Pre-Assessment Screen Determination

for

Anacostia River
Washington, DC

Issued by:
District of Columbia, United States Department of the Interior, and National Oceanic and Atmospheric Administration, in their joint capacity as Trustees for Natural Resources

July 2021

Based on the information contained in this Pre-Assessment Screen, we have determined that it is appropriate to conduct a Natural Resource Damage Assessment for this Site.

8/23/21

Tommy Wells
DOEE Director

Date

Based on the information contained in this Pre-Assessment Screen, we have determined that it is appropriate to conduct a Natural Resource Damage Assessment for this Site.

PENN.TONY.MARTIN.
1365863640

Digitally signed by
PENN.TONY.MARTIN.1365863640
Date: 2021.09.30 16:48:32 -04'00'

Tony Penn	Date

Tony Penn
Chief, Assessment and Restoration Division
Office of Response and Restoration
National Oceanic and Atmospheric Administration
as designated by the Director of the Office of Response and Restoration

Based on the information contained in this Pre-Assessment Screen, we have determined that it is appropriate to conduct a Natural Resource Damage Assessment for this Site.

KIMBERLY HALL

Digitally signed by KIMBERLY HALL
Date: 2021.09.22 17:02:46 -04'00'

Kym Hall
Area Director
National Park Service
Region 1 – National Capital Area
United States Department of the Interior

____
Date

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

ARSP	Anacostia River Sediment Project
AST	Above-ground storage tanks
AVS	Acid volatile sulfide
BaP	Benzo(a)pyrene
BERA	Baseline ecological risk assessment
bss	below sediment surface
BSAF	Biota sediment accumulation factor
BTAG	EPA Biological Technical Assistance Group
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSS	Combined sewer system
CWA	Federal Water Pollution Control Act
CSX	CSX Transportation Corporation
CVOCs	Chlorinated volatile organic compounds
DC Water	District of Columbia Water and Sewer Authority
DC	District of Columbia
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DOEE	Department of Energy and Environment
DOI	Department of Interior
EAA	Early action area
EPA	U.S. Environmental Protection Agency
EPBC	Eastern Power Boat Club
ESV	Ecological screening value
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FS	Feasibility study
HHRA	Human health risk assessment
HPAH	High molecular weight polycyclic aromatic hydrocarbon
HQ	Hazard Quotient
JBAB	Joint Base Anacostia Bolling
JCO	Johnson Company
KPN	Kenilworth Park Landfill North
KPS	Kenilworth Park Landfill South
LPAH	Low molecular weight polycyclic aromatic hydrocarbon
MCL	Maximum contaminant level
MDE	Maryland Department of Environment
MGP	Manufactured gas plant
µg/kg	Microgram per kilogram
MS4	Municipal separate storm sewer system
NAPL	Non-aqueous phase liquid

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFRAP	No Further Response Action Planned
NOAA	National Oceanic and Atmospheric Administrative
NOAEL	No-observed adverse effects level
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRD	Natural resource damages
NRDAR	Natural Resource Damage Assessment and Restoration
OC	Organochlorine
OU	Operable unit
PA	Preliminary Assessment
PAH	Polycyclic aromatic hydrocarbon
PAS	Pre-assessment screen
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
Pepco	Potomac Electric Power Company
PRPs	Potentially Responsible Parties
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SEFC	Southeast Federal Center
SEM	Simultaneously extracted metals
SI	Site Inspection
SOW	Statement of work
SVOCs	Semi volatile organic compounds
TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ	Toxic equivalent
TPH-DRO	Total petroleum hydrocarbons – diesel range organics
TPH-GRO	Total petroleum hydrocarbons – gasoline range organics
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
UST	Underground storage tank
VOCs	Volatile organic compounds
WGL	Washington Gas Light
WNY	Washington Navy Yard
WSSC	Washington Suburban Sanitary Commission

1.0 INTRODUCTION

The United States, pursuant to the authority of Section 107(f) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. § 9607(f); the Clean Water Act (CWA), as amended, 33 U.S.C. § 1251, *et seq*.; and Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R §§ 300.600, 300.605; and the District of Columbia, pursuant to the foregoing as well as pursuant to the Department of the Environment Establishment Act, D.C. Code § 8-151.08(8); and the District of Columbia Brownfield Revitalization Act, D.C. Code §§ 8-632.01 *et seq*.; and other applicable federal and state[1] authorities may act on behalf of the public as natural resource trustees to pursue claims for natural resource damages (NRD) for injury to, destruction of, or loss of natural resources and their services resulting from the discharge of oil or release of hazardous substances to the environment. NRD claims may be pursued against parties that have been identified as responsible for discharging oil or releasing hazardous substances to the environment. Under CERCLA, sums recovered by trustees as damages shall be used to restore, replace, rehabilitate, and/or acquire the equivalent of such natural resources and their services.

Under the CERCLA natural resource damage assessment and restoration (NRDAR) regulations (43 C.F.R. Part 11), the first step in the NRDAR process is the preparation of a pre-assessment screen (PAS). The PAS provides the basis for the trustees' determination that further investigation and assessment efforts are warranted, and that there is a reasonable probability of making a successful claim against the party or parties responsible for the release of hazardous substances. It is based on a review of the readily available information on hazardous substance releases and the potential impacts of those releases on natural resources and their services under the trusteeship of federal and state authorities (43 C.F.R. § 11.23).

The criteria that need to be met to proceed past the PAS to full assessment are:

1. A discharge of oil or release of hazardous substance(s) has occurred;
2. Natural resources for which a state or federal agency or Indian Tribe may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the discharge or release;
3. The quantity and concentration of the discharged oil or released hazardous substance(s) are sufficient to potentially cause injury, as that term is used in NRDAR, to those natural resources;
4. Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
5. Response actions from remedial activities carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

Pursuant to the NCP, 40 C.F.R. §§ 300.600, 300.605, the Secretary of the Department of the

---

[1] In accordance with section 101(27) of CERCLA, 42 U.S.C. 9601(27), and the NCP, 40 C.F.R. § 300.5, for the purposes of this document, the term "state" includes the District of Columbia.

Interior (DOI) through the U.S. Fish and Wildlife Service (FWS) and National Park Service (NPS), the Secretary of Commerce through the National Oceanic and Atmospheric Administration (NOAA), and the Government of the District of Columbia (District) through the Director of the Department of Energy and Environment (DOEE), are designated as the natural resource Trustees (Trustees).

This PAS was prepared by the Trustees in accordance with the CERCLA NRDAR regulations at 43 C.F.R. §§ 11.23 – 11.25.

2.0 INFORMATION ON THE GEOGRAPHIC AREA AND POTENTIAL RELEASES OF HAZARDOUS SUBSTANCES

2.1 Geographic Scope

The Trustees are evaluating potential releases of hazardous substances and related injuries to natural resources in the tidal Anacostia River, Kingman Lake, and the Washington Channel, as well as within terrestrial and upland areas associated with potential release sites.

The tidal Anacostia River begins at the confluence of the Northwest Branch and the Northeast Branch of the Anacostia River near Bladensburg, MD and extends downstream to the confluence of the Anacostia River and the Potomac River. It includes the mainstem Anacostia River, Kingman Lake, and Washington Channel, which are the focal areas of DOEE's Anacostia River Sediment Project (ARSP) (Figure 1). These areas are described in the Interim Record of Decision (ROD) for the ARSP (DOEE 2020a) as follows:

- ***Washington Channel.*** The Washington Channel is a 2-mile long waterway extending from the mainstem Anacostia River near the Potomac River up to the Tidal Basin, adjacent to the National Mall (Figure 1). A peninsula containing East Potomac Park and Haines Point separates the Washington Channel from the Potomac River. Hydraulic interaction between the Washington Channel and the Anacostia River is limited and sedimentation rates in Washington Channel are low relative to the mainstem of the river. The Washington Channel receives small inflows from the Tidal Basin and from several municipal separate storm sewer (MS4) outfalls, and limited tidal influx from the Anacostia and Potomac Rivers.

- ***Kingman Lake.*** Kingman Lake is a shallow, marshy, oxbow-type water body parallel to the mainstem Anacostia River (Figure 1). It was created by the U.S. Army Corps of Engineers (USACE) during the 1910s - 1920s to provide a boating area for District of Columbia residents. The Lake has downstream and upstream inlets to the Anacostia mainstem approximately 3.5 and 5.5 miles upstream of the confluence with the Potomac River. Kingman Lake receives inflows from the main river channel, a few MS4 outfalls, and a small, unnamed tributary draining a wooded portion of the National Arboretum. A restoration project conducted in 1999-2000 created 41-acres of emergent vegetation through the application of ~190,000 cubic yards of material dredged by USACE from the

Anacostia River, with monitoring conducted in 2001 and 2003 (Pinkney et al. 2006, see Section 3.3).

- ***Mainstem Anacostia River***. The mainstem includes the entire main channel of the tidal river (Figure 1). The upper 2.3 miles of the mainstem are located in Maryland and the lower 6.7 miles are located in the District of Columbia. The mainstem receives inflows from five major tributaries, nine minor tributaries, Kingman Lake, Washington Channel, and the Potomac River (during high tide). The three largest tributaries are Northwest Branch, Northeast Branch, and Lower Beaverdam Creek. More than 100 outfalls discharge into the mainstem Anacostia River, including private National Pollution Discharge Elimination System (NPDES) outfalls, MS4 outfalls and combined sewer system (CSS) overflow outfalls. After the Anacostia River Tunnel was completed in 2018, 98% of the discharges from the CSS outfalls were eliminated. To be congruent with the Remedial Investigation (RI; Tetra Tech 2019a) and the Interim ROD (DOEE 2020a), the mainstem Anacostia River is separated into 4 sections based on sediment characteristics and river hydraulics (Figure 1):

    - ***Reach 7*** – most upstream reach, extending from the confluence of Northwest Branch and Northeast Branch to the downstream end of Bladensburg Marina;
    - ***Reach 67*** – extends from the downstream end of Bladensburg Marina to Nash Run;
    - ***Reach 456*** – extends from Nash Run to the CSX Transportation (CSX) Railroad Bridge;
    - ***Reach 123*** – extends from the CSX Transportation Railroad Bridge to the confluence with the Potomac River.

2.2 Hazardous Substances in the Anacostia River Geographic Area

There are elevated concentrations of hazardous substances in surface water and sediment of the Anacostia River. Elevated concentrations of hazardous substances in soil or groundwater at individual potential environmental cleanup sites provide evidence of releases of hazardous substances at these sites, and may represent historic and/or continued releases of hazardous substances to the Anacostia River. The following classes of hazardous substances have been detected in surface water and sediment within the Anacostia River and adjacent tidal areas and/or in soil and groundwater at potential environmental cleanup sites (Tetra Tech 2019a):

- Polychlorinated biphenyls (PCBs)
- Dioxins (polychlorinated dibenzo-*p*-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) congeners)
- Pesticides (e.g. Chlordane, Dichlorodiphenyltrichloroethane/ethylene (4,4’-DDT, 4,4’-DDE))
- Trace elements (e.g. arsenic and lead)

- Polycyclic aromatic hydrocarbons (PAHs)
- Volatile organic compounds (VOCs; e.g. benzene, methyl-tert-butyl ether) and chlorinated VOCs (CVOCs; e.g. tetrachloroethylene, vinyl chloride)

Concentrations of several hazardous substances in the Anacostia River and adjacent tidal areas exceed concentrations likely to cause injury to natural resources and their services. Injury can occur directly as toxicity or indirectly through bioaccumulation from sediment and water into biota. The pathways from sediment and surface water to biota are discussed in Section 3.2.

Surface Water

Concentrations of hazardous substances measured in surface water were compared to either water quality criteria or screening thresholds for potential toxicity to aquatic life. Surface water sampling was conducted as part of the RI for the ARSP. Phase 1 samples were collected during fall of 2014 (dry conditions) and Phase 2 samples were collected during summer, fall, and early winter 2016 (under wet and dry conditions) (Tetra Tech 2019a). The total numbers of samples collected within each river reach during both phases of sampling are listed in Table 1.

Concentrations of total PCB congeners, 4,4'-DDT, and dissolved lead exceeded the District's numerical water quality criteria for chronic toxicity to aquatic life in a small number of samples (Table 1). Total PCB concentrations exceeded the criterion in two samples (of 110 total samples from all locations). These were collected from Reach 456 and Reach 67 (at the head of Kingman Lake). Dissolved lead exceeded the criterion in one sample collected from Kingman Lake (Table 1). Concentrations of 4,4'-DDT exceeded the criterion in one sample from every reach except Reach 67. Concentrations of individual PAHs, such as benzo(a)pyrene (BaP) and pyrene, were compared to screening thresholds for acute and chronic toxicity to aquatic life listed in Buchman (2008), since the District does not have water quality criteria for PAHs. BaP concentrations exceeded the chronic toxicity threshold in at least one sample from all reaches except Reach 67 (Table 1). The highest BaP concentrations (exceeding acute toxicity screening thresholds) were detected in Reach 7 and Kingman Lake. Concentrations of pyrene exceeded the chronic toxicity threshold in the majority of samples collected from all reaches, except Reach 123 and the Washington Channel (Table 1). Dioxin toxicity equivalents (TEQ) were calculated from TCDD and TCDF congener concentrations in samples collected during Phase 1 (n=14) and Phase 2 (n=96) and compared to the aquatic health criterion of 3.8E-07 µg/L determined by Singleton (2014). Concentrations only exceeded this criterion in nine Phase 2 samples, with the maximum in Kingman Lake (Tetra Tech 2019a, Baseline Ecological Risk Assessment (BERA) Attachment I.3.6).

Sediment

Concentrations of contaminants in surface sediment were compared to consensus-based Probable Effects Concentrations (PECs; MacDonald et al. 2000; Table 2). Consensus-based PECs are concentrations of individual contaminants in sediment above which toxicity to benthic organisms is expected to occur, based on a compilation and analysis of published sediment quality guidelines (MacDonald et al. 2000). Consensus-based PECs are used as an injury threshold for effects on sediment-dwelling organisms in NRDAR. For purposes of this PAS, surface sediment is defined as sediment collected from $\leq$6 inches below the sediment surface and represents recent contaminant deposition and contemporary benthic organism exposure. Sampling of surface sediment in the Anacostia River was performed in 2014 and 2016 as part of the RI for the ARSP (Tetra Tech 2019a), with the total number of samples collected from each reach listed in Table 2. Total PCB congener concentrations in surface sediment exceeded the PEC at several locations within Reach 123, Reach 456, and the Washington Channel, with maximum concentrations >2,500 µg/kg (Table 2). Total PCB concentrations did not exceed the PEC in Reach 67 or Reach 7. Lead concentrations in surface sediment exceeded the PEC in several locations in Kingman Lake, Reach 123, Reach 456, and Washington Channel, with a maximum of 700 mg/kg in Reach 123. Total chlordane concentrations exceeded the PEC in most samples from all reaches except Reach 7 and Washington Channel, which had only a few exceedances. Total PAHs in surface sediment exceeded the PEC in a few locations in Reaches 123, 456, and Washington Channel.

A subset of the surface sediment samples collected in 2014 and 2016 were analyzed for PCDD and PCDF congener concentrations and the dioxin TEQ is reported in the RI (Tetra Tech 2019a). There is no consensus-based PEC for dioxin TEQ. A probable effects level (PEL) of 21.5 ng/kg dioxin TEQ is listed in the Canadian Sediment Quality Guidelines for Protection of Aquatic Life (CCME 2001), which is similar to the "moderate" range (toxic effects expected following chronic exposure) of 30-100 ng/kg dioxin TEQ in the Norwegian classification system for contaminated sediment (Bakke et al. 2010). Under the Norwegian classification system, 100-500 ng/kg dioxin TEQ is within the "bad" range (toxic effects following short-term exposure) (Bakke et al. 2010). Calculations of dioxin TEQ differ slightly between studies, but data presented in the 2019 RI (Tetra Tech 2019a, Figure 6.8) illustrate several locations in Reach 123 (n=21), Reach 456 (n=3), Washington Channel (n=3), and Kingman Lake (n=4) with concentrations above the PEL and within the "moderate" range of expected toxicity. One sample collected from the head of the Washington Channel and three samples collected from the Pepco Cove area of Reach 456 (see "Reach 456: Pepco Benning Road Facility" description below) had dioxin TEQ concentrations in the "bad" range of expected toxicity. Areas with the highest concentrations of dioxin TEQ generally correspond to areas with the highest concentrations of total PCBs (Tetra Tech 2019a).

Additional surface sediment samples have been collected as part of various investigations between 1989-2016 and these data were queried from NOAA's web-based application Data Integration Visualization Exploration and Reporting **(**DIVER**)** Explorer (DIVER 2021). Mapping all available surface sediment data (1989-2016) illustrates that elevated concentrations of some hazardous substances are clustered, indicating either depositional areas or areas of likely releases. For example, surface sediment concentrations of total PCB congeners exceeding the PEC are clustered in areas of Reaches 456 and 123 near identified potential environmental cleanup sites, and in the head of the Washington Channel (Figure 2). In contrast, surface sediment concentrations of chlordane exceeding the PEC are dispersed throughout the river (Figure 3). Surface sediment concentrations of total PAHs and lead that exceed PECs are more dispersed than elevated concentrations of PCBs (Figures 4 and 5).

Extensive subsurface (i.e., greater than 6 inches below the riverbed) sediment sampling has also been conducted within the ARSP study area (DIVER 2021). These data may be used to assess historical releases of hazardous substances to the Anacostia River from potential environmental cleanup sites and/or in quantifying past injury in a possible Injury Assessment, but are not discussed in detail in the PAS.

Soil and Groundwater

Elevated concentrations of hazardous substances, particularly trace elements, VOCs (e.g., benzene), CVOCs (e.g., vinyl chloride), and PCBs have been reported in soil and groundwater samples collected from potential environmental cleanup sites within the Anacostia River geographic area. Most of these samples were collected during investigations of specific sites, and concentrations exceeding ecological thresholds (soil) or maximum contaminant levels (MCLs) in drinking water (groundwater samples) are discussed in more detail below.

2.3 History of the Current and Past Use of Sites Identified as Potential Sources of Hazardous Substances

Hazardous substances have been or may be released into the Anacostia River from several contaminated sites that border the River including those described below and identified in Figure 1. This list of potential environmental cleanup sites is not considered to be complete or finalized and does not reflect all potential sources of hazardous substances in the Anacostia River geographic area. Additional sources and associated potential environmental cleanup sites may be identified in the future.

Reach 67:

2.3.1 Colmar Manor Landfill

The former Colmar Manor Landfill (also known as Anacostia River Park site) is the furthest upstream potential environmental cleanup site identified to date. Beginning in the 1930s, the site was used for refuse disposal by local residents (MDE 2002). From 1955 to 1970, the Washington Suburban Sanitary Commission (WSSC) operated the site as a permitted landfill. Following closure of the landfill in 1970, WSSC sold the property to the Maryland-National Capital Park and Planning Commission (M-NCPPC) who redeveloped it as a recreational park and is the current owner of the property. A 1979 congressional report identified the site as a landfill where base ($pH > 12$) solutions, heavy metals, trace metals, and inorganics were placed from 1957 to 1961 (MDE 2002). The landfill was covered with a 12-to-15-inch thick layer of sand and topsoil. A 1000-foot slurry wall was installed in 1982 to prevent leachate migration into an adjacent neighborhood and a methane ventilation system was installed in 1984 (MDE 2002). The U.S. Environmental Protection Agency (EPA) designated the site as one where no further remedial action is planned (Tetra Tech 2019a).

The Maryland Department of the Environment (MDE) conducted an environmental investigation of Colmar Manor Landfill in 1994 (MDE 2002). Sampling included landfill soil, sediment and water from on-site ponds, and surface water and sediment from Dueling Creek; contaminants detected in all media are listed in Table 3. For soil samples, pesticides and PAHs were reported as exceeding 3x site background concentrations, with the most detections of PAHs in a sample collected along the southern site boundary adjacent to Dueling Creek (Tetra Tech 2019a, Table 3). However, the highest reported concentrations of individual PAHs in this sample (BaP and acenaphthylene) were far below ecological screening values (Tetra Tech 2019a, Buchman 2008). Similarly, pesticides and PAHs were detected in sediment from landfill ponds, but only the maximum reported concentration of 4,4'-DDD (68 µg/kg) exceeded the PEC (28 µg/kg). Lead concentrations in sediment samples from multiple ponds were >230 mg/kg, which exceeds the PEC (Tetra Tech 2019a).

Surface sediment samples collected in the vicinity of Colmar Manor Landfill between 1989-2016 (DIVER 2021) did not have concentrations of PCBs exceeding the PEC (Figure 6A), and only a few older (pre-2014) samples had concentrations of PAHs (n=2) and lead (n=1) exceeding their respective PECs (Figures 6B and 6C).

Reach 456:

2.3.2 Kenilworth Park Landfill

The Kenilworth Park Landfill (KPL) is a 130-acre site currently owned by the United States and located within Kenilworth Park, which is part of Anacostia Park (Figure 1). The site comprises two geographic areas divided by Watts Branch (a tributary of the Anacostia River): Kenilworth Park Landfill North (KPN) and Kenilworth Park Landfill South (KPS). Topographical mapping from the early 1900s shows much of the former landfill area as low-lying wet/marsh land. Historical aerial photographs and accounts of the Anacostia River history indicate the site was altered prior to landfilling by seawall construction and placement of dredged sediment along the banks of the River and by the excavation of recreational lakes in the 1930s. Over the course of the landfill operation, the recreational lakes and low-lying areas were filled with waste materials.

The Kenilworth Park Landfill was operated from 1942 to 1970. Waste material disposed in the landfill consists of ash from District municipal solid waste (MSW) incinerators, residue from on-site burning, demolition debris, and unburned MSW disposed between 1968 and 1970 after open burning was discontinued. Although the landfill was created over silt and clay rich mud flats, no engineered liner or leachate collection system was installed. As is typical for landfills operated prior to the 1970s, the Trustees have identified no definitive records documenting the contents or the placement of the waste. Based on a review of historical aerial photographs, NPS determined that it is possible waste was disposed adjacent to the main stem of the Anacostia River and Kenilworth Marsh, at the former inlets to the recreational lakes. When it was closed, the landfill was covered with soil fill and revegetated; recreational facilities including athletic fields, picnic areas, and the Kenilworth Community Center were established within the closed landfill footprint. In addition to the buried waste the soil fill placed over the landfill at closure contained CERCLA hazardous substances, as noted below.

In the late 1990s, soil fill was placed over KPS with the intention to develop additional athletic fields. The fill design included perimeter drainage swales and sedimentation ponds, which were installed early in the filling operation. The contractors engaged to place the fill disposed demolition debris (concrete, bricks, steel rebar, asphalt, etc.) mixed in with soil. NPS discontinued the filling activities and required the contractors to remove deleterious materials from the surface. NPS took additional actions at KPS to stabilize surface conditions by repairing prior drainage control features, installing new berms and drainage swales, and seeding the area to provide vegetative cover.

As the lead remedial agency, NPS initiated CERCLA investigations at KPL in 1998. Multiple studies have since been completed; see the 2019 Remedial Investigation Addendum Report (NPS 2019) for a summary of each investigation and details of the associated findings. NPS recently released a Feasibility Study (NPS 2020a) which identifies remedial alternatives that were evaluated to address risks associated with contaminants in surface soil, and a Proposed Plan (NPS 2020b) for public comment identifying NPS's Preferred Alternative. NPS will identify its selected remedial alternative in a Record of Decision.

Environmental conditions identified in subsurface soil and waste, surface soil, groundwater, and sediment are described below (Table 3).

- Subsurface soil and buried waste at KPL contain PAHs, PCBs, pesticides, and various metals at concentrations that exceeded the ecological screening levels identified in the 2007 and 2008 Remedial Investigation Reports (E&E 2007; E&E 2008). Based on the analysis presented in the 2012 Feasibility Study (The Johnson Company 2012), NPS concluded that no further response action beyond the existing containment was necessary to address ecological exposure conditions in subsurface soil and buried waste. NPS concluded there is no evidence that methane is migrating beyond the perimeter of the landfill, but confirmatory sampling is included in the Proposed Plan.

- Surface soil at KPL contains PAHs, PCBs, pesticides, and metals at concentrations that exceeded the ecological screening levels identified in the 2007 and 2008 Remedial Investigation Reports (E&E 2007; E&E 2008). The remedial investigation concluded that no further response action was necessary to address ecological exposure conditions in surface soil.

- Groundwater at KPL contains VOCs, semi volatile organic compounds (SVOCs), and metals at concentrations that exceed ecological screening levels (Tetra Tech 2019a). With a few exceptions, organic contaminants including VOCs, PAHs, and PCBs were below the lowest ecological screening levels. Inorganic constituents including aluminum, arsenic, barium, copper, iron, and manganese were detected above the ecological screening levels in most site monitoring wells; however, only iron was found to potentially pose an unacceptable ecological exposure risk. Iron is not a CERCLA hazardous substance and has not been identified as a contaminant of concern in the River.

The remedial investigations concluded that contaminant migration through groundwater does not appear to be a significant pathway.

- To supplement the Remedial Investigation Addendum, DOEE collected and analyzed samples from groundwater seeps identified around the perimeter of the landfill. The samples were found to contain PCBs and dioxin-TEQ at concentrations that exceeded screening levels. NPS anticipates additional assessment of these conditions will be performed at the Remedial Design phase of the response.
- PAHs, PCBs, and metals have been detected in sediment samples from surface water bodies adjacent to KPL including the Anacostia River, Watts Branch, an Unnamed Tributary to Watts Branch, and Kenilworth Marsh (Figures 6-8).

2.3.3 Pepco Benning Road Facility

The Pepco Benning Road facility is located at 3400 Benning Road NE, Washington, DC. The Potomac Electric Power Company (Pepco) operated a coal-fired, then oil-fired, electric power generating station from 1906 until 2012, at which time the power station was decommissioned (Tetra Tech 2019a). Pepco commenced demolition of the power station in 2014 and completed the demolition and removal of the power plant building and related infrastructure in 2015. Pepco currently owns the 77-acre site and uses it to manage operations and maintain equipment associated with their electrical distribution system. Several documented PCB, petroleum, and metals releases to the environment occurred between 1987 and 2003 from spills of contaminated oil or leaking equipment. Pepco performed cleanup activities in response to each of these releases pursuant to EPA orders. Pepco prepared a RI/FS Work Plan pursuant to a Consent Decree with the District in 2011. The RI was conducted in two phases, with Phase I sampling between 2013 and 2014, and Phase II sampling between 2016 and 2018; the report was completed in 2020 (AECOM 2020).

Soil sampling was conducted over multiple phases and tasks during the RI; 1,267 soil samples were collected between February 2013 and July 2018 (Tetra Tech 2019a). Total PCB concentrations exceeded screening levels at 51 of 425 locations sampled; the mean concentration (60,000 µg/kg) far exceeds screening thresholds for terrestrial receptors (Buchman 2008, Tetra Tech 2019a, AECOM 2020). In Target Area 12 (Building 57 Area), some samples exceeded the Toxic Substances Control Act (TSCA) limit for disposal (maximum PCB concentration was 8,800,000 µg/kg) (Tetra Tech 2019a, AECOM 2020). Concentrations of dioxin TEQ, metals, and PAHs exceeded ecological screening thresholds in samples collected throughout the site (Table 3; Buchman 2008, Tetra Tech 2019a, AECOM 2020).

Groundwater (n=47) sampling for upper and lower water bearing zones was conducted during Phase 1 of the RI. Additional groundwater sampling was conducted in Phase II to further delineate VOC and CVOC plumes (AECOM 2020). Several contaminants were above screening levels (District drinking water standards or EPA MCLs) in at least one groundwater sample including trace elements, naphthalene, methyl-tert-butyl ether (MTBE), and CVOCs

(Table 3; AECOM 2020). Detectable concentrations of PCB Aroclors and dioxins were present in groundwater monitoring wells but did not exceed screening thresholds. The highest PCB Aroclor concentrations were 0.11 µg/L in lower water bearing zones and 0.034 µg/L in upper water bearing zones.

Surface and subsurface sediment samples were collected in the vicinity of the Pepco site during Phase I (2013-2014) and Phase II (2017) of the RI (AECOM 2020). Maximum surface sediment concentrations of total PCB congeners (11,800 µg/kg), total PAHs (24,000 µg/kg), lead (320 mg/kg), and dioxin TEQ (>395 pg/g) were measured in Pepco Cove, which receives inflow from the main Pepco site stormwater outfall (Outfall 013) (Tetra Tech 2019a, AECOM 2020, DIVER 2021). The results of laboratory toxicity tests conducted with these surface sediments are described in Section 3.3.

Samples collected from Reach 456 between 1989-2016 (DIVER 2021) had concentrations of total PCBs, total PAHs, and lead that exceeded PECs in Pepco Cove (Figures 7A, 7B, and 8). Concentrations of total PCBs and lead also exceeded PECs in the vicinity of a second Pepco outfall (Outfall 101) near the southern end of the site (Figures 7A and 8). Storm drains at the Pepco site are an identified source of PCBs, PAHs, and lead to the Anacostia River and on-site soils have elevated concentrations of PCBs (AECOM 2020). PCBs have been detected in forage fish species with <0.5-mile home ranges, collected near the Pepco site (see Section 3.3).

