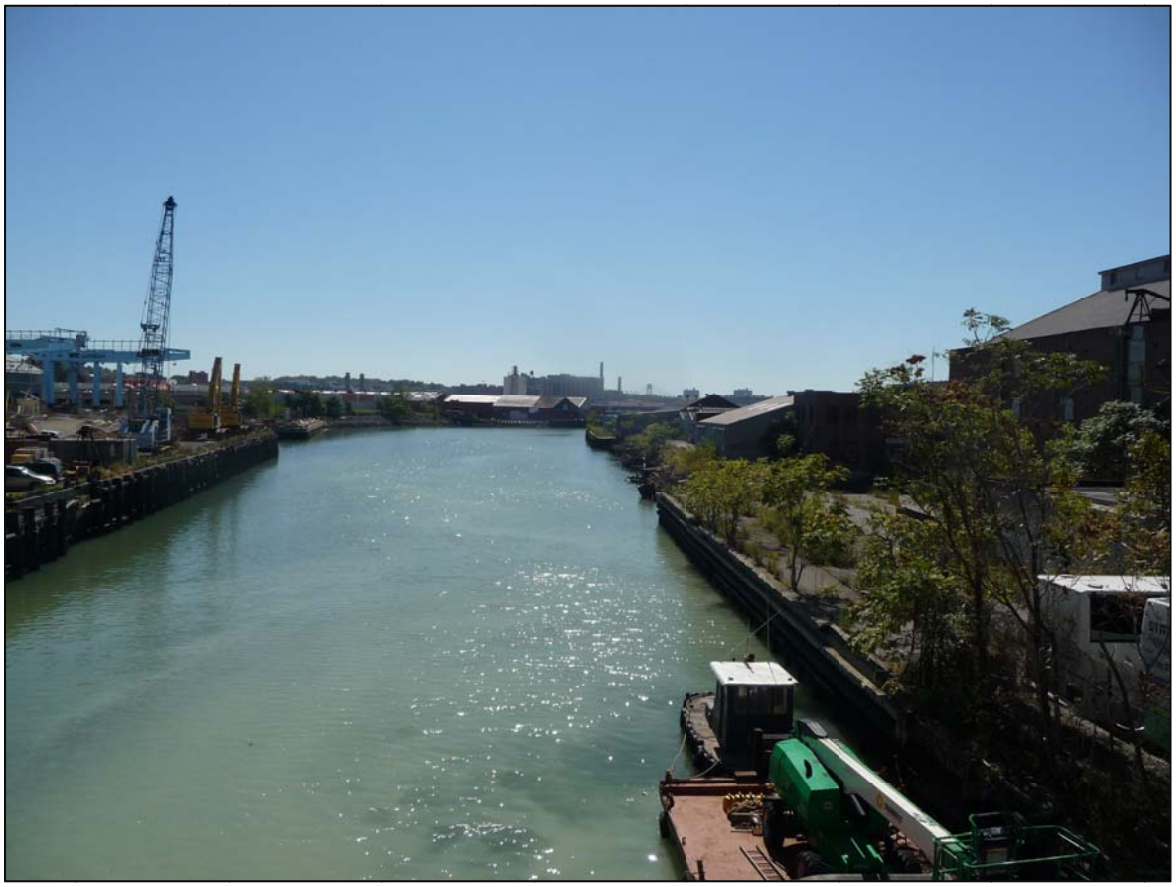
PREASSESSMENT SCREEN
GOWANUS CANAL SUPERFUND SITE

KINGS COUNTY, NEW YORK



Issued by:

The United States Department of the Interior, New York State Department of Environmental Conservation, and National Oceanic and Atmospheric Administration in their capacity as Trustees of Natural Resources

December 2014

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I. INTRODUCTION, AUTHORITIES, AND DELEGATIONS

This determination concerns potential claims for damages pertaining to injured natural resources of or pertaining to the Gowanus Canal Superfund Site and adjacent ecosystems (referred to herein as the "Gowanus Canal Superfund Site" or the "Site"), as authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq., as amended; the Oil Pollution Act of 1990 (OPA), 33 U.S.C. §2701 et seq.; and the Clean Water Act (CWA), 33 U.S.C. §1251 et seq. Based on their review of relevant information gathered as of this date, the U.S. Department of the Interior (DOI), acting through the U.S. Fish and Wildlife Service (USFWS), the State of New York, acting through the New York State Department of Environmental Conservation (NYSDEC), and the Department of Commerce, acting through the National Oceanic and Atmospheric Administration (NOAA) (collectively referred to as the "Trustees") have determined that there is a strong probability that a claim for damages to natural resources under their trusteeship exists for this case. This determination was prepared by the Trustees under the authority of Section 107(f) of CERCLA, as amended, 42 U.S.C. §9607(f); the National Contingency Plan, 40 CFR Part 300; the DOI Natural Resource Damage Assessment Regulations, 43 CFR Part 11; Section 1006 of OPA, 33 U.S.C. §2706, New York State Navigation Law Article 12, and other applicable Federal and State laws, regulations, and directives that serve to designate Federal, Tribal, and State natural resource Trustees and that authorize the recovery of natural resource damages.

43 CFR Part 11 provides that the first step in developing a natural resource damage claim is preparation of a Preassessment Screen. The purpose of a Preassessment Screen is to provide a review of readily available information on hazardous substance releases and potential impacts of those releases on natural resources under the trusteeship of Federal, Tribal, and State authorities. The review should ensure there is a reasonable probability of making a successful claim against the parties responsible for releasing hazardous substances into the environment (hereinafter referred to as the "Potentially Responsible Parties" or "PRPs"). Specifically, the Trustees have determined that:

- A release of hazardous substances and discharge of oil have occurred.
- Natural resources for which the Trustees may assert trusteeship under CERCLA, OPA, CWA, or State statutory and common law claims are likely to have been adversely affected by the discharge or release.
- The quantity and concentration of the discharged oil and/or released hazardous substances is sufficient to potentially cause injury to those natural resources.
- Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.
- Response actions, carried out or planned, do not or will not sufficiently remedy the injury to natural resources without further action.

II. INFORMATION ON THE GOWANUS CANAL SITE AND DISCHARGE OR RELEASE

A. Gowanus Canal Background and History

The Gowanus Canal Superfund Site (Site) was added to the National Priority List in 2010. The Gowanus Canal (Canal) is a 1.8-mile-long waterway in the Borough of Brooklyn, Kings County, New York. The Canal extends from Butler Street in Brooklyn to Gowanus Bay, and ultimately, Upper New York Bay (Figure 1). The watershed is approximately 1,758 acres in size.

The Gowanus Canal was originally a tidal creek with numerous small tributaries and adjoining wetlands. By the 1840s, Gowanus Creek and its tributaries had been dammed and were used to power tide mills (Hunter 2004; USEPA 2011a). In 1848, the State of New York authorized construction of the Gowanus Canal to facilitate barge traffic, flush sewage, and drain wetlands (USEPA 2011a). The Gowanus Canal Improvement Commission completed construction of the Canal and four of its basins between 1866 and 1870 (Hunter 2004).

Once the Canal was constructed in the 1860s and 1870s, development along the Canal grew rapidly and included manufactured gas plants (MGPs), coal yards, cement manufacturers, tanneries, paint and ink factories, chemical plants, lumber yards, and oil terminals. As a result of canal-side industrial development and inadequate treatment of sewage, the Canal has received discharges of industrial waste and sewage for well over 100 years. Although few active industrial dischargers remain, hazardous substances and oil continue to discharge to the Canal from industrial sites. Also, the Canal receives approximately 377 million gallons of combined sewer overflow (CSO) discharge per year during the approximately 75 annual CSO events (New York City Department of Environmental Protection [NYCDEP] 2008). Low fresh water inputs and poor circulation with the downstream bay, coupled with inputs from point and non-point pollution, have contributed to a low oxygen, nutrient rich environment in the Gowanus Canal.

