



A PHI Company

SAMPLING AND ANALYSIS PLAN (DRAFT)
PART I – FIELD SAMPLING PLAN
PART II – QUALITY ASSURANCE PROJECT PLAN

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Part I Field Sampling Plan

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1 Site Background

This Field Sampling Plan (FSP) is prepared to supplement the Remedial Investigation and Feasibility Study (RI/FS) Work Plan to describe the field sampling approach for the RI/FS at Pepco's Benning Road facility (the Site), located at 3400 Benning Road NE, Washington, D.C., and a segment of the Anacostia River adjacent to the Site. The general site location is shown on **Figure 1**. Together, the Site and the adjacent segment of the River are referred to herein as the "Study Area". The RI/FS Study Area consists of a "landside" component which will focus on the Site itself, and a "waterside" component that will focus on the shoreline and sediments in the segment of the river adjacent to and immediately downstream of the Site. The landside and waterside areas of investigation are depicted in **Figure 2**. Pepco has agreed to perform the RI/FS pursuant to a consent decree that was entered by the U.S. District Court for the District of Columbia on December 1, 2011 (the Consent Decree). The Consent Decree documents an agreement between Pepco and the District of Columbia (District) which is part of the District's larger effort to address contamination in and along the lower Anacostia River.

The Site is one of several properties along the Anacostia River that are suspected sources of contamination. There have been five instances since 1985 in which materials containing polychlorinated biphenyls (PCBs) were released at the Site. In each case, Pepco promptly cleaned up the releases in accordance with applicable legal requirements. Nonetheless, it is suspected that these releases, and possibly other historical operations or activities at the Site, may have contributed to contamination in the river. In particular, a site inspection conducted for the U.S. Environmental Protection Agency (USEPA) in 2009 linked polycyclic aromatic hydrocarbons (PAH), PCBs, and inorganic constituents detected in Anacostia River sediments to potential historical discharges from the Site. The site inspection contractor also stated that currently the Site is properly managed and that any spills or leaks of hazardous substances are quickly addressed and, if necessary, properly remediated. The RI will evaluate all spills at the Site as necessary.

The purpose of the RI/FS is to (a) characterize environmental conditions within the Study Area, (b) investigate whether and to what extent past or current conditions at the Site have caused or contributed to contamination of the river, (c) assess current and potential risk to human health and environment posed by conditions within the Study Area, and (d) develop and evaluate potential remedial actions.

The 77-acre Site is bordered by a DC Solid Waste Transfer Station to the north, Kenilworth Maintenance Yard (owned by the National Park Service, NPS) to the northwest, the Anacostia River to the west, Benning Road to the south and residential areas to the east and south (across Benning Road). Most of the Site is comprised of the Benning Service Center, which involves activities related to construction, operation and maintenance of Pepco's electric power transmission and distribution system serving the Washington, D.C., area. The Service Center accommodates more than 700 Pepco employees responsible for maintenance and construction of Pepco's electric transmission and distribution system; system engineering; vehicle fleet maintenance and refueling; and central warehousing for materials, supplies and equipment. The Site is also the location of the Benning Road Power Plant, which is scheduled to be shut down in 2012. The Site is one of several properties along the Anacostia River that are suspected sources of contamination.

Pepco conducted several investigations and removal actions at the Site since 1985 (**Table 1** and **Figure 3**). The USEPA conducted two studies, a Multi-media Inspection and a Comprehensive Environmental Liability and Compensation Act (CERCLA) Site Inspection, within the Study Area. In addition, the NPS completed a remedial investigation at the adjacent Kenilworth Landfill and a Preliminary Assessment/Site Investigation (PA/SI) at Langston Golf Course. AECOM reviewed available information from these studies and other studies conducted in the River by various governmental and non-governmental organizations, and incorporated the findings into the Conceptual Site Model (CSM) and Work Plan development. Detailed information on previous investigations, geology, hydrogeology, hydrology, and site and area descriptions can be found in the RI/FS Work Plan.

The RI/FS will be overseen by the District Department of the Environment (DDOE) and will be performed in accordance with the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Office of Solid Waste and Emergency Response (OWSER) Directive 9355.3-01*, dated October 1988, and other applicable USEPA and DDOE guidance documents. This FSP (Part I of the Sampling and Analysis Plan) is prepared in accordance with the outline provided in the Final RI/FS Scope of Work (SOW) and applicable USEPA guidance.

2 Sampling Objectives

The field investigation activities are designed to characterize conditions in soil, groundwater, surface water and sediment, further refine the CSM, and collect data to support risk assessment and Natural Resource Damage Assessment (NRDA). Data gaps identified during the review of existing data were used to guide the scope of this investigation. Field investigation activities are divided into Landside and Waterside activities and are noted in **Section 1**. All field investigation activities will be conducted in accordance with the RI/FS Work Plan, the Quality Assurance Project Plan (QAPP), and the Health and Safety Plan (HASP), submitted under a separate covers.

The data quality objectives (DQOs) for this investigation are:

- To characterize environmental conditions within the Study Area and refine the CSM
- To collect data to update existing Landside and Waterside datasets so the nature and extent of impacts can be better defined
- To collect data to determine whether and to what extent past or current conditions at the Site have caused or contributed to contamination of the Anacostia River
- To collect data within the Anacostia River to identify potential Site-related, near-Site and far-Site sources of contaminants of potential concern (COPCs) in sediment and surface water
- To collect hydraulic data to better understand the site-specific hydrogeology and evaluate the volumetric flux of groundwater to the Anacostia River
- To collect data to better understand sedimentation in the portion of the Anacostia River within the Study Area
- To collect data to support performance of Human Health and Ecological Risk Assessments
- To collect data to support development and evaluation of remedial alternatives
- To collect data for NRDA evaluation

The Landside and Waterside DQO development process is presented in **Tables 2** and **3**, respectively.

3 Sampling Location and Frequency

In order to meet the RI/FS project schedule expeditiously, the planned investigation will incorporate an iterative, dynamic approach to the investigation using field screening techniques, field-based decision-making and real-time evaluation of data while crews are still in the field, as necessary. In consultation with the DDOE and Pepco project management, the AECOM Field Team Leader will use professional judgment to adjust sampling locations, as appropriate based on field conditions. Field and laboratory data will be rapidly uploaded to the project database to allow a timely evaluation of results and thereby allow near real-time adjustments to the field investigation, as necessary, to complete the delineation of impacts encountered.

3.1 Landside Investigation

The Landside investigation program will include three phases of work, each phase providing necessary information for the planning of the successive phase of work. The Landside data collection program is summarized in **Table 2**. Phase I activities will involve sampling of surface soils and storm drains. In addition, Phase I will first involve the screening of the Site using electrical resistivity imaging (ERI) to identify potential anomalies, followed by soil borings to calibrate the electrical signals with lithologic and chemical sampling.

ERI also provides useful information on soil and groundwater zones impacted by light non-aqueous phase liquids (LNAPLs) and/or dense non-aqueous phase liquids (DNAPLs). These zones will be targeted during Phase II using the direct push technology (DPT) (Geoprobe®) borings to delineate potential zones of impact and identify any continuing sources of contamination. Additional direct push borings will be conducted during Phase II to collect soil and groundwater samples and characterize horizontal and vertical extent of any impacts found using PID and XRF field instruments, and total petroleum hydrocarbon (TPH) and PCB aroclor analysis using an on-site mobile lab. **Figure 4** depicts the proposed surface soil sample and ERI transect locations. **Figure 5** depicts the locations of the proposed soil borings.

Phase III will involve a detailed hydrogeologic investigation involving the installation of monitoring wells, water level gauging, aquifer testing and groundwater monitoring. The locations of the monitoring wells will be based on results from ERI and DPT data collected in Phases I and II.

To help guide all of these Landside investigation activities, AECOM identified several “Target Areas” on the Site based on historical investigations and remediation, UST closures, former and current operations that could have a potential for Site impacts. These Target Areas are depicted on **Figure 3**. It should be noted that Pepco completed investigations and/or cleanups in Target Areas with PCB and petroleum releases in accordance with the District regulations. Some target areas have been identified based on PCB handling operations, which are in compliance with applicable regulations, and current fuel storage. Therefore, the purpose for these Target Areas is to serve as a guide to steer the RI field activities. Target Areas may be grouped together during the initial phases of investigations. As investigation activities proceed in an iterative fashion, they will focus on any impacts observed in or around the Target Areas.