2.3.4 CSX Benning Yard

CSX owns and operates Benning Yard, located at 225 33rd Street, SE, Washington, DC. Benning Yard is an active railroad switching yard. The Benning Yard boundary extends along the trackage from the Anacostia River railroad bridge over the Anacostia River at the southwest end up to the Benning Road overpass at the northeastern end (Figure 1; Tetra Tech 2019a). Historically, a portion of Benning Yard was used to store and dispense diesel fuel to locomotives (Yard Office Area). The historical record search identified a coal shed, a freight car repair shop, and an oil house where containers of oil and other lubricants were stored at the Benning Yard. The Yard also had an electrification system that consisted of catenary lines. Several incidents and spills of fuel oil, coal, transformer oil, and diesel were identified in a search of historical information. Most of the spill locations are unknown (Geosyntec 2010). In 2004, a new office building and parking facility were constructed in the Yard Office Area. Subsurface hydrocarbon contamination was observed during this construction and, subsequently, it was determined that hydrocarbon-impacted groundwater was seeping into the adjacent Fort Dupont Creek, a tributary to the Anacostia River (Tetra Tech 2019a).

CSX conducted subsurface investigation only in the Yard Office Area. The investigations of the observed hydrocarbon contamination at the Yard Office Area revealed the presence of a light non-aqueous phase liquid (LNAPL) plume in the water table aquifer and, on occasion, the presence of a petroleum sheen on Fort Dupont Creek. As part of a LNAPL plume investigation, Geosyntec sampled 23 monitoring wells present at the site in December 2012 (Tetra Tech 2019a). Total petroleum hydrocarbons – gasoline range organics (TPH-GRO), arsenic, and three PAHs were detected above screening criteria (Table 3). PCBs, pesticides and VOCs were not detected in any of the wells installed in the Yard Office Area (Geosyntec 2013). To address this contamination, CSX prepared a corrective action plan (CAP) that included excavating petroleum-impacted soils, installing an oxygen releasing compound in trenches at the bottom of the excavated area, and backfilling with clean fill. The associated cleanup activities were completed in 2016 (Geosyntec 2016). As a part of remediation activities, CSX also stabilized an approximately 150-foot section of the bank of the Fort Dupont Creek to address erosion issues. Currently, CSX is conducting further investigation for the entire yard.

A sediment investigation including Fort Dupont Creek and a portion of the nearshore Anacostia River was conducted in 2011 (EnviroScience 2013). Evaluation of these data, in combination with other surface sediment data collected in Reach 456 between 1989-2016 (DIVER 2021), illustrates that concentrations of total PCBs, PAHs, and lead exceeded their respective PECs immediately upstream and downstream of the Fort Dupont Creek Outfall (F-193-790), including the area between Fort Dupont Creek Outfall and MS4 outfall F-656-309 (Figures 7A, 7B, 8 and 14; Tetra Tech 2019a). Concentrations of lead also exceeded the PEC in the Anacostia River across from the outfalls (Figure 8). Generally, locations with total PAH concentrations exceeding the PEC (Figure 7B) were further upstream and downstream of the outfall than those with elevated concentrations of PCBs and lead (Figures 7A and 8). In addition to inflows from CSX Benning Yard Outfall 002, Fort Dupont Creek also receives runoff from the remaining portion of the 376-acre Fort Dupont Creek watershed. However, concentrations of lead, total PAHs, and total PCBs in Fort Dupont Creek upstream of CSX were low, well below the PECs for these contaminants (Figures 7A, 7B and 8). The concentration of lead exceeded the PEC in one sediment sample collected in Fort Dupont Creek at CSX (Figure 8). Contaminants in various media associated with the CSX Benning Yard are summarized in Table 3.

Kingman Lake:

2.3.5 Langston Golf Course

Kingman Island is an approximately 1.7-mile long man-made island. The mainstem Anacostia River flows southward along the eastern shoreline of Kingman Island; 110-acre Kingman Lake borders the western shoreline (Figure 1). Kingman Lake, Kingman Island, and the adjacent, smaller Heritage Island were constructed by USACE using dredge spoil from the river and adjacent mudflats in the 1910s to 1920s (Tetra Tech 2019a). The 94-acre island is bisected by Benning Road. The northern half is developed as Langston Golf Course, owned by the United States and managed by NPS. The portion of Kingman Island located south of Benning Road was managed by the NPS until 1997, when it was conveyed to the District.

North of Benning Road, Kingman Island and the adjacent tract of land on the western shore of Kingman Lake were used for burning/open dumping of refuse from approximately 1930 through the early 1950s (E&E 2001). In 1937, refuse disposal operations on the island ceased, and this area was reclaimed as the nine-hole Langston Golf Course. Refuse disposal/burning, however, continued on the western (landside) shore of Kingman Lake until 1955, when the dump was covered and redeveloped as the second nine holes of Langston Golf Course (E&E 2001).

Sampling by E&E (2001) included 28 subsurface soil samples and seven groundwater monitoring wells. In soil samples, four PAHs exceeded industrial risk-based concentrations but the total concentration of these PAHs (8,429 µg/kg) was well below the screening value for potential risk to invertebrates or mammals (Buchman 2008) and PAHs were not detected in groundwater samples (Tetra Tech 2019a). Maximum soil concentrations of arsenic (34.8 mg/kg) and lead (1,070 mg/kg) exceeded the screening values for potential risk to avian (lead only), invertebrate (lead only), plant (arsenic and lead) and mammal (arsenic and lead) receptors (Table 3; Buchman 2008). In groundwater samples, maximum concentrations of aluminum, arsenic, and lead exceeded MCLs (Table 3). All soil samples had detectable TPH-diesel range organics (DRO), and TPH-DRO was detected in some groundwater samples. Three subsurface soil samples from the western (landside) shore of the golf course (in landfill material) contained PCB Aroclor 1260 at a maximum concentration of 23.5 µg/kg (Tetra Tech 2019a), which exceeds the lowest screening threshold for potential risk to mammals (0.332 µg/kg; Buchman 2008). PCB Aroclors were not detected in any groundwater samples.

Based on currently available information, including the on-site sampling results and surface sediment sampling adjacent to the Langston Golf Course between 1989-2016 (DIVER 2021), concentrations of PAHs in Kingman Lake adjacent to the site are relatively low (Figure 7B). One surface sediment sample at the upper end of Kingman Lake had a total PCB concentration that exceeded the PEC, but this may be related to an exceptionally high total PCB concentration in the mouth of a nearby tributary (Hickey Run) (Figure 7A). Langston Golf Course has elevated concentrations of arsenic and lead in subsurface soils and groundwater, and lead concentrations exceeded the PEC in one surface sediment sample from Kingman Lake adjacent to the site (Figure 8).

2.3.6 Kingman Island Illicit Dumping Area

South of Benning Road, Kingman Island was initially used by the neighboring communities for fishing, hiking, and gardening (“victory gardens”). After World War II, the island gradually became overgrown with vegetation and became the site of illicit dumping activity (MACTEC Packaging Technologies (MACTEC) 2007).

To investigate the nature and extent of refuse piles resulting from illicit dumping on the portion of Kingman Island south of Benning Road, MACTEC excavated 18 test pits from three soil piles/mounds, two primary mounds and a smaller mound (MACTEC 2007). MACTEC (2007) noted single low-level detections of PCB Aroclor 1254, TPH-GRO, and ethylbenzene.

In November 2015, Tetra Tech, on behalf of DOEE, performed a Site Investigation (SI) of Kingman Island to further evaluate the potential presence of hazardous materials near the three soil mounds/piles (Tetra Tech 2016). Thirty-six subsurface soil samples and nine groundwater samples were collected in the vicinity of the soil piles and 12 test pits were excavated from the piles (Tetra Tech 2016). Chemicals of concern identified at the site included TPH-DRO, PAHs, PCBs (as Aroclor 1260), and several metals due to their presence in all media including subsurface soils, groundwater and test pit soils (organics) or leachate (metals) (Table 3). Concentrations of these contaminants exceeded human health criteria in soil samples and MCLs and EPA Biological Technical Assistance Group (BTAG) screening values in groundwater samples (Tetra Tech 2016). Maximum concentrations of PCBs (as Aroclor 1260) were 2.5 µg/L in groundwater and 320 µg/kg in soil test pit samples, which exceed MCLs and ecological screening criteria, respectively (Buchman 2008). Lead concentrations >1000 mg/kg in soil samples were also reported, which far exceed ecological screening criteria (Tetra Tech 2016, Buchman 2008).

In the Anacostia River, surface sediment samples collected in Kingman Lake adjacent to the site between 1989-2016 (DIVER 2021) did not have elevated concentrations of total PCBs or total PAHs (Figure 7A and 7B). Lead exceeded the PEC in a single sediment sample collected from Kingman Lake adjacent to the site (Figure 8).

Reach 123:

2.3.7 Washington Gas Light (WGL) East Station Site

The WGL East Station Site is the location of a former manufactured gas plant (MGP), which was operated from 1888 to 1948 by WGL (Tetra Tech 2019a). From 1948 to 1983, the plant was operated by WGL only for peaking purposes or once a year to check equipment operation. The plant was closed in 1983 and demolition of the plant was largely completed in 1986. Historical structures on the former East Station facility property included five aboveground oil storage tanks, a natural gas and manufactured gas holder, and underground pipelines that extended from two former loading docks on the Anacostia River to either the Washington Gas aboveground oil storage tanks or the Steuart Petroleum facility. The aboveground oil storage tanks were constructed between 1900 and 1930 (Washington Gas, Progression of Gas Plan Development). Beginning in August 1978, Steuart Petroleum Company leased these five oil storage tanks for storage of No. 2 fuel oil (May 6, 1980 letter revision to August 8, 1978 Letter Contract). These aboveground oil storage tanks were demolished between 1994 and 1998 (based upon a review of the 1994 and 1998 aerial photographs).

The WGL East Station Site includes two distinct sites. The site of the former manufactured gas plant (located north of Water Street) is currently owned by Washington Gas. In 1999, EPA issued a decision document selecting a remedy for that site (a pump-and-treat system to remove contaminants from groundwater and to maintain hydraulic control of the plume to prevent contaminants from reaching the river). The second site (referred to as the "Government Property") includes land situated between the first site and the river, as well as contaminated sediments in the adjacent riverbed.

In 2006, NPS issued a record of decision (ROD) selecting a remedy for the Government Property and requiring continued capture of contaminated groundwater. In 2012, the United States, the District, and Washington Gas entered into a consent decree that required Washington Gas to implement the soil remedy selected in the 2006 NPS ROD and also to conduct a RI/FS for "Operable Unit 2 (OU2)" which is defined to include the "groundwater, surface water, and sediments of the Anacostia River where hazardous substances released at or from the Washington Gas East Station Property have come to be located." NPS is the lead CERCLA response agency for the entire WGL site, and the District provides support. The excavation and backfilling portion of the soil remedy at the Government Property was completed in 2015 (NPS 2015) and revegetation requirements were achieved in 2018. The OU2 riverside and landside data collection efforts were completed in 2019 and a draft remedial investigation report was submitted to NPS and the District for review in June 2020; the report had not been finalized as of July 2021. The OU2 investigation included a bathymetric survey, a benthic organism survey, sediment toxicity tests, collection of pore water samples, and the delineation of the area and depth of contaminated sediment. Sediment sample analysis included fingerprinting/forensic analysis of PAHs.

A groundwater extraction system in the fill and sand plus gravel geological units of the site has been in operation from the mid-1970s through to the present. Where uninfluenced by the extraction system, groundwater in these units discharges to the Anacostia River (Hydro-Terra 1999). As of 2018, there were 82 monitoring wells and piezometers at the site (AECOM 2018). Groundwater sampling was conducted in 2016 and 2017 (AECOM 2018), and also as part of the OU2 investigation. In 2016 and 2017, concentrations of BaP, VOCs, aluminum, arsenic, and cadmium were greater than the MCLs (Table 3). In addition to these contaminants, concentrations of nickel, lead, mercury, and CVOCs were also greater than MCLs in previous sampling events (Tetra Tech 2019a).

Initial sediment sampling conducted by Hydro-Terra in 1999 (n=7) and 2003 (n=39) showed elevated concentrations of VOCs and PAHs in surface sediment. The maximum total PAH concentration was 3,929,000 µg/kg in 2003 (mean concentration 226,794 µg/kg) (Table 3; Hydro-Terra 1999, Hydro-Terra 2005, Tetra Tech 2019a). During recent sampling of the area, DOEE (2020a) noted visual indications of NAPL contamination in river sediment in the area between the site shoreline (bounded by a seawall) and the navigational channel, which is the portion of the mainstem Anacostia River historically dredged to 24 ft (Tetra Tech 2019a). Visual NAPL impacts were observed progressively deeper as distance from the seawall increased. In the area between the seawall and the navigational channel, the PAH signature in the area is consistent with MGP operations (DOEE 2020a). The MGP-associated PAH concentrations occur at progressively greater depths away from the site toward the navigational channel with cleaner sediment overlying the MGP-impacted sediment (DOEE 2020a).

In the Anacostia River, surface sediment sampling conducted between 1989-2016 (DIVER 2021) indicates possible PAH contamination from the site, with several samples collected near the shoreline exceeding the PEC for total PAHs and lower concentrations toward the middle of the channel (Figures 9A and 9B). Total PCB concentrations did not exceed the PEC in any samples collected in the vicinity of the site (Figures 10A and 10B). Isolated subsurface samples collected 5-10 ft below sediment surface (bss) had PCB concentrations that exceeded the PEC (Tetra Tech 2019a). Lead concentrations show a similar pattern as PAHs, with several samples near the shoreline exceeding the PEC (Figures 11A and 11B).

Groundwater transport represents a potential source of trace elements, PAHs, and VOCs to the Anacostia River from the site (AECOM 2018), and exceptionally high PAH concentrations were detected in river sediment adjacent to the site. Additional groundwater data collected as part of the draft OU2 RI may provide more information regarding possible injury to both groundwater and natural resources in the Anacostia River.

2.3.8 Former Steuart Petroleum Company Adjacent to WGL East Station

Steuart Petroleum operated a former bulk oil distribution facility at 1333 M Street SE, adjacent to the WGL East Station (Figure 1; CH2M Hill 2007; NOAA 1992a). The facility was active from approximately 1966 through 1982 and consisted of above-ground storage tanks (ASTs), underground storage tanks (USTs), and truck loading racks (Tetra Tech 2019a). The three USTs (one 2,000-gallon diesel tank, one 5,000-gallon gasoline tank, and one 550-gallon used-oil tank) were installed and in operation on the property from 1966 through 1982 and were removed in 1987 (CH2M Hill 2007; NOAA 1992a). Support Terminal Services (site tenant) used underground and aboveground pipelines to transfer petroleum fuels from a pier on the Anacostia River to the Steuart Petroleum distribution facility and also between the East Station facility oil storage tanks and the distribution facility. Beginning with an agreement signed in August 1948, Steuart Petroleum constructed and operated a 10-inch diameter underground oil pipeline (agreement, dated: August 4, 1948), a 6-inch diameter underground kerosene pipeline (agreement, dated: December 9, 1958), and a 12-inch diameter underground oil pipeline (agreement between Washington Gas and Steuart Pipeline, dated December 29, 1972) along the southern WGL East Station property boundary along Water Street SE. The current owner is 1333 M Street S.E., LLC.

In January 1992, approximately 51,000 gallons of #4 fuel oil spilled from a 3.2 million-gallon AST to the facility's containment area (NOAA 1992a). Approximately 2,000 gallons of product drained into a storm drain that flowed into the Anacostia River. A 1992 environmental investigation of the property included the installation of eight soil borings which were converted to groundwater monitoring wells. Results indicated that the central portion of the property was contaminated with VOCs from a release from a former UST, and the western portion of the property was impacted by a release from an abandoned petroleum pipeline. A leaking UST (LUST) case was opened in April 1993 (CH2M Hill 2007) and quarterly groundwater sampling was conducted from 1993-1996. In 1997, a technical review of the UST site determined that no further investigation or monitoring was warranted. The conclusion was based on the minimal concentrations of petroleum compounds detected in groundwater, decreasing concentrations over time, the industrial use of the area and surrounding properties, and the use of municipally supplied potable water in the District and surrounding counties (CH2M Hill 2007).

In 1998, the District of Columbia Pesticides, Hazardous Waste and UST Management Division issued a conditional case closure pursuant to the District's UST Management Act of 1990 and UST regulations (Tetra Tech 2019a). The case closure letter stated that the UST site did not pose a present threat to human health and the environment. The letter also stipulated that the District would require an approved Work Plan for any future excavation work at the site (CH2M Hill 2007). Most structures related to the former petroleum terminal have been demolished (Tetra Tech 2019a).

A 2017 Environmental Site Characterization report completed by ECS Limited (ECS 2017), on behalf of 1333 M St., SE LLC details the results of soil and groundwater sampling that was completed at Steuart Petroleum Company. Soil samples were collected from a total of 21 borings and groundwater data was collected from the historical existing monitoring wells. Petroleum-impacted soil was generally present from the surface downward in samples collected in the western two thirds of the site; deeper petroleum-impacted zones were noted at depth in three locations. The distribution of these petroleum-impacted soils with respect to the potential sources located onsite indicates that some of the shallow soil material was derived from offsite sources (likely from the Washington Gas site based on the inorganic and cyanide signatures observed) as well as having been impacted by petroleum releases from the former Steuart Petroleum operations. ECS was able to reach the base of the TPH-impacted soil in 19 of the 21 soil borings. Soil with high metals concentrations (lead and mercury) is confined to horizons that are also impacted by TPH. However, very high metals concentrations or cyanide were only noted in 4 of the 44 soil samples and 3 of 21 borings. Numerous VOCs, SVOCs, TPH DRO, and metals were noted in the groundwater samples at concentrations that exceeded EPA Region 3 tap water regional screening levels and DC Surface Water Quality Standards.

Surface sediment samples collected in the Anacostia River near the shoreline running parallel to the site between 1989-2016 (DIVER 2021) did not have concentrations of total PAHs or total PCBs that exceeded the PECs (Figures 9A and 10A), and only one sample had a lead concentration exceeding the PEC (Figure 11A). This sample was collected in the immediate vicinity of a CSS outfall (NPDES 017; Tetra Tech 2019a); it is unknown if the area draining to this outfall includes the site.

2.3.9 Eastern Power Boat Club/District Yacht Club

Washington Gas Light, under the direction of a Consent Order between WGL and the District of Columbia, is completing a remedial investigation regarding potential MGP-associated contamination in soils at the Eastern Power Boat Club (EPBC) (Figure 1). The EPBC is located at 1301 Water St. SE and is bounded to the north by Water Street, to the south by the Anacostia River, to the east by the District Yacht Club, and to the west by the WGL former East Station.

A Contamination & Land Use Study (Phase II) conducted by Hydro-Terra in 1989 found that "[b]reaks in the buried pipelines along former 13th Street (west of current oil tanks) carrying fuel oil from the shoreline piers to Steuart Petroleum and Washington Gas storage tanks" are a source of petroleum contamination on the former East Station property (Hydro-Terra, 1989). Additional information regarding the pipelines can be found in Hydro-Terra (1999).

During field activities, NAPL was observed in soils in the western portion of the EPBC, the western portion of the District Yacht Club, and along the southern portion of both sites (parallel to the sea-wall). Initial sampling results indicate concentrations of PAHs, VOCs, and metals in soils (Table 3). High concentrations of benzene in groundwater were also detected in the western portion of the EPBC (Table 3). Completion of the remedial investigation should result in a more thorough understanding of the nature and extent of contamination associated with this site, as well as relationships between any contamination and adjacent potential environmental cleanup sites, WGL East Station and Former Steuart Petroleum Terminal, and with contaminants in the Anacostia River (Figures 9-11).

2.3.10 Poplar Point

The Poplar Point site is bordered to the north by the Anacostia River. Roadways, ramps and medians for the 11th Street Bridge form the northeast border of the site, roadways and medians for the South Capitol Street Bridge form the northwest edge of the site, and the site is bordered to the south by Howard Road (Figure 1; Tetra Tech 2019a). The Poplar Point site encompasses an area of approximately 96 acres (AMEC 2013). The site includes former plant nurseries that were operated intermittently from 1927 to 1993 by the Architect of the Capitol (~ 13 acres) and the District's Lanham Tree Nursery (~ 20 acres). Approximately 17 acres of the site consists of undeveloped property along the Anacostia River. In addition, a separate portion of the site (~ 46 acres) was used by the Navy as the Naval Receiving Station from 1942 through the 1960s (AMEC 2013). In 1980, the Navy completed the decommissioning of this facility with the demolition or transferal of the remaining buildings to the NPS, on behalf of the United States (Dolph 2001). In 2006, the United States was directed to transfer the property to the District under the DC Lands Act (AMEC 2013).

In general, land uses associated with known or suspected environmental concerns at the Site include: dredge spoils placed on the site from the Anacostia River between 1882 and 1927, with subsequent uncontrolled filling; former DCL and Architect of the Capitol plant nursery operations with associated pesticide/herbicide uses, petroleum underground and aboveground storage tanks (USTs/ASTs), a vehicle garage, and drummed wastes that have been removed; former NRS ordnance laboratories, dry-cleaning facilities, chemical storage buildings, paint application and storage, and petroleum USTs/ASTs; US Park Police (USPP) motorcycle repair, a JP-8 jet fuel AST, chemical storage, and former gasoline USTs; re-worked or imported fill material used to cover the Washington METRO Green Line tunnel excavation; and former petroleum ASTs and petroleum storage/distribution at the adjacent Green Fuel Oil facility. Multiple environmental investigations have been performed in various areas of the Poplar Point Site between 1981 and 2008. These studies were used by the District to develop the scope for an RI. The District is performing a RI/FS pursuant to an Administrative Settlement Agreement and Order on Consent, subject to the regulatory oversight of NPS. Field work for the RI was initiated in 2018 and the Final RI Report is currently scheduled to be completed in March 2022.

AMEC (2013) summarized contaminant concentrations in on-site soil, groundwater, and wetland sediment samples collected at the site through 2008 (Table 3). In surface soil, concentrations of metals, pesticides, PAHs, and total PCBs exceeded ecological screening thresholds at several locations (Table 3; AMEC 2013). Two samples had elevated concentrations of PCB Aroclors 1248 (2,800 µg/kg) and 1260 (3,380 µg/kg) (AMEC 2013). In on-site wetland sediment, concentrations of metals, pesticides, PAHs, and total PCBs (maximum concentration 3,380 µg/kg) exceeded ecological screening levels in several samples

(Table 3; AMEC 2013). Ridolfi (2003) compared the chemical concentrations in groundwater from 1999 and 2003 to EPA and District standards for drinking water, environmental, and industrial uses. Concentrations of seven hazardous metals, VOCs, naphthalene, TPH-DRO, and TPH-GRO exceeded at least one screening level (Table 3).

Anacostia River surface sediment samples were collected in the vicinity of the Poplar Point site between 1989 and 2016 (DIVER 2021) and subsurface sampling was performed by Velinsky et al. (2011) and summarized in Tetra Tech (2019a). Concentrations of total PAHs in surface sediment samples exceeded the PEC in a cluster of samples along the shoreline in the center of the site, near an MS4 outfall (F417-217/Stickfoot Creek; Tetra Tech 2019a) (Figure 9A, Figure 14). Stickfoot Creek receives flow from multiple MS4s distant from Poplar Point, is completely enclosed in a pipe tunneling underneath the site, and has no hydrological connection to the site (AMEC 2013). In surface sediment, concentrations of total PCBs only exceeded the PEC in one location (Figure 10A). Generally, concentrations of PCBs and PAHs in surface sediment are lower than concentrations in subsurface sediment, with the highest concentrations of both contaminants between 3-14 ft bss (Tetra Tech 2019a). Lead concentrations in surface sediment exceeded the PEC at several sampling locations along the length of the site (Figure 11A) and elevated concentrations of lead in subsurface samples generally corresponded with locations of elevated concentrations in surface sediment (Tetra Tech 2019a).

Potential current sources of metals (including lead), VOCs, and naphthalene to the river are indicated by the elevated concentrations of these contaminants in groundwater (AMEC 2013).

2.3.11 Washington Navy Yard

The Washington Navy Yard (WNY) is located on M Street SE, near the 11th Street Bridge in southeast Washington, DC (Figure 1) and owned by the United States. The WNY waterfront has historically consisted of piers, quay walls, slips, and dry dock facilities. WNY commenced operations in 1799 as a shipyard (CH2M Hill 2011a). Throughout its history, operations at WNY have included shipbuilding, ordnance research and production, naval gun manufacturing, and administrative activities (CH2M Hill 2011a). At its largest, the WNY site occupied 129 acres; it was reduced to 63 acres after World War II as the facility's mission transitioned from performing manufacturing operations to providing administrative services (Tetra Tech 2019a). The western 63-acre portion of the WNY site was transferred in 1963 to the General Services Administration (GSA) for redevelopment as the Southeast Federal Center (SEFC) office park.

A "Notification of Hazardous Waste Activity" was submitted to EPA by WNY in 1985. In 1998, the WNY was placed on the EPA National Priorities List because contamination was detected in the adjacent Anacostia River as well as in on-site soil and groundwater (Tetra Tech 2019a). Cleanup activities at the WNY have included: (1) the clean out and renovation of industrial and storm sewers between 1999 and 2000 to address elevated levels of metals, PAHs, and PCBs in the residual sediment in the sewer lines; (2) excavation of PCB-contaminated soil at various times; (3) removal of PCB-contaminated material from the former power plant and coal storage area between 2000 and 2008; and (4) removal of lead-contaminated soil, from the use of lead-based paint, between 2000 and 2008 (CH2M Hill 2014).

A RI for the near-shore area (designated as OU2) was conducted in accordance with the Federal Facilities Agreement (FFA) and results are documented in the Final OU2 RI Report (CH2M Hill 2014). In March 2020, the Navy completed a draft Feasibility Study addressing sediment contamination in the near-shore areas, which is currently under review. The Navy anticipates issuing the FS Report for OU2 in 2021 and completing remedy selection in 2022. OU2 includes the entire 2,400-foot site waterfront (for the WNY portion of the site) and extends into and down the river.

As documented in the OU2 RI Report, sampling activities (2006 and 2009) included surface sediment samples (n=59), sediment cores (n=34), fish tissue analysis, sediment toxicity tests, benthic community characterization, and a sediment stability study (CH2M Hill 2014). The maximum total PAH concentrations (up to 77,690 µg/kg) and total PCB Aroclor concentrations (up to 830 µg/kg) in surface sediment exceeded PECs (CH2M Hill 2014). The highest concentrations of these contaminants were consistently found at the border of WNY and SEFC, near former Pier 5, CSS Outfall NPDES 014, MS4 outfall F-683-324, and the former WNY Outfall 9 (Tetra Tech 2019a).

The OU2 RI Report (CH2M Hill 2014) concluded that additional data were needed to delineate the extent of impacts to surface and subsurface sediment. Thus, surface and subsurface sediment samples were collected in March 2016 and March 2018 (DIVER 2021). Maximum surface sediment total PAH and total PCB congener concentrations were 47,640 µg/kg and 7,368 µg/kg, respectively, exceeding the PECs (DIVER 2021, Tetra Tech 2019a). Similar to results of the sampling conducted in 2006 and 2009, maximum concentrations of PCBs and PAHs were detected in samples at the western edge of the WNY (Tetra Tech 2019a; Figures 9A, 9C, 10A, and 10C). Lead concentrations in surface sediment are also elevated in this area; concentrations in several sampling locations were more than twice the PEC (Figures 11A and 11C).

Groundwater flows across the WNY from northeast to south-southwest toward the Anacostia River. Analysis of data from 131 monitoring wells and follow-up sampling events have identified focal areas of groundwater contamination (CH2M Hill 2014, CH2M Hill 2017, Tetra Tech 2019a). At “Site 24”, a 2.5-acre area located in the northwest quadrant of the WNY, the boundaries of a groundwater plume were established in 2016 (CH2M Hill 2017). The plume is characterized by low levels of several metals and CVOCs, with only vinyl chloride exceeding the MCL (Tetra Tech 2019a). At Building 71, seven monitoring wells were sampled in 2015, and only benzene exceeded the MCL (CH2M Hill 2016). At “Site 21”, the Former Ship Building Repair Deparment, findings of the RI identified soil contaminated with metals and PAHs and groundwater contaminated with CVOCs. The RI determined that a past continuing source of VOCs to the deeper groundwater had not been investigated. In response to the 2019 RI (Tetra Tech 2019a), additional groundwater sampling was conducted to identify past or continuing sources in several specific areas. Results suggested that additional shallow groundwater investigation around Building 184 is warranted (DOEE, personal communication). Building 184 was used for paint and oil storage and may be a potential source of CVOCs. The Navy has prepared a Uniform Federal Policy-Sampling Analysis Plan (UFP-SAP) to further evaluate this potential source area. This document is currently under review by EPA and DOEE.

Elevated concentrations of PCBs, PAHs, and lead in surface sediment in the vicinity of the WNY indicate potential current sources of these contaminants at this site, though the elevated concentrations may also be attributable to other sources. Groundwater is also a potential source of VOCs and CVOCs to the Anacostia River (Table 3).

2.3.12 Southeast Federal Center

SEFC was part of the Navy Yard that included the manufacturing of ordnance and medium and large caliber guns. Manufacturing and production of ordnance at the site ceased in 1962. The site was then transferred to the GSA in 1963. The site is owned by the United States. The site has housed a variety of government activities and clients, including administrative offices, warehouses and storage space, laboratories, and light industrial operations. The Department of the Navy and GSA entered into a Consent Decree, dated April 24, 1998 (consolidated cases 1:96CV01450HHG & 1:96CV011700HHG). GSA is managing all cleanup efforts within the SEFC boundary.

