FINAL

Engineering Evaluation/Cost Analysis
Phase 1 Reach
Lower Neponset River Superfund Site
Boston, Massachusetts

Prepared By:

U.S. ENVIRONMENTAL PROTECTION AGENCY
5 Post Office Square
Boston, MA 02109-3912

AECOM
1 Federal Street, 8th Floor
Boston, MA 02110

WESTON SOLUTIONS, INC.
43 North Main Street
Concord, NH 03301

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LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
AECOM	AECOM Technical Services, Inc.
ARAR	Applicable or Relevant and Appropriate Requirements
BCD	Base Catalyzed Decomposition
bw	body weight
CCC	criterion continuous concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COC	contaminant of concern
COPC	contaminants of potential concern
cy	cubic yards
DCR	Department of Conservation and Recreation
DDT	dichlorodiphenyltrichloroethane
DNAPL	dense nonaqueous phase liquids
dw	dry weight
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency
EPC	exposure point concentration
FIS	Flood Insurance Study
HDPE	high-density polyethylene
HQ	hazard quotient
IC	Institutional controls
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
MCP	Massachusetts Contingency Plan
MDPH	Massachusetts Department of Public Health
mg/kg	milligrams per kilogram
mm	millimeter
NAPL	non-aqueous phase liquids
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NTCRA	Non-Time-Critical Removal Action

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

NAVD 88	North American Vertical Datum of 1988
OC	organic carbon
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	Pre-design investigation
PFAS	polyfluoroalkyl substance
PFO	palustrine forested
PISCES	passive in situ chemical-extraction samples
ppb	parts per billion
PSS	palustrine scrub shrub
PTW	principal threat waste
RA	removal action
RAA	removal action alternative
RAO	removal action objectives
RCRA	Resource Conservation and Recovery Act
RM	River Mile
SCWO	Supercritical Water Oxidation
SI	Site Investigation
Site	Lower Neponset River Superfund Site
SDF	Spillway Design Flood
SPI	sediment profile imaging
SRE	streamlined risk evaluation
START	Superfund Technical Assessment and Response Team
SVOC	semi-volatile organic compounds
T&D	Transportation and Disposal
T&H	Tileston and Hollingsworth
TCLP	toxicity characteristic leaching procedure
TCRA	time-critical removal action
THQ	target hazard quotient
TRV	toxicity reference value
TOC	total organic carbon
TSCA	Toxic Substances Control Act

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

UCL	upper confidence limit
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VOC	volatile organic compounds
ww	wet weight

EXECUTIVE SUMMARY

The United States Environmental Protection Agency (EPA) is proposing to implement a cleanup action to address sediment and floodplain soils contaminated with polychlorinated biphenyls (PCBs), among other hazardous substances, pollutants, and contaminants at the Lower Neponset River Superfund Site (Site). The reasons for this cleanup, along with the cleanup alternatives, are summarized in this report called an Engineering Evaluation/Cost Analysis (EE/CA).

History of the Lower Neponset River Superfund Site

The Lower Neponset River Superfund Site was added to the National Priorities List (NPL) on March 16, 2022, and is currently identified by the EPA as a 3.7-mile stretch of the Neponset River. The Site begins at the point where it merges with the Mother Brook (a tributary to the Neponset River located upstream of Dana Avenue in Hyde Park), extends downstream through City of Boston neighborhoods of Hyde Park, Mattapan, Dorchester, and the Town of Milton, and ends at the Walter Baker Chocolate Dam (located upstream of Adams Street in Dorchester/Milton).

The Neponset River, like most urban rivers in the Northeast, has a long industrial history. Industrialization and subsequent urbanization began in the Neponset River Basin as early as the 1630s. By the mid-1700s, the Neponset River drained one of the most heavily industrialized drainage basins in the United States, draining parts of, and areas adjacent to, the city of Boston. Recognized as the second watershed to be industrialized in the United States, the Neponset River has a complex history of contamination from both point and non-point sources. Used historically for hydro-powered factories, the Neponset River has been home to countless industrial land use ventures, most if not all of which likely had outflow and discharge pipes pumping industrial waste directly into the river.

Why Cleanup is Needed at this Site

The section of the Lower Neponset River Superfund Site that is the subject of this EE/CA is identified as the “Phase 1 Reach,” which flows from the confluence of the Neponset River and the Mother Brook, located in the Boston neighborhood of Hyde Park, downstream approximately one mile to the Tileston and Hollingsworth (T&H) Dam. Identified contaminants present within the Phase 1 Reach include PCBs, metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, dioxins, and furans. PCBs are the primary contaminant of concern (COC) based on the extent and level of risk associated with the PCBs within the Phase 1 Reach.

Risk evaluations were conducted to justify a removal action and identify current or potential exposures that could be mitigated by the implementation of a Non-Time-Critical Removal Action (NTCRA). An evaluation of human health and ecological risks associated with PCBs in sediment and floodplain soil at the Site were documented in a streamlined risk evaluation and two technical memorandums, respectively. The risk evaluations determined that the concentrations of PCBs within the Phase 1 Reach pose significant risk to public health, welfare, and the environment under current conditions. The Phase 1 data and sediment stability analysis support the hypothesis that PCBs and other contaminants in sediment are mobilizing downstream during normal and high flow conditions. Additionally, highly contaminated depositional source areas have the potential to become fully entrained if the T&H Dam fails, resulting in a catastrophic and uncontrolled release of contaminated sediment downstream.

Non-Time-Critical Removal Action

EPA is using its authority to perform a type of cleanup, called a NTCRA, as an early action to advance the cleanup at the Site substantially at this time. The use of a NTCRA is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (popularly known as "Superfund") and regulations issued under the statute entitled the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). In February of 2023, the Remedial Investigation (RI) began. However, based upon prior investigations conducted by the EPA and the Massachusetts Department of Environmental Protection (MassDEP), EPA determined there has been, and continues to be, a release into the environment of hazardous substances that may present an imminent and substantial danger to public health or welfare.

Accordingly, on April 10, 2023, EPA – Region 1 (New England) received approval to perform an EE/CA, which is required pursuant to Section 300.415(b)(4)(i) of the NCP (40 Code of Federal Regulations [CFR] 300.415(b)(4)(i)) for all NTCRAs. A copy of this approval is located in **Appendix A**. Early actions are encouraged as part of an overall site strategy, and are expected to achieve significant risk reduction, to address immediate risks to human health and the environment, and/or to control migration of contamination, and are, by definition, selected before completion of the Remedial Investigation and Feasibility Study (RI/FS) for the site (EPA, 2019).

As further described below, this EE/CA identifies and evaluates removal action alternatives (RAAs) and recommends a cleanup approach to be implemented in the NTCRA. The NTCRA is expected to be a complimentary part of the overall comprehensive remedial action (site cleanup), and the alternatives considered here are all consistent with, and would not conflict with, any reasonably anticipated future remedial action at the Site.

Removal Action Objectives

The EE/CA identifies the Removal Action Objectives (RAOs) for the NTCRA, which are listed below:

- **RAO 1- Sediment:** Reduce risk to human health from PCBs and other contaminants of potential concern (COPCs) in sediment, including reducing the residential and recreational receptor's unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs.
- **RAO 2- Sediment:** Reduce ecological risk from PCBs and other COPCs in sediment, including reducing the unacceptable risk to aquatic and terrestrial ecological receptors due to PCB exposure.
- **RAO 3 - Floodplain Soil:** Reduce risk to human health from PCBs and other COPCs in floodplain soil, including reducing the residential and recreational receptor's unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs.
- **RAO 4 – Floodplain Soil:** Reduce ecological risk from PCBs and other COPCs in floodplain soil, including reducing the unacceptable risk to aquatic and terrestrial ecological receptors due to PCB exposure.
- **RAO 5 – Sediment and Floodplain Soil:** Remove the potential for an uncontrolled release of contaminated sediment and eroding floodplain soils in the event of dam failure.
- **RAO 6 - Sediment and Floodplain Soil:** Prevent the transport of PCBs to both remediated and unremediated areas.

Removal Action Alternatives Evaluated in the EE/CA

RAA-1: No Action

RAA-1 is a "No Action" alternative, which is included as a baseline for comparison purposes.

RAA-2: PCB Hotspot removal and temporary containment

RAA-2 will include the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.
- Removing sediment throughout the remainder of the Phase 1 Reach exceeding the RAA-2 cleanup level of 100 milligrams per kilogram (mg/kg) to the maximum dredge depth. For the purpose of this EE/CA, PCB-contaminated sediment and floodplain soil exceeding 100 mg/kg is considered principal threat waste (PTW). Pre-design investigations may be necessary to clarify the extent of PTW.

- Constructing interim sediment caps over remaining contamination where PCBs exceed the RAA-2 cleanup level of 100 mg/kg and extend below the maximum dredge depth.
- Removing floodplain soil exceeding the RAA-2 cleanup level of 100 mg/kg.
- Backfilling as necessary to stabilize the riverbed, adjacent floodplain soils, and impacted abutting structures.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and floodplain soil (as necessary).
- Transporting and disposing the dewatered sediment and soil off-site.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing Institutional Controls (ICs) as appropriate.

RAA-2 will remove approximately 22,900 cubic yards (34,400 tons) of PCB-contaminated sediment and soil from the Site, which will be shipped off-site for disposal. To prepare the areas for excavation, it is anticipated that at least 820 linear feet of the floodplain may require vegetation and tree removal. Shipping this material off site will result in an estimated 1,145 truckloads of material to be transported off site. A traffic control plan would be developed and implemented to manage the truck traffic and any damage to public roads would be repaired.

The approximate cost of this proposed cleanup plan is $29.9 million. The cleanup is estimated to take approximately two years and nine months to complete (this includes two mobilization and restoration seasons to accommodate suitable dredging weather and replanting windows). **Figure 7** and **Figure 8**, respectively, illustrate the sediment and soil removal areas included in RAA-2.

RAA-3: Targeted removal, temporary containment, and dam removal

RAA-3 includes the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.
- Removing sediment throughout the remainder of the Phase 1 Reach exceeding the RAA-3 cleanup level of 14 mg/kg to the maximum dredge depth. Pre-design investigations may be necessary to clarify the extent of contamination.

- Constructing interim sediment caps over remaining contamination where PCBs exceed the RAA-3 cleanup level of 14 mg/kg and extend below the maximum dredge depth.
- Removing floodplain soil exceeding the RAA-3 cleanup level of 14 mg/kg.
- Removing additional sediment and underlying dense riverbed soil immediately upstream of the T&H Dam as necessary to establish a 10-foot horizontal to 1-foot vertical grade in the riverbed in advance of removing the T&H Dam.
- Backfilling as necessary to stabilize the riverbed, adjacent floodplain soils, impacted abutting structures, and minimize surface water elevation changes.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and excavated floodplain soil (as necessary).
- Transporting and disposing the dewatered sediment and soil off-site.
- Removing the T&H Dam.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing ICs as appropriate.

RAA-3 will remove approximately 31,000 cubic yards (46,500 tons) of PCB-contaminated sediment and soil from the Site, which will be shipped off-site for disposal. To prepare the areas for excavation, it is anticipated that approximately 1,979 linear feet of the floodplain may require vegetation and tree removal. Shipping this material off site will result in an estimated 1,550 truckloads of material to be transported off site. A traffic control plan would be developed and implemented to manage the truck traffic and any damage to public roads would be repaired.

The approximate cost of this proposed cleanup plan is $41.3 million. The cleanup is estimated to take approximately two years and 10 months to complete (this includes two mobilization and restoration seasons to accommodate suitable dredging weather and replanting windows). **Figure 9** and **Figure 10**, respectively, illustrate the sediment and soil removal areas included in RAA-3.

RAA-4: Comprehensive removal, permanent in situ amendment cap, and dam removal (EPA's Recommended Alternative)

RAA-4 includes the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.

- Removing the top three feet of remaining sediment over the full length of the Phase 1 Reach, which will address accessible sediment exceeding the RAA-4 cleanup level of 1 mg/kg.
- Removing additional sediment and underlying dense riverbed soil immediately upstream of the T&H Dam as necessary to establish a 10-foot horizontal to 1-foot vertical grade in the riverbed in advance of removing the T&H Dam.
- Constructing a permanent cap with an in situ amendment over the full length of the Phase 1 Reach.
- Backfilling of the full length of the Phase 1 Reach to stabilize the riverbed, adjacent floodplain soils, impacted abutting structures, minimize surface water elevation changes, and provide ecological habitat.
- Removing floodplain soil exceeding the RAA-4 cleanup level of 1 mg/kg.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and excavated floodplain soil (as necessary).
- Transporting and disposing the dewatered sediment and soil off-site.
- Removing the T&H Dam.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing ICs as appropriate.

RAA-4 will remove approximately 56,000 cubic yards (84,000 tons) of PCB-contaminated sediment and soil from the Site, which will be shipped off-site for disposal. To prepare the areas for excavation, it is anticipated that approximately 7,722 linear feet of the floodplain may require vegetation and tree removal. Shipping this material off site will result in an estimated 2,800 truckloads of material to be transported off site. A traffic control plan would be developed and implemented to manage the truck traffic and any damage to public roads would be repaired.

The approximate cost of this proposed cleanup plan is $78.4 million. The cleanup is estimated to take approximately three years and 10 months to complete (this includes three mobilization and restoration seasons to accommodate suitable dredging weather and replanting windows). **Figure 11** and **Figure 13**, respectively, illustrate the sediment and soil removal areas included in RAA-4.

Comparative Analysis of the Alternatives

A comparison of the removal action alternatives, based on their effectiveness, implementability, and costs, and the reasons for recommending RAA-4 are summarized below.

RAA-1 (i.e., "No Action") incorporates no cleanup activities and would not meet the established RAOs. Existing risks to human health and the environment from the presence of contaminants would remain. RAA-2 and RAA-3 would reduce existing risk to human health and the environment, including to the most highly contaminated sediment and floodplain soil, but would not achieve all RAOs. RAA-3 has a greater degree of protectiveness compared to RAA-2 because it includes removal and capping of contaminated material to a more protective cleanup level and includes the removal of the T&H Dam, which would allow removal of potential contaminated sediment under the dam foundation and eliminate the risk of an uncontrolled release of contaminated media from potential dam failure. RAA-4 provides significantly greater long-term protectiveness, as it would include removal of PCB-contaminated sediment to levels within EPA's acceptable risk range for cancer and non-cancer effects for the direct contact exposure pathway, and it includes removal of the T&H Dam. RAA-4 would achieve all RAOs for this project.

The short-term effectiveness of RAAs 2, 3, and 4 would be similar in scope, including worker safety risk and construction-type impacts on the local community, but would have different durations. RAA-4 would have the longest construction duration because of the greater amount of material to be removed, dewatered, and transported offsite. However, while additional dredging and floodplain soil removal will likely be required in a future remedial action under RAAs 2 and 3, such future actions are less likely to be necessary under RAA-4. Additionally, RAA-4 will break the contaminant exposure pathway entirely to aquatic and terrestrial species. Therefore, the additional short-term impacts from future remedial action, when considered in combination with short-term impacts from RAA-2 or RAA-3 would likely be more significant than the short-term impacts from RAA-4.

RAAs 2, 3, and 4 can all be implemented with existing technologies and equipment that are typically used for dredging, excavating, and dewatering of contaminated sediment and soil. RAA-2 is considered more implementable because it does not include dam removal work. Dam removal work under RAAs 3 and 4 can be implemented using cranes positioned on the south riverbank and a barge and demolition equipment in the river. One potential challenge to implementation for RAAs 2, 3, and 4 may be access to the Phase 1 Reach and use of abutting properties for performing removal activities. Because additional dredging and soil removal activities will likely be necessary in a future remedial action under RAAs 2 and 3, overall implementation challenges during the life of the remediation project, including access challenges, may be greater under those alternatives.

RAA-4 ($78.4 million) is the most expensive alternative. RAA-3 ($41 million) is the second most expensive, and RAA-2 ($29.9 million) is the least expensive alternative other than RAA-1 ($0). However, because additional dredging and floodplain soil removal activities will likely be necessary under RAAs 2 and 3, and may not be necessary under RAA-4, RAA-4 is likely to be the most cost-effective alternative.

Based on the comparative analysis summarized above and detailed in the EE/CA, EPA recommends RAA-4 as the preferred removal action for the NTCRA.

Proposed Determinations

EPA is specifically asking for public comment on the following proposed findings and determinations.

Impacts to Wetlands/Waterways and Floodplains

Section 404 of the Clean Water Act, federal regulations at 44 CFR Part 9, implementing requirements under Executive Orders 11990 (Protection of Wetlands) and 11988 (Floodplain Management) require a determination that there is no practicable alternative to taking federal actions affecting federal jurisdictional wetlands/aquatic habitats and floodplains. Section 404 of the Clean Water Act requires a determination, when circumstances necessitate, that there is no practicable alternative to taking federal actions in waters of the United States, including wetlands, and that EPA's recommended removal action is the "Least Environmentally Damaging Practicable Alternative." Should there be no alternative that can avoid taking an action, the federal actions should minimize the destruction, loss, or degradation of these resources and preserve and enhance their natural and beneficial values. EPA has made, and is requesting public comment on, the following determinations:

- The proposed cleanup will result in the occupancy or modification of wetlands and the 100- and 500-year floodplain.
- Because significant levels of contamination exist in sediments and soil within cleanup areas, there is no practicable alternative to occupancy and modification of floodplains and wetlands and there is no practicable alternative to conducing work in these wetlands or in the river.
- RAA-4 removal activities that impact waterways and wetlands are the least environmentally damaging practicable alternative due to the harmful impacts from contamination present in the aquatic environment and when taking into consideration the potential impacts of additional future response actions in the Phase 1 Reach that may be selected as part of a future remedial action.

Site cleanup activities will be designed and implemented to minimize the destruction, loss, or degradation of these onsite wetlands and aquatic habitats and will preserve and enhance their beneficial values. EPA will minimize harmful impacts to wetlands and floodplain resources to the extent practicable and utilize best management practices for construction that will be determined during design. Where floodplain soils are excavated, the floodplain and riverbanks will be reconstructed such that it is stable and resistant to erosion under normal and high flow conditions while also supporting future ecological habitat. If any wetlands are affected by excavation and fill replacement, wetlands to the extent practicable will be restored at the same surface elevation as pre-existing wetlands.

Toxic Substances Control Action (TSCA) Determination

EPA has determined that contaminated sediment and floodplain soil in the Phase 1 Reach of the Site meet the definition of PCB Remediation Waste as defined under TSCA regulations at 40 CFR Section 761.3. Therefore, these PCB-contaminated sediments and soil are regulated for cleanup and disposal under federal regulations at 40 CFR Section 761. Under 40 CFR Section 761.61(c), EPA may authorize disposal of PCBs in a manner not otherwise prescribed provided that EPA determines that the disposal will not pose an unreasonable risk of injury to health or the environment. EPA has made, and is requesting public comment on, a draft finding that the recommended removal action alternative does not result in an unreasonable risk of injury to health or the environment if the following conditions are met:

1. Compliance with water quality and turbidity performance standards specified in EPA-approved workplans are maintained.
2. The channel is backfilled and/or capped with clean, suitable material of sufficient thickness to isolate the PCB remediation waste physically, chemically, and biologically from the surrounding benthic environment. A bathymetric survey shall be performed upon completion of the channel restoration.
3. All caps are monitored to demonstrate their physical, chemical, and biological quality. This monitoring shall include bathymetric surveys, chemical sampling, and sediment camera work as appropriate. The frequency of this monitoring will be determined in an EPA-approved workplan.
4. An annual report summarizing the cap monitoring shall be submitted to EPA beginning with placement of the cap material. This report shall include a summary discussion of all activities associated with the cap placement or cap monitoring, and shall include, if necessary, any recommendations for corrective action to maintain the physical, chemical, or biological quality of the cap.
5. Corrective actions recommended in the annual reports, or alternatively, those required by EPA based on information in the annual reports, shall be implemented in a timely manner. Corrective actions may include, but are not limited to, installation of additional engineering controls or removal and disposal of PCB remediation waste from the Site if

information indicates that the remedy is not effective in isolating and/or controlling migration of PCBs from the Site.

6. The EPA shall coordinate with federal, state, and local entities to ensure that any as-built cap locations become included in all future navigational or waterway charts with any other required navigational or anchorage controls.
7. All dredged and excavated sediment and floodplain soil is disposed of in accordance with TSCA based on in situ PCB concentrations and not subject to dilution.
8. Engineering controls for the collection and management of liquids from dewatering of sediment and floodplain soils, surface water runoff, dust suppression water, and decontamination water shall be used during dredging, excavation, storage, dewatering, and decontamination activities to ensure that the PCB concentrations in any dewatered liquids, surface water runoff, dust suppression water, and decontamination water from the Site comply with applicable discharge requirements prior to discharge to a publicly owned treatment works or to surface water.
9. Decontamination procedures for excavation equipment and other moveable equipment and vehicles shall be established to ensure that equipment and vehicles are appropriately decontaminated prior to leaving each work area.
10. Engineering controls for dust suppression shall be used during excavation activities. An Air Quality Management and Monitoring Plan shall be developed that includes the following: means and methods used to perform the excavation and waste handling that minimizes airborne particulates; air monitoring procedures, parameters, and detection limits; air action levels; and corrective measures. Air monitoring and dust suppression measures for PCBs shall be maintained until all removal activities are complete, including dredging, excavation, capping, backfilling, and transport of PCB-contaminated sediment and soil.

Next Steps

The EPA is responsible for publishing a Notice of Availability and a fact sheet describing the proposed removal action, which solicits public comment on the EE/CA. In accordance with 40 CFR 300.415(n), this notice announces the period during which the public has an opportunity to review and comment on the EE/CA and the recommended removal action. This EE/CA, along with other documents and information which form the basis for the NTCRA, will be part of the EPA Administrative Record File. As detailed in the NCP at 40 CFR Sections 300.820(a) and 300.825, the Administrative Record File is available for public inspection when the EE/CA is made available for public comment.

EPA will provide a written response (Responsiveness Summary) to each relevant comment received during the public comment period, which will become part of the Administrative Record. Based on the comments received, EPA may modify or change the recommended alternative. A summary of the results of the EE/CA, EPA's response decision, as well as the Responsiveness Summary, will be provided in an Action Memorandum. The NTCRA can be initiated after the Action Memorandum is approved.