3.2 Waterside Investigation

The Waterside investigation is designed to evaluate potential sources of constituents in the sediment of the Anacostia River in the vicinity of the Site, provide horizontal and vertical delineation of constituents in the sediment, and determine the potential effects associated with exposure to sediment constituents on Anacostia River receptors (i.e., human and ecological receptors). Based on the results of prior sampling, the investigation will focus on PAHs, PCBs, and metals, with limited screening samples for VOCs, SVOCs, pesticides, and dioxins/furans. This information will be used to support the risk assessments and the NRDA.

This investigation will primarily address sediment conditions within the Waterside Investigation Area, an area of the Anacostia River approximately 10 to 15 acres in size including approximately 1,500 linear feet to the south (approximately 1,000 feet south of the Benning Road Bridge) and 1,000 linear feet to the north of the Site’s main storm water outfall area (**Figure 6**). The proposed study area is based on its proximity to the Site and results from the USEPA 2009 SI Report.

The Waterside investigation will focus on defining the nature and extent of constituents of potential concern in sediments adjacent to the Site and at selected background locations. A progressive elimination approach will be incorporated into the Waterside sampling program to allow the use of screening parameters to screen larger areas and help focus resources on potential problem areas. Following the evaluation of these findings, additional investigation may be recommended to refine the delineation of chemical data or provide additional site-specific information from selected portions of the study area.

Data for the Waterside area will be collected in two phases. Phase I will involve bathymetric and utility surveys at on-site and background locations. Surface water and sediment sampling will be conducted under Phase II.

Sediment samples will be collected using barge-mounted Vibracore™ equipment. An on-site mobile lab will be used to characterize the extent of sediment impacts using PCBs aroclor analysis.

The Waterside investigation will use a systematic sampling grid to determine sediment and surface water sampling locations during the Waterside investigation (**Figure 6**). This grid will consist of 45 sampling locations on ten (10) sampling transects positioned perpendicular to the shoreline. Three to five sampling locations will be positioned evenly spaced along each transect. Additional sampling locations will be positioned between each transect and close to Outfall 013 and two sampling locations will be placed in the wetland area for a total of 45 sampling locations within the Waterside Investigation Area. The exact locations of the sampling locations may vary according to the conditions of the substrate, the nature of depositional processes observed in the geophysical survey, and agency consultation prior to the field effort.

At each of the 45 sample locations, field measurements will be taken, surface sediment will be collected and inspected, and sediment cores collected. Surface water samples will be collected at a sub-set of the locations within the grid. The locations will be sampled using a motorized boat. While collecting the sediments at each station, the boat will be anchored. The vessel will be mobilized in such a way as to minimize the potential for disturbance of the sediment and surface water via wave or propeller action. A differential global positioning system (DGPS) unit will be used to record all sample station coordinates to sub-meter accuracy. The sampling program will include surface sediment samples and subsurface Vibracore™ samples. While this sampling plan provides a framework for the proposed sampling approach, field observations will determine the final sample selection and which samples are chosen for laboratory analysis.

Ten (10) additional surface sediment and surface water sampling locations will be chosen up river, down river, and across river from the site to provide additional background and baseline area-wide data. An effort will be made to obtain background samples from locations with similar ecological parameters (e.g., sediment grain size, water depth, flow regime, tidal influence, etc.) as those adjacent to the site.

The data collection program for Waterside area is summarized in **Table 5**.

4 Sample Designation

Sample designation is a unique number that identifies each sample under the analytical program. Immediately upon collection, each sample will be labeled with an adhesive label. Each sample label will include the sample number, location, date/time of collection, and analysis. Each sample number will consist of a four part identification system that describes the sampling method, location ID, depth, and sample type, as described below:

- Sampling Method: This part is represented by a three letter code as follows:

Monitoring Well Soil	MWS
Monitoring Well Water	MWW
Soil Boring Soil	SBS
Soil Boring Water	SBW
Direct Push Soil	DPS

Direct Push Water	DPW
Surface Soil Sample	SUS
Sediment	SED
Surface Water	SUW

- Location: This will be a two digit code consisting of numbers, letters or a combination (e.g., 01, 15, C2).
- Sample Depth: Sample depth will be identified using a two digit number (e.g., 05 representing 5 feet below grade). Where sample depth involves an interval, this identifier identifies the starting depth of the interval only. The number "00" will represent surface samples.
- Sample Type: The last character of the sample ID will represent the sample type:
 - N –Field sample
 - R – Field duplicate
 - Q –Quality control (QC) sample (e.g., equipment blank, trip blank)
- Equipment Blank – "EB" followed by date (e.g., EB-070110). If multiple EBs are collected on the same day for differing types of sampling equipment, numerical designations will be used to differentiate the type of equipment blank (e.g., EB01-070110, EB02-070110), with the type of sampling equipment associated with each type of equipment blank documented in the field log book (e.g., EB01-070110 collected from split spoon sampler, EB02-070110 collected from Geoprobe® cutting shoe)

- Trip Blank – “TB” followed by date (e.g., TB-070110). If multiple TBs are collected on the same day for multiple coolers of VOC samples, numerical designations will be used to differentiate the different trip blanks (e.g., TB01-070110, TB02-070110). The cooler specific chain-of-custody forms will document which VOC samples are associated with the trip blanks.

An example of a complete sample ID would be MWW0515N for the groundwater sample collected from monitoring well MW-5 at 15 feet below grade. Another example would be SEDC200R representing duplicate of a surface sediment sample collected at grid node C2.

Samples being designated for matrix spike and matrix spike duplicate (MS/MSD) analysis will *not* include an identifier as part of the sample code, but will be identified as such on the chain-of-custody in the comments section on the same row as the parent sample.

5 Sampling Equipment and Procedures

5.1 Field Techniques

Field work and sampling will be conducted to evaluate impacts to the environmental media in the Study Area, as shown on **Figure 4** and **Figure 5**. Field work will include drilling of soil borings, installation of monitoring wells, groundwater measurements, and collection of soil, sediment, surface water, and groundwater samples for field screening and laboratory analyses. Sampling and data collection planned for Landside and Waterside areas are summarized in **Table 4** and **Table 5**, respectively. A summary of calibration frequency and criteria for field instruments are summarized in **Table 6**.

AECOM has developed a set of standardized Project Operating Procedures (POPs) following USEPA and other applicable standard protocols, for the proposed field sampling and data collection program. Following is a list of AECOM POPs. Copies of the POPs are provided in **Appendix A** of this FSP.

- POP 005 – Sediment Core Sampling Procedures
- POP 016 – Sealed-Screen Groundwater Profiling
- POP 028 – Standard Operating Procedure for the Niton XL3t 600 Niton XRF
- POP 101 –Field Records
- POP 102 – Chain of Custody and Shipping Procedures
- POP 103 – Packaging and Shipping
- POP 105 –Decontamination of Field Equipment
- POP 106 – Investigative Derived Waste Management
- POP 201 – Surface Water Sample Collection
- POP 202 – Sediment Sampling
- POP 301 – Subsurface Soil Sampling by Direct Push Methods
- POP 302 – Subsurface Soil Sampling by Hollow Stem Auger and Split-Spoon Sampler Methods
- POP 304 – Surface Soil Sampling
- POP 305 – Soil Sampling via Hand Auger
- POP 401 – Monitoring Well Construction and Installation

- POP 402 – Monitoring Well Development
- POP 403 – Water Level Measurement in a Monitoring Well
- POP 404 – Low-Flow Groundwater Sampling
- POP 501 – Headspace Analysis of VOCs in Unsaturated Soil Samples
- POP 502 – Water Quality Instrumentation

5.2 Landside Investigation

The phased data collection program described in **Section 3.1** and **Table 4** will be carried out as described in the following paragraphs. These field tasks will be conducted in accordance with approved Work Plan, permits, Health and Safety Plan, and Quality Assurance Project Plan, following the POPs.

The field activities proposed for the Landside investigation are as follows:

- Utility clearance;
- Surface soil sampling;
- Storm drain sampling;
- Electrical Resistivity Imaging (ERI);
- Soil borings;
- Direct Push Technology (DPT) subsurface investigation;
- Monitoring well installation
- Monitoring well gauging and sampling; and
- Aquifer testing

A summary of the data types, quantities, analytes and methodologies, and data uses is presented in **Table 4**. Permits or access agreements that may be required from the District of Columbia will be obtained prior to initiation of the field program.