Under the terms of the Consent Decree, the GSA agreed to sample and analyze near shore river sediment along the SEFC waterfront, which was conducted in August 1999 (Tetra Tech 2019a). PCB Aroclors were detected in 8 of the 11 surface sediment samples. Aroclor 1254 and 1260 were the only mixtures detected. Their concentrations ranged from 100 to 360 µg/kg for 1254 and from 98 to 510 µg/kg for 1260. Three locations were sampled for PCB congeners. Total PCB concentrations ranged from 1,018 to 2,894 µg/kg. One or more PAHs from each sample exceeded EPA Region 3 BTAG screening levels, and the group of detected PAH compounds is consistent across all samples. High molecular weight polycyclic aromatic hydrocarbons (HPAH) concentrations ranged from approximately 592 to 17,890 µg/kg, while low molecular weight polycyclic aromatic hydrocarbons (LPAH) concentrations ranged from 267 to 13,190 µg/kg.

As described above, surface and subsurface sediment samples were collected in March 2016 and March 2018 (DIVER 2021). Surface sediment concentrations of PCBs, PAHs, and lead exceeding respective PECs were measured in samples along the SEFC shoreline (Tetra Tech 2019a; Figures 9A, 9C, 10A, 10C, 11A, and 11C). These results correspond with elevated concentrations of PCB congeners and PAHs in near shore river sediment along the SEFC waterfront in 1999 (Tetra Tech 2019a), possibly indicative of persistent sources of these contaminants to surface sediment.

2.3.13 Joint Base Anacostia-Bolling (JBAB)

The 905-acre Joint Base Anacostia-Bolling (JBAB), located between the Potomac and Anacostia rivers and Interstate 295 (Figure 1), comprises the former U.S. Naval Air Station Anacostia, the former Bolling Air Force Base, and the Bellevue Housing Area (Tetra Tech 2019a). The entire area is owned by the United States. Beginning in 1917, Bolling Air Force Base served as a military airfield and was designated as the first headquarters of the United States Air Force in 1941 (Tetra Tech 2019a). The U.S. Naval Air Station Anacostia was initially established as a testing facility in 1918 and developed over time into a naval air station. Its main mission was to serve as a testing ground for new equipment and provide air defense for the nation's capital. In 1962, fixed wing operations at Bolling Air Force Base and U.S. Naval Air Station Anacostia ceased. Beginning in 1962, U.S. Naval Air Station Anacostia was repurposed primarily as a site for training and for administrative activities. It was decommissioned and renamed the U.S. Naval Support Facility Anacostia in 1996 and is now primarily used by the Navy for administration.

Four areas of environmental concern have been identified at JBAB: Area of Concern (AOC) 1 (former incinerator and solid waste disposal area), Site 2 (two landfill areas), Site 3 Athletic Fields (petroleum discharge), and Site 1 (Building 168 crawlspace) (Tetra Tech 2019a). In 2011, CH2M Hill performed a site investigation of AOC 1 (soil and six groundwater samples) and concluded that dioxins/furans in groundwater may pose potential risks to aquatic organisms in the Anacostia River adjacent to AOC 1 (Table 3; Tetra Tech 2019a). However, the status for AOC 1 is No Further Response Action Planned (NFRAP). The NFRAP Decision Document was developed by the Department of the Navy (Navy), as lead agency, with input solicited from EPA Region 3 (CH2M Hill 2011b). In 2011, CH2M Hill performed a RI at Site 2 including collection of groundwater, surface soil, and subsurface soil samples. Barium was the only hazardous substance identified as posing a potential risk to water column receptors in the Anacostia River (Table 3). CH2M Hill (2011c) concluded that any associated ecological risks were little to none and recommended NFRAP status for Site 2 to the Navy. During a preliminary assessment of the Site 3 Athletic Fields in 1991, petroleum was visible in surface depressions and a petroleum-type odor was noted (Tetra Tech 2019a). In 1992, concentrations of bis[2-ethylhexyl]phthalate, naphthalene, copper, barium, and chromium in groundwater exceeded EPA Region 3 tap water regional screening levels (Table 3). CH2M Hill (2012) concluded that measured soil gas, surface soil, subsurface soil, and groundwater samples were not likely to pose risks to human health and ecological receptors and prepared a No Action Decision Closure Document for the Navy in 2012. Building 168 (Site 1) was investigated in 2010. It was constructed in the 1940s and utilized as a photographic laboratory. Areas within the building where hazardous substances were stored included darkrooms, copying rooms, color labs, and associated storage rooms. Concentrations of arsenic and thallium exceeded drinking water MCLs in samples collected from shallow groundwater wells (Table 3). CH2M Hill (2012) stated contamination specifically related to the crawlspace of Building 168 appears to be primarily inorganic and is likely from localized leakage and is not the result of a wide-spread or large-scale release within Building 168.

Shallow groundwater flows from JBAB toward the Anacostia River. Various contractors installed 46 monitoring wells between 1992 and 2014 to investigate potential sources of contamination at several locations throughout the site (Tetra Tech 2019a). In 1992, groundwater concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX); zinc; and cyanide exceeded MCLs (Table 3). More recently, CH2M Hill (2011a) reported detections of a range of VOCs, PAHs, hexavalent chromium, and dioxins in groundwater samples from an area associated with a former landfill (Table 3). In addition, during the investigation of a waterfront area, CH2M Hill (2011c) identified several trace elements as chemicals of potential concern (Table 3).

In all surface sediment samples collected from the Anacostia River in the vicinity of JBAB between 1989-2016 (DIVER 2021), concentrations of total PCBs, total PAHs, and lead were relatively low and did not exceed PECs (Figures 9A, 10A, and 11A).

2.3.14 Former Hess Oil Corporation Petroleum Terminal

Hess Corporation (Hess) operated a former bulk oil facility located at 1620 South Capitol Street SE and adjacent to the South Capitol Street Bridge and Anacostia River (Figure 1). The facility was active from approximately 1920 through 1985 and included multiple large capacity ASTs with associated aboveground and sub-grade piping and several USTs (CH2M Hill 2007; NOAA 1992b, 1992c).

Several environmental investigations were performed at the property and the most recent known investigation occurred in 2004 (Tetra Tech 2019a). The investigations indicated soil and groundwater concentrations were above reportable conditions for metals, TPH, PAHs and VOCs (e.g. BTEX) (Table 3; Tetra Tech 2019a). Remediation was recommended for soil and groundwater at the facility. As of 2005, the tanks had been removed and only limited remediation had occurred at this site (MACTEC 2005, Tetra Tech 2019a). The District is the current owner of the site.

Concentrations of PCBs and lead in surface sediment samples collected from the Anacostia River adjacent to the site between 1989-2016 (DIVER 2021) exceeded respective PECs for these contaminants (Figures 10A and 11A), but concentrations of PAHs were below the PEC (Figure 9A).

2.3.15 Former Steuart Petroleum Company/Gulf Oil Company Petroleum Terminal

Gulf Oil Company (Gulf) formerly operated a bulk gasoline and fuel oil terminal at the addresses of 1721 and 1724 South Capitol Street SE on property located adjacent to the Hess facility (Figure 1). The facility was active from approximately 1930 through 1969 (Tetra Tech 2019a). Steuart Petroleum Company (and later as Steuart Investment Company; Steuart) purchased the facility from Gulf in 1969 and operated it until approximately 1989 after which Steuart ceased operations. When in service, Steuart used the property as a terminal for kerosene and fuel oils and reportedly operated a 1.2-million-gallon AST, a 20,000-gallon AST, and fourteen 4,000-gallon USTs. In addition, Pepco operated a bulk gasoline and fuel oil storage facility adjacent to the site (opposite side of Half Street north of S Street; Figure 1) for use in a former electric power generating station.

Steuart Investment Company and Pepco jointly conducted investigations on the Steuart and Pepco properties (MACTEC 2005, Tetra Tech 2019a). NAPL was observed on both sites and NAPL recovery efforts were implemented. Soil was also excavated from the properties based on BTEX, TPH, and PAH contamination. LUST case documents indicated that the combined sites' pump and treat groundwater remediation recovered 2,171 gallons of NAPL as of April 2005 (MACTEC 2005).

The riverfront area of the Steuart/Gulf site is adjacent to the Hess facility described above. Thus, the location of surface sediment with concentrations of PCBs and lead exceeding the PECs described previously in association with the Hess facility are also in close proximity to the Steuart/Gulf site (Figures 10A and 11A).

Washington Channel:

2.3.16 Fort McNair

Fort McNair is a 108-acre Army facility adjacent to the mouth of the tidal Anacostia River. Fort McNair is part of the Joint Base Myer-Henderson Hall command. The facility occupies the western portion of Buzzard Point, the peninsula separating the Anacostia River from the Washington Channel. Initially established in 1794 as an arsenal for defending the Capitol, the facility has since included a federal penitentiary, a general hospital, and an Army education and training facility (Tetra Tech 2019a). Nine potentially contaminated areas of the site were identified between 1984 and 1997 (U.S. Army 2016). The U.S. Army lists six of these areas as having completed studies with no cleanup required and one area, which included numerous ASTs, as having all required cleanup(s) completed.

The portion of Fort McNair currently delineated as a potential environmental cleanup site (Figure 1; Tetra Tech 2019a) includes the two remaining areas with documented contamination from USTs— the Old Tempo Boiler/Physical Fitness Center (PFC) site and the Army and Air Force Exchange Service Station Remediation site (U.S. Army 2016). The PFC site had two 20,000-gallon USTs that were removed in 1987 (U.S. Army 2016). Soils in the vicinity of the USTs were contaminated with lead, arsenic, and TPH. TPH was also detected in groundwater. Contaminated soil was removed during construction activities at the PFC site, and after completion of quarterly sampling in 2012, DOEE listed the site as closed. However, because not all site contamination was removed, the Army is required to conduct annual inspections at the site to document that land use is unchanged (U.S. Army 2016). The Service Station site had seven USTs that were removed in 1991 (U.S. Army 2016). Upon removal, free product (gasoline) was observed in the base of the pits. A groundwater extraction and remediation system operated at the site from 1994 to 1997. The most recent groundwater sampling was conducted in 2011, and only naphthalene exceeded DOEE screening criteria. The site was closed in 2012, but because not all site contamination was removed, the Army is required to conduct annual inspections at the site to document that land use is unchanged (U.S. Army 2016).

Surface sediment sampling in the Washington Channel in the vicinity of Fort McNair conducted between 1989-2016 (DIVER 2021) indicated one area with concentrations of PCBs, PAHs, and lead that exceeded respective PECs for these contaminants (Figure 12A-12C). Although this general location is in close proximity to the site, the contaminants may be associated with a group of three MS4 outfalls (Figures 12A-12C); it is unknown if a hydrological connection with the site exists.

2.3.17 Bureau of Engraving and Printing

The Bureau of Engraving and Printing (BEP) has been involved in printing U.S. currency and postage stamps since the 1880s and currently produces U.S. paper currency and other security documents. The BEP facility is located at the southeast end of the Tidal Basin, where it meets the Washington Channel, and east of Maine Avenue. BEP's current facility was constructed in 1914 and occupies three buildings – the Main Building, the Annex Building, and a Freight Building located at 14th and C Streets, SW, Washington, D.C. The Main Building was completed in 1914, and the Annex Building was completed in 1938. BEP has been in continuous operation since completion of these buildings. The buildings are connected by a tunnel that runs under 14th Street. All direct currency printing operations are currently located in the Main Building. Additional processes in the Main Building include electroplating, machining, currency inspection, trimming, packaging, storage and shipment, press roller reconditioning, research and development, test printing, equipment service, wiping solution manufacturing, and the pretreatment plants for wastewater from water wipe intaglio presses and electroplating operations. The Annex Building currently houses ink manufacturing, equipment service, carpentry, painting, plumbing, machine, sheet metal, electric shops, quality assurance/quality control, inspection and testing laboratories, offices, storage vaults, paper shredding, and a shipping and receiving loading dock. The Freight Building houses flammable and non-flammable storage rooms, the hazardous waste storage room, and emergency generators.

Hazardous materials and petroleum substances have been used at BEP since the beginning of its operations. Prior to 1938, when the Blue Plains Wastewater Treatment Plan was constructed, it is believed that BEP discharged wastewater directly into the Tidal Basin and the Washington Channel. A review of public records shows that BEP used PCBs in its inks prior to 1980 and possessed PCB-containing equipment until at least 1988. BEP formerly had 12 PCB-containing transformers at the property. Nine PCB-containing transformers were located in the Annex Building. All nine were removed and disposed of in 1981. Three additional PCB-containing transformers were housed in the Main Building. These were removed and disposed of in 1988 (Table 3). BEP also had 42 large PCB-containing capacitors at the property. The PCB-containing capacitors were removed in 1988 (Table 3). BEP presently has PCB-containing electronic ballasts associated with older fluorescent lights, which are disposed of offsite.

Currently, all storm water from the facility discharges to the municipal storm sewer system and then either to the Tidal Basin or the Washington Channel. There are no storm water management systems other than overland flow from paved areas to storm drains.

Surface sediment samples collected from the head of the Washington Channel (closest to the Tidal Basin) between 1989-2016 had concentrations of PCBs and lead that exceeded respective PECs (DIVER 2021; Figure 12). These samples were collected in the vicinity of two MS4 outfalls (Figure 12), one of which has an apparent hydrological connection to storm water from BEP (Figure 13). Groundwater and soil data are not available at this site.

2.4 Potentially Responsible Parties (PRPs)

There are several PRPs associated with the presence of hazardous substances in the Anacostia River. This list is preliminary and is not considered to be complete or finalized. Some of the identified PRPs include: the Potomac Electric Power Company (Pepco); CSX Transportation, Washington Gas Light Company, the United States, and the District of Columbia (Washington, DC).

2.5 Damages Excluded from Liability Under CERCLA

The CERCLA NRDAR regulations at 43 C.F.R. § 11.24 provide that the Trustees must determine whether the damages being considered are barred by specific defenses or exclusions from liability under CERCLA. These determinations are whether:

1. damages resulting from the discharge or release were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable environmental analysis, that the decision to grant the permit or license authorizes such commitment of natural resources, and that the facility or project was otherwise operating within the terms of its permit or license, so long as, in the case of damages to an Indian tribe occurring pursuant to a Federal permit or license, the issuance of that permit or license was not inconsistent with the fiduciary duty of the United States with respect to such Indian tribe; or

2. the release of a hazardous substance from which the damages have resulted have not occurred wholly before the enactment of CERCLA; or

3. resulted from the application of a pesticide product registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 7 U.S.C. §§ 135-135k; or

4. damages resulted from any other federally permitted release, as defined in section 101 (10) of CERCLA; or

5. damages resulted from the release or threatened release of recycled oil from a service station dealer described in section 107(a)(3) or (4) of CERCLA if such recycled oil is not mixed with any other hazardous substance and is stored, treated, transported or otherwise managed in compliance with regulations or standards promulgated pursuant to section 3014 of the Solid Waste Disposal Act and other applicable authorities.

The Trustees must also determine whether the discharge meets one or more of the exclusions provided in sections 311(a)(2) or (b)(3) of the CWA.

In the Anacostia River, substantial releases have occurred that have the potential to cause or continue to cause injury to natural resources that are not excluded from liability under CERCLA.

Historical releases occurred at the site prior to any permitting under environmental laws, and these contaminants continue to be present and potentially causing injuries. There are also potential continuing non-permitted releases that may result in injury to natural resources and natural resource damages. The Trustees know of no environmental impact statement or similar environmental analysis that has identified an irretrievable or irreversible commitment of natural resources. Aside from discharges permitted under the National Pollution Discharge Elimination System (NPDES) and injuries associated with legal application of chlordane as a termiticide, the Trustees do not believe that any exclusions from damages, as described above, are applicable to this Site. Therefore, the continuation of an assessment of injuries to natural resources is not precluded.

3.0 PRELIMINARY IDENTIFICATION OF RESOURCES POTENTIALLY AT RISK

3.1 Potentially Affected Resources

Natural resources affected or potentially affected under the trusteeship of some or all of the Trustees include, but are not limited to the following:

- freshwater/estuarine fishes, including migratory species (for a full list refer to Appendix A, Table A.1),
- freshwater/estuarine invertebrates including freshwater mussels, clams, snails, crayfish, and aquatic insects (Appendix A, Table A.1),
- migratory and non-migratory birds (Appendix A, Tables A.2 and A.3),
- aquatic/piscivorous mammals, including the river otter (*Lontra canadensis*) (Appendix A, Table A.4),
- bats, including the federally listed threatened Northern Long-eared Bat (*Myotis septentrionalis*) (Appendix A, Table A.4),
- amphibians and reptiles (Appendix A, Table A.4),
- lands and plant communities, including tidal marshes, non-tidal wetlands, forested tidal and non-tidal wetlands, shoreline, mud flats, riparian forests, and upland forests and meadows,
- emergent and submerged aquatic vegetation,
- surface water and sediment, and
- groundwater.

Services provided by these natural resources include the full range of ecological services and human use services. These include, but are not limited to, the following:

- habitat for Trustee species that provides services such as food, shelter, breeding areas, nesting habitat, and other factors essential to survival, and
- human uses such as recreation, birding, fishing, boating, wading, and swimming.

3.2 Potential Pathways of Exposure Associated with Potential Environmental Cleanup Sites

Pathway identification is an essential component of the determination of injury to natural resources. Pursuant to 43 C.F.R. § 11.14(dd), a pathway is defined as:

> *The route or medium through which…a hazardous substance is or was transported from the source of the discharge or release to the injured resource.*

There are several potential pathways for exposure and subsequent injury to natural resources from hazardous substances that enter the Anacostia River from potential environmental cleanup sites (in-river) and also hazardous substances located within on-site land-based habitats (on-site) (Figure 15). Contaminated soil is a primary pathway of exposure to on-site and in-river resources. Contaminated soil carried in runoff can enter unsecured drains on-site, erode directly into the river, or enter surface tributaries flowing through a potential environmental cleanup site. Contaminants can also leach from soil into groundwater. Contaminants that were released during the operational period of the facility may be stored in sediment deposits within storm drains and outfalls, and these reservoirs can be contemporary sources of contaminants long after operations cease. Direct placement of hazardous material into aquatic habitat, erosion, runoff/surface water transport, groundwater, and site outfalls are potential sources of particulate-associated and dissolved (aqueous) contaminants to the Anacostia River (Figure 15).

Once in the river, particulate-associated and hydrophobic contaminants may sorb to sediment in the vicinity of the potential environmental cleanup site. Sediment-associated contamination in the vicinity of a potential environmental cleanup site may include a mixture of historic and contemporary releases from the potential environmental cleanup site as well as other sources. These sediment-associated contaminants may cause toxicity to sediment-dwelling invertebrates through pore-water exposure and exposure at the sediment-water interface (Figure 15). Potential risks of adverse biological effects from sediment-associated contaminants are most directly related to concentrations of freely dissolved chemicals in sediment pore water, not necessarily to total contaminant concentrations (Mayer et al. 2014). Bioaccumulation in benthic organisms can occur through direct ingestion of contaminated sediment as well as sorption through the integument from contaminated water, including pore water and overlying water at the sediment-water interface. For example, Ghosh et al. (2020) estimated that sediment with total PCB concentrations above 190 µg/kg may serve as sources of PCBs to the overlying water, contributing to bioaccumulation in organisms at the sediment-water interface. Effects on benthic invertebrates can lead to effects on higher trophic levels, including bioaccumulation and depletion of food resources. River-associated resources that may be affected include fishes, birds, reptiles, and piscivorous mammals. In turn, services that these resources provide (e.g. recreational and subsistence fishing) will also be affected.

Particulate-associated and hydrophobic contaminants can also be transported to other areas of the river through tidal action and resuspension (Figure 15). Once deposited in other areas of the river, including shallow-water habitats such as tidal wetlands, toxicity to invertebrates, bioaccumulation, and effects on higher trophic levels, can occur through the same pathways as described previously. In addition, the services that these shallow-water areas provide to wildlife (e.g. habitat) and humans (e.g. recreation) will also be affected.

Dissolved contaminants that enter the Anacostia River from the potential environmental cleanup site through runoff/surface water transport, groundwater, or outfalls can potentially cause direct toxicity to natural resources, including invertebrates and fishes (Figure 15). Once in the river, these contaminants may be transported to areas away from the potential environmental cleanup site due to flow and tidal action. These contaminants may sorb to particles, and can cause toxicity, bioaccumulation, and effects on higher trophic levels as previously described.

In addition to effects to receptors that can occur from transport of contaminants to the Anacostia River, contaminants within on-site habitats may result in exposure of on-site natural resources and negative effects on the services that these habitats provide (Figure 15). On-site soil can result in exposure and potential toxicity to plants and invertebrates and potential bioaccumulation of contaminants in higher trophic levels, including reptiles, amphibians, birds, and mammals. Dissolved contaminants in on-site wetlands and streams may cause direct toxicity to aquatic organisms (invertebrates, amphibians, and fishes) and all of these resources may be negatively affected by bioaccumulation of hydrophobic and particulate-associated contaminants that enter the food web.

3.3 Other Potential Sources of Hazardous Substances to the Anacostia River

3.3.1 Combined Sewer System (CSS) Outfalls

CSS outfalls owned and operated by the District of Columbia Water and Sewer Authority (DC Water) historically discharged substantial volumes of surface water and sediment to the tidal Anacostia River. To avert flooding during a storm when the combined wastewater and storm water flows exceed the wastewater system capacity, CSS outfalls divert a mixture of raw sewage and storm water directly to the receiving surface water body. Most of these outfalls are located in the lower Anacostia River in Reach 123 (Tetra Tech 2019a). DC Water indicates that 15 CSS outfalls currently discharge to the Anacostia River and sandy deltas can be observed at many of these (Tetra Tech 2019a). Each CSS outfall is permitted by EPA through the National Pollutant Discharge Elimination System (NPDES) permit program. DC Water initiated construction of the Anacostia River Tunnel (ART) in 2011 to reduce CSS outfall discharges. The first of two tunnels came on-line in March 2018. DC Water estimates that 98 percent of CSS discharges to the Anacostia River will be diverted by the ART to the Blue Plains Advanced Wastewater Treatment Plant by 2023. The O-Street CSS outfall complex is associated with a cluster of surface sediment samples with concentrations of PCBs, PAHs, and lead exceeding respective PECs for these contaminants (Figures 9B, 10B, 11B, and 14).

3.3.2 Municipal Separate Storm Sewer System (MS4) Outfalls

MS4 outfalls discharge storm water runoff without contributions from the sanitary sewer system. Figure 14 shows MS4 outfalls listed in the DC Water database as outfalls to the tidal Anacostia River (Tetra Tech 2019a). Also shown are MS4 outfalls in Prince George's County, MD (labeled as "PG-TMP-#") identified from available data by Tetra Tech (2019a). The MS4 outfalls are most numerous in Reach 123 and in the Washington Channel. Several outfalls originate as surface streams, including Stickfoot Creek, Fort Davis Creek, Texas Avenue Tributary, Fort Dupont Creek, and Fort Chaplin Creek. Not all MS4 outfalls that discharge to the Anacostia River are represented by the figure; particularly the numerous outfalls that discharge to tributaries of the Anacostia River.

Sampling of sediment within 20 MS4 outfalls indicated elevated concentrations of contaminants in the outfall prior to discharge into the Anacostia River (Tetra Tech 2019b) and several MS4 outfall locations coincide with areas of elevated contaminant concentrations in the river between 1989-2016 (DIVER 2021). These locations may warrant further evaluation of potential releases of hazardous substances within the MS4 drainage areas. In Washington Channel, sediment from three outfalls near Fort McNair (F-073-094, F-561-14 and F-018-809) had elevated concentrations of PCBs, PAHs, lead, and pesticides (Figure 14; Tetra Tech 2019b) and these outfalls are adjacent to locations of surface sediment samples with concentrations of these contaminants that exceeded their respective PECs (Figures 12A-12C). Three additional outfalls discharging to the head of Washington Channel (F-290-057, F-447-703, and F-882-366) are adjacent to locations of surface sediment samples with exceptionally high concentrations (>2x PEC) of PCBs and lead (Figures 12A and 12C) and one of the highest concentrations of dioxin TEQ within the entire Anacostia River (Tetra Tech 2019a). In Reach 123, elevated concentrations of PCBs were detected in sediment from one outfall near WNY (F-683-324) and one outfall on the south side of the river near Poplar Point (F-837-845) (Figure 14; Tetra Tech 2019b), and these outfalls are in close proximity to locations with surface sediment concentrations of PCBs that exceeded the PEC (Figure 10C).

3.3.3 Tributaries

There are 14 tributary streams to the tidal Anacostia River within the study area (Figures 1 and 14). Five are considered major tributaries based on the percentage of total flow contributed to the tidal river. These are: Northwest Branch, Northeast Branch, Lower Beaverdam Creek, Watts Branch, and Hickey Run. Based on 2017 data, USGS ranked these tributaries in the loading of suspended sediments (kg/year) into the tidal Anacostia River as follows: Northwest Branch (50%), Northeast Branch (33%), Lower Beaverdam Creek (14%), Watts Branch (2%), and Hickey Run (1%) (Wilson 2019). Loadings of PAHs and chlordane (grams/year) were calculated for each tributary (Wilson 2019) and their relative contributions to total contaminant loads were similar to relative contributions of suspended sediments.

Wilson (2019) reported that despite the lower flow, Lower Beaverdam Creek contributed 75 percent of tributary total PCB loading (in grams/year). This high contribution reflects the average concentrations of total PCBs in suspended sediments: Lower Beaverdam Creek (130 µg/kg), Hickey Run (69 µg/kg), Watts Branch (34 µg/kg), Northwest Branch (6.6 µg/kg) and Northeast Branch (5.9 µg/kg).

Similarly, Ghosh et al. (2020) estimated that Lower Beaverdam Creek concentrations (and loadings) of freely dissolved PCBs in deployed passive samplers (in 2016 and 2017) were far higher than that from the four other major tributaries. Ghosh et al. (2020) also documented far higher total PCB concentrations in freshwater mussels (Common Elliptio: *Elliptio complanata*) deployed in 2016 and 2017 in Lower Beaverdam Creek compared with the other four major tributaries. Concentrations of total PCBs were two to nine times higher in mussels from Lower Beaverdam Creek locations compared with the Northwest and Northeast Branch locations.

Collections of Mummichog (MC: *Fundulus heteroclitus*) and Banded Killifish (BK: *F. diaphanus*) in 2018 from Lower Beaverdam Creek had median total PCB concentrations of 719 to 1055 µg/kg (Pinkney and Perry 2020; see Section 3.3). These concentrations were far higher than those in the other four tributaries: Watts Branch (MC: 272, BK: 273 µg/kg), Hickey Run (MC: 132 µg/kg), Northwest Branch (BK: 54.6 µg/kg), and Northeast Branch (MC: 48.4, BK: 74.6 µg/kg). There was considerably less variability in total chlordane concentrations which ranged from 51-138 µg/kg (Lower Beaverdam Creek) to 156 µg/kg (Northwest Branch).

Results of the Ghosh et al. (2020) and Pinkney and Perry (2020) studies along with the MDE (MDE 2020a) and NPS (The Johnson Company 2019) sediment studies are indicative of the presence of current sources of PCBs in Lower Beaverdam Creek. MDE is continuing to investigate potential contaminant sources (Lis Green, MDE, personal communication). The ongoing investigations may lead to the identification of additional potential environmental cleanup sites and PRPs.

3.4 Exposure of Potentially Injured Natural Resources

As detailed in previous sections, extensive sampling of surface water and sediment has occurred in the Anacostia River. Concentrations of several contaminants exceeded ecological criteria, including consensus-based PECs (sediment) and water quality criteria for aquatic life use (surface water), in multiple locations throughout the river. As indicated in the descriptions of the potential environmental cleanup sites, several contaminants in groundwater exceed drinking water MCLs. Thus, injury to surface water, sediment, and groundwater has been documented.

Several studies of biota in the Anacostia River have also been conducted. Results of these studies, separated by taxonomic group, are detailed below. These include collection and analysis of contaminant concentrations in field-collected biota and laboratory toxicity tests. For lists of taxa documented in the Anacostia River, see Appendix A. The lists include those designated as species of greatest conservation need in the District of Columbia Wildlife Action Plan (DOEE 2015).

3.4.1 Invertebrates

Field-collected invertebrates

As part of the BERA, invertebrate tissue samples were targeted for use in the food chain modeling. In 2014, only a single sample was obtained—Asiatic clam, *Corbicula fluminea*, collected from location R3-12, near the Sousa Bridge in Reach 123. In 2016, a larger effort resulted in collection of red swamp and spinycheek crayfish (*Procambarus clarkii*, *Orconectes limosus*), the Chinese mystery snail (*Bellamya japonica*) and more Asiatic clams. For both years, composite samples consisted of Asiatic clams (n=10), snails (n=11), and crayfish (n=8, separated by species) (Tetra Tech 2019a BERA Att. I.6).