1. INTRODUCTION

This EE/CA supports the selection of the NTCRA for the Phase 1 Reach of the Lower Neponset River Superfund Site in Boston and Milton, Massachusetts. The Phase 1 Reach of the Site includes the one-mile reach of the Lower Neponset River between the confluence with the Mother Brook and the T&H Dam.

EPA has three removal action approaches: emergency, time-critical, and non-time-critical. These approaches are based on the urgency with which cleanup must be initiated to respond to a threat to human health and the environment posed by a release or potential release of hazardous substances. Emergency and time-critical removal actions are initiated to respond to a release or potential release where less than six months is available for planning the response. A NTCRA may be implemented in cases where more than six months are available for planning a response to a release or potential release.

Section 300.415(b)(2) of the NCP (40 Code of Federal Regulations [CFR] 300.415(b)(2)) lists factors for EPA to consider in determining whether Site conditions indicate performance of a removal action is appropriate.

i. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants;
ii. Actual or potential contamination of drinking water supplies or sensitive ecosystems;
iii. Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
iv. High concentrations of hazardous substances, pollutants, or contaminants in soils largely at or near the surface, that may migrate;
v. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;
vi. Threat of fire or explosion;
vii. The availability of other appropriate federal or state response mechanisms to respond to the release; and
viii. Other situations or factors that may pose threats to public health or welfare or the environment.

EPA has determined that conditions at the Site correspond to several factors in Section 300.415(b)(2) of the NCP, and that a NTCRA is appropriate to address threats to human health and the environment. Section 300.415(b)(4)(I) of the NCP requires the development of an EE/CA, along with a public comment period prior to the signing of the Action Memorandum, to initiate the NTCRA. EPA issued an EE/CA Approval Memorandum on April 10, 2023, which included the evaluation of Site conditions that warrant a NTCRA and authorized the preparation of the EE/CA for the Lower Neponset River Superfund Site. The EE/CA Approval Memorandum is included in **Appendix A**.

1.1 PURPOSE AND SCOPE

This EE/CA has been conducted in accordance with EPA guidance on conducting NTCRAs under CERCLA (42 U.S.C. §§ 9601 et seq.). The EE/CA will support decision making for a NTCRA under CERCLA to address contaminated sediment and soil within the Phase 1 Reach that poses an immediate and/or direct risk to human health and the environment, as well as the potential for uncontrolled releases of such contamination from potential dam failure.

The purpose and scope of this EE/CA is to identify removal action objectives of this removal action; identify alternatives that may satisfy those objectives; and analyze the alternatives with respect to cost, effectiveness, and implementability.

The proposed NTCRA is one element of EPA's activities under CERCLA and will constitute a portion of the cleanup action for the Site. A final remedy for the Site, to address any remaining CERCLA risks that are not addressed by the NTCRA, will be selected at a future date and be documented in a Record of Decision (ROD) issued by EPA. The proposed NTCRA is an early action to advance the cleanup at the Site substantially at this time, is expected to be a complimentary part of the overall comprehensive remedial action, and will be consistent with and not conflict with any reasonably anticipated future remedial action at the Site.

1.2 REPORT ORGANIZATION

This report has been organized into the following sections:

- **Section 1: Introduction** – Describes the purpose and scope of this EE/CA and report organization.
- **Section 2: Site Characterization** – Describes the physical attributes, history, previous sampling investigations, the sources, nature, and extent of contamination, and site conditions that justify removal action for the Site.
- **Section 3: Identification of Removal Action Objectives** – Identifies potential applicable or relevant and appropriate requirements (ARARs), RAOs, principal threat waste, and cleanup levels for each removal action alternative.
- **Section 4: Removal Action Alternatives** – Summarizes the development of removal action alternatives, including technology screening and evaluation criteria, provides detailed descriptions of the removal action alternatives, and presents analysis of alternatives based on effectiveness, implementability, and cost.
- **Section 5: Comparative Analysis of Alternatives** – Compares the alternatives to each other using the criteria of effectiveness, implementability, and cost.

- **Section 6: Statutory Limits of Non-Time-Critical Removal Actions** – Discussion of conditions at the Site that meet the CERCLA Section 104(c)(1) criteria for the emergency exemption and consistency exemption for removal actions exceeding $2 million or 12 months.
- **Section 7: Recommended Removal Action Alternative** – Recommends a removal action alternative for the Site and describes proposed statutory and regulatory findings and determinations.
- **Section 8: References**

2. SITE CHARACTERIZATION

2.1 SITE DESCRIPTION AND PHYSICAL SETTING

As illustrated on **Figure 1**, the Lower Neponset River Superfund Site is an approximately 3.7-mile segment of the Neponset River extending from the confluence of the Neponset River and the Mother Brook, located in the Boston neighborhood of Hyde Park, downstream to the Walter Baker Chocolate Dam in the Boston neighborhood of Dorchester and Town of Milton. The section of the Site that is the subject of this EE/CA report is defined as the Phase 1 Reach, which encompasses the most upstream one-mile reach of the Lower Neponset River Superfund Site, from the Neponset River confluence with the Mother Brook downstream to the T&H Dam. Site is an urban river bordered by residential, commercial, industrial, and public land, including the Neponset River Greenway, and is used daily by the surrounding communities. The Lower Neponset River channel ranges from approximately 40 feet to 300 feet wide.

2.1.1 Climate

The region has a humid continental climate with distinct seasonal variations. Winters have temperatures averaging between the mid-20 to mid-30 degrees Fahrenheit. Summers are humid, with temperatures ranging from 70 to 80 degrees Fahrenheit, and frequent thunderstorms. The nearby Atlantic Ocean moderates temperature extremes and contributes to consistent precipitation throughout the year. The mean annual precipitation of Boston, Massachusetts, is 43.76 inches (World Climate, 2024); for the purposes of this report, 43.76 inches of rain per year is assumed to be representative of the mean annual precipitation rate at the Site.

2.1.2 Regional and Local Geology

According to the Bedrock Geology Map of Massachusetts, the bedrock underlying the Site is Mattapan Volcanic Complex (Proterozoic Z or younger) which consists of rhyolite, melaphyre, agglomerate, and tuff; and Roxbury Conglomerate (Proterozoic Z to earliest Paleozoic) which consists of conglomerate, sandstone, siltstone, argillite, and melaphyre, consisting of the Brookline, Dorchester, and Squantum Members (USGS, 1983).

2.1.3 Sediment

To support the EE/CA, Integral Consulting Inc. performed a Sediment Profile Imaging (SPI) survey for the Phase 1 Reach. SPI was commercialized in the 1980s as a rapid reconnaissance tool for characterizing physical, geochemical, and biological sediment processes.

The SPI survey was conducted, providing a view of surface (top 20 centimeters) sediment physical, geochemical, and biological conditions as inferred from the imagery. A total of 64 stations were attempted within the Phase 1 Reach. The SPI prism was only able to penetrate 46 of the 64 stations due to large materials (e.g., cobbles, tree branches) impeding penetration. A wide range of natural and anthropogenic materials were observed on the river bottom in the SPI images. Silt, sand, gravel, cobble, large and small wood debris, leaf litter, bricks, metal, and bottles were observed in the images in various combinations. Results indicate that the Phase 1 Reach is dominated by a hard or debris-laden bottom with a few exceptions:

- Significant penetration was achieved on the south side of the river within the impoundment upstream of the T&H Dam, and a patchy stretch (deep penetration interspersed with low/nonpenetrative stations) immediately downstream of Fairmount Avenue; and
- A single location, immediately upstream of the T&H Dam, shows banded depositional layers, possibly indicative of past construction/dredging/disposal activity in that area.

AECOM Technical Services, Inc. (AECOM) also conducted a sediment coring program in 2023, which encompassed a collection of 63 cores, penetrating up to three strata, to a maximum depth of 6.3 feet. Sieve and hydrometer analysis were conducted on the Phase 1 sediment samples, in accordance with ASTM Method D 422. Fine sand (greater than 0.125-0.25 millimeter [mm]) was the dominant classification in the majority of the samples, with approximately 90 of 154 samples classifying as sand. Clay was identified as the primary material in fewer than 30 of the samples. AECOM compiled sediment logs for Phase 1, and all but three coring locations had lithologic descriptions consisting of fill throughout the sampled column. Additional details on sediment grain size composition within the Phase 1 Reach are available in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024b).

2.1.4 Hydrology & Hydrogeology

The Neponset River drains approximately 101 square miles of land and flows approximately 29 miles from its headwaters in Foxboro, Massachusetts into the Neponset River Estuary downstream of the Walter Baker Chocolate Dam. The Phase 1 Reach is a one mile stretch of the Lower Neponset River between the confluence with the Mother Brook and the T&H Dam. Water flows into the Lower Neponset River from the upper segment of the Neponset River and from the Mother Brook. The Neponset River is a Zone AE regulated floodway, with an effective Flood Insurance Study (FIS) dated 1977. Since the 1977 FIS, additional hydrologic and hydraulic analyses have been conducted on the Lower Neponset River to evaluate dam removal and stream restoration alternatives. These are summarized in the Hydraulics and Sediment Stability Analysis located in **Appendix B**. At the Walter Baker Chocolate Dam, according to the FIS and confirmed by the most recent hydrologic study of the Neponset River, the one percent (%) annual exceedance probability (100-year) peak flow is 3,730 cubic feet per second (cfs), and the 0.2% annual exceedance probability (500-year) peak flow is 4,750 cfs.

Water levels within the Phase 1 Reach are influenced by the T&H Dam. The T&H Dam is not currently used by the Department of Conservation and Recreation (DCR) for active flood control (GEI Consultants, Inc., 2021), and the gates do not hold stage due to significant deterioration, as documented in **Appendix C**. The results of the hydraulics and sediment analysis, summarized in **Appendix B**, indicate that the T&H Dam with its gates down can convey the 100-year and 500-year flows without overtopping the embankments.

Stream flow and water levels are also influenced by seasonal factors including leaf cover, ground cover, snowpack, and frozen ground. These factors impact the amount of runoff that occurs within the Neponset River Watershed as a result of precipitation events. AECOM evaluated mean monthly flows recorded by USGS stream flow gage located upstream of the Walter Baker Chocolate Dam. The average mean monthly flows are provided in **Appendix B**, with the maximum mean monthly flow occurring in April, which is recorded as 550 cfs.

The groundwater beneath the Lower Neponset River Superfund Site is classified as category GW-3 by MassDEP. The GW-3 classification applies to groundwater at all disposal sites that are a potential source of discharge to surface water bodies (310 CMR 40.0000). According to previous reports, within the Lewis Chemical Removal Site area, depth to groundwater is shallow (i.e., less than 15 feet below ground surface) across the Site (Woodard & Curran, 2015). The horizontal hydraulic gradients were approximately 0.03 feet/foot in the overburden aquifer and to 0.10 feet/foot in the bedrock aquifer (Woodard & Curran, 2015). Generally, the hydrogeological data available across the Lower Neponset River Superfund Site is very limited and is expected to vary across the 1-mile Phase 1 Reach, especially in the vicinity of the T&H Dam.

Precipitation at the DCR Neponset River Reservation, adjacent to the Lewis Chemical Removal Site, infiltrates into the ground and/or runs off into the Neponset River. Groundwater flow patterns, and consequently contaminant flow paths and behavior, can be impacted by precipitation and seasonal variations in surface water elevations of the Neponset River. While groundwater is generally considered to flow from the Lewis Chemical Removal Site to the river, a reversal of flow from the river to the surrounding properties is possible during flood events (CDW Consultants, Inc., 2014).

Additional details regarding the hydrology and hydrogeology at the Lower Neponset River Superfund Site are available in the Conceptual Site Model report (AECOM, 2024a).

2.1.5 Ecological Setting

Between March and June 2023, AECOM conducted the majority of reconnaissance activities specifically within the Phase 1 Reach of the Lower Neponset River Superfund Site. In December of 2024, a one-day site reconnaissance event was performed on small portion of the Phase 1 Reach where site reconnaissance could not be conducted in 2023. The reconnaissance activities included a geospatial survey, wetland delineation, and ecological evaluations (AECOM, 2023b). The geospatial survey documented the width of the river channel to range from approximately 60 to 200 feet within the Phase 1 Reach. The water surface elevation during the time of surveys was documented to be between 33.5 to 33.7 feet North American Vertical Datum of 1988 (NAVD 88), and the deepest portions of the river were recorded at 23 feet NAVD 88.

AECOM wetland scientists conducted wetland and ecological evaluations of the Phase 1 Reach. The wetland scientists noted that much of the banks are heavily armored with boulders and large rocks, particularly at and near bridge abutments. The ordinary high-water mark and bank elevations coincided in most areas, except one small area on the south bank near Dana Avenue. AECOM delineated two on-site palustrine forested/scrub shrub (PFO/PSS) wetlands along the northwest bank, one PFO wetland along the southeast bank, and two intermittent streams.

During the evaluations, vegetation and wildlife species observations (including evidence of species presence, such as tracks and scat) were documented. Vegetation observed within the riverine environment of the Phase 1 Reach included red maple, river birch, green ash, white ash, cottonwood, red oak, silky dogwood, honeysuckle, buttonbush, multiflora rose, glossy buckthorn, poison ivy, jewelweed, smartweeds, sedges, fox grape, and greenbrier. Wildlife observed in and around the river and riverine environment of the Phase 1 Reach included 22 species (or evidence of their use) (AECOM, 2023b).

Additional details on the ecological setting within the Phase 1 Reach are available in the Phase 1 Site Reconnaissance Memorandum (AECOM, 2023b).

2.2 SITE HISTORY

2.2.1 Site Industrial History Overview

The Site contains a substantial amount of PCB-contaminated sediment and floodplain soils, among other hazardous substances, pollutants, and contaminants accumulated from both suspected and unknown sources. Industrialization and subsequent urbanization began in the Neponset River Basin as early as the 1630s. The Mother Brook is a flood-diversion canal constructed in the late 1600s to early 1700s, which connected the Charles River and the Neponset River. By the mid-1700s, the Neponset River drained one of the most heavily industrialized areas in the nation, draining parts of, and areas adjacent to, the City of Boston (Breault, Concentrations, Loads, and Sources of Polychlorinated Biphenyls, Neponset River and Neponset River Estuary, Eastern Massachusetts (Version 1.1), 2014). The river was used historically for hydro-powered factories and other diverse industrial operations (Weston Solutions, Inc., 2019). Several industries that used hazardous substances, including PCBs, were located along the Neponset River from the 1930s to the 1970s. Following the flood of 1955, which damaged many of the dams along the Neponset River and flooded much of southern

New England, multiple flood control measures were implemented (Breault, Cooke, & Merrill, Data on Sediment Quality and Concentrations of Polychlorinated Biphenyls from the Lower Neponset River, Massachusetts, 2002-03, 2004a). Around this time, two dams located on the Lower Neponset River (the Walter Baker Chocolate Dam and T&H Dam) were rebuilt. At around the same time, sections of the Lower Neponset River were straightened, dredged and deepened on the main channel, floodplain soils were armored and steepened, and dredge spoils were placed within low lying areas along the Neponset River.

2.2.2 Historical Contamination and Previous Response Actions Near the Site

The Neponset River has a complex history of contamination from both point and non-point sources. Suspected sources of the accumulated contaminated sediment in Lower Neponset River include inflowing tributaries, urban stormwater runoff, and overland flow from adjacent sites. In 1955, catastrophic flooding led to multiple dam failures within the Lower Neponset River, which contributed to contaminated sediment being transported downstream into lower segments of the river. The 2019 Lower Neponset River Site Inspection Report suggests that widespread PCB contamination within the Lower Neponset River originated from the Mother Brook, a Neponset River tributary, starting sometime prior to 1955 (Weston Solutions, Inc., 2019). The contaminated sediment is suspected to have migrated due to natural erosion along the riverbed, resulting in transport downstream and sediment accumulation in low-energy areas, such as dam impoundments. A summary of historical investigations conducted on the Neponset River is presented in Section 2.3.

Several response actions have been conducted both upstream of, and adjacent to, the Lower Neponset River Superfund Site:

- Lower Mother Brook is located directly upstream of the Lower Neponset River Superfund Site. The Former L.E. Mason Company was located at 98 Business Street, on the north bank of the Mother Brook, approximately 0.25 miles upstream of the confluence with the Neponset River (the beginning of the Lower Neponset River Superfund Site). Remediation of PCB contamination adjacent to and within the Mother Brook was performed from 2007 through 2010, as detailed in the MCP Phase IV Completion Statement for the Former L.E. Mason Company (Shaw Environmental & Infrastructure, Inc, 2011). The company produced cast zinc and aluminum electrical supplies from 1945 to 2002 (Weston Solutions, Inc., 2019). Remediation at the Former L.E. Mason Company included the removal of 17,546 tons of sediment from three segments of the Mother Brook. The three segments consisted of the Upper Mother Brook (the area adjacent to the Former L.E. Mason Company and downstream to the Massachusetts Bay Transportation Authority (MBTA) bridge), the Middle Mother Brook (the area between the railroad bridge and Hyde Park Avenue), and the Lower Mother Brook (Hyde Park Avenue downstream to approximately 50 feet upstream of the confluence of the Mother Brook and the Neponset River) (Shaw Environmental &

Infrastructure, Inc, 2011). As part of the Remedial Investigation, AECOM collected 24 sediment samples from the Upper Neponset River and Mother Brook in 2023. Total PCB concentrations ranged from to 0.00891 mg/kg to 1.13 mg/kg, with the average total PCB concentration at 0.3 mg/kg.

- Lewis Chemical Removal Site is located within the Phase 1 Reach of the Lower Neponset River Superfund Site on Fairmount Court in Hyde Park. The Lewis Chemical Removal Site is the location of the former Lewis Chemical Corp. facility and is comprised of three properties (the city of Boston owns two parcels, and the other property is owned by the Commonwealth of Massachusetts and managed as environmental preservation land by the DCR). A time-critical removal action (TCRA) was performed in 2023-2024 and included the excavation and off-site disposal of 5,704 tons of PCBs, metals, and VOC-contaminated soils (Weston Solutions, Inc., 2025). The former Lewis Chemical Corp. facility may remain as a potential source of contamination to the Lower Neponset River Superfund Site via groundwater discharges, although further investigations are needed to make this determination.
- Former Tileston and Hollingsworth Mill was located at 892 River Street in Hyde Park, Boston and was used as a paper mill starting in 1773. Previous investigations at the property identified elevated PCBs in soil around the base of two transformers. The current owner is UE Shops at Riverwood, LLC and a Release Abatement Measure Plan was submitted to MassDEP in 2008 to manage contaminated soil and groundwater generated during demolition and construction of “The Shops at Riverwood” project . Between 2008 and 2010, demolition, earthwork, and remedial activities were completed. That work included off-site disposal of transformers, railroad ties, concrete rubble, approximately 9,000 tons of soil, pulp grit/oily wood material, 435 tons of dioxin and PCB-contaminated soil, 1,320 tons of PCB-contaminated soil, and 268 tons of sluiceway sludge material (Haley & Aldrich, Inc., 2010).
- The Capen Street Removal Site was located on or adjacent to Capen Street near a dredge spoil in Milton, Massachusetts. In 2011, EPA conducted a TCRA resulting in the removal of 677 tons of arsenic-contaminated soil and 60 tons of lead-contaminated soil from 14 residential properties (Weston Solutions, Inc., 2011).
- Two additional sites with a history of PCB contamination are located on the Neponset River upstream of the confluence of Mother Brook and the Neponset River. Those sites are the Canton Airport site (located along Neponset Street in Canton approximately 6 miles upstream of the Mother Brook and Neponset River confluence) and the Norwood PCBs Superfund Site (located along Meadow Brook in Norwood and approximately 7.5 miles upstream of the confluence of Mother Brook and the Neponset River). Both the Canton Airport and Norwood PCB sites have been remediated and are no longer considered to be ongoing sources of PCB contamination in the Neponset River (Weston Solutions, Inc., 2019).

2.2.3 Tileston and Hollingsworth Dam

A key characteristic of the Phase 1 Reach is the T&H Dam, which is at the downstream end of the Phase 1 Reach and impounds water and sediment, including contaminated sediment, upstream of the T&H Dam.

The most recent full inspection of the T&H Dam occurred in 2021 and is documented in the Inspection and Investigation Report for the T&H Dam (GEI Consultants, Inc., 2021). The inspection determined that the T&H Dam is in “Poor Condition,” which is defined by the Commonwealth of Massachusetts Office of Dam Safety as the presence of “significant structural, operation, and maintenance deficiencies [under] normal loading conditions.” A follow-up inspection occurred in May of 2024 and is documented in the May 2024 Poor Condition Dam Follow-up Inspection report (Pare Corporation, 2024). The T&H Dam is classified as an intermediate-sized, significant (Class II) hazard potential, under Commonwealth of Massachusetts dam safety rules and regulations because failure of the dam at maximum pool may result in property damage and possible loss of life. Failure of the dam would result in the downstream transport of a significant amount of contaminated sediment that has accumulated upstream of the dam.

A review of documents regarding the safety and stability of the T&H Dam is provided in **Appendix C**. The review finds that while the concrete sill supporting the gate structures on the dam is stable, there are:

- Deficiencies with the gate structures, including portions of the gates that need to be removed or replaced. This is of particular concern because failure of the remaining steel gate structures could result in release of the sediment impounded behind the dam;
- Localized voids under the concrete sill that require grouting;
- Spalling and cracks in concrete gate house structures that require repair; and
- Expansion joints that need to be sealed.

The T&H Dam Spillway Design Flood (SDF) is the 100-year flood in accordance with Chapter 302, CMR 10.00 of the Massachusetts Dam Safety Regulations. The SDF is estimated by modeling extreme rainfall events occurring in conjunction with a conservatively selected set of hydrologic and watershed conditions to produce an inflow hydrograph for spillway design purposes based on the structure size and hazard classification. The resulting 100-year peak discharge at the dam was determined to be 3,500 cfs. Modeled inflow into the Lower Neponset River during a 100-year flood and 500-year flood is predicted to be 3,750 cfs and 4,750 cfs, respectively.

2.3 PREVIOUS SAMPLING INVESTIGATIONS

Previous investigations of the Lower Neponset River Superfund Site have been conducted by the United States Army Corps of Engineers (USACE), USGS, MACTEC, AMEC Environment & Infrastructure, Inc., and the Weston Solutions, Inc. This section provides a brief overview of each investigation in chronological order.