In 1911, the City of New York began operating the Gowanus Canal flushing tunnel to ameliorate the discharge of sewage and other waste into the canal. The flushing tunnel connected the head of the Canal with the Buttermilk Channel in Upper New York Bay. This tunnel was designed to flush contaminants from the canal by pumping water in either direction. It functioned until the mid-1960s when it fell into disrepair. It was reactivated in 1999 by the NYCDEP and again shut down in 2010 to perform facility improvement (USEPA 2011a, 2013). Flushing tunnel and pump station improvements were implemented and the flushing tunnel was reactivated in May of 2014. In the absence of an operational flushing tunnel, dissolved oxygen levels throughout most of the Canal can fall below the 3.0 mg/L water quality standard for Class SD waters (NYCDEP 2008).

Limited dredging of Canal sediments has occurred. The most recent navigational dredging of the Gowanus Canal was conducted by the U.S. Army Corps of Engineers (USACE) in 1971 and 1975. The NYCDEP dredged sediment from the Canal in 1998 as part of the flushing tunnel reactivation (NYCDEP 2008).

Figure 1. Gowanus Canal

The Gowanus Canal is tidal, with a vertical tidal range of 4.7 to 5.7 feet. The only significant fresh water flows to the Gowanus Canal are precipitation and CSO discharges. The Gowanus Canal is designated by the State of New York as a Class SD waterbody, indicating that its best use is for fishing and the waters are supposed to be suitable for fish, shellfish, and wildlife survival. Although the Gowanus Canal is designated as a Class SD waterbody, the NYSDEC has determined that the Gowanus Canal does not support the designated use of fishing and the Canal has been on the Clean Water Act Section 303(d) list of impaired waterbodies since 1998. The cause of the 303(d) listing was/is floatables, odors, and oxygen demand due to urban and storm runoff and CSOs. The Gowanus Canal remains on the 303(d) list as of 2012 (http://www.dec.ny.gov/chemical/31290.html). The Gowanus Canal discharges to Upper New York Bay, which is also currently on the USEPA Clean Water Act 303(d) list of impaired waters due to polychlorinated biphenyls (PCBs) and other toxics that may include mercury, dioxins/furans, polycyclic aromatic hydrocarbons (PAHs), pesticides, and other heavy metals (http://www.dec.ny.gov/docs/water_pdf/303dlistfinal12.pdf).

B. Hazardous Substance, Oil and Combined Sewer Overflow Releases

Hazardous Substances

Historical industries along the Canal that likely contributed to the release of hazardous substances included coal yards, cement manufacturers, tanneries, paint and ink factories, chemical plants, oil terminals, and three manufactured gas plants (MGPs). The MGPs are significant sources of contaminants to the Site. They are the former Citizens Gasworks MGP, Metropolitan Gas Light Company MGP, and Fulton MGP (Figure 1). Manufactured gas plants produced gas by heating hydrocarbon-based products such as coal and oil. The production process produced hazardous waste, including coal tars, that have contaminated soil, groundwater, and surface water at the Site (USEPA 2011a). The NYSDEC, in coordination with the USEPA, is conducting environmental investigations or remedial activities at the three MGPs. These MGPs are a source of non-aqueous phase liquid (NAPL) containing high concentrations of PAHs to the Gowanus Canal (USEPA 2013).

In addition to the three MGPs, a large number of other industries/facilities have operated along the Gowanus Canal. Some of these entities are mentioned in the USEPA "Self-Guided Walking Tour of the Gowanus Canal" (USEPA undated) or in the Phase I Cultural Assessment for the Gowanus Canal Corridor Re-Zoning Project (Louis Berger and Historical Perspectives 2009). A partial list of industries/facilities that have operated along the Canal follows. Many of the companies listed below have changed ownership/names or are defunct. This is not intended as a list of potential responsible parties.

- Bayside Fuel Oil Terminal
- Koppers Coal Yard
- Pure Oil Facility
- Brooklyn Rapid Transit Power Station
- Consolidated Edison
- American Can

- Coignet Stone Company
- Burns Brothers Coal Pocket
- Benson Scrap Metal
- New York Tartar Facility
- Chemtura/Witco Chemical Factory
- Barrett Tar Roofing Facility
- Amerada Hess
- Northeast Plastics Company
- Plastics Products manufacturing
- Magnet Fuel Corporation
- John Carlson Printing Ink Manufacturing
- Paper mills (e.g., HA Philip & Co. Paper Mill, Brooklyn Steam Paper Mills)
- Multiple coalyards (e.g. Nelson and Son, J.F. Schmadeke Inc, Sackett, John Larney, Murtha/John H. O'Rourke, Brooklyn Union)
- Brickyards (e.g. Morton and Canda Limeyard, John Morton & Sons Lime and Brickyard)
- Feed mills (e.g. Shaw Truesdell Grain Co.)
- Lumber yards (e.g., Watson & Pittinger, Kenyon and Newton)

Oil Releases

According to NYCDEP (2008), 131 spills (mostly small volume and including hazardous waste spills) occurred within a one-block radius of the Gowanus Canal in the 15 years prior to 2008. The NY Times on March 11, 2010, described a 1976 oil spill in which more than 2.5 million gallons of oil spilled into the Gowanus Canal in one day following an explosion at a storage facility. There was a 1998 spill at the Bayside Fuel Company that resulted in the release of 200 gallons of No. 4 fuel oil into soil (NYCDEP 2008). The Record of Decision (ROD) (USEPA 2013) describes oil and gravel barges that operate near the mouth of the canal and also refers to a removal action at 400 Carroll Street, "the site of a former oil terminal facility and a suspected coal tar hotspot." The MGP Sites are described as being contaminated with coal tar and "petroleum products" (NYCDEP 2008) and NAPL discharges may also manifest themselves as an oily sheen.

Although there is limited information (discussed above) on discrete oil spill events on the Canal, the Major Oil Storage Facility (MOSF) database indicates that three MOSFs are located in proximity to the Canal – Bayside @ Sackett, Bayside @ Smith and Amerada Hess Brooklyn Terminal (NYCDEP 2008). The Bayside facility on Sackett Street has not been in operation since 2005; underground storage tanks with a capacity of 1,501,000 gallons were used to store No. 1, 2 and/or 4 fuel oil at that site. The Bayside facility on Smith Street has six tanks with a total storage capacity of 1,989,390 gallons of fuel oil. The Amerada Hess facility has ten underground storage tanks with a total capacity of 29,191,558 gallons of fuel oil (NYCDEP 2008). These facilities are all Resource Recovery and Conservation ACT (RCRA) sites (hazardous waste treatment, storage or disposal facilities) and the Bayside @ Sackett facility is a brownfield site with a Voluntary Cleanup Program agreement in place for the cleanup of fuel oil (NYCDEP 2008). These MOSFs are potential and confirmed (Bayside @ Sackett) sources of oil to the Gowanus Canal.

Releases from Combined Sewer Overflows/Stormwater

According to the USEPA ROD (USEPA 2013), 92 percent of the Gowanus Canal watershed is serviced by CSOs (sewers that receive both sewage and stormwater flow). This watershed reliance on CSOs results in significant inputs of sewage and hazardous substances to the Canal when rainfall is significant and the capacity of the Owls Head and Red Hook sewage treatment plants are exceeded. There are ten active CSOs discharging to the Gowanus Canal.

There also are approximately 250 other outfalls that discharge to the canal. Most of these outfalls are believed to be unused pipes associated with historic industrial facilities; the significance of the flows from these outfalls is unknown, but effluent from at least 12 of these outfall pipes was found to contain VOCs, PAHs, and metals (USEPA 2013).

In addition to hazardous substance, oil and related releases, the significant influx of sewage along the Canal impacts the Site's trust resources.

C. Natural Resources of the Gowanus Canal

Natural Resources of the Gowanus Canal have been evaluated as part of several site investigations conducted by the NYCDEP, USEPA, and USACE. A summary of the more significant studies is provided in Table 1 and discussed below.

