

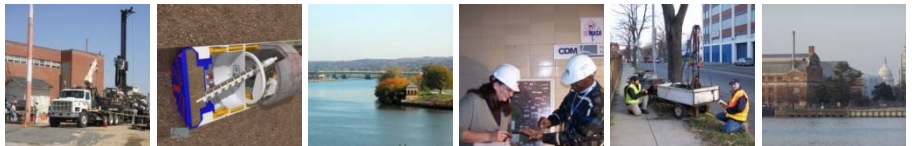
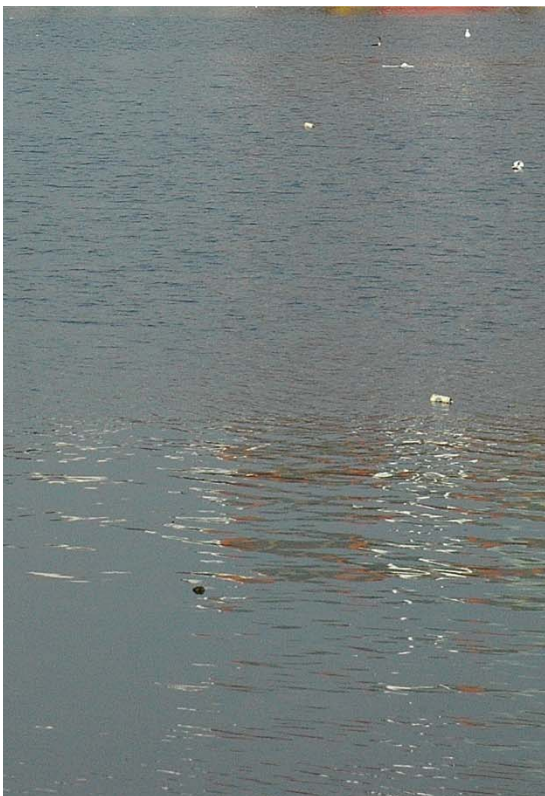
DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY

LONG TERM CSO CONTROL PLAN

ANACOSTIA RIVER PROJECTS



DOCUMENT II-3:5-FI FACILITY PLAN



SUMMARY REPORT AND DETAILED IMPLEMENTATION SCHEDULE

SEPTEMBER 23, 2008

CDM/HMM, A JOINT VENTURE – FACILITY PLAN, DCFA #399-WSA

GREELEY AND HANSEN LLC - OPERATIONAL PLAN, EPMC-III



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Summary Report and Detailed Implementation Schedule

This report is a summary of findings and recommendations based on the Facility Plan developed for the District of Columbia Water and Sewer Authority's (Authority or WASA) Anacostia River Projects which are part of WASA's Long Term Control Plan for Combined Sewer Overflows. It has been prepared to satisfy the requirement for the Authority to submit to the United States Environmental Protection Agency (EPA), no later than September 23, 2008, a summary report and detailed implementation schedule for the Anacostia River Projects as described at Section VI, paragraph A.9. of the Consent Decree entered into by the Authority, the United States and the District of Columbia, effective March 23, 2005. Detailed information regarding the Facility Plan for the Anacostia River Projects, is provided in Document II-3:4 FD, Facility Plan, which includes a main document volume and four Appendix volumes of supporting and reference information.

When completed, the Anacostia River Projects are expected to reduce the average year volume of combined sewer overflows to the Anacostia River by 98 percent, and number of overflows from 82 to 2 in the average year.

1. Background and Introduction

Communities with combined sewer systems are required to prepare long term plans for control of combined sewer overflows (CSOs) in accordance with the CSO Policy at Section 402 (q) of the Clean Water Act. The Authority, after extensive stakeholder and public participation, completed its Long Term Control Plan (LTCP) for the District's combined sewer system in July 2002. The LTCP provides for control of CSOs to the Anacostia River, Rock Creek and Potomac River and was submitted for approval to the District Department of Health (DOH) and EPA.

The LTCP was approved by DOH on August 28, 2003, and on December 16, 2004 EPA reissued the Authority's National Pollutant Discharge Elimination System (NPDES) permit to include the CSO control provisions of the DOH approved LTCP. Subsequently, the Authority, the District of Columbia and the United States entered into a Consent Decree to implement the LTCP. The Consent Decree includes the schedule for the facilities included in the LTCP and was entered by the Federal Court on March 23, 2005.

Projects to control CSOs to the Anacostia River are at the top of the court ordered schedule, and the Authority is required to prepare a Facility Plan for these projects. The Facility Plan for the Anacostia River CSOs comprises engineering studies to advance the LTCP conceptual plan to a level sufficient to proceed into detailed design and construction.

The Consent Decree schedule for the Anacostia River Projects, including milestone dates, is summarized in Table 1.



Table 1
Anacostia River Projects
Consent Decree Milestone Dates
(not later than dates)

Project	Award Contract for Design	Award Contract for Construction	Place in Operation
Anacostia River Projects Facility Plan	Sep 23, 2005	n/a	Sep 23, 2008 ⁽¹⁾
Storage/Conveyance Tunnel From Poplar Point to Northeast Boundary	Mar 23, 2009	Mar 23, 2012	Mar 23, 2018
Anacostia Outfall Consolidation	Mar 23, 2013	Mar 23, 2016	Mar 23, 2018
Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer	Mar 23, 2015	Mar 23, 2018	Mar 23, 2025
Northeast Boundary Side Tunnels	Mar 23, 2019	Mar 23, 2022	Mar 23, 2025
Poplar Point Pumping Station	Mar 23, 2012	Mar 23, 2015	Mar 23, 2018
Separate Fort Stanton Drainage Area (Outfall 006)	Mar 23, 2006	Mar 23, 2008	Mar 23, 2010
Fort Stanton Interceptor	Mar 23, 2013	Mar 23, 2016	Mar 23, 2018

(1) Requires WASA to submit a summary report and detailed implementation schedule to EPA.

There are fourteen existing CSO outfalls along the Anacostia River as shown on Figure 1. Under the LTCP, the area tributary to Outfall 006 is being separated. That project is under construction and scheduled to be placed in operation by March 23, 2010. The remainder of the CSOs, shown on Figure 1, are included in the facilities that comprise the Facility Plan for the Anacostia River Projects (ARP) program. The ARP program comprises a tunnels system together with diversion and overflow facilities to capture, store and convey combined sewer flow. In addition to providing CSO control, the tunnels system is designed to control chronic surface flooding on the combined sewer system in the Northeast Boundary Area. The chronic surface flooding is the result of a lack of adequate capacity in the existing Northeast Boundary Trunk Sewer. The tunnels system, CSO locations and the Northeast Boundary areas prone to surface flooding are shown on Figure 2.

