Newtown Creek
Natural Resource Damage Assessment Plan

Draft | March 1, 2024

Prepared by:

Newtown Creek Natural Resource Damage Assessment Trustee Council:
National Oceanic and Atmospheric Administration
New York State Department of Environmental Conservation
United States Department of the Interior, U.S. Fish and Wildlife Service

With assistance from:

Industrial Economics, Incorporated (IEc)

Photo credits for cover page clockwise from left:

Canoeing on Newtown Creek: Mitch Waxman
Atlantic Striped Bass: National Oceanic and Atmospheric Administration
Double-crested cormorant: U.S. Fish and Wildlife Service
Blue crab: National Park Service

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Exhibits

List of Acronyms

BERA	Baseline Ecological Risk Assessment
CBR	Critical body residue
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CM	creek mile
COCs	contaminants of concern
CSOs	combined sewer overflows
DMP	data management plan
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
FCAs	fish consumption advisories
FS	Feasibility Study
FWS	U.S. Fish and Wildlife Service
HQ	hazard quotient
LOAEL	lowest observed adverse effect level
LOEC	lowest observed effect concentration
NCA	Newtown Creek Alliance
NAPL	non-aqueous phase liquid
NCG	Newtown Creek Group
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NRDA	Natural Resource Damage Assessment
NYC	New York City
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health

OU	Operable Unit
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PEL	probable effects level
PI	principal investigator
ppb	parts per billion
ppm	parts per million
PRPs	potentially responsible parties
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCDP	Restoration and Compensation Determination Plan
RAO	remedial action objective
RI	Remedial Investigation
SGV	Sediment Guidance Value
SQG	sediment quality guideline
TDI	total dietary intake
TOC	total organic carbon
TRV	toxicity reference value
WWTP	wastewater treatment plant

Executive Summary

Kosciuszko Bridge over Newtown Creek.

Newtown Creek is a 3.8-mile-long tidal waterbody that separates the boroughs of Brooklyn and Queens in New York City (NYC) and flows into the East River in the New York-New Jersey Estuary. A federally designated navigational waterway, Newtown Creek is currently also designated by NYC as a Significant Maritime Industrial Area. Over time, the bed and shorelines of Newtown Creek have been altered by dredging and channelization, and the Creek has a long history of oil and hazardous substance contamination resulting from industrial and commercial operations. Wastewater discharges and surface runoff from surrounding urban communities have also contributed to contamination in Newtown Creek. Due to the nature and extent of the contamination, the United States Environmental Protection Agency added Newtown Creek to the National Priorities List in 2010, making it a Superfund Site subject to investigation and remediation. While remediation of Newtown Creek is beneficial, it does not compensate the public for past, present, or future injuries to natural resources and resource services resulting from releases of oil or hazardous substances.

Acting under their authority as natural resource trustees under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oceanic and Atmospheric Administration (NOAA), the New York State Department of Environmental Conservation (NYSDEC), and the United States Department of the Interior represented by the U.S. Fish and Wildlife Service (FWS), collectively the Trustees, are conducting a natural resource damage assessment (NRDA) for Newtown Creek. The Trustees will seek damages with the goal of restoring injured natural resources and services resulting from the releases of oil or hazardous substances and compensating the public for interim losses (i.e., losses resulting from natural resource injuries from when the injury occurred until resources have returned to their baseline condition). Damages (e.g., money) collected by the Trustees from parties potentially responsible for the contamination (referred to as potentially responsible parties or PRPs) will be used to plan, implement, and monitor restoration projects. This Newtown Creek Natural Resource Damage Assessment Plan (Plan) describes the Trustees' proposed approach to conducting the NRDA, summarizes existing data, and outlines potential analyses and studies that may be used to evaluate contaminants and their effects on the natural resources and resource services of Newtown Creek. Throughout this process, the Trustees will communicate and coordinate with relevant federal and state agencies and the public to ensure that the assessment is conducted in a systematic manner and at a reasonable cost.

This Plan focuses on ecological resources in Newtown Creek including sediment, surface water, and biological resources such as invertebrates, aquatic vegetation, fish, birds, and aquatic-dependent mammals. This Plan also focuses on the ecological (e.g., food web) and human services (e.g., recreational opportunities, community connections) provided by these resources. To determine injury to natural resources, the Trustees will first document the pathway of contaminants from their release to natural resource exposure. The Trustees will review existing information on contaminant releases into Newtown Creek, including direct discharges, leaks and spills, operations from adjacent industrial facilities, and wastewater from combined sewer overflows. Building on existing information, the Trustees will demonstrate that injury to natural resources has occurred or is likely to have occurred. Current lines of evidence include contaminant concentrations in exceedance of regulatory criteria or literature-based adverse effects thresholds, results of site-specific toxicity tests, and consumption advisories. Additional research and analysis of existing information, as well as primary studies, may be conducted to further determine injury to natural resources within Newtown Creek.

Once injury to natural resources has been determined, quantification of that injury is undertaken to establish a basis for scaling restoration and quantifying damages. The Trustees will adhere to the NRDA regulations for assessing ecological and human use losses (43 CFR § 11.83).

- **Ecological**: The Trustees anticipate quantifying ecological service losses to representative biological resources. Assessed resources may include benthic organisms, aquatic vegetation, fish, birds, and/or aquatic-dependent mammals that utilize intertidal or subtidal habitats in the Newtown Creek. For each species group in each habitat, ecological injury quantification would focus on toxicological effect endpoints that are considered the most biologically relevant (i.e., endpoints that most directly reflect a resource's ability to function and provide services) such as growth, reproduction, and survival. The Trustees plan to identify the area of habitat over which the injury has occurred in the past and is expected to occur in the future. The damages required to compensate for ecological injuries may be determined using equivalency analyses to scale restoration projects such that sufficient ecological benefit is provided to compensate for losses. Damages would be calculated based on the cost of implementing that restoration.

- **Human Use**: Recreational and other potential losses would be quantified based on the nature and extent of lost services. Damages may result from reduced use of the resources or a diminished recreational experience due to the presence of contaminants in Newtown Creek. The Trustees plan to evaluate whether existing data on angler effort and relevant economic values is adequate to conduct a benefit transfer analysis of recreational fishing and crabbing damages. The Trustees plan to consider evaluating additional potential sources of recreational use losses including boating, birding, and wildlife observation, as well as other potential losses related to weakened community connections to Newtown Creek due to the presence of contaminants. These connections may include other forms of interaction with Newtown Creek resources by nearby residents.

To determine and quantify natural resource injuries, the Trustees plan to maximize the use of existing data, conduct analyses, identify data gaps, and, if warranted, conduct primary studies. This Plan identifies potential types of studies that may be implemented. If conducted, these studies would inform injury determination and quantification, determination of damages, and identification and scaling of restoration projects. The Trustees recognize that additional or alternative study types not identified in this Plan may become necessary and therefore be conducted as the assessment proceeds and new information becomes available. Any significant modification to the Plan would be made available for public review. The mention of a study type within this Plan does not guarantee that it will be undertaken because the Trustees may determine that some of these efforts are not needed or have lower priority. Planning documents for each implemented study will contain appropriate quality assurance and quality control procedures to ensure that data are of sufficient quality to support Trustee decisions in the context of the NRDA process.

This Plan will be made available to the public at the following websites for public comment through **April 15, 2024**. The Trustees will review, respond to, and incorporate public comments into the Final Assessment Plan as applicable. Public comments and Trustee responses will be attached to the Final Assessment Plan, which also will be made publicly available.

An electronic copy of this Plan is available at each of the following websites:

U.S. Fish and Wildlife Service website
https://www.fws.gov/media/newton-creek-nrda

NOAA website
https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/6837

NYSDEC website
https://dec.ny.gov/regulatory/nrd/major-ongoing-nrd-assessments

A hard copy of the Plan is also available at the following locations:

Queens Public Library
Sunnyside Branch
43-06 Greenpoint Avenue
Long Island City, NY 11104
Tel: (718) 784-3033

NYS Department of Environmental Conservation - Region 2
4740 21st Street
Long Island City, NY 11101
Tel: (718) 482-4900

Comments can be sent to:

NYS Department of Environmental Conservation
Natural Resource Damages Section
c/o Alicia Pasos
625 Broadway, 14th Floor
Albany, NY 12233
E-mail: nrd@dec.ny.gov

CHAPTER 1 | Introduction

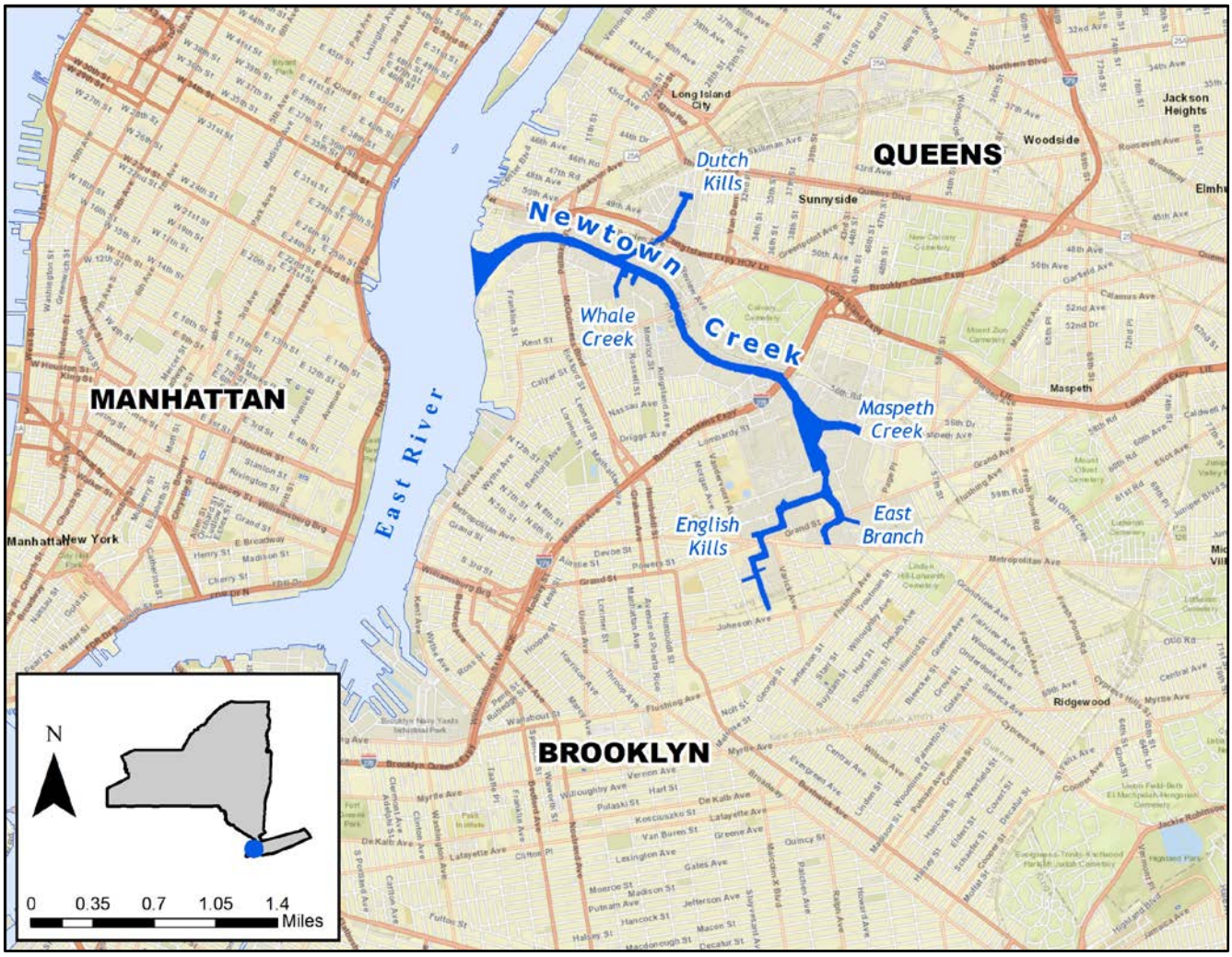
Newtown Creek is a tidal waterbody located between the boroughs of Brooklyn and Queens in New York City (NYC; Exhibit 1-1). Part of the New York-New Jersey Harbor Estuary, Newtown Creek feeds into the East River. Since the early 1800s, it has been influenced by industrialization, channelization, and municipal pollution. Associated industrial activities, as well as sewer outfalls, have released oil and hazardous substances including organic pollutants and metals (together, contaminants) into Newtown Creek. Natural resources such as surface water, sediment, benthic invertebrates, fish, birds, and mammals have been exposed to these contaminants, resulting in adverse impacts to their health and viability. These impacts have caused a loss in both ecological and human use services (i.e., functions) that Newtown Creek's natural resources would otherwise provide. Due to the nature and extent of the contamination, the United States Environmental Protection Agency (EPA) added Newtown Creek to the National Priorities List in 2010, making it a Superfund Site subject to investigation and remedial actions (EPA 2023). While remediation of Newtown Creek is beneficial, it does not compensate the public for past, present, and future contaminant-related injuries to natural resources and resource services.

Acting under their authority as natural resource trustees under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Department of Commerce, acting through the National Oceanic and Atmospheric Administration (NOAA), the New York State Department of Environmental Conservation (NYSDEC), and the United States Department of the Interior (DOI), acting through the United States Fish and Wildlife Service (FWS), collectively the Trustees, are conducting a Natural Resource Damage Assessment (NRDA) for Newtown Creek. This document describes the Trustees' approach to conducting the NRDA, summarizes existing data, and outlines proposed analyses and studies that the Trustees may undertake to evaluate contaminants related to releases of hazardous substances and oil in Newtown Creek and their effects on natural resources and resource services.

WHAT IS NRDA?

A Natural Resource Damage Assessment is a regulatory process to determine the appropriate amount and type of restoration and/or dollars needed to compensate the public for injuries to natural resources resulting from the release of hazardous substances or oil into the environment.

Exhibit 1-1: Map of Newtown Creek



1.1 Purpose and Overview of the Assessment Plan

The Trustees developed this Assessment Plan (Plan) to describe their proposed approach to determining and quantifying injury to natural resources and corresponding damages pursuant to CERCLA NRDA regulations (42 USC § 9601 et seq., 43 CFR Part 11). The Plan will:

- Ensure efforts are conducted in a systematic manner and at a reasonable cost[1] as required by CERCLA and other applicable federal and state laws.
- Create a comprehensive strategy for assessing natural resource injuries and determining damages.
- Facilitate coordination between the Trustees and the public, including a public comment period for this Plan.
- Assist with coordination between Trustee NRDA efforts and EPA's remedial process.

This Plan may be modified as additional information becomes available. Any significant modification to the Plan will be made available for public review for a period of 45 days (43 CFR § 11.32(e)(2)(i)).

1.2 History of Newtown Creek

Newtown Creek is a 3.8-mile tidal waterbody that forms the border between the NYC Boroughs of Queens and Brooklyn. Prior to the nineteenth century, Newtown Creek was a dynamic saline tributary fed by freshwater streams that overflowed into salt marshes when the tide came in (Exhibit 1-2; AECOM 2011, Riverkeeper and NCA 2018, NCA 2023a). Newtown Creek drained the uplands of western Long Island, flowing through wetlands and marshes (EPA 2011).

WHAT IS INJURY?

In NRDA, injury refers to a decrease in a natural resource's ability to provide services due to contamination. Examples include, but are not limited to:

- Lower nesting success in birds,
- Contaminant concentrations in groundwater exceeding drinking water thresholds,
- Wetlands unable to support vegetation and biota, and
- Decreased quality of fishing experience due to consumption advisories

Regulatory definition at 43 CFR § 11.14(v)

WHAT ARE SERVICES?

Natural resource services are the physical and biological functions performed by the natural resources including the human uses of those functions.