Total PCB Aroclor concentrations in clam tissues tended to be higher than in crayfish and snails, with a maximum concentration of 840 µg/kg found in Reach 123 in the single 2014 sample. PCB Aroclor concentrations in clams ranged from 240 to 840 µg/kg overall, with a median concentration of 500 µg/kg. In snails, the maximum concentration (120 µg/kg) was found in Reach 123. In crayfish, total PCB Aroclors were highest in Kingman Lake at 74 µg/kg.

Dioxins were detected in all invertebrate tissue samples and reported as TEQ as well as individual congeners. For clams and snails, dioxin TEQ ranges were 0.263 to 0.752 ng/kg and 0.217 to 1.221 ng/kg, respectively. Concentrations were highest in Reach 456 for both taxa. In crayfish, dioxin TEQ ranged from 0.0572 to 0.828 ng/kg, with the highest concentrations detected in Reaches 67 and 7.

Chlordane was detected in all clam samples (maximum concentration of 390 µg/kg) and seven snail samples (maximum concentration of 22 µg/kg). Maximum concentrations for both clams and snails were detected in Reach 123. Chlordane was not detected in crayfish.

Mercury was detected in five clam samples (0.045 to 0.097 mg/kg) and five snail samples (0.041 to 0.077 mg/kg). Maximum concentrations were detected in Reach 123 for clams and in Reach 7 for snails. Mercury was not detected in crayfish. Lead was detected in all clam samples (0.26 to 6.1 mg/kg) and all snail samples (0.99 to 4.8 mg/kg). Maximum concentrations were detected in Reach 123 for clams and Reach 456 for snails. Lead was detected in all crayfish samples (0.32 to 5.1 mg/kg), with the maximum concentration in Reach 67 and Reach 7.

Sediment toxicity tests

Laboratory toxicity tests were performed as part of the BERA (Tetra Tech 2019a, including Appendix D and Appendix I) on sediment samples collected in 2014 (n=45) and 2015 (n=46 including 5 from the Potomac River reference area). The amphipod crustacean *Hyallela azteca* was tested for 42 days, with survival, growth, and reproduction as endpoints. The midge, *Chironomus dilutus*, was tested for 10 days with survival and growth endpoints. For *H. azteca*, 7 of the 82 Anacostia River samples and none of the reference samples had significant reductions in survival relative to the laboratory controls (Table 4). None of the *H. azteca* samples had <50%

survival (Table 5). Regarding growth, 22 of 82 samples (27%) had significantly reduced growth (Table 4), but none had <50% of control growth (Table 5). For reproduction, 14 of 82 (17%) had reduced reproduction and for 11 of these, reproduction was <50% compared to the laboratory controls (Tables 4 and 5).

For *Chironomus*, 35 of 82 samples (42%) had significantly reduced survival relative to the laboratory controls (Table 4). Ten of these samples had <50% survival, ranging from 12% to 48% (Table 5). These samples were distributed as follows: 5 from Reach 123, 4 from Reach 456, and 1 from Kingman Lake. For the growth endpoint, 46 of 82 (56%) experienced significantly reduced growth relative to controls (Table 4). A total of 25 had <50% of the control growth, but 7 of these were in samples with <50% survival (2 from Reach 123, 4 from Reach 456, and 1 from Kingman Lake). Of the remaining 18 samples, 11 were from Reach 123, 3 from Reach 456, 1 from Kingman Lake, and 3 from Washington Channel (Table 5). There were no statistically significant reductions in survival or growth in the Potomac River samples compared with the control samples.

As part of the ARSP BERA, a linear regression analysis was conducted with the toxicity test endpoints to determine the relative impacts (by percent) of contaminants including ammonia, dioxin-like PCBs, DDE, DDT, and total PAHs. In the lower portion of the Anacostia River, PAH potency ratio and dioxin-like PCBs significantly impacted *C. dilutus* growth, explaining 42 and 40% of the response, respectively. PAH potency ratio was responsible for 76% of the response for *H. azteca* 28-day survival and total PAHs were responsible for 75% of the response for 42-day survival in the whole river. In the lower river, PAH potency ratio accounted for 69% of the 42-day growth response (see Tetra Tech 2019a for further details).

In 2015, 16 surface sediment samples were collected to analyze bioaccumulation of toxic constituents in oligochaetes (*Lumbriculus variegatus)*, with additional endpoints of survival and growth (Tetra Tech 2019a BERA). *L. variegatus* were exposed to sediment samples for 28 days, and collected tissues were analyzed for constituents of concern. Detectable concentrations of PCB Aroclors, Dioxin TEQ, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane, and arsenic were present in all samples, and at 12 of the sampling locations, surface sediment samples were collected and used in the calculation of biota-sediment accumulation factors (BSAFs). BSAF values greater than 10 were considered to indicate bioavailability and exposure. Maximum BSAF values (≥10) for total PCBs (by Aroclors), Aroclor 1248, Aroclor 1260, 4,4' DDD, Aldrin, Endosulfan Sulfate, and Endrin were found in Reach 123. For all reaches, BSAF values for PCB Aroclors ranged from 2.9 to 15. The maximum BSAF value for chlordane was 19, found in Washington Channel. Only one SVOC, di-n-octyl phthalate, displayed a BSAF greater than 10 (BSAF=16, Reach 123).

For the Pepco Benning Road RI, toxicity tests were performed on 15 surface sediment samples (7 within Pepco Cove, 8 from the adjacent mainstem river channel) and compared with 5 from upstream locations designated as background. Midges (*C. dilutus*) and amphipods (*H. azteca*) were tested for 10 days with survival and growth endpoints (AECOM 2020). For *C. dilutus*, two samples (1 from Pepco Cove and 1 background) had significantly reduced survival compared with the laboratory control (82% and 84% of control, respectively). One *C. dilutus* sample from the Cove and one from the mainstem river showed reduced growth (75% and 87% of laboratory control). For *H. azteca*, one upstream background sample had significantly reduced survival (84%) compared to the laboratory control. Four of the seven *H. azteca* samples from within the Pepco Cove and five of the eight samples from the mainstem river channel showed reduced growth that was 71% to 88% of the laboratory control (AECOM 2020 Appendix BB BERA).

3.4.2 Fish

Field-collected fish

In the most recent Water Quality Assessment Integrated Report, the Anacostia River was classified as "not supporting" for protection and propagation of fish, shellfish and wildlife, as well as protection of human health related to fish and shellfish consumption (DOEE 2020b). Since 1994, fish consumption advisories have been issued by Maryland and the District of Columbia for the entire Anacostia River. For Maryland, the current advisory warns the public to avoid eating Carp (*Cyprinus carpio*), Channel Catfish (*Ictalurus punctatus*), and Blue Catfish (*I. furcatus*) due to elevated PCB concentrations (MDE 2020b). Other species have meals/month consumption restrictions due to PCBs; Sunfish (*Lepomis* spp.) are the only species with a consumption restriction based on both PCBs and mercury. The District's Fish Consumption Advisory applies to all District waters (DOEE 2016) and is based on 2013 data (Pinkney 2014). It recommends avoiding eating Striped Bass (*Morone saxatilis*), American Eel (*Anguilla rostrata*), and Carp due to elevated PCB concentrations. For other species, the public is advised to limit consumption to between one and four meals a month.

The District of Columbia fish consumption studies (using filleted samples) conducted in the 1990s, 2000, 2007, 2013, and 2017-2018 show that PCBs are the primary risk driver for human consumption. In general, total PCB concentrations were higher in the 1990s and 2000s compared with the 2013 and 2017-2018 studies (summarized in Pinkney 2018). In the 1990s and 2000s, total PCB concentrations in Channel Catfish, American Eel, and Carp were often in the 900 to 1300 µg/kg range. In the most recent sampling 2017-2018, total PCB concentrations in Channel and Blue Catfish were in the 67 to 396 µg/kg range; Carp concentrations ranged from 91 to 166 µg/kg, and a single American Eel composite had a total PCB concentration of 258 µg/kg (Pinkney 2018).

For the BERA, whole-body samples of forage fish, mid-level predators, and top predators were collected from the tidal Anacostia River in 2014, and the upper, non-tidal Anacostia and Potomac Rivers in 2016 (Tetra Tech 2019a). A total of 37 unique species were collected. Samples were analyzed for constituents including PCB Aroclors and congeners,dioxins and furans, organochlorine (OC) pesticides, PAHs, and metals. Total PCB Aroclors, PCB congeners, dioxin-like PCB congeners, dioxin TEQ, and the following organochlorine (OC) pesticides: aldrin, endrin, endosulfan sulfate, gamma-BHC (lindane), and total DDT were detected in all tidal Anacostia River whole fish samples. For the tidal Anacostia, a total of 123 whole fish samples were analyzed for total PCBs. PCBs were detected in all samples and concentrations ranged from 71 to 1900 µg/kg, with the maximum concentration found in Reach 123. For a detailed description of sampling methods, analysis and complete analytical results, please see the ARSP RI (Sections 4.9, 10.1.4, and Appendix A).

To provide more localized data on fish contamination, Mummichog (MC) and Banded Killifish (BK) were collected in 2018 and 2019 from the Anacostia mainstem and Kingman Lake, five Anacostia tributaries, and three Potomac River locations as background (Pinkney and Perry 2020). These species were selected because of their high site fidelity (<0.5-mile home range) and 3- to 4-year lifespan. Samples were composites of 2 to 18 individual fish, and whole-body residues of PCBs and OC pesticides were determined. In Pepco Cove (see Section 2.3) median total PCB concentrations were 372 µg/kg (BK from 2019), and 444 and 223 µg/kg in MC from 2018 and 2019, respectively. The highest median total PCB concentrations were in Lower Beaverdam Creek (719 to 1055 µg/kg). Intermediate total PCB concentrations (132 to 460 µg/kg) were reported in many locations in the tidal Anacostia River, Kingman Lake, and several tributaries. The lowest concentrations were in Northwest Branch, Northeast Branch, and the Potomac sites: 29.0 to 89.5 µg/kg. There was considerably less variability in median total chlordane concentrations which ranged from 43.9 to 218 µg/kg across the Anacostia/Kingman/tributary sites and from 25.5 to 37.4 µg/kg in the Potomac.

Pinkney and Perry (2020) relied on tissue concentration-based effects thresholds developed by Berninger and Tillitt (2019) to interpret possible adverse effects from bioaccumulated PCBs. Their analysis predicted that a whole-body total PCB concentration of 100 µg/kg would not result in increased mortality, but was associated with a 6% decrease in growth, and a 27% inhibition of reproduction. Total PCBs in fish tissue at 500 µg/kg would result in a 10% increase in mortality, a 12% inhibition of growth, and 35% inhibition of reproduction. A whole-body PCB concentration of 1000 µg/kg would result in a 17% increase in mortality, a 15% inhibition of growth, and a 39% inhibition of reproduction (Berninger and Tillitt 2019). Based on these thresholds, inhibition of reproduction is of greatest concern in the Anacostia River and its tributaries, with the greatest likelihood of adverse effects in Lower Beaverdam Creek. Although MC and BK are tributary-specific, one of the Lower Beaverdam Creek fish sampling locations (LB1) was only 0.6 miles from the Anacostia. It is likely that MC and BK from LB1 would be consumed by piscivorous fish from the Anacostia that feed in Lower Beaverdam Creek.
PCB homolog patterns were found to be substantially different in fish collected from Lower Beaverdam Creek compared with those from other locations (Pinkney and Perry 2020). Lower Beaverdam Creek fish showed mainly trichloro- and tetrachloro-homologs, while penta- and hexachloro-homologs were dominant in the mainstem Anacostia and Kingman Lake. An elevated proportion of tri-chlorobiphenyls was detected in one of the three Lower Beaverdam Creek sediment samples MDE (2020a) reported with total PCB concentrations greater than 2000 µg/kg. The detection of lower chlorinated homologs in Lower Beaverdam Creek fish and sediments is an indication of a fresh/current source of PCB contamination, since they are degraded faster than the higher chlorinated homologs (Ghosh et al. 1998).

Brown Bullhead (*Ameiurus nebulosus)* liver and skin tumor surveys were conducted in the Anacostia River and nearby areas between 1996 and 2016 (Pinkney et al. 2019). For liver tumors, Pinkney et al. (2019) cited literature that has shown a strong linkage with PAHs as tumor initiators and some evidence that PCBs are tumor promoters. The liver tumor prevalence in bullheads from the Anacostia River near the CSX Bridge has been and continues to be elevated relative to a statistically-derived Chesapeake Bay Reference Group. Using logistic regression, Pinkney et al. (2019) showed the liver tumor prevalence for a 280 mm Brown Bullhead was as follows: 1996 and 2001 combined (female, 77.8%; male, 48.6%), 2009 to 2011 (female, 42.5%; male, 16.6%), and 2014 to 2016 (female, 18.0%; male, 5.7%). Although the liver tumor prevalence for females and males has declined over time, results from all years are significantly higher than the reference group (female, 9.4%; male, 2.7%). Fish tumors are recognized as a NRDAR injury under 43 C.F.R. 11.62.

Toxicity tests

In 2016, larval Fathead Minnow (*Pimephales promelas)* 10-day survival and growth toxicity tests were performed using sediment and overlying water from the Anacostia River and compared to 5 reference samples from the Potomac River as part of the ARSP BERA (Tetra Tech 2019a). There were no effects on survival, which exceeded 90% in river samples and was 100% in laboratory controls. Growth was significantly reduced in 1 of 3 samples (33%) from Kingman Lake, with growth reduced to 87% of laboratory control, and in 1 of 12 samples (8%) from Reach 123, with growth reduced to 86% of the control (Table 4).

3.4.3 Birds and Mammals

Two Anacostia River studies examined contaminant concentrations in birds in relation to reproductive success. Both documented exposure but not reproductive impact. Tree Swallows (*Tachycineta bicolor*) are used in avian contaminant studies as a sentinel species with nest boxes deployed to attract pairs that feed locally. Lohnes (2006) conducted a three-year (2002-2004) tree swallow contaminant and nesting success study, comparing Kingman Lake, Kenilworth Marsh, and a reference site at Patuxent Research Refuge (Laurel, MD). Although there were higher PCB concentrations in eggs and nestlings from the Anacostia marshes, there was no statistically significant difference in clutch size or nestling weight. The only statistically significant difference in response was reduced hatching success at Kenilworth Marsh (68%, vs. 89% at Patuxent and 90% at Kingman Lake). The author concluded that contaminant concentrations and biomarker data suggest no serious impacts to tree swallows residing in Kenilworth Marsh and Kingman Lake.

Lazarus et al. (2015) evaluated halogenated contaminants (including PCBs and OC pesticides) and reproductive success in Osprey (*Pandion haliaetus*) in three Regions of Concern in the Chesapeake Bay area: Anacostia River, Baltimore Harbor, and Elizabeth River. The nests from the Anacostia (n=2) and middle Potomac (DC/MD, n=7) were merged into a single site for comparison with other areas (Poplar Island (reference site), Baltimore Harbor/Patapsco River, and Elizabeth River). Both Anacostia nests (near the Frederick Douglas Bridge) were successful, with two fledglings per nest (Barnett Rattner, USGS co-author, personal communication). Five of the seven nests in the middle Potomac were also successful. Lazarus et al. (2015) reported that total PCB concentrations in Anacostia and Potomac eggs were similar and elevated up to five times the Poplar Island concentrations. OC pesticides were detected most frequently in eggs from the Anacostia/middle Potomac, with a mean 4,4'-DDE concentration of 0.725 µg/g. Across all sites, Osprey productivity was adequate to sustain local populations, and there was no relation between productivity and halogenated contaminants.

Food chain models are often used to assess risks to birds and mammals. The ARSP BERA used Belted Kingfisher (*Megaceryle alcyon*), Green Heron (*Butorides virescens*), Osprey (*Pandion haliaetus*) and River Otter (*Lontra canadensis)* as representative ecological receptors. Intake of chemicals was estimated based on site-specific chemical concentrations and information on diet, ingestion rates, and foraging range (Tetra Tech 2019a BERA). Chemicals evaluated included total PCB Aroclors, PCB congeners, dioxin-like PCB TEQ, 4,4'-DDE, 4,4'-DDT, and various metals. These estimated intakes were compared to literature reported toxicity-reference values (TRVs, see Table 6 for a listing of TRVs for all chemicals discussed in this section). Low TRVs are equivalent to a no-observed adverse effects level (NOAEL), and high TRVs represent a mid-level intake at which adverse effects have been detected in laboratory studies. Hazard quotients (HQs) were based on the ratio of the intake to low and high TRVs. HQs greater than 1.0 using the high TRV indicate probable risk, while HQs < 1.0 using the low TRV indicate minimal risk.

For the Osprey, no locations within the ARSP study area had HQs exceeding 1.0. For the Belted Kingfisher, no estimated intake exceeded the high TRV, however HQs were frequently above 1.0 using the low TRV (Tetra Tech 2019a BERA Table I.3.48; and Table 6). HQs using the low TRV for PCB Aroclors for the Belted Kingfisher were greater than 1.0 in all river reaches, with the highest (HQ=3.5) in Reach 67. For total PCBs, HQs using the low TRV were greater than 1.0 for Reaches 123 (HQ=1.9), 456, 67, and Kingman Lake (HQs=2.2). Dioxin-like PCB TEQ HQs using the low TRV exceeded 1.0 for the Belted Kingfisher in Reach 67 and Kingman Lake. For the Green Heron, no estimated intake exceeded the high TRVs, but HQs frequently exceeded 1.0 using the low TRV (BERA Table I.3.49). For the Green Heron, HQs using the low TRV for PCB Aroclors exceeded 1.0 in all reaches of the river, ranging from 2.82 in Washington Channel to 3.90 in Reach 67. HQs using the low TRV for lead also exceeded 1.0 for the Green Heron in all reaches, ranging from 1.22 in Reach 7 to 4.29 in Washington Channel. HQs greater than 1.0 for the Green Heron using the low TRV for total PCB congeners were found in Reaches 123, 456, 67, and Kingman Lake. For the River Otter, no HQ was greater than 1.0 using the high TRV. Using the low TRV for Aroclor 1248, HQs were greater than 1.0 in all reaches except Reach 67 (Tetra Tech 2019a BERA Table I.3.50).

Pinkney et al. (2006) assessed the potential for ecological risk due to exposure to contaminants within the newly constructed wetland area of Kingman Lake (see Section 2.1). Sediment and forage fish samples were collected in 2001 and 2003 from three areas: Kingman Lake, Dueling Creek, and a reference marsh (Great Marsh, Mason Neck National Wildlife Refuge along the Potomac River). HQ ranges for Green Heron and Raccoon (*Procyon lotor*) were calculated using estimated doses and food-chain modeling. The HQ range is from the low TRV (NOAEL) and high TRV (lowest observable adverse effects level (LOAEL)) (see Table 6). In general, risk of food-chain exposure through contaminated prey from Kingman Lake was comparable to that for

Dueling Creek, but higher than that for Mason Neck. For Kingman Lake, HQ ranges for Green Heron were 1.6 to 2.7 for aluminum, 0.2 to 2.8 for mercury, 0.4 to 1.0 for selenium, and 0.2 to 1.9 for total PCBs. For Raccoons, the risk ranges were 16 to 206 for aluminum, 0.5 to 7.1 for nickel, 1.1 to 13 for selenium, 0.1 to 1.3 for zinc, 1.3 to 2.9 for total PCBs, and 0.1 to 1.4 for high molecular weight PAHs.

In 2000, screening-level risk assessments with Green Heron and Raccoon were performed using existing data (SRC and NOAA 2000). The study area was divided into the lower river (Anacostia mouth to Sousa Bridge), upper river (Sousa Bridge to confluence with Northwest and Northeast Branches) and the Washington Channel. Comparing estimated intakes to low literature TRVs (NOAEL) for total PCBs resulted in HQs for Green Heron above 1 in the lower river (1.08) and Washington Channel (3.08). Total DDT HQs for the Green Heron were 24.59 for the lower river, 8.40 for the upper river, and 92.62 for the Washington Channel. Lead and methyl mercury showed HQs above 1.0 for the lower river and the Washington Channel. Using an estimated intake and NOAEL TEQ for 2,3,7,8-TCDD, HQs for the Raccoon in the upper river and lower river were 4.56 and 12.15, respectively. For total PCBs, HQs for Raccoons were 1.96 in the upper river, 13.60 in the lower river, and 4.45 in the Washington Channel.

3.4.4 Reptiles

In June of 2016, six male and one female Snapping Turtles (*Chelydra serpentine*) were collected from the Anacostia River for tissue analysis in support of the ARSP BERA. Three turtles were collected in Kingman Lake, two turtles from Reach 456, and two from Reach 67. Liver, fat and muscle samples were collected from each turtle and analyzed for contaminants such as PCB Aroclors, OC pesticides, and metals. The mean concentration of PCBs in Anacostia River Snapping Turtle fat samples was 32.19 mg/kg, which exceeds some but not all published concentrations from reference and low pollution areas. Dioxin was detected in liver, fat and muscle samples from all of the turtles collected, and dioxin concentration in turtle fat from the Anacostia River increased with size of turtle, ranging from 0.011 to 0.028 µg/kg. Dieldrin, 4,4'-DDE, and heptachlor epoxide were detected in fat and livers of all seven turtles from the Anacostia River. Although these OC pesticides show evidence of bioaccumulation and biomagnification in Snapping Turtle tissues, concentrations vary in relationship to “clean” reference sites in Maryland and New Jersey (Albers et al. 1986). For instance, the mean dieldrin concentration in Snapping Turtle fat was 104 µg/kg in the Anacostia River samples, compared with 70 µg/kg at the reference area, while the mean heptachlor epoxide concentration in Anacostia River turtle fat was 166 µg/kg, compared with 380 µg/kg at the reference site (Tetra Tech 2019a BERA).

4.0 GENERAL CRITERIA FOR PROCEEDING WITH A DAMAGE ASSESSMENT

In accordance with 43 C.F.R. § 11.23, the Trustees have determined that all of the following criteria have been met:

4.1 Criterion 1 - A release of a hazardous substance has occurred.

Releases of hazardous substances including PCBs (including dioxin-like congeners), PAHs, benzene, dioxin TEQ, OC pesticides, arsenic, and lead have been documented. Some of these releases are historical and date as far back as the late 19th century while others are current and occurring through releases from contaminated groundwater, runoff from site soils and via outfalls, and through tributaries. Examples include the documented releases of PAHs from the Washington Gas East Station Site (Hydro-Terra 1999, 2005), PCBs from the Washington Navy Yard (CH2M Hill 2014), and PCBs from the Pepco Benning Road Facility (AECOM 2020).

4.2 Criterion 2 - Natural resources for which the Trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release.

The natural resources adversely affected by releases of hazardous substances are under the jurisdiction of the Trustees. These resources include migratory and resident fish, birds, mammals, reptiles, and invertebrates, as well as their supporting habitats including soil, sediments, pore water, and surface water. These receptors are reported widely throughout the river, associated marshes, and flood plain and are documented in the District of Columbia Wildlife Action Plan, species lists compiled in the ARSP RI, and lists developed by the National Park Service. Habitat areas for these receptors coincide with areas that have elevated concentrations of hazardous substances above PECs. Additionally, groundwater resources provide a range of services including the provision of water for drinking, agricultural, and industrial purposes. As recognized by 21 DCMR 1150.2, groundwater shall be protected for beneficial uses, including surface water recharge, drinking water in other jurisdictions, and potential future use as a raw drinking water source in the District. Contamination has been identified in groundwater in some areas of the Anacostia River at concentrations that may cause adverse effects.

4.3 Criterion 3 - The quantity and concentration of the released hazardous substances are sufficient to potentially cause injury.

Natural resources for which the Trustees may assert trusteeship have likely been adversely impacted in the past and are likely to continue to be adversely impacted by hazardous substances. Studies conducted have documented elevated concentrations of hazardous substances, particularly PCBs and PAHs, in surface water, sediment, soil, groundwater, and biological tissues (primarily PCBs), which have been attributed to releases from multiple sources. Further, it is likely that contaminated natural resources could adversely impact other natural resources through various pathways of exposure (e.g., direct contact or dietary exposure). For example, fish consumption advisories for PCBs and other contaminants are in place for the Anacostia River.

4.4 Criterion 4 - Data sufficient to pursue an assessment can be obtained at a reasonable cost.

Data currently exist from the ARSP including the RI/FS, DOEE-funded game and forage fish monitoring, specific site investigations, and tributary studies that will be helpful and cost effective to further assess natural resource injury. Ongoing studies at potential environmental cleanup sites will further help in the injury assessment process. Current source-tracking investigations in Lower Beaverdam Creek may result in the identification of additional contaminant sources. Some additional studies are needed to further quantify injury and service losses for some resources, but it is likely that these can be obtained at reasonable costs.

4.5 Criterion 5 - Response actions, if any, carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

Generally, the purpose of response actions is to address threats to human health and the environment. Such actions do not necessarily restore or replace injured public natural resources or resource services. To date, on-site actions in and around the Anacostia River have been aimed at remediation, and many have not incorporated additional actions to restore or replace injured natural resources and resource services. Moreover, as of March 2021, there are no approved in-river (i.e., sediment) remediation plans for any of the potential environmental cleanup sites. While actions have been taken to address terrestrial contamination at some of the potential environmental cleanup sites, those response actions, on their own, do not entirely address injuries to natural resources. The ARSP Interim ROD (DOEE 2020a) calls for remediation in early action areas (EAAs) in Kingman Lake, the mainstem Anacostia, and Washington Channel, but to date none of the implementation plans have been finalized. Accordingly, at present, there is nothing to suggest that response actions will sufficiently address hazardous substance injury to natural resources with appropriate restoration.

5.0 PRE-ASSESSMENT SCREEN DETERMINATION

Based on the review of the studies and data described in this Preassessment Screen, the Trustees have made a preliminary determination that the criteria specified in the CERCLA NRDAR regulations have been met. Furthermore, the Trustees have determined that there is a reasonable probability of making a successful claim for damages with respect to natural resources over which the Trustees have trusteeship. Therefore, the Trustees have determined that a NRDAR is warranted.

Preliminarily, the Trustees will focus on evaluating, scaling, and quantifying natural resource injuries. During the assessment phase, the Trustees will also develop a comprehensive, river-wide strategy for restoration that incorporates categories and types of activities previously identified as priorities by the *Anacostia River Watershed Restoration Plan and Report* (https://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Appendix_C_Anacostia_Restoration_Plan_Report.pdf). These include:

- Restoration and Conservation of Habitat (stream restoration, wetland enhancement and creation, riparian re-forestation, etc.)
- Restoration of Water Quality (stormwater, runoff, trash reduction)
- Rehabilitation and Replenishment of Impaired Riparian Species (Fish, Freshwater Mussels, Waterfowl, Birds, etc.)
- Enhancement of Recreational Use and Enjoyment Opportunities

Restoration activities will be appropriately scaled in a Restoration Plan that addresses injury to these types of public natural resources and resource services as determined and quantified by the Trustees.

6.0 LITERATURE CITED

AECOM. 2018. Operable Unit 2 – Remedial Investigation and Feasibility Study Washington Gas Light East Station Site. Technical Memorandum 5. Hydrogeologic Data and Mass Flux/Mass Discharge Results. Prepared by AECOM. January 2018.

AECOM. 2020. Remedial Investigation Report (Final Report) Pepco Benning Road Facility. Prepared for Pepco and Pepco Energy Services. February 2020.

Albers, P.H., L. Sileo, and B.M. Mulhern. 1986. Effects of Environmental Contaminants on Snapping Turtles of a Tidal Wetland. *Archives of Environmental Contamination and Toxicology* 15: 39-49.

AMEC Environment and Infrastructure. 2013. Conceptual Remedial Investigation Scoping Document, Poplar Point, Southeast, Washington, DC. Prepared for Deputy

Mayor for Planning and Economic Development, Washington, DC. May 2013.

Bakke, T., T. Kallqvist, A. Ruus, G.D. Breedveld, and K. Hylland. 2010. Development of Sediment Quality Criteria in Norway. *Journal of Soils and Sediments* 10: 172-178.

Berninger, J.P. and D.E. Tillitt. 2019. Polychlorinated Biphenyl Tissue-Concentration Thresholds for Survival, Growth, and Reproduction in Fish. *Environmental Toxicology and Chemistry* 38: 712-736.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration p. 34.

Canadian Council of Ministers of the Environment (CCME). 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Polychlorinated Dioxins and Furans (PCDD/Fs). In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CH2M Hill. 2007. 11th Street Bridges Final Environmental Impact Statement, Volume 1. Prepared for District of Columbia Department of Transportation. October 2007.

CH2M Hill. 2011a. Operable Unit 2 Remedial Investigation Report, Washington Navy Yard, Washington DC. Prepared for the Department of the Navy Naval Facilities Engineering Command. May 2011.

CH2M Hill. 2011b. Draft Site Investigation Report – AOC 1, Joint Base Anacostia Bolling, Washington, DC. Prepared for Department of the Navy Naval Facilities Engineering Command. March 2011.

CH2M Hill. 2011c. Draft Remedial Investigation Report, Site 2, Metro Fill Area and Waterfront Fill Area, Joint Base Anacostia Bolling, Washington DC. Prepared for Department of the Navy Naval Facilities Engineering Command. June 2011.

CH2M Hill. 2012. No Further Response Action Planned Decision Document Site 1 – Building 168. Prepared for Department of the Navy Naval Facilities Engineering Command. 2012.

CH2M Hill. 2014. Operable Unit 2 Remedial Investigation Report Washington Navy Yard Washington DC. Prepared for the Department of the Navy Naval Facilities Engineering Command. February 2014.