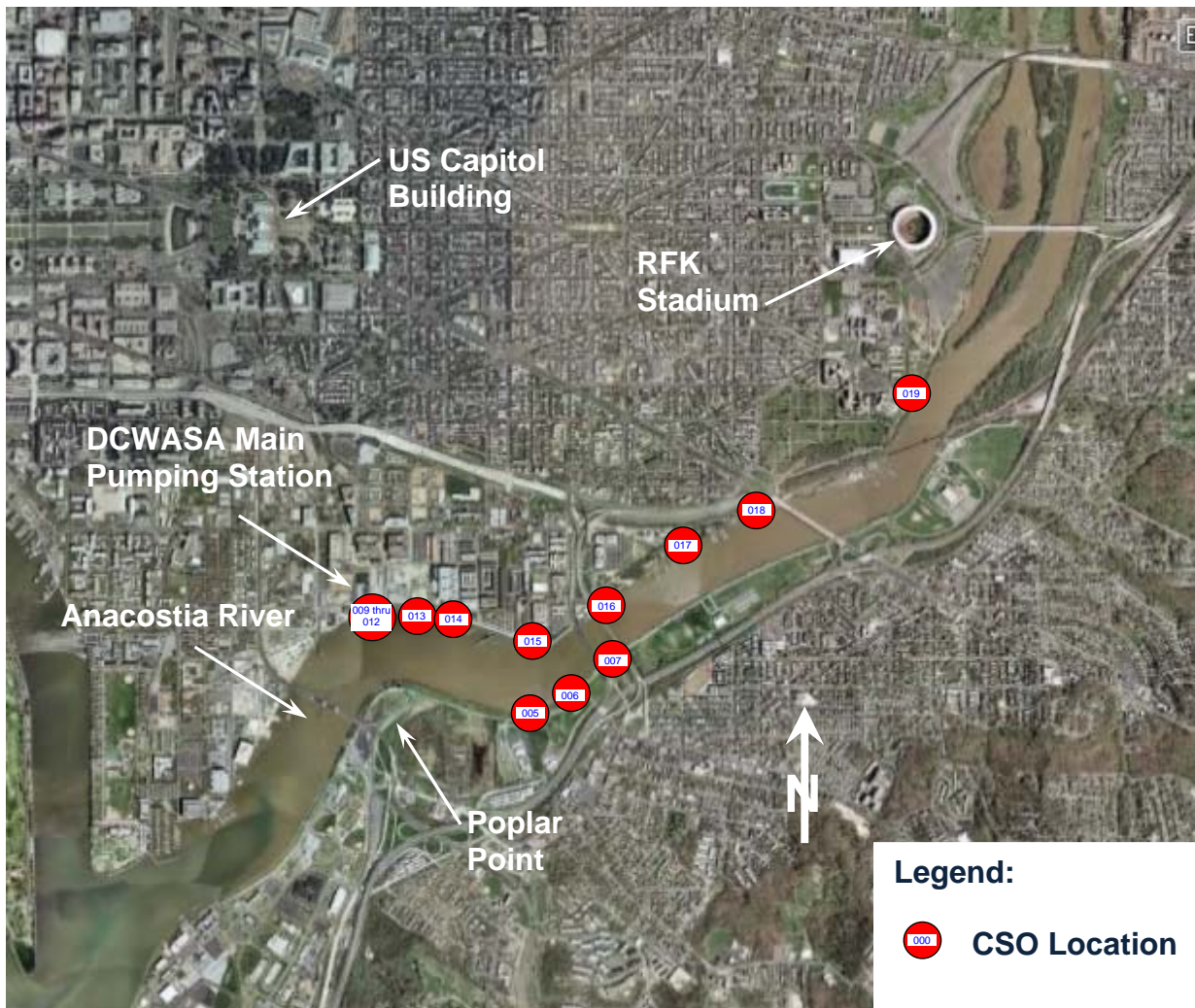


Figure 1: Locations of Combined Sewer Overflows along the Anacostia River

As shown on Figure 2, the tunnels system extends from the Authority's Blue Plains Advanced Wastewater Treatment Plant (Blue Plains or BPAWWTP), along the Potomac and Anacostia Rivers and into the Northeast Boundary Area. Existing CSOs will be conveyed into the tunnels system through a system of diversion sewers and drop shafts. Similar diversion facilities will be used to provide relief for the existing Northeast Boundary Trunk Sewer. Flow captured in the tunnels will be treated at Blue Plains. Flows in excess of the tunnels storage capacity and Blue Plains treatment capacity will overflow to the Potomac and Anacostia Rivers at locations shown on Figure 2.



Figure 2: Location of Tunnels System Relative to CSOs and Flooding Areas



The tunnels system shown on Figure 2, is a result of the following:

- The LTCP approved by DOH on August 28, 2003, which provided for the tunnel's system to terminate at its south end on Poplar Point and;
- Supplement No.1 to the LTCP, which comprises the Blue Plains Total Nitrogen Removal/Wet Weather Plan submitted to EPA on October 12, 2007. This plan provides for modifying the LTCP Consent Decree to blend the new nitrogen limit for Blue Plains and wet weather treatment. The principal provisions of the plan include the addition of enhanced nitrogen removal (ENR) at Blue Plains and extension of the tunnels system from Poplar Point to Blue Plains, including tunnel dewatering and enhanced clarification facilities at the tunnels system terminus.

2. Project Scope & Description of Facilities

Principal facilities included in the Anacostia River Projects are shown on Figure 3 and include approximately 12.9 miles of tunnels, 17 shafts for conveyance of flows into the tunnels system, overflow structures, air venting and management, and maintenance and inspection access. In addition to the underground works, diversion chambers and sewers will be constructed to capture and divert flows from the existing combined sewer system into drop shafts that will convey the flows to the tunnels system. The tunnels will be constructed using pressurized-face soft ground tunnel boring machines (TBMs). The tunnels and shafts will be constructed at depths to invert between 70 and 200 below existing ground elevation.

The principal elements that comprise the ARP are described briefly as follows:

- **Blue Plains Tunnel (BPT)** –The BPT follows an alignment that starts at Blue Plains, traverses west of Interstate 295 along the Potomac River through Bolling Air Force Base (BAFB) and the Anacostia Naval Annex, then crosses under the Anacostia River north of the existing WASA Main Outfall Sewers (which extend from WASA's Main Pumping Station to Poplar Point), and terminates in the north yard area of WASA's Main Pumping Station. The BPT will have an inside diameter of 23 feet and a permanent lining of precast concrete segments connected by bolts and gaskets. This lining system will be used for all tunnel reaches on the ARP for bored tunnels. Shafts located along the BPT include a dewatering pumping station shaft at Blue Plains; a tunnel overflow shaft within BAFB downstream of a new connection to the Potomac Outfall Sewers; a combination drop and junction shaft with the Anacostia River Tunnel near Poplar Point; and a drop shaft at WASA's Main Pumping Station.
- **Anacostia River Tunnel (ART)** – The ART begins at the junction shaft with the BPT at a location approximately 750 feet south of the existing Poplar Point Pumping Station. It then traverses under the Washington Metropolitan Area Transit Authority (WMATA) Green Line at Poplar Point, follows Anacostia Park to a point east of the 11th Street Bridges where it crosses the Anacostia River, and then follows the north (west) shore of the river from Water Street to an interface with the Northeast Boundary Tunnel immediately north of the planned CSO 019 facilities. The ART is planned to be constructed from the CSO 019 area southward to the junction shaft with the BPT, with all