The following sections describe the field activities that will be performed during the Landside investigation. All of the sampling locations proposed within the Landside Investigation Area are presented in **Figure 4**. Additional samples will be collected from the background sampling areas.

Phase I, Task 1: Utility Clearance

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Utility plans will be obtained and reviewed while selecting sampling locations. Prior to the start of intrusive operations, utility

clearance will be conducted by public and private utility locators in proposed investigation areas. Miss Utility will be contacted for the identification of all recorded public utilities servicing the Site. Following public utility identification, a private utility locating contractor will be utilized to identify and locate any utilities that Pepco is unable to clear. A review of available as-built drawings will be conducted to locate any additional subsurface structures prior to intrusive activities. If insufficient data is available to accurately determine the location of the utility lines within the proposed investigation area, AECOM will hand clear or use soft dig techniques to a depth of at least five ft bgs in the proposed areas of subsurface investigation.

Phase I, Task 2: Surface Soil Sampling

The purpose of surface soil sampling is to evaluate surface soil quality and to help plan the DPT investigation. The analytical data will also be used to develop correlations with field instruments to be used for screening during Phase II activities. Surface soil samples will be collected from within the top 12 inches of the subsurface after coring through existing pavement or ground cover. Each sample will be screened with a field PID and XRF instrument and the results will be recorded. As shown in **Table 4**, a total of 25 surface samples will be collected from various portions of the Site. The surface soil samples locations will be distributed to get a good coverage of the entire facility, while using some biased samples to address the Target Areas presented (**Figure 3**).

Phase I, Task 3: Storm Drain Sampling

AECOM will identify the storm drains in locations that would be impacted by potential releases, based on evaluation of data from prior sampling events, site inspections, and discussions with Pepco personnel. The purpose of storm drain sampling is to determine, if current or historical discharges from the storm drain system contributed to contamination in the River. A total of five sediment/residue and five water samples will be collected from Site storm drains. Up to two of these locations will be selected for forensic analysis.

Phase I, Task 4: Electrical Resistivity Imaging (ERI)

ERI techniques are commonly used in environmental site characterization and involve the measurement of electrical conductivity/resistivity of the ground. A variation of the ERI technology known as GeoTrax™ is offered by Aestus, LLC. Each GeoTrax Survey™ will be performed by installing specialized 3/8-inch diameter stainless steel electrodes into the ground along a straight line or transect that could run hundreds of feet long depending on the target depth of investigation. The electrodes are hammered into the ground just far enough to get electrical contact with the earth, typically 6 to 15 inches. The resulting data is processed using proprietary algorithms to produce a color-coded, high-resolution, 2-dimensional or 3-dimensional image that can be used to identify

anomalies that represent changes in subsurface lithology, buried objects, and LNAPL/DNAPL plumes, and chlorinated compounds such as PCBs. GeoTrax™ imaging can be used as a screening tool and when calibrated with actual lithologic and chemical data collected from a direct push boring, it provides a rapid site characterization tool. Up to eight GeoTrax™ transects will be run along cross section A-A', in the former sludge dewatering area, and other Target Areas to the top of the Arundel Clay unit as identified in **Figure 4**. Calibration borings will be performed using a combination of soil borings in Phase I and direct-push borings under Phase II.

Phase I, Task 5: Soil Borings

A geotechnical investigation will be conducted to aid in the verification of the existing data and design of monitoring wells. Five soil borings (SB-1 through SB-5) will be installed at the approximate locations shown on **Figure 5**. The soil borings will be advanced approximately 10 feet into the confining layer (Arundel Clay) using a Hollow Stem Auger (HSA) Drill rig to obtain split-spoon and Shelby tube samples. Split-spoon samples will be obtained using the standard penetration test (SPT) in accordance with the American Society for Testing and Materials (ASTM) Standard D1586. The blow counts (hammer strikes) required to advance the sampler a total of 18 inches or 24 inches will be counted and reported. Soils will be logged in accordance with the Unified Soil Classification System (USCS). Split spoon samples will be collected continuously from the surface to the water table and then every five feet from the water table to the terminal depth of the boring. Soil samples will be field screened for VOCs using a calibrated PID. Up to five Shelby tube or disturbed samples (from drill cuttings) will be collected from each boring in accordance with ASTM Standard D1587 and analyzed for ASTM Permeability, Grain size and Atterberg limits. To aid in the identification of the Arundel Clay, three Shelby tube samples will be collected from the bottom (approximately 10 feet into the confining unit) from three selected soil borings and analyzed for ASTM Permeability, Grain size and Atterberg limits. One split-spoon soil sample from each soil boring will be collected from the middle of the water table aquifer and analyzed for ASTM Grain size and Atterberg limits.

Groundwater levels will be collected during installation of the geotechnical borings and 24 hours following completion of the borings. Dedicated investigative tooling and materials will be properly decontaminated in accordance with the SAP. Disposable materials and supplies (e.g. tubing, personal protective equipment (PPE), etc.) will be disposed of with the municipal waste. Soil cuttings generated during boring installation will be temporarily staged on-site in 55-gallon drums while awaiting characterization.

Upon completion of soil boring activities, soil borings will either be converted to monitoring wells (if determined feasible) or properly abandoned with grout using a tremie pipe to the maximum extent possible. The ground

surface will be restored to match the existing surface cover. Soil boring locations will be surveyed (x, y and z-planes) into existing site datum by a licensed surveyor.

Phase II, Task 1: DPT Subsurface Investigation

Following the completion of Phase I, DPT borings will be advanced in and around Target Areas identified on **Figure 3** as well as any anomalies identified by the ERI activities. As described in **Section 3.0**, Target Areas identified on **Figure 3** are for guidance purposes only. Several of the Target Areas that are geographically close may be grouped together and investigated as one area based on field logistics. A total of 40 DPT soil borings are planned. Soil borings will be advanced to approximately 5 feet below the first water table or refusal, whichever is encountered first. Soil cores will be screened continuously using a PID. A field geologist will continuously log the cores in accordance with the USCS to the terminal depth of the boring.

Soil samples will be collected from three depths and subjected to screening using an XRF field instrument, and total petroleum hydrocarbon (TPH) and PCB aroclor analysis using an on-site mobile laboratory. Boring locations and characterization parameters will be adjusted based on the screening data. Investigation activities will focus on any Target Areas where impacts are observed. Groundwater samples will be collected in-situ from the within the top five feet of the water table using a discrete sampling DPT tool. It should be noted that groundwater sample intervals may be adjusted based on the results of the ERI screening. Groundwater and soil samples will be submitted for laboratory analysis as noted in **Table 4**. A subset (approximately 20%) of the samples will be subjected to metals analysis for confirmation of the field XRF data.

Reusable investigative tools and materials will be properly decontaminated in accordance with the SAP. Disposable materials and supplies (e.g. direct push liners, tubing, PPE, etc.) will be rinsed and disposed of as ordinary solid waste. Soil cuttings and purge water generated during boring installation will be temporarily staged on-site in 55-gallon drums while awaiting characterization.

Upon completion of soil boring activities, soil borings will be properly abandoned with grout following the DDOE guidance. The ground surface will be restored to match the existing surface cover. Soil boring locations will be surveyed (x, y and z-planes) into existing site datum by a licensed surveyor.

Phase III, Task 1: Monitoring Well Installation

Following the completion of Phase II, monitoring wells will be designed and installed based on the results of ERI, DPT, and geotechnical investigative activities. The number or location of the wells cannot be determined at this time. Upon review of results from Phase I and Phase II, Pepco will prepare and submit a Work Plan addendum to

DDOE to describe the selection of monitoring well locations. Upon DDOE approval of the Addendum, monitoring wells will be installed using a drill rig equipped with 12.25-inch outer diameter hollow stem augers (8.25-inch inner diameter). Split-spoon samples will be obtained in accordance with the ASTM Standard D1586. Soils will be logged in accordance with the USCS. Split-spoon samples will be collected continuously from the surface to the water table and then every five feet from the water table to the terminal depth of the boring. Soil samples collected from the vadose zone will be field screened using a PID for VOCs.