CH2M Hill. 2016. Semi-annual Monitoring Data Report Second Half 2015 Site 111/224 Underground Storage Tank Case Site Case Number 98034. Washington Navy Yard. March 2016.

CH2M Hill. 2017. Remedial Investigation Report for Site 2, Washington Navy Yard, Washington, DC. Draft, November 2017.

DIVER. 2021. Web Application: Data Integration Visualization Exploration and Reporting Application, National Oceanic and Atmospheric Administration. Retrieved: multiple days, January 2021, from https://www.diver.orr.noaa.gov.

DOEE. 2015. District of Columbia Wildlife Action Plan: A Conservation Strategy for Washington, DC Accessed: multiple days, January 2021, from https://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan.

DOEE. 2016. Fish Consumption Advisory. Accessed: November 15, 2020, from https://doee.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/Fish%20Consumption%20Advisory%202016.pdf.

DOEE. 2020a. Interim Record of Decision (ROD). Early Action Areas in the Main Stem, Kingman Lake, and Washington Channel. Anacostia River Sediment Project, Department of Energy and Environment, Government of the District of Columbia.

DOEE. 2020b. District of Columbia Water Quality Assessment 2020 Integrated Report. To the U.S. Environmental Protection Agency and Congress pursuant to Sections 305(b) and 303(d) Clean Water Act. July 2020.

Dolph, J.E. 2001. Industrial History of the Former Naval Receiving Station, Anacostia Park, Washington, DC. Prepared for the National Oceanic and Atmospheric Association, December 2001.

ECS. 2017. Environmental Site Characterization, Former Steuart Petroleum Bulk Terminal, prepared for 1333 M St. S.E. LLC.

Energy and Environment (E&E). 2007. Final Remedial Investigation of Kenilworth Park North, Northeast, Washington, D.C. Prepared for the National Park Service. November 2007.

Energy and Environment (E&E). 2001. Preliminary Assessment/Site Investigation of Langston Golf Course, N.E. Washington, DC. Prepared for the National Park Service. April 2001.

Energy and Environment (E&E). 2008. Final Remedial Investigation at the Kenilworth Park South Landfill N.E. Washington, DC Prepared for the National Park Service. June 2008.

Enviroscience. 2013. Draft Analytical Sampling Results Report: Fort DuPont Creek and the Anacostia River, Washington, DC. Prepared for CSX Transportation, Inc. April 2013.

Geosyntec Consultants. 2010. Historical Report, November 2010.

Geosyntec Consultants. 2013. Final Yard Office Site Assessment Report and Corrective Action Plan, Benning Yard, District of Columbia. Prepared for CSX Transportation, Inc. April 2013.

Geosyntec Consultants. 2016. Yard Office Corrective Action Plan Construction Completion Report, Benning Yard, Washington, DC. Prepared for CSX Transportation, Inc. June 2016.

Ghosh, U., A.S. Weber, J.N. Jensen, and J.R. Smith. 1998. Dissolved PCB Congener Distribution in Generator Column Solutions. *Water Research* 32: 1373-1382.

Ghosh, U., N. Lombard, M. Bokare, A. Pinkney, L. Yonkos, and R. Harrison. 2020. Passive Samplers and Mussel Deployment, Monitoring, and Sampling for Organic Constituents in Anacostia River Tributaries: 2016-2018. Final Report Sept. 2020. Prepared for District of Columbia, Department of Energy and Environment, Washington, DC. CBFO-C20-03.

Hydro-Terra, Inc., 1989. Contamination & Land Use Study, Phase II; East Station Property, Volumes I & II (Phase II).

Hydro-Terra Inc. 1999. Additional Remedial Investigation and Feasibility Study, East Station, Washington DC (Phase IV). Prepared for Washington Gas Light. March 1999.

Hydro-Terra Inc. 2005. Sediment Studies in the Anacostia River Vicinity of the East Station Study Area. Prepared for Washington Gas Light. March 2005.

The Johnson Company, Inc. 2012. Feasibility Study Report. Kenilworth Park Landfill Northeast, Washington, DC. Prepared for the National Park Service. April 2012.

The Johnson Company, Inc. 2019. Draft NPS Tributary Sediment Sampling Study Report, Anacostia River Sediment Project Site, National Capital Region. Prepared for the National Park Service. July 2019.

Lazarus, R.S., B.A. Rattner, P.C. McGowan, R.C. Hale, S.L. Schultz, N.K. Karouna-Renier, and M.A. Ottinger. 2015. Decadal Re-evaluation of Contaminant Exposure and Productivity of Ospreys (*Pandion haliaetus*) Nesting in Chesapeake Bay Regions of Concern. *Environmental Pollution* 205: 278-290.

Lohnes, K.L., 2006. Impact of Reconstructed Wetlands on the Tree Swallow *(Tachycineta bicolor)*. M.S. Thesis, University of Maryland, College Park, MD.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39: 20-31.

MACTEC. 2005. Phase 1 Environmental Site Assessment and Contaminated Materials Management Report: Proposed South Capitol Street Bridge Realignment, Southeast, Washington DC. Prepared for District of Columbia Department of Transportation. December 2005.

MACTEC. 2007. Fill Mound Environmental Assessment Report, Kingman Island, Northeast Washington, DC. Prepared for Anacostia Waterfront Corporation. March 2007.

Maryland Department of the Environment (MDE). 2002. Expanded Site Investigation Report for Anacostia River Park (MD-024), Prince George's County, Maryland. September 1994, Revised April 2002.

Maryland Department of the Environment (MDE). 2020a. Fish Consumption Advisory Map. Accessed: November 2020, from https://mdewin64.mde.state.md.us/WSA/FCA/index.html.

Maryland Department of the Environment (MDE). 2020b. Lower Beaverdam Creek PCB Investigation. Land Restoration Program, March 2020.

Mayer, P., T.F. Parkerton, R.G. Adams, J.G. Cargill, J. Gan, T. Gouin, P.M. Gschwend, S.B. Hawthorne, P. Helm, G. Witt, and J. You. 2014. Passive Sampling Methods for Contaminated Sediments: Scientific Rationale Supporting use of Freely Dissolved Concentrations. *Integrated Environmental Assessment and Management* 10:197-209.

National Park Service (NPS). 2015. Community Fact Sheet – Washington Gas Site – Operable Unit 1 - CERCLA – Activity- Restoration. Fall 2015. Accessed: February 2021, from https://www.nps.gov/nace/learn/management/upload/2015-10-23-WG-OU1-Fact-Sheet-Fall_Final.pdf.

National Park Service (NPS). 2019. Final RI Addendum Report, Kenilworth Landfill Park.

National Park Service (NPS). 2020a. Final Feasibility Study Addendum Report. Kenilworth Park Landfill Site, Anacostia Park, Washington DC. September 2020. Prepared by Vanasse Hangen Brustlin, Inc. (VHB).

National Park Service (NPS). 2020b. Proposed Plan for Cleanup of the Kenilworth Park Landfill Site. Accessed: November 2020, from https://www.nps.gov/nace/learn/management/upload/Kenilworth-Park-Landfill-ProposedPlan.pdf.

NOAA. 1992a. Steuart Petroleum, Anacostia River, Washington, DC Incident Response Document. IncidentNews. January 19, 1992. Accessed: February 2021, from www.incidentnews.noaa.gov/incident/6867.

NOAA. 1992b. Steuart Petroleum, Incident Response Document: Situation Update. IncidentNews. January 21, 1992. Accessed: February 2021, from www.incidentnews.noaa.gov/incident/6867/514312

NOAA. 1992c. Steuart Petroleum, Incident Response Document: Situation Update. IncidentNews. January 21, 1992. Accessed: February 2021, from www.incidentnews.noaa.gov/incident/6867/514311.

Pinkney, A.E. 2014. Analysis of Contaminant Concentrations in Fish Tissue Collected from the Waters of the District of Columbia, Final Report. Prepared for The District Department of the Environment, Natural Resources Administration, Water Quality Division. September 2014, revised November 2017.

Pinkney, A.E. 2018. Contaminant Concentrations in Fish Tissue Collected from the Waters of the District of Columbia: 2017-2018. Prepared for The District Department of the Environment, Natural Resources Administration, Water Quality Division. September 2018.

Pinkney, A.E. and E.S. Perry. 2020. Polychlorinated Biphenyls and Organochlorine Pesticide Concentrations in Whole Body Mummichog and Banded Killifish from the Anacostia River Watershed: 2018-2019. Prepared for Dev Murali, Government of the District of Columbia, Department of Energy and Environment, Washington, DC. June 2020.

Pinkney, A.E., P.C. McGowan, and D.J. Fisher. 2006. Risk-Based Monitoring of the Kingman Lake Restored Wetland, Washington, DC. May 2006.

Pinkney, A.E., J.C. Harshbarger, M.A. Rutter, and P.C. Sakaris. 2019. Trends in Liver and Skin Tumor Prevalence in Brown Bullhead (*Ameiurus nebulosus*) from the Anacostia River, Washington, DC, and Nearby Waters. *Toxicologic Pathology* 47: 174-189.

Ridolfi Engineers, Inc. 2003. Phase 1 Environment Site Assessment, Poplar Point Site (Section One), Washington DC. Prepared for the District of Columbia and National Oceanic and Atmospheric Administration. January 2003.

Singleton, H. J. 2014. Environmental Criteria for Dioxins and Furans to Protect Aquatic Life. Accessed: February 2021, from http://fishphysiology.org/wp-content/uploads/2014/02/singleton.pdf.

Syracuse Research Corporation (SRC) and National Oceanic and Atmospheric Association (NOAA). 2000. Interpretive Summary of Existing Data Relevant to Potential Contaminants of Concern within the Anacostia River Watershed. Prepared for Geo-Centers, Inc. On behalf of the Anacostia Watershed Toxics Alliance. June 2000.

Tetra Tech. 2016. Draft Soil Pile Site Investigation Report, Kingman Island, Washington, DC. Prepared for Department of Energy and Environment. March 2016.

Tetra Tech. 2019a. Remedial Investigation Report. Anacostia River Sediment Project, Washington DC. Prepared for Department of Energy and Environment. December 2019.

Tetra Tech. 2019b. Manhole Sediment Investigation Report. Anacostia River Sediment Project, Washington, DC. Prepared for Department of Energy and Environment. December 2019.

U.S. Army. 2016. Fort McNair Army Defense Environmental Restoration Program Installation Action Plan. February 2017.

Velinsky, D.J., G.F. Riedel, J.T.F Ashley, and J.C. Cornwell. 2011. Historical Contamination of the Anacostia River, Washington, DC. *Environmental Monitoring and Assessment* 183: 307-328.

Wilson, T.P. 2019. Sediment and Chemical Contaminant Loads in Tributaries to the Anacostia River, Washington, DC, 2016-2017. US Geological Survey Scientific Investigations Report 2019-5092.

Table 1. Surface water samples collected from each reach of the Anacostia River (2014-2016) including Kingman Lake (KL) and Washington Channel (WC). For each reach, the number of samples (n) exceeding the threshold for chronic toxicity to aquatic life listed for each contaminant and the maximum measured concentration are shown.

Reach	Total Samples	Total PCBs >0.014 µg/L	Lead >2.5 µg/L	4,4'-DDT >0.011 µg/L	Benzo(a)pyrene >0.014 µg/L	Pyrene >0.025 µg/L
7	5	-	-	n= 1; 0.018 µg/L	n= 1; 1.5 µg/L *	n= 3; max 0.42 µg/L
67	10	n=1; 0.017 µg/L	-	-	-	n=9 max 0.050 µg/L
KL	18	-	n=1; 3.3 µg/L	n=1; 0.016 µg/L	n=1; 1.4 µg/L *	n=11; 0.36 µg/L
456	25	n=1; 0.018 µg/L	-	n=1; 0.016 µg/L	n=2, max 0.052 µg/L	n=20, max 0.090 µg/L
123	36	-	-	-	n=3; max 0.13 µg/L	n=12; max 0.071 µg/L
WC	16	-	-	-	n=1; 0.14 µg/L	n=2; max 0.088 µg/L

* exceeds Benzo(a) pyrene acute toxicity screening threshold of 0.24 µg/L

Table 2. Surface sediment samples collected from each reach of the Anacostia River (2014-2016), including Kingman Lake (KL) and Washington Channel (WC), with measured concentrations of contaminants exceeding the listed probable effects concentrations (PECs) for adverse effects to benthic organisms. For each reach, the number of samples (n) exceeding the PEC and the maximum measured concentration are shown.

Reach	**Total Samples**	**Total PCBs >676 µg/kg**	**Lead >128 mg/kg**	**Chlordane >17.6 µg/kg**	**Total PAHs >22,800 µg/kg**
7	13	-	-	n= 2; max 90 µg/kg	-
67	19	-	n=1; 170 mg/kg	n=17; max 120 µg/kg	-
KL	26	n=1, 875 µg/kg	n=4; max 150 mg/kg	n=26; max 140 µg/kg	-
456	49	n=5; max 3,711 µg/kg	n=4; max 200 mg/kg	n=42; max 130 µg/kg	n=1, 24,330 µg/kg
123	109	n=7; max 3,485 µg/kg	n=15; max 700 mg/kg	n=87; max 320 µg/kg	n=2; max 28,025 µg/kg
WC	21	n=5; max 2,698 µg/kg	n=10; max 670 mg/kg	n=5; max 54 µg/kg	n=1; 31,430 µg/kg

Table 3. Descriptions of identified potential environmental cleanup sites within each reach of the tidal Anacostia River, including contaminants exceeding screening thresholds in various site media as reported in previous investigations. River sediment data include results from site-specific studies and general sampling in the vicinity of the site. Not sampled: media was not sampled or not included in the site reports. No outfalls: no site-specific outfalls.

Site	Reach	Type of industry/ operation	Clean-up action(s)	Key studies/reports	River sediment	Site-specific outfall	On-site soil/ sediment/surface water (SW)	Groundwater
Colmar Manor Landfill	67	Local residents' refuse disposal (1930s); Former landfill (1955-1970)	Sand/soil cap, slurry wall (installed in 1982), methane ventilation (installed in 1984) (MDE) No further action planned (Tetra Tech 2019)	MDE 2002 (EI)	Site-specific: Not sampled Vicinity: PAHs, Lead	No outfalls	Soil: PAHs, Pesticides (Chlordane, 4,4'-DDT) Pond sediment: PAHs, Pesticides (4,4'-DDD), Lead Dueling Creek SW: Arsenic	Not sampled
Kenilworth Park Landfill	456	Municipal waste dump (1942-1968); Sanitary landfill for Washington DC (1968-1970)	Clay/topsoil cap (1970) and KPN converted to park (1980) Soil and debris placed on KPS (1997-1998) Re-graded and seeded (2002)	E&E 2008 (RI) The Johnson Company 2012 (FS) NPS 2019 (RI Addendum)	Vicinity: PCBs, PAHs, Lead	No outfalls	Soil: PAHs, Pesticides, Metals (unspecified)	VOCs, PAHs, PCBs, and Metals in some samples; only Fe above threshold for ecological exposure risk
Pepco Benning Road Facility	456	Former coal/oil-fired power station (1906- 2012); Demolished 2015; Now: operation, management, and equipment maintenance facility	Storm drain cleanup & repairs (as required between 1987 and 2003)	AECOM 2020 (RI) Final FS/TS to be completed 2021	Site-specific: PCBs, PAHs, Dioxins, Lead Vicinity: PCBs, PAHs, Lead	Outfalls 013 and 101: PCBs, PAHs, Lead	Soil: PCBs, PAHs, Dioxins, Metals (As, Co, Ni, Pb, V)	PCBs, PAHs (naphthalene), Dioxins, VOCs (MTBE), CVOCs (trichloroethylene, tetrachloroethene), Metals (As, Cd, Co, Ni, V)

Abbreviations: Al=Aluminum, As=Arsenic, Ba=Barium, BaP=Benzo(a)pyrene, BTEX=Benzene Toluene Ethylbenzene Xylenes, CAP= Corrective Action Plan, CCR= Construction Completion Report, Cd=Cadmium, Co=Cobalt, Cr=Chromium, Cu=Copper, DRO=Diesel Range Organics, EA= Environmental Assessment, EI= Environmental Investigation, Fe=Iron, FS= Feasibility Study, GRO=Gasoline Range Organics, Hg=mercury, IAP= Installation Action Plan, LUST= Leaking Underground Storage Tank, NAPL=Non-aqueous Phase Liquid, NFRAP= No Further Response Action Planned, Ni=Nickel, PA= Preliminary Assessment, PAHs=Polycyclic aromatic hydrocarbons, Pb=Lead, PCBs=Polychlorinated Biphenyls, PECs = Probable Effects Concentrations, RA= Remedial Action, RD= Remedial Design, RI= Remedial Investigation, ROD= Record of Decision, SA= Site Assessment, SI= Sediment Investigation, Tl=Thallium, TPH=Total Petroleum Hydrocarbons, TS= Treatability Study, UFP-SAP= Uniform Federal Policy Sampling and Analysis Plan, V=Vanadium, VOCs=Volatile Organic Compounds, WP= Work Plan

Table 4, Continued. Descriptions of identified potential environmental cleanup sites within each reach of the tidal Anacostia River, including contaminants exceeding screening thresholds in various site media as reported in previous investigations. River sediment data include results from site-specific studies and general sampling in the vicinity of the site. Not sampled: media was not sampled or not included in the site reports. No outfalls: no site-specific outfalls.

Site	Reach	Type of industry/ operation	Clean-up action(s)	Key studies/reports	River sediment	Site-specific outfall	On-site soil/ sediment/surface water (SW)	Groundwater
CSX Benning Yard	456	Active railroad switching yard; New office building and parking area (est. 2004)	Excavated petroleum-impacted soils, installed oxygen releasing compound, backfilled with clean fill, stabilized bank of Fort Dupont Creek (2016)	EnviroScience 2013 (SI) Geosyntec 2013 (SA/CAP) Geosyntec 2016 (CCR)	Site-specific: PCBs, PAHs, Lead Vicinity: PCBs, PAHs, Lead	Fort Dupont Creek at CSX Outfall 002: Lead	Not sampled	TPH-GRO, PAHs (Benzo(a)-anthracene, benzo(b)-fluoranthene, naphthalene), Arsenic
Langston Golf Course	Kingman Lake / 456	Kingman Island North, Refuse disposal/ burning until 1937; Western shore Kingman Lake, Refuse disposal/ burning until 1955	Redeveloped as golf course: Kingman Island North (1937), western shore Kingman Lake (1955)	E&E 2001 (PA/SI)	Site-specific: Not sampled Vicinity: PCBs, Lead	No outfalls	Soil: PCBs, TPH-DRO, Metals (As, Pb)	TPH-DRO, Metals (Al, As, Pb)
Kingman Island Illicit Dumping Area	Kingman Lake / 456	Former illicit dumping ground	None reported	MACTEC 2007 (SI/EA) Tetra Tech 2016 (SI)	Site-specific: Not sampled Vicinity: Lead	No outfalls	Soil: PCBs, PAHs, TPH-DRO, Metals (As, Pb, V, Zn)	PCBs, PAHs, TPH-DRO, Metals (As, Pb, V, Zn)
Washington Gas Light (WGL) East Station	123	Former manufactured gas plant (1888-1948); Electrical peaking purposes only (1948-1983); Demolished (1986)	Remaining oil storage tanks removed (1997) OU1 remedial actions: excavation of contaminated soil, backfilled with clean fill and topsoil (2015)	Hydro-Terra 1999 (RI/FS), 2005 (SI) NPS 2015 (OU1: RD/RA; OU2: RI/FS WP) AECOM 2018 (draft RI/FS)	Site-specific: VOCs, PAHs Vicinity: PAHs, Lead	No outfalls	Not sampled	PAHs (BaP), VOCs: (benzene, toluene, ethylbenzene), CVOCs (tetrachloroethene), Metals (Al, As, Cd, Hg, Ni, Pb)

Abbreviations: Al=Aluminum, As=Arsenic, Ba=Barium, BaP=Benzo(a)pyrene, BTEX=Benzene Toluene Ethylbenzene Xylenes, CAP= Corrective Action Plan, CCR= Construction Completion Report, Cd=Cadmium, Co=Cobalt, Cr=Chromium, Cu=Copper, DRO=Diesel Range Organics, EA= Environmental Assessment, EI= Environmental Investigation, Fe=Iron, FS= Feasibility Study, GRO=Gasoline Range Organics, Hg=mercury, IAP= Installation Action Plan, LUST= Leaking Underground Storage Tank, NAPL=Non-aqueous Phase Liquid, NFRAP= No Further Response Action Planned, Ni=Nickel, PA= Preliminary Assessment, PAHs=Polycyclic aromatic hydrocarbons, Pb=Lead, PCBs=Polychlorinated Biphenyls, PECs = Probable Effects Concentrations, RA= Remedial Action, RD= Remedial Design, RI= Remedial Investigation, ROD= Record of Decision, SA= Site Assessment, SI= Sediment Investigation, Tl=Thallium, TPH=Total Petroleum Hydrocarbons, TS= Treatability Study, UFP-SAP= Uniform Federal Policy Sampling and Analysis Plan, V=Vanadium, VOCs=Volatile Organic Compounds, WP= Work Plan

Table 5, Continued. Descriptions of identified potential environmental cleanup sites within each reach of the tidal Anacostia River, including contaminants exceeding screening thresholds in various site media as reported in previous investigations. River sediment data include results from site-specific studies and general sampling in the vicinity of the site. Not sampled: media was not sampled or not included in the site reports. No outfalls: no site-specific outfalls.

Site	Reach	Type of industry/ operation	Clean-up action(s)	Key studies/reports	River sediment	Site-specific outfall	On-site soil/ sediment/surface water (SW)	Groundwater
Former Steuart Petroleum Company adjacent to WGL	123	Former bulk oil distribution facility (1966-1982); Now mostly demolished	Most structures related to petroleum terminal demolished 3 UST tanks removed (1987)	NOAA 1992 (AST Spill incident response) CH2M Hill 2007 (LUST case)	Site-specific: None Vicinity: Lead	No outfalls	Soil: VOCs, TPH, cyanide	VOCs, TPH-DRO, Metals
Eastern Power Boat Club (EPBC)	123	Adjacent to WGL and Steuart Petroleum; Affected by former pipelines from the facilities	None	RI in progress	Site-specific: None	No outfalls	Soil: PAHs, VOCs, Metals (unspecified)	VOCs (benzene)
Poplar Point	123	Former plant nurseries for Washington DC (1927 to 1993); Naval Receiving Station (1942 to 1960s)	Nurseries abandoned in 1993 Naval buildings demolished in 1980 or transferred to NPS	Ridolfi 2003 (EA) Velinsky et al. 2011 (report) AMEC 2013 (RI scoping document) Phase 1 RI Report scheduled to be completed 2022	Site-specific (subsurface sediment only): PCBs, PAHs Vicinity: PCBs, PAHs, Lead	No outfalls	Soil: PCBs, PAHs (BaP, fluoranthene, pyrene), Pesticides (4,4-DDT, 4,4’-DDE), Metals (As, Cr, Pb) Wetland sediment: PCBs, PAHs (pyrene, benzo(a)-anthracene, phenanthrene), Pesticides (4,4’-DDT, 4,4’-DDD, 4,4’-DDE), Metals (Cr, Pb, Ni)	TPH-DRO, TPH-GRO, PAHs (naphthalene), VOCs (vinyl chloride, benzene, ethylbenzene), Metals (Al, As, Cd, Cr, Pb, Tl, V)

Abbreviations: Al=Aluminum, As=Arsenic, Ba=Barium, BaP=Benzo(a)pyrene, BTEX=Benzene Toluene Ethylbenzene Xylenes, CAP= Corrective Action Plan, CCR= Construction Completion Report, Cd=Cadmium, Co=Cobalt, Cr=Chromium, Cu=Copper, DRO=Diesel Range Organics, EA= Environmental Assessment, EI= Environmental Investigation, Fe=Iron, FS= Feasibility Study, GRO=Gasoline Range Organics, Hg=mercury, IAP= Installation Action Plan, LUST= Leaking Underground Storage Tank, NAPL=Non-aqueous Phase Liquid, NFRAP= No Further Response Action Planned, Ni=Nickel, PA= Preliminary Assessment, PAHs=Polycyclic aromatic hydrocarbons, Pb=Lead, PCBs=Polychlorinated Biphenyls, PECs = Probable Effects Concentrations, RA= Remedial Action, RD= Remedial Design, RI= Remedial Investigation, ROD= Record of Decision, SA= Site Assessment, SI= Sediment Investigation, Tl=Thallium, TPH=Total Petroleum Hydrocarbons, TS= Treatability Study, UFP-SAP= Uniform Federal Policy Sampling and Analysis Plan, V=Vanadium, VOCs=Volatile Organic Compounds, WP= Work Plan

Table 6, Continued. Descriptions of identified potential environmental cleanup sites within each reach of the tidal Anacostia River, including contaminants exceeding screening thresholds in various site media as reported in previous investigations. River sediment data include results from site-specific studies and general sampling in the vicinity of the site. Not sampled: media was not sampled or not included in the site reports. No outfalls: no site-specific outfalls.

Site	**Reach**	**Type of industry/ operation**	**Clean-up action(s)**	**Key studies/reports**	**River sediment**	**Site-specific outfall**	**On-site soil/ sediment/surface water (SW)**	**Groundwater**
Washington Navy Yard (WNY) & Southeast Federal Center (SEFC)	123	WNY: Shipyard (1799-present); SEFC: Former ordnance manufacturing plant (until 1963); Transitioned to administrative services (post-WWII)	Clean out of industrial and storm sewers (1999 to 2000); Excavation/removal of PCB-contaminated soil and materials, removal of Pb-contaminated soil (2000 to 2008)	CH2M Hill 2014, 2017 (RI) UFP-SAP under review by EPA and DOEE (2021) FS for OU2 to be finalized 2021	Site-specific and vicinity: PCBs, PAHs, Lead	Vicinity of WNY 009: PCBs, PAHs	Soil: PAHs, Metals (unspecified)	VOCs (benzene), CVOCs (vinyl chloride)
Joint Base Anacostia-Bolling (JBAB)	123	Former military airfield (1917-1962) and testing facility (1918-1962); Now administrative purposes	No remedial actions reported	CH2M Hill 2011a, 2011b, 2011c, 2012	Site specific: Not sampled Vicinity: None exceeding PECs	No outfalls	Soil: None exceeding ecological criteria	Dioxins, PAHs VOCs (BTEX), cyanide, Metals (Al, As, Ba, Cd, Cr, Cu, Pb, Tl, V, Zn)
Former Hess Oil Corporation Petroleum Terminal	123	Former bulk oil facility (1920-1985)	Tanks removed (2005)	NOAA 1992a (LUST incident response) CH2M Hill 2007 (LUST case) MACTEC 2005 (EI)	Site Specific: Not sampled Vicinity: PCBs, Lead	No outfalls	Soil: PAHs, VOCs (BTEX), TPH, Metals (unspecified)	PAHs, VOCs (BTEX), TPH, Metals (unspecified)

Abbreviations: Al=Aluminum, As=Arsenic, Ba=Barium, BaP=Benzo(a)pyrene, BTEX=Benzene Toluene Ethylbenzene Xylenes, CAP= Corrective Action Plan, CCR= Construction Completion Report, Cd=Cadmium, Co=Cobalt, Cr=Chromium, Cu=Copper, DRO=Diesel Range Organics, EA= Environmental Assessment, EI= Environmental Investigation, Fe=Iron, FS= Feasibility Study, GRO=Gasoline Range Organics, Hg=mercury, IAP= Installation Action Plan, LUST= Leaking Underground Storage Tank, NAPL=Non-aqueous Phase Liquid, NFRAP= No Further Response Action Planned, Ni=Nickel, PA= Preliminary Assessment, PAHs=Polycyclic aromatic hydrocarbons, Pb=Lead, PCBs=Polychlorinated Biphenyls, PECs = Probable Effects Concentrations, RA= Remedial Action, RD= Remedial Design, RI= Remedial Investigation, ROD= Record of Decision, SA= Site Assessment, SI= Sediment Investigation, Tl=Thallium, TPH=Total Petroleum Hydrocarbons, TS= Treatability Study, UFP-SAP= Uniform Federal Policy Sampling and Analysis Plan, V=Vanadium, VOCs=Volatile Organic Compounds, WP= Work Plan

Table 7, Continued. Descriptions of identified potential environmental cleanup sites within each reach of the tidal Anacostia River, including contaminants exceeding screening thresholds in various site media as reported in previous investigations. River sediment data include results from site-specific studies and general sampling in the vicinity of the site. Not sampled: media was not sampled or not included in the site reports. No outfalls: no site-specific outfalls.

