wetlands. The CZMA consistency determination is provided to state resource agencies and the locality for review and comment. A public notice is also published, in accordance with 15 CFR §930.2, in the VDEQ Office of Environmental Impact Review (OEIR's) program newsletter and on the VDEQ website to solicit public comments.

The enforceable policies include the following items: Fisheries Management (VDGIF), Wetlands Management (VDEQ), Subaqueous Lands (VMRC), Air Pollution Control (VDEQ State Air Pollution Control Board), Coastal Lands Management (Chesapeake Bay Act-locality), and Nonpoint Source Pollution Control (VDEQ). Once these agencies and the public have provided input, a final consistency determination is anticipated to be issued by the VDEQ CZM program. AlexRenew will consider all substantive comments received in the implementation of this project.

² Note that AlexRenew is also seeking authorization from NPS for impacts to riverine wetlands, the Potomac River bed and surface wetlands within Jones Point Park.

Chapter 5. References

- AlexRenew. 2018. *Combined Sewer System Long Term Control Plan Update Report*. Online: <https://www.alexandriava.gov/tes/info/default.aspx?id=97879>. Accessed June 10, 2019.
- AlexRenew. 2019. *RiverRenew Sound Level Study for Five Work Areas*. Prepared for AlexRenew by GEI Consultants.
- Barse, William P. Jeffrey Harbison, Ingrid Wuebber, and Meta Janowitz. 2006. *Phase III Archeological Mitigation of the Prehistoric and Historic Components of Site 44AX185, Jones Point Park, Alexandria, Virginia*. Prepared for the Federal Highway Administration and Virginia Department of Transportation and the National Park Service by URS Corporation.
- Bike Arlington. 2019. BikeArlington Counter Dashboard. Online: <http://counters.bikearlington.com/>. Accessed May 7, 2019.
- CCB. 2018. The Center for Conservation Biology VA Eagles Nest Locator. Online: <https://ccbbirds.org/maps/#eagles>. Accessed August 31, 2018.
- CEQ. 1979(a). 40 CFR § 1502.16 - Environmental consequences. Online: <https://www.law.cornell.edu/cfr/text/40/1502.16>. Accessed May 7, 2019.
- CEQ. 1979(b). 40 CFR § 1508.27 - Significantly. Online: <https://www.law.cornell.edu/cfr/text/40/1508.27>. Accessed May 7, 2019.
- CEQ. 1979(c). 40 CFR § 1508.7 - Cumulative impact. Online: <https://www.law.cornell.edu/cfr/text/40/1508.7>. Accessed May 7, 2019.
- City of Alexandria. 2003. Final Windmill Hill Plan April 12, 2003. Online: <https://www.alexandriava.gov/uploadedFiles/recreation/parks/FinalWindmillHillPlan12April2003.pdf>. Accessed May 7, 2019.
- City of Alexandria. 2016. *Chapter 4 – Erosion and Sediment Control Ordinance*. Online: <https://www.alexandriava.gov/uploadedFiles/tes/oeq/info/Title%205,%20Chapter%204,%20Erosion%20and%20Sediment%20Control%20Ordinance.pdf>, accessed May 7, 2019.
- City of Alexandria. 2017. Noise Codes Section 11-5. Online: <https://www.alexandriava.gov/tes/oeq/info/default.aspx?id=4034>. Accessed May 7, 2019.
- City of Alexandria. 2019. African American Heritage Park. Online: <https://www.alexandriava.gov/historic/blackhistory/default.aspx?id=37348>. Accessed June 10, 2019.
- City of Alexandria DPZ. 2012. *Alexandria Waterfront Small Area Plan* (Adopted by Ordinance No. 4749). Online: https://www.alexandriava.gov/uploadedFiles/planning/info/masterplan/City_Master_Plan_Map/WaterfrontPlanCurrent.pdf. Accessed May 7, 2019.
- City of Alexandria DPZ. 2019. Planning & Zoning. Online: <https://www.alexandriava.gov/Planning>. Accessed May 7, 2019.
- Cultural Landscape Foundation. 2018. About Cultural Landscapes, <https://www.tclf.org/places/about-cultural-landscapes>. Accessed December 10, 2018.
- COV. 2010. Chesapeake Bay TMDL Phase I Watershed Implementation Plan. Online: <https://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/Baywip/vatmdlwipphase1.pdf>. Accessed May 7, 2019.