2.3.1 2001 United States Army Corps of Engineers Study

In 2001, the USACE collected one composite sediment sample at each of the upstream pools of the T&H Dam and the Walter Chocolate Baker Dam (Milone & MacBroom, Inc., 2006). The location and depth of the samples are unknown. The samples were analyzed for nutrients, metals, pesticides, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, VOCs, PCBs as six Aroclors, and grain size (Milone & MacBroom, Inc., 2006). The analytical results concluded:

- Concentrations of several metals were above the lowest severe effect level in 1994;
- Aroclor detections were limited to Aroclor 1016/1242; concentrations of 32,630 parts per billion (ppb) and 91,820 ppb were detected in the samples from the Walter Baker Chocolate Dam and T&H Dam, respectively;
- Total petroleum hydrocarbons and polycyclic aromatic hydrocarbons were both detected; and
- Pesticides and VOCs were not detected.

2.3.2 2002-2003 United States Geological Survey Study (USGS)

In 2002 and 2003, USGS collected sediment-grab samples from 20 stations, sediment core samples from 31 stations, and water column passive in situ chemical-extraction samples from 12 stations (Breault, Cooke, & Merrill, Data on Sediment Quality and Concentrations of Polychlorinated Biphenyls from the Lower Neponset River, Massachusetts, 2002-03, 2004a). The study was conducted in partnership with the Massachusetts Department of Fish and Game, Division of Ecological Restoration, Riverways Program with the goal of measuring the extent and magnitude of PCB contamination and determining the source(s) of the contamination. Sediment-grab samples were collected between Fowl Meadow and the Walter Baker Chocolate Dam; PISCES samples were collected within the same area, in addition to upstream, downstream, and within the Mother Brook. Sediment-core samples were collected upstream of the T&H Dam, the Walter Baker Chocolate Dam, and within the braided channel.

Sediment grab and core samples were analyzed for trace elements, total organic carbon (TOC), PCBs as Aroclors, pesticides, and grain size. Sediment core samples were also analyzed for extractable petroleum hydrocarbons. In addition, a subset of the sediment grab samples was analyzed for polycyclic aromatic hydrocarbons and PCB congeners. Select sediment core samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals and reactive sulfide analysis. PISCES samples were analyzed for PCB congeners. The analytical results indicate:

- PCB Aroclor concentrations as high as 78,300 ppb upstream of the Walter Baker Chocolate Dam, 68,900 ppb within the braided channel, and 229,300 ppb upstream of the T&H Dam;
- Bottom sediment was enriched in elements and organic compounds when compared to “non-urban background” concentrations; however, most constituent concentrations were equal to or less than those detected in other urban rivers; and
- The data indicated the PCB contamination was likely from several sources, the exact location of which could not be determined; however, the data did indicate a major source was likely on or near the confluence of the Neponset River and the Mother Brook.

2.3.3 2004-2006 United States Geological Survey Study

Based on the conclusions of the 2002-2003 study, USGS conducted additional investigations between 2004 and 2006 to determine more information about the concentrations, loads, and sources of PCBs (Breault, Cooke, & Merrill, Sediment Quality and Polychlorinated Biphenyls in the Lower Neponset River, Massachusetts, and Implications for Urban River Restoration, 2004b). The following tasks were performed as part of the study:

- Bottom-sediment grab samples were collected from five stations in the Mother Brook and eight stations in the Neponset Estuary;
- PISCES were deployed at four stations in the Mother Brook, one station in the Meadow Brook, one station in the Neponset River upstream of the confluence with the Mother Brook, two stations downstream of the confluence of the Neponset River and the Mother Brook, and four stations in the Neponset Estuary;
- Automatic, flow-proportional, fixed-point sampling of water was conducted at the USGS stream gage at Milton Village;
- White sucker samples were collected from the T&H and the Walter Baker Chocolate Dam impoundment areas;
- Mummichog samples were collected from the Neponset River Estuary; and
- Water samples were collected upstream and downstream of the braided channel during a large storm.

Bottom sediment, PISCES, water, and tissue samples were analyzed for PCB congeners, homologs, and Aroclors. Bottom sediment samples were also submitted for elemental analysis. Results indicate:

- Total Aroclor concentrations in bottom sediment in the Mother Brook were as high as 25,751 ppb;
- PCB concentrations in the estuarine mud samples averaged about 900 ppb; and
- Concentrations decreased with distance from the river mouth into the estuary.

The study concluded that concentrations of PCBs in the Neponset River were above sediment-quality guidelines in some bottom sediment samples, above the continuous chronic criteria for dissolved concentrations in some water samples, and above concentrations considered to be safe for consumption of fish by wildlife and humans in white sucker tissue samples. The concentrations suggested PCB sources to the Neponset River included areas along the Mother Brook and the Meadow Brook as well as areas along the river near Fairmont Avenue, the T&H Dam, and the braided channel (Breault, Concentrations, Loads, and Sources of Polychlorinated Biphenyls, Neponset River and Neponset River Estuary, Eastern Massachusetts (Version 1.1), 2014).

2.3.4 2007-2008 MACTEC Study

In 2007 and 2008, MACTEC conducted surface soil sampling at eight areas along the Neponset River where historical dredge spoils had been placed and that are currently accessible to the public. Sediment sampling was also conducted at four canoe launches. The purpose of the sampling was to determine if PCBs and metals were present at levels of concern in soil within the historical dredge spoil areas. Surface soil and sediment samples were analyzed for PCBs as Aroclors. Sediment samples and select surface soil samples were also analyzed for priority pollutant metals. The historical dredge spoil areas where soil was evaluated are shown in the Final Report for Lower Neponset River PCBs Site Inspection (Weston Solutions, Inc., 2019).

Results from the soil in spoil areas associated with the 1962 dredging were summarized in a presentation titled Neponset River Dredge Spoils Assessment Results Boston and Milton (MACTEC Engineering and Consulting, Inc., 2007). The results indicated:

- Lead concentrations above levels of concern in the soil at the historical dredge spoil area at one location (referred to as 1962-E); and
- Results for PCBs indicated soils are safe for recreational use with respect to these compounds in the soil at spoil areas associated with the 1962 dredging.

It is noted that one of the historical dredge spoil areas, referred to as 1964-A, is the Riverside Square PCB Removal Site. In 2023, EPA performed a preliminary assessment and site investigation (SI) under the removal program (Westons Solutions, Inc., 2024). In July 2024, EPA authorized the performance of a time-critical removal action for the Riverside Square PCB Removal Site (EPA, 2024).

2.3.5 2013 AMEC Environment & Infrastructure, Inc. Sediment Core Sampling at Four Areas

In 2013, the MassDEP requested that AMEC Environment & Infrastructure, Inc. perform core sediment sampling at four areas along the Neponset River. The four areas are approximately 3,000 feet downstream and 1,000, 3,000 and 4,000 feet upstream of the confluence of the Neponset River and Mother Brook. Each sampling area consisted of three sediment core locations, resulting in a total of twelve sediment core locations (AMEC, 2013). PCB concentrations were highest downstream of the Mother Brook confluence. PCBs concentrations results ranged from non-detect to 45 mg/kg (AMEC, 2013), and indicated that PCB concentrations were highest downstream of the confluence of the Mother Brook and the Neponset River.

2.3.6 2017 START Study

In 2017, Weston Solutions, Inc., START collected seven sediment samples from the Walter Baker Chocolate Dam impoundment area (from the Walter Baker Chocolate Dam upstream to the Central Avenue Bridge), 11 sediment samples from the braided channel area (from the Central Avenue Bridge upstream to the Harvest River Bridge), two sediment samples from the Blue Hill Avenue area (from the Harvest River Bridge upstream to the T&H Dam), seven sediment samples from the T&H Dam impoundment area (from the T&H Dam upstream to Fairmount Avenue), and three sediment samples from the Fairmount & Mother Brook Confluence area (from the Fairmount Avenue Bridge upstream to the confluence of the Mother Brook with the Neponset River). A total of 30 samples were also collected from 18 background/reference stations; these areas were located within the Pine Tree Brook, the Mother Brook, and the Neponset River upstream of its confluence with the Mother Brook. The sampling was conducted to support the Site Inspection (Weston Solutions, Inc., 2019).

Samples were analyzed for PCBs as Aroclors, percent solids, TOC, and grain size. The analytical results from the study are reported in the Final Report for Lower Neponset River PCBs Site Inspection (Weston Solutions, Inc., 2019). Additionally, see Section 2.7.8.

2.3.7 2018 START Study

In 2018, Weston Solutions, Inc., START conducted additional sediment sampling for PCB congener analysis. The sampling included the collection of 13 samples from the Walter Baker

Chocolate Dam impoundment area, 36 samples from the braided channel area, 11 samples from the Blue Hill Avenue area, 16 samples from the T&H Dam impoundment area, and seven samples from the Fairmount and Mother Brook confluence area. An additional 20 samples were collected from background/reference stations from within the Pine Tree Brook, the Mother Brook, and from the Neponset River upstream of its confluence with the Mother Brook.

The sediment samples were field screened for PCBs as Aroclors (Weston Solutions, Inc., 2019). Based on the screening results, the spatial distribution of samples, environmental targets, and similarities of samples, 21 of the samples were submitted for laboratory analysis for PCBs as Aroclors and 12 of the samples were submitted for laboratory analysis for PCB congeners and TOC (Weston Solutions, Inc., 2019).

Analytical results for PCBs (as Aroclors and congeners) show that all the samples collected within the Lower Neponset River Superfund Site had concentrations above reference/ background levels. Total PCB congener concentrations were as high as 1,100 mg/kg in the vicinity of the Lewis Chemical Removal Site, 11,000 mg/kg upstream of the T&H Dam, 47 mg/kg within the braided channel, and 70 mg/kg upstream of the Walter Baker Chocolate Dam.

The study concluded that PCBs are present in sediment above reference/background levels throughout the Lower Neponset River. The contaminated sediment is likely to have accumulated from both suspected and unknown sources.

2.3.8 2023 AECOM Study

Previous investigations have detected elevated levels of PCBs throughout much of the Phase 1 Reach (Weston Solutions, Inc., 2019). In 2023, an investigation was performed by AECOM and consisted of the following:

- A geospatial data survey;
- A historic and cultural resource survey;
- An SPI survey;
- Ecological evaluations including a wetland survey;
- Sampling and analysis of sediment samples for PCBs and other COPCs;
- Sampling and analysis of floodplain soil samples for PCBs and other COPCs; and
- Sampling and analysis of surface water and pore water for PCBs and other COPCs.

The boundaries of the investigation area include the Federal Emergency Management Agency (FEMA) 100-year flood zone located along the floodplain soils of the Neponset River where floodplain soil was evaluated and the area that extends 100 feet out from the high-water line of the Neponset River on both the north and south banks where the ecological characterization and evaluation was conducted. As part of this study, samples were also collected from background locations in Mother Brook and in the Neponset River upstream of its confluence with Mother Brook.

The results of the 2023 Phase 1 field investigation were presented in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024). One of the objectives of the 2023 Phase 1 field investigation was to collect the data needed to complete an EE/CA for a potential NTCRA of contaminated media within the Phase 1 Reach. Another objective was to develop a dataset that can be used to support the comprehensive remedial investigation and feasibility study that is to be completed in the future for the entire 3.7-mile Lower Neponset River Superfund Site.

The work was performed in accordance with a project-specific Quality Assurance and Project Plan (AECOM, 2023a). Sediment cores were advanced to a target depth of six feet at a total of 85 locations within the Phase 1 Reach and the reference/background areas immediately upstream in both the Mother Brook and the Neponset River stems. Total core depths ranged from 0.3 to 6.3 feet, and samples were collected from multiple depths. Surface sediment samples (0 to 0.5 feet) were collected at all locations. Additionally, floodplain soil samples were collected at a total of 109 locations within the Phase 1 Reach; surface samples were collected at all locations (0 to 1 feet or less if groundwater was encountered) and subsurface soil samples were collected at 29 of the locations. Pore-water sampling was conducted at five locations co-located with sediment sampling locations. Pore-water samples were collected from a vessel using a henry sampler from a depth of approximately 0.5 feet using a peristaltic pump.

Sediment and soil samples were analyzed for a range of analytical parameters including VOCs, SVOCs, metals (including mercury), cyanide, pesticides, PCB congeners, polychlorinated dibenzodioxins and furans, total organic carbon, and grain size. Samples from the surface interval were also submitted for analysis of acid volatile sulfide/simultaneously extracted metals. Select samples had insufficient sediment mass for all the target analytes. Filtered and unfiltered pore-water samples were collected as presented in Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024). Pore-water samples were analyzed for dissolved metals (including mercury), dissolved organic carbon (DOC), PCB congeners, polychlorinated dibenzodioxins and furans, polycyclic aromatic hydrocarbons (PAHs), and 1,4-dioxane.

A key distinction of the 2023 Phase 1 field investigation is that all samples were analyzed for PCB congeners via the EPA Method 1628. A majority of previous investigations used EPA Method 8082, which analyzes for PCBs as Aroclors. EPA Method 1628 is a low-resolution gas chromatography/mass spectroscopy method, using isotope dilution that provides analytical results for all 209 PCB congeners. Quantification of total PCB concentrations generated using summed congener data from Method 1628 is generally considered more accurate than total PCBs calculated as the sum of Aroclors.

Figure 2 illustrates PCB concentrations (sum of detected congeners) at reference locations within Neponset River and the Mother Brook sediment, upstream of the Phase 1 Reach. PCBs were detected at all of the reference locations, with concentrations ranging from 0.00891 mg/kg to 1.13 mg/kg. The average concentration of PCBs within the background area is 0.27 mg/kg. 75% of the reference samples had PCB concentrations less than 0.51 mg/kg, and 95% of the reference samples had PCB concentrations less than 1 mg/kg; one reference sample location had PCB concentrations greater than 1 mg/kg (location 23A-080, which had 1.13 mg/kg PCBs in the original sample and 1.07 mg/kg PCBs in the field duplicate).

Figure 3 presents the results of the 2023 Phase 1 field investigation for total PCBs (sum of detected congeners) in sediment. Based on the 2023 Phase 1 field investigation results, elevated levels of PCBs are present in several areas within the Phase 1 Reach, which is consistent with the results of previous investigations. In surface sediment (0 to 0.5 feet) total PCBs range from 0.11 mg/kg to 437 mg/kg, with the highest concentration recorded at sample location 23A-0062-PLC1, which is adjacent to the former Lewis Chemical facility. When sediment samples from all depths are considered, total PCBs range from 0.00572 mg/kg to 2,670 mg/kg, with the highest concentration recorded at sample location 23A-0063-PLC1 at a depth of 0.5 to 3.7 feet; that sample location is also adjacent to the former Lewis Chemical Removal Site.

Figure 4 illustrates the PCB concentrations (sum of detected congeners) in floodplain surface soil within the Phase 1 Reach. PCB concentrations in the floodplain soil are generally lower than in the sediment, with a maximum soil concentration reported as 173 mg/kg. Additional details on sediment and floodplain soil concentrations within the Phase 1 Reach can are available in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024).

PCB congeners were detected in all pore-water samples, with a maximum of 19 micrograms per liter (µg/L). Additional details on sediment, floodplain soil, surface water, and pore-water concentrations within the Phase 1 Reach are presented in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024).

2.4 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

2.4.1 Extent of PCB Contamination

Based upon the extent and level of risk associated with PCBs throughout the Phase 1 Reach, PCBs are the primary COCs considered in the EE/CA. Within the Phase 1 Reach sediment, total PCB congeners were detected in 156 out of 157 samples with detected concentrations ranging from 0.00572 mg/kg to 2,670 mg/kg. The maximum concentration of 2,670 mg/kg was measured in the 0.5 – 3.7-foot interval at location 23A-0063 (RM 3.46),[1] which is adjacent to the former Lewis Chemical facility. During the Phase 1 Reach field investigation in 2023, 24 samples were analyzed from 11 locations adjacent to the former Lewis Chemical facility (sample ID 23A-0004, 23A-0005, 23A-0025, 23A-0026, 23A-0044, 23A-0045, 23A-0061, 23A-0062, 23A-0063, 23A-0064, and 23A-0065) with concentrations ranging from 1.3 mg/kg to 2,670 mg/kg. The next highest concentrations of 2,050 mg/kg, 934 mg/kg, and 915 mg/kg were measured in the 3.7 – 5.7-foot interval at 23A-0064 (RM 3.45), and the 3 – 4.7 foot and 0.5 – 3.0-foot intervals at 23A-0062 (RM 3.47), respectively; these samples were also located at the former Lewis Chemical Facility.

In areas of the Phase 1 Reach that are not in the vicinity of the former Lewis Chemical Facility, a maximum concentration of 853 mg/kg was measured in the 2.3 - 4.2-foot interval at location 23A-0070 (RM 2.69), which is in the T&H Dam impoundment. During the Phase 1 Reach field investigation, 23 samples were analyzed from eight locations in the T&H Dam impoundment (23A-0020, 23A-0040, 23A-0060, 23A-0066, 23A-067, 23A-0068, 23A-0069, and 23A-0070) with concentrations ranging from 0.00572 mg/kg to 853 mg/kg. During the 2017 – 2018 Site Investigation, prior to the Site's listing to the NPL, two samples were analyzed for PCB congeners in the T&H Dam impoundment with concentrations ranging from 270 mg/kg to 11,000 mg/kg.

Figure 3 illustrates the spatial distribution of total PCB congeners in sediment collected during the 2023 Phase 1 Reach field investigation in the areas of the former Lewis Chemical facility, T&H Dam impoundment, and other areas of the Phase 1 Reach. The figure shows that PCB concentrations greater than 100 mg/kg were measured in the top 0 – 0.5-feet of sediment at 24 locations throughout the Phase 1 Reach. Additionally, the figure shows that PCB concentrations greater than 100 mg/kg were measured in the in the 3- to 6-foot subsurface interval adjacent to and downstream of the former Lewis Chemical facility and within the T&H Dam impoundment. During the 2023 Phase 1 Reach field investigations, the depth to refusal was recorded at each sampling location if possible. This data was used to assist in estimating sediment thickness, and was compared to the 1964 dredging design plans of the Metropolitan District Commission (now a part of the Massachusetts DCR) which are located in **Appendix F**. The objective of that evaluation was to determine if comparing the 1964 dredging design to the current (2023) bathymetry could be used to supplement the estimate the volume of soft sediment throughout the Phase 1 Reach. The results of this evaluation concluded that the elevations on the 1964

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[1] RM refers to River Mile. River Miles measure distance along the course of the river and are not necessarily the straight-line distance. River Mile is used on several figures in this EE/CA as a measuring scheme to locate features along the Lower Neponset River Superfund Site. The measurements indicate the distance in RM from the Walter Baker Chocolate Dam upstream to the confluence of the Neponset River and the Mother Brook.

MDC design drawings do not provide a reasonable baseline that can be used to calculate the thickness of sediment that has accumulated since the 1964 dredging work.

Within the Phase 1 Reach floodplain soil, total PCB congeners were detected in 135 out of 138 samples, with detected concentrations ranging from 0.000605 mg/kg to 173 mg/kg. The maximum concentration of 173 mg/kg was measured in the 0 – 1 foot interval at location 23D-0052 (RM 2.82), which is on the north bank in the Riverside Square PCB Removal Site area. The next highest concentration of 145 mg/kg was measured in the 0 – 1 foot interval at location 23D-0054 (RM 2.79), which is also on the north bank in the Riverside Square PCB Removal Site area. Soil in the Riverside Square PCB Removal Site area is currently being addressed using a time-critical removal action, which is expected to continue through 2025.

Figure 4 illustrates the spatial distribution of total PCB congeners in the Phase 1 Reach floodplain soil. The figure shows that PCB concentrations above 100 mg/kg were measured in seven locations (sample locations 23D-0014, 23D-0052, 23D-0054, 23D-0060, 23D-0069, 23D-0074and 23D-0114). Additionally, PCB concentrations above 25 mg/kg but less than 100 mg/kg were in an additional eight locations (sample locations 23D-0017, 23D-0020, 23D-0021, 23D-0050, 23D-0053, 23D-0055, 23D-0056, 23D-0120). The floodplain soil adjacent to the former Lewis Chemical facility were excavated and restored in 2024 during the Lewis Chemical time-critical removal action.

2.4.2 Additional Contaminants of Potential Concern

Additional COPCs are present at the Site and may pose a risk to human health and the environment. In summary, detections in sediment in the Phase 1 Reach include:

- 16 of 17 dioxins/furans (PCDD/Fs);
- 205 of 209 PCB congeners;
- 14 of 21 pesticides;
- 23 of 23 metals;
- cyanide;
- 33 of the 54 volatile organic compounds (VOCs); and
- 32 of the 68 semi-volatile organic compounds (SVOCs).

In summary, detections in floodplain soil in the Phase 1 Reach include:

- 17 of 17 PCDD/F;
- 204 of 209 congeners;
- 23 of 23 metals;
- 12 of 54 VOCs;
- 32 of 68 SVOCs; and
- Asbestos.

Among the detected constituents, select PCB congeners, PCDD/Fs, metals, pesticides, and SVOCs had a relatively high percentage of sediment samples with concentrations above human health and/or ecological project action limits as reported in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024).[2] Additional information, including figures of this data, is available in the Conceptual Site Model report (AECOM, 2025).

Using the full Phase 1 sediment data set, which is available in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024), an evaluation was conducted to determine whether contaminants with elevated concentrations in sediment are likely to remain and continue to pose a potential risk to human health and the environment following implementation of each removal action alternative. This evaluation included all Phase 1 sediment analytes except for PCBs and dioxins/furans. Based on a review of Phase 1 data, EPA determined that dioxin and furans are co-located with PCBs in sediment in the Phase 1 Reach and that focusing on PCBs for the EE/CA would incorporate areas with elevated levels of dioxins and furans. Remaining COPCs following the completion of each RAA were compared to human health and ecological risk-based project action limits and the maximum concentration detected in background sediment. The outcome of this evaluation specific to RAA-2, RAA-3, and RAA-4 are discussed further in Section 4.4.10, Section 4.5.12, Section 4.6.12, respectively, and **Appendix E**.

2.4.3 Sources of PCB Contamination

Historical investigations conclude that PCBs are present in sediment above background concentrations throughout the Lower Neponset River Superfund Site and suggest that contaminated sediment has accumulated within the Phase 1 Reach from both suspected and unknown sources. A major suspected historical source of contamination is the Mother Brook (Weston Solutions, Inc., 2019). Other potential sources of contamination that have been identified include facilities upstream of the confluence of Mother Brook and the Neponset River, and from facilities adjacent to the Lower Neponset River Superfund Site (Weston Solutions, Inc., 2019). These potential sources are summarized in the following sections, including the status of any remediation. For further discussion regarding prior response actions, see Section 2.2.2.