Table 1. Summary of Significant Gowanus Canal Biological Studies			
Site Investigation	Year	Description	Citation
New York City Department of Environmental Protection	1997 and 1999	Study to characterize conditions before and after flushing tunnel reactivation - plankton; benthic invertebrates; limited fish trawls Gowanus Bay	Hazen & Sawyer 2001 (in NYCDEP 2008)
NY Harbor-wide Ichthyoplankton Field Sampling and Analysis Plan (FSAP)	2001	1 station Gowanus Bay	Hydroqual 2001a (in NYCDEP 2008)
NY Harbor-wide Epibenthic Recruitment & Survival FSAP	2001	1 station Gowanus Bay	Hydroqual 2001b (in NYCDEP 2008)
Subtidal Benthos & Icthyoplankton Characterization	2002 - 2003	Total organic carbon (TOC), grain size, benthos,~ 4 stations Gowanus Canal & Bay	Hydroqual 2003a (in NYCDEP 2008)
FSAP New York Harbor-wide tributary assessment	2002	Physical habitat and water quality models – 7 stations Gowanus Canal & Bay	Hydroqual 2002 (In NYCDEP 2008)
Tributary Toxicity Characterization FSAP	2001, 2002, 2003	Water column and sediment toxicity – 3 stations Gowanus Canal	Hydroqual 2003b (in NYCDEP 2008)
U.S. Army Corps of Engineers	2003	Sediment analysis and benthic invertebrate characterization – 30 stations Gowanus Canal	USACE 2003a, b &c (in NYCDEP 2008)
Gowanus Bay and Canal Ecosystem Restoration Project	2006	Sediment analysis – 10 stations Gowanus Canal, *Ampelisca abdila* acute toxicity tests	USACE 2006 (in USEPA 2011a)
Remedial Investigation	2010	Sediment, surface water, groundwater, fish and shellfish analysis, ecological risk assessment	USEPA 2011a

Benthic and Epibenthic Invertebrates

The NYCDEP conducted sampling in the Gowanus Canal for benthic invertebrates as part of its Use and Standards Attainment Project. The most abundant invertebrates in the Canal were annelid worms (polychaetes and oligochaetes), with some amphipods and small mollusks (NYCDEP 2008). Epibenthic organisms found in the Gowanus Canal included "sea grapes" (*Molgula manhattensis*), barnacles (*Balanus sp*.), blue mussels (*Mytilus edulis*), clam worms (*Nereis succinea*), amphipods (*Leptocheirus pinguis*), blue crabs (*Callinectes sapidus*), and spider crabs (*Libinia emarginata*) (NYCDEP 2008). Benthic invertebrates, including annelid worms (polychaetes and oligochaetes), amphipods, small mollusks, and blue crabs were documented in the Canal during the Phase 3 sampling activities for the Remedial Investigation (RI) (USEPA 2011a).

Fish

Fish captured in the Gowanus Canal and adjacent Gowanus Bay as a part of 2001 NYCDEP trawl and ichthyoplankton surveys and 2010 USEPA Phase 3 sampling included Atlantic menhaden (*Brevoortia tyrannus*), blueback herring (*Alosa aestivalis*), bay anchovy (*Anchoa mitchilli*), bluefish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*), winter flounder (*Pseudopleuronectes americanus*), weakfish (*Cynoscion regalis*), scup (*Stenotomus chrysops*), blennies (*Blennidae*), rock gunnel (*Pholis gunnelus*), mackerel (*Scomberomorus sp*.), killifish (*Cyprinodontidae*), silver perch (*Bairdiella chrysoura*), Atlantic tomcod (*Microgadus tomcod*), mummichog (*Fundulus heteroclitus*), three-spined stickleback (*Gasterosteus aculeatus*), American eel (*Anguilla rostrata*), tautog (*Tautoga onitis*), and white perch (*Morone americana*) (Hydroqual 2001a; USEPA 2011b).

Fish eggs and/or larvae collected in the Gowanus Canal and Bay during NYCDEP's Harbor-Wide Ichthyoplankton Field Sampling Analysis Program (FSAP) in 2001 were winter flounder larvae, windowpane flounder (*Scophthalmus aquosus*) eggs and larvae, wrasse (*Labrida)* eggs and larvae, bay anchovy, menhaden eggs, and naked goby (*Gobiosoma bosc*) eggs and larvae (NYCDEP 2008).

Fish species designated as having Essential Fish Habitat[1] in Gowanus Bay and Upper New York Bay are red hake (*Urophycis chuss*), winter flounder, windowpane flounder, Atlantic sea herring (*Clupea harengus*), bluefish, Atlantic butterfish (*Peprilus triacanthus*), Atlantic mackerel (*Scomber scombrus*), summer flounder (*Paralicthys dentatus*), scup, king mackerel (*Scomberomorus cavalla*), black sea bass (*Centropristus striata*), Spanish mackerel (*Scomberomorus maculatu*s), cobia (*Rachycentron canadum*), clearnose skate (*Raja eglanteria*), little skate (*Leucoraja erinacea*), winter skate (*Leucoraja ocellata*), sandbar shark (*Carcharinus plumbeus*), sand tiger shark (*Carcharius taurus*), and dusky shark (*Carcharhinus obscurus*).

1 The 1996 amendments to the Magnuson-Stevens Act strengthened the ability of the National Marine Fisheries Service (NMFS) to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (http://www.nero.noaa.gov/hcd/webintro.html).

Birds

During the USEPA Phase 3 sampling event in 2010, a few birds, including double-crested cormorant (*Phalacrocorax auritus*), black-crowned night heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*) and black duck (*Anas rubripes*), were observed in the Canal (USEPA 2011b). Egrets and mallards have also been seen using the Canal (C. Tsiamis, USEPA, personal communication, July 2014).

Mammals

No mammals were observed during the Phase 3 Remedial Investigation (USEPA 2011b). There have been at least two reports of marine mammals in the Canal – a common dolphin in 2013 and a Minke whale in 2007 (http://www.nytimes.com/2013/01/26/nyregion/dolphin-in-gowanus-canal.html?_r=0). Muskrats have been reported to use the Canal (C. Tsiamis, USEPA, personal communication, July 2014).

Endangered Species, Threatened Species, and Species of Concern

The federally- and state-listed as endangered shortnose sturgeon (*Acipenser brevirostrum*) is the only threatened or endangered fish species with the potential to occur in the Gowanus Canal.

Four species of marine turtles, all state- and federally-listed, are found in the waters surrounding New York City. These marine turtles are the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and Atlantic (Kemps) ridley (*Lepidochelys kempii*) (USEPA 2011b). Juvenile Atlantic ridley and adult loggerhead turtles regularly enter the New York Harbor and bays in the summer and fall. The other two turtle species may enter the higher salinity areas of the New York Harbor Estuary (USFWS 1997). However, these four turtle species mostly inhabit Long Island Sound and Peconic and Southern Bay and do not nest in the New York Harbor Estuary, nor reside there year-round. Based on the limited habitat available, it is unlikely these sea turtle species would enter the Gowanus Canal. The northern diamondback terrapin (*Malaclemys t. terrapin*), an estuarine species that feeds and nests in salt marshes and adjacent upland, has been observed in the wetlands of Jamaica Bay (USFWS 1997). This species would not likely be present in the Gowanus Canal due to the lack of salt marshes and natural shorelines within the Canal.

Eight avian species with federal or state endangered, threatened, or species of concern status may potentially occur in the vicinity of the Gowanus Canal. However, these species typically either reside in areas with sandy and/or wetland habitat, both of which are limited in the Gowanus Canal. These species are the common tern (*Sterna hirundo*), least bittern (*Ixobrychus exilis*), least tern (*Sterna antillarum*), pied-billed grebe (*Podilymbus podiceps*), roseate tern (*Sterna dougallii*), and upland sandpiper (*Bartramia longicauda*). Bald eagles (*Haliaeetus leucocephalus*), ospreys (*Pandion haliaetus*), and peregrine falcons (*Falco peregrinus*) may occur in the vicinity of the Gowanus Canal, but are not expected to use the Canal for any significant period of time due to limited habitat.

The Gowanus Canal is part of the New York – New Jersey Estuary, which has been designated by the USEPA as one of the 28 U.S. estuaries of national significance (http://water.epa.gov/type/oceb/nep/index.cfm).

D. Contaminants of Concern

Contaminants of concern in the Gowanus Canal include oil, PAHs, PCBs, volatile organic compounds, including benzene, toluene, ethylbenzene, xylene (BTEX), phthalates, pesticides, and metals, including, copper, lead, cadmium, zinc, chromium, arsenic, nickel, and mercury.

E. Damages Excluded from Liability under CERCLA, OPA, or CWA

The DOI regulations provide that the Natural Resource Trustees must determine whether the damages being considered are barred by specific defenses or exclusions from liability under CERCLA, RCRA, OPA, or the CWA (43 CFR §11.24).