Regulatory definition at 43 CRF § 11.14(nn)

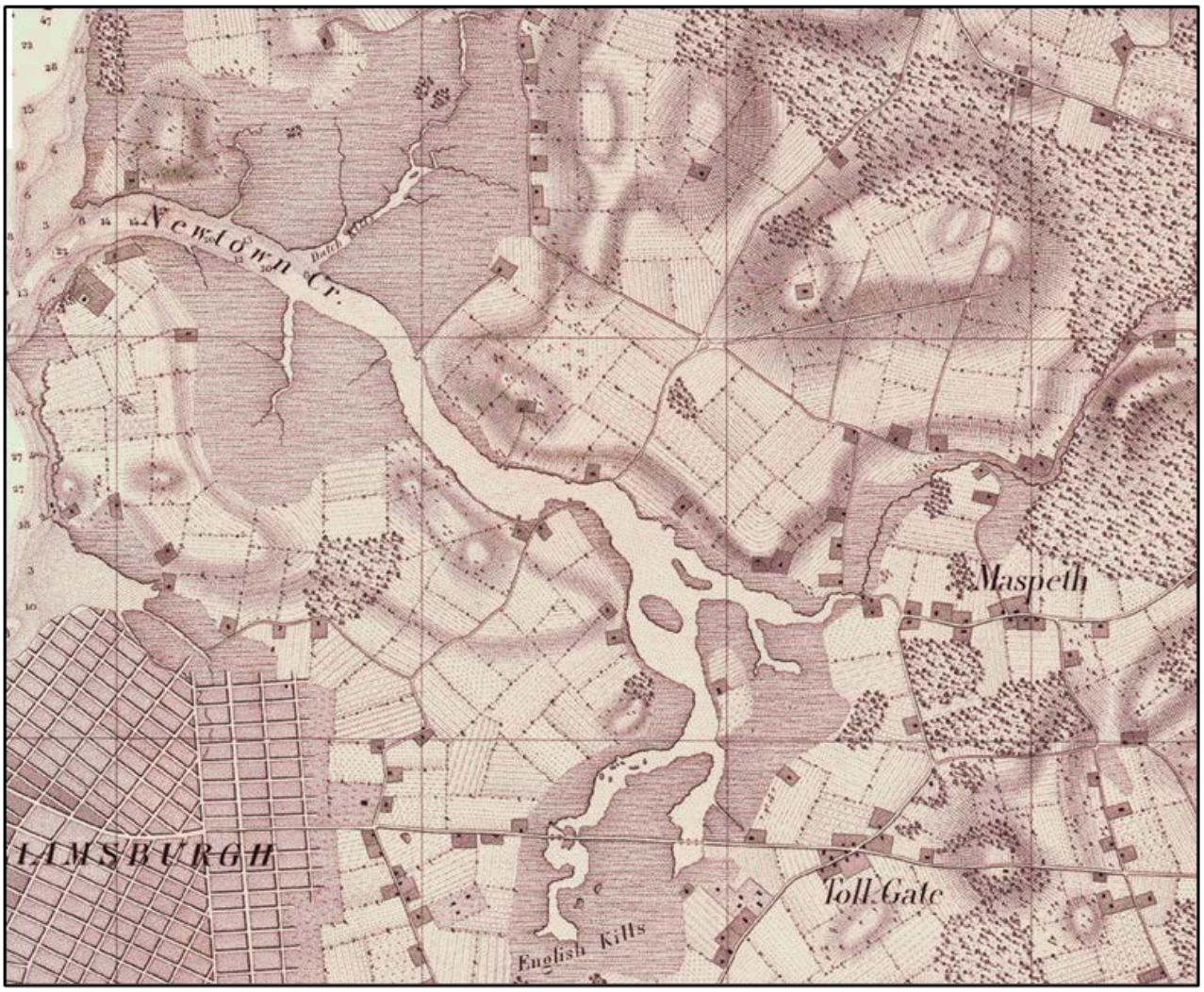
WHAT ARE DAMAGES?

In NRDA, damages refer to the amount of money needed to replace or restore resources to their baseline condition (i.e., condition without contamination) and compensate for interim losses. Trustees seek these monies from parties responsible for contamination.

Regulatory definition at 43 CRF § 11.14(l)

[1] Reasonable cost means the dollar amount that may be recovered for the cost of performing a damage assessment. Costs are reasonable when: the Injury Determination, Quantification, and Damage Determination phases have a well-defined relationship to one another and are coordinated; the anticipated increment of extra benefits in terms of the precision or accuracy of estimates obtained by using a more costly injury, quantification, or damage determination methodology are greater than the anticipated increment of extra costs of that methodology; and the anticipated cost of the assessment is expected to be less than the anticipated damage amount determined in the Injury, Quantification, and Damage Determination phases (43 CFR § 11.14 (ee)).

Exhibit 1-2: Historical Aerial Map of Newtown Creek (U.S. Coast Survey 1844)



Courtesy of David Rumsey Map Collection, David Rumsey Map Center, Stanford Libraries.

However, beginning in the 1800s, heavy industrial use of Newtown Creek and surrounding lands, combined with decades of dredging, infill, channelization, and bulkheading, transformed the waterway. By the mid-1800s, over 50 petroleum refineries, as well as manufacturing plants, factories, and other facilities, operated along the banks of Newtown Creek and were directly discharging industrial waste, stormwater, and sewage into the waterway. These discharges contained concentrations of hazardous substances including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), pesticides, and metals such as lead, mercury, and copper (more details are provided in Section 3.1). Most of these industrial activities continued throughout the 1900s. Currently, waterfront properties along Newtown Creek are largely occupied by heavy industrial operations, including scrap metal processors, warehouse and distribution facilities, transfer stations, lumber storage, oil terminals, liquefied natural gas facilities, electric utility operations, asphalt recyclers, and ready-mix concrete plants (Anchor QEA 2014). The majority of Newtown Creek's shoreline and the surrounding area are land-use zoned for heavy manufacturing and industrial use (AECOM 2011, Riverkeeper and NCA 2018). NYC has designated 780 acres

surrounding Newtown Creek as a Significant Maritime and Industrial Area, suggesting that in the future much of the land near Newtown Creek will remain largely industrial (Exhibit 1-4; Anchor QEA 2014). In addition, there is a federally designated navigational channel within Newtown Creek and its tributaries, and nine of the eleven bridges over Newtown Creek are designed as draw or swing bridges to allow maritime traffic (AECOM 2011).

Extensive engineering in Newtown Creek drives the drainage and hydrology of the waterway. Ninety-nine percent of the shoreline consists of bulkheads, riprap, or rock,[2] and water in the tributaries often stagnates because of insufficient flow (Anchor QEA 2018, Riverkeeper and NCA 2018).

A Remedial Investigation (RI) was performed by several parties potentially responsible for the contamination (potentially responsible parties; PRPs) under EPA's oversight and the Final RI report was released in early 2023. Newtown Creek is currently divided into three operable units (OUs) for contaminant cleanup:

- OU1 consists of the entire remedial Study Area, which includes the impact of hazardous substances, such as PCBs, PAHs, and copper, on the surface water and sediments of Newtown Creek and its five branches (Dutch Kills, Maspeth Creek, Whale Creek, East Branch, and English Kills) up to the high-water mark. [3] While interim early actions and remedial activities are undergoing evaluation, the Feasibility Study (FS) is underway and expected to be finalized in 2028.
- OU2 includes the current and anticipated future releases of hazardous substances from combined sewer overflow (CSO) discharges.[4] Under agreements with EPA (EPA 2018, EPA 2022), NYC evaluated the nature and extent of the contamination resulting from CSOs as well as current and anticipated future releases. NYC has already started long-term monitoring of the CSOs and continues to control and reduce discharges from CSOs and wastewater treatment plants as well as improve the overall performance of these systems and the quality of their infrastructure (NYCDEP 2017).
- OU3 is associated with the potential interim early action for creek mile (CM) 0-2 of the Study Area.[5] Work to be conducted by several PRPs includes a focused feasibility study to identify and evaluate the potential alternatives for remedial action (EPA 2019). However, after thorough consideration of technical information and stakeholder concerns, EPA determined that the remedial action for this portion of the Newtown Creek should be deferred pending completion of the OU1 FS (EPA 2023).

[2] Bulkheads are human-made barriers between shoreline and water to prevent liquid movement between them. Riprap is loose stone used to stabilize the shoreline.

[3] As defined in the 2011 Administration Settlement Agreement and Order on Consent between EPA and six respondents, which include the City of New York (NYC), Phelps Dodge Refining Corporation, Texaco, Inc., BP Products North America Inc., the Brooklyn Union Gas Company d/b/a National Grid NY, and ExxonMobil Oil Corporation (EPA 2011).

[4] Not all sewage discharges from CSOs are considered CERCLA hazardous substances.

[5] As described in the 2019 Administration Settlement Agreement and Order on Consent between EPA and the five respondents: Phelps Dodge Refining Corporation, Texaco, Inc., BP Products North America Inc., the Brooklyn Union Gas Company d/b/a National Grid NY, and ExxonMobil Oil Corporation (EPA 2019).

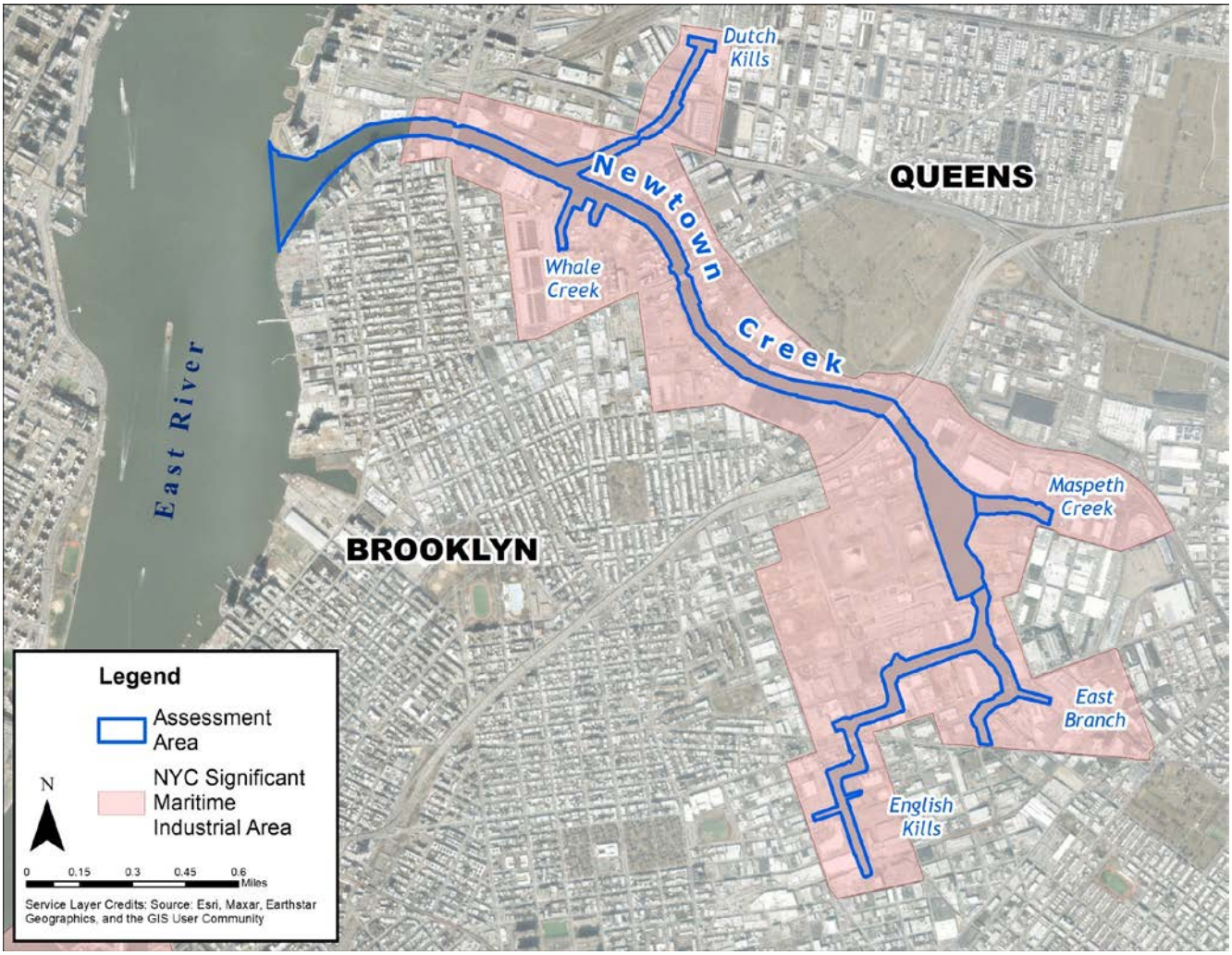
A timeline of major contamination and associated remedial actions is presented in Exhibit 1-3.

Exhibit 1-3: Timeline of Major Contamination and Remediation Events

Year	Event
Early 1800s	Early filling of surrounding marshes and channelization of Newtown Creek for heavy industrial activities.
Mid 1800s	Multiple oil refineries began operations, eventually consolidating into Mobil Oil Brooklyn Refinery in 1892.
1866	Chemical production began at the Laurel Hill Site, one of the first major industrial facilities.
1928	Manufactured gas plant and coking operations began at Greenpoint Energy Center.
1931	Crankcase oil refining began at Quanta Resources Site.
1952	Greenpoint Energy Center ended use of Manufactured Gas Plant Site.
1966	Brooklyn Refinery ceased operation, demolished the refinery, and sold some portions of the property.
1967	Newtown Creek Wastewater Treatment Plant began operating.
1978	U.S. Coast Guard detected signs of an oil spill entering Newtown Creek. It is later known as the Greenpoint Oil Spill, estimated to be more than 52 acres in size with a total volume of approximately 17-30 million gallons of petroleum product.
1979	Initiation of product recovery systems and remedial activities by ExxonMobil (ongoing).
1983	Laurel Hill Site discontinued operations.
1998	Newtown Creek listed as an impaired waterbody (Section 303(d)) due to low dissolved oxygen and CSOs.
2009	EPA conducted an Expanded Site Investigation.
2010	EPA listed Newtown Creek on the National Priorities List, becoming a Superfund Site.
2011	EPA, NYC, Phelps Dodge Refining Corporation, Texaco, Inc., BP Products North America Inc., the Brooklyn Union Gas Company d/b/a National Grid NY, and ExxonMobil Oil Corporation entered into an Administrative Settlement Agreement and Order on Consent to perform a RI/FS (on-going).
2018	As part of the RI, a Baseline Ecological Risk Assessment was completed for OU1.
2021	EPA issued the Record of Decision (final remedial decision document) for OU2, which concludes no action to further address the volume of CSO discharges to Newtown Creek beyond the anticipated implementation of the Long-Term Control Plan for Newtown Creek and associated monitoring.
2022	EPA determined that the selection of a remedy for OU3 (CM 0-2) should be deferred pending completion of the OU1 studies.
2023	Studies related to the RI/FS for OU1 are ongoing.

In addition to the Remedial Investigation and cleanups associated with the EPA's Superfund program, Newtown Creek is also being investigated, particularly the adjacent upland properties, as part of the New York State Superfund program.

Exhibit 1-4: Significant Maritime Industrial Area Associated with Newtown Creek (adapted from NYCDCP 2016)



1.3 Trusteeship and Authority

Under federal and state regulations, designated federal and state agencies and tribal governments are authorized to act on behalf of the public as trustees of natural resources. For Newtown Creek, the Trustees are:

- National Oceanic and Atmospheric Administration,
- New York State Department of Environmental Conservation, and
- U.S. Department of the Interior, U.S. Fish and Wildlife Service.