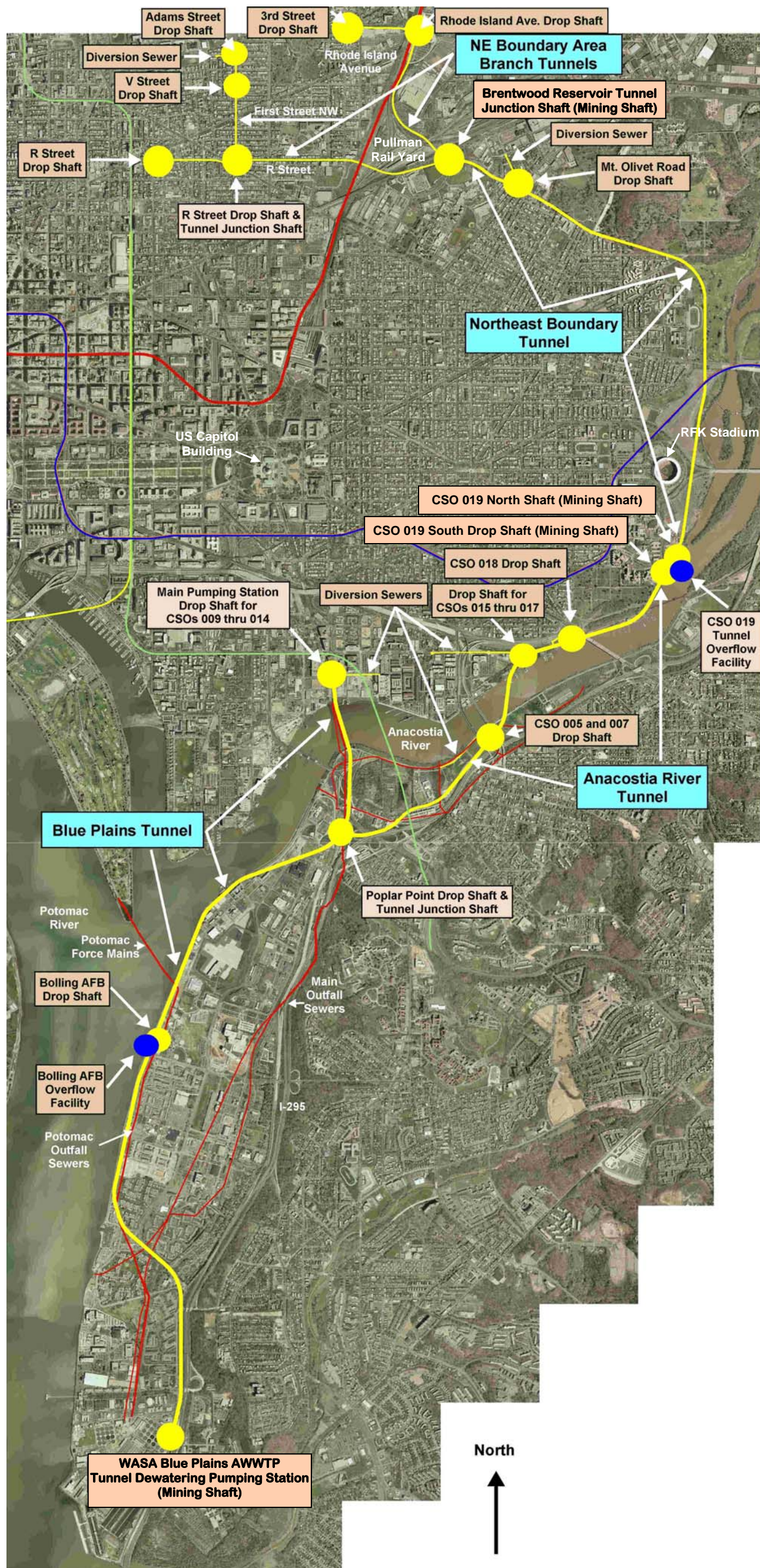


Figure 3: Principal Anacostia River Projects Facilities



tunnel construction staging from the south parking lot area of RFK Stadium. Flows from CSOs 005 and 007 on the south side of the river will be captured in a new diversion sewer and conveyed into the tunnel at a drop shaft located between the approach roadways for the 11th Street Bridges. Flows from CSOs 015, 016 and 017 on the north (west) side of the river also will be captured in a new diversion sewer and conveyed to a drop shaft located at the intersection of Water Street SE and M Street SE. Flows from CSO 018 on the north (west) side of the river will be conveyed to a drop shaft somewhat to the east along M Street near Barney Circle. At the CSO 019 area, a drop shaft will accept flows from the existing Northeast Boundary Trunk Sewer above CSO 019. In addition, the drop shaft will serve as a tunnel overflow shaft, and a second tunnel overflow shaft will also be constructed. The CSO 019 area is the limit of the first phase of facilities construction and facilities system operation. The Consent Decree requires the new ARP facilities from Blue Plains to the CSO 019 area to be placed in operation by March 23, 2018.

- **Northeast Boundary Tunnel (NEBT)** – The NEBT will be excavated north from the CSO 019 area under the RFK Stadium parking lots along the Anacostia River, Langston Golf Course and under the National Arboretum. It will then continue west along Mount Olivet Road NE and terminate at WASA’s Brentwood Reservoir site adjacent to New York Avenue. Since the ART will be operating while the NEBT is under construction, a temporary isolation plug or physical separation (bulkhead) between the ART and NEBT tunnels must be in place to provide for the safety of the workers constructing the NEBT. This separating plug or bulkhead will be constructed by the ART construction contractor. Along the NEBT there will be a drop shaft near the intersection of Mount Olivet Road NE and West Virginia Avenue NE to receive flows from this flooding area. The tunnel terminus at the Brentwood Reservoir will be at a shaft for extraction of the TBM. This shaft will also serve as a junction shaft for connecting the Northeast Boundary Area branch tunnels to the NEBT, and as the mining shaft for the R Street and Rhode Island Avenue branch tunnels.
- **Northeast Boundary Area Branch Tunnels** – Three branch tunnels will convey flows from flooding areas west of the Pullman Rail Yard: the R Street Branch Tunnel (RSBT), the Rhode Island Avenue Branch Tunnel (RIBT), and the First Street NW Branch Tunnel (FSNWB). These tunnels have been planned with inside diameters of 12 feet. Drop shafts are planned at the upstream ends of the respective tunnels. The RSBT and FSNWB will join at an intermediate, combination drop and junction shaft. As for other drop shafts, these will connect to the existing combined sewer system via diversion chambers and sewers.

Diversion Chambers and Sewers – In order to capture and convey flows from the existing combined sewer system to the respective drop shaft facilities, diversion chambers will be constructed at the points of diversion, and diversion sewers will be constructed from those points to the nearest drop shafts. These will involve surface construction at the diversion points and potentially at intermediate locations along the diversion sewer alignments, depending on the construction technology applied. Microtunneling and pipe-jacking applications are being considered for construction of diversion sewers, depending



on the feasibility of the respective technologies with respect to the site conditions. The most significant diversion sewer alignments include:

- Tingey Street SE, connecting to drop shaft facilities at the Main Pumping Station
- M Street SE and Water Street SE areas, connecting to drop shaft facilities along Water Street SE and M Street SE
- Mount Olivet Road neighborhood area diversions
- Northeast Boundary Area diversions connecting to the branch tunnels described above

3. Project Setting

Facilities to be constructed and operated will be located in a variety of settings ranging from open space and public lands to well developed residential and commercial neighborhoods. Several areas are also being planned to undergo substantial development and infrastructure improvements prior to and during construction of the ARP facilities. Therefore, the siting of facilities and planning for construction and facilities operations has involved a substantial degree of coordination and collaboration with numerous government agencies, citizen groups and neighborhoods, military commands, railroad entities, utility companies and other interested parties. Planning has been designed to minimize disturbance to neighborhoods as well as physical and construction staging interfaces with planned property development and major infrastructure projects.

The storage and conveyance tunnels are predominantly located in soil strata, and therefore soft ground tunneling technologies will be employed. Tunnel construction will be performed by Tunnel Boring Machines (TBMs) that will be driven from mining shafts at locations shown on Figure 3. The majority of tunnel construction activities will be concentrated at the mining shaft locations. Consequently, the mining shaft areas require substantial staging areas for material handling, construction logistics, and utility support. The recommended plan is based on the use of two sites for the majority of tunnel construction: WASA's Blue Plains site for construction of the BPT to Main Pumping Station and the southern parking lot area of RFK Stadium for construction of the ART to its junction with the BPT; and the NEBT to its terminal shaft at Brentwood Reservoir in the vicinity of New York Avenue NE. The Brentwood Reservoir site will also be a construction work site for mining and construction of approximately 2.6 miles of the branch tunnels.

Improvements in tunneling technology during the past couple of decades will result in fewer impacts on the surrounding neighborhoods and environment than in the past and provides the ability to construct tunnels within more variable and difficult ground conditions than in the past. However, the minimization of risks associated with the ARP tunnels program is a key consideration as for any other underground construction program. Such risks could involve, but are not limited to:

- Ability to perform the work under varying or adverse geological conditions
- Protection of structures and utilities from settlement or other adverse impacts
- Encountering unknown subsurface obstructions that impede tunnel advance



- Major mechanical failures of the TBM that may require construction of an unplanned access from the surface or extensive ground improvement to rescue and repair the TBM

These risks are particularly important considerations for the design and construction of soft ground tunnels compared to tunnels constructed in intact rock, as has been the case for many CSO tunnels that have been constructed prior to the introduction of modern soft-ground tunneling technology.

In consideration of the risks above, as well as in the interest of minimizing the need to acquire private property or easements, the tunnel alignments have been located to be predominantly in open land within public space and to not pass directly below existing surface structures. These public lands include D.C. streets and properties occupied by WASA, development land, park land, BAFB, the Anacostia Naval Annex, the RFK Stadium site, and the National Arboretum. Rights are required for construction and operation of the tunnels underneath private properties, including CSX and WMATA properties at five locations and several small privately owned parcels for subsurface easements along the tunnels alignments. Easements for small privately owned parcels along sections of the alignments are required because of the minimum turning radii needed for the TBMs to facilitate excavation and construction of the pre-cast concrete tunnel lining.

To avoid subsurface obstructions and to protect structures and utilities from settlement-induced damage, the Facility Plan development included a limited subsurface geotechnical exploration program to investigate geological conditions along the planned tunnel alignments and research of the major infrastructure and structures in proximity to the alignments. The alignment of the ART is greatly influenced by avoidance of past, present, and future bridge piers and piles while maintaining a minimum radius of curvature for tunnel construction. Protection and avoidance of damage to WMATA transit structures is also a consideration. The tunnel alignments cross under the subsurface Green Line just west of Anacostia Station, the aerial section of the Blue Line in the northern parking area of RFK Stadium, and the surface Red Line track south and north of the Rhode Island Avenue Station. Additionally, the Tingey Street Diversion Sewer will cross above the WMATA Green Line. Traversal of the Bolling AFB and Anacostia Naval Annex also include consideration of not only protection of existing structures and infrastructure, but also security considerations during construction and systems operations.

For the branch tunnels west and north of the NEBT terminus shaft, the local area along the tunnel alignments is predominantly residential with some commercial properties and small public parks. Tunnels in this area will be primarily to provide conveyance of storm flows rather than provide storage during a storm event. Consequently, they are planned to be smaller than the main storage / conveyance tunnels, which lessens the potential for surface or structural settlement. At the currently planned diameters, these tunnels will be constructed using the same methodology as the main storage / conveyance tunnels. If it is determined, as the design proceeds, that these can be smaller tunnels, alternative tunnel construction technologies may be applied, such as pipe jacking or micro-tunneling. The determination of the appropriate technology will likely occur during the design phase of the program based on a more extensive site characterization and geotechnical investigation program.