The Trustees must determine whether the damages:

(i) 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

(ii) the release of a hazardous substance from which the damages have resulted have not occurred wholly before the enactment of CERCLA; or

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

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

(v) resulted from a 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 section 311(a)(2) or (b)(3) of the CWA or Section 2703 of the OPA.

The Trustees have determined that none of the above-specified liability exclusions are applicable to this Site. Further, the Trustees are not aware at this time of any other defenses or exclusions

from liability under applicable laws that would forestall initiating a natural resource damage assessment. Thus, they are not precluded from pursuing a successful natural resource damage claim for injuries caused by the release of hazardous substances and/or oil to the Site.

III. PRELIMINARY IDENTIFICATION OF RESOURCES POTENTIALLY AT RISK

A. Potentially Affected Resources

Numerous Trust resources at the Site have been potentially affected by the releases of oil and hazardous substances (see Section IIIC). Currently, water/sediment quality conditions and impaired physical habitat preclude the diversity and abundance of fish and wildlife resources that would normally be expected in an urban estuarine habitat of this type. For example, there is a limited number and diversity of benthic invertebrates in the Canal, most of which are characterized as annelid worms and other pollution-tolerant organisms (NYCDEP 2008). Also, if Canal habitat conditions were improved, it is anticipated that the Canal may support bird species that are found in the East River and other tributaries to Upper New York Bay. These birds include an array of wading birds, gulls, terns, shorebirds, waterfowl, raptors, and songbirds (USFWS 1997).

The Gowanus Canal is part of the New York – New Jersey Estuary, which has been designated by the USEPA as one of the 28 U.S. estuaries of national significance (http://water.epa.gov/type/oceb/nep/index.cfm). The National Contingency Plan, 40 C.F.R. § 300.600(b)(1), specifically designates estuaries as federal Trust resources, while the Estuarine Program Act, 15 U.S.C. § 1511c (2012), specifies NOAA's role in asserting trust responsibilities over estuaries and related resources, including connected rivers and streams.

B. Exposed Areas

The Gowanus Canal in its entirety has been exposed to contaminants of concern. Releases from the Gowanus Canal may also have impacted Gowanus Bay and Upper New York Bay. These areas are collectively termed the "Site."

C. Preliminary Identification of Pathways

Primary pathways by which Trust resources have been exposed to oil and hazardous substances from the Site are likely to include: surface water transport, groundwater discharge, overland runoff and sedimentation, combined sewer overflows, wastewater treatment plant and industrial outfall discharges, food chain and airborne transport, and atmospheric fallout of particulates.

D. Exposed Water and Sediment Estimates

All of the area and volume of the Gowanus Canal (both surface water and sediment), and portions of Gowanus Bay and Upper New York Bay are believed to have been exposed to oil and hazardous substances.

E. Estimates of Concentrations

Contaminants of concern in the Gowanus Canal include oil, PAHs, PCBs, volatile organic compounds, including BTEX, phthalates, pesticides and metals, including copper, lead, cadmium, zinc, chromium, arsenic, nickel, and mercury.

Surface Water

Surface water is a Trust resource per 43 CFR § 11.14, which defines surface water resources as "the waters of the United States, including the sediments suspended in water or lying on the bank, bed, or shoreline, and sediments in or transported through coastal and marine areas."

Surface water of the Gowanus Canal has been contaminated by releases of oil, VOCs, SVOCs, and metals from point and non-point sources along the length of the Canal, as described below.

- Oil

  According to NYCDEP (2008), 131 spills (mostly small volume and including hazardous waste spills) occurred within a one-block radius of the Gowanus Canal in the 15 years prior to 2008. The NY Times on March 11, 2010, described a 1976 oil spill in which more than 2.5 million gallons of oil spilled into the Gowanus Canal in one day following an explosion at a storage facility. There was a 1998 spill at the Bayside Fuel Company that resulted in the release of 200 gallons of No. 4 fuel oil into soil (NYCDEP 2008). The ROD (USEPA 2013) describes oil and gravel barges that operate near the mouth of the canal and also refers to a removal action at 400 Carroll Street, "the site of a former oil terminal facility and a suspected coal tar hotspot." The MGP Sites are described as being contaminated with coal tar and "petroleum products" (NYCDEP 2008) and NAPL discharges may also manifest themselves as an oily sheen.

  In addition, the Major Oil Storage Facility (MOSF) database indicates that three MOSFs are located in proximity to the Canal – Bayside @ Sackett, Bayside @ Smith and Amerada Hess Brooklyn Terminal (NYCDEP 2008). These sites have the potential to, or have been known to, discharge oil into the environment adjacent to the Canal. We will continue to evaluate oil releases at the Site.

- Volatile Organic Compounds (VOCs)

  As part of Phase 3 of the RI, surface water was collected from the Canal during wet weather and dry weather events. The most frequently detected VOCs were BTEX compounds, tetrachloroethylene, and acetone. VOC concentrations were below ecological screening levels, but exceeded human health benchmarks for benzene, ethylbenzene, and tetrachloroethylene (USEPA 2011a).

- Semi-volatile organic compounds (SVOCs)

  PAHs were detected in most surface water samples. None of the PAH compounds exceeded ecological screening benchmarks, but some PAH compounds exceeded human health screening benchmarks. Bis (2-ethylhexyl) phthalate also exceeded a human health screening benchmark concentration (USEPA 2011a).

- Pesticides/PCBs

  Pesticides and PCBs were not detected in surface water samples (USEPA 2011a).

- Metals

  Metals that exceeded ecological surface water screening benchmarks either during the dry weather or wet weather sampling included copper, lead, and nickel (see Table 4-8a of USEPA 2011a). Dissolved copper was detected in dry weather surface water at concentrations from 181 – 282 µg/L (mean = 107 µg/L), in excess of the 3.1 µg/L USEPA saltwater chronic value (CCC) for the protection of aquatic life. Lead was detected in wet weather surface water at concentrations of 2.9 – 26.8 µg/L (mean = 13 µg/L), in excess of the 8.1 µg/L USEPA saltwater chronic value (CCC) for the protection of aquatic life. Nickel was detected in dry weather surface water at concentrations from 2 – 52.3 µg/L (mean = 6.3 µg/L), in excess of the 8.2 µg/L USEPA saltwater chronic value (CCC) for the protection of aquatic life.

Sediment

Sediment is a Trust resource as defined at 43 CFR § 11.14, "Surface water resources means the waters of the United States, including the sediments suspended in water or lying on the bank, bed, or shoreline and sediments in or transported through coastal and marine areas."

The sediment of the Gowanus Canal contains concentrations of a number of constituents that greatly exceed ecological screening values. These contaminants include PAHs, BTEX, pesticides, PCBs, and metals, including, but not limited to, copper, lead, mercury, cadmium, chromium, nickel, arsenic, and zinc (USEPA 2011a). A summary of contaminants of concern in sediments is presented in Table 2. These data will be discussed in Section IV. Contaminants are generally present in greater concentrations in subsurface (also referred to as soft sediment) than surface sediment (USEPA 2011a). Non-aqueous Phase Liquid (NAPL) was commonly found in sediment cores collected as part of the Phase 3 sampling for the RI. NAPL is a free-phase hydrocarbon-based product that typically contains organic products such as PAHs and BTEX (USEPA 2011a). At most sampling locations, NAPL, as well as high PAH concentrations, were found in sediment at all depths. The highest PAH and BTEX concentrations were found in sediment collected near the former MGP facilities (USEPA 2011a).