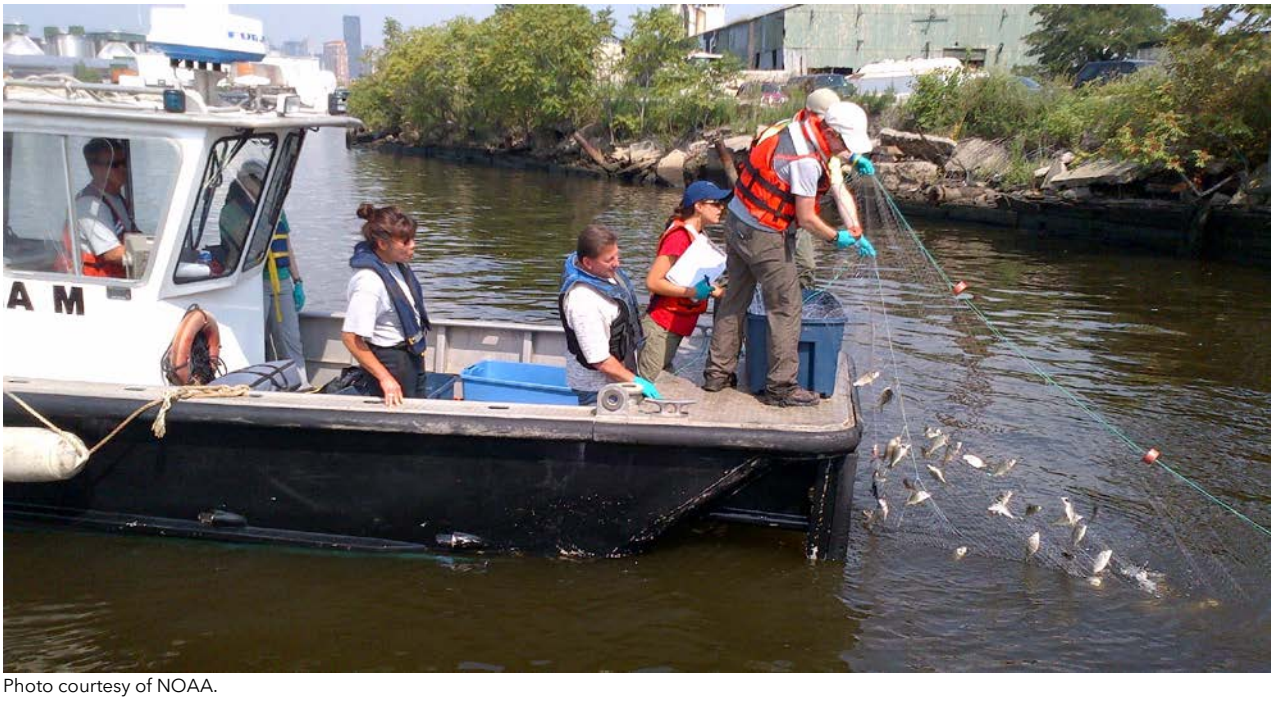


Photo courtesy of NOAA.

The legal framework for the Trustees' actions is provided by CERCLA, 42 USC § 9601 et seq.; the Oil Pollution Act of 1990, 33 USC § 2701 et seq.; the Clean Water Act, 33 USC § 1321; the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, Subpart G; and Executive Orders 12580 (as amended by Executive Order 13016) and 12777. Under the authority of CERCLA and the Clean Water Act, DOI issued regulations (43 CFR Part 11) to guide Trustees in the assessment of natural resource injuries and damages to restore resources following the release of hazardous substances or oil[6]. The purpose of these regulations "is to provide standardized and cost-effective procedures for assessing natural resource damages" (43 CFR § 11.11).

Under these legal authorities, natural resource trustees seek damages with the goal of ensuring that the natural resources, as well as the services that would have been provided by injured resources (see Section 2.3) but for the release of hazardous substances and oil into Newtown Creek, are restored and that the public and environment are made whole for interim losses (i.e., losses resulting from natural resource exposure to contaminants from when the injury occurred until resources have returned to their baseline condition, see Section 1.4). Damages collected by the Trustees from PRPs are used to plan and implement restoration projects. For example, restoration projects may be designed to improve habitat for native biota, create recreational opportunities for the public, and/or create key services that address losses to compensate for injuries attributable to contamination.

[6] Under the authority of the Oil Pollution Act, NOAA issued regulations (15 CFR Part 990) for the assessment of damages resulting from a discharge or substantial threat of a discharge of oil into or upon the navigable waters of the United States, adjoining shorelines, or the Exclusive Economic Zone. In this case, where both hazardous substances and oil have been released, application of the CERCLA NRDA regulations is appropriate, though the OPA NRDA regulations may also provide useful guidance (15 CFR 990.20(c)).

1.4 Overview of Natural Resource Damage Assessment

The purpose of a NRDA and the goal of the Trustees is to restore natural resources that have been injured by contaminants to their baseline condition (defined as the condition of the resource that would have existed if the hazardous substances or oil were not released [43 CFR §11.14(e)]) and obtain compensation for public losses pending restoration to that baseline condition. The Trustees are conducting a NRDA consistent with the CERCLA NRDA regulations (43 CFR Part 11).

1.4.1 Determination to Pursue Type B Assessment

Sections 11.34 through 11.36 of 43 CFR set forth two assessment methods: Type A and Type B. Type A assessments rely on a computer model where input parameters related to the site are required, such as mass or volume of the substance released, the duration of the release, the location of the release, air temperature, and wind conditions. Type A assessments are limited to evaluation of relatively minor, short duration discharges or releases. Type B assessments include more comprehensive studies and analyses, such as collection of additional data to fill information gaps. Type B assessments are typically selected when a contaminant release occurs over a long timeframe, consists of multiple contaminants, or occurs in a complex system that cannot be simplified sufficiently to be modeled by a computer program. Type B assessments allow for a wider range of scientific and economic methodologies to fill data gaps than Type A assessments. The Trustees determined that a Type B assessment is appropriate for assessing injury and damages at Newtown Creek.

This Plan describes types of information the Trustees expect to gather and the approaches the Trustees plan to apply to conduct the assessment (identified in 43 CFR §§ 11.61, 11.70, and 11.80). Type B assessment steps are described in Section 1.4.2 of this Plan under Assessment Phase. Specific requirements for Type B procedures listed in 43 CFR § 11.31(c) and applied to Newtown Creek are:

(1) Confirmation of natural resource exposure to Newtown Creek-related hazardous substances and oil, described in Sections 3.2 and 3.4.

(2) A Quality Assurance Plan that satisfies the requirements listed in the National Contingency Plan and applicable EPA and FWS guidance for quality control and quality assurance plans, provided in Appendix A; and

(3) The objectives of any testing and sampling for injury or pathway determination, described in Exhibit 5-1.

A Restoration and Compensation Determination Plan (RCDP; see Section 1.4.2) may be developed following the Injury Determination and Quantification phases and would be made available for public review and comment at that time (43 CFR § 11.31 (c)(4)).

1.4.2 Steps in the Natural Resource Damage Assessment Process

The NRDA process includes three distinct phases: Preassessment, Assessment, and Post-assessment. These phases are described generally below.

Preassessment Phase

During the Preassessment Phase, trustees review readily available information and data related to the release of hazardous substances and oil and the potential impacts of those substances on natural resources. The review leads to a determination of whether there is evidence to support claims for natural resource damages against the parties responsible for releasing these substances to the environment. This step also documents the trustees' determination of whether further investigation and assessments are warranted (i.e., that a NRDA could and should be performed). This phase is a prerequisite to conducting a formal assessment. The Trustees determined that a NRDA is warranted in their Preassessment Screen for Newtown Creek (DOI et al. 2012).

Assessment Phase

Development of an Assessment Plan is often the first step in the Assessment Phase. The second step is implementation of the plan. The various stages of drafting this Plan and conducting the NRDA include:

Assessment Planning. The assessment planning step is encompassed in this Plan but may be amended in the future by the Trustees. This Plan sets forth the methods for determination and quantification of natural resource injury and damages.

Injury Determination. Determination of injury to natural resources under CERCLA NRDA regulations consists of documentation that there is: (1) a pathway for the released hazardous substance or oil from the point of release to a point at which natural resources are exposed to the released substance, and (2) that injury to a natural resource for which a trustee is responsible (e.g., air, surface water, sediment, soil, groundwater, biota) has occurred, as defined in 43 CFR § 11.62. Generally, injury is defined as a measurable adverse change in the chemical or physical quality or viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance (43 CFR § 11.14(v)).

Injury Quantification. Once the trustees have determined that a resource(s) has been injured, the scope and scale of the injury is quantified for each resource for which damages will be sought. Quantification can use a wide range of metrics, depending on the injured resource and corresponding lost service (discussed further in Chapter 4). Baseline conditions must be determined and accounted for in this phase of the injury assessment.

Damage Determination. This phase involves determining damages resulting from the release of contaminants based on the information obtained in the injury quantification phase. Damages are defined as the amount of money sought by the natural resource trustee as compensation for injury, destruction, or loss of natural resources (43 CFR § 11.14(l)). Damages can be quantified based on the cost of restoration that is expected to provide the same services as those that were lost, accounting for the interim loss of services (past and future); and/or the monetary value of lost resources and/or services. Damage determination often includes the development of a RCDP, which describes options for achieving the scale of restoration or replacement/acquisition of equivalent resources such that sufficient compensation for injuries is achieved. The RCDP may build upon previous restoration evaluation and implementation efforts.

Early Restoration of Injured Resources. Trustees may identify and potentially implement early restoration opportunities, that is, chances to implement a restoration project before the previous assessment phases have been completed. These opportunities may be time sensitive, or there may be a benefit to early implementation (e.g., restoration of natural resources earlier than may otherwise be achieved). Using available information, trustees may estimate restoration credits for such projects and identify offsets against future tallies of natural resources damages. Such early restoration projects, by definition, take place before completion of the assessment process. Early restoration projects for the Newtown Creek NRDA could be selected if consistent with the Trustees' restoration preferences (e.g., project type, location) and CERCLA restoration criteria (43 CFR § 11.82(d)).

Post-Assessment Phase

The Post-assessment Phase may include a Report of Assessment if the assessment proceeds to that stage and requires a project-specific Restoration Plan(s). The Report of Assessment describes the results of the Assessment Phase and includes all the documentation supporting the determinations that were made in the Assessment Phase (e.g., the Preassessment Screen Determination; the Assessment Plan and documentation used in the Injury Determination, Quantification, and Damage Determination phases; and the RCDP).

Following recovery of damages, the Trustees may develop a Restoration Plan based on the RCDP (if completed) or previously completed restoration planning documents to more fully develop the restoration alternatives to compensate for natural resource injuries and service losses. Trustees would conduct environmental analyses under the National Environmental Policy Act and other authorities to carry out restoration activities and fulfill the Trustees' compliance obligations.

1.4.3 Comparison of Remedy and NRDA

NRDA is a process that occurs *in addition* to the remedial process (cleanup) conducted by regulatory agencies like EPA and New York State. Remedy and NRDA have different goals (Exhibit 1-5). An important step in the remedial process is developing remedial action objectives (RAOs) to guide the cleanup. RAOs are risk-based in that they are developed to protect human health and the environment from unacceptable risk of further harm. Remedies (cleanup actions) are selected based on evaluation criteria that are used to compare remedial alternatives and their expected success in achieving the RAOs. Even after a remedy is complete, some contamination may remain in the environment (even the best efforts and technologies may not be able to remove all of the contamination).

In contrast, the goal of NRDA is to restore injured natural resources to their baseline condition and compensate the public for resource-related losses (Exhibit 1-5). NRDA focuses on ecological functions and human uses of natural resources (not human health). Losses resulting from natural resource exposure to contaminants are calculated over time (i.e., interim losses), including both past losses and, if post-remedy contaminant concentrations remain at levels sufficient to cause injury to natural resources, future losses.

However, there are components of NRDA and remedy that overlap. For example, NRDA-related restoration must account for remedial responses that are completed, underway, or planned. That is, the extent to which remediation returns natural resources and the services they provide to their

baseline condition should be considered in the NRDA process. For example, work to remedy a site may partially restore injured natural resources, with NRDA accounting for the remaining injuries persisting into the future even after remedial activities are complete. In addition, remedial actions may cause collateral injury to habitat (e.g., physical disturbance or destruction of habitat). Assessment and restoration of remedy-induced injury is also evaluated within NRDA.

Exhibit 1-5: Overview of Remedy (Cleanup) and NRDA

EPA/New York State – Cleanup/Remedy

- Reduce or eliminate present and future harm to human health and/or the environment from release of a hazardous substance(s)
  - Often directed at the substance itself (e.g., removal via dredging) and the risk of exposure
- May not eliminate current or future natural resource injuries caused by exposure to that substance(s)
- Does not address losses to resources and/or resource uses over time (i.e., past and future)

NRDA Trustees – Restoration

- Restore natural resources injured by releases of hazardous substances or oil to baseline
- Obtain compensation for the public for both lost natural resource functions and the public's lost uses of the resources over time (past, present, and future)
- Account for injuries to natural resources related to remedial activities

1.4.4 Summary of NRDA Activities at Newtown Creek

NRDA activities at Newtown Creek have been going on for several years:

- NYSDEC, NOAA, and FWS signed a Memorandum of Agreement in 2008 to establish a Newtown Creek Natural Resource Trustee Council. This Memorandum of Agreement provides a framework for the Trustees to efficiently plan and implement NRDA and restoration activities, and coordinate Trustee actions with the remedial process (NYSDEC, NOAA, FWS 2008).
- The Trustees completed a Preassessment Screen in 2012 and determined that: 1) hazardous substances were released into Newtown Creek and potentially caused injury to natural resources, and 2) existing data and information sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost.
- Since 2010, EPA has identified (and continues to identify) multiple parties who are potentially liable for the contamination of Newtown Creek. The Trustees have interacted and will continue to work cooperatively with willing PRPs to carry out assessment activities and expedite early restoration whenever possible.
- The Trustees are working with EPA to coordinate NRDA-related activities with the remedial process.
- The Trustees drafted this Assessment Plan.

1.5 Use of Existing Information

Consistent with the CERCLA NRDA regulations, which require that the assessment be conducted in a planned, systematic manner and at a reasonable cost (43 CFR § 11.13(c)), the Trustees are prioritizing cost effectiveness in planning and implementing studies. As such, the Trustees plan to review and gather existing data and other information prior to undertaking any new data collection, including data collected as part of remedial and restoration efforts. The existing information and data of sufficient quality would be used and incorporated into the assessment to the extent feasible and help inform data gaps. Where existing data do not allow for the determination of the nature or extent of injuries, the Trustees may implement studies focused on filling those data gaps. Such studies will be designed and implemented in phases to allow for subsequent adjustments based on initial findings.

1.6 Coordination with Potentially Responsible Parties

Under CERCLA, the parties potentially responsible for contaminant releases may be invited to participate cooperatively in the NRDA and, when appropriate, restoration planning (43 CFR §11.32(a)(2)). The Trustees welcome PRPs' participation and are interested in facilitating cooperative discussions. Cooperative assessments can reduce duplication of effort, expedite the assessment, and accomplish resource restoration earlier than might otherwise be the case. However, the final authority regarding determinations of injury and restoration rests with the Trustees.

1.7 Coordination with the Public

Public participation and review are integral to the assessment planning process and are specifically mentioned in the CERCLA NRDA regulations (e.g., 43 CFR § 11.81(d)(2)). To facilitate public involvement in the planning process for potential assessment activities, the Trustees encourage the public to review and comment on this draft Assessment Plan. The review period is for 45 days (in accordance with 43 CFR § 11.32(c)(1)), from March 1 to April 15, 2024. The Trustees will review, respond to, and incorporate public comments into the Final Assessment Plan as applicable. Public comments and Trustee responses will be attached to the Final Assessment Plan, which also will be made publicly available.

An electronic copy of this Plan is available at each of the following websites:

U.S. Fish and Wildlife Service website
https://www.fws.gov/media/newton-creek-nrda

NOAA website
https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/6837

NYSDEC website
https://dec.ny.gov/regulatory/nrd/major-ongoing-nrd-assessments

A hard copy of the Plan is also available at the following locations:

Queens Public Library
Sunnyside Branch
43-06 Greenpoint Avenue
Long Island City, NY 11104
Tel: (718) 784-3033

NYS Department of Environmental
Conservation - Region 2
4740 21st Street
Long Island City, NY 11101
Tel: (718) 482-4900

Interested parties can obtain a hard copy of this Plan by submitting a written request to

NYS Department of Environmental Conservation
Natural Resource Damages Section
c/o Alicia Pasos
625 Broadway, 14th Floor
Albany, NY 12233
E-mail: nrd@dec.ny.gov

As the Trustees move forward with this NRDA, there will be additional opportunities for public participation. These opportunities include a review of documents such as significant revisions to this Plan, future study plans, restoration plans, and proposed settlement agreements filed in court, as well as input regarding human uses of and connections to Newtown Creek – specifically, how those uses and connections have been impacted by contamination and what actions would restore them. The Trustees intend to facilitate communication with the public and provide sufficient notification in advance of these opportunities in an efficient, effective, and inclusive manner.