Coordination with other planned development and infrastructure projects also had a significant influence on the siting of the facilities. The Principal projects include those shown on Figure 4 and are:

- The planned development of residential and commercial properties and public lands at Poplar Point and the planned replacement of the South Capitol Street Bridge with associated modifications to the I-295 interchange in this area.
- The planned development of Diamond Teague Park, currently under construction, located along the north bank of the Anacostia River immediately to the south and east of Nationals Stadium and to the south and west of WASA's O Street Pumping Station.



Figure 4: Principal Planned Development and Infrastructure Projects in ARP Area



- On the north (west) shore of the Anacostia River, planned property development at the Southeast Federal Center near WASA's Main Pumping Station, Maritime Plaza and Boathouse Row developments near Water Street, and the Hill East development project near CSO 019 have to be considered relative to the siting of facilities.
- Another major infrastructure project that impacts the design and construction of facilities on both sides of the Anacostia River is the replacement of the 11th Street Bridges by the District Department of Transportation (DDOT). Coordination is required for diversion chambers and sewers as well as the drop shaft facility for CSO 005 and CSO 007.
- In the Northeast Boundary Area, extensive development has been accomplished near New York and Florida Avenues, with more planned to be completed over the next 20+ years while the ARP is under design and construction. Much of this development will be accomplished under the District's NoMA project (North of Massachusetts Avenue).

4. Investigation and Evaluation of Alternatives

During development of the recommended plan, a number of alternatives and variations of alternatives for the configuration of facilities were investigated and evaluated in an organized and systematic manner. The major alternative alignment corridors which were investigated are presented on Figure 5. These alternatives were evaluated relative to their ability to achieve the required system hydraulic operational performance, as well as their respective programmatic profiles (e.g., estimated cost, schedule, risks, real estate needs, permitting, and degree of required coordination with other agencies and projects and community impacts, if any).

Overall, 12 alternative tunnel horizontal alignments, with some associated variations for localized conditions, were investigated for the tunnels between Poplar Point and the Northeast Boundary Area. For the BPT, three alternative alignments were investigated to varying degrees.

Alternative configurations were also investigated for construction and operation of deaeration facilities and drop shafts. Where such facilities have been constructed in rock as part of CSO storage and conveyance systems in major cities such as Milwaukee and Atlanta, deaeration facilities were constructed in horizontal chambers at the terminus of tunnel segments or adjacent to the tunnel with a small-diameter connecting tunnel or adit between the drop shaft and the tunnel. In those cases, the deaeration chambers were also typically of similar or larger cross-section than the tunnel. For the soil conditions anticipated for the ARP, construction of that same type of configuration could prove difficult and risky. Accordingly, an alternative configuration for locating the deaeration facility within a construction shaft in line with the tunnel has been developed for the ARP program. For this configuration, flows will enter the drop shaft through a tangential approach ramp and vortex generator, which is typical for many CSO facilities. However, at the base of the drop shaft the flow would transition to a circular channel to allow deaeration of the flow before the flow enters the tunnels system.

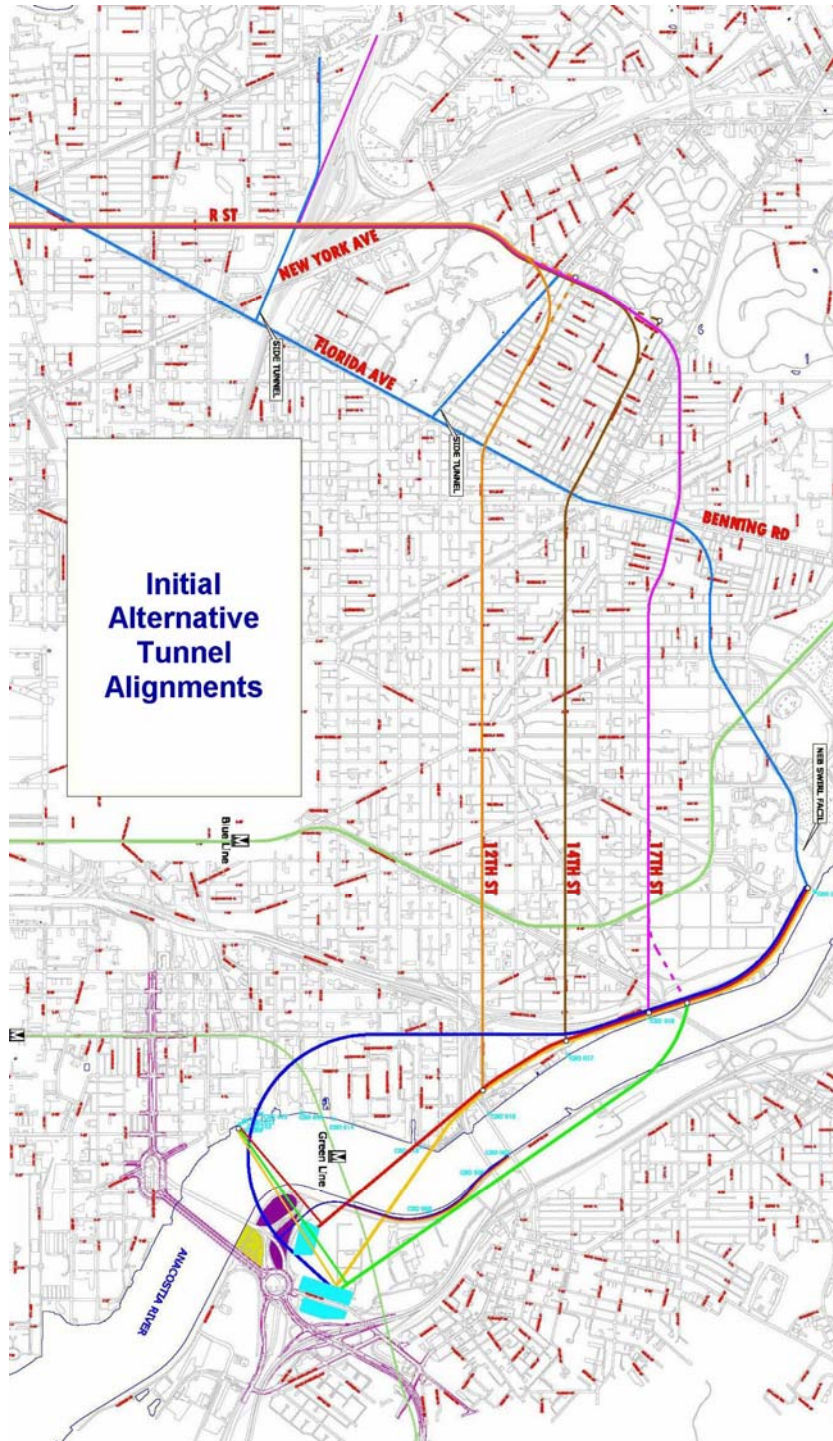


Figure 5: Alternative Tunnel Alignment Corridors



5. Recommended Implementation Schedule for Anacostia River Projects

The Facility Plan documents provide an expanded description of the facilities to be designed, constructed and placed in operation for the Anacostia River Projects, together with an associated schedule, estimated costs and other program related activities and issues.

The implementation schedule for the ARP has been developed to provide for construction through a number of individual contracts or contract divisions based on principal consideration as follows:

- Limit the value of construction contracts to the availability of bonding capacity and contractor resources in the tunneling industry.
- Separate work by degree of risk, contractor specialty and availability of local resources. Basically, this means separating the deep tunnel work from the near surface work such as diversion structures and sewers.
- Sequencing and interfacing requirements for the individual contract divisions
- Ability to meet and exceed goals for MBE/WBE participation.
- Timeframes required for the various construction activities such as time for procurement and delivery of the large tunnel boring machines and anticipated tunnel mining rates.

Construction contract divisions developed for implementation of the ARP are summarized in Table 2 and shown on Figure 6.

A comparison between the projects developed in the Facility Plan and those in the Consent Decree is summarized in Table 3. This comparison relates compliance dates for the Consent Decree projects to the Facility Plan Contract Divisions.

A detailed implementation schedule for the Facility Plan Contract Divisions is shown on Figure 7. Also shown on Figure 7 are the proposed projects and milestone dates for a modification of the Consent Decree that reflects facility planning. Additionally, the schedule shows permitting timeframes related to the proposed construction. The modified Consent Decree projects milestones match the milestones for the projects in the existing Consent Decree.

Principal features included in the detailed implementation schedule shown on Figure 7 are summarized as follows:

- An 18-month period from award of construction contract, for manufacture, delivery, assembly and start-up of a TBM. This means that actual tunnel mining starts 18 months after construction contract award.
- Tunnels shafts construction starts upon award of construction contract.
- Tunnels mining derived from the available geotechnical information and other experience has been based on an average rate of 40 feet per day.