Table 2. Average and Maximum Concentrations of Selected Contaminants of Concern in Sediment from Gowanus Canal (From USEPA 2011a – Table 4-4a and 4-6)

Constituent	**Average/Maximum Surface Sediment Concentration (0 – 6 inch depth)**	**Average/Maximum Soft Sediment Concentration (below depth of 6 inches)**	**Effects Range Low ERL ***	**Effects Range Median ERM ***
Total BTEX (µg/kg)	364/5,669	188,000/3,810,000	NA	580 (ERM for chlorobenzene); 5,900 µg /kg BTEX NYSDEC Class C sediment
Total PAHs (µg/kg)	527,000/8,000,000	3,490,000/45,000,000	4,022	44,792
Total DDT (µg/kg)	235/1,100	441/3,600	1.58	46.1
Total PCBs (µg/kg)	432/3,400	3,470/50,700	22.7	180
Bis(2-ethylhexyl) phthalate (µg/kg)	15,600/160,000	80,500/2,800,000	182#	182/2,647 (TEL/PEL)**
Alpha-chlordane (µg/kg)	80/530	77/1,200	0.5 (chlordane)	6 (chlordane)
Methoxychlor (µg/kg)	792/5,300	518/8,600	NA	NA
Arsenic (mg/kg)	12.1/44.7	13.9/105	8.2	70
Copper (mg/kg)	226/790	388/1,610	34	270
Lead (mg/kg)	533/4,220	770/2,880	46.7	218
Mercury (mg/kg)	1.27/2.30	2.63/61.6	0.15	0.71
Cadmium (mg/kg)	6/20	10/98	1.2	9.6
Chromium (mg/kg)	76/139	135/874	81	370
Nickel (mg/kg)	44/84.5	77.9/484	20.9	51.6
Zinc (mg/kg)	744/1,520	872/4,350	150	410

*MacDonald et al. 1996 – Florida coastal SQGs (An ERL is defined as a concentration at the low end of a continuum that relates bulk chemistry with toxicity – toxicity is unlikely at concentrations less than the ERL. An ERM is defined as the median concentration of a substance in sediment among sediment samples that were associated with some level of sediment toxicity (Long and MacDonald 1992).

**TEL – threshold effect level {concentration below which adverse effects would be rarely observed} and PEL – probable effect level {concentration above which adverse effects are expected to occur frequently} (Smith et al. 1996).

Groundwater

Groundwater resources are Trust resources and are defined at CFR § 11.14 as "water in a saturated zone or stratum beneath the surface of land or water and the rocks or sediments through which ground water moves. It includes ground water resources that meet the definition of drinking water supplies".

Chemicals detected in groundwater in excess of human health criteria include BTEX, phthalates, arsenic, chromium, lead, and nickel (USEPA 2011a). Total PAHs were detected in groundwater at a concentration as high as 50,200 µg/L (USEPA 2011a). In 1980, USEPA developed ambient water quality criteria to protect human health from the carcinogenic effects of PAH exposure. The recommendation was a goal of zero (nondetectable level) for carcinogenic PAHs in ambient water. The USEPA, as a regulatory agency, sets a maximum contaminant level (MCL) for benzo(a)pyrene, the most carcinogenic PAH, at 0.2 ug/L http://www.atsdr.cdc.gov/csem/csem.asp?csem=13&po=8). Benzo(a)pyrene was detected at a maximum concentration of 11 ug/L in groundwater (USEPA 2011a).

Local groundwater is not currently used as a source for potable water (USEPA 2013).

Biological Resources

Biological resources are Trust resources and are defined at CFR § 11.14 as "those natural resources referred to in section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, nongame, and commercial species; and threatened, endangered, and State sensitive species. Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms not otherwise listed in this definition."

In 2010, fish and shellfish were analyzed for SVOCs, metals, pesticides, PCBs, and dioxin (Tables 3 & 4).

Table 3. Concentrations of Organic Constituents in Fish and Blue Crab from the Gowanus Canal (USEPA 2011a)			
	Range (Mean) All units µg/kg		
Species (all whole body)	**DDT**	**PCB**	**Total PAH**
Blue Crab Canal	2.08 – 2.79 (1.28) total DDT	133 – 194 (157)	106-300 (184)
Blue Crab Reference	1.25 – 1.25 total DDT	67 – 127	29.5 – 58.3
Am. Eel Canal	40.6 – 40.6 (20) p,p' DDT	505 – 946 (800)	NA
Am. Eel Reference	9.7 – 9.7 (9.7) p,p' DDT	446 – 446 (446)	NA
Striped Bass Canal	11.4 – 13 (5.38) p,p' DDT	604-1,230 (916)	NA
White Perch Canal	14.9 – 14.9 (14.9) p,p' DDT	901 – 1,110 (1,010)	NA
Small Prey Fish Canal	8.5 – 8.5 (2.5) p,p' DDT	117 – 650 (273)	NA
Small Prey Fish Reference	13 – 13 (7.33) p,p' DDD	150 – 205 (178)	NA
Note: Reference Area is New York Harbor (USEPA 2011b)			

Table 4. Concentrations of Metals in Fish and Blue Crab from the Gowanus Canal (USEPA 2011a)						
	Range (Mean) All units mg/kg					
Species	**Arsenic**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Zinc**
Blue Crab	0.90 – 1.47 (1.21)	NA	8.19 – 11.7 (9.65)	NA	0.08 – 0.14 (0.11)	18.9 – 24 (20.9)
Blue Crab Ref	1.08 – 1.82 (1.37)	NA	14 – 18.9 (15.6)	NA	0.08 – 0.32 (0.17)	22.4 – 29.5 (25.4)
Am. Eel Canal	0.49 – 0.49 (0.28)	0.42 – 0.80 (0.49)	1.11 – 7.51 (2.48)	0.60 – 0.60 (0.30)	0.065 – 0.28 (0.14)	12.3 – 26.3 (18.7)
Am. Eel Ref	NA	NA	NA	NA	0.13 – 0.13 (0.13)	19.3 – 19.3 (19.3)
Striped Bass Canal	0.45 – 0.57 (0.47)	0.43 – 0.46 (0.32)	0.922 – 1.28 (1.02)	NA	0.13 – 0.18 (0.15)	9.51 – 16.7 (12.5)
White Perch Canal	NA	NA	6.36 – 18.2 (12.3)	NA	0.15 – 0.153 (0.15)	12.0 – 16.8 (14.4)
Small Prey Fish Canal	NA	0.33 – 0.40 (0.46)	0.84 – 4.50 (2.20)	0.69 – 0.69 (0.51)	0.072 – 0.10 (0.09)	7.20 – 42.3 (21.9)
Small Fish Ref	1.2 – 1.2 (0.84)	NA	1.0 – 1.0 (1.13)		0.08 – 0.09 (0.08)	4.9 – 8.8 (6.85)
Note: Reference Area is New York Harbor (USEPA 2011b)						

IV. PREASSESSMENT SCREEN CRITERIA

43 C.F.R. §11.23(e) specifies five criteria that must be met before proceeding with a natural resource damage assessment. The criteria are as follows:

1) A discharge of oil or a release of a hazardous substance has occurred.

2) Natural resources for which the Trustees may assert trusteeship under CERCLA, OPA, CWA, or State statutory and common law claims 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 is sufficient to potentially cause injury, as that term is used in this part, to those natural resources.

4) Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.

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

These criteria are satisfied for the releases of hazardous substances covered by this Preassessment Screen, as follows:

Criteria #1: A discharge of oil or a release of a hazardous substance has occurred.

There have been releases of oil and other hazardous substances, as defined by CERCLA, OPA, and the CWA. Hazardous substances that have been released into the Gowanus Canal and may be found at the Site include, but are not limited to, the following:

- Oil (total petroleum hydrocarbons);
- PAHs (Polycyclic aromatic hydrocarbons);
- PCBs (Polychlorinated biphenyls);
- Phthalates;
- BTEX (benzene, toluene, ethlybenzene, xylene)
- Metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc;
- Pesticides: alpha-chlordane, methoxychlor, gamma chlordane, p,p'-DDE, p,p'-DDD, p,p'-DDT, and total DDTs.

Liability for injuries to natural resources as a result of releases of oil and hazardous substances is addressed in CERCLA, CWA and OPA pursuant to Section 102(a) and 107(a)(4)(C) of CERCLA, 42 U.S.C. §§9602(a); 9607; 43 C.F.R. Part 11; 40 C.F.R. §302.4, and Section 311 of the Federal Water Pollution Control Act, 33 U.S.C.§1321, as well as OPA, 33 U.S.C. §2701(20); 2702(b)(2); 15 C.F.R. Part 990. These substances have been released into the geographic area of concern from various sources including, but not limited to, manufactured gas production facilities, coal yards, cement manufacturers, tanneries, paint and ink factories, chemical plants,

oil refinery and storage facilities, wastewater treatment plants and CSOs. These released contaminants have infiltrated the groundwater, surface water, and sediment of Gowanus Canal and the adjacent ecosystems, and have injured Trust resources.