Site	Reach	Type of industry/ operation	Clean-up action(s)	Key studies/reports	River sediment	Industrial outfall	On-site soil/ sediment/surface water (SW)	Groundwater
Former Steuart Petroluem/ Gulf Oil Company Petroleum Terminal	123	Former bulk gasoline and fuel oil terminal (Gulf Oil 1930- 1969; Steuart Oil 1969-1989)	NAPL recovery efforts implemented-recovered 2,171 gallons of NAPL (MACTEC 2005)	MACTEC 2005 (EI)	Site Specific: Not sampled Vicinity: PCBs, Lead	No outfalls	Soil: PAHs, VOCs (BTEX), TPH	PAHs, VOCs (BTEX), TPH
Fort McNair	Wash-ington Channel	Army facility, part of the Joint Base Myer-Henderson Hall command	USTs removed in 1987 and 1991 Soil/groundwater contamination resolved according to DOEE	U.S. Army 2016 (IAP)	Site Specific: Not sampled Vicinity: PCBs, PAHs, Lead	No outfalls	Soil: TPH, Metals (As, Pb)	PAHs (naphthalene), TPH
Bureau of Engraving and Printing (BEP)	Wash-ington Channel	Printing of U.S. currency and other security documents (1880s-present)	Removal of PCB-containing transformers and capacitors	None	Site Specific: Not sampled Vicinity: PCBs, Lead	No outfalls	Not sampled	Not sampled

Abbreviations: Al=Aluminum, As=Arsenic, Ba=Barium, BaP=Benzo(a)pyrene, BTEX=Benzene Toluene Ethylbenzene Xylenes, CAP= Corrective Action Plan, CCR= Construction Completion Report, Cd=Cadmium, Co=Cobalt, Cr=Chromium, Cu=Copper, DRO=Diesel Range Organics, EA= Environmental Assessment, EI= Environmental Investigation, Fe=Iron, FS= Feasibility Study, GRO=Gasoline Range Organics, Hg=mercury, IAP= Installation Action Plan, LUST= Leaking Underground Storage Tank, NAPL=Non-aqueous Phase Liquid, NFRAP= No Further Response Action Planned, Ni=Nickel, PA= Preliminary Assessment, PAHs=Polycyclic aromatic hydrocarbons, Pb=Lead, PCBs=Polychlorinated Biphenyls, PECs = Probable Effects Concentrations, RA= Remedial Action, RD= Remedial Design, RI= Remedial Investigation, ROD= Record of Decision, SA= Site Assessment, SI= Sediment Investigation, Tl=Thallium, TPH=Total Petroleum Hydrocarbons, TS= Treatability Study, UFP-SAP= Uniform Federal Policy Sampling and Analysis Plan, V=Vanadium, VOCs=Volatile Organic Compounds, WP= Work Plan

Table 8. Summary of sediment toxicity test results with invertebrates and larval fish. Comparisons are with laboratory control sediment. Tetra Tech invertebrate tests were from samples collected in 2014 and 2015, and larval fish tests were from samples collected in 2016 (Tetra Tech 2019a, including Appendix D and I). Pepco tests were from samples collected in 2017 (AECOM 2020).

Tetra Tech BERA (samples collected in 2014 and 2015)	**Amphipod *(Hyalella azteca)* 42-day survival, growth, and reproduction**				**Midge *(Chironomus dilutes)* 10-day survival and growth**	
Reach	**# Samples**	**No. (%) with reduced survival**	**No. (%) with reduced growth**	**No. (%) with reduced reproduction**	**No. (%) with reduced survival**	**No. (%) with reduced growth**
Washington Channel	6	1 (17%)	0	0	2 (32%)	6 (100%)
123	34	3 (8%)	7 (20%)	8 (24%)	14 (40%)	21 (62%)
456	20	2 (20%)	8 (40%)	0	6 (54%)	4 (36%)
67	7	0	3 (42%)	6 (86%)	7 (100%)	7 (100%)
7	5	0	2 (40%)	0	2 (40%)	1 (20%)
Kingman Lake	10	1 (10%)	2 (20%)	0	4 (40%)	6 (60%)
Total ARSP area	82	7 (8%)	22 (26%)	14 (17%)	35 (42%)	46 (56%)
Potomac River reference	5	0	0	0	0	0
Tetra Tech BERA (samples collected in 2014 and 2015)	**Larval fathead minnow *(Pimephales promelas) 10-day survival and growth***					
Reach	**# Samples**	**No. (%) with reduced survival**	**No. (%) with reduced growth**	**Notes**		
Washington Channel	3	0	0			
123	12	0	1 (8%)	13% decrease from mean control		
456	7	0	0			
67	4	0	0			
7	2	0	0			
Kingman Lake	3	0	1 (33%)	14% decrease from mean control		
Total ARSP area	31	0	2 (6%)			
Pepco (2017)	***Hyalella azteca* (10-day)**				***Chironomus dilutus* (10-day)**	
Reach	**# Samples**	**No. (%) with reduced survival**	**No. (%) with reduced growth**		**No. (%) with reduced survival**	**No. (%) with reduced growth**
Pepco Cove	7	0	4 (57%)		1 (14%)	1 (14%)
Mainstem River	8	0	5 (62%)		0	1 (12%)

Table 9**.** Details on samples with at least a 50% survival or a 50% decline in growth or reproduction compared with average control response. Those samples marked with * also had ≤50% survival. Data from ARSP BERA Appendix D (Tetra Tech 2019a). None of the samples collected for the Pepco Waterside Investigation had < 50% survival or growth (AECOM 2020).

Amphipod *(Hyalella azteca)* 42-day test (2014 samples, n=45)			
	Samples with ≤50% of control survival	**Samples with ≤50% of control growth**	**Samples with ≤50% of control reproduction**
Control range	Survival (%): 85-100	Growth (mg): 0.69 to 0.91 based on n=10 (mean= 0.79)	Reproduction (young/female): 7.1–12.8 (mean=10.4)
Threshold	≤50	≤0.39	≤5.2
Reach and total (n) for those ≤ threshold with response	None	None	Reach 456 (n=3)1.2, 4.6, 5.0
Amphipod *(Hyalella azteca)* 42-day test (2015 samples, n=46, including 5 Potomac reference)			
Control range	**Survival (%): 88-91**	**Growth (mg): 0.31 to 0.44 based on n=10 (mean=0.40)**	**Reproduction (young/female): 4.5–6.4 (mean=5.8)**
Threshold	≤50	≤0.20	≤2.9
Reach and total (n) for those ≤ threshold with response	None	None	Reach 123 (n=6): 2.3, 1.2, 1.9, 2.7, 1.6, 1.8; Reach 456 (n=2): 1.2, 2.2
Midge *(Chironomus dilutes)* 10-day test (2014 samples, n=45)			
	Survival (%):	**Growth (mg):**	
Control range	77.5 to 95.0	1.9 to 2.6 based on n=10 (mean=2.3)	
Threshold	≤50	< 1.1	
Reach and total (n) for those ≤ threshold with response	Reach 123 (n=3): 41.3, 46.3, 47.5; Reach 456 (n=1): 45.0; Kingman Lake (n=1): 42.5	Reach 456 (n=1): 1.1*; Kingman Lake (n=2): 1.0*, 1.1; Washington Channel (n=1): 0.9	
Midge *(Chironomus dilutes)* 10-day test (2015 samples, n=46, including 5 Potomac reference)			
Control range	**Survival (%): 77.5 to 96.3**	**Growth (mg): 2.0 to 2.7, mean=2.2**	
Threshold	≤ 50	≤ 1.1	
Reach and total (n) for those ≤ threshold with response	Reach 123 (n=2): 46.3, 30; Reach 456 (n=3): 12.5, 20, 12.5	Reach 123 (n=13)1.0, 0.9, 0.5*, 0.8, 1.0, 0.7, 0.8, 1.0, 0.3*, 0.6, 1.1, 0.9, 0.7; Reach 456 (n=6): 0.1*, 1.0, 1.0, 0.3*, 0.0*, 0.9 Washington Channel (n=2): 0.6, 1.0	

Table 10. Bird, mammal, and fish lowest observable effect levels (LOAELs) and no observable effect levels (NOAELs) used in the food chain models. Units: mg/kg body weight per day.

Tetra Tech (2019a)	**Belted Kingfisher**		**River Otter**	
Analyte	**Bird High TRV**[a]	**Bird Low TRV (NOAEL)**	**Mammal High TRV**[a]	**Mammal Low TRV (NOAEL)**
Total PCBs	1.27	0.09	1.28	0.36
Aroclor 1248	1.27	0.09	0.1	0.001
Dioxin TEQ	0.00014	0.000014	0.00001	0.000001
Lead	8.75	1.63	240.64	1.0
Pinkney et al. (2006)	**Green Heron**		**Raccoon**	
Analyte	**Bird LOAEL**	**Bird NOAEL**	**Mammal LOAEL**	**Mammal NOAEL**
Aluminum	68.7	49.8	19.3	1.93
Mercury	0.051	0.0051	0.16	0.032
Nickel	79	57.2	1.33	0.13
Selenium	0.8	0.4	0.25	0.025
Zinc	273/223.5[b]	145/10.5[b]	225	22.5
PCBs	0.94	0.094	0.1	0.05
HMW PAHs	20	2	10	1
SRC and NOAA (2000)	**Green Heron**		**Raccoon**	
Analyte	**Bird NOAEL**		**Mammal NOAEL**	
PCBs	0.41		0.069	
Total DDT	0.003		0.62	
Lead	1.13		6.15	
Methyl mercury	0.0006		0.015	
2,3,7,8-TCDD	0.000014		0.0000008	

[a] High TRV: mid-level effect concentration (Tetra Tech 2019a)

[b] Pinkney et al. (2006) used different TRVs for zinc in 2003/2005.

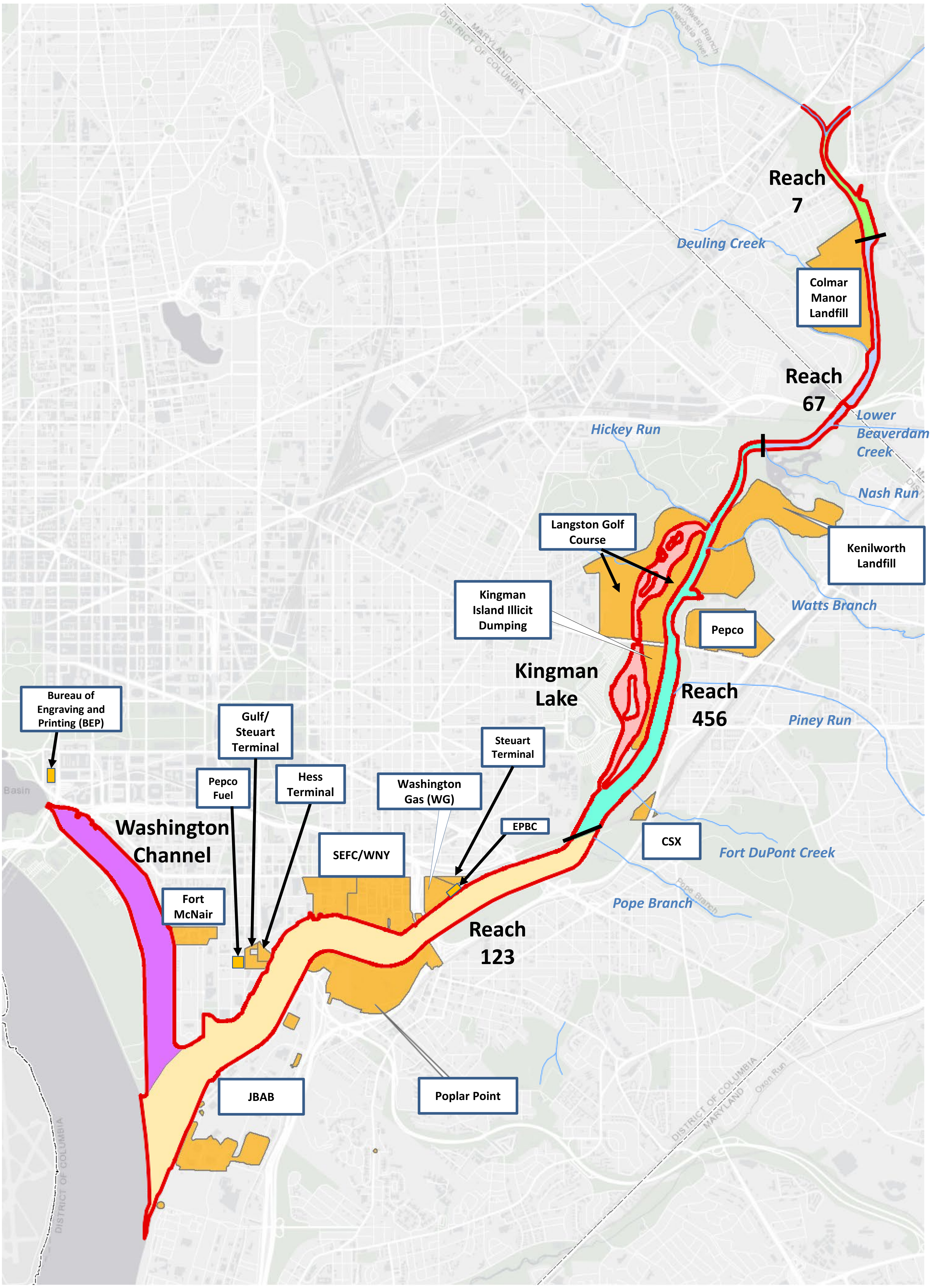

Figure 1. Designated reaches of the tidal Anacostia River, including Kingman Lake and the Washington Channel and locations of potential environmental cleanup sites along each reach. Source of basemap: Final Remedial Investigation Report, Figure 2.16 (TetraTech 2019a).

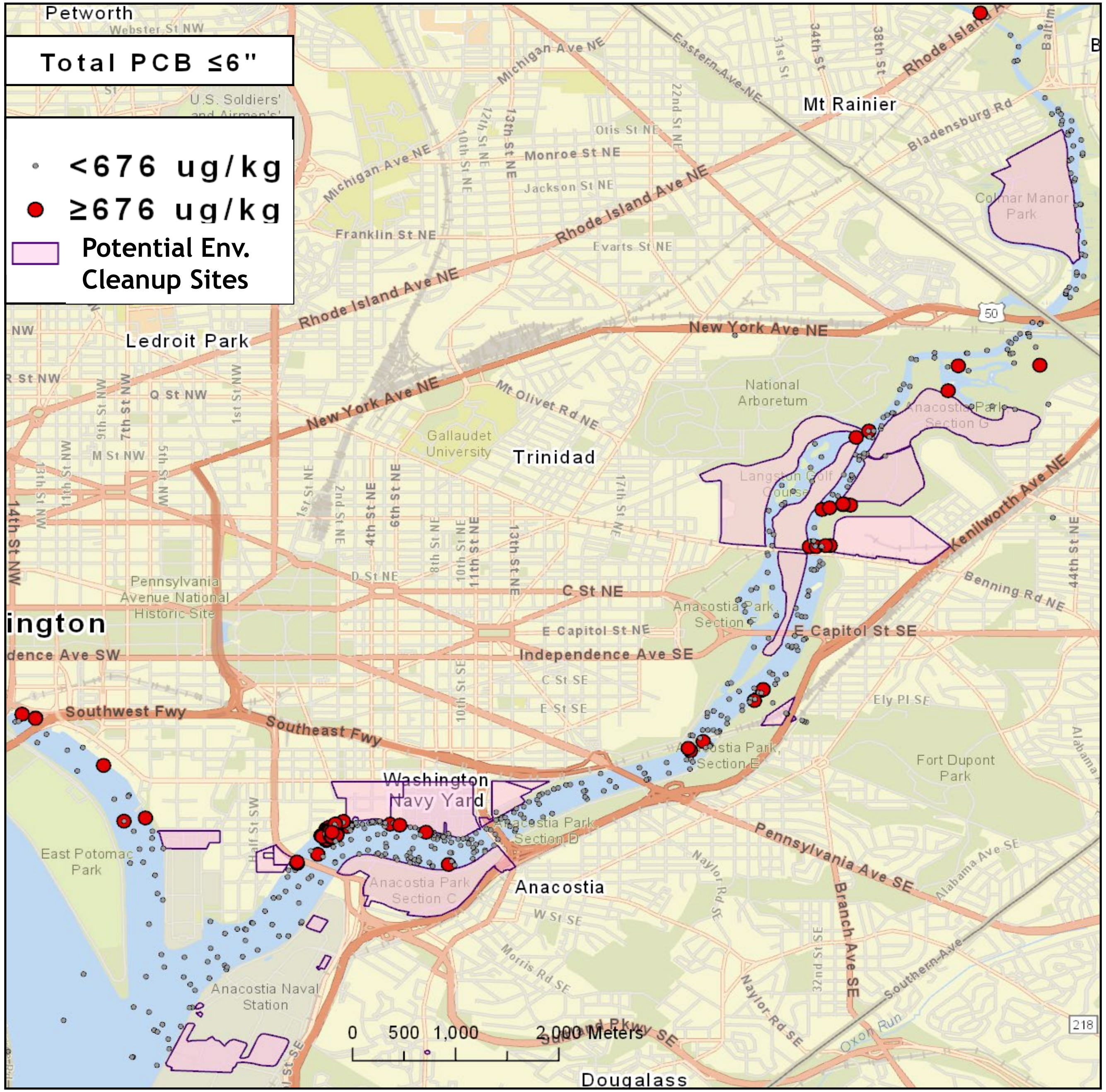

Figure 2. Concentrations of total PCBs in surface sediment samples collected from the tidal Anacostia River between 1989-2016 compared to the consensus-based probable effect concentration, 676 µg/kg (below=grey; exceeded=red). Outlines of potential environmental cleanup sites are also indicated.

Figure 3. Chlordane concentrations in surface sediment samples collected from the tidal Anacostia River between 1989-2016 compared to the consensus-based probable effect concentration, 17.6 µg/kg (below=grey; exceeded=red). Outlines of potential environmental cleanup sites are also indicated.

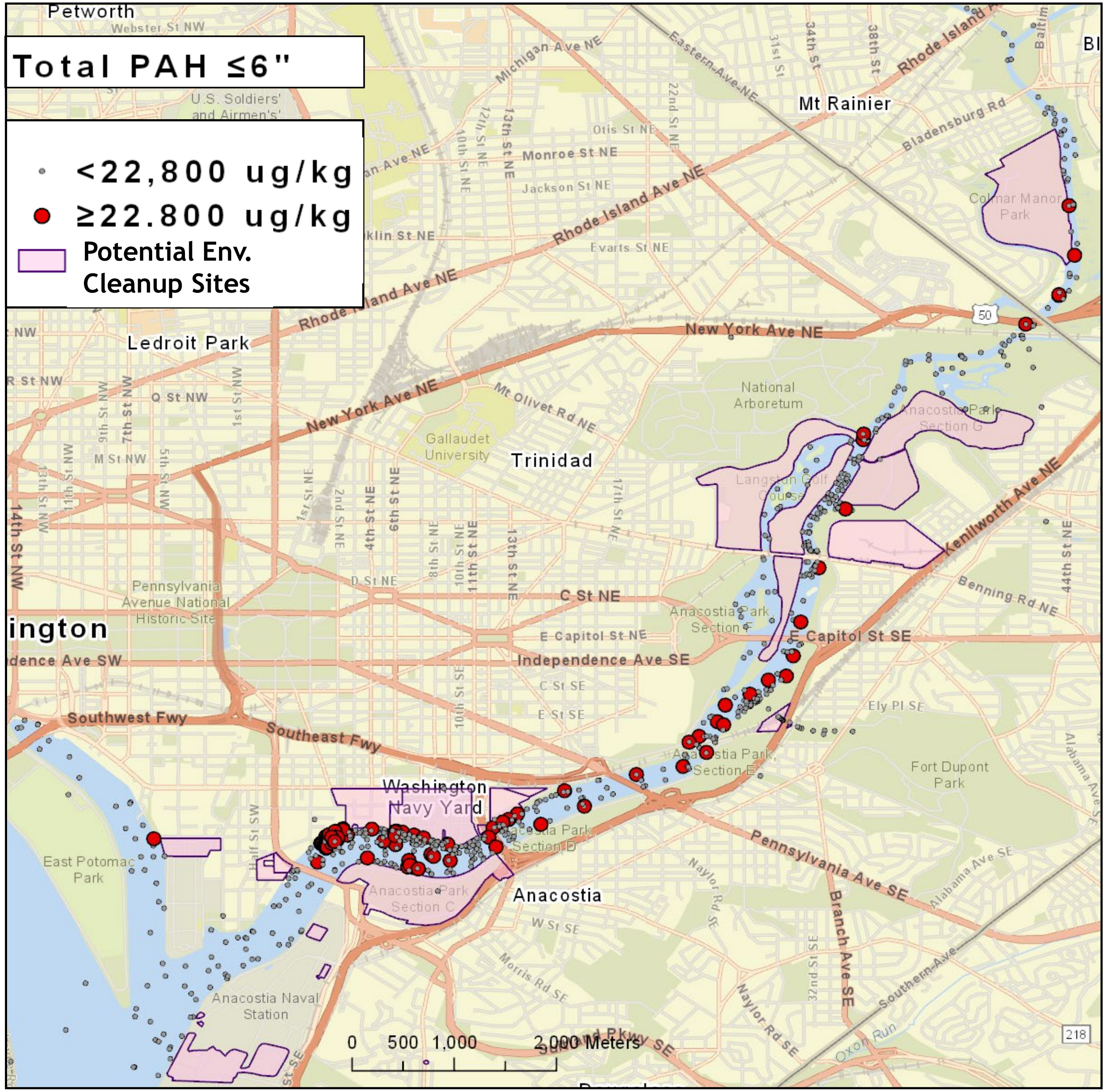

Figure 4. Concentrations of total PAHs in surface sediment samples collected from the tidal Anacostia River between 1989-2016 compared to the consensus-based probable effect concentration, 22,800 µg/kg (below=grey; exceeded=red). Outlines of potential environmental cleanup sites are also indicated.

Figure 5. Lead concentrations in surface sediment samples collected from the tidal Anacostia River between 1989-2016 compared to the consensus-based probable effect concentration, 128 mg/kg (below =grey; exceeded =red). Outlines of potential environmental cleanup sites are also indicated.

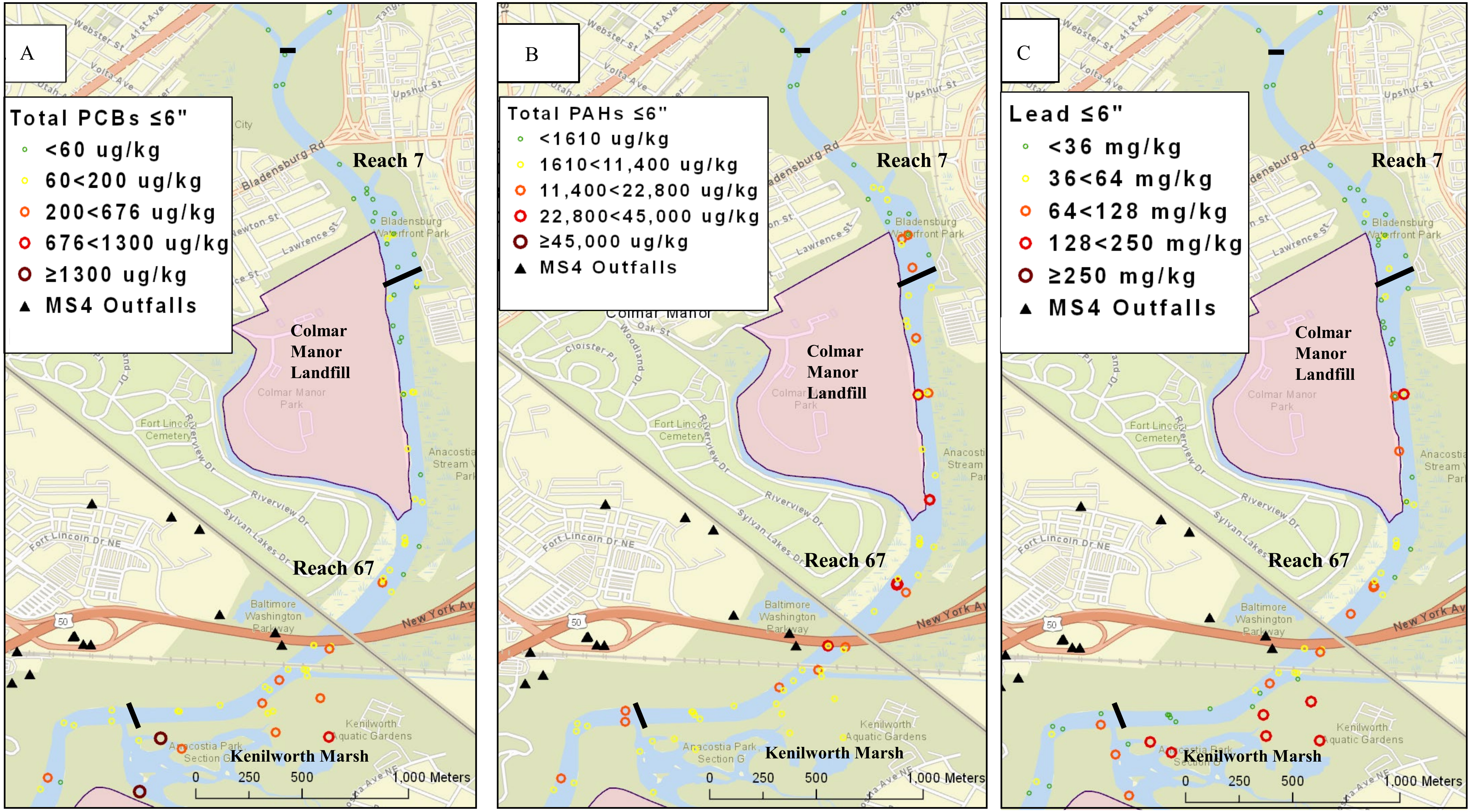

Figure 6. Concentrations of total PCBs (A), total PAHs (B) and lead (C) in surface sediment samples collected from the tidal Anacostia River in Reach 7 and Reach 67 between 1989-2016 compared to consensus-based probable effects concentrations: 676 µg/kg (PCBs), 22,800 µg/kg (PAHs), 128 mg/kg (lead) (below =green, yellow, and orange; exceeded =red and maroon). The outline of one potential environmental cleanup site is indicated.

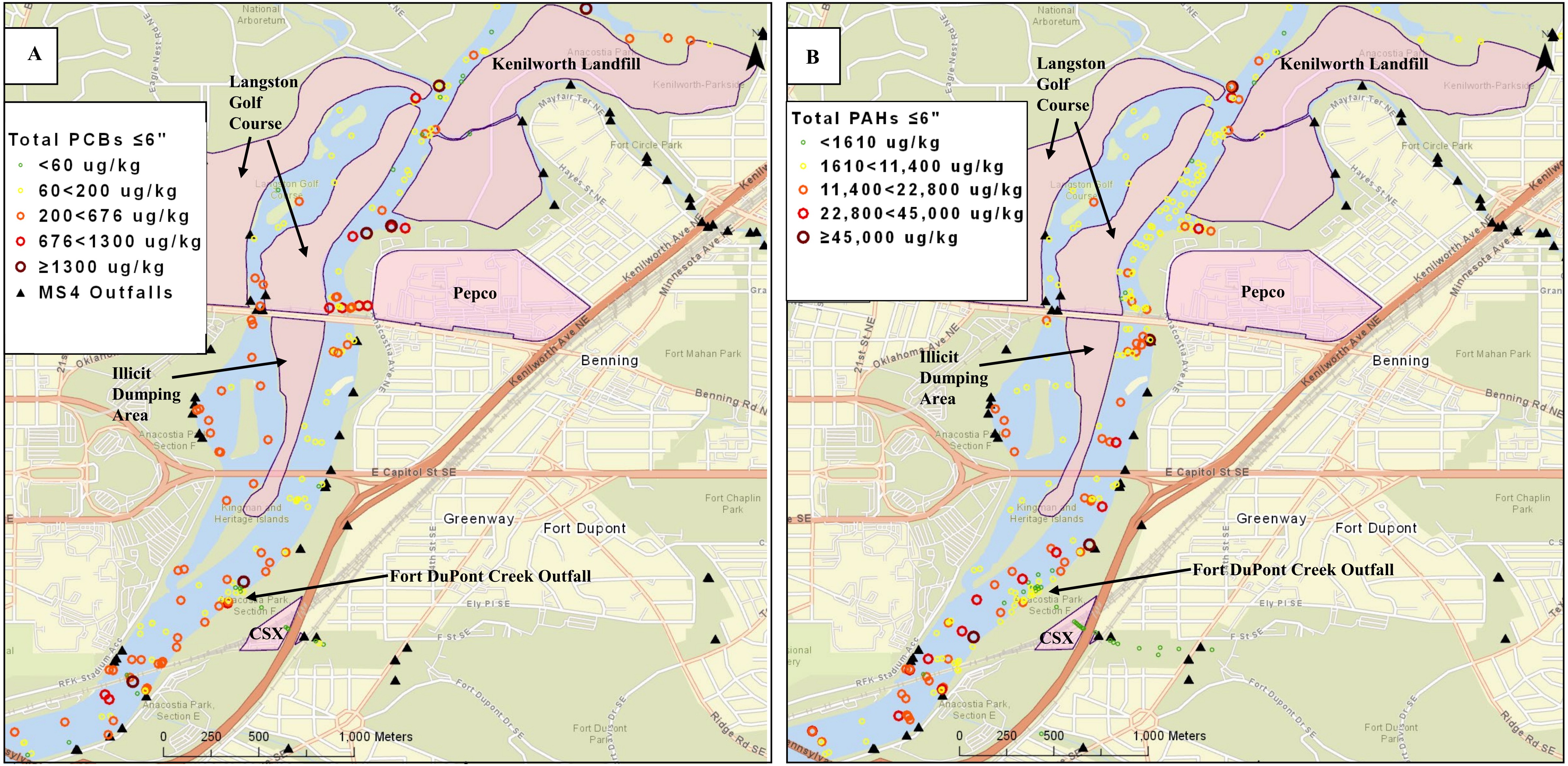

Figure 7. Concentrations of total PCBs (A) and total PAHs (B) in surface sediment samples collected from the tidal Anacostia River in Reach 456 between 1989-2016 compared to consensus-based probable effect concentrations: 676 µg/kg (PCBs) and 22,800 µg/kg (PAHs) (below =green, yellow, and orange; exceeded =red and maroon). The outline of potential environmental cleanup sites are indicated.