2.4.3.1 Mother Brook

A major suspected historical source of PCB contamination of the Lower Neponset River Superfund Site is the Mother Brook. Prior to the Lower Neponset River Superfund Site proposal to the NPL, the MassDEP completed a file review of waste sites within the Neponset River Basin.

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[2] The project action limits for sediment were selected based on the lower of the human health and ecological based levels. Human health levels are based on EPA regional screening levels (RSLs) for residential soil based on a target hazard quotient of 0.1 and a target risk level of 1E-06 (EPA, 2022), and ecological levels are based on EPA Region 4 ecological screening values for freshwater sediment (EPA, 2018).

In its review, MassDEP identified sites within proximity of the Neponset River, or one of its tributaries, listing PCBs as a COC. MassDEP concluded that the major sources of PCB contamination to the Lower Neponset River were located along the Mother Brook. MassDEP identified 10 properties that are potential sources of PCBs to the Neponset River either directly or through one of its tributaries, six of which were located along the Lower Mother Brook, including:

- The former LE Mason Facility at 98 Business Street (associated with MassDEP Release Tracking Numbers (RTNs) 3-0000730, 3-0019974);
- The former Allis & Chalmers Manufacturing Facility at 1377 Hyde Park Avenue (RTN 3-0027067);
- The Former American Tool and Machine at 1415 Hyde Park Avenue (RTNs 3-0027790, 3-0027791, 3-0028336 & 3-0028835);
- The former Allis & Chalmers Electrical Manufacturing facility at 1344 Hyde Park (30032581);
- The former location of a Junkyard/Paint Manufacturing Facility at 56R Business Street (RTN 3-0023869); and
- The North and South Banks of Mother Brook (RTN 3-0027168).[3]

Several PCB-related response actions, including sediment removal, have occurred near the location of the former LE Mason Facility. Additionally, contaminated sediment within the Mother Brook was removed adjacent to the Allis & Chalmers Manufacturing Facility, the former American Tool and Machine Facility, and the former Junkyard/Paint Manufacturing Facility (Weston Solutions, Inc., 2019). Soil at these properties has been investigated previously, and it was determined that either a condition of No Significant Risk existed, or response actions were performed so that a condition of No Significant Risk was achieved.

2.4.3.2 Neponset River Upstream of Confluence with the Mother Brook

Potential sources of PCB contamination to the Lower Neponset River Superfund Site from the Neponset River, upstream of its confluence with the Mother Brook, include the former

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[3] The North and South Banks of Mother Brook site does not include a facility and has been defined as encompassing the North and South Banks along a stretch of approximately 400 square feet of Mother Brook between the easterly (downstream) side of the MBTA/Amtrak railroad bridge (downstream of the former LE Mason/98 Business Street Facility) and the westerly (upstream) side of the Hyde Park Avenue bridge. Thomas & Betts and New Albertson's jointly performed remediation activities with respect to this site, pursuant to the Massachusetts Contingency Plan (MCP).

Norwood PCBs Superfund Site and the former Canton Airport (Weston Solutions, Inc., 2019). These two sites were also identified by MassDEP in its file review of potential PCB sources to the Lower Neponset River.[4]

The former Norwood PCBs Superfund Site is located in Norwood, Massachusetts, approximately 7.5 miles upstream of the Lower Neponset River Superfund Site at the confluence with Mother Brook. Response actions included sediment removal in the Meadow Brook, a tributary to the Neponset River. The former Canton Airport is located on Neponset Street, east of Interstate 95 in Canton, Massachusetts, approximately six miles upstream of the Mother Brook confluence. The property was used as an airport from the 1930s to the mid-1950s and was then used by several different types of businesses. Previous investigations at the former Canton Airport indicated the presence of elevated PCBs in the soil. To address the high levels of PCBs at the property, the soil was excavated.

2.4.3.3 Former Facilities Adjacent to the Site (Lewis Chemical Removal Site and Bay State Paper)

Facilities adjacent to the Site that are potential sources of PCB contamination include the former Lewis Chemical facility and the former Bay State Paper Company (Weston Solutions, Inc., 2019). These two sites were also identified by MassDEP in its file review of potential PCB sources to the Lower Neponset River.[5] The locations of these properties are shown on **Figure 1**.

Elevated concentrations of PCBs and other contaminants have been detected in sediment adjacent to the former Lewis Chemical Corp. facility, located at 0 and 12-24 Fairmount Court in Hyde Park. EPA recently completed a time-critical removal action at the Lewis Chemical Removal Site, which extends 500 feet along the northern bank of the river as shown on **Figure 1**. The removal action involved excavation and off-site transportation and disposal (T&D) of riverbank and upland soil that were contaminated with PCBs, VOCs, asbestos, and metals. At the Lewis Chemical Removal Site, over 5,000 tons of contaminated soil and debris were removed from a portion of the floodplain soil and upland areas. After removal of the contaminated materials, the Lewis Chemical Removal Site was backfilled, graded, and seeded (Weston Solutions, Inc., 2025).

The former Bay State Paper Company was located at 892 River Street in the Boston neighborhood of Hyde Park. The facility, which historically included adjacent properties in

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[4] The Norwood PCB Site is associated with MassDEP Release Tracking Number 4-3000403. Associated Release Tracking Numbers for the Canton Airport Site include 4-3000941, 4-3020140, and 4-0022292.

[5] MassDEP Release Tracking Numbers associated with the former Lewis Chemical facility include 3-0001616, 3-0031548, 3-0033111 and 3-0031697. Release Tracking Numbers associated with the former Bay State Paper facility include RTNs 3-0025435, 3-0018680 and 3- 0027201.

Boston and Milton, was used as a paper mill starting in 1773 by the Tileston and Hollingsworth families (Weston Solutions, Inc., 2019). Following ownership and operations by intervening companies, the Bay State Paper Company purchased the mill in 1994 and continued to operate the mill until 2004 (Haley & Aldrich, 2007). Previous investigations at the former Bay State Paper Company property identified elevated PCBs in soil around the base of two transformers (Weston Solutions, Inc., 2019).

2.4.4 Conceptual Site Model Involving Sediment Stability and T&H Dam

As part of the preliminary EE/CA development, the following data gaps were identified in the Conceptual Site Model report for the Phase 1 Reach:

1. The stability of contaminated sediment and risk of downstream migration; and
2. The impact of removal of the T&H Dam on riverine conditions and sediment stability.

To address these data gaps, a hydraulic model and sediment stability analysis was performed, as summarized in **Appendix B**.

The hydraulic model was used to calculate bed shear stresses for the sediment stability analysis. The results indicate that areas of sediment that are stable under normal flow conditions have the potential to be transported downstream under flood conditions.

The hydraulic model was also used to evaluate the impact of T&H Dam removal on riverine conditions and water levels. The model results indicate that the T&H Dam has limited impact on the Neponset River flood elevations and floodplain, as shown in **Figures 1** and **2** of **Appendix B**. Under average annual April flow conditions, the removal of the T&H Dam would draw down the Neponset River approximately 2.1 feet directly upstream of the dam's current location. For a 100-year simulated storm event, the water levels upstream of the dam's current location would lower 0.15 feet with the dam removed.

A hydraulic and sediment stability analysis was performed assuming no change to the channel geometry when the T&H Dam is removed. This simplification was for the purpose of understanding the impact of dam removal on water elevations and sediment mobility. Once a removal action is selected, additional hydraulic analysis will be required to determine the removal action's impact on flood elevations specific to the remedial conditions.

2.5 POTENTIAL RECEPTORS, EXPOSURE PATHWAYS, AND RISK

For the purpose of this EE/CA, potential receptors, exposure pathways, and risk from PCBs were evaluated.[6] As previously noted, PCBs are the primary contaminant of concern within the Phase 1 Reach. Based on data from animal studies, the United States Department of Health and Human Services and EPA consider PCBs a probable human carcinogen; noncarcinogenic health effects have also been associated with PCBs (e.g., immune, reproductive, eye and skin effects) (EPA, 1996; ATSDR, 2000, 2011). PCBs bioaccumulate and biomagnify in the food chain, which means they have the potential to increase in concentration as they are transferred to higher trophic levels (including fish and piscivorous species).

2.5.1 Human Health Receptors

Land use surrounding the Phase 1 Reach includes residential, recreational, commercial, and industrial properties. According to U.S. Census data, there is a high population density within 0.1, 0.25, and 0.5 miles of the Phase I Reach as stated below:

- Within 0.1 miles: 2,115 people;
- Within 0.25 miles: 8,229 people; and
- Within 0.50 miles: 18,935 people.

Additionally, there are approximately 30 residential properties within 250 feet of the Phase 1 Reach.

2.5.1.1 Drinking Water

There are seven Massachusetts towns that are located (or partially located) within four radial miles of the Site, including Boston, Brookline, Milton, Dedham, Canton, Quincy, and Westwood. Most of the population is served by public water (Weston Solutions, Inc., 2019). Drinking water for Dedham and Westwood is obtained from 14 groundwater supply wells located two or more radial miles from the Site. There are an undetermined number of residences served by private drinking water wells in these two towns (Weston Solutions, Inc., 2019). Boston, Brookline, Milton, Quincy, and Canton are served by the MWRA, which obtains drinking water from surface water locations in central Massachusetts. The Site Inspection report indicates that a very small number of people in Boston are served by private wells located within one and four radial miles of the Site, but the exact number could not be determined; the nearest private wells are

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[6] As noted in Section 2.4.2, additional contaminants of potential concern are present at the Site at elevated levels. These contaminants contribute to Site risks to human health and the environment, which will be fully evaluated in a baseline risk assessment to support the long-term remedial action. As further discussed in Section 3.2, an objective of the proposed NTCRA is to also address risks from COPCs.

located 0 to 0.25 miles south of the Site (Weston Solutions, Inc., 2019). Surface water from the Lower Neponset River is not used as a drinking water source.

2.5.1.2 Recreational Use

The segment of the Lower Neponset River within the Phase 1 Reach is designated a Class B surface water body (314 CMR 4.06). Class B waters are designated for primary and secondary contact recreation and are a habitat for fish, other aquatic life, and wildlife, for their reproduction, migration, growth, and other critical functions. The Phase 1 Reach is bordered by a nearly continuous forested riparian corridor, which provides habitat for a variety of bird and mammal species.

Recreational activities include walking, biking, kayaking, and canoeing. Swimming and wading are not recommended but are not prohibited. The Neponset River Watershed Association's Community Water Monitoring Network (CWMN) monitors water quality in the Neponset River Watershed. Results from water sampling performed by CWMN inform the EPA's Water Quality Report Card. According to the 2022 Neponset River Report Card the Lower Neponset River is 70.9% in compliance with Massachusetts bacterial standards for water-based recreation (Neponset River Watershed Association, 2022). In other words, the Lower Neponset River was unsuitable for swimming or boating approximately 30% of the time within the two-year period due to elevated bacteria levels.

Access to the Lower Neponset River is unrestricted, except in areas where private properties prevent access to the river. The Phase 1 Reach includes the following abutting recreational and/or conservation land: Walnut Street Conservation Land, West Street Park, Doyle Park, Riverside Conservation land, and Neponset River Reservoir Conservation land. As also documented in the Baseline Reuse Assessment, there are several DCR master plans guiding development activities along the Phase 1 and 2 Reaches (EPA, 2023b). Greater public access to the Phase I Reach increases risk and exposure prevalence and opportunity for fish consumption, incidental ingestion, and dermal contact with river sediment, floodplain soils, and surface water.

Recreational receptors may be exposed to contaminants in floodplain soil, surface water, and sediment via incidental ingestion and dermal contact. While it is possible that contaminants in floodplain soil, sediment, and surface water could volatilize or adhere to soil particles that become dust, it is likely that the air exposure pathway is minor relative to direct contact exposures (i.e., ingestion and dermal contact).

2.5.1.3 Anglers

Anglers may fish in the Lower Neponset River as fishing is not prohibited. While fish consumption advisories are in place due to PCBs and dichlorodiphenyltrichloroethane (DDT), these advisories may not be followed and anglers who consume their catch may be exposed to contaminants that have bioaccumulated in fish tissue (MDPH, 2022).[7] Based upon community interviews conducted by EPA in 2022 and 2023, as documented in the Lower Neponset River Community Involvement Plan (EPA, 2023a),[8] some people rely on fish from the river as a food source.

2.5.1.4 Human Health Exposure Pathways

The following exposure pathways were evaluated as potentially complete for human receptors under both current and potential future scenarios, see **Table 1** below.

Receptor	Media	Incidental Ingestion	Dermal Contact	Consumption
Recreator and Resident	Floodplain Soils	X	X	
	Sediment	X	X	
Recreational Angler	Floodplain Soils	X	X	
	Sediment	X	X	
	Fish Tissue			X

Table 1 – SRE Human Exposure Pathways

2.5.2 Ecological Receptors

2.5.2.1 Aquatic Species

Fish species observed by the USACE in a 2002 fishery population study included chain pickerel, common carp, bluegill, American eel, white sucker, brown bullhead, pumpkinseed, largemouth bass, fallfish, tessellated darter, brook trout, and brown trout (Milone & MacBroom, Inc., 2006). Infaunal benthic invertebrates and aquatic invertebrates are also expected to be present within the river; these likely include larval stages of dragonflies, damselflies, mayflies, stoneflies, caddisflies, and mosquitoes.

Several aquatic-dependent birds have been observed around the river such as great blue heron, mallard duck, Canada goose, and belted kingfisher (Milone & MacBroom, Inc., 2006). Reptiles and amphibians that inhabit the river include common snapping turtle, painted turtle, eastern garter snake, common water snake, green frogs, bull frogs, American toad, and spring peeper (Milone & MacBroom, Inc., 2006).

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[7] The Massachusetts Department of Public Health advisory recommends that children under 12, pregnant women, nursing mothers, and women that may become pregnant should not eat any fish caught from the Neponset River between the Hollingsworth and Vose Dam in Walpole and the Walter Baker Chocolate Dam. All other people should not eat any American eel or white sucker fish from this area and should limit consumption of all other freshwater fish from this area to no more than two meals per month (MDPH, 2022).

[8] EPA, Lower Neponset River Community Involvement Plan (EPA, 2023a), available at https://semspub.epa.gov/work/01/677693.pdf,

2.5.2.2 Terrestrial Species

Additional birds and mammals likely to be found along the riparian fringe of the river include common yellow throat, Baltimore oriole, common grackle, red-winged blackbird, yellow warbler, eastern kingbird, eastern phoebe, eastern chipmunk, common gray squirrel, raccoon, opossum, muskrat, white-tailed deer, woodchuck, bats, and cottontail rabbit (Milone & MacBroom, Inc., 2006).

Several Canada geese and evidence of beaver activity have been observed throughout the Phase 1 Reach during the Remedial Investigation. During the Wetland Delineation and Ordinary High Water Mark Assessment conducted in June 2023, a total of 22 species (or evidence of their use) were observed in or around the study corridor. These species are reported in the Phase 1 Site Reconnaissance Memorandum (AECOM, 2023b). These observations included common bird species such as blue jay, American robin, starling, and common grackle, as well as mammals including beaver, raccoon, white-tailed deer, weasel, skunk, and chipmunk.

2.5.2.3 Ecological Receptor Exposure Pathways

Based on the habitat present and the previous observations, ecological receptor groups within the Site include:

- Aquatic invertebrates and fish;
- Infaunal benthic invertebrates;
- Aquatic-dependent birds and mammals foraging on food items within the river; and
- Terrestrial birds and mammals foraging on food items within riparian areas.

While the river supports a variety fish and other aquatic life, the ecological receptor groups of greatest concern for exposure to PCBs in sediment and the food chain consist of benthic invertebrates and piscivorous wildlife feeding in the aquatic habitats of the Phase 1 reach. Although infaunal successional stages could not be determined at most locations during the sediment profile imaging survey, relatively high-order benthic communities appear to be present in some areas. Benthic invertebrates are directly exposed to PCBs within the surface sediment horizon, and invertebrates may also ingest sediment and food items containing PCBs.

Due to the bioaccumulative nature of PCBs, birds and mammals that ingest prey items such as fish, amphibians, or benthic invertebrates are likely to be exposed to higher concentrations of PCBs than herbivores consuming vegetation. Birds and mammals may be exposed to PCBs in sediment via incidental ingestion while foraging and via ingestion of prey items (e.g., shellfish, amphibians, fish) that have bioaccumulated PCBs from the sediment and water column. PCB exposure may also occur via ingestion of surface water, but this level of exposure is expected to be much lower than exposure through the diet. Birds and mammals such as heron or mink may consume larger fish contaminated by PCBs that have consumed smaller fish contaminated by PCBs. Therefore, these piscivorous receptors are typically exposed to the highest levels of PCBs in the diet.

2.5.3 Streamlined Risk Evaluations of Sediment and Soil

EPA performed streamlined risk evaluations for PCBs in sediment and soil, which are documented as follows in **Appendix D**:

1. **Report:** Streamlined Risk Evaluation in Sediment
2. **Technical Memorandum:** Streamlined Human Health Risk Evaluation in Soil
3. **Technical Memorandum:** Streamlined Ecological Risk Evaluation in Soil

A streamlined risk evaluation is intermediate in scope between a limited risk evaluation to support emergency removal actions and the conventional baseline assessment to support remedial actions. Consistent with the EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, the streamlined risk evaluations aid in justifying a removal action and identifying what current or potential exposures should be prevented (EPA, 1993). The streamlined risk evaluations performed to support this EE/CA and proposed NTCRA, which are discussed in further detail below, only evaluated risks posed by PCBs.[9] EPA uses the term "Increased Lifetime Cancer Risk (ILCR)" to quantify the probability of getting cancer over a lifetime due to exposure related to the Site (e.g., 1 in 1,000,000 or 1E-06). EPA uses the term Hazard Quotient (HQ) to quantify non-cancer risk, which is the ratio of the exposure dose divided by the oral Reference Dose (RfD). Human health risks for sediment and soil were compared to a target ILCR of 1E-04 (1 in 10,000), which is the least conservative of EPA's acceptable risk range of 1E-06 to 1E-04 (1 in 1,000,000 to 1 in 10,000), and a non-cancer HQ of 3, consistent with EPA's derivation of Removal Management Levels.[10]

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[9] The streamlined risk evaluations focused on PCBs. The Phase 1 data indicates that PCBs are widespread and of high concentration in many areas. Potentially unacceptable risks for PCBs exist to varying extents in all areas of the Phase 1 Reach. Because the streamlined risk evaluations concluded that the risks at the Site from PCBs alone warrant the performance of a removal action, other COPCs were not included in the evaluation. However, as noted in Section 2.4.2, additional contaminants of potential concern are present at the Site and contribute to risks to human health and the environment, which will be fully evaluated in a baseline risk assessment to support the long-term remedial action. To the extent other COPCs are collocated with PCBs at the Site, the proposed NTCRA is expected to also address risks from these COPCs. For more information, see Section 2.4.2 and **Appendix E**.

[10] https://www.epa.gov/risk/regional-removal-management-levels-rmls-users-guide

Ecological risks also use the HQ to indicate if a contaminant and exposure pathway pose potential adverse ecological risks. A HQ greater than 1 indicates that there is potential for unacceptable risk for effects to occur with how much a specific ecological receptor is exposed to the contaminant with known toxicity effects.

The streamlined risk evaluations for PCBs in sediment and soil in the Phase 1 Reach are summarized in Section 2.5.4 and Section 2.5.5 below, respectively.

2.5.4 Summary of the Streamlined Risk Evaluation for Sediment

The principal human exposure pathway of concern evaluated in the SRE was direct contact with river sediment. Sediment data from the 2023 investigation in the Phase 1 reach were used in the risk calculations. Consumption of Lower Neponset River fish was also evaluated as it can be an important exposure pathway at sediment sites with bioaccumulative compounds such as PCBs. Historical fish tissue data (collected in 2003 and 2005) were used in the SRE in a screening level analysis to support the NTCRA because more recent fish tissue data was not available. Fish tissue data was collected in Fall of 2024 will be available in 2025 to support sitewide risk assessments that will be conducted in the future.

The ecological risk assessment (ERA) for the SRE was conducted in accordance with EPA guidance, primarily the Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA, 1997). EPA's eight-step approach for conducting ERAs includes a screening level ERA (SLERA) (Steps 1 and 2) followed, when necessary, by a baseline ERA (BERA) (Steps 3 through 8). The SLERA is intended as a conservative evaluation of the data and site conditions designed to focus further risk assessment activities on the most important stressors and exposure pathways and eliminate stressors and exposure pathways without potential for risk. The SLERA has limited capacity to assess the likelihood or magnitude of ecological risks. Therefore, if potential risks are identified, they are assessed in the more complex and site-specific BERA. The ecological evaluation for the SRE is not intended to help identify whether further risk assessment activities are warranted; rather the evaluation is intended to help decide whether to take a cleanup action and assess what exposures need to be addressed by the action (EPA, 1993). Therefore, this ERA includes elements of the SLERA and the BERA (e.g., use of 95% upper confidence limit (UCL), and low effect toxicity values).

Five sediment exposure concentration areas were defined within the Phase 1 reach, as illustrated in **Figure 5**. Each exposure area is about 0.2 miles in length. The exposure areas were developed to support the analysis of RAAs for the EE/CA, as indicated below:

- **Exposure Area 1:** Sediment located immediately upstream of the T&H Dam (this includes the impounded sediment).

- **Exposure Area 2:** Sediment located near the Riverside Square PCB Removal Site and West Street Park.
- **Exposure Area 3:** Sediment located from the MBTA railroad bridge crossing upstream near West Street Park upstream to the start of the Fairmount MBTA train station area.
- **Exposure Area 4:** Sediment located near and slightly downstream of the Lewis Chemical Removal Site.
- **Exposure Area 5:** Sediment located from the MBTA railroad bridge crossing just upstream of the Lewis Chemical Removal Site to the confluence with the Neponset River and the Mother Brook.

For the human and ecological receptors evaluated in the SRE, sediment exposure is expected to be limited to surface sediment (0 to 0.5 feet). However, to support the evaluation of RAAs, which consider the risk related to an uncontrolled release of contaminated sediment in the event of dam failure, a second evaluation including deeper sediment was also considered in the SRE (0 to the maximum sediment sample depth of 6.2 feet).

2.5.4.1 Human Health Risks from Sediment

A recreational receptor (child and adult) is assumed to contact surface sediment in the Phase 1 Reach while doing activities such as wading, swimming, boating, rowing, and kayaking.