Pursuant to 43 CFR § 11.91(c), the Trustees are compiling information to plan and conduct the assessment, including this draft Plan, in a publicly available Administrative Record. The Administrative Record will be available online through NOAA's Data Integration, Visualization, Exploration, and Reporting (DIVER) platform at: https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/6837

1.8 Plan Organization

The remaining chapters in this plan are organized as follows:

- **Chapter 2** – **Natural Resources and Resource Services in the Assessment Area**: This chapter provides an overview of the natural resources in Newtown Creek, including the geographic scope of the assessment and a summary of Newtown Creek's natural resources and the services they provide.
- **Chapter 3** – **Injury Determination Approach**: This chapter outlines the potential pathways of contaminants released from operations on or adjacent to Newtown Creek's natural resources, describes information demonstrating injury to natural resources, and provides an overview of the Trustees' proposed approach to determining injury as a result of these releases.
- **Chapter 4** – **Injury Quantification and Damage Determination Approach**: This chapter discusses the framework for quantifying injury to natural resources and the services they provide (accounting for baseline) and the Trustees' proposed methods for determining damages.
- **Chapter 5** – **NRDA Studies and Analyses**: This chapter discusses the categories and objectives of ongoing data review and analysis efforts in addition to types of potential primary studies.

CHAPTER 2 | Natural Resources and Resource Services

The focus of a NRDA is to evaluate and restore the natural resources and resource services that are exposed to and injured by hazardous chemical contaminants and oil. This chapter provides information on the geographic scope within which exposure has likely occurred, the physical and biological characteristics of the area, and the natural resources and the types of services those natural resources provide (43 CFR §11.31(a)(2)).

2.1 Geographic Scope

The geographic scope of the Assessment Area is defined as the area within which natural resources have been directly or indirectly affected by industrial and municipal-related oil and hazardous substances in Newtown Creek (43 CFR § 11.14 (c)). Based on the CERCLA NRDA regulations, the industrial history of Newtown Creek, the ongoing and proposed remedial actions, and a review of available data, the Trustees have identified the Assessment Area as the aquatic habitat within the entire Newtown Creek. The Assessment Area is approximately 166 acres and includes the intertidal zone.[7] The size and extent of the Assessment Area are presented in Exhibit 2-1. The Trustees may expand or revise the geographic scope as the assessment progresses.

Exhibit 2-1: Assessment Area

[7] The area where the water of Newtown Creek meets the land between high and low tides.

2.2 Description of the Assessment Area

Newtown Creek is a 3.8-mile-long tidal arm of the New York-New Jersey Harbor Estuary that feeds into the East River and drains approximately 6,815 acres of highly urbanized watershed, the majority of which is served by the Newtown Creek Wastewater Treatment Plant (WWTP; NYCDEP 2017). With a total surface area of approximately 166 acres and a depth of up to 30 feet, it has five tributaries branching off the main channel: Dutch Kills, Whale Creek, Maspeth Creek, East Branch, and English Kills (Exhibit 2-1; Giffen 2013). Newtown Creek receives saltwater through estuarine tidal exchange and freshwater from several sources, including storm sewer and CSO outfalls, groundwater discharge, and overland flow (AECOM 2011, Anchor QEA 2018). Net surface water flow in Newtown Creek is generally from east to west toward the mouth of Newtown Creek, but reversed flow may occur with incoming tides (AECOM 2011). Prior to 1903, groundwater from the water table aquifer followed its natural flow path, moving towards and discharging to the nearest surface water. After the start of the public water supply in 1903, which created a cone of depression in the water table from excessive withdrawals, groundwater may have flowed from the north under Newtown Creek toward the pumping center until the water supply pumping was discontinued in 1947 (AECOM 2011). Newtown Creek is underlain by four geological units: artificial fill consisting of construction and domestic debris, fluvial creek and marsh deposits, Upper Glacial Aquifer, and bedrock (AECOM 2011, Anchor QEA 2014).

Kosciuszko Bridge over Newtown Creek.

Following over 100 years of industrial development, almost all of Newtown Creek's shorelines are comprised of bulkheads, riprap, or rock, with sparse coverage of non-native vegetation. Channelization and shoreline hardening have contributed to stagnation (lack of flow) in Newtown Creek's tributaries (Anchor QEA 2018, Riverkeeper and NCA 2018). The existing in-creek habitat is largely subtidal, with intertidal habitats found mainly in the tributaries (Anchor QEA 2018). The subtidal habitat supports communities of benthic invertebrates, fish, swimming birds, and possibly submerged macrophytes (aquatic plants), though rooted vegetation may be limited to a small portion of Maspeth Creek (Anchor QEA 2014, Anchor QEA 2018). EPA's Baseline Ecological Risk Assessment (BERA) indicates the presence of shoreline habitat, which provides foraging habitat for wading birds in up to five percent of the Assessment Area (Anchor QEA 2018). However, vertical bulkheads limit access to the intertidal habitat by semi-aquatic mammals (Anchor QEA 2018).

The surface water of Newtown Creek has been classified as a Class SD waterbody by NYSDEC, meaning it is suitable for fishing and for fish, shellfish, and wildlife survival, but does not meet requirements for fish propagation (NYCDEP 2017, NYSDEC 2020). Current recreational usage of Newtown Creek includes boating and kayaking, wading, fishing, crabbing, scuba diving, and other activities (AECOM 2011, Anchor QEA 2014). However, the New York State Department of Health (NYSDOH) has issued advisories for fish and crab consumption for the Upper New York Bay,

Looking out from Maspeth Creek. Photo courtesy of NOAA.

including Newtown Creek, since at least 1981; current advisories range from "Up to 4 meals/month" to "DON'T EAT" depending on the fish or shellfish species and human demographic group (NYSDOH 2023).

The first phase of the remedial investigation suggests that surface sediment (approximately zero to six inches in depth) from the mouth of Newtown Creek to CM 2.0 is characterized by relatively low total organic carbon (TOC) content associated with very fine materials (i.e., clay and silt). Surface sediments from areas at the Turning Basin exhibit elevated TOC and high percent fines, and sediment from areas in the tributaries have a wider range of TOC and grain size. The level of TOC in sediment is one parameter that can influence contaminant bioavailability.[8] Coarser materials are found in the vicinity of the outfalls, which suggests that the finer materials are being transported and deposited further downstream.

2.3 Natural Resources

Under the CERCLA NRDA regulations, natural resources include land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other resources that belong to, are managed by, or held in trust by, appertaining to, or otherwise controlled by the United States, State or local governments, foreign governments, or Indian tribes (43 CFR § 11.14(z)). These resources are organized into five categories: surface water (including sediments), groundwater, air, geological (including soil), and biological resources.

This Plan focuses on the sediment, surface water, and biological resources in the Assessment Area, including both the ecological and human services provided by these resources. Groundwater and air have been exposed to Creek-related contaminants, and the Trustees reserve the right to quantify distinct injuries to these resources at a future time. However, for the purposes of this Plan, the Trustees currently consider air and groundwater as primary pathways of hazardous substances to sediment, surface water, and biological resources.

Spotted sandpiper – a bird species found at Newtown Creek. Photo courtesy of New York State Department of Environemntal Conservation.

Properly functioning sediment and surface water are essential for a healthy ecosystem and directly and/or indirectly support numerous biological resources. The CERCLA NRDA regulations define biological resources as those natural resources referred

[8] Bioavailability is the amount or fraction of a substance that is available to be taken up by an organism.


From left: Blue crab. Photo courtesy of National Park Service; Double-crested cormorant. Photo courtesy of Fish and Wildlife Service.

to in section 101(16) of CERCLA as fish, wildlife, and other biota including marine and freshwater species, aquatic and terrestrial species, game, nongame, and commercial species, threatened and sensitive species (designated by federal or state law), and other living organisms that are otherwise not listed in the definitions (43 CFR § 11.14(f)). Biological resources exposed or potentially exposed to contaminants released into Newtown Creek include, but are not limited to, the plants, invertebrates, fish, birds, and mammals that utilize the aquatic habitat in the Assessment Area.

Results of RI/FS Phase 1 and Phase 2 community surveys noted the presence of benthic invertebrates (dominated by oligochaetes, polychaetes, and amphipods), bivalves (especially ribbed mussels), crabs (especially blue crab), and fish (dominated by mummichog, Atlantic menhaden, and striped bass) in the subtidal[9] habitat of Newtown Creek (Anchor QEA 2018). RI/FS surveys also documented the presence of semi-aquatic birds (most often spotted sandpiper and double-crested cormorant), as well as birds and mammals commonly found in urban environments such as gulls, rock doves, Norway rats, feral cats, and raccoons (Exhibit 2-2; Anchor QEA 2013b, 2016, as cited in Anchor QEA 2018).

In addition, the Newtown Creek Alliance (NCA) conducted extensive wildlife surveys of Newtown Creek and recorded observations of over fifty bird species, over thirty species of fish and shellfish, over fifteen species of other invertebrates and insects, and six mammal species as of 2016 (Riverkeeper and NCA 2018, NCA 2013). To supplement the qualitative observations of several mollusk taxa in Newtown Creek, NCA also completed an exhaustive survey of the Newtown Creek shoreline in 2016, and noted the presence of over 200,000 ribbed mussels in the intertidal habitat on a variety of human-made shoreline surfaces (Riverkeeper and NCA 2018, NCA 2013). For a working inventory of animal species observed at Newtown Creek, see NCA's Newtown Creek Wildlife Survey (NCA 2013).

Examples of biota that are found in Newtown Creek are presented in Exhibit 2-2.

[9] An area of Newtown Creek that is below the lowest tide.

Exhibit 2-2: Example Biota Found in Newtown Creek

Species Type	Common Name	Scientific Name
Invertebrates	Barnacle	*Balanus spp.*
	Blue claw crab	*Callinectes sapidus*
	Green crab	*Carcinus maenas*
	Horseshoe crab	*Limulus polyphemus*
	Mussel	*Mytilus spp.*
	Soft shelled clam	*Mya arenaria*
	Hard shelled clam	*Mercenaria mercenaria*
Fish	Atlantic menhaden	*Brevoortia tyrannus*
	American eel	*Anguilla rostrata*
	Banded killifish	*Fundulus diaphanus*
	Mummichog	*Fundulus heteroclitus*
	Striped bass	*Morone saxatilis*
	Summer flounder	*Paralichthys dentatus*
	Winter flounder	*Pseudopleuronectes americanus*
Birds	American bittern	*Botaurus lentiginosus*
	American black duck	*Anas rubripes*
	American crow	*Corvus brachyrhynchos*
	American robin	*Turdus migratorius*
	Belted kingfisher	*Ceryle alcyon*
	Black-crowned night heron	*Nycticorax nycticorax*
	Canada goose	*Branta canadensis*
	Double-crested cormorant	*Phalacrocorax auratus*
	Great blue heron	*Ardea Herodias*
	Northern mockingbird	*Mimus polyglottos*
	Spotted sandpiper	*Actitis macularia*
Mammals	Feral cat	*Felis sylvestris*
	Norway rat	*Rattus norvigicus*
	Raccoon	*Procyon lotor*

Sources: Anchor QEA 2013, NCA 2013

2.4 Natural Resource Services

Natural resource services are the physical and biological functions performed by natural resources, including the human uses of those functions, and reflect the quality of the resource (43 CFR § 11.14 (nn)).

2.4.1 Ecological Services

Each of the natural resources mentioned above provides a variety of ecological services. For example, Newtown Creek contains sediment that provides nutrients and minerals to the aquatic system and substrate for aquatic plants and benthic invertebrates. These plants and invertebrates cycle nutrients, aerate sediment, and feed larger animals. Fish help control prey populations (e.g., algae, insects), comprise parts of the aquatic food web, and contribute to nutrient and energy cycling. Aquatic birds and mammals prey on invertebrates and fish, contribute to nutrient and energy cycles, connect aquatic and terrestrial ecosystems, and serve as pollinators, scavengers, and seed dispersers. These resources have been exposed or are potentially exposed to contaminants in the Assessment Area mainly through contact with contaminated sediment and water and ingestion of contaminated prey.

2.4.2 Human Use Services

In addition to ecological services, Newtown Creek directly and indirectly provides a suite of services to the public. These include recreational use as well as non-recreational community activities and connections.

Photo courtesy of Mitch Waxman.

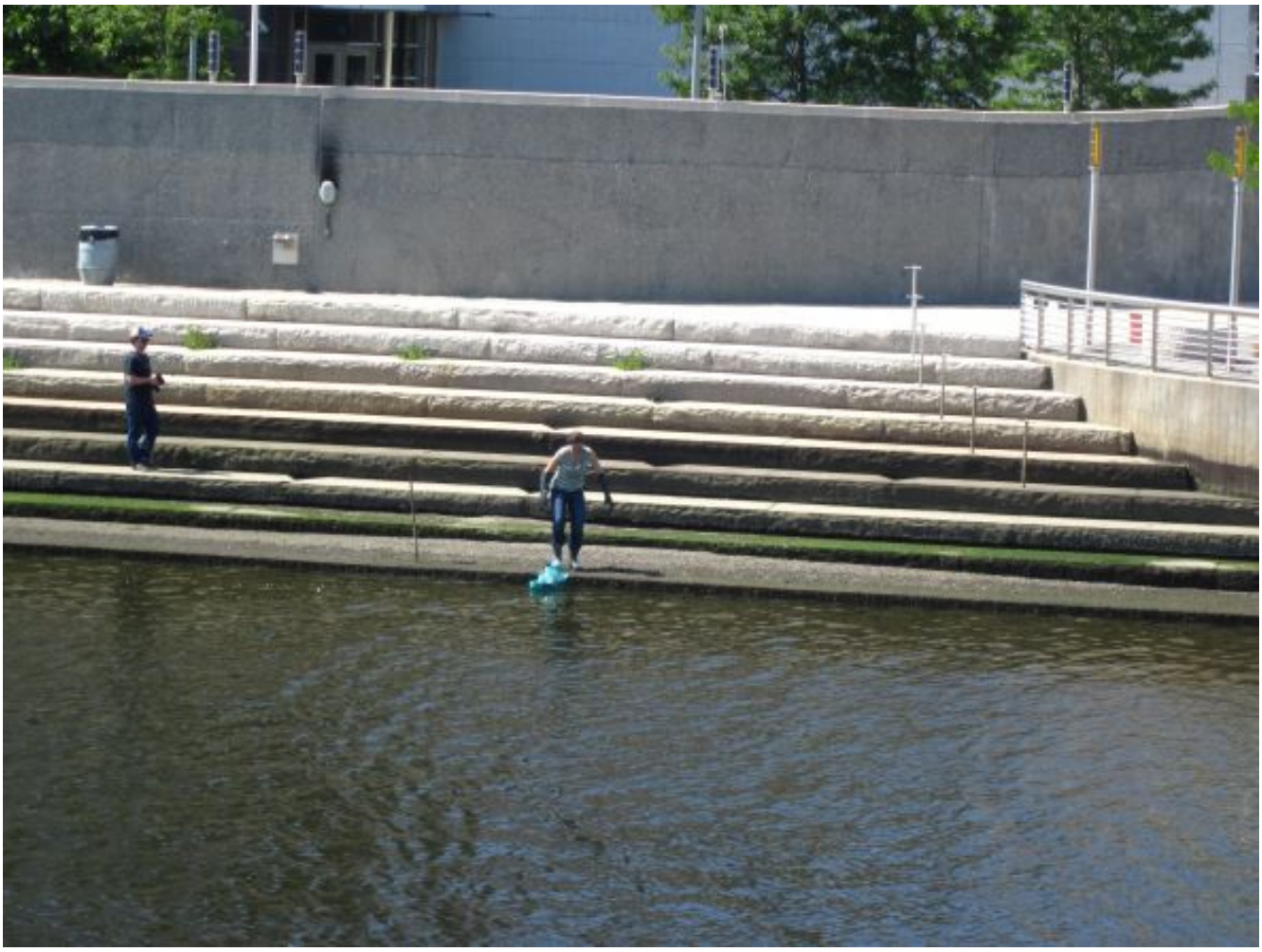
Recreational Use

Newtown Creek serves as a local recreational resource and supports a variety of recreational activities such as fishing, crabbing, boating, canoeing, kayaking, swimming, and scuba diving. Newtown Creek also provides public benefits and value to surrounding communities (NYSDOH 2014b). Contamination of Newtown Creek has likely impaired all of these activities to varying degrees. This Plan addresses recreational fishing and crabbing losses; however, the Trustees may consider additional recreational losses as the assessment proceeds.