The monitoring wells will be constructed using two-inch diameter Schedule 40 polyvinyl chloride (PVC) well casing and slotted PVC well screen. If two water-bearing zones within the Patapsco formation are confirmed, the wells will be constructed of 2-inch diameter PVC casing as nested wells with two discrete screened intervals. A certified clean sand filter pack will be installed in the annular space between the borehole and the well screen and casing from the bottom of the boring to approximately one foot above the screened interval. Approximately two feet of bentonite clay will then be placed on top of the sand pack and hydrated to form a seal above the sand. After allowing the bentonite to set, the remaining portion of the annular space will be tremie grouted with a bentonite-portland cement mixture to grade. Each monitoring well will be completed inside a traffic-rated 18-inch road box/well vault. Upon completion of monitoring well installation, construction logs will be completed providing the details of the well construction and depth.

Following installation, the wells will be developed using a surge block and submersible pump. The surge block will be used inside the well to flush fine sediments from the sand filter, grade formational sediments, and remove the sediment lining on the borehole that is inherent in most drilling methods. After the well is surged, a submersible pump will be lowered into the well and groundwater will be withdrawn. Temperature, pH, specific conductance and turbidity readings will be monitored and pumping will proceed until the readings have stabilized or five well volumes have been removed.

Drill cutting and development water will be managed as described in **Section 5.4** below. Top of casing elevations and locations for each groundwater monitoring well will be surveyed into existing Site datum by a licensed surveyor. In addition, one or more river gauging stations will be established in the Anacostia River and surveyed as well.

Phase III, Task 2: Monitoring Well Gauging and Sampling

All groundwater monitoring wells will be allowed to equilibrate for a minimum of 7 days after development prior to groundwater sample collection. Prior to the groundwater sampling, a site-wide water level measurement event will be performed during the period of slack tide in order to determine groundwater elevations at the Site and accurately

characterize local groundwater flow conditions. In addition, the Anacostia River elevations will be determined concurrently by collection of water levels at gauging stations with referenced elevations surveyed to the same control datum as the monitoring wells. The surface water elevations will also be measured during the period of slack tide to determine the elevation relationship between the site groundwater and the Anacostia River. Two such gauging events will be conducted.

Groundwater samples will be collected from monitoring wells with portable bladder pumps using disposable bladders and low-flow sampling techniques. Groundwater samples will be collected and analyzed as noted in **Table 4**. Disposable sampling materials, decontamination water and purge water will be containerized and managed as described in **Section 5.4** below.

Phase 3, Task 3: Aquifer Testing

Aquifer testing will be conducted using slug testing techniques. Approximately two weeks following pump test activities, slug testing will be conducted on select monitoring wells to characterize hydraulic properties of the water table aquifer. The tests will consist of falling-head and rising-head slug tests to determine the hydraulic conductivity of the material in the vicinity of each well. The tests will proceed until the water levels have recovered to within 10% of the static pretest levels or 24 hours have elapsed. Slug testing data will be interpreted using the Bouwer-Rice solution for an unconfined aquifer on Aqtesolv™ or similar aquifer test analysis software.

5.3 Waterside Investigation

The phased data collection program described in **Section 3.2** and **Table 5** will be carried out as described in the following paragraphs. These field tasks will be conducted in accordance with approved Work Plan, permits, Health and Safety Plan, and Quality Assurance Project Plan, following the POPs.

The field activities proposed for the Waterside investigation are as follows:

- Bathymetric and utility survey;
- Surface sediment sampling;
- Subsurface sediment sampling using Vibracore™;
- Surface water sampling; and
- Laboratory testing including forensics evaluations.

A summary of the data types, quantities, analytes and methodologies, and data uses is presented in **Table 5**. Permits or access agreements that may be required from the District of Columbia, United States Coast Guard

(USCG), the United States Army Corps of Engineers (USACE) and the NPS will be obtained prior to initiation of the field program.

The following sections describe the field activities that will be performed during the Waterside investigation. All of the sampling locations proposed within the Waterside Investigation Area are presented in **Figure 5**. Additional samples will be collected from the background sampling areas.

Phase I, Task 1: Bathymetric and Utility Surveys

Prior to initiation of any intrusive sediment sampling, a bathymetric and utility survey will be conducted in the Waterside Investigation Area. The bathymetric survey will provide a basis for understanding the depth of the water column and the configuration of the river bottom and will be used to prepare a contour map of the top of the sediment surface in and around the investigation areas. The utility survey will be conducted to identify river bottom pipelines, cables and lines that may be located in the planned area of investigation. Their presence and global positioning system (GPS) benchmarked locations will be noted on a base map of the area.

A specialty subcontractor will perform the utility survey within the Waterside Investigation Area identified in **Figure 6**. A limited bathymetric survey will also be performed at background sampling locations to assure the similarity of river bottom morphology with that at the site and to confirm the lack of utility crossings at these locations. Side scan sonar and/or magnetometer surveys will be used to identify any utilities or large pieces of debris that might interfere with the proposed sampling activities.

It is anticipated that parallel survey lines will be run at 50-foot intervals throughout the survey area. Additional tie lines will be run perpendicular to these lines. The contractor will use a survey-grade precision fathometer (Odom Hydrotrack Fathometer or equivalent) to collect continuous water depth data along the track lines. The contractor will continuously log each geographic position (X-Y location) using DGPS. Depth and geographic location will be sent to the survey computer using the Integrated Survey Software package. Time will be continuously recorded; therefore, tidal correction will be available for post-processing using data from a tide gage that will be installed and surveyed prior to the bathymetric survey. Survey accuracy will follow the USACE Manual No. 1110-2-1003 for hydrographic surveying (USACE, 2002).

Phase II, Task 1: Surface Water Sampling

Surface water sampling will be conducted prior to sediment sampling to assure the integrity and representative nature of the sample. A total of twenty (20) water samples will be collected from immediately above the sediment-

water interface in order to capture potential impacts of groundwater discharge. Ten (10) samples will be collected from within the Waterside Investigation Area and ten (10) samples will be collected from background sampling locations.

The sampling boat will be located above the selected sampling location using GPS coordinates. Upon arrival at each sampling station, a depth-to-sediment measurement will be collected to record the water depth. The water depth will be recorded with an accuracy of ± 0.1 feet. Two sets of field measurements of water quality will be taken at each station. One measurement will be taken near the water surface, approximately one foot below the water surface, and a second measurement within one foot from the top of the sediment surface. Only one water quality measurement will be taken at mid-water depth and at stations where the water depth is less than three feet. The water quality parameters to be measured in the field include the following:

- Temperature (degrees Celsius, °C);
- Dissolved Oxygen (milligrams per liter, mg/L);
- pH (standard units, S.U.);
- Turbidity (Nephelometric Turbidity Units NTU); and
- Conductivity (micromhos per centimeter, $\mu\text{mhos/cm}$).

The surface water sample for chemical analysis will be obtained from approximately one foot above the sediment-water interface using a depth specific sampling device. The water samples will immediately be packaged for shipment to the laboratory following preservation and management protocols described in the accompanying SAP.

Surface water samples will be analyzed for the following parameters:

- In all samples – Total and dissolved phase metals, PCB aroclors, PAH16, and hardness.
- In a sub-set of up to 10 samples - VOCs, SVOC, pesticides, dioxins/furans.

A summary of the analytes and methodologies is presented in **Table 5** and details on chemical analyses are provided in the SAP.

Phase II, Task 3: Surface Sediment Samples

The sediment sampling activities outlined below will conform to U.S. USEPA and ASTM standard methods where appropriate (ASTM, 2000a; ASTM, 2000b; U.S. USEPA, 2001).

A surface sediment grab sample will be collected at all 45 of the sampling locations shown in **Figure 6**, in addition to 10 background locations (total of 55 surface sediment samples). If obstructions such as boulders or cobbles are encountered at a specific station, the location of the station may be changed to collect sediment samples as required. In the case that boulders or debris are encountered, samples will be collected as close as possible to the specified sample location.

All surface sediment samples will be collected from a depth of 0 to 6 inches below sediment surface with a Petite Ponar grab sampler or the equivalent. During this phase of work, the surface samples will be logged for visual and physical observations. A portion of the sample will be placed in a pan, inspected for sediment type, color, odor, obvious signs of biota and other notable features, and then returned to the river. The remainder of the sample will then be prepared for shipment to the laboratory.

Field personnel will record field observations of the physical characteristics of the sediment encountered at each sampling station and also important observations regarding the physical characteristics of the study area.

Information recorded will include:

- Sample station designation;
- Presence of fill material, coal or coke, or asphalt- or tar-like materials;
- Presence or absence of aquatic vegetation;
- Sediment color, texture, and particle size; and
- Odor and presence of sheens or LNAPL and/or DNAPL.