As illustrated in **Table 2** below, for exposure to surface sediment, the ILCR ranges from 2E-05 (Area 2) to 2E-04 (Area 4), and HQ ranges from 1 to 31. Yellow highlighting indicates ILCR greater than 1E-04 or HQ greater than 3. For exposure to all sediment, the ILCR ranges from 5E-05 (Area 2) to 2E-03 (reach-wide), and the HQ ranges from 2 to 304. Cancer risks and noncancer hazards are higher due to generally higher levels of PCBs in deeper sediment.

Exposure Point	ILCR (child/Adult)	HQ (Child)	HQ (Adult)
Surface Sediment			
Area 1	7E-05	12	2
Area 2	2E-05	4	1
Area 3	1E-04	27	4
Area 4	2E-04	31	5
Area 5	6E-05	12	2
Reach-wide	1E-04	20	3
All Sediment			
Area 1	2E-04	37	6
Area 2	5E-05	9	2
Area 3	2E-04	35	6
Area 4	5E-04	93	16
Area 5	6E-05	10	2
Reach-wide	2E-03	304	51

Table 2 - Summary of Sediment Exposure Area Risks and Hazards to the Recreational Receptor

Notes:

ILCR – Increased lifetime cancer risk

HQ – Hazard Quotient

Yellow highlighting indicates an ILCR greater than 1E-04 or HQ greater than 3.

A recreational angler (child and adult) is assumed to consume fish caught from the Site. Screening level potential risks and hazards were calculated using white sucker fillet tissue from the T&H impoundment. The ILCR and the HQ for PCBs were calculated two ways for total PCBs and for the sum of PCB TEQ and total non-DLC PCBs.[11] The ILCR exceeds 1E-04 and the HQ exceeds 3 for the T&H Dam impoundment area where historical fish tissue data was available. More information is available in the Streamlined Risk Evaluation for Sediment in **Appendix D**.

Scenario	ILCR (Child/Adult)	HQ (Child)	HQ (Adult)
Total PCBs	1E-03	186	70
PCB TEQ+ total non-DLC PCBs	2E-03	219	82

Table 3 - Summary of Screening Level PCB Fish Consumption Risks and Hazards to the Recreational Angler

Notes:

DLC – dioxin-like congener

TEQ – toxicity equivalence

Yellow highlighting indicates an ILCR greater than 1E-04 or HQ greater than 3.

2.5.4.2 Ecological Risks from Sediment

Risks were evaluated for the benthic invertebrate community in direct contact with the sediment, and piscivorous wildlife (great blue heron and mink) that consume whole fish with incidental sediment ingestion.

Benthic invertebrates were evaluated based on comparisons to bulk sediment benchmarks and equilibrium-partitioning-based benchmarks adjusted to the area and a depth-specific average of total organic carbon (OC). The HQs above 1 based on bulk sediment benchmark comparisons were calculated for surface sediment and all sediment in the exposure areas identified above. The equilibrium partitioning-based evaluation predicted percent benthic injury levels for the benthic invertebrate community ranging from 54% to 97% in surface sediment and 92% to 100% in all sediment across the exposure areas and reach-wide.

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[11] For fish tissue, a second estimate of total PCBs was calculated as described below to account for coplanar congeners that may enrich in biological tissues. The group of 209 PCB congeners includes 12 coplanar congeners that are considered to have potential dioxin-like effects. The World Health Organization's 2005 mammalian toxic equivalency factors (TEFs), which were adopted by EPA, were used to calculate a toxicity weighted concentration for each of the coplanar PCB congeners. For each sample, the concentration of PCB toxicity equivalence (PCB-TEQ) was calculated by summing the toxicity weighted concentration for each detected congener. The concentration of total PCBs in each fish tissue sample was calculated as the sum of detected non-dioxin like congeners (non-DLC) and PCB-TEQ.

Horizon	**Surface Sediment (0-0.5 ft)**					
	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
Average Total Organic Carbon (%)	13.0	6.8	9.9	4.7	2.2	8.0
Average Fraction Organic Carbon (OC)	0.13	0.0068	0.099	0.047	0.022	0.080
PCB Exposure	57.6	16.8	125	146	56.1	91.5
Predicted Percent Benthic Injury at EPC	**74**	**54**	**93**	**98**	**97**	**91**

Table 4 - Summary of Surface Sediment Predicted Benthic Injury

Notes:
EPC – Exposure Point Concentration
OC – Organic carbon

Horizon	**All Sediment Depths**					
	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
Average Total Organic Carbon (%)	6.3	3.7	5.0	3.6	1.7	4.5
Average Fraction Organic Carbon (OC)	0.063	0.037	0.050	0.036	0.017	0.045
PCB Exposure	176	43.5	164	434	48.4	1425
Predicted Percent Benthic Injury at EPC	**98**	**92**	**98**	**100**	**98**	**100**

Table 5 - Summary of All Sediment Predicted Benthic Injury

Risks to piscivorous wildlife were evaluated using a food web model that assumed an exclusive diet of fish with incidental sediment ingestion. Whole body white sucker data collected from the T&H Dam impoundment area from prior USGS studies were used to represent the fish tissue concentration of PCBs within all exposure areas evaluated in the food web model. HQs were calculated based on both No Observed Adverse Effects Level and Lowest Observed Adverse Effects Level toxicity reference values. HQs above 1 suggest the potential for risk to these ecological receptors. HQs equal to or above 1 were calculated for the great blue heron within Exposure Areas 1, 3 and reach wide. HQs above 1 were calculated for the mink within Exposure Areas 1, 2, 3, 4 and reach wide.

2.5.5 Streamlined Risk Evaluation in Floodplain soils

Floodplain soils within the Phase 1 Reach were evaluated to determine the magnitude of potential human health and ecological exposures from PCBs (the primary contaminant of potential concern for this risk evaluation).

Exposures to PCBs in soil for humans and wildlife were evaluated for nine floodplain exposure areas and on a reach-wide basis, as illustrated on **Figure 6** and described below:

- **Exposure Area 1:** Floodplain soils located on the northern bank from the T&H Dam to the Riverside Square PCB Site.
- **Exposure Area 2:** Floodplain soils located on the northern bank within the Riverside Square PCB Site and West Street Park.[12]
- **Exposure Area 3:** Floodplain soils located on the southern bank from the T&H Dam to the MBTA railroad bridge crossing.
- **Exposure Area 4:** Floodplain soils located on the northern bank between the MBTA railroad bridge crossing and the Fairmount Avenue bridge.
- **Exposure Area 5:** Floodplain soils located on the southern bank between the MBTA railroad bridge crossing and the Fairmount Avenue bridge.
- **Exposure Area 6:** Floodplain soils located on the north bank along the former Lewis Chemical facility.[13]
- **Exposure Area 7:** Floodplain soils located on the southern bank across from the former Lewis Chemical facility between the MBTA railroad bridge crossing and the Fairmount Avenue bridge.
- **Exposure Area 8:** Floodplain soils located on the northern bank between the MBTA railroad bridge crossing and the confluence of the Mother Brook and the Neponset River.
- **Exposure Area 9:** Floodplain soils located on the southern bank between the MBTA railroad bridge crossing and the confluence of the Mother Brook and the Neponset River.

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[12] The Riverside Square PCB Site removal action is ongoing.

[13] A portion of the riverbank along the former Lewis Chemical facility was addressed and restored during the Lewis Chemical removal action due to structural and stability requirements. Unaddressed floodplain soils continue to pose a threat to human health and the environment.

For human health, each exposure area for soil is evaluated separately in the risk evaluation. An evaluation of potential ecological risk was also conducted for the nine exposure areas along the Phase 1 Reach, similar to the human health SRE for soil, to estimate potential ecological risks from exposure. However, because the Phase 1 Reach of the Site is bordered by a nearly continuous forested riparian corridor, which provides habitat for a variety of bird and mammal species, the SRE of PCBs in soil to estimate ecological risk was performed reach wide. The riparian corridor is recommended to be treated as single unit (i.e., reach-wide) as there is no significant distinction between the riparian segments for either species because the majority of the Phase 1 Reach is a suitable habitat.

2.5.5.1 Human Health Risks from Soil

Recreating child and adult receptors are assumed to directly contact surface soil within the FEMA 100-year floodplain of the Phase 1 Reach. The results of the recreational receptor risk evaluation for PCBs in floodplain soil for the nine exposure areas of the Site are presented below in **Table 6.** The estimated ILCR for the recreating adult and child receptor ranges from 1E-04 (1 in 10,000) to 4E-06 (4 in 1,000,000). No exposure areas exceeded an ILCR of 1E-04 (1 in 10,000) for the adult and child. Non-cancer hazards for the child are above an HQ of 3 for Exposure Areas 1, 2, 3, 4, 6, and 7, as depicted as highlighted cells in **Table 6** below.[14] Exposure Area 5, 8, and 9 do not exceed an ILCR of 1E-04 (1 in 10,000) or an HQ of 3 for the adult and child recreator scenario. The results of the SRE for soil indicate exceedance of removal risk criteria for the recreator for Exposure Areas 1, 2, 3, 4, 6, and 7.

Exposure Areas	Exposure Point Concentration	Child HQ	ILCR (lifetime, child/adult)
1	101	**22**	1E-04 (1 in 10,000)
2	56.14	**12**	6E-05 (6 in 100,000)
3	18.27	**4**	2E-05 (2 in 100,000)
4	18.69	**4**	2E-05 (2 in 100,000)
5	3.68	1	4E-06 (4 in 1,000,000)
6	49.99	**11**	6E-05 (6 in 100,000)
7	103.9	**22**	1E-04 (1 in 10,000)
8	9.60	2	1E-05 (1 in 100,000)
9	7.10	2	8E-06 (8 in 1,000,000)

Table 6 – Summary of Floodplain Soil Exposure Area Risks and Hazards to the Recreational Receptor

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[14] Non-cancer risk was also estimated for the adult and child resident. However, only the child resident results for non-cancer risk are presented in the results summary because the child is the most conservative receptor.

Residential child and adult receptors are also assumed to directly contact surface soil within the FEMA 100-year floodplain of the Phase 1 Reach. The results of the residential receptor risk evaluation for PCBs in floodplain soil for the nine exposure areas of the Site are presented below in **Table 7**.[15] The estimated ILCR for the adult and child residential receptor range from 3E-04 (3 in 10,000) to 1E-05 (1 in 100,000). Exposure Areas 1, 2, and 7 exceed an ILCR of 1E-04 (1 in 10,000). Non-cancer hazards for the child resident are above an HQ of 3 for Exposure Areas 1, 2, 3, 4, 6, 7, 8, and 9.[16] Exposure Area 5 does not exceed an ILCR of 1E-04 (i.e., 1 in 10,000) or an HQ of 3. Risk results for the resident indicate exceedance of removal risk criteria for Exposure Areas 1, 2, 3, 4, 6, 7, 8, and 9. Exposure Area 5 did not exceed removal risk criteria for the residential receptor scenario.

Exposure Areas	Exposure Point Concentration	Child HQ	ILCR (lifetime, child/adult)
Exposure Area 1	101	86	3E-04 (3 in 10,000)
Exposure Area 2	56.14	48	2E-04 (2 in 10,000)
Exposure Area 3	18.27	16	6E-05 (6 in 100,000)
Exposure Area 4	18.69	16	6E-05 (6 in 100,000)
Exposure Area 5	3.68	3	1E-05 (1 in 100,000)
Exposure Area 6	49.99	43	1E-04 (1 in 10,000)
Exposure Area 7	103.9	88	3E-04 (3 in 10,000)
Exposure Area 8	9.60	8	3E-05 (3 in 100,000)
Exposure Area 9	7.10	6	2E-05 (2 in 100,000)

Table 7 – Summary of Floodplain Soil Exposure Area Risks and Hazards to the Residential Receptor

2.5.5.2 Ecological Risks from Soil

In ecological risk assessment, it is not possible to directly evaluate risks to all individual species and populations in an ecosystem. Therefore, surrogate species were selected to represent omnivorous birds and mammals. The American Robin (*Turdus migratorius*) was selected to estimate risks to omnivorous birds, and the Short-tailed Shrew (*Blarina brevicauda*) was selected to represent omnivorous mammals. These species are commonly used to represent the omnivorous feeding guilds in risk assessments throughout New England. While other terrestrial species may be used in an ecological SRE, the American Robin and the Short-tailed Shrew are well suited to evaluate the risk from bioaccumulating and biomagnifying contaminants such as PCBs.

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[15] Based upon current land use, exposure area's 3, 4, and 6 do not have residential properties at this time.

[16] Non-cancer risk was also estimated for the adult and child resident. However, only the child resident results for non-cancer risk are presented in the results summary because the child is the most conservative receptor.

HQs were calculated based on the lowest observed adverse effect level (LOAEL) toxicity reference values. As demonstrated in **Table 8**, an HQ above 1 occurs in all exposure areas for the Short-tailed Shrew and for exposure areas 1, 2, 3, 4, 6, 7, 8 for the American Robin.

Exposure Areas	Exposure Point Concentrations of PCBs (mg/kg)	Short-tailed Shrew HQ	American Robin HQ
Exposure Area 1	101	112.9	13.8
Exposure Area 2	56.14	62.7	7.7
Exposure Area 3	18.27	20.4	2.5
Exposure Area 4	18.69	20.9	2.6
Exposure Area 5	3.68	4.1	0.5
Exposure Area 6	202	225.7	27.7
Exposure Area 7	315.2	352.2	43.2
Exposure Area 8	9.60	10.7	1.3
Exposure Area 9	7.10	7.9	1.0

Table 8 – Summary of Floodplain Soil Exposure Area Risks and Hazards to Omnivorous Birds and Mammals

3. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

This section describes the Applicable or Relevant and Appropriate Requirements (ARARs), the RAOs, and the cleanup levels pertinent to each RAA.

3.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with 40 CFR 300.415(j), on-site removal actions conducted under the CERCLA are required to attain ARARs "to the extent practicable considering the exigencies of the situation." ARARs are defined by the NCP (40 CFR 300.5) as follows:

- ***Applicable Requirements*** - "means those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state [Massachusetts] environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."
- ***Relevant and Appropriate Requirements*** - "means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state [Massachusetts] environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate."

To-Be-Considered standards and guidance (TBCs) are comprised of non-promulgated advisories or guidance issued by federal or state regulatory bodies that are not legally binding but may be useful in developing cleanup alternatives. ARARs and TBCs are subdivided into three categories: chemical-specific (that apply to establishing chemical cleanup standards), location-specific (that apply to certain locations such as rivers and wetlands), and action-specific (that apply to certain activities such as dredging and filling). The potential chemical-specific, location-specific, and action-specific ARARs and TBCs identified for the Lower Neponset River Superfund Site are presented in **Table 15-1**, **Table 15-2**, and **Table 15-3.** The sections below summarize the key ARARs and TBCs considered in the development of the RAAs.

3.1.1 Chemical-Specific ARARs and TBCs

Chemical-specific ARARs are usually health- or risk-based numeric values that define concentrations of specific hazardous contaminants deemed to be protective of human health and the environment under site-specific exposure conditions. No chemical-specific ARARs were identified in this EE/CA. However, a number of EPA guidance documents were included as TBCs for developing risk-based cleanup standards. The potential chemical-specific ARARs and TBCs are presented in **Table 15-1**.

3.1.2 Location-Specific ARARs and TBCs

Location-specific ARARs serve to protect individual characteristics, resources, and specific environmental features on a site, such as wetlands, water bodies, floodplains, and sensitive ecosystems. For example, requirements have been identified as ARARs because portions of the Lower Neponset River Superfund Site are occupied by wetlands or are situated in the 100-year and/or 500-year floodplain. Location-specific ARARs may affect or restrict remediation and site activities.

The potential location-specific ARARs identified in this EE/CA are presented in **Table 15-2** and generally include:

- State and federal requirements that require protection of wetlands and floodplains. Federal regulations at 44 CFR Part 9, which implement Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands), require that wetlands and floodplains be protected and that adverse impacts be minimized. If the proposed action will result in the occupancy and modification of floodplains or wetlands, EPA must determine that that there is no practicable alternative to the proposed actions. As part of this EE/CA, and as further discussed in Section 7, **EPA is seeking specific comments from the public regarding proposed impacts to floodplain and wetland resources.**
- Section 404 of the Clean Water Act and state wetland protection regulations prohibit activities, including dredging and filling activity, that adversely affect wetlands and waterways if there are practicable alternatives with less adverse impact. In accordance with these ARARs, EPA must determine that the recommended alternative is the least environmentally damaging practicable alternative to protect wetland and aquatic resources. As part of this EE/CA, and as further discussed in Section 7, **EPA is seeking specific comments from the public regarding EPA’s determination that the recommended removal action is the least environmentally damaging practicable alternative.**
- Federal and state requirements related to the protection of fish and wildlife resources and their habitats, and the protection of threatened or endangered species or their critical habitats, should any such species be identified at the Lower Neponset River Superfund Site.
- Federal and state requirements protecting archeological and historical resources.

3.1.3 Action-Specific ARARs and TBCs

Action-specific ARARs are usually technology- or activity-based requirements that govern activities or processes that may be implemented on a site, including storage, transportation, and disposal methods of hazardous substances as well as construction of facilities or treatment processes. Selection of a particular response action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

The potential action-specific ARARs and TBCs identified in this EE/CA are presented in **Table 15-1**, **15-2**, and **15-3** and generally include:

- Clean Air Act and state regulations regulating air emissions and dust generated during removal activities.
- Clean Water Act and state surface water quality standards and regulations regulating the discharge of treated water from removal activities, including dewatering of dredged sediment and floodplain soils.
- Resource Conservation and Recovery Act (RCRA) standards and state hazardous waste management regulations, including requirements relating to the identification and management of characteristic hazardous waste; regulations for management of solid waste; requirements for hazardous waste generators; standards for treatment, storage, and disposal of hazardous waste; and requirements for management of waste piles.
- Toxic Substances Control Act (TSCA) regulations at 40 CFR 761.61(c) provides risk-based cleanup and disposal options for PCB remediation waste and requires a risk-based determination that finds that the cleanup and disposal method will not pose an unreasonable risk of injury to human health or the environment provided certain conditions are met. As part of this EE/CA, and as further discussed in Section 7, **EPA is seeking specific comments from the public regarding EPA's draft determination that the recommended removal action alternative will not pose an unreasonable risk of injury to human health and the environment.**
- TBCs that have been identified include federal guidance documents regarding remediation of contaminated sediment and management of investigation-derived wastes, state guidance documents regarding dam removal, and a state fish consumption advisory.

3.2 REMOVAL ACTION OBJECTIVES

The development of RAAs begins with the establishment of RAOs, which define the goals for the removal action. The following RAOs were established for the NTCRA for the Phase 1 Reach:

- **RAO 1- Sediment:** Reduce risk to human health from PCBs and other COPCs in sediment, including reducing the residential and recreational receptor's unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs.
- **RAO 2- Sediment:** Reduce ecological risk from PCBs and other COPCs in sediment, including reducing the unacceptable risk to aquatic and terrestrial ecological receptors due to PCB exposure.
- **RAO 3 - Floodplain soil:** Reduce risk to human health from PCBs and other COPCs in floodplain soil, including reducing the residential and recreational receptor's unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs.
- **RAO 4 – Floodplain soil:** Reduce ecological risk from PCBs and other COPCs in floodplain soil, including reducing the unacceptable risk to aquatic and terrestrial ecological receptors due to PCB exposure.
- **RAO 5 – Sediment and Floodplain soil:** Remove the potential for an uncontrolled release of contaminated sediment and eroding floodplain soils in the event of dam failure.
- **RAO 6 - Sediment and Floodplain soil:** Prevent the transport of PCBs to both remediated and unremediated areas.

3.3 PRINCIPAL THREAT WASTE

A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur (EPA, 1990). EPA generally considers PTW to include source material contaminated with PCBs at concentrations exceeding 100 mg/kg for sites in residential areas or concentrations exceeding 500 mg/kg for sites in industrial areas (EPA, 1990). Because the Phase 1 Reach is in a densely populated residential, recreational, and commercial area, for the purpose of this EE/CA, EPA considers PCB-contaminated sediment and floodplain soil at the Lower Neponset River Superfund Site exceeding 100 mg/kg as principal threat waste.

Consistent with EPA's Guidance on Conducting Non-Time-Critical Removal Actions, whenever practicable, the alternatives selection process should consider the CERCLA preference for treatment over conventional containment or land disposal approaches to address the principal threat at a site (EPA, 1993). Although the CERCLA preference for treatment,[17] provided in

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[17] The term ''treatment,'' when used in connection with hazardous waste, means any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or

CERCLA Section 121(b), applies only to remedial actions, EPA guidance provides that this preference is also an appropriate goal for removal actions, while noting that removal actions cannot conform entirely to requirements for remedial actions because of site related time constraints and statutory limits on removal actions (EPA, 1993).

Treatment of contaminated sediment typically involves a combination of processes to address various contaminant problems, including pretreatment, operational treatment, and/or effluent treatment/residual handling. During the screening of technologies, EPA considered various treatment technologies to address contaminated material in the Phase 1 Reach, as further described in **Table 16**. Due to the nature of the contamination and implementation barriers in the urban setting of the Site, many treatment options were determined to be unsuitable. However, treatment options including pretreatment, immobilization and solidification/ stabilization, particle size separation, and effluent treatment were carried forward as potential elements of the removal action alternatives (in combination with dredging, excavation, and capping) to address principal threat wastes and other source material.

3.4 PRELIMINARY REMOVAL GOALS

PCB-specific preliminary removal goals for the Phase 1 Reach were developed to support the selection of cleanup levels and the development of the RAAs. For both sediment and floodplain soil, a range of human health preliminary removal goals were calculated using a range of target cancer risk levels (TCR) and target hazard quotients (THQ) based upon direct contact (incidental ingestion and direct contact) exposure pathways. A noted in EPA guidance, "[s]ince removal and remedial action cleanup levels may differ, all early action decisions should consider the possible long-term action and corresponding cleanup levels" (EPA, 1993). Accordingly, the preliminary removal goals were developed to support the development of RAA cleanup levels in consideration of the future remedial action and potential corresponding cleanup levels.[18]

The preliminary removal goals were calculated based upon:

- A TCR of 1E-04 (1 in 10,000) and a THQ of 3 for direct contact, consistent with EPA's derivation of Removal Management Levels; and

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composition of any hazardous waste so as to neutralize such waste or so as to render such waste nonhazardous, safer for transport, amenable for recovery, amenable for storage, or reduced in volume. Such term includes any activity or processing designed to change the physical form or chemical composition of hazardous waste so as to render it nonhazardous (42 U.S.C. §§ 9601(29), 6903(34)).