Criteria #2: Natural resources for which the Trustees may assert trusteeship under CERCLA, OPA, CWA, or State statutory and common law claims have been or are likely to have been adversely affected by the releases.

The Trust natural resources in the assessment area that have been or are likely to have been adversely affected by releases of hazardous substances include, but are not limited to, surface water, groundwater, sediment, and biological resources (43 C.F.R. §11.14z).

- Surface water of the Site has been contaminated by releases of VOCs (BTEX, tetrachloroethylene, acetone, and tetrachloroethylene), SVOCs (PAHs, phthalates), and metals (copper, lead, nickel) from point and non-point sources along the length of the Canal. Concentrations of these substances have exceeded ecological or human health screening benchmarks. Surface water injuries extend to the Site's function as an estuary.

- Groundwater has been contaminated with PAHs, BTEX, phthalates, arsenic, chromium, lead, and nickel in excess of human health screening benchmarks.

- Gowanus Canal sediment has been contaminated by oil, PAHs, PCBs, volatile organic compounds, including benzene, toluene, ethylbenzene, and xylene, phthalates, pesticides, and metals, including copper, lead, cadmium, zinc, chromium, arsenic, nickel, and mercury in excess of ecological screening benchmarks. There may also be sediment contamination in Gowanus Bay and Upper New York Bay.

- Fish and blue crabs have been exposed to and accumulated PAHs, PCBs, DDT and metals, including arsenic, chromium, copper, lead, mercury, zinc (Tables 3 and 4). Based on the high concentrations of certain substances in the sediment, biological organisms are likely to have been exposed to concentrations of hazardous substances that have caused significant adverse effects. This is further discussed in Criteria #3 below.

Criteria #3: The quantity and concentration of the discharged oil or released hazardous substance is sufficient to potentially cause injury, as that term is used in this part, to those natural resources.

43 C.F.R. §11.14(v) defines injury as "a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge or release of a hazardous substance, or exposure to a product of reactions resulting from…[such] discharge…or release…."

The quantity and concentration of the oil and hazardous substances that have been released have caused injuries to natural resources in the assessment area. Documented injuries to natural resources in the assessment area include:

1) New York State Department of Health (NYSDOH) human health advisories;

2) Toxicity of sediments to benthic organisms, as demonstrated by laboratory or field studies;

3) Concentrations of substances in Gowanus Canal sediments that exceed sediment toxicity thresholds and/or have been associated with toxic effects in fish, benthic organisms, and other biota, as documented in the scientific literature;

4) Concentrations of substances in the Gowanus Canal surface water that exceed State or Federal water quality standards; and

5) Concentrations of substances in excess of Federal or State laws or regulations that establish standards for drinking water, in groundwater that was potable prior to the discharge or release.

These injuries are discussed below in greater detail.

1) NYSDOH Human Health Advisories

The NYSDOH has issued fish consumption advisories for the Upper Bay of New York Harbor (north of Verrazano Narrows Bridge), Newark Bay, Arthur Kill, Kill Van Kull, and Raritan Bay that include all tributaries and connected waters (including the Gowanus Canal) (NYSDOH 2013). The Advisory is to eat no American eel, gizzard shad, white perch, or striped bass from Newark Bay, Arthur Kill, and Kill Van Kull, and no crab and lobster tomally (hepatopancreas) and cooking liquid. The Advisory also is to eat no more than one meal per month of Atlantic needlefish, bluefish, or rainbow smelt and no more than one meal per month of striped bass from the Upper Bay of New York Harbor and western Raritan Bay. The contaminants of concern for these waters are listed as PCBs and dioxin in fish, and cadmium, dioxin, and PCBs in lobster and crab.

The USEPA Human Health Risk Assessment prepared for the Gowanus Canal Superfund Site (USEPA 2011c) concluded that there are unacceptable human risk levels for surface water/sediment contact and fish consumption. These risks are primarily associated with carcinogenic PAHs in the surface water and surface sediment, as well as concentrations of PCBs in fish and crab samples from the Canal that are in excess of human health guidelines.

The NYSDOH and Agency for Toxic Substances and Disease Registry are currently reviewing the USEPA Draft Gowanus Canal Remedial Investigation and Risk Assessment reports released in January 2011. They will be incorporating any new data relevant to the public health evaluation for the Gowanus Canal into a draft Public Health Assessment document (http://www.health.ny.gov/environmental/investigations/gowanus/factsheet.htm).

2) Toxicity of Sediments to Benthic Organisms as Demonstrated by Laboratory or Field Studies

A toxicological evaluation of Gowanus Canal sediment was conducted as part of Phase 3 of the Remedial Investigation. Twelve sediment samples were collected in 2010 from the Gowanus Canal from near Sackett Street to Gowanus Bay. A 28-day growth, survival, and reproduction toxicity test was performed using the estuarine amphipod, *Leptocheirus plumulosus*, and a 28-day survival and growth test was performed using the polychaete, *Nereis virens* (USEPA 2011b). Survival, reproduction, and growth for *L. plumulosus* were impaired in almost all Gowanus Canal sediment samples, when compared with results from the control sediment. The most significant effects (100% mortality) were detected in sediment from the mid-section of the Canal, coincident with the greatest concentrations of PAHs and other COCs in sediment. Reduced survival and growth of *N. virens* was noted in sediments from the mid-section of the Canal only. Chemical analysis of the mid-canal sediments indicated PAH concentrations generally in excess of 2,000,000 µg/kg.

Other water column and sediment toxicity tests were conducted at three locations within the Gowanus Canal as part of the NYCDEP Use and Sustainability Attainment Project (Hydroqual 2003b, as cited in NYCDEP 2008). Seven day water toxicity studies found 97% survival of sheepshead minnow and 95% survival of mysid shrimp exposed to Gowanus Canal water, with lower growth than at reference stations. Mortality of the amphipod, *Leptocheirus plumulosus,* was close to 100% after 28 days of exposure to sediment from two of the three Gowanus Canal sample locations. Amphipod mortality at the third Gowanus Canal station (near the head of the Canal) was 20%.

A number of studies have determined that the majority of invertebrates in the Gowanus Canal are pollution tolerant annelid worms (polychaetes and oligochaetes), indicative of an impaired ecosystem (Hydroqual 2001b, 2002, 2003a; Hazen and Sawyer 2001).

3) Concentrations of substances in Gowanus Canal sediments that exceed sediment toxicity thresholds and/or have been associated with toxic effects in fish, benthic organisms, and other biota, as documented in the scientific literature

As presented in Section IIIE and summarized on Table 2, a number of hazardous substances, including PAHs, PCBs, DDT, chlordane, phthalates, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc, have been detected in sediment at concentrations that exceed screening level benchmarks, such as ERLs or ERMs.

PAHs

The mean concentration of PAHs in the surface sediments of Gowanus Canal (527,000 µg/kg) is an order of magnitude greater than the PAH ERM of 44,792 µg/kg. The mean concentration of PAHs in soft sediments of the Gowanus Canal (3,490,000 µg/kg) exceeds the ERM by two orders of magnitude, with Station 315 showing a concentration of PAHs at nearly 1%. The ERM is defined as the median concentration of a substance in sediment among sediment samples that were associated with some level of sediment toxicity (Long and MacDonald 1992).

PAHs are strongly associated with or known to cause a variety of adverse effects in aquatic organisms. Several PAHs, including benzo(a)anthracene, benzo(a)pyrene, chrysene, and dibenzo(a,h)anthracene are potent carcinogens (Eisler 1987a). Although the occurrence of cancer in aquatic organisms has not been definitively linked to PAHs and no histopathological studies have been performed on aquatic organisms in the Gowanus Canal, PAHs have been implicated in causing a variety of developmental anomalies and tumors in fish and aquatic mammals. PAHs have also been shown to cause a variety of other toxicological responses in aquatic organisms, birds, and mammals, including but not limited to, inhibition of survival, growth, and reproduction (Eisler 1987a).