- COV. 2016. Administrative Code 9VAC25-840-40. Minimum Standards. Online: <https://law.lis.virginia.gov/admincode/title9/agency25/chapter840/section40/>. Accessed May 7, 2019.
- COV. 2017. Code of Virginia § 62.1-44.15:52 Virginia Erosion and Sediment Control Program. Online: <https://law.lis.virginia.gov/vacode/title62.1/chapter3.1/section62.1-44.15:52/>. Accessed May 7, 2019.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. United States Department of the Interior. Fish and Wildlife Service. Online: <https://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf>. Accessed May 7, 2019.
- Cressey, P. 1995. "New Park Incorporates Historic Black Cemetery". *Alexandria Port Gazette*. July 13, 1995.
- DC DOEE. 2016. *District of Columbia Water Quality Assessment: 2016 Integrated Report to the U.S. Environmental Protection Agency and Congress Pursuant to Sections 305(b) and 303(d) Clean Water Act* (P.L. 97-117). Online: <https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/2016%20Final%20IR.pdf>. Accessed May 7, 2019.
- FGDC. 2013. *Classification of Wetlands and Deepwater Habitats of the United States* (FGDC-STD-004-2013). Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.
- Gilpin, G., Clarke, T. & Thomas, J. V. 1798. *Plan of the town of Alexandria in the District of Columbia*. [Alexandria: I. Thomas] [Map] Retrieved from the Library of Congress. <https://www.loc.gov/item/91681006/>. Accessed December 7, 2018.
- Harrison, A. M., Hilgard, J. E., Bache, A. D., *United States Army Corps of Engineers & United States Coast Survey*. (1863) Jones Point, Potomac River, near Alexandria, Virginia. [Map] Retrieved from the Library of Congress, <https://www.loc.gov/item/91686261/>. Accessed December 7, 2018.
- Hopkins, G. M. 1894. *The Vicinity of Washington, D.C.* [Philadelphia: Griffith M. Hopkins, C.E] [Map] Retrieved from the Library of Congress. <https://www.loc.gov/item/88693364/>. Accessed December 7, 2018.
- Little, Barbara, Erika Martin Seibert, Jan Townsend, John H. Sprinkle, Jr. and John Knoerl
2000 National Register Bulletin: Guidelines for Evaluating and Registering Archeological Properties. U.S. Department of the Interior, National Park Service, National Register, History and Education.
- NPS. 1996. *Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. Online: <https://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm>. Accessed June 10, 2019.
- NPS. 2011. *Director's Order #12 and Handbook: Conservation Planning, Environmental Impact Analysis, and Decision Making*. Washington, DC.
- NPS. 2015a. *NEPA Handbook*. Online: https://www.nps.gov/subjects/nepa/upload/NPS_NEPAHandbook_Final_508.pdf. Accessed June 10, 2019.
- NPS. 2015b. Jones Point Park Improvements Project. Online: <https://www.alexandriava.gov/recreation/info/default.aspx?id=34692>

- NPS. 2016. *Procedural Manual 77-1: Wetland Protection*. Online: https://www.nps.gov/policy/DOrders/Procedural_Manual_77-1_6-21-2016.pdf. Accessed May 7, 2019.
- Page, Robert R., Cathy A. Gilbert and Susan A. Dolan. 1998. *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques*. U.S. Department of the Interior National Park Service, Washington, D.C.
- Sanborn Map Company (1907) *Sanborn Fire Insurance Map from Alexandria, Independent Cities, Virginia*. Sanborn Map Company, Nov. [Map] Retrieved from the Library of Congress, https://www.loc.gov/item/sanborn08968_005/. Accessed December 7, 2018.
- US Advisory Council on Historic Preservation. 2004. 36 CFR § 800.16 Protection of Historic Properties - Definitions. Online: <https://www.law.cornell.edu/cfr/text/36/800.16>. Accessed May 7, 2019.
- USACE. 1987. *Corps of Engineers Wetlands Delineation Manual*. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Technical Report. Y-87-I. 100 pp.
- USACE. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic Gulf Coast Regional Supplement (Version 2.0)*, ed. J. F. Berkowitz, J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-12-9. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
- USDOT. 2006. *Construction Noise Handbook*. FHWA-HEP-06-015 DOT-VNTSC-FHWA-06-02 NTIS No. PB2006-109102. U.S. Department of Transportation Federal Highway Administration Office of Natural and Human Environment. Washington, D.C.
- USEPA. 2010. *Chesapeake Bay TMDL Document*. Online: <https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document>. Accessed May 7, 2019.
- USFWS. 2018a. Wetlands Mapper. National Wetlands Inventory. Online: <https://www.fws.gov/wetlands/data/Mapper.html>. Accessed May 9, 2019.
- USFWS. 2018b. Information, Planning, and Conservations System. Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service. Online: <http://ecos.fws.gov/ipac/>. Accessed August 31, 2018.
- USFWS. 2018c. Virginia Field Office's Bald Eagle Map Tool. Online: <http://fws.maps.arcgis.com/apps/Viewer/index.html?appid=0e5ca36a4056471db1b12c1b4065f3cb>. Accessed August 31st, 2018.
- VCRIS. 2018. Virginia Cultural Resource Information System (VCRIS) Database. Online: <https://www.dhr.virginia.gov/archive>. Accessed May 7, 2019.
- VDEQ. 2018. Final 2016 305(b)/303(d) Water Quality Assessment Integrated Report. Online: <https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2016305b303dIntegratedReport.aspx>. Accessed May 7, 2019.
- VDEQ. 2019. Voluntary Remediation Program. Online: <https://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/VoluntaryRemediationProgram.aspx>. Accessed June 10, 2019.
- VDHR. 2013. Virginia Cultural Resources Information System Version 2.0.0. Online: <https://vcris.dhr.virginia.gov/vcris/>. Accessed May 7, 2019.
- VDHR. #100-0121. Alexandria Historic District. Online: <https://www.dhr.virginia.gov/historic-registers/100-0121/>. Accessed June 10, 2019.

- VDHR. #100-0138. Alexandria National Cemetery. Online: <https://www.dhr.virginia.gov/historic-registers/100-0138/>. Accessed June 10, 2019.
- VDHR. #100-0149. Orange & Alexandria Railroad Hooffs Run Bridge. Online: <https://www.dhr.virginia.gov/historic-registers/100-0149/>. Accessed June 10, 2019.
- VDOT. 2019. Level of Service Definitions. Online: <http://www.virginiadot.org/projects/resources/LOS-defined.pdf>. Accessed June 10, 2019.
- Watts, Gordon P., Jr. 1986. *Acoustic and Magnetic Remote Sensing and Site Identification Survey Along the Alexandria, Virginia Waterfront Between Oronoco and Franklin Streets and Oronoco Bay*. Prepared for the City of Alexandria by Tidewater Atlantic Research. January 6, 1986.