[18] The preliminary removal goals developed for this EE/CA and are not intended to preclude the development of future preliminary remediation goals during the remedial process.

- EPA's cancer risk range of 1E-04 to 1E-06 (1 in 10,000 to 1 in 1,000,000) and noncancer HQ of 1 for direct contact.

Sediment preliminary removal goals were derived using equations from EPA's Regional Screening Level (RSL)/Removal Management Level (RML) Calculator[19] for a recreational receptor (adult and young child) with site-specific exposure assumptions, as described further in the Streamlined Risk Evaluation for Sediment within **Appendix D**. Cancer-based preliminary removal goals were derived for a combined child and adult receptor, and noncancer-based preliminary removal goals were derived for both the child and adult age groups. The selected sediment preliminary removal goal for each TCR/THQ scenario is the lower of the cancer-based and noncancer-based value at the bottom of the **Table 9** below.

Endpoint	**Units**	**Total PCBs Preliminary Removal Goal**			
Target Cancer Risk: **Target Hazard Quotient:**		**1E-04** **3**	**1E-04** **1**	**1E-05** **1**	**1E-06** **1**
Cancer-based Preliminary Removal Goal (lifetime, adult/child)	mg/kg	88	88	8.8	0.88
Noncancer based Preliminary Removal Goal (child)	mg/kg	15	5	5	5
Noncancer based Preliminary Removal Goal (adult)	mg/kg	84	28	28	28
Selected Preliminary Removal Goal (lower of cancer/noncancer)	mg/kg	**15**	**5**	**5**	**0.88**

Table 9 - Calculations and TCR/THQ-derived Direct Contact Sediment Preliminary Removal Goals for the Recreational Receptor

Floodplain soil preliminary removal goals for the Phase 1 Reach were derived using the recreational, residential, and ecological receptors that are in direct contact with floodplain soils within the Phase 1 Reach FEMA 100-year floodplain.

Floodplain soil preliminary removal goals for the Phase 1 Reach were derived using the recreational and residential receptor scenarios and toxicity assumptions described in the technical memoranda in **Appendix D**. Cancer-based preliminary removal goals were derived for a combined child and adult receptor, and noncancer-based preliminary removal goals were derived for both the child and adult age groups. The selected soil preliminary removal goals for each TCR/THQ scenario are the lower of the cancer-based and noncancer-based value at the bottom of the tables below.

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[19] https://www.epa.gov/risk/regional-removal-management-levels-rmls-users-guide.

Endpoint	**Units**	**Total PCBs Preliminary Removal Goals**			
Target Cancer Risk:		**1E-04**	**1E-04**	**1E-05**	**1E-06**
Target Hazard Quotient:		**3**	**1**	**1**	**1**
Cancer-based Preliminary Removal Goal (lifetime, adult/child)	mg/kg	87	87	9	1
Noncancer based Preliminary Removal Goal (child)	mg/kg	15	5	5	5
Selected Preliminary Removal Goal (lower of cancer/noncancer)	mg/kg	**15**	**5**	**5**	**1**

Table 10 – Calculations and TCR/THQ-derived Direct Contact Floodplain Soil Preliminary Removal Goals for the Recreational Receptor

Endpoint	**Units**	**Total PCBs Preliminary Removal Goals**			
Target Cancer Risk:		**1E-04**	**1E-04**	**1E-05**	**1E-06**
Target Hazard Quotient:		**3**	**1**	**1**	**1**
Cancer-based Preliminary Removal Goals (lifetime, adult/child)	mg/kg	24	24	2	0.2
Noncancer based Preliminary Removal Goals (child)	mg/kg	4	1	1	1
Selected Preliminary Removal Goals (lower of cancer/noncancer)	mg/kg	**4**	**1**	**1**	**0.2**

Table 11 – Calculations and TCR/THQ-derived Direct Contact Floodplain Soil Preliminary Removal Goals for the Residential Receptor

Preliminary removal goals were calculated to provide a target range protective of both omnivorous mammals and omnivorous birds. Exposure to contaminant loads greater than 0.89 mg/kg for the Short-tailed Shrew and 7.3 mg/kg for the American Robin have potential to induce unacceptable ecological risk with the known toxicity of total PCBs. Maintaining an environmental concentration closer to total exposure values resulting in an HQ of 1 for the short-tailed shrew reduces the likelihood that there will be unacceptable risk to that ecological receptor from contaminant loads greater than the LOAEL. **Table 12** and **Table 13** provide the preliminary removal goal calculations that result in an acceptable risk (LOAEL-Based HQ of 1) to the representative ecological receptors.

Supporting Calculations for Derivation of Preliminary Removal Goals										
COC	**Selected Soil Preliminary Removal Goal for the American Robin (mg/kg)**	**Media Concentrations**			**Potential Daily Dose (mg/kg$_{bw}$/day)**				LOAEL-Based TRV (mg/kg$_{dw}$/day)	LOAEL-Based THQ
		Soil (mg/kg$_{dw}$)	Terrestrial Plant (mg/kg$_{ww}$)	Soil Invertebrate (mg/kg$_{ww}$)	Soil	Terrestrial Plant	Soil Invertebrate	Total Daily Dose		
Total PCBs	**7.3**	7.3	0.0095	7.8	0.0065	0.0039	1.8	1.8	1.8	1

Table 12 - Calculations and THQ-derived Preliminary Removal Goals for the American Robin

Notes:
bw: body weight
dw: dry weight
ww: wet weight
TRV: toxicity reference value

Supporting Calculations for Derivation of Preliminary Removal Goals												
COC	**Selected Soil Preliminary Removal Goal for the Short-tailed Shrew (mg/kg)**	**Media Concentrations**				**Potential Daily Dose (mg/kg$_{bw}$/day)**					LOAEL-Based TRV (mg/kg$_{dw}$/day)	LOAEL-Based THQ
		Soil (mg/kg$_{dw}$)	Terrestrial Plant (mg/kg$_{ww}$)	Soil Invertebrate (mg/kg$_{ww}$)	Small Mammal (mg/kg$_{ww}$)	Soil	Terrestrial Plant	Soil Invertebrate	Small Mammal	Total Daily Dose		
Total PCBs	**0.89**	0.89	0.0012	0.95	0.28	0.001	0.000049	0.666	0.00914	0.68	0.68	1

Table 13 - Calculations and THQ-derived Preliminary Removal Goals for the Short-tailed Shrew

The preliminary removal goal range generated for the Short-tailed Shrew and American Robin are based on an HQ of 1 and are calculated using a total daily dose (TDD) from exposures to the total PCB concentration in the soils within the Phase 1 Reach of the Lower Neponset River Superfund Site. A soil concentration of 0.89 mg/kg will produce exposures that result in a HQ of 1 for the Short-tailed shrew and a soil concentration of 7.3 mg/kg will produce exposures that result in a HQ of 1 for the American Robin. Terrestrial birds and mammals are foraging on food items across the Phase 1 Reach riparian areas and therefore the selection of a removal cleanup goal reflective of the omnivorous mammal (represented by the Short-tailed Shrew) would reduce the potential for unacceptable risk to ecological receptors. Additionally, consistent with the EPA's Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA, consideration of the possible long-term action and corresponding cleanup levels are recommended.

3.5 REMOVAL ACTION ALTERNATIVE CLEANUP LEVELS

Specific removal action alternative cleanup levels for PCBs in sediment and floodplain soil were identified for RAA-2, RAA-3, and RAA-4. The individual RAA cleanup levels are summarized below:

- RAA-2 cleanup level in sediment and floodplain soil: 100 mg/kg
- RAA-3 cleanup level in sediment and floodplain soil: 14 mg/kg
- RAA-4 cleanup level in sediment and floodplain soil: 1 mg/kg

The application of the cleanup levels pertains to accessible sediment and floodplains soils posing a risk to human health and the environment. Inaccessible contamination at depth below the maximum dredge depth may be temporarily or permanently capped.

The RAA-2 cleanup level of 100 mg/kg total PCBs was selected to address PCB source material and principal threat waste throughout the Phase 1 Reach. RAA-2 is a "hot spot" removal action, addressing the most highly contaminated media. EPA has defined principal threat waste at the Site as sediment and floodplain soil above 100 mg/kg total PCBs. See Section 3.4 above. The RAA-2 cleanup level does not result an acceptable risk within EPA's cancer risk range of 1E-04 to 1E-06 (1 in 10,000 to 1 in 1,000,000) or acceptable noncancer risk.

Preliminary removal goals, as summarized in Section 3.4 above, were considered in selecting cleanup levels for RAA-3 and RAA-4. The RAA-3 cleanup level of 14 mg/kg total PCBs was selected based on the selected preliminary removal goal corresponding to a THQ of 3 for a child recreational receptor for sediment. 14 mg/kg was also selected as the RAA-3 cleanup level for floodplain soil to be consistent with the cleanup level for sediment to prevent the transport of PCBs exceeding the RAA-3 cleanup level for sediment via erosion of floodplain soils to both remediated and unremediated areas. This concentration is more stringent than the floodplain soil selected preliminary removal goal for the recreational receptor (15 mg/kg corresponding to a THQ of 3), but less stringent than the selected preliminary removal goal for the residential receptor (4 mg/kg corresponding to a THQ of 3). The RAA-3 cleanup level will result in remaining risk from PCBs in residential floodplain soil above an HQ of 3.

The RAA-4 cleanup level of 1 mg/kg total PCBs for sediment and floodplain soils was selected based on the selected preliminary removal goal corresponding to a TCR of 1E-06 (1 in 1,000,000) for a combined adult and child recreational and residential receptor (rounded up from 0.88 mg/kg for sediment and 1 mg/kg for soil). For the combined adult and child residential receptor for floodplain soil, the RAA-4 cleanup level corresponds to a THQ of 1, and an ILCR between 1E-06 (1 in 1,000,000) and 1E-05 (1 in 100,000). The RAA-4 cleanup level is also consistent with the selected floodplain soil preliminary removal goal for the Short-tailed Shrew (representing the omnivorous mammal) corresponding to an HQ of 1 (rounded up from 0.89 mg/kg), which EPA determined would reduce the potential for unacceptable risk to ecological receptors.

The application of these RAA cleanup levels in the evaluation of RAAs for the Phase 1 Reach is discussed in Section 4.

4. REMOVAL ACTION ALTERNATIVES

Based upon the RAOs and RAA cleanup levels identified in Section 3, four RAAs have been developed to address the contamination posing a risk to human health and the environment within the Phase 1 Reach. Each RAA has been developed based on an evaluation and screening of the potential technologies that could be implemented to achieve the RAOs and the cleanup levels specific to that RAA. The four RAAs are:

- RAA-1 No Action - included as a baseline for comparison purposes.
- RAA-2 Hotspot removal and temporary containment
- RAA-3 Targeted removal, temporary containment, and dam removal
- RAA-4 Comprehensive removal, permanent *insitu* amendment cap, and dam removal (EPA's Recommended Alternative)

To present and evaluate each RAA, Section 4 includes:

- Screening of potentially applicable technologies for attainment of the RAOs and the RAA cleanup levels (Section 4.1);
- Descriptions of the evaluation criteria used to analyze each of the RAAs (Section 4.2); and
- Descriptions of RAAs 1 through 4, respectively, and an evaluation of each RAA with respect to the evaluation criteria (Sections 4.3 through 4.6).

The estimates and assumptions provided in this EE/CA are based upon existing information and are subject to change upon further NTCRA design work.

4.1 IDENTIFICATION AND SCREENING OF REMOVAL TECHNOLOGIES

4.1.1 General Response Actions

General response actions were evaluated for their applicability to site-specific conditions, the environmental media of concern, the nature of the contaminants, their ability to mitigate potential risks and attain the RAOs. The general response actions and/or technologies determined to be inappropriate for the site-specific conditions were eliminated from further consideration. The general response actions identified as applicable for this EE/CA include No Action, ICs, engineering controls to restrict access, containment, dredging, excavation, capping, dewatering of dredged sediment, monitoring, disposal, and treatment.

The No Action general response action would not attain RAOs or address the existing risk to human health and the environment identified in Section 2.5 above. The NCP at 40 CFR Section 300.430(e)(6) requires that a No Action alternative be included in the evaluation of remedial alternatives. While this requirement does not specifically apply to an EE/CA in the NTCRA development process, EPA has determined that it is appropriate to include a No Action alternative in this EE/CA as a baseline for evaluating all other removal alternatives under consideration.

4.1.2 Technology Screening

PCB remediation treatment technologies for the Phase 1 Reach were evaluated for general cost, efficiency, duration, and toxic byproducts. General response actions were then developed using this information for screening evaluation purposes. General response action technologies were selected for inclusion in the screening if they had the potential to result in the safe containment, removal, conveyance, treatment, and disposal of the sediment and soil targeted for the NTCRA. A screening of technologies was performed to reduce the number of technologies that were potentially applicable to a manageable number prior to performing a more stringent screening. During the screening, process options and technology types were evaluated based on technical implementability. Those process options and technology types that could not be implemented effectively were eliminated from further consideration.

Process options and technology types retained for further evaluation were combined to create the removal action alternatives described below. Dredging of PCB-contaminated sediment was selected as the major component for each of the removal action alternatives due to the nature and extent of contamination as described in Section 2, waterway usage (regulated floodway, flood storage, recreational use), high sediment mobility, sedimentation and impoundment, and the condition of the T&H Dam. Failure of the dam will result in an uncontrolled release downstream of highly contaminated sediment. Dredging is a vetted technology that provides an immediate solution. It is important to note that when selecting an appropriate technology, it's essential to consider site-specific factors including PCB concentration, soil/sediment characteristics, regulatory requirements, and available resources.

The PCB Remediation Treatment Technology Screening and Site-specific technology screening tables are presented in **Table 16-1** and **Table 16-2**.

4.2 EVALUATION CRITERIA

In accordance with EPA's Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993), each RAA is evaluated with respect to effectiveness, implementability, and cost.

Effectiveness refers to the ability of the alternative to meet RAOs and is evaluated using the following criteria:

- Overall protection of the environment
- Long-term effectiveness and permanence

- Short-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Compliance with ARARs and other criteria, advisories, and guidance[20]

Evaluations of effectiveness also consider the level of treatment or containment expected, residual effects, and/or requirements to maintain control until a longer-term solution can be implemented.

Implementability is evaluated using the following criteria:

- Technical feasibility
- Administrative feasibility
- Availability of services and materials
- State and community acceptance

The technical implementability evaluation also includes review of how each alternative would contribute to or interfere with potential future investigations and response actions, as well as a review of the ability to complete the alternative within a one-year timeframe. The administrative implementability evaluation includes the need for permits, access requirements, and considering potential impacts to adjoining properties.

Cost estimates of each alternative include capital costs (both direct and indirect) and post-closure operations and maintenance (O&M) costs, as well as present worth analysis. These costs are estimated based on expected operating, maintenance, and monitoring requirements.

4.3 RAA-1: NO ACTION

4.3.1 Description of RAA-1

The NCP at 40 CFR Section 300.430(e)(6) requires that a “No Action” alternative be included in the evaluation of remedial alternatives. While this requirement does not specifically apply to an EE/CA in the NTCRA development process, EPA has determined that it is appropriate to include a No Action alternative in this EE/CA. RAA-1 is a No Action alternative that is reflective of current site conditions and retained as baseline for comparison to RAA-2, RAA-3, and RAA-4. RAA-1 does not include any treatment, removal of contaminants, engineering controls, or additional ICs. The Massachusetts Department of Public Health Freshwater Fish Consumption

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[20] On-site removal actions conducted under the CERCLA are required to attain ARARs “to the extent practicable considering the exigencies of the situation.” 40 CFR Section 300.415(j).

Advisory for the Neponset River,[21] which includes the stretch of the river comprising the Lower Neponset River Superfund Site, will remain in effect.

4.3.2 Analysis of RAA-1

4.3.2.1 Effectiveness

RAA-1 will not be effective in the short term or the long term. RAA-1 will not be protective of public health, the community or the environment. RAA-1 will not implement any action, and therefore, an evaluation of its protectiveness of workers during implementation is not applicable. No ARARs are associated with RAA-1. RAA-1 will not achieve the RAOs or reduce the toxicity, mobility, or volume through treatment.

Site conditions consistent with Section 300.415(b)(2) of the NCP will continue to pose an immediate risk to public health or welfare of the United States or the environment. Further, this risk is compounded by the potential of a substantial uncontrolled release of highly contaminated sediment and soil if the T&H Dam were to fail (which is currently rated in poor condition and previously failed in 1959 after a large storm event). Contaminated sediment is anticipated to continue mobilizing downstream, as demonstrated by the change in depositional sediment thickness between 2002 and 2021 (the maximum depositional sediment thickness impounded by the T&H Dam decreased from 9.7 feet in 2002 to 4.8 feet in 2021). RAA-1 will not maintain control of the site conditions that pose an immediate risk to public health or welfare of the United States or the environment.

4.3.2.2 Implementability

RAA-1 will be technically and administratively feasible to implement. RAA-1 will not be dependent on the availability of services and material as no action will occur.

4.3.2.3 Cost

RAA-1 will cost $0, as no action will be performed.

4.4 RAA-2 – HOTSPOT REMOVAL AND TEMPORARY CONTAINMENT

4.4.1 Summary of RAA-2

RAA-2 will include the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing

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[21] For the Neponset River, sensitive populations are advised to “not eat any fish” and general populations are advised to “not eat American Eel, White Sucker, and limit other species to two meals per month.”

to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.

- Removing sediment throughout the remainder of the Phase 1 Reach exceeding the RAA-2 cleanup level of 100 mg/kg (for the purpose of this EE/CA, PCB-contaminated sediment and floodplain soil exceeding 100 mg/kg is considered PTW). Pre-design investigations may be necessary to clarify the extent of PTW.
- Constructing interim sediment caps over remaining contamination where PCBs exceed the RAA-2 cleanup level of 100 mg/kg and extend below the maximum dredge depth.
- Removing floodplain soil exceeding the RAA-2 cleanup level of 100 mg/kg.
- Backfilling as necessary to stabilize the riverbed, adjacent floodplain soil, and impacted abutting structures.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and floodplain soil (as necessary).
- Transporting and disposing of soil and dewatered sediment off-site.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing ICs as appropriate.

An overview of the areas targeted for sediment and floodplain soil under RAA-2 are illustrated in **Figure 7** and **Figure 8**, respectively.

4.4.2 Removal of Contaminated Sediment

4.4.2.1 Areas and Volumes of Sediment to be Removed

RAA-2 is anticipated to remove contaminated sediment from approximately 224,325 square feet of area throughout the Phase 1 Reach, as illustrated on **Figure 7**. The average dredge depth is estimated to be approximately 2.7 feet, which results in a total volume of 22,500 cubic yards, as detailed in **Table 14**. The volume of sediment to be dredged was estimated by evaluating the thickness of sediment based upon the 2023 sediment sampling penetration depth prior to encountering refusal combined with a one foot over dredge.

As stated previously, identified PCB source material include the highly contaminated sediment in the T&H Dam impoundment and the former Lewis Chemical facility depositional area. The remaining sediment exceeding the RAA-2 cleanup levels is primarily located in the top 0 – 3 feet directly downstream of the former Lewis Chemical facility (denoted as the red squares in **Figure**

7). There are two additional sediment locations farther from the former Lewis Chemical facility exceeding the RAA-2 cleanup level as follows:

- Sample location 23A-0023, located upstream of the former Lewis Chemical facility (near RM 3.00); and
- Sample ID 23A-0054 located downstream of the former Lewis Chemical facility (near RM 3.55).

To promote cost-efficiency and accuracy, pre-design investigations may be necessary to further delineate the extent of contamination near the T&H Dam impoundment, the former Lewis Chemical facility, and throughout the remainder of the Phase 1 Reach. Additionally, pre-design investigations are recommended adjacent to the former Lewis Chemical facility to assess the possible presence of non-aqueous phase liquids (NAPL).

4.4.2.2 Sediment Removal Procedures

Removal of contaminated sediment can be accomplished while submerged (dredging) or after water has been diverted (dry excavation). For purposes of cost estimates, hydraulic dredging was assumed for submerged sediment removal. Hydraulic dredging[22] involves pumping the sediment from the riverbed via a barge floating in the river as a slurry through a high-density polyethylene (HDPE) pipeline to a dewatering, staging, and load out area, where the sediment will be conditioned, dewatered, and then loaded into transport vehicles for transportation to an off-site disposal facility. Mechanical dredging may be used in limited areas if needed (e.g., shallow sediments removed along with floodplain soil. During the NTCRA design phase of the project when additional data are collected to support the design basis, the most appropriate and cost-effective method to remove sediment will be determined.

If surveys prior to commencement of the dredging identify large debris or other items in the riverbed that need to be removed prior to hydraulic dredging, those items may be removed separately using a barge-mounted excavator prior to dredging. The debris may also be left in place and capped, if appropriate. Depending on the level of contamination within or on the removed debris, the debris will be washed and managed as non-TSCA waste. If washing is not practical, the large debris may be combined with the dewatered sediment and disposed of as a

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[22] Mechanical dredging may be used in limited areas if needed (e.g., shallow sediments removed along with floodplain soil).

TSCA waste.[23] If bedrock or consolidated deposits not amenable to dredging are encountered, the unconsolidated sediment above the bedrock targeted for dredging will be removed.

Based upon the nature and extent of contamination, a maximum dredge depth is anticipated to be finalized during design based upon the results of pre-design investigations. Inaccessible contamination at depth below the maximum dredge depth may be temporarily capped. A maximum dredge depth will be implemented due to environmental, engineering, and safety reasons.[24]

EPA will make an effort to avoid/minimize impacts to any historical and cultural resources at the Site. Potential impacts to historical and cultural resources will be further evaluated during the NTCRA design phase (i.e., as more specific details of the cleanup are finalized). If impacts to these features are unavoidable, then preconstruction archaeological data recovery is recommended. More information, including tables summarizing the archaeological sites, historic districts, and inventoried areas/structures within the area of potential effect and within 0.5 miles of the area of potential effect, are available in the Site Reconnaissance Summary (AECOM, 2023b).

All dredging and backfilling of sediment will proceed from upstream to downstream to prevent potentially contaminated sediment from impacting downstream portions of the Phase 1 Reach.