Reduced growth and suppressed immune function were observed in salmonids from sites with sediment total PAH levels in the 5,000 – 10,000 µg/kg range (Arkoosh et al. 1998). Similarly, Heintz et al. (1999) reported increased mortality in pink salmon embryos exposed to oiled gravel with total PAH concentrations in the 3,800 – 4,600 µg/kg range. Hinkle-Conn (1998) reported reduced benthic invertebrate diversity at sediment PAH concentrations of 10,000 µg/kg, altered foraging behavior of spot at 22,000 µg/kg PAH in sediment and inhibited tube construction by *Chironomus decorus* at 25,000 µg/kg PAH in sediment. PAH concentrations in Gowanus Canal sediment greatly exceed these sediment PAH concentrations associated with adverse effects in fish and benthic invertebrates. The data indicate probable toxicity to fish and other aquatic organisms in the Gowanus Canal as a result of exposure to PAHs.

METALS

Lead was detected in Gowanus Canal surface and sub-surface soft sediment samples at mean concentrations of 533 and 770 mg/kg, respectively. These concentrations are well in excess of the ERM of 218 mg/kg. These data indicate probable sediment toxicity related to lead. Lead has been shown to adversely affect growth, reproduction, and survival in aquatic organisms and may contribute to deformities. Lead has been linked with weight loss, neurological effects, and mortality in birds, including waterfowl (Eisler 1988a).

Cadmium was detected in Gowanus Canal surface and sub-surface sediments at mean concentrations of 6 and 10 mg/kg, respectively, in excess of the ERL (1.2 mg/kg) and the ERM (9.6 mg/kg) for cadmium. These data indicate probable sediment toxicity related to cadmium. Cadmium is a known teratogen and carcinogen and probable mutagen in vertebrates. In aquatic organisms, cadmium has been associated with reduced growth, respiratory disruption, reduced reproduction, immobilization, molt inhibition, and death (Eisler 1985).

Zinc was detected in Gowanus Canal surface and sub-surface soft sediment samples at mean concentrations of 744 and 872 mg/kg, respectively, with a maximum sub-surface sediment zinc concentration of 4,350 mg/kg. These concentrations are well in excess of the ERM of 410 mg/kg. These data indicate probable sediment toxicity related to zinc. Zinc can affect survival of benthic invertebrates and benthic community diversity (Iwasaki et al. 2011; Watzin and Roscigno 1997; Eisler 1993).

Mercury was detected in Gowanus Canal surface and sub-surface soft sediment samples at mean concentrations of 1.27 and 2.63 mg/kg, respectively. These concentrations are well in excess of the ERM of 0.71 mg/kg. These data indicate probable sediment toxicity related to mercury. Mercury is a mutagen, teratogen, and carcinogen, and causes embryocidal, cytochemical, and histopathological effects. Mercury adversely affects the reproduction, growth, behavior, metabolism, blood chemistry, osmoregulation, and oxygen exchange of marine and freshwater organisms (Eisler 1987b).

Nickel was detected in Gowanus Canal surface and sub-surface sediments at mean concentrations of 44 and 77.9 mg/kg, respectively, in excess of the ERL (20.9 mg/kg) and the ERM (51.6 mg/kg) for nickel. These data indicate probable sediment toxicity related to nickel. Nickel exposure has been correlated with reduced survival in benthic invertebrates, with nickel bioavailability affected by sediment physicochemical characteristics such as AVS (acid volatile sulfide), total organic carbon (TOC), and particle size distribution (Besser et al. 2011; Eisler 1998b).

Arsenic was detected in Gowanus Canal surface and sub-surface sediments at mean concentrations of 12.1 and 13.9 mg/kg, respectively, in excess of the ERL (8.2 mg/kg), but not the ERM (72 mg/kg) for arsenic. These data indicate possible sediment toxicity related to arsenic. Arsenic is a carcinogen and teratogen in vertebrates and causes mortality in benthic invertebrates, zooplankton, and algae (Eisler 1988b). Arsenic has been shown to accumulate in fish from waterbodies contaminated with arsenic (Eisler 1988b), and mortality and teratogenicity have been associated with arsenic exposures in various bird species (Eisler 1988b).

Chromium was detected in Gowanus Canal surface and sub-surface sediments at mean concentrations of 76 and 135 mg/kg, respectively, in excess of the ERL (81 mg/kg), but not the ERM (370 mg/kg) for chromium. These data indicate possible sediment toxicity related to chromium. Chromium is mutagenic, teratogenic, and carcinogenic to a wide variety of organisms. Hexavalent chromium (Cr^{+6}) is the most biologically active form of chromium and has been associated with abnormal enzyme activities, altered blood chemistry, lowered resistance to pathogenic organisms, behavioral modifications, disrupted feeding, histopathology, osmoregulatory upset, alterations in population structure and species diversity indices, and inhibition of photosynthesis in a variety of organisms (Eisler 1986a).

Copper concentrations in Gowanus Canal surface sediment samples were as high as 790 mg/kg, with a mean concentration of 226 mg/kg. The sub-surface soft sediments contained a mean and maximum copper concentration of 388 and 1,610 mg/kg, respectively. The surface sediment mean copper concentration exceeded the copper ERL (34 mg/kg), but not the ERM (270 mg/kg). The soft sediment mean copper concentration exceeded the ERM. These data indicate probable sediment toxicity related to copper.

Copper is associated with a variety of adverse effects in benthic macroinvertebrates, zooplankton, algae, and many freshwater and marine fish species (Eisler 1998a). At high concentrations, copper can cause gill damage in aquatic invertebrates and interferes with osmoregulation in fish (Eisler 1998a). Copper-stressed common mussels (*Mytilus edulis*) die

more quickly because they have greater difficulty adapting to conditions of anoxia, high temperatures, and low salinities (Weber et al. 1992, as cited in Eisler 1998a).

Availability of Metals

As part of the Remedial Investigation (USEPA 2011a & b), sediments were evaluated for AVS/SEM (acid volatile sulfide/simultaneously extracted metal), a measure of the capacity for sediment to develop bonds with the divalent metals cadmium, copper, lead, nickel, and zinc and the monovalent silver, making these metals less bioavailable. At most locations along the Canal, AVS/SEM, normalized to organic carbon, indicated that the bioavailability of cadmium, copper, lead, nickel, and zinc may be limited, thereby reducing the likelihood of toxicity to benthic organisms from these metals in most sections of the Canal. Three Canal stations (306, 308A, and 310) show elevated SEM with respect to AVS, indicating greater bioavailability of metals at these locations. AVS is only formed under anoxic conditions; improved oxygenation in the Canal would decrease AVS, potentially increasing the bioavailability of these metals.

PCBs

PCBs were detected in Gowanus Canal surface sediment samples at concentrations as high as 3,400 µg/kg (mean of 432 µg/kg) and in soft sediments at a maximum concentration of 50,700 µg/kg (mean of 3,470 µg/kg). Mean concentrations of PCBs in surface and soft sediment exceed the ERM of 180 µg/kg, with maximum concentrations exceeding the ERM by one to two orders of magnitude.

PCBs can cause a variety of adverse effects in organisms, including but not limited to liver and dermal toxicity, teratogenic, reproductive and neurological effects. Responses depend on the impacted species and the particular congener mixture to which that species is exposed and can, therefore, vary from subtle (e.g., induction of hepatic microsomal enzymes) to severe (e.g., impaired reproduction and death). In addition, toxic effects are likely to be more severe at higher trophic levels due to bioconcentration and biomagnification (Eisler 1986b).

Benzene, Toluene, Ethylbenzene, and Xylene (BTEX)

Total BTEX compounds were detected in Gowanus Canal surface and sub-surface sediment at mean concentrations of 364 and 188,000 µg/kg, respectively, with a maximum surface and sub-surface BTEX concentration of 5,669 and 3,810,000 µg/kg, respectively (USEPA 2011a). There are no ERLs or ERMs for BTEX. The NYSDEC regards sediment with concentrations of BTEX < 960 µg/kg as having "no appreciable contamination" and categorizes them as Class A sediment with respect to dredging and disposal (NYSDEC 2004). Sediments with between 960 and 5,900 µg/kg BTEX are classified as Class B sediments, and sediments with greater than 5,900 µg/kg are Class C sediments, requiring dredging/disposal measures such as closed bucket dredging, lined disposal sites, and no barge overflow. The thresholds established by NYSDEC for Class B and C sediments are based on known and presumed impacts on aquatic organisms/ecosystems (NYSDEC 2004). The Gowanus Canal has sediment with concentrations of BTEX compounds that frequently qualify them as Class C sediments (in excess of NYSDEC thresholds for impacts to biota), particularly at depths greater than six inches.