Non-recreational Community Loss

Even within a highly developed area, Newtown Creek is a place where people can enjoy being near and feeling connected to a natural environment. For local human communities, Newtown Creek is not only an industrial waterway important for jobs and the local economy, it is also an essential part of the culture of local neighborhoods where more than a million people live and work (U.S. Census Bureau 2022). For example, some local community groups have used parts of Newtown Creek for educational programs, volunteering events, and scientific projects, such as The Living Dock that NCA created and has maintained since 2015 (NCA 2023b). The Newtown Creek

Nature Walk, an urban park along the shoreline of Whale Creek near the wastewater treatment plant, provides opportunities for the public to explore, relax, and have a panoramic view of the waterway (NYC 2023). Because of Newtown Creek's past and current contaminated state, community enjoyment of and connections to Newtown Creek have likely diminished, and in some cases, eliminated altogether.



Granite steps at Newtown Creek Nature Walk. Photo courtesy of NOAA.

CHAPTER 3 | Injury Determination Approach

The CERCLA NRDA regulations define natural resource injuries as generally falling into two categories (43 CFR § 11.62). The first establishes injury based on physical, chemical, or biological changes to the resources as a result of contaminant exposure. Examples include changes in an organism's physical development, reproductive success, or survival. The second category establishes injury based on exceedance of regulatory criteria, including state health advisories recommending limits on consumption of contaminated biota. The Trustees plan to evaluate both types of injuries within the Assessment Area.

To determine injury in a planned, systematic manner and at a reasonable cost (43 CFR § 11.30(b)), the Trustees identified parameters on which to focus assessment efforts. The Trustees' proposed approach also emphasizes the use of existing information and identification of data gaps and may include evaluation of potential methods for addressing those data gaps. If studies are determined to be necessary, they may be designed and implemented in phases to allow for subsequent adjustments based on initial findings. The Trustees will consider the relationship between injury and restoration to ensure that the metrics used to assess each type of natural resources are comparable and that restoration will provide resources and resource services of a type and quality that are consistent with what was lost.

This Chapter identifies the hazardous substances that the Trustees plan to focus on in this assessment, confirms exposure, discusses pathways for contaminants to reach natural resources, describes proposed approaches for injury determination for natural resources and their human uses, and summarizes how the Trustees may evaluate the impacts of remediation.

3.1 Hazardous Substances

This assessment will focus on injuries resulting from exposure to hazardous substances released into Newtown Creek from past and current industrial activities, as well as CSOs. [10] These contaminants include, but are not limited to, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), hazardous pesticides, and metals such as lead, mercury, and copper. Currently, the Trustees plan to focus on PAHs, PCBs, and copper as the primary contaminants of concern (COCs) for assessing natural resource injury. The selection of these three COCs is consistent with EPA's Record of Decision for OU2, which identifies PAHs, PCBs, and copper as the primary contaminants leading to unacceptable risk to organisms exposed to study area sediment (EPA 2020). The Trustees may assess injury resulting from natural resource exposure to additional COCs as the NRDA progresses and new information becomes available.

PAHs are compounds that consist of clusters of benzene rings with a variety of substituted groups and are typically of petrogenic (petroleum products) or pyrogenic (incomplete burning of organic matter) origin (Kuzia and Black 1985). Once they enter aquatic environments, PAHs are not very mobile and are typically adsorbed (stuck) to particles that settle into the sediments (Eisler 2000).

[10] Not all sewage discharges from CSOs are considered CERCLA hazardous substances.

They can bioconcentrate[11] in an individual organism as well as biomagnify[12] through food webs, depending on the specific PAH and an organism's ability to absorb, metabolize[13], and excrete PAHs. These compounds can cause a variety of developmental anomalies and tumors in fish and aquatic-dependent mammals, as well as other toxicological responses in organisms such as inhibited survival, growth, and reproduction (Eisler 2000).

PCBs are a chemical class of 209 individual chlorinated hydrocarbon chemicals (PCB congeners). PCBs were manufactured from the 1930s until their production was banned in the United States in 1979 (EPA 1979). Because of their chemical stability at high temperatures, PCBs were used primarily as insulating materials for electrical transformers and capacitors, as well as in diverse products such as paints and carbon copy paper. PCBs degrade very slowly in the environment. The chemical structure of PCBs also allows these compounds to accumulate in the fatty tissues of organisms and biomagnify through food webs (Eisler 2000). In organisms, PCBs can cause a range of adverse health effects, including liver and skin toxicity, developmental and other reproductive effects, and neurological or behavioral effects.

Copper, an essential element for all known living organisms, occurs naturally in rock, soil, water, sediment, and air, and can be found in metal products such as wire, sheet metal, pipe, and pennies (ATSDR 2004). Because metals do not degrade, copper remains in the environment and can be subsequently taken up by biota (ATSDR 2004). Exposure to high concentrations of copper can result in adverse effects ranging from gastrointestinal distress to kidney damage, anemia, immunotoxicity, developmental toxicity, and mortality (ATSDR 2004).

The following sections indicate that these contaminants are pervasive and persistent in the aquatic environment of Newtown Creek, and that sufficient information related to Newtown Creek exists to describe both the extent of the contamination in the Assessment Area and the associated toxicity to natural resources.

3.2 Confirmation of Exposure

A natural resource has been exposed to a hazardous substance or oil if the resource is, or has been, in physical contact with a hazardous substance or oil or with media containing a hazardous substance or oil (43 CFR § 11.14(q), 15 CFR § 990.30). Consistent with 43 CFR § 11.31(c)(1) and § 11.37, this Plan documents that natural resources have been exposed to hazardous substances and/or oil, supporting the Trustees' decision to implement a formal assessment. For example, sediment and surface water samples from Newtown Creek had detected concentrations of multiple hazardous substances including PAHs, PCBs, and copper. Detection of these COCs in sediment confirms exposure to Newtown Creek's natural resources and indicates the potential for injury.

[11] Bioconcentration is the process by which the concentration of a chemical in an organism becomes higher than its concentration in the surrounding water.

[12] Biomagnification is an increased chemical concentration in an organism resulting from ingestion of contaminated prey in lower trophic levels.

[13] Metabolism is a chemical process in the body of an organism that involves breaking down a substance into smaller units (catabolism) and synthesizing complex substances from smaller units (anabolism).

3.3 Pathway

An important step in determining injury to natural resources is to establish a pathway from a known release or source of a hazardous substance or oil to exposure of natural resources. Pathway is defined as the route or medium through which a hazardous substance is or was transported from the source of the release to the injured resource (43 CFR §11.14(dd)). The main pathways of contaminants to Newtown Creek include direct discharge to surface water and groundwater transport. In Newtown Creek, contaminants initially collect in the sediments and organisms are exposed through biological uptake directly from sediments or surface water, or by consuming contaminated organisms that were exposed to contaminated sediment or surface water. A conceptual site model of major pathways is presented in Exhibit 3-1.

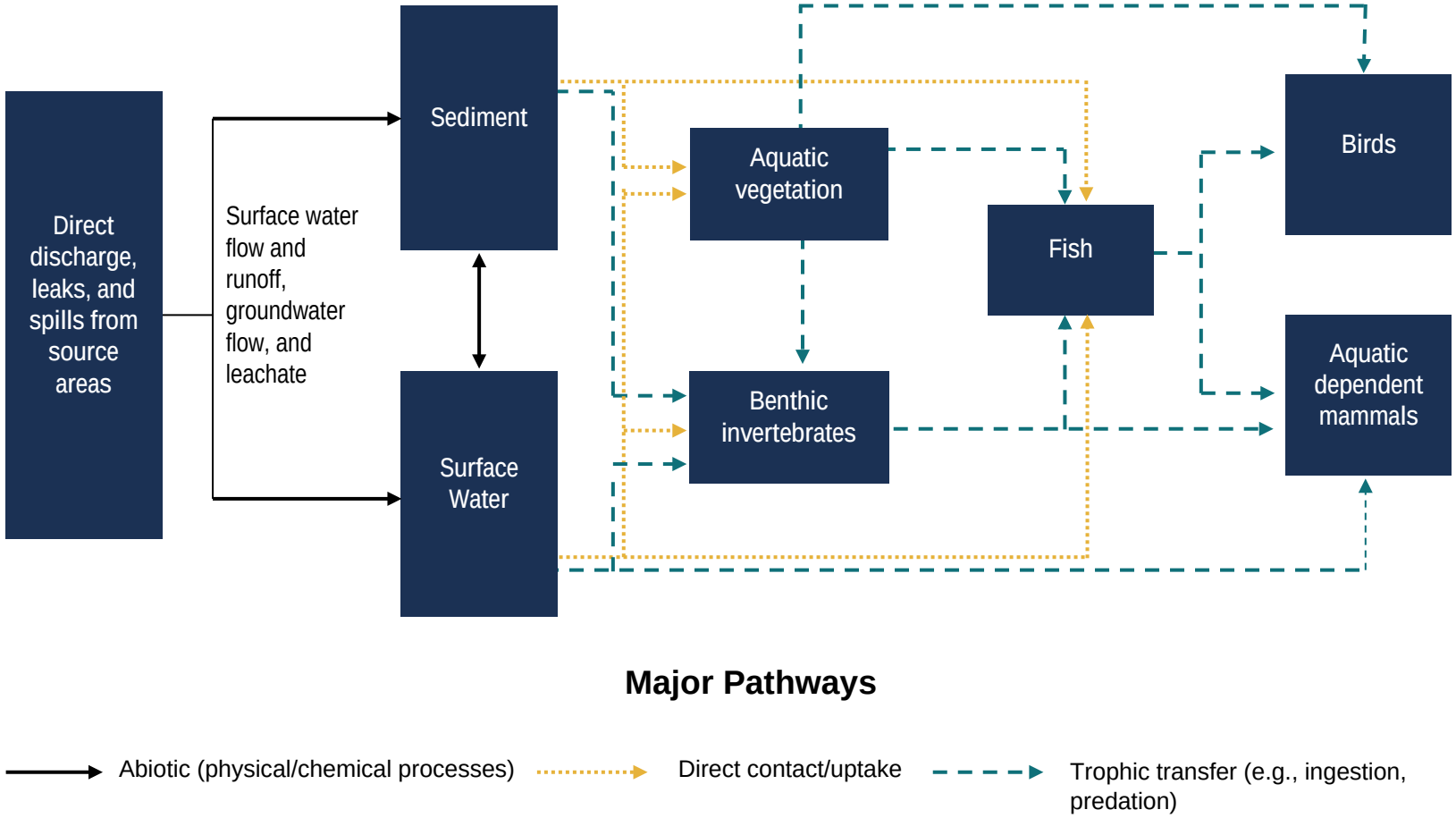
3.3.1 Direct Discharge

Industrial and municipal activities have in the past and continue to directly discharge waste into Newtown Creek. For example, in the late 1800s, over 100 distilleries operated by Standard Oil discharged up to 30,000 gallons of effluent per week into Newtown Creek (EPA 2007, NCA 2023a), while the Brooklyn Department of Health documented significant quantities of oil and oily wash water (which typically contain PAHs) flowing into Newtown Creek from numerous oil refineries as a result of the kerosene treatment process (Anchor QEA 2012). Currently, Newtown Creek receives ongoing contaminant inputs from point sources such as CSOs and stormwater discharge, including PAHs, PCBs, and copper. Spatial patterns of surface sediment contamination also provide evidence of hazardous substance inputs from CSOs: levels of PAHs, PCBs, copper, and other compounds typically associated with CSOs (e.g., nonylphenols and the bacterium *Clostridium perfringens*) are elevated in the upstream portions of the Assessment Area and tributaries (i.e., in the vicinity of major CSO outfalls) compared to more downstream areas of Newtown Creek (Anchor QEA 2014).

3.3.2 Groundwater Transport

PCBs, PAHs, and metals have been detected in the groundwater flowing from underneath industrial facilities to the Assessment Area. Typically, contaminants reach groundwater because a contaminated material or waste is released onto surface soil, buried, or injected into the ground. Contaminants infiltrate the soil along with precipitation or other released liquids and travel downwards until they reach groundwater. Groundwater then flows downgradient into surface water – in this case Newtown Creek. For example, all three COCs were measured in groundwater flowing from a former oil terminal toward Newtown Creek and in the sediment adjacent to the terminal (Anchor QEA 2012). Non-aqueous phase liquid (NAPL), a separate-phase material composed of undissolved petroleum hydrocarbons that often contains PAHs, has been detected in the groundwater beneath several historically contaminated sites, in seeps throughout the Assessment Area, and in the sediments of Newtown Creek (Anchor QEA 2012, 2018, 2023b). In addition, a 17- to 30-million-gallon plume of oil in the groundwater beneath Greenpoint seeped upwards into Newtown Creek. Although the exact source and start date of the plume is unclear, it is likely the result of decades of leakage of oil and petroleum products from storage tanks and pipelines that operated adjacent to Newtown Creek for decades (EPA 2007, Riverkeeper and NCA 2018).

Exhibit 3-1: Conceptual Site Model Showing Major Pathways



3.3.3 Biological Uptake

Plants and animals are exposed to COCs in the Assessment Area through direct contact with and ingestion of contaminated surface water, sediment, porewater[14], plants, and prey (Anchor QEA 2018). The hydrophobicity[15] and stability of PAHs and PCBs allow them to be taken up by biota; PCBs are then bioaccumulated and biomagnified through the food web (Eisler 2000). Similarly, either aqueous copper or copper bound to organic molecules suspended in the surface water and sediment may be taken up by and accumulate in aquatic organisms, especially filter feeders (ATSDR 2004). Site-specific data document PAHs, PCBs, and/or copper in the tissue of biological resources (e.g., benthic invertebrates, crabs, fish) within the Assessment Area (Anchor QEA 2018). Contaminated lower trophic level biota are a pathway for exposure of higher trophic level organisms to those contaminants (Eisler 2000).

3.4 Injury to Natural Resources

The Trustees have confirmed natural resource exposure to contaminants and identified environmental pathways and will evaluate whether injury to natural resources has occurred. This Plan focuses on assessing injury to biological resources that utilize the Assessment Area, including:

- Injury to sediment (categorized as a surface water resource (43 CFR 11.14(pp))) based on adverse impacts to biota exposed to contamination in the sediment;
- Injury to plants and animals based on the toxic effects of contaminants; and
- Injury to surface water, sediment, and animals based on exceedances of regulatory criteria or the existence of consumption advisories.

3.4.1 Surface Water Resources (including Sediment)

An injury to surface water, including sediment, has resulted from the release of a hazardous substance or oil if, for example:

- Concentrations of hazardous substances or oil in surface water exceed applicable federal or state regulatory water quality criteria (e.g., established under section 304(a)(1) of the Clean Water Act).
- Concentrations and duration of hazardous substances measured in suspended sediments, or bed, bank, or shoreline sediments are sufficient to have caused injury to biological resources (43 CFR § 11.62(b)(1)(v)).