4.4.2.3 Minimizing Risk Related to Resuspension, Release, and Residuals

The risk of resuspension, release, and residual contaminated sediment is common to all dredging projects (Bridges, et al., 2010). Dredging will be implemented in a manner to minimize the risk of:

1. Suspending contaminated sediment in the water column in a manner that could:
    a. Contaminate areas that have already been dredged and/or capped;
    b. Contaminate downstream areas that do not exceed the RAA cleanup level and are not designated for dredging or capping; or
    c. Cause negative impacts to ecological communities in the water column.

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[23] "TSCA waste" generally refers to waste containing PCBs at concentrations of 50 mg/kg or more. Such wastes are required to be disposed of in TSCA-permitted facilities. Wastes containing PCBs at concentrations less than 50 mg/kg may be disposed of in non-TSCA approved disposal facilities.

[24] The Occupational Safety and Health Administration (OSHA) generally requires shoring for trenches five feet or deeper, but excavations four feet or deeper require a competent person to determine if a protective system is needed. For trenches and excavations less than 5 feet, OSHA requires a competent person to inspect and determine if a cave-in risk exists, and if so, a protective system is required. When dredging, which is essentially an excavation, these requirements still apply.

2. Releasing contaminants to the river water from resuspended sediment particles, the dredging cut face, or by other means.
3. Generating dredging residuals with contaminant levels that exceed the RAA cleanup level.

A key factor that impacts resuspension and residuals is the particle size of the materials being dredged. For the Phase 1 Reach, particle size distribution analyses were conducted as part of the 2023 Phase 1 Reach remedial investigation and demonstrate that fine sand (greater than 0.125-0.25 millimeters (mm)) was the dominant grain size classification in the majority of samples (90 out of 154). Clay was identified as the dominant grain size classification in fewer than 30 of the samples.[25] Clay, which consists of much smaller particle sizes and larger surface area than sand (per unit of mass), generally remains resuspended in water for longer periods of time. Increased suspension in the water column increases the risk of the particle's transport outside of the dredging area. Sand particles are heavier and larger than clay and settle through the water column faster than clay. The risk associated with resuspension is therefore reduced because the predominant material to be dredged is sand.

There are several measures that can be implemented to minimize risks associated with resuspension, release, and residuals. Best management practices will be specified in the detailed design to minimize the release of sediment from the active area of dredging. In general, they will include the following:

1. Sequence the dredging to proceed from upstream to downstream, thereby increasing the potential for recapture of resuspended contaminated sediment that settles onto the riverbed within downstream areas that are designated for dredging and/or capping.
2. Install and maintain silt curtains downstream of dredging areas to capture resuspended sediment impacting downstream areas that are not designated for dredging (refer to **Figure 7**).
3. Use dredging equipment and procedures designed to minimize resuspension of sediment. This includes:
    a. Use of hydraulic dredging pumps with strong suction force to maximize the capture of displaced sediment;

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[25] It is important to note that using the Pearson correlation coefficient method, the 2023 sampling presented very weak ($|r| < 0.3$) correlations between clay and fine sand grain sizes and total PCB concentration.

   b. Prevention of excessive rotational speed of the dredge cutter head to prevent the propelling of material away from the suction pipe inlet;

   c. Steady and systematic dredging of thin layers of sediment; and

   d. Prevention of excessive swing rate of the dredge cutter head.

4. Schedule the dredging for the time of year when high river flows are least likely, and when challenging weather is less likely to compromise the procedures implemented to minimize resuspension and release.

5. Place cover (i.e., a cap or backfill) as soon as possible after the completion of dredging in areas that exceed the prescribed maximum dredge depth and RAA cleanup level to minimize the duration when contaminants can be released from the dredge cut face.

6. Collect verification samples in areas upstream of areas where dredging has been completed to verify that resuspension, release, and residuals have not caused unacceptable impacts in those areas. Conduct additional dredging or capping of upstream areas as necessary to address unacceptable impacts.

7. Collect samples from downstream areas that are not designated for dredging to assess impacts from upstream dredging. Adjust dredging locations as necessary based on the sample results.

8. Collect post-dredge sampling of the areas not designated for removal will be performed to verify that contaminated sediment has not been transported downstream at levels that exceed the RAA cleanup level.

Literature values for the amount of residual contaminated sediment remaining after dredging operations range from 2% to 9%, with a mean of 4% (Bridges, et al., 2010). Based upon the predominant particle size and substrate throughout the Phase 1 Reach (fine sand), coupled with the implementation of best management practices described above, the level of recontamination associated with sediment removal procedures is anticipated to be low.

4.4.3 Capping and Backfilling Within the River Channel

The placement of backfill and capping can resuspend and release contaminated sediment similar to dredging, as described in Section 4.4.2.3. Best management practices consistent with Section 4.4.2.3 are recommended. Applying backfill and capping material slowly and uniformly can minimize the amount of sediment disruption and resuspension, and designs should include plans to minimize and monitor impacts during and after construction.

4.4.3.1 Capping

Containment or caps are designed to reduce unacceptable risk through:

1. Physically isolating the contaminated sediment or floodplain soil to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface;
2. Stabilization and erosion/scour protection to reduce re-suspension or erosion/scour of contaminated sediment and transport to downstream areas; and
3. Chemical isolation of contaminated media to reduce exposure from contaminants transports into the water column.

Generally, caps require monitoring and maintenance in perpetuity to ensure that the cap is performing successfully. Caps can be constructed with a variety of materials based upon the complexity of the design.

- Conventional capping places sand or other natural materials directly over the contaminated sediment area. The cap has to be at least as thick as the large populations of burrowing benthic organisms to keep them from becoming contaminated. Also, current velocity, availability of capping materials, and the type of contamination present determine cap thickness, and the materials used. Typically, sand caps are used in low velocity waterways to protect them from scouring by strong (high energy) currents.
- Amended sediment capping generally include amendments that are mixed into the capping materials or placed as separate layers to both isolate and treat contaminated sediment layers.
- Armored capping places an additional layer of stone or rip rap over a conventional cap to provide additional protection from high velocity currents.
- Composite capping places several layers of sand, rock, and geomembrane/ textile over the contaminated sediment to further isolate it. Geomembranes can be employed when there is a concern that advection by upward groundwater gradients or diffusion will carry contamination up into the clean cap area. Geomembranes are, however, problematic if anaerobic gas is generated from the underlying sediment.

If contamination at concentrations greater than the RAA-2 cleanup level extends below the maximum dredge depth, an interim cap may be placed for stabilization purposes. During the NTCRA design phase of the project when additional data are collected to support the design basis, the most appropriate and cost-effective capping method to stabilize sediment will be determined.

4.4.3.2 Backfilling

Where dredging occurred to achieve the RAA-2 cleanup level of 100 mg/kg, backfilling will be conducted, where necessary, to stabilize the riverbed, adjacent floodplain soils, and impacted abutting structures. As described in **Appendix B**, it may not be necessary to restore the original bathymetry of the riverbed to maintain sediment stability across the Phase 1 Reach in entirety;

it is expected that depositional areas where backfilling is not necessary will gradually fill in via natural processes.

With the exception of soft sediment, backfill material will be replaced with a similar particle size of removed contaminated material to minimize disruptions to the ecological habitat. Soft sediment will be backfilled with larger material to increase accuracy of dredge placement and reduce the migration of residuals throughout the water column.

A “Telebelt”-type conveyor system could be used to distribute the backfill materials to the riverbed within approximately 100 feet of the shore access locations. For areas that cannot be reached by the Telebelt, the backfill materials will be loaded onto barges using the Telebelt, and then transported to the backfill locations for placement onto the riverbed. EPA will seek consent for access prior to conducting work on any property.

4.4.4 Removal of Floodplain Soil

4.4.4.1 Areas and Volumes of Floodplain Soil to be Removed

RAA-2 is anticipated to remove contaminated soil from approximately 8,315 square feet of area throughout the Phase 1 Reach floodplain soils, as illustrated on **Figure 8**. As further detailed in the Data Evaluation Summary Memorandum – Phase 1, floodplain soils exceeded the RAA-2 cleanup level of 100 mg/kg in 7 of the 109 locations sampled. The average depth of contamination is estimated to be approximately 1.5 feet, which results in a total volume of 430 cubic yards, as detailed in **Table 14**.

In each area where floodplain soil will be removed, the areal extent of soil to be removed is estimated to be half the distance to the next sample location that does not exceed the RAA-2 cleanup level. The extent of soil to be removed away from the river edge was determined based upon the floodplain grade. This allowed for a more reliable method of estimating floodplain soil volume compared to using the FEMA 100-year flood elevation, which does not always correlate well with sample locations and the ordinary high-water mark. For locations with steep banks, the horizontal extent of soil removal perpendicular to the river is limited to approximately six feet. In areas with more gradual floodplain soils, and where the soil samples were collected further from the edge of water, a greater extent of soil (10 feet or more) perpendicular to the river is proposed for excavation. To prepare the areas for excavation, it is anticipated that approximately 820 linear feet of the floodplain soils may require vegetation and tree removal. EPA will seek consent for access prior to conducting work on any property.

4.4.4.2 Floodplain Soil Removal Procedures

Floodplain soil may be removed from the river (using a barge-mounted excavator and scows) or from the shore using traditional excavation equipment. Floodplain soil removed by barge may encounter challenges due to the two low underpass MBTA bridges in the Phase 1 Reach, which may restrict transport of contaminated material by river.

Floodplain soil removed from the shore may require construction of multiple staging areas and access roads following clearing and grubbing. Access roads include roads that extend from existing public roadways to the general vicinity of the river. Haul roads are considered roads constructed parallel to the river. The access and haul roads will likely be constructed using conventional earthwork techniques utilizing road base materials (granular fill and dense graded aggregates) with a geotextile separation fabric placed on the exposed subgrade or through the use of temporary mats. Additional subgrade improvement such as “corduroy” techniques or the incorporation of high-strength fabrics / geogrid may be required in overly soft or wet subgrade areas. Where necessary, drainage structures such as culverts or drainage swales will be installed within concentrated flow path crossings.

EPA will make an effort to avoid/minimize impacts to any historical and cultural resources at the Site. Potential impacts to historical and cultural resources will be further evaluated during the design phase (i.e., as more specific details of the cleanup are finalized). If impacts to these features are unavoidable, then preconstruction archaeological data recovery is recommended. More information, including tables summarizing the archaeological sites, historic districts, and inventoried areas/structures within the area of potential effect and within 0.5 miles of the area of potential effect, are available in the Site Reconnaissance Summary (AECOM, 2023b).

Where soil removal activities will be occurring in floodplains and wetlands, harmful impacts to wetland and floodplain resources will be minimized to the extent practicable and best management practices for construction will be determined during design.

4.4.5 Floodplain Restoration

In areas where the floodplain soils are excavated, the area will be reconstructed such that it is stable and resistant to erosion under normal and high flow conditions while also supporting future ecological habitat. Stabilization methods used will vary depending on the grade, height, floodplain soil use, and flow conditions at each restoration location. Stabilization measures will likely include the use of one or more of the following methods:

- Rip rap;
- Rip rap with living stakes/vegetation planting;
- Gabions;
- Vegetated geolifts;
- Coir logs with vegetative plantings;
- Topsoil bank layers wrapped in geotextile with native vegetative plantings; and
- Erosion control blankets with native vegetative plantings.

The last three methods will be prioritized, where possible, to minimize potential ecological impacts resulting from construction. Floodplain soil stabilization procedures to be implemented where floodplain soil is removed will be specified during the design. Examples of floodplain soil stabilization and restoration designs are provided in **Figure 19**. If any wetlands are affected by excavation and fill replacement, wetlands to the extent practicable will be restored at the same surface elevation as pre-existing wetlands.

4.4.6 Dewatering and Staging of Removed Sediment and Soil

For conceptual purposes of this EE/CA, the dewatering, staging, and loadout area for the dredged sediment and excavated soil are assumed to be located on DCR-owned property near the T&H Dam. A conceptual process flow diagram for dewatering of sediment and treatment of filtrate is provided in **Figure 18**. EPA will seek consent for access prior to conducting work on any property.

Slurry generated during dewatering operations is anticipated to be conditioned with polymer or other conditioning agent (as necessary for effective dewatering), processed through a thickener, and then pumped to geotextile dewatering tubes. Bench and/or pilot testing of dewatering using representative sediment samples from the Phase 1 Reach will be performed during the design to select the most cost-effective dewatering equipment. Key criteria for selection of the dewatering equipment are:

- Maximizing the amount of water removed from the sediment in order to minimize the addition of solidification agents to render the material void of free liquids for transport and minimize the total weight of sediment transported off-site for disposal; and
- Dewatering the sediment at a rate such that, if possible, the Phase 1 Reach can be dredged in two construction seasons.

Geotextile tubes are made of high-strength, permeable, woven polypropylene fabric that allows excess water to pass through the walls of the tube while the dewatered sediment is retained inside the tube. Geotextile tubes are set up and connected to a manifold such that the flow of sediment slurry can be directed to one geotextile tube at a time. The flow of sediment slurry is rotated between the geotextile tubes such that one tube is filling while water drains from the others. Additional slurry is added to the geotextile tubes as water drains out through the walls of the tubes and additional volume inside the tubes becomes available. The use of a thickener prior to the geotextile tubes will improve the efficiency of the dewatering process by reducing the amount of time needed to dewater the sediment to the point where it can be transported off-site for disposal. If there are significant space limitations, in most circumstances the geotextile tubes can be stacked, if necessary.

Filtrate from dewatering of the sediment will be processed through a water treatment system consisting of multi-media filters (as necessary depending on the level of suspended solids in the filtrate) and activated carbon adsorption, prior to discharge downstream of the T&H Dam into the Lower Neponset River. It is assumed that the effluent from the water treatment system will be required to comply with the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) Remediation General Permit for Massachusetts.

4.4.7 Transportation and Disposal of Dewatered Sediment and Soil

Generally, the term “disposal” in this EE/CA refers to the placement of dredged or excavated material and process wastes into a temporary or permanent structure, site, or facility. The goal of disposal is generally to manage sediment and/or residual wastes to prevent contaminants associated with them from impacting human health and the environment. Disposal is typically a major cost and logistical component of any dredging or excavation alternative. The identification of disposal locations can often be the most controversial component of planning and implementing a dredging remedy. For the purposes of cost estimating, it is presumed that dewatered sediment and soil will be shipped “off-site”.

Off-site transportation will include loading the dewatered sediment and floodplain soil into lined dump trailers or roll-off “gondolas” for transport. Section 121(d)(3) of CERCLA applies to any CERCLA response action involving the off-site transfer of any hazardous substance, pollutant or contaminant (CERCLA wastes). That section requires that CERCLA wastes may only be placed in a facility operating in compliance with the RCRA or other applicable Federal or State requirements. That section further prohibits the transfer of CERCLA wastes to a land disposal facility that is releasing contaminants into the environment and requires that any releases from other waste management units must be controlled. Contaminated sediment and floodplain soil removed from the Site will require additional waste profile characterization to determine their off-site disposal location.

Soil and dewatered sediment will be placed in lined roll-offs or dump trailers for T&D to an EPA-approved disposal facility. Every cubic yard of dredged sediment is estimated to result in 1.5 tons of dewatered sediment. As detailed in **Table 14**, RAA-2 soil removal volume estimates are 430 cubic yards, which are estimated to weigh approximately 650 tons. RAA-2 dredged sediment volume estimates are 22,500 cubic yards, which are estimated to weigh approximately 33,800 tons. Combined soil and dewatered sediment tonnage is estimated to be 34,400 tons. For estimating purposes, lined roll-off trucks are anticipated to hold approximately 35 tons.[26]

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[26] This is based upon T&D that occurred at the New Bedford Harbor Superfund Site in 2024 and 2025. It is important to note that truck weight is dependent upon the specific truck/trailer and the resulting gross vehicle weight.

RAA-2 is estimated to require 1,145 truckloads of contaminated material transported off site to an EPA-approved disposal facility. A traffic control plan would be developed and implemented to manage the truck traffic and any damage to public roads would be repaired.

The lined roll-off trucks will be transported to a rail terminal in Worcester, Massachusetts or Nashua, New Hampshire. The soil and dewatered sediment will then be transported by rail to a disposal facility in the midwestern United States such as the Wayne Disposal Inc. facility in Bellville, Michigan or the Heritage Landfill in Roachdale, Indiana. Pricing for T&D of the soil and dewatered sediment as a TSCA waste to the Heritage Landfill in Roachdale, Indiana is included in the cost estimates within **Tables 17-2**, **17-3**, and **17-4**.

The TSCA landfills used for cost estimate purposes in this document are not licensed to accept RCRA hazardous waste. However, the 2023 Phase 1 Reach field investigation results do not indicate a likely potential for exceedance of the RCRA characteristic hazardous waste criteria. The 2023 results for RCRA Hazardous Waste characteristics measured are below the “20 times rule” for all parameters except for lead and chromium. For lead and chromium, the 2023 data show exceedance of the 20 times rule at approximately 48 and 6 sample locations, respectively. However, the 2023 waste characterization sample (sample ID LNR-SED-20231205) had a total analysis of 220 mg/kg of lead with a corresponding TCLP analysis of 0.22 milligrams per liter (mg/L) lead in the TCLP leachate, which is well below the 5 mg/L TCLP criterion for lead. The 20 times rule is a conservative estimator of TCLP exceedances based on the dilutions used during the TCLP extraction procedure. The data for other 2023 monitoring parameters do not indicate other RCRA characteristics (reactivity, corrosivity, ignitability) would cause the dewatered sediment to be classified as a RCRA hazardous waste.

If higher levels of lead or other metals are detected during pre-dredging in situ waste characterization sampling that result in exceedances of the TCLP leachate limits, then ex situ treatment will be attempted to meet TSCA landfill requirements. As described in **Table 16**, ex situ treatment includes the use of chemical reagents to precipitate, immobilize and bind contaminants in soil matrix. Reagents can include cement, cement kiln dust, apatite, asphalt cement or similar.

If ex situ treatment is unsuccessful, RCRA/TSCA waste may require T&D to a RCRA/TSCA facility such as the Clean Harbors Deer Park Incineration Facility located in La Porte, Texas. The T&D to this facility is estimated to cost approximately $2000/ton (in comparison to the T&D cost estimate of $260/ton for TSCA waste).

To reduce T&D costs, if practicable, sediment with PCB concentrations less than 50 mg/kg may be able to be segregated from sediment with PCB concentrations greater than 50 mg/kg. Pilot testing, which is an iterative approach, may be performed to implemented to better determine the effectiveness of waste segregation in relation to cost savings.

Once all soil and sediment are removed from the processing area for T&D, all site-related equipment with the potential of contamination will be thoroughly cleaned and decontaminated. Once all equipment and support infrastructure are removed from the Site, the staging and processing area will be restored.

4.4.8 Monitoring and Maintenance

Monitoring and maintenance relative of various components of RAA-2 are necessary to:

- Identify changes in conditions;
- Detect movement of environmental constituents of interest (COPCs, silt, etc.) from one location to another; and
- Demonstrate the effectiveness of a particular activity or action.

A site-specific monitoring and maintenance plan will be developed during the design of the removal action and is expected to include, but is not limited to, the following components:

- Backfill and cap placement monitoring to minimize and monitor resuspension, release, and residual impacts during and after construction.
- Cap performance monitoring, which may include:
    - Erosion or other physical disturbance of cap;
    - Contaminant flux into cap material and into the surface water from underlying contaminated sediment (e.g., ground water advection, molecular diffusion);
    - Recolonization of cap surface and resulting bioturbation.
- Sediment impoundment monitoring behind the T&H Dam.
- Monitoring of restoration effectiveness.
- Environmental monitoring before, during, and immediately following construction, including analysis of sediment, floodplain soils, surface water, pore water, fish tissue, and air.
- Institutional control monitoring and maintenance, as necessary (e.g., signage maintenance and/or repair).

4.4.9 Institutional Controls

The term “institutional control” (IC) generally refers to non-engineering measures intended to affect human activities in such a way as to prevent or reduce exposure to hazardous substances, often by limiting land or resource use. ICs can be used at all stages of the remedial process to reduce exposure to contamination. The objectives of ICs are to prevent exposure to contaminants on both a short-term and long-term basis until protective levels are achieved for all populations and to maintain the integrity of the engineered components of the remedy.

EPA intends to utilize signage and educational outreach as ICs throughout the Superfund process. EPA plans to collaborate with the Community Advisory Group (CAG) and the community to assist in the development of Superfund signage to be placed around the Site.

As noted in Section 2.5.1.3, the Massachusetts Department of Public Health has installed 25 fishing advisory signs around the Site and has developed the Recreational Use of the Neponset River Community Fact Sheet 2022 (MDPH, 2022). This information is discussed, shared, and distributed at all EPA community involvement events. EPA plans to conduct a site-specific creel survey, which is a method used to gather data on fishing practices and consumption to help understand potential human health risks from contaminated fish. EPA will also use this information to improve site-specific ICs (e.g., signage and educational outreach). EPA collected fish tissue data in 2024 and once this data is validated, EPA will share this data with the Massachusetts Department of Public Health to update the current fish advisory and existing signage. This information will also be utilized to bolster the effectiveness of the existing fish consumption advisory by improving outreach through public education programs, brochures, postings in bait/tackle shops, fishing license proprietors, talks to community groups or schools, and discussion about alternatives to fishing.

In addition, ICs under RAA-2 will include land use and/or access restrictions limiting land use activities during and after implementation of the removal action, as appropriate, and waterway restrictions to limit river use activities during and after implementation of the removal action, as appropriate. The evaluation and implementation of waterway use restrictions will be needed to protect the integrity and maintain the purpose of any caps in relation to current and future uses of the Site. Additional institutional control mechanisms may be developed during the design of this removal action.

4.4.10 Analysis of RAA-2

4.4.10.1 Effectiveness

RAA-2 is minimally effective in achieving four of the six RAOs, which are described in Section 3.2. RAA-2 will generally reduce risks to human health from PCBs and other COPCs in sediment and soil, including reducing the residential and recreational receptor’s unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs (RAO 1 and RAO 3). RAA-2 will also generally reduce risks to ecological receptors from PCBs and other COPCs in sediment and soil, (RAO 2 and RAO 4). However, it is important to note that RAA-2 cleanup level of 100 mg/kg is reflective of a “hot spot” removal action (i.e., addressing the most highly contaminated media), and will not result in acceptable long-term risk to human health and the environment. RAA-2 will not remove the potential for an uncontrolled release of contaminated sediment and eroding floodplain soils in the event of dam failure (RAO 5) because the dam will not be repaired or removed. As sediment and eroding floodplain soils are prone to movement due to hydrodynamic forces, RAA-2 will not prevent the transport of PCBs below the RAA-3 cleanup level to both remediated and unremediated areas (RAO 6).