- Contract Divisions C, E, F and G, which interface with Contract Division H, the Anacostia River Tunnel, will be completed to a “Ready to be Placed in Operation” stage before the Division H contract is awarded.
- The construction contract award date for Contract Division K, the Northeast Boundary Branch Tunnels, occurs on the “Place in Operation” date for Contract Division H, the Anacostia River Tunnel.
- The construction contract award date for Contract Division J, the Northeast Boundary Tunnel occurs at a point when there should be sufficient time for Contract Division K to vacate the Brentwood shaft site, which is the recovery shaft for Contract Division J.
- Contract Division H, Anacostia River Tunnel has the responsibility for activating connections, constructed under other contracts, to place the system between Blue Plains and CSO 019 in operation.
- Contract Division J, Northeast Boundary Tunnel has the responsibility for activating connections, constructed under other contracts, to place the system between CSO 019 and the Northeast Boundary area in operation.

Table 2
Construction Contract Divisions for Anacostia River Projects

CONTRACT DIVISION	DESCRIPTION
A	Blue Plains Tunnel and Main Outfall Sewers Diversion
B	Tingey Street Diversion Sewer for CSOs 013 and 014
C	CSO 019 Overflows and Diversion Structures
D	Bolling AFB Overflow and Potomac Outfall Sewer Diversion
E	M Street Diversion Sewer for CSOs 015, 016, and 017
F	CSO 018 Diversion Sewer
G	CSO 005 and 007 Diversion Sewer
H	Anacostia River Tunnel
I	Main Pumping Station Diversions
J	Northeast Boundary Tunnel
K	Northeast Boundary Branch Tunnels
L	Northeast Boundary Diversions
M	Mt. Olivet Road Diversions
Y	Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility
Z	Poplar Point Pumping Station Replacement

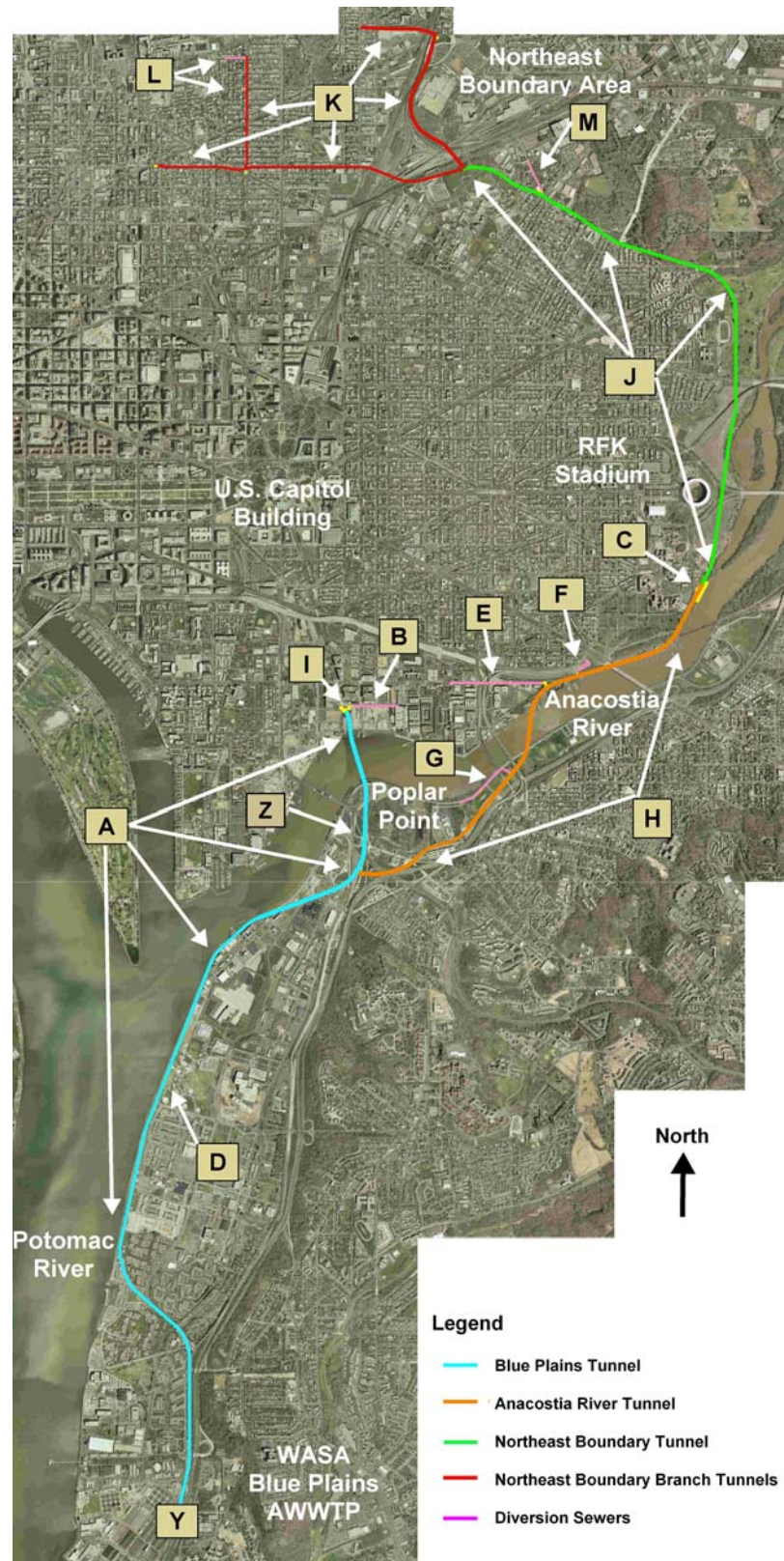


Figure 6: Locations of Contract Divisions






Table 3
Anacostia River Projects
Comparison of Facility Plan and Consent Decree Projects

FACILITY PLAN CONTRACT DIVISION	FACILITY PLAN PROJECT	MATCHING CONSENT DECREE PROJECT	CONSENT DECREE COMPLIANCE DATES RELATED TO FACILITY PLAN PROJECT
A	Blue Plains Tunnel and Main Outfall Sewers Diversion	Storage/Conveyance Tunnel from Poplar Point to Northeast Boundary	Contract Division A award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates
E	M Street Diversion Sewer for CSOs 015, 016, and 017	Anacostia Outfall Consolidation	Contract Divisions E and F award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates
F	CSO 018 Diversion Sewer		
H	Anacostia River Tunnel	Storage/Conveyance Tunnel from Poplar Point to Northeast Boundary	Contract Division H Place in Operation Date to be used to determine compliance for Consent Decree project date
G	CSO 005 and 007 Diversion Sewer	Fort Stanton Interceptor	Contract Division G replaces function of Consent Decree project; Fort Stanton Interceptor to be deleted.
Z	Poplar Point Pumping Station Replacement	Poplar Point Pumping Station	Contract Division Z has same compliance dates as Consent Decree project
J	Northeast Boundary Tunnel	Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer	Contract Division J Place in Operation date to be used to determine compliance for Consent Decree projects date
K	Northeast Boundary Branch Tunnels	Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer	Contract Division K award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates
K	Northeast Boundary Branch Tunnels	Northeast Boundary Side Tunnels	Contract Division K award dates for detailed design and contract for construction and Place in Operation date to be used to determine compliance for Consent Decree project dates
Y	Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility (ECF)	Poplar Point Pumping Station and Excess Flow Improvements	Contract Division Y Place in Operation date to be used to determine compliance for Consent Decree project date; ECF replaces Excess Flow Improvements



LEGEND

-  Detailed Design
-  Bid and Award
-  Construction

Note:

- 1 See Table 3 for comparison of Facility Plan and Consent Decree Projects
- 2 Means that facilities included in contract can be placed in operation when a subsequent contract is placed in operation.
- 3 Will be placed in operation when Contract Division H is placed in operation.
- 4 Will be placed in operation when Contract Division J is placed in operation.

Figure 7: Anacostia River Projects Detailed Facility Plan Contract Divisions Implementation Schedule



6. Program Implementation

The Authority and its consultants have developed the Facility Plan and implementation schedule. This work has been frequently reviewed by the Authority's Project Review Board (PRB). The PRB is comprised of nine individuals with a high level of experience and expertise in planning, engineering, construction and management of projects of similar type and scope to those in the ARP program. The Project Review Board has endorsed the Facility Plan and contributed suggestions and recommendations for its implementation.

The following subsections describe findings to-date regarding issues and other factors associated with the implementation of the Anacostia River Projects together with discussion of various aspects that are pertinent to its successful and timely completion.

Operational Plan and Hydraulic Design

The following criteria were selected by WASA for the operational plan and hydraulic design of the Anacostia River Projects.