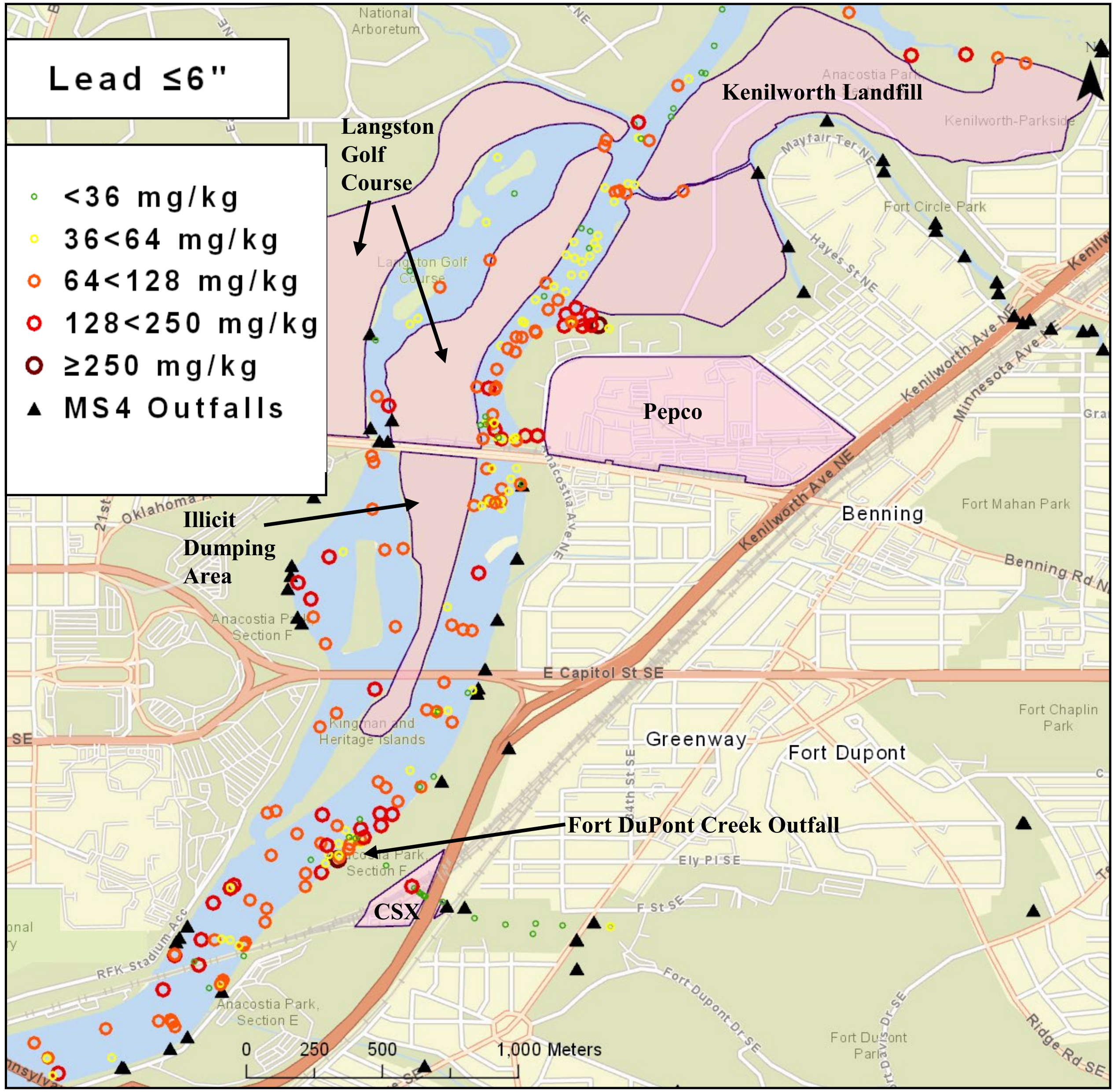

Figure 8. Lead concentrations in surface sediment samples collected from the tidal Anacostia River in Reach 456 between 1989-2016 compared to the consensus-based probable effect concentration, 128 mg/kg (below =green, yellow, and orange; exceeded =red and maroon). The outlines of potential environmental cleanup sites are indicated.

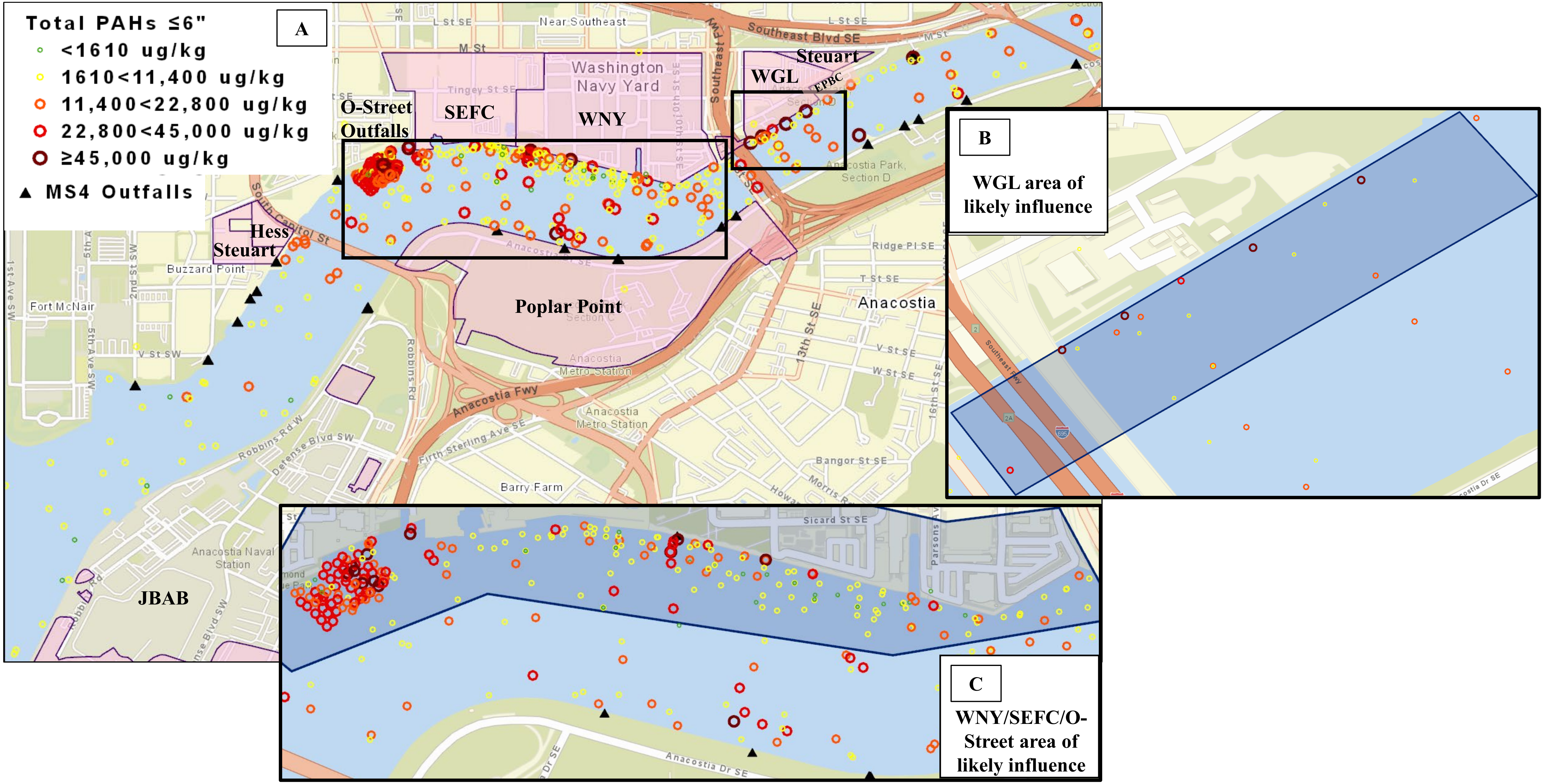

Figure 9. Concentrations of total PAHs in surface sediment samples collected from the tidal Anacostia River in Reach 123 between 1989-2016 compared to the consensus-based probable effect concentration, 22,800 µg/kg (below =green, yellow, and orange; exceeded = red and maroon). The outlines of potential environmental cleanup sites are indicated for the entire reach (A). Shaded areas within cutouts show the areas of likely influence for Washington Gas Light (B) and Washington Navy Yard/Southeast Federal Center/O-Street Outfall Complex (C).

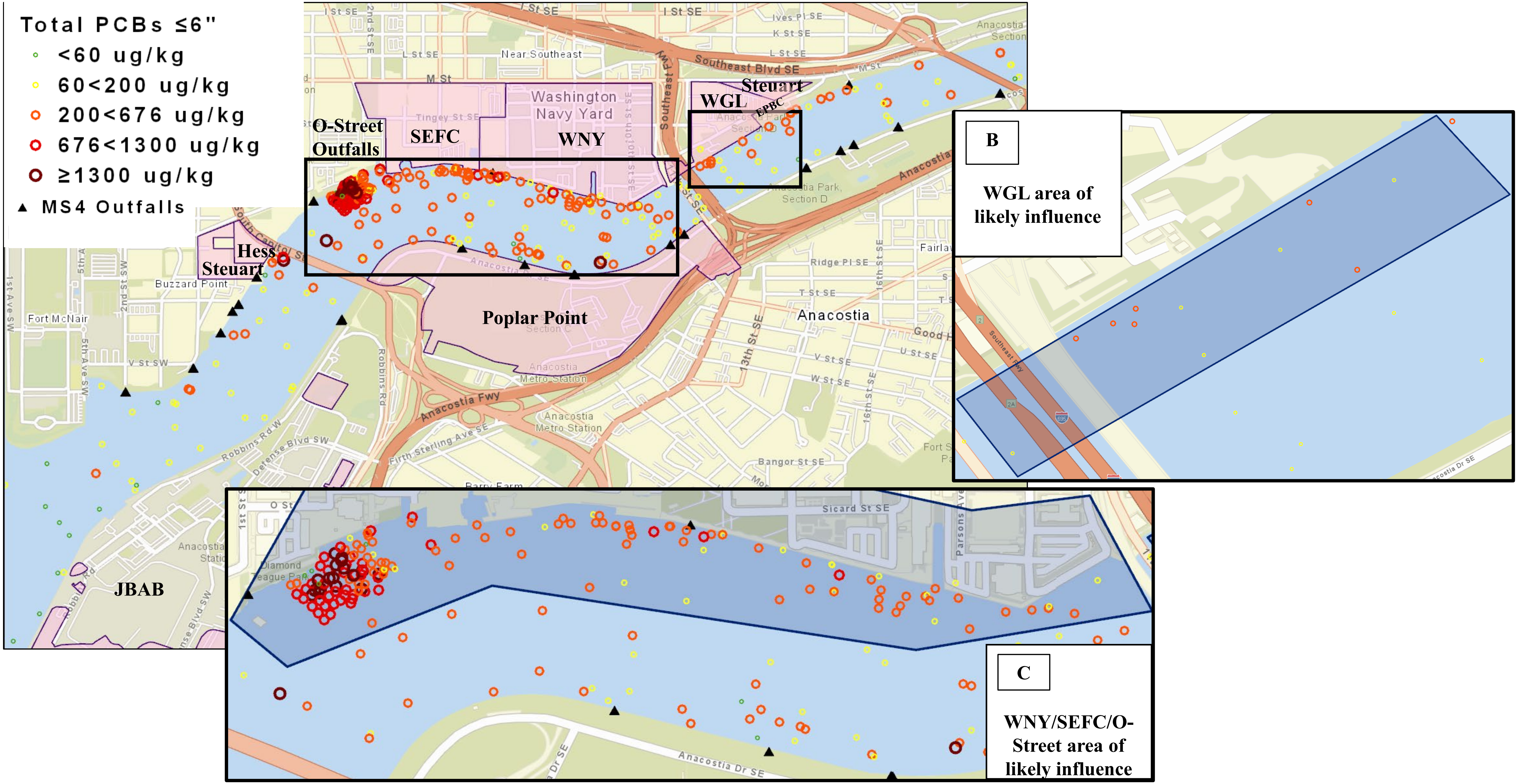

Figure 10. Concentrations of total PCBs in surface sediment samples collected from the tidal Anacostia River in Reach 123 between 1989-2016 compared to the consensus-based probable effect concentration, 676 µg/kg (below = green, yellow, and orange; exceeded = red and maroon). The outlines of potential environmental cleanup sites are indicated for the entire reach (A). Shaded areas within cutouts show the areas of likely influence for Washington Gas Light (B) and Washington Navy Yard/Southeast Federal Center/O-Street Outfall Complex (C).

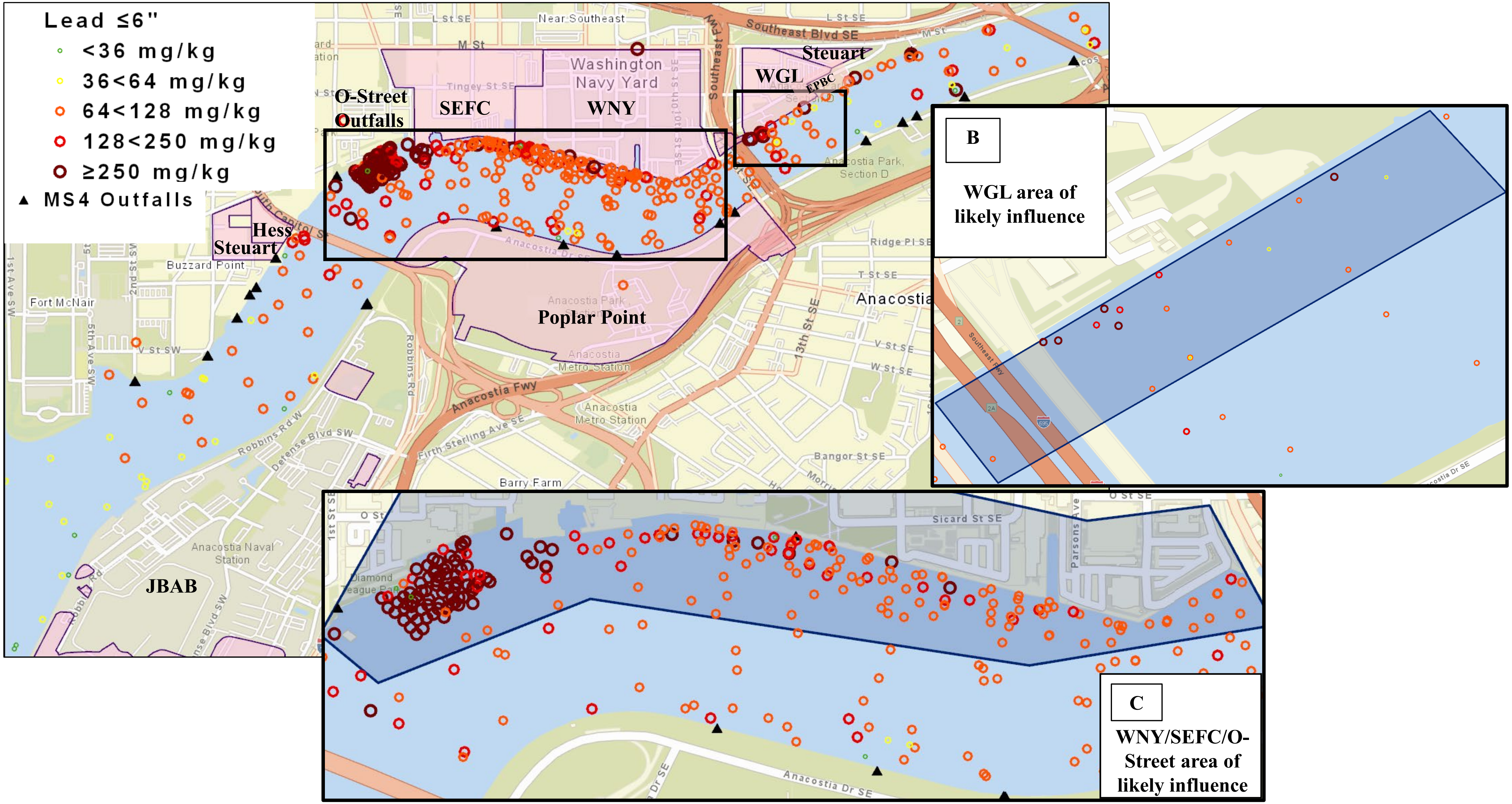

Figure 11. Lead concentrations in surface sediment samples collected from the tidal Anacostia River in Reach 123 between 1989-2016 compared to the consensus-based probable effect concentration, 128 mg/kg (below = green, yellow, and orange; exceeded = red and maroon). The outlines of potential environmental cleanup sites are indicated for the entire reach (A). Shaded areas within cutouts show the areas of likely influence for Washington Gas Light (B) and Washington Navy Yard/Southeast Federal Center/O-Street Outfall Complex (C).

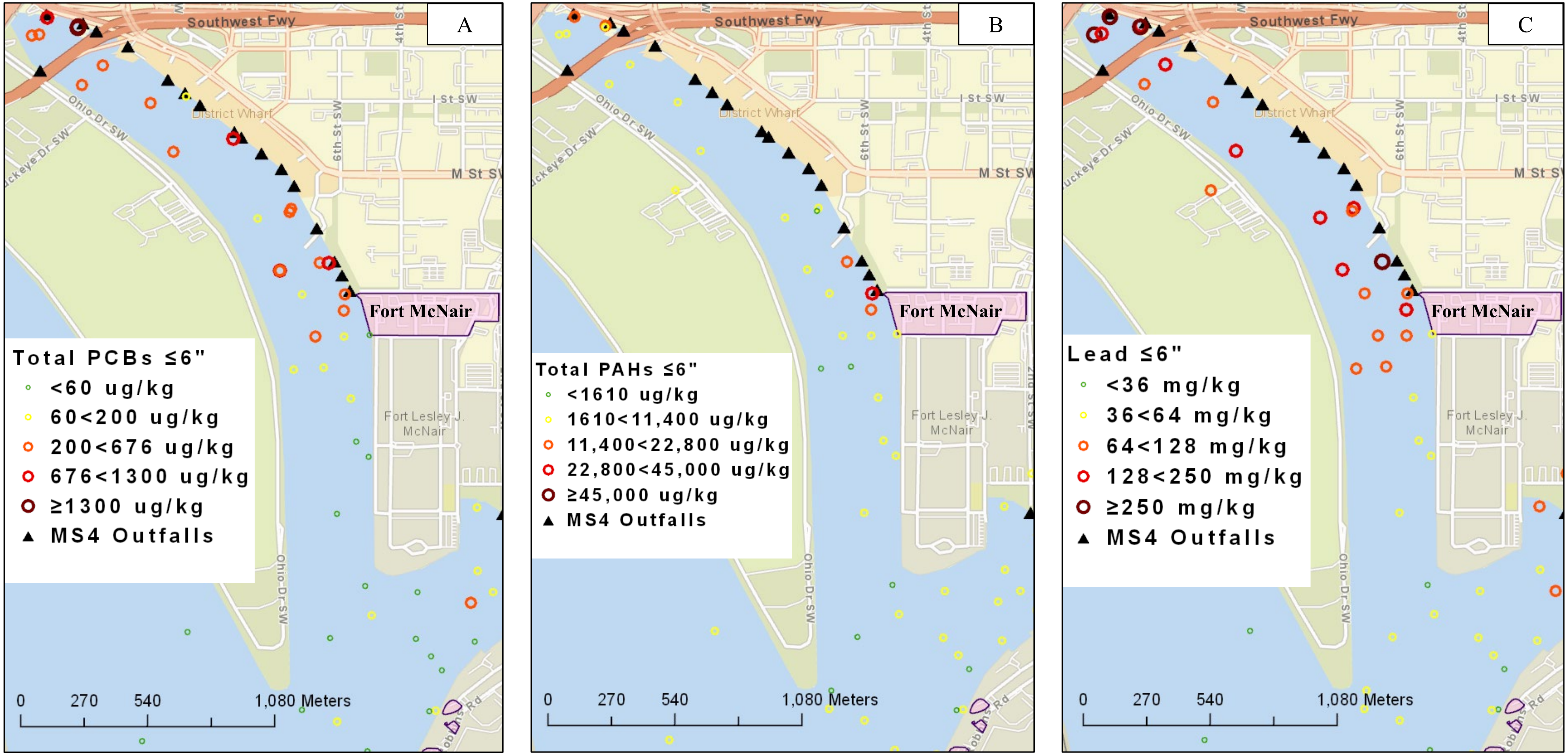

Figure 12. Concentrations of total PCBs (A), total PAHs (B) and lead (C) in surface sediment samples collected from the tidal Anacostia River in the Washington Channel between 1989-2016 compared to consensus-based probable effect concentrations: 676 µg/kg (PCBs), 22,800 µg/kg (PAHs), 128 mg/kg (lead) (below = green, yellow, and orange; exceeded = red and maroon). The outline of one potential environmental cleanup sites is also indicated.

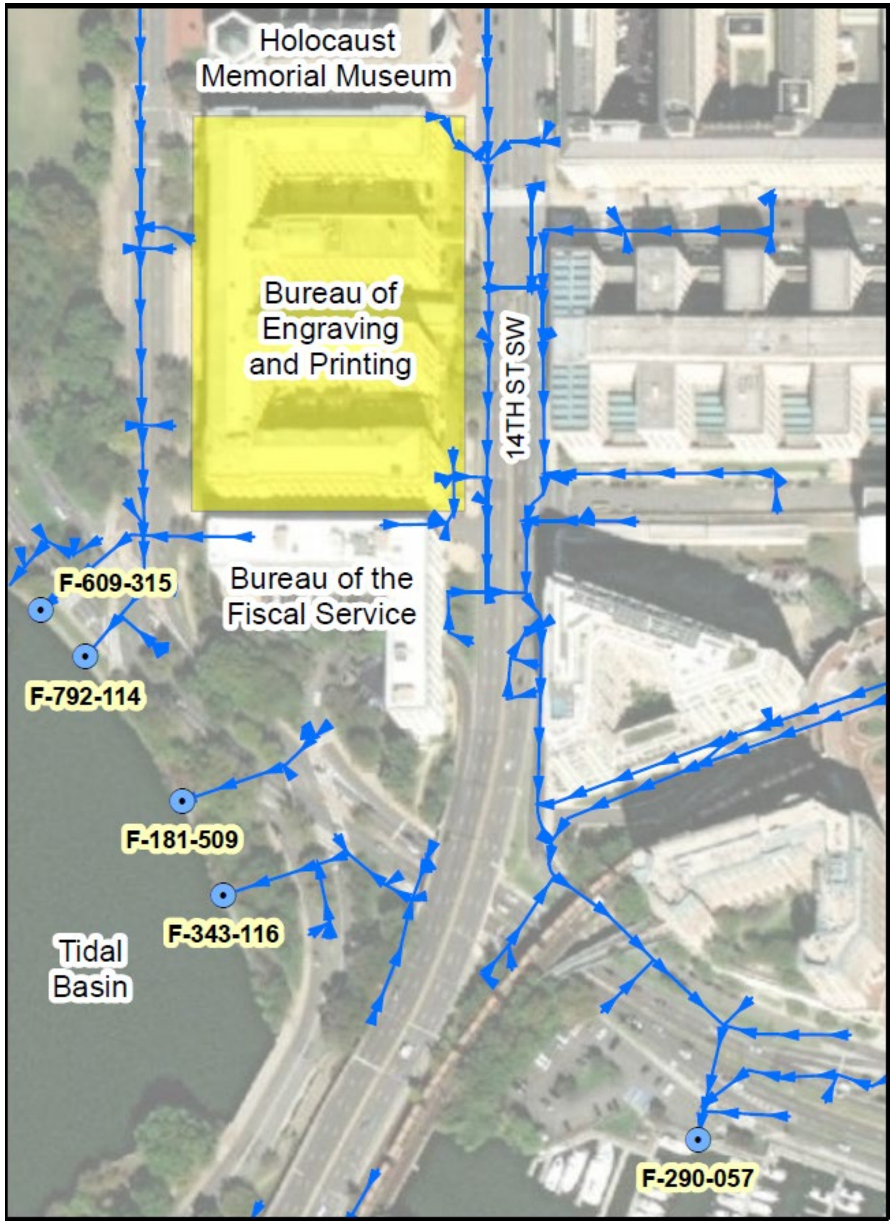

Figure 13. Flow pathways of storm water to MS4 outfalls in the Tidal Basin and the head of the Washington Channel (Outfall F-290-057).

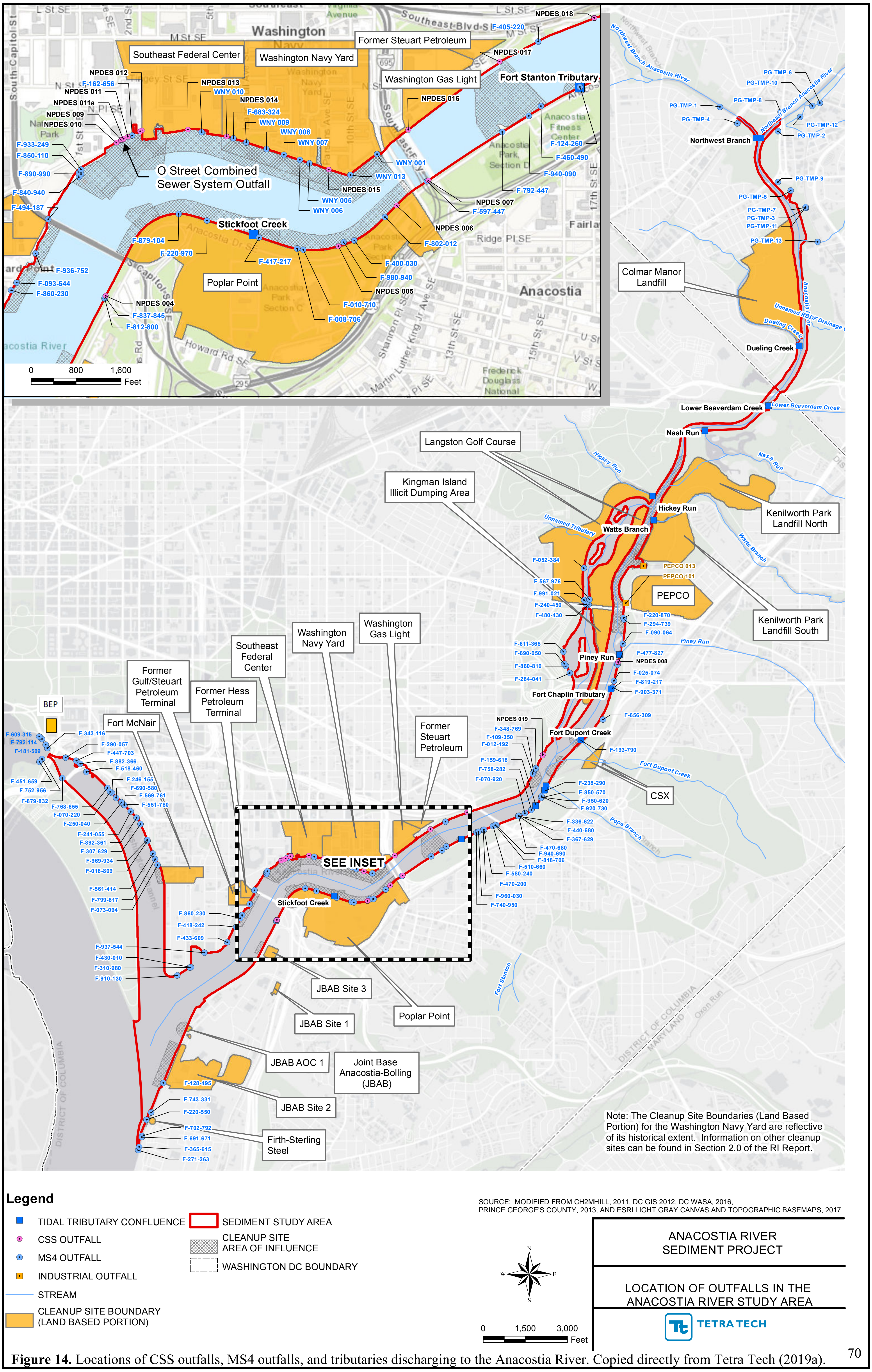

Figure 14. Locations of CSS outfalls, MS4 outfalls, and tributaries discharging to the Anacostia River. Copied directly from Tetra Tech (2019a).