The Trustees intend to use existing data, as well as any additional data collected as part of the assessment, to determine: 1) whether concentrations of COCs in surface water or sediments exceed applicable water quality or sediment quality criteria or guidelines, and 2) whether COC concentrations in Assessment Area sediment are sufficient to injure biological resources, as

[14] Water within the small spaces between particles in soils or sediments.

[15] Hydrophobicity is the property of repelling water rather than absorbing it or dissolving in it.

described in Section 3.4.2. Other studies or analyses to further determine injury to sediment may be developed as necessary (see Chapter 5).

Concentrations of numerous hazardous substances, including copper, exceeded NYSDEC water quality standards, especially in the upper reach of Newtown Creek. A 2003 acute toxicity test conducted with mysid shrimp (*Mysidopsis* spp.) exposed to surface water of Newtown Creek indicated adverse effects on the test organisms such as significantly reduced growth (DOI et al. 2012).

Initial review of concentration data from surface sediment samples collected in 2012 and 2014 as part of the Remedial Investigation demonstrates that sediment COC concentrations are higher than relevant sediment quality guidelines (SQGs) and literature values (Exhibit 3-2). For example, most sediment samples contained total PAHs, total PCBs, and copper levels in exceedance of corresponding probable effects levels (PELs), above which adverse biological effects frequently occur, and Sediment Guidance Values (SGVs), which are levels above which sediments are considered to be highly contaminated and likely to pose a risk to aquatic life (NYSDEC 2014).

Exhibit 3-2: Surface Sediment Concentrations of COCs at Newtown Creek (2012 and 2014) and Example Sediment Quality Guidelines

Contaminant	Number of Samples	Concentration Range (ppm)	Median (ppm)	PEL (ppm)	SGV Class C (ppm)
Total PAHs	370	0.55 - 5,400	89	16.77	45
Total PCBs	401	0.015 - 380	1.4	0.189	1
Copper	401	11 - 37,000	330	108	270

Notes:
1. ppm = parts per million
2. PEL = Probable Effects Level (MacDonald et al. 1996)
3. SGV Class C = Sediment Guidance Value (NYSDEC 2014)
4. COCs = contaminant of concerns, PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls

Source: Anchor QEA (2023a)

3.4.2 Biological Resources

Injury to biological resources has resulted from the release of a hazardous substance or oil if the concentration of the substance:

- Is sufficient to cause adverse changes to the biological resource or its offspring;
- In edible portions of the organisms exceeds action or tolerance levels established under section 401 of the Food, Drug, and Cosmetic Act (21 U.S.C 342); or
- Exceeds levels set by State health agencies for consumption (43 CFR § 11.62(f)(1)).

Therefore, injury to biological resources can be assessed through documented site-specific toxicity, exceedances of toxic effect or tolerance thresholds, or the existence of a consumption advisory.

Information on resources within the Assessment Area suggests that benthic invertebrates, fish, birds, and mammals have likely been injured due to the release of hazardous substances. Information demonstrating injury or the potential for injury to these resources is presented below. The Trustees may also consider other resources as the assessment progresses.

The Trustees intend to use existing data and information to the fullest possible extent to establish injury metrics. Additionally, the Trustees plan to consider a phased approach for developing studies or analyses as necessary to address any data gaps. These are cost effective strategies that are expected to comply with the definition and standard of reasonable cost described in 43 CFR § 11.14(ee).

Benthic Macroinvertebrates

The potential for injury to benthic macroinvertebrates is demonstrated by the following lines of evidence:

(1) Surface sediment concentrations of PAHs, PCBs, and copper exceed SQGs, indicating that reductions in growth, survival, and/or mortality are likely to occur (Exhibit 3-2). The Trustees may consider the bioavailability of these COCs when determining injury.

(2) Porewater concentrations of PAHs and copper exceed threshold values considered protective of the aquatic community (i.e., concentrations above which adverse effects on organisms exposed to porewater such as benthic invertebrates and fish are expected to occur) at some locations in the Assessment Area (Exhibit 3-3; Anchor QEA 2013, 2018).

(3) Sediment toxicity tests indicated greater adverse effects, including reduced reproduction and increased mortality, when benthic invertebrates were exposed to Assessment Area sediment as compared to exposure to reference[16] area sediment (Exhibit 3-4).

(4) Site-specific animal tissue concentrations of PAHs and PCBs exceed critical body residues (CBRs), that is, concentrations above which adverse effects have been documented in the literature. Using these tissue concentrations and CBRs, the BERA reports Hazard Quotients (HQs), or ratios of potential exposure to a substance and the level above which adverse effects are expected to occur (Lowest Observed Adverse Effect Level; LOAEL), for each contaminant-receptor pair (Exhibit 3-5). A HQ value greater than one indicates exposure sufficient to cause adverse effects, such as reduction in survival, growth, and reproduction.

(5) Studies indicate a stressed benthic community, based on Weisberg Biotic Index[17] scores of less than two for most stations in the Assessment Area (Anchor QEA 2013, 2018). Sampling in the spring and summer of 2012 and 2014 indicated that the Assessment Area and reference area were dominated by only a few species of pollution-tolerant organisms, especially polychaetes (Anchor QEA 2013, 2018). No benthic invertebrates were observed in Maspeth Creek, East Branch, English Kills, or the mainstem of Newtown Creek above CM

[16] Reference areas are located outside of the Assessment Area and reflect environmental conditions similar to the Assessment Area but without contamination.

[17] An index developed by EPA for estuaries in the northeastern United States and was used in the BERA as a metric to evaluate the status of the Assessment Area and reference area benthic communities.

2.0 during sampling in the summer of 2012. In contrast, many benthic organisms were found with equivalent sampling efforts in reference areas (Anchor QEA 2013, 2018). This change in the benthic community can reduce the quality and quantity of food for predators and affect the energy cycle within the aquatic food web.

Exhibit 3-3: Example Porewater Threshold Values for the Aquatic Community for PAHs, PCBs, and Copper

Contaminant	Threshold Value (ppb)	Reference
PAHs[1]	0.28 – 307	EPA-600-R-02-013 (EPA 2003)
PCBs[1]	0.54	Fuchsman et al. 2006
	0.05 (for fish)	EPA 823-R-78-023 (EPA 1978)
Copper[2]	7.9	NYSDEC Saline Surface Waters (NYSDEC 1998)

Notes:
ppb = parts per billion, PAHs = polycyclic aromatic hydrocarbons, PCBs = polychlorinated biphenyls
1. Chronic Threshold Value indicating the level of contamination above which adverse effects such as reduced reproduction and survival occur as a result of long-term exposure. These effects can lead to ecological impacts such as reduced prey availability for consumers. For PAHs, threshold value is reported as range of individual PAH chronic thresholds. For PCBs, value is total PCB congeners chronic threshold.
2. NYS Acute Aquatic Water Quality Standard indicating suitability for fish survival but not propagation (i.e., reproduction).

Source: (Anchor QEA 2018)

Exhibit 3-4: Summary of Site-Specific Toxicity Tests

Exposure Area	Mean Survival	Mean Biomass Gain Per Individual	Mean Juveniles Per Surviving Female
Assessment Area: All	43%	41%	21%
Assessment Area: Downstream of CM 2.0	72%	68%	31%
Assessment Area: Upstream of CM 2.0	9%	5%	4%
Reference Area	93%	102%	92%

Notes:
1. Tests were 28-day toxicity tests conducted with the marine amphipod *Leptocherius plumlosus* using samples from 36 stations in Newtown Creek and 2 replicates from each of the 6 stations in the reference area (Gerritsen Creek).
2. Values are percent responses for surviving individuals that were control-adjusted (divided the replicate response by the batch-average control response). Lower survival, biomass gain, or reproductive capacity in the assessment area than the reference area indicates injury to benthic invertebrates.
3. Biomass per individual is the replicate final weight minus the initial organism weight, divided by the number of organisms at test initiation. Lower weight gain in the Assessment Area compared to the reference area indicates that organisms are smaller in the Assessment Area (e.g., provide less food for predators).

Source: Anchor QEA (2018)

Exhibit 3-5: Hazard Quotients for Exposure to PAHs, PCBs, and Copper in Biological Resources

Receptor	Contaminant	Tissue Residue-Based		Dietary Intake-Based	
		LOEC	NOEC	LOAEL	NOAEL
Polychaete	PAHs	**1.2**	**11**		
	PCBs	**15**	**48**		
Bivalve (ribbed mussel)	PAHs	**1.9**	**19**		
	PCBs	**3.9**	**13**		
Crab	PAHs	< 1	**2**		
	PCBs	**8.8**	**29**		
	Copper	**1.6**	**3.8**		
Striped bass	PCBs	**4**	**12**		
	Copper	< 1	**3.4**	< 1	**1.5**
Mummichog	PCBs	**9.2**	**29**		
	Copper	**2.1**	**9.7**	**1.2**	**2.3**
Spotted sandpiper	PCBs			**1.7**	**2.5**
	Copper			**1.04**	**3.1**
Green heron	PCBs			**2.3**	**3.2**
Black-crowned night heron	PCBs			**1.7**	**2.4**
Belted kingfisher	PCBs			**1.8**	**2.6**
Raccoon	PCBs			< 1	**1.7**

Notes:

1. PAHs = total PAHs. PCBs = total PCB congeners. NOEC = no observed effect concentration. LOEC = lowest observed effect concentration. NOAEL = no observed adverse effect level. LOAEL = lowest observed adverse effect level.
2. Reported values are hazard quotients (HQs), with values greater than 1 in bold, indicating exposure sufficient to cause adverse effects (LOEC) or that may be sufficient to cause adverse effects (NOEC). Grayed out cells indicate that calculation of HQs was not undertaken for the given receptor-contaminant-medium combination.
3. Tissue-residue-based HQs are calculated using EPA Region 2 CBRs. HQs calculated using Newtown Creek Group (NCG) NOEC CBRs were omitted because EPA interpreted NCG CBRs to be less conservative than those EPA selected for the Lower Passaic River. All NCG NOEC-based HQs were <1.
4. Dietary intake-based HQs for mummichog (copper) were calculated for exposure area 2 (upstream of CM 2). For exposure area 1 (downstream of CM 2), NOAEL-based HQ = 1.3 and LOAEL-based HQ <1.

Source: (Anchor QEA 2018).

Crabs and Bivalves

The potential for injury to crabs and bivalves is demonstrated by the following lines of evidence:

(1) Tissue concentrations of PAHs, PCBs, and copper in blue crab and ribbed mussel[18] collected in the Assessment Area exceed CBRs (Anchor QEA 2018). LOEC-based HQs were greater than one for all three COCs, except PAHs in crabs (Exhibit 3-5), indicating negative effects on these species from COC exposure would be expected.

(2) Consumption advisories recommend restrictions on eating crabs from the Upper New York Bay, including Newtown Creek, due to PCBs and other contaminants (per- and polyfluoroalkyl substances (PFAS), dioxin, and cadmium). These advisories have been issued with varying levels of severity since the early 1980s (Exhibit 3-6).

Exhibit 3-6: Fish and Crab Consumption Advisories (NYSDOH 2023)

Waterbody (County) [1]	Fish	Men Over 15 and Women Over 50	Women Under 50 and Children Under 15	Chemicals of Concern
East River to Throgs Neck Bridge (Queens, New York, Kings, Bronx) Harlem River (New York, Bronx) Hudson River (New York, Bronx) Upper New York Bay, north of Verrazano Narrows Bridge (Richmond, New York)	Crab or lobster tomalley [2] (hepatopancreas, mustard) and cooking liquid	DON'T EAT	DON'T EAT	PCBs, PFAS, Dioxin, Cadmium
	Channel catfish, Gizzard shad, White catfish	DON'T EAT	DON'T EAT	PCBs
	Blue crab meat [2]	Up to 4 meals/month (six crabs per meal)	DON'T EAT	PCBs, Cadmium
	Atlantic needlefish, Bluefish, Carp, Goldfish, Rainbow smelt, Striped bass, White perch	Up to 1 meal/month	DON'T EAT	PCBs
	All other fish	Up to 4 meals/month	DON'T EAT	PCBs

[1] The specific health advisories for the waters listed above also apply to tributaries (for example, Gowanus Canal and Newtown Creek) and connected waters if there are no dams, falls, or barriers to stop the fish from moving upstream or downstream. Some tributaries may also be listed based on additional information about fish or waterbodies.

[2] Don't eat the soft "green stuff" (mustard, tomalley, liver, or hepatopancreas) found in the body section of crabs and lobsters from any waters because cadmium, PCBs, and other contaminants concentrate there. As contaminants are transferred to cooking liquid, you should also discard crab or lobster cooking liquid.

Fish

The potential for injury to fish, specifically striped bass and mummichog, is demonstrated by the following lines of evidence:

(1) Sediment and porewater concentrations of PAHs, PCBs, and copper exceed chronic threshold values that are considered protective of the aquatic community (including a threshold specific to marine fish for total PCBs) at some locations in the Assessment Area

[18] Due to reported challenges collecting bivalves in Newtown Creek, EPA conducted a 60-day caged bivalve study using ribbed mussels at ten locations in Newtown Creek to analyze tissue concentrations of contaminants (Anchor QEA 2018).

(Exhibit 3-3; Anchor QEA 2013, 2018). These thresholds reflect levels above which adverse effects on endpoints such as growth, reproduction, and survival are likely to occur to these species as a result of long-term exposure to contaminants.

Striped bass. Photo courtesy of NOAA.

(2) Measured tissue concentrations of PCBs and copper in fish collected from the Assessment Area exceed CBRs. LOEC-based HQs were greater than one for mummichog (PCBs and copper) and striped bass (PCBs). Concentrations of total PAHs in fish tissue were not evaluated in the BERA, as most fishes typically metabolize PAHs with minimal bioaccumulation (Exhibit 3-5; Anchor QEA 2013, 2018).

(3) Total dietary intake (TDI) of copper exceeds dose-based toxicity reference values (TRVs) for mummichog. TDI was calculated for striped bass on an Assessment Area-wide basis and for mummichog in two exposure areas based on measured concentrations of COCs in prey tissue and Assessment Area sediment (Anchor QEA 2013, 2018). TDI was not calculated for PAHs or PCBs (Exhibit 3-5).

(4) Fish community studies in the Assessment Area indicate significantly lower species richness and diversity than in the reference area (Anchor QEA 2013, 2018). The Assessment Area fish community, sampled primarily for tissue analysis purposes, was dominated by mummichog (which comprised over 75% of the catch), Atlantic menhaden, and striped bass (Anchor QEA 2013, 2018).

(5) Fish consumption advisories recommend restrictions on eating fish from the Upper New York Bay, including Newtown Creek, due to PCBs. These advisories have been issued with varying levels of severity since the early 1980s (Exhibit 3-5).

Birds and Mammals

Currently there are no site-specific COC exposure data (e.g., tissue concentrations) for Assessment Area birds or mammals. Therefore, the Trustees used modeled information in the BERA to evaluate the potential for injury to these species groups.

Kingfisher. Photo courtesy of Fish and Wildlife Service.

In assessing contaminant-related risks to birds and mammals, the BERA identified six indicator species to represent four feeding guilds: spotted sandpiper (birds that eat invertebrates), green heron and black-crowned night heron (birds that eat invertebrates and fish), double-crested cormorant and belted kingfisher (fish-eating birds), and raccoon (mammal that eats a varied diet (omnivore); Anchor QEA 2013, 2018). The BERA reports the following:

(1) TDI of copper in spotted sandpiper and PCBs in spotted sandpiper, green heron, black-crowned night heron, belted kingfisher, and raccoon exceed dose-based TRVs. Anchor QEA (2018) calculated TDIs using measured concentrations of COCs in prey tissue, surface water, and sediment samples from the intertidal zone of the Assessment Area. These exceedances resulted in LOAEL-based HQs greater than 1 (Exhibit 3-5).

(2) Wildlife surveys indicate low species richness within three avian feeding guilds in the assessment area (9-10 species) as compared to the reference area (21-24 species). The assessment area community was dominated by a few species, with spotted sandpiper accounting for 251 of the 254 invertebrate-eating birds and double-crested cormorant accounting for 222 of the 224 fish-eating birds in spring 2014 wildlife surveys (Anchor QEA 2013, 2018).