- Comply with the LTCP Consent Decree, as modified to accommodate the Total Nitrogen Removal / Wet Weather (TN/WW) Plan.
- Reduce CSO overflows on the Anacostia River to the level identified in the approved LTCP: two CSO overflows and 54 million gallons (mg) of overflow per average year.
- Provide flood relief to the Northeast Boundary (NEB) Drainage Area up to a 6-hour 15-year design storm.
- Provide solids and floatables control for remaining overflows.
- Consolidate CSO's 016, 017 and 018 in the Anacostia Marina area such that all overflows are either stored in the tunnel or conveyed by the tunnel for overflow at another location.
- Configure the system to operate passively by gravity, without use of active operation gates or other such controls.
- Configure the system to prevent flooding of basements and flooding to grade. Where existing conditions in the collection system cause these conditions, arrange the tunnel system to improve hydraulic performance to the extent practicable.

The hydraulic design of the tunnels system was performed using the model prepared to develop the LTCP: the Danish Hydraulic Institute's MOUSE Model. The model was updated to reflect changes to the collection system since the development of the LTCP. The following summarizes key elements of the hydraulic design and operational plan:

- System operation: The tunnels system is designed to fill by gravity. If storms produce volumes that exceed the capacity of the system, the tunnels system has been configured to overflow to the receiving waters by gravity. The only facility that requires active operation during storms is the tunnel dewatering pumping station. The facilities that control diversions into and overflows from the tunnel typically comprise weirs, orifices and other static hydraulic controls.



- **Extent of Northeast Boundary Flooding Protection:** The tunnels system is designed to provide flooding protection to the Northeast Boundary area up to a 15-year, 6-hour design storm. It has been determined that most existing trunk and local street sewers in the drainage area do not have adequate capacity to convey the design storm. This is not unexpected since the sewers were constructed prior to the adoption of the 15-year storm as the bases for design. Since most of the existing sewers in the Northeast Boundary area do not have the capacity to convey the design storm, evaluations were made to determine the extent of flooding relief that would be provided by the ARP. These evaluations showed that it was cost prohibitive to bring all sewers in the Northeast Boundary area up to the 15-year design standard. Instead, the following design criteria were adopted for the program:
 - Provide flooding relief for the Northeast Boundary Trunk Sewer from it's outlet at CSO 019 to 1st Street NW
 - Provide relief to the following chronic flood areas and to the trunk sewers serving the areas listed below that are located between the Northeast Boundary Trunk Sewer and the flood areas:
 - Area 1 - Rhode Island Avenue N.E. between 4th and 6th Streets
 - Area 2 - West Virginia Avenue N.E. near Mt. Olivet Road
 - Area 3 - P Street and 1st Street N.W.
 - Area 5 - Rhode Island Avenue N.W., near 6th and R Streets
 - Area 6 – Thomas and Flagler Streets, NW
 - Size the tunnel and its appurtenances so they are large enough to accommodate future relief in the Northeast Boundary Area.

These criteria will provide relief for the identified flooding in the drainage area up to the design storm. In addition, the tunnel is sized large enough to allow future relief of other sub-sewer sheds in the Northeast Boundary area if relief is required in other areas in the future.

- **Storage Volume:** The tunnels system is designed to provide 157 million gallons of storage at a tunnel fill elevation of -24.0 (DC DPW Datum).
- **Tunnel Overflow Facilities:** Tunnel overflow facilities have been sited at Bolling Air Force Base (BAFB) and at CSO 019 which serves the Northeast Boundary area. After the tunnel is full, the BAFB overflow facility will typically convey flow from CSOs 005, 007, 009, and 011 through 018, while the overflow facility at CSO 019 will provide relief for the Northeast Boundary area combined sewer flow and relief flow for the flood prone locations in the Northeast Boundary area.
- **Tunnel Dewatering Pumping Station** – In accordance with the TN/WW Plan, the facility will have an installed firm capacity of 225 mgd. To provide for future expansion, the facility will be designed to be expandable.
- **Other Aspects:** Analyses have been conducted during the facility planning regarding odor control, venting, hydraulic transients, access, isolation of the tunnel, monitoring and keeping the tunnel clean. These are described in detail in the Facility Plan document.

Risk Management and Construction Planning

Underground construction for shafts and tunnels is a highly specialized field with inherent risks. Design and construction efforts and activities should, therefore, progress in concert with an appropriate risk management program. Section 8 of the Facility Plan discusses the risk management efforts accomplished to date and outlines a risk management program considered as part of facility planning efforts. Figure 8 below illustrates the relationship between the implementation elements of the projects and the risk management program as suggested in the Facility Plan.

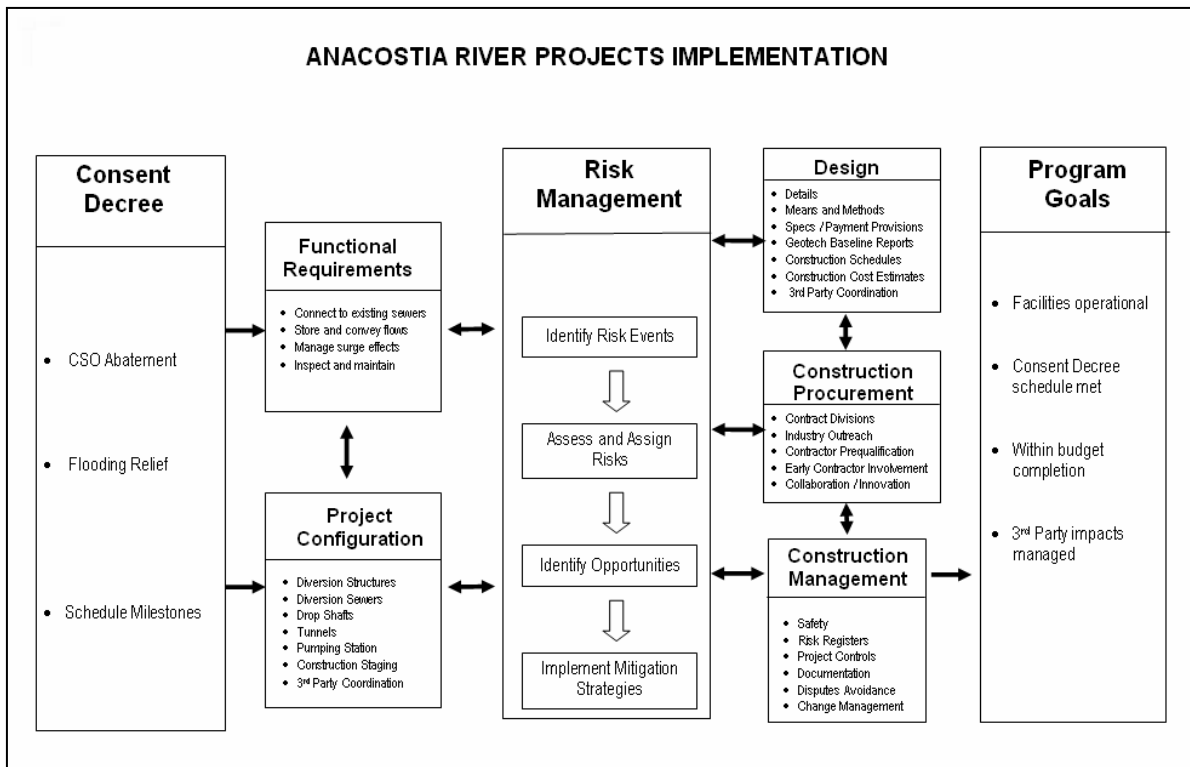


Figure 8: Program Implementation and Risk Management

The general risk management considerations diagrammed in Figure 8 will be evaluated further to develop a comprehensive approach in the future phases of the ARP implantation.