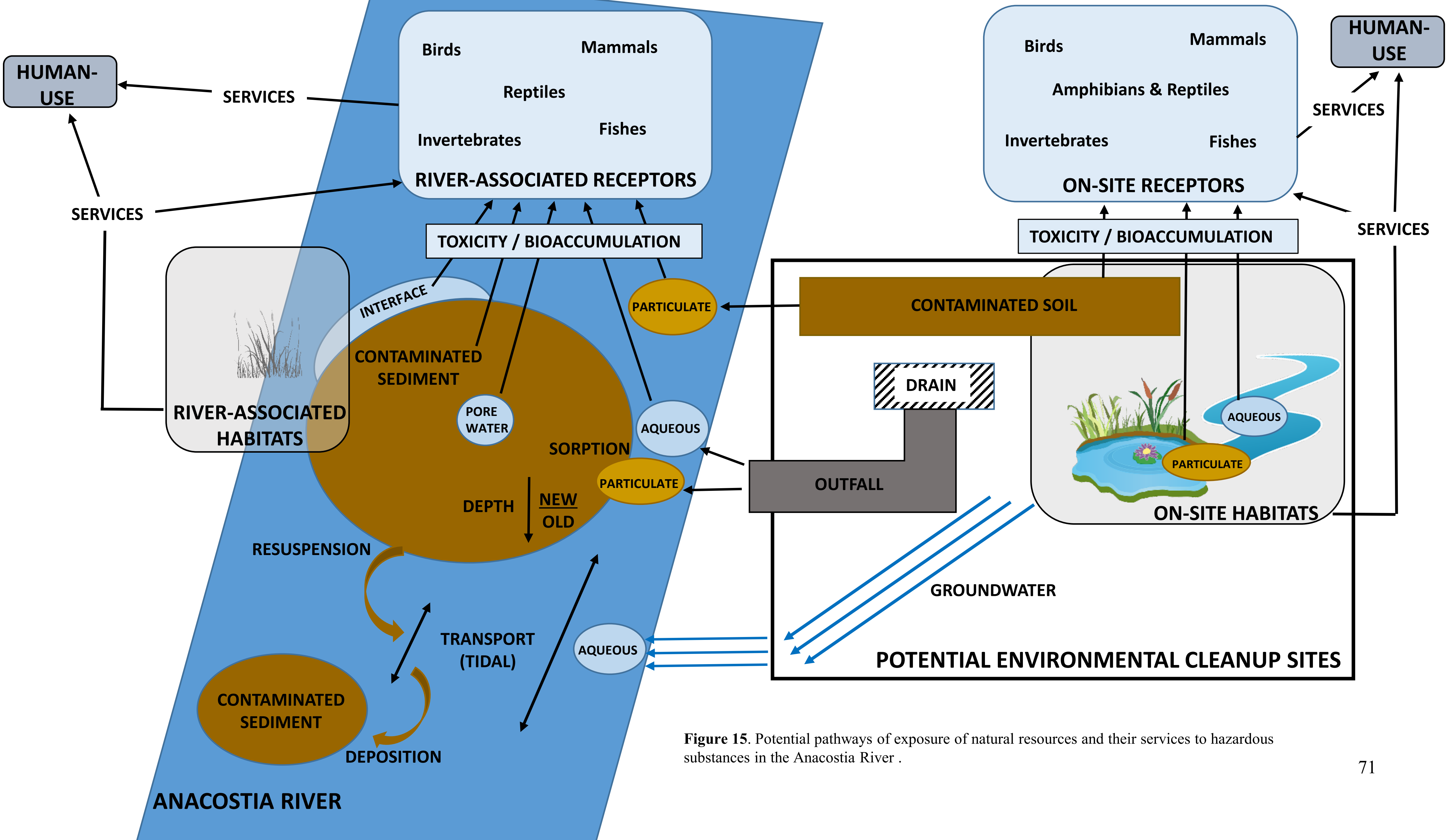

Figure 15. Potential pathways of exposure of natural resources and their services to hazardous substances in the Anacostia River .

APPENDIX A – SPECIES KNOWN OR EXPECTED TO OCCUR IN ANACOSTIA PARK AND THE ANACOSTIA WATERSHED

Table A.1. Fish and Aquatic Invertebrate Species Known or Expected to Occur in the Anacostia Watershed.

Common Name	Scientific Name	Reported in MWCOG (2009)	Collected during DOEE RI (2014)
Fish			
Sea Lamprey	*Petromyzon marinus*	Y	Y
Longnose Gar	*Lepisosteus osseus*	Y	
American Eel	*Anguilla rostrata*	Y	Y
Bay Anchovy	*Anchoa mitchilli*	Y	
Gizzard Shad	*Dorosoma cepedianum*	Y	Y
Blueback Herring	*Alosa aestivalis*	Y	
Alewife	*Alosa pseudoharengus*	Y	
Hickory Shad	*Alosa mediocris*	Y	
American Shad	*Alosa sapidissima*	Y	
Menhaden	*Brevoortia tyrannus*	Y	
Common Carp	*Cyprinus carpio*	Y	Y
Goldfish	*Carassius auratus*	Y	Y
Spottail Shiner	*Notropis hudsonius*	Y	Y
Bluntnose Minnow	*Pimephales notatus*	Y	Y
Eastern Silvery Minnow	*Hybognathus regius*	Y	Y
Golden Shiner	*Notropis crysoleucas*	Y	Y
Bridle Shiner	*Notropis bifrenatus*	Y	
Swallowtail Shiner	*Notropis procne*	Y	
Spotfin Shiner	*Cyprinella spiloptera*	Y	
Common Shiner	*Luxilus cornutus*	Y	
Central Stoneroller	*Campostoma anomalum*		
Quillback	*Carpiodes cyprinus*	Y	Y
Creek Chubsucker	*Erimyzon oblongus*	Y	Y
White Sucker	*Catostomus commersonii*	Y	Y
Golden Redhorse	*Moxostoma erythrurum*	Y	Y
Northern Hogsucker	*Hypentelium nigricans*		Y
Shorthead Redhorse	*Moxostoma macrolepidotum*	Y	
Yellow Bullhead	*Ameiurus natatlis*	Y	Y
Brown Bullhead	*Ameiurus nebolusus*	Y	Y
Blue Catfish	*Ictalurus furcatus*		Y
Channel Catfish	*Ictalurus punctatus*	Y	Y
Eastern Mudminnow	*Umbra pygmaea*	Y	
Atlantic Needlefish	*Strongylura marina*	Y	
Banded Killifish	*Fundulus diaphanus*	Y	Y
Mummichog	*Fundulus heteroclitus*	Y	Y
Eastern Mosquitofish	*Gambusia holbrooki*	Y	Y
Smallmouth Bass	*Micropterus dolomieu*	Y	Y
Largemouth Bass	*Micropterus salmoides*	Y	Y
Black Crappie	*Pomoxis nigromaculatus*	Y	Y
White Crappie	*Pomoxis annularis*	Y	
Redbreast Sunfish	*Lepomis auritus*	Y	Y

Table A.1. Continued.

Common Name	Scientific Name	Reported in MWCOG (2009)	Collected during DOEE RI (2014)
Green Sunfish	*Lepomis cyanellus*	Y	Y
Pumpkinseed	*Lepomis gibbosus*	Y	Y
Longear Sunfish	*Lepomis megalotis*	Y	
Warmouth	*Lepomis gulosus*		Y
Bluegill	*Lepomis macrochirus*	Y	Y
Redear Sunfish	*Lepomis microlophus*		Y
Silverjaw Minnow	*Lepomis gulosus*		
Inland Silverside	*Menidia beryllina*	Y	Y
Tessellated Darter	*Etheostoma olmstedi*	Y	Y
Yellow Perch	*Perca flavescens*	Y	Y
Walleye	*Sander vitreus*	Y	N
Greenside Darter	*Etheostoma blennioides*		
White Perch	*Morone americana*	Y	Y
Striped Bass	*Morone saxatilis*	Y	Y
Northern Snakehead	*Channa argus*	Y	Y
Summer Flounder	*Paralichthys dentatus*	Y	
Bowfin	*Amia calva*		
Shortnosed Sturgeon*	*Acepinser brevirostrum**		
Atlantic Sturgeon*	*Acipenser oxyrhynchus**		
Mollusks – Freshwater Mussels			
Eastern Floater	*Pyganodon cataracta*		
Alewife Floater	*Anodonta implicata*		
Eastern Elliptio	*Elliptio complanata*		
Tidewater Mucket	*Leptodea ochracea*		
Eastern Pondmussel	*Ligumia nasuta*		
Paper Pondshell	*Utterbackia imbecillis*		
Creeper	*Strophitus undulatus*		
Green Floater	*Lasmigona subviridis*		
Eastern Lampmussel	*Lampsilis radiata*		
Northern Lance	*Elliptio, fisheriana*		
Crayfish			
Red Swamp Crayfish	*Procambarus clarkii*		Y
Spinycheek Crayfish	*Orconectes limosus*		Y
Insects – Damselflies and Dragonflies			
Blue-fronted Dancer	*Argia apicalis*		
Familiar Bluet	*Enallagma civile*		
Big Bluet	*Enallagma durum*		
Orange Bluet	*Enallagma signatum*		
Fragile Forktail	*Ischnura posita*		
Common Green Darner	*Anax junius*		
Prince Baskettail	*Epicordulia princeps*		
Eastern Pondhawk	*Erythemis simplicicollis*		
Needham's Skimmer	*Libellula needhami*		

Table A.1. Continued.

Common Name	Scientific Name	Reported in MWCOG (2009)	Collected during DOEE RI (2014)
Twelve-spotted Skimmer	*Libellula pulchella*		
Blue Dasher	*Pachydiplax longipennis*		
Wandering Glider	*Pantala flavescens*		
Spot-winged Glider	*Pantala hymenaea*		
Eastern Amberwing	*Perithemis tenera*		
Common Whitetail	*Plathemis lydia*		

* Federally Listed Endangered species.

DOEE RI = Department of Environment and Energy Remedial Investigation (Tetra Tech 2019).

MWCOG = Adapted from Metropolitan Washington Council of Governments (MWCOG). (2009). Tidal River Environmental Baseline Conditions and Restoration Report (Appendix 3 to the Anacostia River Watershed Restoration Plan). (pp. 26): Prepared for Anacostia Watershed Restoration Partnership.

Table A.2. Non-Aquatic Birds Known or Expected to Occur in Anacostia Park.

Common Name	Scientific Name	Migratory
Bluebird, eastern	*Sialia sialis*	X
Bobolink	*Dolichonyx oryzivorus*	X (Breeds May 20 to Jul 31)
Bunting, indigo	*Passerina cyanea*	X
Cardinal, northern	*Cardinalis cardinalis*	X
Catbird, gray	*Dumetella carolinensis*	X
Chat, yellow-breasted	*Icteria virens*	X
Chickadee, Carolina	*Poecile carolinensis*	X
Cowbird, brown-headed	*Molothrus ater*	X
Creeper, brown	*Certhia americana*	X
Crossbill, white-winged	*Loxia leucoptera*	X
Crow, American	*Corvus brachyrhynchos*	X
Cuckoo, black-billed	*Coccyzus erythropthalmus*	X (Breeds May 15 to Oct 10)
Cuckoo, yellow-billed	*Coccyzus americanus*	X
Dickcissel	*Spiza americana*	X
Dove, mourning	*Zenaida macroura*	X
Eagle, American bald	*Haliaeetus leucocephalus*	X (Breeds Oct 15 to Aug 31)
Falcon, peregrine	*Falco peregrinus*	X
Finch, house	*Haemorhous mexicanus*	X
Finch, purple	*Haemorhous purpureus*	X
Flicker, northern	*Colaptes auratus*	X
Flycatcher, Acadian	*Empidonax virescens*	X
Flycatcher, great crested	*Myiarchus crinitus*	X
Flycatcher, least	*Empidonax minimus*	X
Flycatcher, willow	*Empidonax traillii*	X
Flycatcher, yellow-bellied	*Empidonax flaviventris*	X
Gnatcatcher, blue-gray	*Polioptila caerulea*	X
Goldfinch, American	*Spinus tristis*	X
Grackle, common	*Quiscalus quiscula*	X
Grosbeak, blue	*Passerina caerulea*	X
Grosbeak, evening	*Coccothraustes vespertinus*	X
Grosbeak, rose-breasted	*Pheucticus ludovicianus*	X
Harrier, northern	*Circus hudsonius*	X
Hawk, broad-winged	*Buteo platypterus*	X
Hawk, cooper's	*Accipiter cooperii*	X
Hawk, red-shouldered	*Buteo lineatus*	X
Hawk, red-tailed	*Buteo jamaicensis*	X
Hawk, sharp-shinned	*Accipiter striatus*	X
Hummingbird, ruby-throated	*Archilochus colubris*	X
Jay, blue	*Cyanocitta cristata*	X
Junco, dark-eyed	*Junco hyemalis*	X
Kestrel, American	*Falco sparverius*	X
Killdeer	*Charadrius vociferus*	X
Kingbird, eastern	*Tyrannus tyrannus*	X
Kingbird, western	*Tyrannus verticalis*	X
Kinglet, golden-crowned	*Regulus satrapa*	X
Kinglet, ruby-crowned	*Regulus calendula*	X
Lark, horned	*Eremophila alpestris*	X
Martin, purple	*Progne subis*	X
Meadowlark, eastern	*Sturnella magna*	X

Table A.2. Continued.

Common Name	Scientific Name	Migratory
Merlin	*Falco columbarius*	X
Mockingbird, northern	*Mimus polyglottos*	X
Nighthawk, common	*Chordeiles minor*	X
Nuthatch, red-breasted	*Sitta canadensis*	X
Nuthatch, white-breasted	*Sitta carolinensis*	X
Oriole, Baltimore	*Icterus galbula*	X
Oriole, orchard	*Icterus spurius*	X
Owl, barred	*Strix varia*	X
Owl, great horned	*Bubo virginianus*	X
Owl, snowy	*Bubo scandiacus*	X (Breeds elsewhere)
Phoebe, eastern	*Sayornis phoebe*	X
Pigeon, rock	*Columba livia*	
Pine siskin	*Spinus pinus*	X
Pipit, American	*Anthus rubescens*	X
Quail, bobwhite common	*Colinus virginianus*	
Raven, common	*Corvus corax*	X
Robin, American	*Turdus migratorius*	X
Sapsucker, yellow-bellied	*Sphyrapicus varius*	X
Sparrow, American tree	*Spizelloides arborea*	X
Sparrow, chipping	*Spizella passerina*	X
Sparrow, field	*Spizella pusilla*	X
Sparrow, fox	*Passerella iliaca*	X
Sparrow, grasshopper	*Ammodramus savannarum*	X
Sparrow, house	*Passer domesticus*	X
Sparrow, Lincoln’s	*Melospiza lincolnii*	X
Sparrow, savannah	*Passerculus sandwichensis*	X
Sparrow, song	*Melospiza melodia*	X
Sparrow, swamp	*Melospiza georgiana*	X
Sparrow, vesper	*Pooecetes gramineus*	X
Sparrow, white-crowned	*Zonotrichia leucophrys*	X
Sparrow, white-throated	*Zonotrichia albicollis*	X
Starling, European	*Sturnus vulgaris*	
Swallow, bank	*Riparia riparia*	X
Swallow, barn	*Hirundo rustica*	X
Swallow, cliff	*Petrochelidon pyrrhonota*	X
Swallow, northern rough-winged	*Stelgidopteryx serripennis*	X
Swallow, tree	*Tachycineta bicolor*	X
Swift, chimney	*Chaetura pelagica*	X
Tanager, scarlet	*Piranga olivacea*	X
Tanager, summer	*Piranga rubra*	X
Thrasher, brown	*Toxostoma rufum*	X
Thrush, gray-cheeked	*Catharus minimus*	X
Thrush, hermit	*Catharus guttatus*	X
Thrush, Swainson's	*Catharus ustulatus*	X
Thrush, veery	*Catharus fuscescens*	X
Thrush, wood	*Hylocichla mustelina*	X (Breeds May 10 to Aug 31
Titmouse, tufted	*Baeolophus bicolor*	X
Towhee, eastern	*Pipilo erythrophthalmus*	X
Turkey, wild	*Meleagris gallopavo*	

Table A.2. Continued.

Common Name	Scientific Name	Migratory
Vireo, blue-headed	*Vireo solitarius*	X
Vireo, red-eyed	*Vireo olivaceus*	X
Vireo, warbling	*Vireo gilvus*	X
Vireo, white-eyed	*Vireo griseus*	X
Vireo, yellow-throated	*Vireo flavifrons*	X
Vulture, black	*Coragyps atratus*	X
Vulture, turkey	*Cathartes aura*	X
Warbler, American redstart	*Setophaga ruticilla*	X
Warbler, bay-breasted	*Setophaga castanea*	X
Warbler, black and white	*Mniotilta varia*	X
Warbler, black poll	*Setophaga striata*	X
Warbler, blackburnian	*Setophaga fusca*	X
Warbler, black-throated blue	*Setophaga caerulescens*	X
Warbler, black-throated green	*Setophaga virens*	X
Warbler, blue-winged	*Vermivora cyanoptera*	X
Warbler, Canada	*Cardellina canadensis*	X (Breeds May 20 to Aug 10)
Warbler, Cape May	*Setophaga tigrina*	X
Warbler, cerulean	*Setophaga cerulea*	X (Breeds Apr 29 to Jul 20)
Warbler, chestnut-sided	*Setophaga pensylvanica*	X
Warbler, common yellowthroat	*Geothlypis trichas*	X
Warbler, Connecticut	*Oporornis agilis*	X
Warbler, hooded	*Setophaga citrina*	X
Warbler, Kentucky	*Geothlypis formosa*	X (Breeds Apr 20 to Aug 20)
Warbler, magnolia	*Setophaga magnolia*	X
Warbler, Nashville	*Leiothlypis ruficapilla*	X
Warbler, orange-crowned	*Leiothlypis celata*	X
Warbler, ovenbird	*Seiurus aurocapilla*	X
Warbler, palm	*Setophaga palmarum*	X
Warbler, pine	*Setophaga pinus*	X
Warbler, Northern parula	*Setophaga americana*	X
Warbler, prairie	*Setophaga discolor*	X (Breeds May 1 to Jul 31)
Warbler, prothonotary	*Protonotaria citrea*	X (Breeds Apr 1 to Jul 31)
Warbler, Wilson's	*Cardellina pusilla*	X
Warbler, worm-eating	*Helmitheros vermivorum*	X
Warbler, yellow	*Setophaga petechia*	X
Warbler, yellow-rumped	*Setophaga coronata*	X
Waterthrush, Louisiana	*Parkesia motacilla*	X
Waterthrush, northern	*Parkesia noveboracensis*	X
Waxwing, cedar	*Bombycilla cedrorum*	X
Woodcock, American	*Scolopax minor*	X
Woodpecker, downy	*Dryobates pubescens*	X
Woodpecker, hairy	*Dryobates villosus*	X
Woodpecker, pileated	*Dryocopus pileatus*	X
Woodpecker, red-bellied	*Melanerpes carolinus*	X
Woodpecker, red-headed	*Melanerpes erythrocephalus*	X (Breeds May 10 to Sep 10)
Wood-pewee, eastern	*Contopus virens*	X

Table A.2. Continued.

Common Name	Scientific Name	Migratory
Wren, Carolina	*Thryothorus ludovicianus*	X
Wren, house	*Troglodytes aedon*	X
Wren, marsh	*Cistothorus palustris*	X
Wren, winter/pacific	*Troglodytes hiemalis*	X

X = species is considered migratory and listed as protected by the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-712), the Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 742l), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j).
Blank = species is not considered migratory.

Table A.3. Reported Aquatic Birds Known or Expected to Occur in Anacostia Park.

Common Name	Scientific Name	Feeding Habit	Migratory
Duck-Like Birds			
Bufflehead	*Bucephala albeola*	Omnivore	X
Canvasback	*Aythya valisineria*	Grazer	X
Coot, American	*Fulica americana*	Grazer	X
Duck, American black	*Anas rubripes*	Invertebrates	X
Duck, ring-necked	*Aythya collaris*	Grazer	X
Duck, ruddy	*Oxyura jamaicensis*	Grazer	X
Duck, long-tailed	*Clangula hyemalis*	Invertebrates	X
Duck, wood	*Aix sponsa*	Grazer	X
Grebe, eared	*Podiceps nigricollis*	Piscivore	X
Grebe, horned	*Podiceps auritus*	Piscivore	X
Grebe, pied-billed	*Podilymbus podiceps*	Piscivore	X
Grebe, red-necked	*Podiceps grisegena*	Piscivore	X
Gadwall	*Mareca strepera*	Omnivore	X
Gallinule, common	*Gallinula chloropus*	Omnivore	X
Goldeneye	*Bucephala clangula*	Invertebrates	X
Goose, Canada	*Branta canadensis*	Grazer	X
Goose, snow	*Anser caerulescens*	Grazer	X
Loon, common	*Gavia immer*	Piscivore	X
Loon, red-throated	*Gavia stellata*	Piscivore	X (Breeds elsewhere)
Mallard	*Anas platyrhynchos*	Omnivore	X
Merganser, common	*Mergus merganser*	Piscivore	X
Merganser, hooded	*Lophodytes cucullatus*	Invertebrates	X
Merganser, red-breasted	*Mergus serrator*	Piscivore	X
Oldsquaw	*Clangula hyemalis*	Invertebrates	X
Phalarope, red-necked	*Phalaropus lobatus*	Invertebrates	X
Pintail	*Anas acuta*	Omnivore	X
Rail, sora	*Porzana carolina*	Omnivore	X
Rail, Virginia	*Rallus limicola*	Omnivore	X
Scaup, lesser	*Aythya affinis*	Invertebrates	X
Scaup, greater	*Aythya marila*	Invertebrates	X
Shoveler, northern	*Spatula clypeata*	Omnivore	X
Swan, tundra	*Cygnus columbianus*	Grazer	X
Teal, green-winged	*Anas crecca*	Omnivore	X
Teal, blue-winged	*Spatula discors*	Omnivore	X
Wigeon, American	*Mareca americana*	Grazer	X
Shorebirds			
Bittern, American	*Botaurus lentiginosus*	Piscivore/ Invertebrates	X
Bittern, least	*Ixobrychus exilis*	Piscivore/ Invertebrates	X
Dowitcher, long-billed	*Limnodromus scolopaceus*	Invertebrates	X
Dowitcher, short-billed	*Limnodromus griseus*	Invertebrates	Breeds elsewhere
Dunlin	*Calidris alpina*	Invertebrates	X (Breeds elsewhere)
Egret, cattle	*Bubulcus ibis*	Invertebrates	X
Egret, great	*Ardea alba*	Invertebrates	X

Table A.3. Continued.

Common Name	Scientific Name	Feeding Habit	Migratory
Egret, snowy	*Egretta thula*	Piscivore/Invertebrates	X
Gull, Bonaparte's	*Chroicocephalus philadelphia*	Invertebrates	X
Gull, great black-backed	*Larus marinus*	Omnivore	X
Gull, herring	*Larus argentatus*	Omnivore	X
Gull, laughing	*Leucophaeus atricilla*	Piscivore	X
Gull, ring-billed	*Larus delawarensis*	Omnivore	X
Heron, black-crowned night	*Nycticorax nyticorax*	Piscivore/ Invertebrates	X
Heron, yellow-crowned night	*Nyctanassa violacea*	Invertebrates	X
Heron, great blue	*Ardea herodias*	Piscivore	X
Heron, green	*Butorides virescens*	Piscivore/ Invertebrates	X
Heron, little blue	*Egretta caerulea*	Piscivore/ Invertebrates	X
Ibis, glossy	*Plegadis falcinellus*	Invertebrates	X
Plover, semipalmated	*Charadrius semipalmatus*	Invertebrates	X
Sanderling	*Calidris alba*	Invertebrates	X
Sandpiper, least	*Calidris minutilla*	Invertebrates	X
Sandpiper, pectoral	*Calidris melanotos*	Invertebrates	X
Sandpiper, semipalmated	*Calidris pusilla*	Invertebrates	X (Breeds elsewhere)
Sandpiper, solitary	*Tringa solitaria*	Invertebrates	X
Sandpiper, spotted	*Actitis macularius*	Invertebrates	X
Sandpiper, stilt	*Calidris himantopus*	Invertebrates	X
Snipe, Wilson's	*Gallinago delicata*	Invertebrates	X
Stilt, black-necked	*Himantopus mexicanus*	Invertebrates	X
Stork, wood	*Mycteria americana*	Piscivore	X
Tern, Caspian	*Hydroprogne caspia*	Piscivore	X
Tern, Forsters	*Sterna forsteri*	Piscivore	X
Tern, least	*Sternula antillarum*	Piscivore	X (Breeds Apr 20 to Sep 10)
Yellowlegs, greater	*Tringa melanoleuca*	Invertebrates	X
Yellowlegs, lesser	*Tringa flavipes*	Invertebrates	X (Breeds elsewhere)
Blackbirds			
Blackbird, red-winged	*Agelaius phoeniceus*	Omnivore	X
Blackbird, rusty	*Euphagus carolinus*	Omnivore	X (Breeds elsewhere)
Other Species			
Cormorant, double-crested	*Phalacrocorax auritus*	Piscivore	X
Crow, fish	*Corvus ossifragus*	Omnivore	X
Kingfisher, belted	*Megaceryle alcyon*	Piscivore	X
Osprey	*Pandion haliaetus*	Piscivore	X

X = species is considered migratory and listed as protected by the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-712), the Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 742l), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j).
Blank = species is not considered migratory.

Table A.4. Mammals, Amphibians, and Reptiles Known or Expected to Occur in Anacostia Park.

Common Name	Scientific Name
Mammals	
Beaver	*Castor candensis*
Big brown bat	*Eptesicus fuscus*
Eastern chipmunk	*Temias striatus*
Eastern cottontail	*Sylvilagus floridanus*
Eastern gray squirrel	*Sciurus carolinesis*
Eastern mole	*Scalopus aquaticus*
Gray fox	*Urocyon cinereoargenteus*
Meadow vole	*Microtus pennsylvanicus*
Mink	*Mustela vision*
Muskrat	*Ondatra zibethica*
Northern long-eared bat*	*Myotis septentrionalis**
Opossum	*Diadelphis marsupialis*
Raccoon	*Procyon lotor*
Red bat	*Lassiurus borealis*
Red fox	*Vulpes vulpes*
River otter	*Lultra canadensis lataxina*
Short-tail shrew	*Blarina brevicauda*
Starnose mole	*Condylura cristata*
White-footed mouse	*Peromyscus leucopus*
White-tailed deer	*Odocoileus virginiana*
Woodchuck	*Marmota monax*
Amphibians	
Gray treefrog	*Hyla versicolor*
Green frog	*Rana darnitans meianota*
Marbled salamander	*Ambystoma opacum*
Northern cricket frog	*Acris crepitans*
Northern dusky salamander	*Desmognathus fuscus*
Northern red salamander	*Pseudotriton ruber*
Northern two-lined salamander	*Eurycea bislineata bislineata*
Pickerel frog	*Rana palustris*
Red spotted newt	*Notothalmus viridescens*
Red-backed salamander	*Plethodon cinereus*
Southern leopard frog	*Rana utricularia*
Spotted salamander	*Ambystoma maculaturm*
Spring peeper	*Pseudactis crucifer*
Upland chorus frog	*Pseudacris triseriata*
Wood frog	*Rana sylvatica*
Reptiles	
Black rat snake	*Elaphe o. obsoleta*
Common musk turtle	*Sternotherus odoratus*
Eastern box turtle	*Terrapene c. carolina*
Eastern garter snake	*Thamnophis sirtalis*

Table A.4. Continued.

Common Name	Scientific Name
Eastern hognose snake	*Heterodon pfatyrhinos*
Eastern mud turtle	*Kinosternon s. subrubrum*
Eastern painted turtle	*Chrysemys p. picta*
Eastern worm snake	*Carphophis amoenus*
Fence lizard	*Sceloporus undulatus hyacinthinus*
Five-lined skink	*Eumeces fasciatus*
Northern black racer snake	*Columber c. constrictor*
Northern brown snake	*Storeria d. dekayi*
Northern ringneck snake	*Diadophis punctatus edwardsi*
Northern water snake	*Nerodia s. sipedon*
Queen snake	*Regina septemvittata*
Red-bellied turtle	*Pseudemys rubriventris*
Red-eared slider turtle	*Trachemys scripta elegans*
Ribbon snake	*Thamnophis sauritis*
Rough green snake	*Ophedodrys aestivus*
Snapping turtle	*Chelydra serpentina*
Spotted turtle	*Clemmys guttata*

*Federally listed threatened species

Sources

Ashton, M. and K. Sullivan. 2016. Assessment of the Freshwater Mussel Community of the Tidal-freshwater Anacostia River. Prepared for Anacostia Watershed Society. Maryland Department of Natural Resources.

eBird Dataset, Cornell Lab of Ornithology. 2019. Retrieved from https://www.allaboutbirds.org/guide/

National Park Service. 2018. Birds and Climate Change: Anacostia Park.

Orr, R. 2001. The Dragonflies and Damselflies (Insecta: Odonata) of the Aquatic Gardens, Kenilworth Marsh, Kingman Lake/Marsh, National Arboretum and the Anacostia River from New York Avenue south to Benning Bridge (Washington, DC). Report prepared for the Nature Conservancy, January 2001.

TetraTech. 2019. Remedial Investigation Report, Appendix I. Anacostia River Sediment Project, Washington DC. Prepared for Department of Energy and Environment. December 2019.

U.S. Fish and Wildlife Service. 2020. General Provisions; Revised List of Migratory Birds. *Federal Register* 85 (74): 21282-21305.