3.5 Injury Caused by Remedial Actions

Remedial actions often do not fully return natural resources and/or lost services to baseline conditions because remedial actions are designed to manage unacceptable immediate and future risks to human health and the environment (Section 1.4.3). Further, remedial actions that involve sediment removal or capping, stream reconstruction, vegetation removal, or other physical alterations of the environment may also result in unavoidable, additional injury that is compensable under the CERCLA NRDA regulations (43 CFR § 11.15(a)(1)). The Trustees will identify and quantify the extent to which remediation affects natural resources by assessing both physical injuries and injuries resulting from residual contamination throughout the documented or expected timeframe of recovery. This evaluation will be based on consultations with EPA and a review of remedial documents that describe what remedial actions have occurred or are being planned and the timing of those actions, as well as the result, or expected result, in terms of residual contamination, habitat condition, or other relevant parameters (43 CFR §11.15(a)(1)).

Remedial actions are planned for future implementation in the Assessment Area (Section 1.2). The Trustees will use available information to identify remediation-related impacts in affected areas, such as currently available documents pertaining to early actions at East Branch (e.g., Draft Focus Feasibility Study Work Plan, NAPL report; Anchor QEA 2023). The Trustees will also look for opportunities to coordinate remedial actions and NRDA-related restoration efforts to increase efficiencies (i.e., cost and time) as well as benefit natural resources within the Assessment Area. Restoration work conducted in conjunction with the remedy and any proposed compensation for natural resource injuries will be reviewed for approval by the Trustees.

3.6 Summary of Injury Determination

Currently available data demonstrate that natural resources in the Assessment Area have been exposed to and injured, or potentially injured, by contamination released into Newtown Creek (e.g., sediment contamination data in exceedance of adverse effects thresholds, presence of fish consumption advisories). The Trustees have identified specific categories of injury and corresponding resources that constitute the proposed focus of NRDA efforts, that is, the effects of the COCs on biological resources. The Trustees may consider additional research and analysis of existing information, as well as primary studies, to further determine injury to natural resources within the Assessment Area. Potential injury assessment studies are described in Chapter 5.

CHAPTER 4 | Injury Quantification & Damages Determination Approach

Once injury to natural resources has been determined, the Trustees intend to quantify that injury to establish a basis for scaling restoration and determine damages (43 CFR § 11.70(a)). Injuries to natural resources can be quantified in terms of the actual measured loss of specific resources and/or the services that the injured resources would have provided had the contaminant releases not occurred. In the quantification phase, the extent of the injury is measured, baseline condition and services are identified, recoverability of the injured resource is determined, and reductions in services resulting from the contaminants are calculated (43 CFR § 11.70(c)). Damages would be determined using methods described in the CERCLA NRDA regulations where applicable (43 CFR § 11.80).

To quantify losses and damages, the Trustees plan to select and scale (where feasible) restoration options. The Trustees anticipate using scaling approaches tailored to the specific services that are affected by contamination related to Newtown Creek. These include:

- Ecological losses may be quantified and scaled to restoration using equivalency analysis. Damages would be calculated as the cost of implementing the type and scale of restoration that is expected to generate future ecological services equivalent to lost ecological services.
- Human use losses, such as recreational losses, may be quantified based on the nature and extent of lost human use services (e.g., lost and diminished recreational fishing trips, lost community connections to Newtown Creek). Damages would be determined as the corresponding value lost to the public from that change.

The steps and approaches to quantify injury and determine damages are discussed below, including determination of baseline conditions and the temporal scope of the assessment.

4.1 Baseline

Baseline is defined as the natural resource or resource service condition(s) that would have existed if the hazardous substances or oil had not been released into the Assessment Area (43 CFR §11.14(e)). Therefore, baseline data should reflect expected conditions in the Assessment Area had the release of the contaminants not occurred. The baseline condition of natural resources reflects natural processes and changes that result from human activities that are not contaminant-related (e.g., structural alterations to Newtown Creek). Because site-specific historical data applicable to establishing baseline have not been located for Newtown Creek, the Trustees plan to use, in order of priority, data from reference areas/control groups (43 CFR § 11.72(d)) and/or relevant literature (43 CFR § 11.72(c)(2)).

4.2 Ecological Injury Quantification and Damage Determination Approach

Losses of ecological services may result from the effects of contaminants on natural resources. These losses reflect a reduction in the ability of a resource to provide the level and type of ecological functions that would have been provided under baseline conditions.

For this NRDA, the Trustees anticipate quantifying ecological service losses to representative resources for intertidal and subtidal aquatic habitat. These resources may include benthic invertebrates, aquatic vegetation, fish, and birds. For each species group, ecological injury quantification would focus on effect endpoints that are considered the most biologically relevant (i.e., endpoints that most directly impact a resource's ability to function and provide services) such as growth, reproduction, and survival. The Trustees also plan to consider the exposure of these resources to COCs over time (i.e., in the past and expected to occur in the future; 43 CFR § 11.70(e)). Existing data, in combination with the potential analyses and studies described in Chapter 5, would generate data appropriate for quantifying losses for each resource and endpoint over time. The Trustees plan to consider each resource/endpoint combination as independent indicators of losses in the Assessment Area. Studies may include, but are not limited to, field-based efforts (e.g., to confirm exposure to Newtown Creek contaminants and assess the type and magnitude of injury resulting from that exposure), laboratory studies to confirm that the COCs cause the kinds of effects that have been observed in field-based studies, and studies to verify the completeness of contaminant pathways.

To determine damages required to compensate for ecological injures to resources within the Assessment Area, the Trustees intend to use appropriate equivalency analyses (e.g., habitat equivalency analysis, resource equivalency analysis, habitat-based resource equivalency method; 43 CFR § 11.83(c)(2)) to scale restoration projects such that sufficient ecological benefit is provided to compensate for losses. Equivalency analyses quantify resource losses from contamination over the spatial extent and timeframe of injury and quantify resource gains from restoration over the spatial extent and timeframe of the restoration project(s). Losses and gains would be measured in the same unit for clear comparison (e.g., number of organisms, biomass, acres of habitat). Damages would be calculated as the cost to implement that restoration.

The Trustees will ensure that there is no double-counting of losses in the quantification process (43 CFR § 11.83(c)(20)). This approach will require the evaluation of whether restoration scaled to the losses experienced by one resource will also compensate (fully or partially) for the losses associated with another injured resource.

4.3 Human Use Quantification and Damage Determination Approach

As noted in Section 2.4 of this Plan, Newtown Creek supports a variety of recreational activities and other human uses which have been limited due to releases of hazardous substances and/or oil. The presence of the crab and fish consumption advisories described previously constitute an injury under the CERCLA NRDA regulations and suggests that there has been, and will continue to be, associated compensable losses. Damages related to recreational losses would be quantified based on the nature and extent of lost recreational services (e.g., lost and diminished recreational fishing and crabbing trips; 43 CFR § 11.83(c)(2)).

Based on an ongoing review of available information, the Trustees anticipate that existing data on angler effort and relevant economic values may be adequate to conduct a secondary (i.e., benefit transfer-based) analysis of recreational fishing and crabbing damages (43 CFR § 11.83(c)(2)(vi)). Benefit transfer analysis involves adapting research estimating economic values under one set of circumstances to an alternate situation. In this manner, estimates of recreational fishing and

crabbing in the Assessment Area are combined with existing valuation research from a similar location to develop a damage estimate. Should this analysis reveal significant sources of uncertainty, or if additional information regarding the nature and extent of potential losses becomes available, the Trustees may consider designing and implementing a primary valuation study to calculate damages.

Other potential sources of recreational use losses include boating, birding, and wildlife observation. The Trustees plan to continue gathering available information on the nature, location, and levels of such activities in relation to Newtown Creek, as well as the extent to which releases have reduced or diminished use. To augment existing information, the Trustees may consider conducting targeted qualitative research in the form of interviews or focus groups to determine whether further evaluation and potential data collection related to these other uses is warranted.

Additional losses may exist in the form of disrupted or diminished community connections to Newtown Creek. The Trustees may consider further investigating this category of injury through background research, interviews, and/or other qualitative methods. If these additional analyses reveal a basis for pursuing related service losses and damages, the Trustees would then evaluate the sufficiency of existing information to inform whether/how to conduct a secondary analysis (as described earlier in this section) and may pursue primary data collection in the form of focus groups or surveys to support quantification and damage determination.

4.4 Temporal Scope

The temporal scope of this assessment is based on the determination of injury to natural resources and corresponding damages (43 CFR § 11.14(c)). Based on the industrial history of Newtown Creek, natural resources have likely been exposed to and injured by contaminants since the early 1800s and are likely to continue to be injured in the future. In accordance with the promulgation of CERCLA in 1980, to the extent injuries pre- and post-CERCLA are distinguishable, the Trustees would quantify injury after the enactment of CERCLA. Where injuries are not distinguishable, injury would be quantified for all years that injury occurred in the past and is expected to occur in the future. All injury quantification calculations will include losses through the reasonable expected recovery of resource services. Rate of recovery will be based upon proposed or implemented remedial actions, potential upgradient contaminant source control, restoration activities, natural attenuation, and expected resource recovery. If a resource is not expected to fully recover, the associated injuries will be considered permanent.

CHAPTER 5 | NRDA Studies and Analyses

The previous chapters describe some of the key components of the Newtown Creek NRDA and discuss the framework and general approaches the Trustees plan to apply. The NRDA itself will be composed of a series of iterative analyses aimed at assessing the severity and magnitude of natural resource injury resulting from contaminants released into the Assessment Area. Proposed efforts focus on natural resources that are found in the Assessment Area and have likely been injured by the COCs. These resources include, but are not limited to, benthic invertebrates, aquatic plants, fish, birds, and mammals. To advance the injury assessment process outlined in Chapters 3 and 4, the Trustees plan to undertake additional review and analysis of existing data, synthesize pertinent literature information, and/or potentially conduct primary studies. These efforts would enable the Trustees to determine and quantify the injury to natural resources and lost services resulting from contamination in Newtown Creek and assist in identifying and scaling restoration projects that would compensate for those injuries.

Previous efforts, such as the Trustees' Preassessment Screen (DOI et al. 2012) and reports related to EPA's remedial process, documented existing information on Newtown Creek. This enabled the Trustees to identify preliminary data gaps regarding the exposure of natural resources to the COCs and corresponding effects on ecological and human use services. This Chapter describes efforts the Trustees are presently undertaking or considering to fill these data gaps and generate sufficient information to conduct the full assessment – injury determination, injury quantification, and damage determination. These efforts include: (1) review and analysis of existing information targeted to specific injury evaluations and resources of focus, and (2) primary studies designed to address data gaps such that when combined with existing information, the Trustees' determination and quantification of injury and damages is strengthened compared to an assessment using existing information alone. The potential types of analyses and studies detailed in the following section represent the Trustees' current understanding of the information that may be needed to further refine the determination and quantification of injury to natural resources and resource services.

The scope of this Plan does not preclude additional or alternative studies not identified in this Plan that may be undertaken during the assessment. The Trustees recognize that other studies may be identified as necessary or advisable as the assessment proceeds and new information becomes available, or new data gaps are identified. Additionally, the inclusion of a study within this Plan does not guarantee that it will be undertaken. For example, the Trustees may decide that some studies are not needed if reasonable assumptions supported by expert opinion and/or existing site information can be made, considering the cost of additional research projects or sampling against the expected gain in information from a particular study. As such, this Plan provides a starting point from which the Trustees can prioritize study efforts and implement the NRDA. As assessment efforts progress and additional information is generated, the Trustees may provide amendments to this Plan for public review.

5.1 Analysis and Study Categorization

The Trustees intend to identify and prioritize assessment activities that are expected to assist in determining and quantifying the scale of natural resource injury stemming from releases of hazardous substances and/or oil to the Assessment Area. Considerations include, but are not limited to:

- Can an injury/loss evaluation be conducted based on existing information or does it require primary studies?
- Which resources are directly impacted by the toxicity of COCs in Newtown Creek? Indirectly impacted?
- Which resources are most representative of those impacted by COCs in Newtown Creek?
- Which resource services may be affected by COCs in Newtown Creek?
- How will the result of the analysis or study assist in quantifying or qualitatively describing losses?
- Can analyses or studies be conducted in a manner that is consistent with standard methods?
- Is the analysis or study dependent on the results of other analyses or studies?
- Will efforts help to inform the determination of damages and scaling for relevant types of restoration?

Based on these and potentially other considerations, the Trustees have organized assessment activities into categories. As the assessment progresses and additional information is developed, the Trustees may add or remove studies as needed.

Category 1: Preliminary compilation and analysis of existing data on natural resources and resource services of focus. Collection and analysis of existing data on:

- Trustee resources and resource services of focus (e.g., benthic invertebrates, aquatic plants, fish, birds (songbirds and water birds), aquatic-dependent mammals, recreation, and non-recreation community losses).
- Injury-related topics (e.g., pathway, remedial injury) essential to assess injury to natural resources of focus.
- Restoration of relevant natural resources and associated habitats and human use services.

Information collected from existing data and analyses (e.g., site-specific studies, remedial process, literature studies) would be used to determine:

- Which resources the Trustees will focus on to quantify injury,
- Which resource injuries the Trustees will describe qualitatively, and
- Whether primary field or laboratory studies or human use surveys are needed to evaluate and quantify injury to specific resources or resource services and scale restoration.

Category 2: Conduct studies to fill data gaps. Based on the results of Category 1 studies, these efforts include primary field and/or laboratory studies that may be necessary to:

- Effectively determine and quantify injury to initial natural resources and resource services of focus (e.g., fish, songbirds).
- Quantify and scale the benefits of relevant restoration projects or project types.

This may also include collection of ephemeral data to ensure that the Trustees can adequately characterize the current biological, chemical, and physical characteristics of Newtown Creek and its resources before remedial activities are implemented and change those characteristics.

Category 3: Adapt assessment to address additional natural resource or resource services. Based on the results of Category 1 and 2 analyses and studies, these efforts may cover the following:

- Assessment of injury to any additional resources or resource services within the Assessment Area that the Trustees identify as significant as the assessment proceeds, as well as potential additional site-specific primary studies.
- Habitat restoration pilot studies to inform scaling, coordinated with EPA early remediation actions as appropriate.

5.2 Injury Assessment Studies & Analyses

The potential studies and analyses that the Trustees are considering as part of an injury assessment are presented in Exhibit 5-1. The table summarizes the objectives, description, and category of each type of study or analysis effort associated with each resource or resource service. The Trustees propose to develop the general approach to conducting specific studies and analyses subsequent to this Plan in collaboration with principal investigators and documented in study-specific plans, which would be made available to the public.

The assessment of ecological resources and resource services includes review and analysis of existing information from available sources that will be able to substantially characterize contaminant pathways, describe and quantify contaminant-related exposure and effects of ecological resources such as surface water, sediment, invertebrates, aquatic vegetation, birds, fish, and aquatic-based mammals. To fill data gaps, potential additional study efforts, building on existing information, may focus on collection of additional site-specific data through means such as field sampling or laboratory tests to produce results useful for injury quantification. This may include quick-turnaround sampling for data that may otherwise be lost once remedial actions begin in Newtown Creek (e.g., if dredging disturbs or removes sediment).

Similarly, assessment of human use service losses initially involves review and analysis of existing recreational and community use data/information to evaluate contaminant-related effects and associated damages. Where data are unavailable or there is significant uncertainty that cannot otherwise be addressed, primary studies in the form of surveys or other forms of data collection could be conducted to support quantification.