The 55 surface sediment samples used for chemical testing will be processed by personnel in the field. The samples will be screened using a PID and oversized material such as twigs, shells, leaves, stones, pieces of wood, and vegetation will be removed by hand. The grab sample will be removed from the sampling device using a stainless steel spoon/scoop and placed in a decontaminated 1-gallon stainless steel or Pyrex glass mixing bowl. Each sample will be visually examined for physical characteristics such as composition, layering, odor, and discoloration. Samples for VOC, Simultaneously Extracted Metals (SEM), and acid volatile sulfide (AVS) analyses will be collected prior to sediment homogenization. The remaining sample will be homogenized in the mixing bowl and placed in appropriate sample containers. Sediment sampling equipment such as bowls, spoons, augers, and dredges will be decontaminated prior to and following sample collection as described in the accompanying SAP. Each jar will be properly labeled with the name of the study site, the station location designation, the time of collection, the date of collection, and name of collector. Following sample preparation, glass jars will be kept at 4°C. Surface sediment samples will be analyzed for the following parameters:

- In all samples – Total Organic Carbon (TOC), grain size, metals, SEM and AVS, PCB aroclors, and PAH16.
- In a sub-set of up to 20 samples - VOCs, SVOC, pesticides, dioxins/furans.

A summary of the analytes and methodologies is presented in **Table 5** and details on chemical analyses are provided in the SAP.

Phase II, Task 4: Subsurface Sediment Samples/Vibracore™ Borings

Forty-five Vibracore™ sediment borings will be completed at the sediment sampling locations shown on **Figure 6** (i.e., co-located with the surface sediment sampling locations). The sediment cores will be collected using a small boat equipped to advance a 3-inch diameter Vibracore™ sampler to a maximum depth of 10 feet below the sediment surface, or to refusal, whichever is encountered first. The ten foot target depth is based on published average sedimentation rates for the Anacostia River (approximately 4 to 6.5 cm/yr) and should provide a sediment column that includes sedimentation which generally predates the operation of the facility. A second consideration is the general limits of the Vibracore™ sampling tool which vary depending on sediment type and compaction history.

To meet the objectives for this task, the sampling will be performed as follows:

- The core sampler, equipped with a plastic liner, will be driven and extracted at each of the designated sample locations;
- The core liner will be extracted from the core barrel and split open;
- The sediment sample will be screened for organic vapors with a PID and logged for physical characteristics; and
- Samples from up to three horizons within each core will be collected.

It is estimated that up to 165 discrete interval subsurface sediment samples will be collected for laboratory analysis from the 45 sampling locations in the Waterside Investigation Area and the 10 background locations (3 horizons at 55 locations). Subsurface sediment samples will be analyzed for the following parameters:

- In all samples - PCB aroclors (performed using an on-site lab), and PAH16;
- In a sub-set of up to 20 samples – TOC and grain size; and
- In a sub-set of up to 7 samples – forensic testing to evaluate PCB and PAH origins and contributions.

These data will establish a database from which to further evaluate the horizontal and vertical extent of PCB and PAH constituents in river sediments adjacent to the Benning Road facility. Visually-impacted zones will be logged

and the PCB data will help to define impacted areas of concern, concentration gradients, and sediment quality data gaps, if they exist. These data will serve as the basis from which to refine potential future sampling events.

A summary of the analytes and methodologies is presented in **Table 5** and details on chemical analyses are provided in the SAP. The Waterside sampling program will include the collection of up to seven (7) sediment samples for submittal to a specialty forensics laboratory for fingerprinting purposes. Testing will be performed to identify PCBs and PAH contributors to the total PCB and PAH load identified in the samples. Testing may also include upstream (i.e., background) samples, if field observations indicate an alternative potential source of PCBs and PAHs that warrants further consideration. This forensic analysis will be used to differentiate between Benning Road sources and other potential sources of PCBs and PAHs in the Anacostia River sediments.

5.4 Investigation-Derived Waste (IDW) Management

IDW generated during the Landside and Waterside investigations include the following:

- Disposable material such as Geoprobe®/Vibracore™ liners, personal protective equipment (PPE), plastic sheeting, etc.
- Drill cuttings
- Excess soil/sediment leftover from sampling activities
- Well development water
- Purge water
- Decontamination water

Minimally-contaminated disposable sampling materials and PPE will be rinsed and disposed of as ordinary solid waste. Drill cuttings, soil and sediment will be containerized and sampled for RCRA waste characteristics and PCBs. These wastes will be managed as dictated by the waste characterization results and disposed of at properly permitted off-site disposal facilities. All water will be containerized, sampled and disposed of at a permitted off-site facility.

5.5 Field Data Collection and Transmission

Each investigation point will be located using a global positioning system receiver with sub-two-meter accuracy. These data will be transmitted daily to the office for inclusion in the project database. Based on accessibility, exterior locations will also be surveyed in by a licensed surveyor, while locations in building interiors will be field-measured off known landmarks.

Field notes will be transmitted to the project team in a timely manner. Laboratory deliverables will be provided in a format ready for upload into the project database.

6 Sampling Handling and Analysis

Sample handling includes packaging and shipping samples to designated laboratories, upon completion of sample collection. The QAPP discusses the analytical parameters, methods, laboratory locations, and contacts. Field Teams are responsible for all aspects of sample handling and will communicate to the laboratories and AECOM Analytical Task Manager of any changes/deviations due to sampling problems. Potential sampling problems may include:

- Filling out paperwork incorrectly or incompletely
- Collecting less than the required sample volume
- Shipping samples to the wrong lab
- Using incorrect sample containers
- Leaking sample containers
- Equipment malfunction
- Severe weather conditions

If any of these problems occur, the Field Team must promptly report the problem to the AECOM Field Operations Manager and Project Manager, and implement necessary corrective measures as directed.

Field samples will be packed and shipped to the laboratory according to POP 103 – Packaging and Shipment of Samples (**Appendix A**). Samples will be properly packaged on ice at 4°C for shipment and dispatched to the laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be sealed and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.

If the samples are sent by common carrier, the waybill will be used. Waybills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

7 Field Quality Control

7.1 Preventing Cross Contamination

Proper equipment preparation, cleaning, and field decontamination procedures are necessary to prevent cross contamination of samples. These procedures are discussed in the following paragraphs:

Pre-sampling Preparation

Dedicated sampling equipment will be pre-cleaned and wrapped prior to arrival on-site. Other sampling equipment will be decontaminated prior to the start of activities and between sampling locations in accordance with the specifications described below. Field personnel performing the collection procedures will don a new pair of nitrile rubber latex examination gloves prior to handling any sampling equipment, between sampling and decontamination procedures and between sampling locations.

Cleaning Materials

Laboratory grade glassware detergent will be a standard brand of phosphate-free detergent such as Alconox or Liquinox. Tap water will be obtained from a local municipal supply or commercial source. Distilled, analyte-free water will be used as the final water rinse.

Field Decontamination Procedures

Non-dedicated sampling equipment and tools will be decontaminated prior to each use by scrubbing with laboratory grade glassware detergent and tap water to remove visual contamination followed by a generous tap water rinse and a final distilled and/or deionized water rinse.

7.2 Quality Control Sampling

In addition to the sampling program presented in **Tables 4** and **5**, several QC samples will be collected to estimate precision and accuracy of the analytical results, and to examine the sources of error introduced by the field and laboratory practices.

Field Blanks

Field (rinseate) blanks are required for all phases of sampling in which non-dedicated field sampling equipment will be used. Field blanks consist of pouring de-ionized analyte-free water over decontaminated sampling equipment as a check that the decontamination procedure has been adequately carried out and that there is no cross-contamination of samples occurring due to the equipment itself. Collection of field blanks is performed for all analytes of interest. One field blank will be taken per day as needed when reusable sampling equipment is utilized in the sample collection process.

Field Duplicate Samples

A field duplicate consists of an actual sample for which twice as much volume as necessary to fill all sample containers has been collected. Aliquots of this volume are then equally distributed in two sets of sample containers. This division results in two equal samples collected from one sampling location. Field duplicates are used to assess consistency of sampling, sample homogeneity, and laboratory analytical consistency. These sample duplicates may be submitted as laboratory blind duplicates and are analyzed for all analytes of interest. Field duplicates will be collected at a minimum frequency of five percent (1 in 20) of the total number of samples collected per sample matrix.