Fuchsman et al. (1999) developed a model to predict a probable effects threshold concentration for chlorinated benzenes in sediment. Using an equilibrium partitioning approach, they developed a predicted effect threshold for chlorobenzene (one of the BTEX compounds) of 32,000 ug/kg (@ 1% organic carbon). They determined that multiple chlorinated benzene congeners will show approximately additive toxicity, as characteristic of nonpolar narcotic toxicants. The mean concentration of BTEX in subsurface sediment (188,000 µg/kg) greatly exceeds the predicted probable effects threshold for chlorobenzene of 32,000 ug/kg.

PHTHALATES

Bis(2-ethylhexyl) phthalate was detected in Gowanus Canal surface and sub-surface soft sediment samples at mean concentrations of 15,600 and 80,200 µg/kg, respectively, with maximum surface and sub-surface sediment concentrations of 160,000 and 2,800,00 µg/kg, respectively. These concentrations are well in excess of the Probable Effects Level (PEL) of 2,647 µg/kg. These data indicate probable sediment toxicity related to phthalates.

Phthalates may cause acute toxicity or reproductive impairment in benthic invertebrates and reduce benthic invertebrate diversity. In general, the lower molecular weight esters are more toxic than higher molecular weight esters (Staples et al. 1997).

PESTICIDES

Total DDT was detected in Gowanus Canal surface and sub-surface sediment at mean concentrations of 235 and 441 µg/kg, with a maximum sub-surface concentration of 3,600 µg/kg. The mean concentrations exceed the ERM for total DDT of 46.1, indicating probable sediment toxicity due to DDT. DDT is persistent in the environment, undergoing slow biodegradation to DDD, DDE, and other metabolites. It is well-established that DDT and its major metabolite, DDE, cause a reduction in the thickness and strength of avian eggshells, as well as embryolethality. In addition, these compounds may contribute to reduced growth and altered behavior in birds (Blus 1996; U.S. Department of Health and Human Services 2002).

Alpha-chlordane was detected in Gowanus Canal surface and sub-surface sediment at mean concentrations of 80 and 77 µg/kg, respectively, with maximum surface and sub-surface concentrations of 530 and 1,200 µg/kg. The mean concentrations exceed the ERM for total chlordane of 6 µg/kg, indicating probable sediment toxicity due to chlordane.

Chlordane is a persistent organochlorine pesticide that has been banned for all uses in the United States since 1988. Exposure to chlordane by fish and aquatic invertebrates may result in death, impaired reproduction, and/or histopathological changes; exposure to chlordane by birds may result in death, impaired reproduction, and/or neurological impairments (Eisler 1990).

4) **Concentrations of substances in Gowanus Canal surface water that exceed State or Federal water quality standards.**

As part of Phase 3 of the RI, surface water was collected from the Canal during wet weather and dry weather events. The most frequently detected VOCs were BTEX compounds, tetrachloroethylene, and acetone. VOC concentrations were below ecological screening levels, but exceeded human health benchmarks for benzene, ethylbenzene, and tetrachloroethylene (USEPA 2011a).

Oil spills have been reported along the Canal. For example, 131 spills (mostly small and some of which are hazardous substances vs. oil) have occurred within a one-block radius of the Gowanus Canal within the past 15 years (NYCDEP 2008). The NY Times on March 11, 2010, described a 1976 oil spill in which more than 2.5 million gallons of oil spilled into the Gowanus Canal in one day following an explosion at a storage facility. There was a 1998 spill at the Bayside Fuel Company that resulted in the release of 200 gallons of No. 4 fuel oil into soil (NYCDEP 2008). The MGP sites have released coal tar and "petroleum products" and NAPL discharges may also manifest themselves as an oily sheen. Other releases of oil may have occurred from major oil storage facilities such as Bayside Sackett, Bayside Smith or Amerada Hess. The New York State water quality standard for oil is, "No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease."

5) **Concentrations of substances in excess of drinking water standards established by Federal or State laws or regulations that establish such standards for drinking water, in groundwater that was potable before the discharge or release.**

Chemicals detected in groundwater in excess of human health criteria included BTEX, phthalates, arsenic, chromium, lead, and nickel (USEPA 2011a). Total PAHs were detected in groundwater at a concentration as high as 50,200 µ/L (USEPA 2011a). In 1980, USEPA developed ambient water quality criteria to protect human health from the carcinogenic effects of PAH exposure. The recommendation was a goal of zero (nondetectable level) for carcinogenic PAHs in ambient water. The USEPA, as a regulatory agency, sets a maximum contaminant level (MCL) for benzo(a)pyrene, the most carcinogenic PAH, at 0.2 ug/L http://www.atsdr.cdc.gov/csem/csem.asp?csem=13&po=8). Benzo(a) pyrene was detected at a maximum concentration of 11 ug/L in groundwater (USEPA 2011a).

Criteria #4: Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.

Data sufficient to pursue an assessment can be obtained at a cost that is substantially less than the anticipated monetary damage amount (the cost of restoring, rehabilitating, replacing, and/or acquiring the equivalent of the resources injured by the release of hazardous substances at or from the Site). Significant sediment, surface water, and groundwater data exist for the Gowanus Canal. Some data on chemical contamination in aquatic organisms also exists and some sediment toxicity testing has been performed. The availability of all this information will facilitate the preparation of both an assessment plan and a natural resource damage assessment, thereby reducing associated costs. Any costs associated with additional data collection and analysis should be significantly less than the anticipated monetary damage amount.

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

Response actions will not sufficiently remedy the injury. The USEPA released a Record of Decision for the Gowanus Canal Superfund Site (USEPA 2013) that describes the selected remedy for addressing contamination in the Canal. The remedy includes significant dredging of sediment, in conjunction with multi-layered capping and in-situ stabilization of sediment in areas with high concentrations of NAPL. A critical component of the remedy is the future control of upland sources of hazardous substances to the Canal, including the former MGP facilities and CSOs (USEPA 2012). It is highly likely that due to the magnitude of contaminated sediment in the Canal and challenges associated with controlling future discharges of hazardous substances to the Canal, residual contamination will remain in the Gowanus Canal. Furthermore, response actions will not assess or develop restoration plans for the injuries to natural resources and the services provided by those resources from 1981 until the completion of remedial activities. For example, activities anticipated as part of the remedial process will not address the injuries and lost services from the time of release or necessarily ensure a return to baseline. Also, the ongoing/anticipated cleanup may not fully address cumulative ecosystem impacts of hazardous substance releases, such as residual contamination in sediment and bioaccumulation in biota. In addition, the full remedy will not take place for a number of years. Therefore, it has been determined by the Trustees that response actions carried out or currently planned will not remedy the injury to the natural resources of the Gowanus Canal without further action.

V. PREASSESSMENT SCREEN DETERMINATION

Following the review of information described in this Preassessment Screen, the Trustees have made a preliminary determination that the criteria specified in 43 C.F.R. Part 11 (Natural Resource Damage Assessments) have been met. The Trustees have further determined that there is a reasonable probability of making a successful claim for damages with respect to the Gowanus Canal Superfund Site natural resources over which the Trustees have trusteeship. Therefore, the Trustees have determined that an assessment of Gowanus Canal natural resource damages is warranted.

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Gowanus Canal Site
Preassessment Screen

The U.S. Department of Commerce, by its Authorized Official

By: _____

Name: David Westerholm

Title: Director, Office of Response and Restoration

Date: FEB 5TH, 2015

Gowanus Canal Site
Preassessment Screen

The State of New York, by its Authorized Official

By: _____

Name: Joseph J. Martens

Title: Commissioner, NYS Department of Environmental Conservation

Date: 4/7/15

Gowanus Canal Site
Preassessment Screen

Approvals:

The U.S. Department of the Interior, by its Authorized Official

By: 

Name: Wendi Weber

Title: Regional Director, U.S. Fish and Wildlife Service, Region 5

Date: MAR 18 2015