Exhibit 5-1: Potential Assessment Studies & Analyses

Resource/ Resource Service	Study/Analysis	Objective	Category
Exposure Pathway	Review existing pathway-related data	Review existing information on physical and chemical transport mechanisms within the Assessment Area to document contaminant exposure pathways. Include history of releases and data on surface water, groundwater, soil, and sediment.	1
	Analyze media to support source and pathway analyses	Collect Newtown Creek soil, overland surface water runoff and/or groundwater. Analyze physical characteristics and COC concentrations in these media to assess connections between COC sources and Assessment Area natural resources.	2
Resources Potentially Impacted by Remedial Activities	Collect time sensitive field samples	Collect and analyze samples from the Assessment Area to characterize current conditions prior to remedial actions that may affect those conditions (e.g., if dredging disturbs or removes sediment).	2
Surface Water	Review existing surface water data	Document whether injury to surface water has occurred through compilation of existing COC concentration data and comparison of those data to relevant federal and state water quality criteria.	1
Sediment	Review existing sediment data	Evaluate the extent, quality, and appropriateness of available sediment chemistry and associated toxicity data for injury assessment, information on physical parameters, and timing of relevant remedial actions.	1
	Analyze new sediment samples	Collect Newtown Creek sediments, as needed, to complement studies of benthic invertebrate and fish exposure and toxicity and pathway. Analyze COC concentrations in Assessment Area sediments, and corresponding physical parameters, as compared to reference site sediments.	2
Aquatic Vegetation	Review existing aquatic vegetation data	Evaluate the extent, quality, and appropriateness of available contaminant chemistry and toxicity data associated with relevant aquatic vegetation species to inform the potential severity and magnitude of injury.	1
	Assess aquatic vegetation exposure and toxicity	Design and implement field and laboratory studies of the site-specific effects of COCs on aquatic vegetation to inform the severity and magnitude of injury.	2

Resource/ Resource Service	Study/Analysis	Objective	Category
Aquatic Invertebrates	Review existing invertebrate data	Evaluate the extent, quality, and appropriateness of available contaminant chemistry and toxicity data associated with relevant invertebrate species (e.g., benthic, epibenthic or pelagic insect larvae, bivalves, crustaceans) to inform the potential severity and magnitude of injury.	1
	Compile invertebrate community data and habitat extent	Compile and review existing information to determine invertebrate community characteristics (e.g., abundance of target species) and habitat extent within the Assessment Area and reference area(s). Results may inform design of subsequent primary studies.	1
	Assess invertebrate exposure and toxicity	Design and implement field and/or laboratory studies of the site-specific effects of COCs on aquatic invertebrates (e.g., benthic, epibenthic or pelagic insect larvae, bivalves, crustaceans). This will inform the severity and magnitude of injury.	2
Fish	Review existing fish exposure and toxicity data	Review available contaminant concentrations in fish tissue, sediment, and water in Assessment Area, as well as data related to fish toxicity studies (site-specific or literature) to inform the potential severity and magnitude of injury.	1
	Review existing fish life history and habitat use	Document fish presence and abundance, especially for sensitive life stages (from Newtown Creek surveys and/or literature studies from comparable sites), and habitat type and quality. Results may inform design of subsequent primary studies.	1
	Assess fish exposure and toxicity	Design and implement field and/or laboratory studies of the site-specific effects of COCs on fish, with particular focus on species, life stage, and effect endpoints. This will inform the severity and magnitude of injury.	2
Birds	Review existing avian exposure, toxicity, life history, and habitat use data	Review existing data on when, where, and how many breeding songbirds, shorebirds, wading birds, and waterfowl use the Assessment Area to determine focal species and identify the time periods that they are exposed to contamination in Newtown Creek. Use existing data on COC concentrations in sediment, soil, and prey items to model exposure. Compare results to existing literature on adverse effects of COCs on relevant bird species to demonstrate potential injury. Results may inform historic COC exposure and effects as well as the design of subsequent primary studies.	1

Resource/ Resource Service	Study/Analysis	Objective	Category
	Assess avian exposure and toxicity	Design and implement primary field and/or laboratory studies of the effects COCs on birds, with particular focus on species, life stage, and endpoints. This will confirm site-specific exposure and inform the severity and magnitude of injury.	2
Aquatic-Dependent Mammals	Review existing mammalian exposure, toxicity, life history, and habitat use data	Review existing data on exposure and toxicity, life history, and habitat use for aquatic-dependent mammals to determine if additional assessment is warranted.	1
Remedial Activities	Evaluate impacts of remedial activities	Compile existing information on remedial activities (completed, ongoing, and planned) and evaluate the severity of impacts to Assessment Area resources and habitat. This includes the timing, location, spatial extent, and type of remedial activities.	1
Ecological Restoration	Review existing information on wetland/marsh restoration and shoreline softening	Review existing data and information on wetland/marsh habitat restoration and shoreline softening projects to assess potential methods and benefits to inform scaling (e.g., timeframe of implementation, rate of success, rate of recovery, types of ecological improvements, metrics, recontamination potential).	1
	Assess success of marsh restoration and/or shoreline softening	Implement pilot study to assess the success of marsh restoration and/or shoreline softening in Newtown Creek. Coordinate with EPA remedial actions.	3
Recreation	Review existing outdoor recreational use data and Newtown Creek characteristics	Review existing data and information on the types and levels of potentially affected recreational activities and values in the Assessment Area over time. Review existing public information on, and awareness of, contamination in the Assessment Area, including via consumption advisories and guidelines, news reports, and community information sources. Compile literature information on trip values.	1
	Complete outdoor recreational use interviews and focus groups	Organize and implement interviews and focus groups with recreators to gain information and insights into outdoor recreational use, such as fishing, crabbing, swimming, boating, and wildlife viewing in the Assessment Area. Consider results along with previously collected information and/or information collected from reference sites to determine whether further assessment efforts are warranted.	2

Resource/ Resource Service	Study/Analysis	Objective	Category
	Primary recreation survey	Collect primary data to calculate site-specific change in recreational activities and associated monetary values resulting from contamination-related restrictions in the Assessment Area.	3
Non-Recreational Community Loss	Primary non-recreation community survey	Collect primary data to evaluate and estimate site-specific change in community connection and relationship to Assessment Area resources resulting from contamination-related degradation.	2

Notes:

Category 1: Preliminary compilation and analysis of existing data on natural resources and resource services of focus.

Category 2: Conduct studies to fill data gaps.

Category 3: Adapt assessment to address additional natural resource or resource services.

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APPENDIX A | Quality Assurance

The CERCLA NRDA regulations require that trustees develop a Quality Assurance Plan that satisfies the requirements listed in the National Contingency Plan and applicable EPA guidelines for quality control and quality assurance plans (43 CFR § 11.31(c)(2)). The collection, compilation, evaluation, and reporting of environmental data are necessary to perform the assessment. The Trustees must properly document the origin and quality of the data used to make decisions so that data limitations may be identified, and assessments of the severity, location, and extent of injury are accurate. This documentation assists the Trustees in making appropriate decisions regarding the type and scale of restoration actions necessary to compensate for natural resource injuries. Also relevant to this effort are the NOAA and FWS guidelines on data generation, use, and reporting established under the Information Quality Act of 2001. All information developed and used in this NRDA will comply with these guidelines, as described in agency publications including the FWS Data Management Handbook (FWS 2021) and the FWS Information Quality Guidelines (FWS 2012).

This Plan considers studies that evaluate existing datasets as well as studies that generate new information. With respect to the evaluation of existing data, the study's principal investigator (PI) will carefully document the source(s) of all data, available information about quality assurance (QA)/quality control (QC) procedures used by the original investigator, and any data qualifiers or other information restricting application of the data. This approach will also be applied to new data and analyses developed by federal and state agencies, academics, and information developed under other activities or programs. For new studies that are specifically undertaken to support the NRDA process, appropriate study-specific Quality Assurance Project Plans (QAPPs) or Data Management Plans (DMPs) will be developed according to the general principles described below.[19] The CERCLA NRDA regulations also state that the Assessment Plan shall contain procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified PRPs and other natural resource trustees (43 CFR § 11.31(a)(4)). These procedures and schedules would be identified within the QAPP or DMP for individual studies, should they be undertaken, as described below.

As noted by EPA (2001), QAPPs/DMPs will vary according to the nature of the work being performed and the intended use of the data and as such, need to be tailored to match the specific data-gathering needs of a particular project (40 CFR § 300.5). The NRDA effort will entail a variety of widely different data-gathering efforts; therefore, it is not appropriate to develop a single, detailed plan to cover all these activities. Instead, the Trustees will ensure that individual study plans adequately address project-specific QA issues and provide appropriate QC for analyses and products. The discussion in this document therefore focuses on the required elements of an acceptable study plan.

In general, a study specific QAPP or DMP must provide sufficient detail to demonstrate that:

- The project's technical and quality objectives are identified and agreed upon;

[19] QAPPs are an EPA-defined product which meets a list of criteria defined in EPA 2001. DMPs are defined by FWS 2021 and may include all of the same elements as a QAPP but are focused on the Service's needs for project implementation guidance and data quality and sharing.

- The intended measurements, data generation, or data acquisition methods are appropriate for achieving project objectives;
- Assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and
- Any limitations on the use of the data can be identified and documented (EPA 2001).

Accordingly, study planning documents developed for this assessment will include these elements, per FWS (2021):

- **Project Management** - documents the structure of the project team, that the project has a defined goal(s), that the participants understand the goal(s) and the approach to be used, and that the planning outputs have been documented.
- **Data Generation and Acquisition** - ensures that all aspects of project design and implementation including methods for sampling, split samples, measurement and analysis, data collection or generation, data compilation/handling, and QC activities are documented and employed.
- **Assessment and Oversight** - assesses the effectiveness of the implementation of the project and associated QA and QC activities.
- **Data Validation and Usability** - addresses the QC activities that occur after the data collection or generation phase of the project is completed.
- **Reporting and Documentation** – describes the frequency, extent, and method of data reporting. This also describes how the report and data (with associated metadata) will be disseminated to other Trustees and PRPs, including release to the public if appropriate.

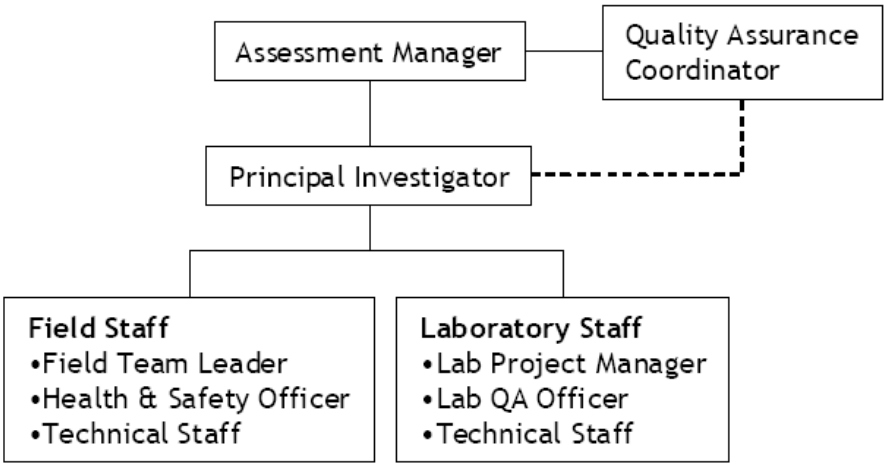
A.1 Project Management

Effective implementation of project objectives requires clear project organization, which includes carefully defining the roles and responsibilities of each project participant. Unambiguous personnel structures help ensure that each individual is aware of their specific areas of responsibility, as well as clarifying internal lines of communication and authority, which is important for decision-making as projects progress. Individuals' and organizations' roles and responsibilities may vary by study or task, but each person's role and responsibility should be clearly described in the project's study plan. Exhibit A-1 below presents a generic personnel plan for a NRDA project.

The Assessment Manager is the designated Trustee representative with responsibility for the review and acceptance of the project-specific study plan. This individual is also responsible for ensuring that the project's goals and design will meet the broader requirements of the NRDA. The Assessment Manager coordinates efforts with the Quality Assurance Coordinator and oversees the PI for the study.

The QA Coordinator oversees the overall conduct of the quality system. Appointed by the Trustees, this individual's responsibilities include, but are not limited to: reviewing/assisting the PI with the development of project-specific study plans; conducting audits and ensuring implementation of both project-specific and overall plans; archiving samples, data, and all documentation supporting the data in a secure and accessible form; and reporting to the Trustees. To ensure independence, the person serving as QA Coordinator will not serve as either the Assessment Manager or as a PI for any NRDA study.

Exhibit A-1: Personnel Plan



Study-specific PIs oversee the design and implementation of particular NRDA studies. Each PI has the responsibility to ensure that all health, safety, and relevant QA requirements are met. If deviations from the planning documents occur, the PI (or their designee) will document these deviations and report them to the Assessment Manager and the QA Coordinator.

The Field Team Leader supervises day-to-day field investigations, including sample collection, field observations, and field measurements. The Field Team Leader generally is responsible for ensuring compliance with all field quality assurance procedures defined in the study-specific QAPP/DMP. Similarly, the Laboratory Project Manager is responsible for monitoring and documenting the quality of laboratory work. The Health & Safety Officer (who may also be the Field Team Leader) is responsible for ensuring adherence to specified safety protocols in the field.

A.2 Data Generation and Acquisition

All studies under the direction of the Trustees that are specifically undertaken in support of the NRDA will have a prepared QAPP or DMP that will be completed prior to the initiation of any work. These plans will be submitted to, and approved by, the QA Coordinator or designee and will include discussion of the following data generation and acquisition topics:

- Rationale for generating or acquiring the data.
- Proposed method(s) for generating or acquiring the data, including descriptions of (or references to) standard operating procedures for all sampling or data-generating methods and analytical methods.
- Types and numbers of samples required.
- Analyses to be performed.
- Sampling locations and frequencies.
- Sample handling and storage procedures.
- Chain-of-custody procedures.

- Data quality indicators (for instance, with respect to precision, accuracy, completeness, representativeness, comparability, and sensitivity).
- Description of the procedures and acceptance criteria to be used in determining if the data meet these requirements.
- Description of the interpretation techniques to be used, including statistical analyses.
- Split sample protocols and procedures for archiving samples and management of residuals.

In addition, to the extent practicable, laboratories will be required to comply with Good Laboratory Practices. This includes descriptions and documentation of maintenance, inspections of instruments, and acceptance testing of instruments, equipment, and their components, as well as the calibration of such equipment and the maintenance of all records relating to these exercises. Documentation to be included with the final report(s) from each study will include field logs for the collection or generation of the samples, chain of custody records, and other QA/QC documentation as applicable.

A.3 Assessment and Oversight

Each QAPP or DMP will have a process for ensuring appropriate implementation of assessment and oversight procedures. To ensure that the study plan for each project is implemented effectively, the QA Coordinator will review QAPPs or DMPs for all Trustee studies that generate data. The QA Coordinator or designee will also audit all such studies. Audits will include technical system audits (e.g., evaluations of operations) as well as scrutinizing data and reports (e.g., evaluations of data quality and adequacy of documentation).

If, in the professional opinion of the QA Coordinator, the results of an audit indicate a compromise in the quality of the collection, generation, analysis, or interpretation of the data, the QA Coordinator has the authority to stop work by oral direction. Within two working days of this direction, the QA Coordinator will submit to the Trustees a written report describing the necessity for this direction. The Assessment Manager will consult with the Trustees regarding measures to be taken in response to the QA Coordinator's report.

A.4 Data Validation and Usability

The QAPP or DMP will include a process for determining data quality and usability which may address both verification and validation steps, depending on the type of information and analyses in the study plan. In addition to the assessment and oversight activities described previously, analytical chemistry data will be considered for validation by an independent third party. Prompt validation of analytical chemistry data can assist the analyst or analytical facility in developing data that meet the requirements for precision and accuracy. If undertaken, it is expected that data validation will use the study-specific study plans and EPA Guidance on Environmental Verification and Validation (EPA 2002).

A.5 Reporting and Documentation

The DMP or QAPP will also describe the data reporting and documentation process. Data reporting consists both of processes for sharing information with other Trustees and PRPs and for sharing with the public. All datasets will include appropriate metadata, which describes the "who, what, when, where, why, and how of the dataset," using current guidelines at the time of study

design, such as described in FWS (2021). The DMP or QAPP will also describe procedures for archiving and preserving data and associated documentation generated as described in sections A.3 and A.4 to meet appropriate litigation hold and administrative record requirements and Information Quality Act guidance.

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