Duplicates of sediment samples will be homogenized prior to filling appropriate sample containers. It may be necessary to co-locate or depth integrate collection so that enough volume is available for duplicate sample collection.

Trip and Temperature Blank Samples

A pre-prepared trip blank and temperature blank consisting of de-ionized water will accompany each sample cooler during transport to the laboratory. These will be used as a standard to ensure that samples were maintained within laboratory specifications during shipment. Trip blanks will be collected at a frequency of one per day when VOC analysis is involved.

7.3 Sample Documentation, Custody and Shipping

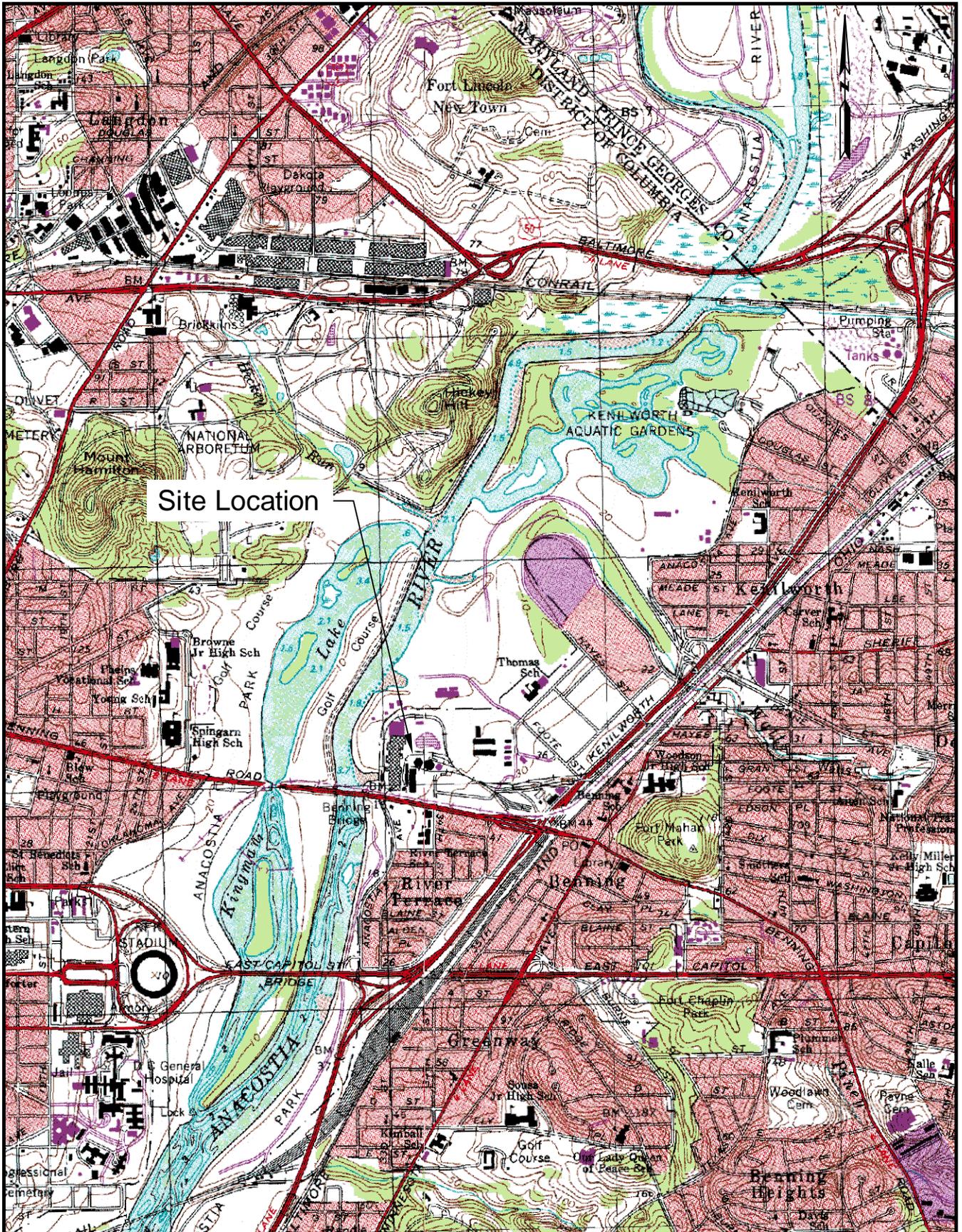
A sample is physical evidence collected from the project site. Due to the evidentiary nature of the data collected, the possession of samples must be traceable from the time the empty sample containers are prepared by the container supplier through the reporting of the analytical results. When samples are to be collected for chemical or physical

characteristics analysis, documentation such as sample labels and Chain of Custody (COC) forms will be completed. An example of a COC record is provided as **Figure 7**.

Each sample label will include the sample number, location, date/time of collection, and analysis. These labels will be used to assist in the tracking of samples and to facilitate retrieval of analytical results. The sample identification number will be used on sample labels and COC forms. Sample designation methodology is described in **Section 4**.



Figures



AECOM

Source:
USGS 7.5 Minute Topographic Map
Washington East Quadrangle

0 1000 2000 4000
SCALE IN FEET

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Site Location Map

DATE: 06/20/2012

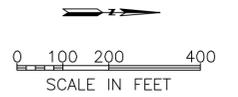
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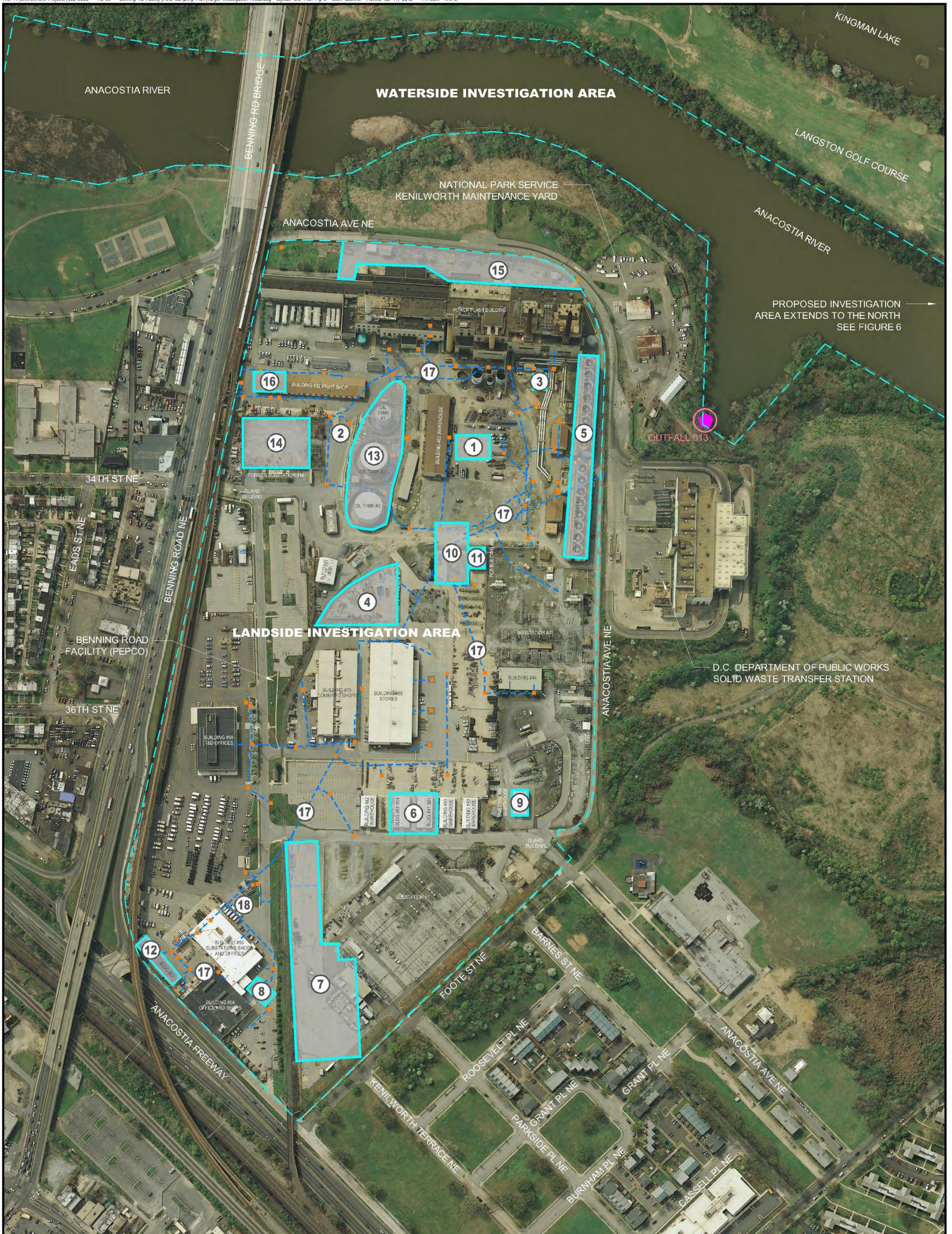
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FIGURE 1