Additionally, the risk management program will need to include provisions to mitigate construction impacts on areas and neighborhoods during construction. Such provisions include by may not be limited to impacts to residences and businesses, traffic routes, noise, dust, utilities and other public concerns. The design and construction phases of the ARP program will, therefore, include outreach elements to accommodate public and institutional needs



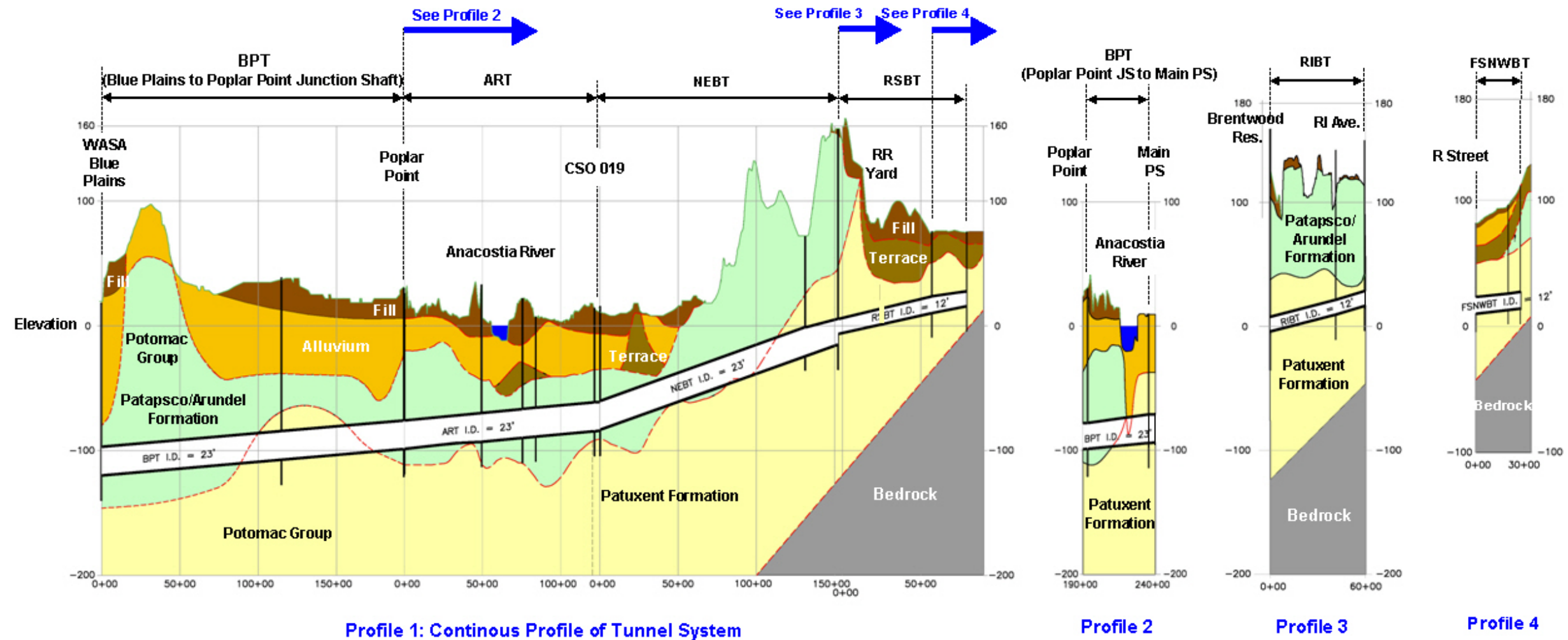
Geotechnical Investigations

Planning level geotechnical investigations have been made for the development of the Facility Plan. Most of these investigations have been completed, but some will continue through the end of 2008. Data from the latter investigations will be included in subsequent phases of project implementation. The geotechnical investigations have included research of existing information; geophysical surveys; borings by conventional rotary and sonic drilling methods; field instrumentation and testing programs; laboratory testing of recovered soil and rock samples; and groundwater monitoring. The Facility Plan includes a Preliminary Geotechnical Data Report as Appendix Volume III.

Figure 9 shows the locations of borings and geophysical surveys performed as part of the Facility Plan development. Figure 10 presents a general composite of the geological profile of the currently anticipated ground conditions along the tunnels alignments. Geotechnical investigations during design will provide more detailed information regarding the conditions which may be expected at specific shaft and structure locations as well as along the diversion sewers and tunnels alignments.



Figure 9: Locations of Borings and Geophysical Survey



TUNNELS:

BPT = Blue Plains Tunnel
ART = Anacostia River Tunnel
NEBT = Northeast Boundary Tunnel
RSBT = R Street Branch Tunnel
RIBT = Rhode Island Branch Tunnel
FSNWB = First Street NW Branch Tunnel

Figure 10: Summary Geologic Profiles



Project Permitting

The Consent Decree includes requirements relative to acquisition of permits and approvals associated with the ARP. These requirements include identification of the permits required for the ARP as well as the timing for submittals applications. Table 4 identifies the agencies and organizations that will require some type of permit or approval for construction of the facilities defined for the project. The detailed implementation schedule shown on Figure 7 also includes a graphical summary of the permits process timeline.

The permitting agencies and organizations presented in Table 4 have been divided into the following categories:

- Utility agencies
- District of Columbia (D.C.) agencies
- Regional agencies
- Federal agencies, including applicable military commands
- Private organizations/property owners

The permit requirements vary among the different agencies. Section 11 of the Facility Plan identifies, to the extent identified as being applicable, all of the agencies that will have jurisdiction over the planned alignments, and appurtenant facilities sites, and it outlines the requirements and procedures for obtaining a permit from each respective agency. Section 14 of the Facility Plan provides additional information relative to those agencies and other entities that will require on-going coordination beyond the formal permitting process throughout the design and construction periods.

Land Acquisition and Approvals

Section 12 of the Facility Plan provides a detailed listing of the property acquisitions, easements and agreements required for the project. The scope of the respective property acquisitions relative to the planned facilities and tunnels alignments are also shown on several figures included within Section 12. The evaluations of alternative tunnel alignments were based on locations that would minimize impacts on private property owners and establish the locations of tunnels corridors in public owned areas. Approximately 10 percent of the tunnels alignments and facilities defined in the Facility Plan are located on privately owned locations.

A summary of property owners identified on Figures 12-1 through 12-23 of the Facility Plan is presented in Table 5. More than 90 percent of the tunnels length is located below land owned by the United States Government and controlled by the military (Bolling Air Force Base and Anacostia Naval Annex) or the National Park Service, or below the public right-of-way. Various railroad companies, including CSX Railroad and WMATA own or control the land above approximately 6 percent of the tunnels length and private entities own the land above approximately 3 percent of the tunnels length.



Table 4, Sheet 1 of 3
Project Permitting and Submittal Deadline Requirements
Based on Information Available During Facility Planning

Contract Division Designation and Major Components	Agency/Organization																											
	Utilities					DC Agencies										Federal Agencies										Other Agencies/Private		
	Potomac Electric Power Company		Washington Gas Company	Telephone (Comcast/Verizon)	DC Water and Sewer Authority	District Department of Transportation	DC Office of Planning	Department of Consumer & Regulatory Affairs	Department of Health / D.C. Fire & Emergency Medical Services	District Department of Environment	Navy Research Laboratory	Deputy Mayor for Planning and Economic Development	Various Advisory Neighborhood Commissions	DC Department of Public Works	DC Department of Parks & Recreation	National Mall and Memorial Parks	U.S. Army Corps of Engineers	Department of the Interior (Marinas)	National Park Service - East	Bolling AFB (DoD) or Department of the Air Force	U.S. Navy	National Arboretum	National Capital Planning Commission	U.S. Coast Guard (Sector Baltimore)	Washington Metropolitan Area Transit Authority	CSX Corporation	Private Property Owners	U.S. Postal Service
	Request for New Service	Utility Relocation Review	Utility Relocation Request	Utility Relocation Request	Construction Site Permit	Maintenance of Traffic Schemes	Document Review	Public Space Application/PSMA- WOSE/Others	Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT	ESC/SMP/NPDES	Property Access	Site Acquisition	Letter Notification	Site Layout Permit	Tree Protection Permit	RFK Stadium Access	404 Permit (s)	Document Review	Site Acquisition /Document Review	Document Review/Site Access Permit	Document Review/Site Access Permit	Document Review	Document Review	River Crossing	Real Estate Application	Document Review/Right of Entry Permit	Letter of Notification	Document Review
A BPT, BPTDS, BAFB-DS, PP-JS (excavation & support), MPS-DS, MOS-DC, and approach channel	At 30% design	At 30% design	—	—	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	At 30% design	3 mo. prior to 60% design	At NTP for design	At 30% design	At 30% design	—	—	2 mo. Prior to 30%	—	2 mo. prior to 30% design	At NTP design	At NTP design	—	3 mo. prior to 60% design	At NTP design	—	—	—	—	
B CSO 013-DC, CSO 014-DC and microtunnel	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
C CSO 019-S, CSO 019-N, CSO 019-JC-2 and approach channel	At 60% design	At 30% design	2 mo. prior to 60% design	—	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	2 mo. prior to const. NTP	At 30% design	—	2 mo. prior to 30% design	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
D BAFB-OF, BPOS-DC and approach channel	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	30% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	—	At 30% design	At 30% design	2 mo. prior to const. NTP	—	At 30% design	—	2 mo. prior to 30% design	At NTP design	—	—	3 mo. prior to 60% design	At NTP design	—	—	—	—
E CSO 015-DC, CSO 016-DC, CSO 017-DC, microtunnel and approach channel	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	2 mo. prior to const. NTP	—	—	At 30% design	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	—



Table 4, Sheet 2 of 3
Project Permitting and Submittal Deadline Requirements
Based on Information Available During Facility Planning