- LEGEND:**
- PROPOSED INVESTIGATION AREA
 - BENNING ROAD FACILITY PROPERTY BOUNDARY
 - PROPERTY BOUNDARY



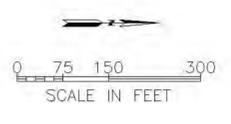


PROPOSED INVESTIGATION AREA EXTENDS TO THE NORTH SEE FIGURE 6

D.C. DEPARTMENT OF PUBLIC WORKS SOLID WASTE TRANSFER STATION

- LEGEND:**
- 18 TARGET AREA # - CORRESPONDS TO DESCRIPTION IN TABLE 2
 - TARGET AREA
 - 013 OUTFALL 013
 - INVESTIGATION AREA
 - STORM WATER UTILITY

- TARGET AREA KEY:**
- | | |
|---|--------------------------------------|
| ① FORMER SLUDGE DEWATERING AREA | ⑩ RED TAG STORAGE AREA |
| ② BENNING FUELING ISLAND | ⑪ BUILDING #68 (PCB BUILDING) |
| ③ FORMER 15,000 GALLON No. 2 FUEL OIL UST | ⑫ BUILDING #57 |
| ④ 2003 SALVAGE YARD INVESTIGATION | ⑬ BULK STORAGE ASTS AND LOADING RACK |
| ⑤ 1995 CLEANUP AREA | ⑭ FORMER RAILROAD SWITCHYARD |
| ⑥ 1991 CLEANUP AREA | ⑮ GENERATING STATION TRANSFORMERS |
| ⑦ 1988 PARKING LOT CLEANUP AREA | ⑯ PRINT SHOP |
| ⑧ 1985 EXCAVATION AREA | ⑰ STORM DRAIN SYSTEM |
| ⑨ GREEN TAG STORAGE AREA | ⑱ KENILWORTH FUELING ISLAND |

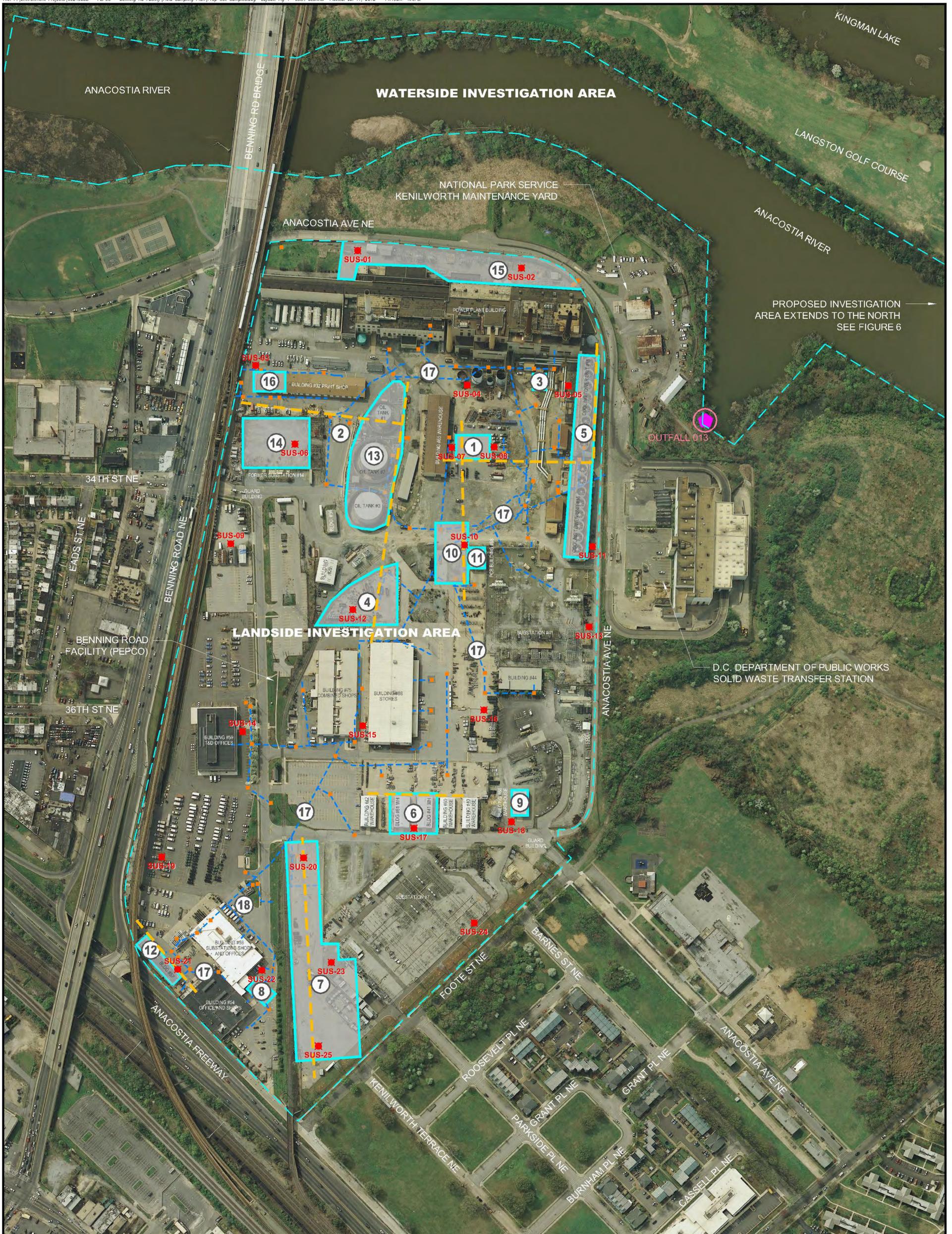


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Target Investigation Areas

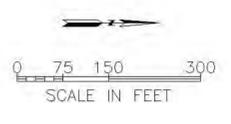
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FIGURE 3



- LEGEND:**
- **SUS-01** PROPOSED SURFACE SOIL SAMPLE LOCATION
 - POTENTIAL ELECTRICAL RESISTIVE IMAGING (ERI) TRANSECT
 - 18 TARGET AREA # - CORRESPONDS TO DESCRIPTION IN TABLE 2
 - TARGET AREA
 - OUTFALL 013
 - INVESTIGATION AREA
 - STORM WATER UTILITY

- TARGET AREA KEY:**
- | | |
|---|--------------------------------------|
| ① FORMER SLUDGE DEWATERING AREA | ⑩ RED TAG STORAGE AREA |
| ② BENNING FUELING ISLAND | ⑪ BUILDING #68 (PCB BUILDING) |
| ③ FORMER 15,000 GALLON No. 2 FUEL OIL UST | ⑫ BUILDING #57 |
| ④ 2003 SALVAGE YARD INVESTIGATION | ⑬ BULK STORAGE ASTS AND LOADING RACK |
| ⑤ 1995 CLEANUP AREA | ⑭ FORMER RAILROAD SWITCHYARD |
| ⑥ 1991 CLEANUP AREA | ⑮ GENERATING STATION TRANSFORMERS |
| ⑦ 1988 PARKING LOT CLEANUP AREA | ⑯ PRINT SHOP |
| ⑧ 1985 EXCAVATION AREA | ⑰ STORM DRAIN SYSTEM |
| ⑨ GREEN TAG STORAGE AREA | ⑱ KENILWORTH FUELING ISLAND |

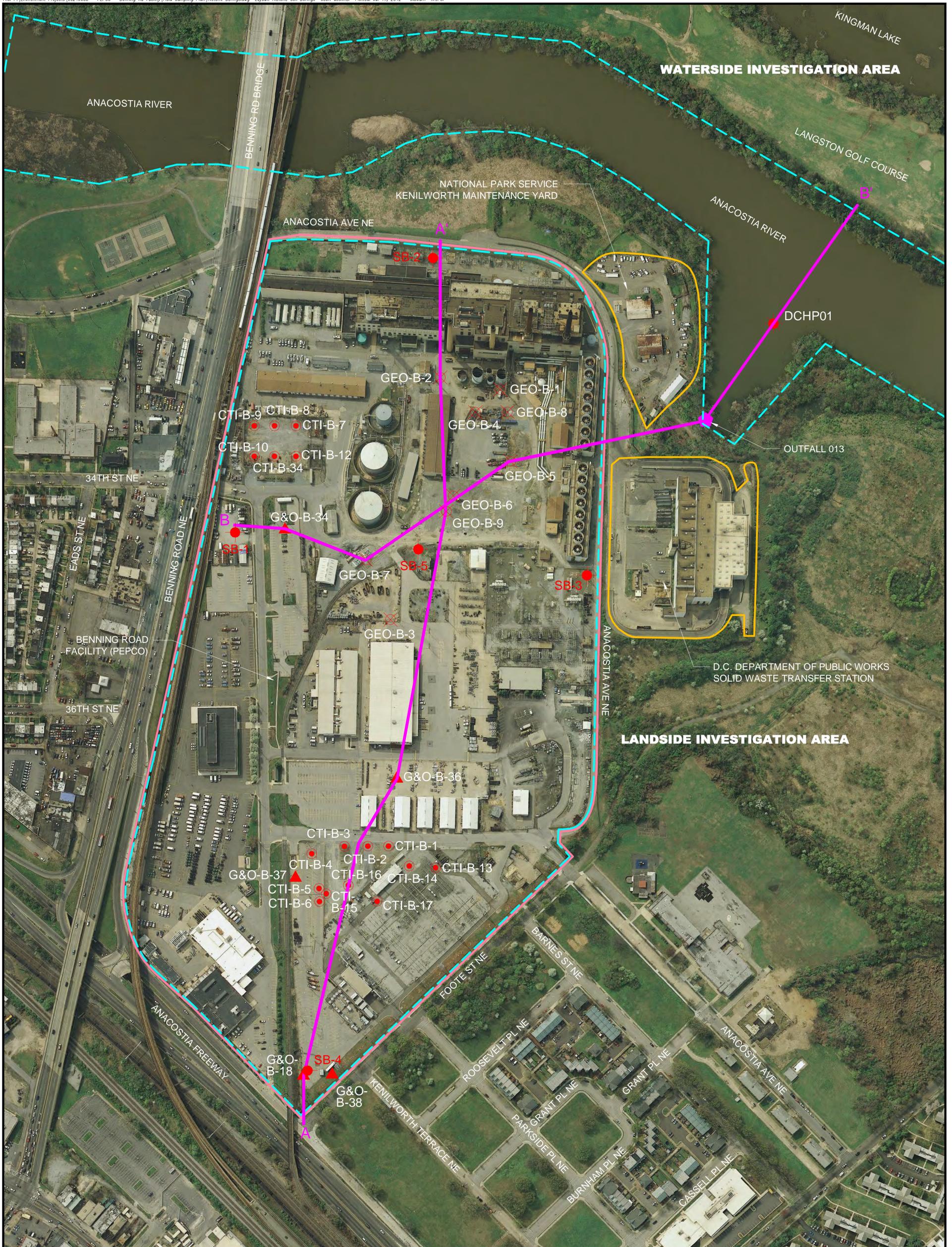


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**Proposed Surface Soil Sample and
ERI Transect Locations**

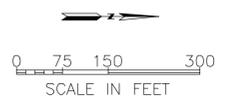
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FIGURE 4



- LEGEND:**
- ✗ APPROXIMATE LOCATION OF SOIL BORING INSTALLED BY GEOMATRIX, INC. IN 1988
 - APPROXIMATE LOCATION OF SOIL BORING INSTALLED BY CTI CONSULTANTS, INC. IN 2009
 - ▲ APPROXIMATE LOCATION OF SOIL BORING INSTALLED BY GREENHOUSE & O'MARA, INC. IN 2009
 - ★ USGS SOIL BORING DCHP01 INSTALLED IN 2002
 - ◆ PROPOSED SOIL BORING

- PROPOSED INVESTIGATION AREA
- BENNING ROAD FACILITY PROPERTY BOUNDARY
- PROPERTY BOUNDARY
- A-A' LINE OF CROSS-SECTION



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Washington, DC 20019

HISTORICAL AND PROPOSED
SOIL BORINGS

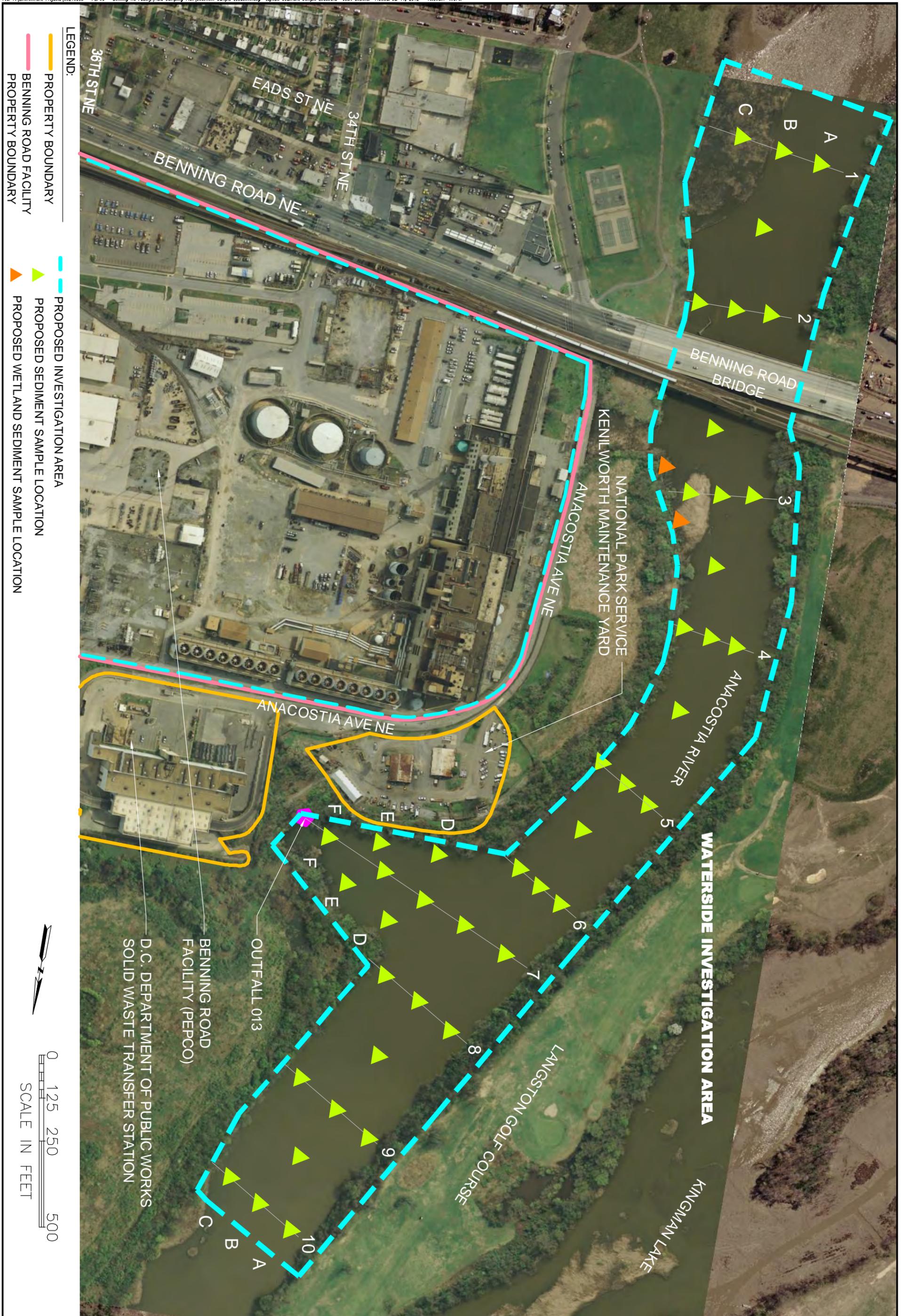
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DATE: 07/17/2012

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FIGURE 5



Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Sediment Sample Locations

DATE: 07/17/2012

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FIGURE 6