Contract Division Designation and Major Components	Agency/Organization																												
	Utilities					DC Agencies										Federal Agencies										Other Agencies/Private			
	Potomac Electric Power Company	Washington Gas Company	Telephone (Comcast/Verizon)	DC Water and Sewer Authority	District Department of Transportation	DC Office of Planning	Department of Consumer & Regulatory Affairs	Department of Health / D.C. Fire & Emergency Medical Services	District Department of Environment	Navy Research Laboratory	Deputy Mayor for Planning and Economic Development	Various Advisory Neighborhood Commissions	DC Department of Public Works	DC Department of Parks & Recreation	National Mall and Memorial Parks	U.S. Army Corps of Engineers	Department of the Interior (Marinas)	National Park Service - East	Bolling AFB (DoD) or Department of the Air Force	U.S. Navy	National Arboretum	National Capital Planning Commission	U.S. Coast Guard (Sector Baltimore)	Washington Metropolitan Area Transit Authority	CSX Corporation	Private Property Owners	U.S. Postal Service		
	Request for New Service	Utility Relocation Review	Utility Relocation Request	Utility Relocation Request	Construction Site Permit	Maintenance of Traffic Schemes	Document Review	Public Space Application/PSMA-WOSE/Others	Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT	ESC/SMP/NPDES	Property Access	Site Acquisition	Letter Notification	Site Layout Permit	Tree Protection Permit	RFK Stadium Access	404 Permit (s)	Document Review	Site Acquisition /Document Review	Document Review/Site Access Permit	Document Review/Site Access Permit	Document Review	Document Review	River Crossing	Real Estate Application	Document Review/Right of Entry Permit	Letter of Notification	Document Review	
F CSO 018-DC, manholes, microtunnel and approach channel	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	2 mo. prior to const. NTP	—	—	At 30% design	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
G CSO 005-DC, CSO 007-DC, microtunnel and approach channel	At 60% design	At 30% design	2 mo. prior to 60% design		2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	2 mo. prior to const. NTP	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
H ART, PP-JS, CSO 005/007-DS, CSO 015/016/017-DS, CSO 018 DS, CSO 019-S and CSO 109-N	At 30% design	—	At 60% design	—	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	At 30% design	—	—	—	At 30% design	At 30% design	At 30% design	—	At NTP design	At 30% design	2 mo. prior to 30% design	—	—	—	3 mo. prior to 60% design	At 30% design	1 mo. prior to 30% design	—	At 30% design / NTP const.	—	
I CSO 009-DC, CSO 011A-DC, CSO 012-DC, CSO 011A/012-JC and junction sewer	At 60% design	At 30% design	—	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	—	At 30% design	At 30% design	2 mo. prior to const. NTP	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	—	
J NEBT, MOR-DS, BR-JS (final lining), CSO 019-N (final lining)	At 30% design	—	—	—	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	At 30% design	—	—	—	At 30% design	At 30% design	2 mo. prior to const. NTP	At 30% design	—	—	2 mo. prior to 30% design	—	—	At 60% design	3 mo. prior to 60% design	—	1 mo. prior to 30% design	At NTP for design	At 30% design / NTP const.	—	



Table 4, Sheet 3 of 3
Project Permitting and Submittal Deadline Requirements
Based on Information Available During Facility Planning

Contract Division Designation and Major Components	Agency/Organization																											
	Utilities					DC Agencies										Federal Agencies										Other Agencies/Private		
	Potomac Electric Power Company		Washington Gas Company	Telephone (Comcast/Verizon)	DC Water and Sewer Authority	District Department of Transportation	DC Office of Planning	Department of Consumer & Regulatory Affairs	Department of Health / D.C. Fire & Emergency Medical Services	District Department of Environment	Navy Research Laboratory	Deputy Mayor for Planning and Economic Development	Various Advisory Neighborhood Commissions	DC Department of Public Works	DC Department of Parks & Recreation	National Mall and Memorial Parks	U.S. Army Corps of Engineers	Department of the Interior (Marinas)	National Park Service - East	Bolling AFB (DoD) or Department of the Air Force	U.S. Navy	National Arboretum	National Capital Planning Commission	U.S. Coast Guard (Sector Baltimore)	Washington Metropolitan Area Transit Authority	CSX Corporation	Private Property Owners	U.S. Postal Service
	Request for New Service	Utility Relocation Review	Utility Relocation Request	Utility Relocation Request	Construction Site Permit	Maintenance of Traffic Schemes	Document Review	Public Space Application/PSMA-WOSE/Others	Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT	ESC/SMP/NPDES	Property Access	Site Acquisition	Letter Notification	Site Layout Permit	Tree Protection Permit	RFK Stadium Access	404 Permit (s)	Document Review	Site Acquisition /Document Review	Document Review/Site Access Permit	Document Review/Site Access Permit	Document Review	Document Review	River Crossing	Real Estate Application	Document Review/Right of Entry Permit	Letter of Notification	Document Review
K RSBT, FSNWBT, RIBT, RIA-DC, 3S-DC, FA-DC/1S-DC, RS-DC, RIA-DS, 3S-DS, RS-JS, RS-DS, VS-DS, AS-DS, BR-DS (excavation and support) and approach channels	At 30% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	At 30% design	—	—	At NTP for design	At 30% design	At 30% design	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	At NTP for design	At 30% design / NTP const.	At 30% design	
L AS-DC, VS-DC, microtunnels and approach channels	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
M GS-DC, CA-DC, CA-JC and microtunnel	At 60% design	At 30% design	2 mo. prior to 60% design	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	—	3 mo. prior to 60% design	—	At NTP for design	At 30% design	At 30% design	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	
Y Blue Plains Tunnel Dewatering Pumping Station	At 60% design	At 30% design	—	At 30% design	2 mo. prior to 60% design	At 60% design	At NTP design	3 mo. prior to 60% design	At 30% design	3 mo. prior to 60% design	—	—	At 30% design	At 30% design	—	—	—	—	—	—	—	3 mo. prior to 60% design	—	—	—	—	—	



Table 5
Summary of Property Owners along the Proposed Tunnels
System Alignments

Property Owners	Approximate Length of Tunnel (Ft)	% of Total Length
Public Right-of-Way	20,775	32.9%
National Park Service (USA)	18,260	28.9%
Military (BAFB and Navy)	15,390	24.4%
Railroad Entities	4,025	6.4%
US Army Corps of Engineers (USA)	2,300	3.6%
Private Property	1,915	3.0%
USA (other)	1,725	2.7%
National Arboretum (USDA)	1,660	2.6%
District of Columbia	1,370	2.2%
WASA controlled (owned by DC and/or USA)	510	0.8%
PEPCO	105	0.2%
Total	68,035	100%

Public Notification

A visual CSO notification system has been installed and is in operation on the Anacostia River as shown on Figure 11. Under the Consent Decree, at least three additional systems are required. Because extensive redevelopment planning and new bridge construction planning is underway all along the Anacostia River in the area of all the CSO outfalls, it is not practicable, at this time, to finalize the details of the public notification system. For example, some of the redevelopment plans are considering new public access to the river, but the locations and other details are only conceptual. In view of the circumstance associated with the redevelopment and bridge construction, the Authority proposes to include the visual notification systems under Contract Division H, Anacostia River Tunnel, which is scheduled for award of design by November 1, 2011.



Figure 11: CSO Warning Lights on Anacostia River



Other ARP Implementation Factors

The ARP have been developed at this stage to a level sufficient to proceed to detailed design and construction. However, uncertainties remain, and these uncertainties could impact the design and schedule of the facilities included in the Facility Plan. In addition to uncertainties discussed under project setting, risk management and construction planning, geotechnical information, permitting and land acquisition, there are those criteria, standards, regulations, laws, guidelines and assumptions upon which the ARP and schedule are based. The following list includes, but may not be limited to, factors for which changes from the bases upon which the Facility Plan has been prepared, could require changes to the ARP and the implementation schedule:

- Those items listed in subsection 13.7 of the LTCP, Final Report, July 2002
- EPA's approval and approval conditions of the Authority's Blue Plains Total Nitrogen Removal/Wet Weather Plan, LTCP Supplement No. 1, Final, October 2007
- The terms and conditions related to nitrogen removal and the combined sewer system in the proposed and final reissued NPDES permit for Blue Plains
- The terms and conditions in a modified Consent Decree necessary to incorporate LTCP Supplement No. 1 and the Facility Plan
- Actions, decision, conditions and delays created, caused or contributed by third parties that impact the design and schedule bases of the ARP included in the Facility Plan. Third parties include, but may not be limited to, the parties to the Consent Decree, other than the Authority, and all their branches, departments and agencies; utility agencies, transportation agencies, the affected public, special interest groups, suppliers, and contractors.