RAA-2 is not protective of human health and the environment and is not effective in the long term because PCBs with concentrations less than 100 mg/kg and other COPCs outside of the sediment and soil management areas may continue to pose an unacceptable risk to human health and the environment. After RAA-2 is completed, 78 sample intervals with COPCs above background area concentrations and/or the risk-based project action limits will remain in place and may continue to pose an unacceptable risk to human health and the environment. More information is available in **Appendix E**. The construction of interim sediment caps over remaining contamination where PCBs exceed the RAA-2 cleanup level and extend below the maximum dredge depth may not be protective in the long term if the caps fail due to natural or anthropogenic causes. As discussed in Section 4.4.9, the implementation of waterway use restrictions and monitoring will be necessary to protect the integrity and maintain purpose of the cap in relation to any current and future uses of the Site.

In the short term, RAA-2 is effective in mildly reducing risk to human and ecological receptors by removing and stabilizing the most highly contaminated sediment from the Phase 1 Reach, though unacceptable risk to human health and the environment will remain. The risk of entrainment of source areas in the event of dam failure will be reduced, as the highly contaminated sediment from the T&H Dam impoundment and former Lewis Chemical facility depositional area will be removed.

RAA-2 presents short-term risks to workers during implementation of the removal action. General work near waterways and construction activities presents inherent and significant risk due to the nature of the work. RAA-2 will include on-water and floodplain soil work, operations near an active dam, dredging, excavation, vegetation and tree removal, and the processing and management of hazardous waste, which pose significant risks to construction workers. The use of a site-specific Health and Safety Plan (HASP) and Job Hazard Analyses (JHAs) will be used to increase worker protectiveness. Only qualified contractors will be allowed to perform work for RAA-2. Continued monitoring and oversight of safety throughout implementation of RAA-2 will be necessary.

RAA-2 also presents short-term risks to the community and the environment during implementation of the removal action. The RAA-2 short-term risks include, but are not limited to:

- Significant temporary disturbance of the riverbed, floodplain soils, and associated ecosystems during the dredging, excavation, backfilling, and capping operations;
- Closure of the Phase 1 Reach to all recreational activities during dredging and floodplain soil removal and restoration work; and
- Increased truck traffic.

The use of traffic plans, restricted access areas, air monitoring, and community outreach and engagement will be used to increase protectiveness of the community.

RAA-2 serves as an interim action to abate and stabilize PCB sources and PCB PTW. RAA-2 includes limited containment controls (i.e., interim caps) and ICs to reduce short-term risk until a longer-term solution can be implemented. Future subsequent and final actions will be necessary to achieve acceptable risk levels to human health and the environment. During the implementation of future actions, the short-term risks presented above are anticipated to recur.

RAA-2 would include limited treatment of water generated by sediment dredging and dewatering. Additional treatment processes, such as pretreatment, immobilization and solidification/stabilization, and particle size separation may be implemented during processing of contaminated sediment and floodplain soil. While it is not expected, ex situ treatment may be utilized if higher levels of lead or other metals are detected during pre-dredging in situ waste characterization sampling that result in exceedances of TCLP leachate limits to meet TSCA landfill requirements. This alternative will comply, to the extent practicable, with established ARARs. The potential chemical-specific, action-specific, and location-specific ARARs and TBCs are included in **Table 15-1**, **15-2**, **and 15-3**, respectively, and are also summarized in Section 3.1. Location-specific ARARs include federal and state standards to protect floodplain and wetland/aquatic resources. RAA-2 will involve the alteration of floodplain and wetland/aquatic resources, including from dredging, excavation, and potential capping activities. Because significant levels of contamination exist in floodplain soils, EPA has determined that there is no practicable alternative to action within the floodplains. Mitigation measures will be required.

4.4.10.2 Implementability

Implementation of RAA-2 is technically feasible, although physical accessibility challenges are anticipated, as further discussed below. The majority of removal action support materials and services (e.g., barges, excavators, lined roll off trucks, HAZWOPER-trained personnel) are anticipated to be readily available to support the removal action. However, specialized equipment and personnel (e.g., an amphibious excavator and operator) may require additional lead time to obtain. Dredging, excavation, dewatering, and off-site T&D of contaminated sediment and soil are well-established removal action procedures and there are experienced HAZWOPER-trained contractors capable of performing this work. RAA-2 does not involve the use of innovative or trial remedial technologies that would require specialized and/or limited services or materials.

Challenges to physical accessibility are anticipated due to the Site's location within in a densely populated residential, recreational, and commercial area, and there is limited available shoreline frontage on the river. Low water levels in areas of the river and bridge underpass access (there are four bridges throughout the Phase 1 Reach) may limit access by barges and require the use of specialized amphibious dredging and transportation equipment and/or the construction and eventual removal of gravel work roads in the river. A large staging, dewatering, access, load-out, and water processing area will be necessary to facilitate sediment and soil removal, which is anticipated to require two field seasons. Further, performing work near the active T&H Dam and MBTA tracks will present additional physical accessibility challenges. RAA-2 is administratively feasible, but coordination with property owners to obtain access will likely present administrative issues that will require time to resolve.

RAA-2 ICs (educational outreach, signage, waterway use restrictions, and land use and/or access restrictions) are anticipated to be technically and administratively implementable.

The length of time for RAA-2 is anticipated to be greater than one year due to the substantial efforts necessary to support the removal action, the assumption that dredging will take place during two field seasons, and the required restoration efforts following the action. A detailed conceptual schedule is provided in **Table 18-1**.

In addition, RAA-2 may impact implementability of future investigations and response actions as follows:

- Resampling of the Phase 1 Reach will be necessary prior to the implementation of each future action to delineate the spatial distribution of contaminants and develop accurate area and volume estimates. (It is anticipated the subsequent actions will take place years after RAA-2. Sediment and floodplain soils are susceptible to hydrodynamic forces resulting in transport of sediment and floodplain soil downstream.)
- Removal or possible amendments to the interim caps will be necessary if permanent caps are selected as part of subsequent future actions.
- Backfill that was placed for stabilization purposes may need removed if subsequent future actions intend to remove additional contamination.
- The placement of backfill as necessary to stabilize the channel.

State and community acceptance will be evaluated after the completion of the public comment period.

4.4.10.3 Cost Estimate

RAA-2 is estimated to cost approximately $29,900,000. A detailed cost estimate for RAA-2 is provided in **Table 17-2**.

4.5 RAA-3 – TARGETED REMOVAL, TEMPORARY CONTAINMENT, AND DAM REMOVAL

4.5.1 Summary of RAA-3

RAA-3 includes the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.
- Removing sediment throughout the remainder of the Phase 1 Reach exceeding the RAA-3 cleanup level of 14 mg/kg. Pre-design investigations may be necessary to clarify the extent of contamination.
- Constructing interim sediment caps over remaining contamination where PCBs exceed the RAA-3 cleanup level of 14 mg/kg and extend below the maximum dredge depth.
- Removing floodplain soil exceeding the RAA-3 cleanup level of 14 mg/kg.
- Removing additional sediment and underlying dense riverbed soil immediately upstream of the T&H Dam as necessary to establish a 10-foot horizontal to 1-foot vertical grade in the riverbed in advance of removing the T&H Dam.
- Backfilling as necessary to stabilize the riverbed, adjacent floodplain soils, impacted abutting structures, and minimize surface water elevation changes.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and excavated floodplain soil (as necessary).
- Transporting and disposing of soil and dewatered sediment off-site.
- Removing the T&H Dam.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing ICs as appropriate.

An overview of the areas targeted for sediment and floodplain soil under RAA-3 are illustrated in **Figure 9** and **Figure 10**, respectively.

4.5.2 Removal of Contaminated Sediment

4.5.2.1 Areas and Volumes of Sediment to be Removed

RAA-3 is anticipated to remove PCB-contaminated sediment from approximately 299,868 square feet of area throughout the Phase 1 Reach, as illustrated in **Figure 9**. The average dredge depth is estimated to be approximately 2.5 feet, which results in a total volume of 27,400 cubic yards, as detailed in **Table 14**. The volume of sediment to be dredged was estimated by evaluating the thickness of sediment based upon the 2023 sediment sampling penetration depth prior to encountering refusal combined with a one foot over dredge. The maximum dredge depth will be finalized during the design.

As stated previously, identified PCB source material include the highly contaminated sediment in the T&H Dam impoundment and the former Lewis Chemical facility depositional area. The remaining sediment exceeding the RAA-3 cleanup levels is primarily located in the top 0 – 3 feet throughout the majority of the Phase 1 Reach (denoted as the orange and red squares in **Figure 9**).

To promote cost-efficiency and accuracy, pre-design investigations may be necessary to further delineate the extent of contamination near the T&H Dam impoundment, the former Lewis Chemical facility, and throughout the remainder of the Phase 1 Reach. Additionally, pre-design investigations are recommended adjacent to the former Lewis Chemical facility to assess the possible presence of NAPL.

4.5.2.2 Sediment Removal Procedures

Contaminated sediment removal will be performed in the same manner as described in RAA-2.

4.5.2.3 Minimizing Risk Related to Resuspension, Release, and Residuals

The risk of dredging related resuspension, release, and residuals is comparable to RAA-2. Best management practices to minimize risk will be performed in the same manner as described in RAA-2.

4.5.3 Removal of Dense Riverbed Soil to Facilitate Dam Removal

4.5.3.1 Areas and Volumes of Material to be Removed

Once the highly contaminated sediment in the T&H Dam impoundment is removed, approximately 2,600 cubic yards of consolidated riverbed soil will be dredged in order to remove the T&H Dam and to create a stable channel bottom slope (assumed 10-foot horizontal to 1-foot vertical for planning purposes) between the existing channel grades upstream and downstream of the T&H Dam. The consolidated riverbed soil beneath the T&H Dam impoundment profile was not characterized during the 2023 Phase 1 Reach field investigation as it exists below the 6-foot characterization depth. Three of the four coring locations that extended to a six-foot depth within the T&H Dam impoundment, which overlays the consolidated riverbed soil discussed in this paragraph, contained PCB concentrations greater than 100 mg/kg in the deepest interval.[27] Due to this information, it is anticipated that contamination is present in the underlying dense riverbed soil at concentrations greater than the RAA-3 cleanup level of 14 mg/kg. Pre-design investigations may be necessary to clarify the extent of contamination.

4.5.3.2 Dense Riverbed Soil Removal Procedures

Riverbed soil beneath the T&H Dam sediment impoundment removal is anticipated to be performed in the same manner as described for contaminated sediment removal (Section 4.4.2.2). Pre-design investigations may be necessary to further evaluate and inform the best technology method to remove the dense riverbed soil.

4.5.4 River Channel Capping, Backfilling, and Restoration

4.5.4.1 Capping

The construction of interim caps, as necessary, will be performed in the same manner as described in RAA-2.

4.5.4.2 Backfilling

Generally, backfilling will be performed in the same manner as described in RAA-2. However, due to the removal of the T&H Dam, a series of grade control riffles through the regraded channel and dam breach zone will be constructed to minimize reductions in surface water elevation.

4.5.5 Removal of Floodplain Soil

4.5.5.1 Areas and Volumes of Floodplain Soil to be Removed

RAA-3 is anticipated to remove contaminated soil from approximately 20,325 square feet of area throughout the Phase 1 Reach floodplain soils, as illustrated on **Figure 10**. As further detailed in the Data Evaluation Summary Memorandum – Phase 1, floodplain soils exceeded the RAA-3 cleanup level of 14 mg/kg in 17 of the 109 locations sampled. The average depth of contamination is estimated to be approximately 1.4 feet, which results in a total volume of

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[27] Sample ID 23A-0020, 23A-0060, and 23A-0070.

1,000 cubic yards, as detailed in **Table 14**. The method of estimating aerial extent and volume of floodplain soil removal is the same as that used for RAA-2. To prepare the areas for excavation, it is anticipated that approximately 1,979 linear feet of the floodplain soils may require vegetation and tree removal. EPA will seek consent for access prior to conducting work on any property.

4.5.5.2 Floodplain Soil Removal Procedures

Contaminated floodplain soil removal will be performed in the same manner as described in RAA-2.

4.5.6 Floodplain Restoration

Floodplain restoration will be performed in similar to the manner as described in RAA-2. In the event that haul roads and staging area were constructed to support floodplain soil removal, all haul roads and staging areas will be restored to a similar to prior conditions.

4.5.7 Dewatering and Staging of Removed Sediment and Soil

The dewatering and staging of removed sediment and soil will be performed in the same manner as described in RAA-2.

4.5.8 Transportation and Disposal of Dewatered Sediment and Soil

T&D of soil and dewatered sediment will be performed in the same manner as described in RAA-2. As detailed in **Table 14**, RAA-3 soil removal volume estimates are 1,000 cubic yards, which are estimated to weigh approximately 1,500 tons. RAA-3 dredged sediment volume estimates are 27,400 cubic yards, which are estimated to weigh approximately 41,100 tons. Riverbed soil volume estimates are 2,600 cubic yards, which are estimated to weigh approximately 3,900 tons. Combined soil and dewatered sediment tonnage is estimated to be 46,500 tons. RAA-3 is estimated to require 1,550 truckloads of contaminated material transported off site to an EPA-approved disposal facility.

4.5.9 Removal of the T&H Dam

Conceptually, the T&H Dam is anticipated to be removed as described in **Appendix C** and detailed in the T&H Dam Inspection and Investigation Report (GEI Consultants, Inc., 2021). The dam removal is presumed to consist of:

- Removing the crest bascule gates and steel pedestrian walkway from the entire dam;
- Removing the entire middle half of the dam structure including the center pier, gatehouse, and approximately 80 feet of the concrete sill;
- Repair of the remaining concrete sill as necessary (approximately 35 feet of the concrete sill will remain on each side of the river);

- Decommissioning of the water intake vault; and
- Repair of the training walls, including grouting of voids, repair of concrete spalling, and removal of trees and roots that have the potential to further impair the training walls.

Dam removal will be implemented in a manner to minimize the risk of suspending sediment into the water column and causing negative impacts downstream human receptors. PCB-contaminated sediment exceeding the RAA-3 cleanup level will be abated or stabilized prior to removing the T&H Dam.

Prior to removal of the T&H Dam, evaluations of the revised shear stresses on the upstream bridge structures and floodplain soils will be performed to determine if scour countermeasures are required. Additionally, a geomorphic assessment will be conducted to predict channel adjustments (including post-dam removal channel erosion and sediment transport) post-dam removal. As necessary, significant reductions in surface water elevation will be minimized by creating a series of grade control riffles through the regraded channel and dam breach zone. Installation of riffles would improve river functioning, habitat, and could be designed to allow fish passage.

4.5.10 Monitoring and Maintenance

Excluding sediment impoundment monitoring behind the T&H Dam, monitoring and maintenance be performed in the same manner as described in RAA-2.

4.5.11 Institutional Controls

ICs be performed in the same manner as described in RAA-2.

4.5.12 Analysis of RAA-3

4.5.12.1 Effectiveness

RAA-3 is moderately effective in achieving five of the six RAOs. RAA-3 will generally reduce risks to human health via direct contact from PCBs and other COPCs in sediment and soil (RAO 1 and RAO 3). RAA-3 will also generally reduce risks to ecological receptors from PCBs and other COPCs in sediment and soil (RAO 2 and RAO 4). However, unacceptable ecological risk will remain. It is important to note that RAA-3 cleanup level of 14 mg/kg is reflective of EPA's least conservative acceptable risk range and will likely not result in acceptable long-term risk to human health and the environment. RAA-3 will remove the potential for an uncontrolled release of contaminated sediment and eroding floodplain soils in the event of dam failure (RAO 5) because the dam will be removed. As sediment and eroding floodplain soils are prone to movement due to hydrodynamic forces, RAA-3 will not prevent the transport of PCBs below the RAA-3 cleanup level to both remediated and unremediated areas (RAO 6).

RAA-3 will likely not result in acceptable long-term risk to human health and the environment because PCB concentrations less than 14 mg/kg and other COPCs outside of the sediment and soil management areas may continue to pose an unacceptable risk to human health and the environment. After RAA-3 is completed, 62 sample intervals with COPCs above background area concentrations and/or the risk-based project action limits will remain in place and may continue to pose an unacceptable risk to human health and the environment. More information is available in **Appendix E**. The construction of interim sediment caps over remaining contamination where PCBs exceed the RAA-3 cleanup level and extend below the maximum dredge depth present a risk in the long term if the caps fail due to natural or anthropogenic causes. As discussed in Section 4.4.9, the implementation of waterway use restrictions will be necessary to protect the integrity and maintain purpose of the cap in relation to any current and future uses of the Site.

In the short term, RAA-3 is effective in moderately reducing risk to human and ecological receptors by removing and stabilizing the highly contaminated sediment from the Phase 1 Reach. The risk of entrainment of source areas in the event of dam failure will be removed because the T&H Dam impoundment, former Lewis Chemical facility depositional area, and the T&H Dam will be removed. RAA-3 will also remove restrictions on the flow of the river, reduce the risk of upstream flooding, and improve fish passage.

RAA-3 presents short-term risks to workers during implementation of the removal action. General work near waterways and construction activities presents inherent and significant risk due to the nature of the work. RAA-3 will include on-water and floodplain soils removal work, operations near an active dam, dredging, excavation, vegetation and tree removal, processing and management of hazardous waste, and removal of the T&H Dam, which pose significant risks to construction workers. The use of a site-specific HASP and JHAs will be used to increase worker protectiveness. Only qualified contractors will be allowed to perform work for RAA-3. Continued monitoring and oversight of safety throughout implementation of RAA-3 will be necessary.

RAA-3 also presents short-term risks to the community and the environment during implementation of the removal action. The RAA-3 short-term risks include, but are not limited to:

- Significant temporary disturbance of the riverbed, floodplain soils, and associated ecosystems during the dredging, excavation, backfilling, and capping operations;
- Closure of the Phase 1 Reach to all recreational activities during dredging and floodplain soil removal and restoration work; and
- Increased truck traffic.

The use of traffic plans, restricted access areas, air monitoring, and community outreach and engagement will be used to increase protectiveness of the community.

RAA-3 serves as an interim action to abate and stabilize PCB-contaminated sediment and floodplain soils exceeding the RAA-3 cleanup level of 14 mg/kg. RAA-3 includes containment controls (i.e., interim caps) and ICs to reduce short-term risk. Future subsequent and final actions may be necessary to achieve acceptable risk levels to human health and the environment. During the implementation of future actions, the short-term risks presented above are anticipated to recur.

RAA-3 would include limited treatment of water generated by sediment dredging and dewatering. Additional treatment processes, such as pretreatment, immobilization and solidification/stabilization, and particle size separation may be implemented during processing of contaminated sediment and floodplain soil. While it is not expected, ex situ treatment may be utilized if higher levels of lead or other metals are detected during pre-dredging in situ waste characterization sampling that result in exceedances of TCLP leachate limits to meet TSCA landfill requirements. This alternative will comply, to the extent practicable, with established ARARs. The potential chemical-specific, action-specific, and location-specific ARARs and TBCs are included in **Tables 15-1**, **15-2**, and **15-3** and summarized in Section 3.1. Location-specific ARARs include federal and state standards to protect floodplain and wetland/aquatic resources. RAA-3 will involve the alteration of floodplain and wetland/aquatic resources, including from dredging, excavation, and potential capping activities. Because significant levels of contamination exist in floodplain soils, EPA has determined that there is no practicable alternative to action within the floodplains. Mitigation measures will be required.

4.5.12.2 Implementability

Implementation of RAA-3 is technically feasible, although physical accessibility challenges are anticipated, as further discussed below. The majority of removal action support materials and services (e.g., barges, excavators, lined roll off trucks, HAZWOPER-trained personnel) are anticipated to be readily available to support the removal action. However, specialized equipment and personnel (e.g., an amphibious excavator and operator) may require additional lead time to obtain. Dredging, excavation, dewatering, and off-site T&D of contaminated sediment and soil are well-established removal action procedures and there are experienced HAZWOPER-trained contractors capable of performing this work. RAA-3 does not involve the use of innovative or trial remedial technologies that would require specialized and/or limited services or materials.

Challenges to physical accessibility are anticipated due to the Site's location within in a densely populated residential, recreational, and commercial area, and there is limited available shoreline frontage on the river. Low water levels in areas of the river and bridge underpass access (there are four bridges throughout the Phase 1 Reach) may limit access by barges and require the use of specialized amphibious dredging and transportation equipment and/or the construction and eventual removal of gravel work roads in the river. A large staging, dewatering, access, load-out, and water processing area will be necessary to facilitate sediment and soil removal, which is anticipated to require two field seasons. Further, performing work near the active T&H Dam and MBTA tracks will present additional physical accessibility challenges. RAA-3 is administratively feasible, but coordination with property owners to obtain access will likely present administrative issues that will require time to resolve.

RAA-3 ICs (educational outreach, signage, waterway use restrictions, and land use and/or access restrictions) are anticipated to be technically and administratively implementable.

The length of time for RAA-2 is anticipated to be greater than one year due to the substantial efforts necessary to support the removal action, the assumption that dredging will take place during two field seasons, and the required restoration efforts following the action. A detailed conceptual schedule is provided in **Table 18-2**.

In addition, RAA-3 may impact implementability of future investigations and response actions as follows:

- Resampling of the Phase 1 Reach will be necessary prior to the implementation of each future action to delineate the spatial distribution of contaminants and develop accurate area and volume estimates. (It is anticipated the subsequent actions will take place years after RAA-3. Sediment and floodplain soils are susceptible to hydrodynamic forces resulting in transport of sediment and floodplain soil downstream.)
- Removal or possible amendments to the interim caps will be necessary if permanent caps are selected as part of subsequent future actions.
- Backfill that was placed for stabilization purposes may need removed if subsequent future actions intend to remove additional contamination.
- The placement of backfill as necessary to stabilize the channel.

State and community acceptance will be evaluated after the completion of the public comment period.

4.5.12.3 Cost Estimate

RAA-3 is estimated to cost approximately $41,000,000. A detailed cost estimate for RAA-3 is provided in **Table 17-3**.

4.6 RAA-4: COMPREHENSIVE REMOVAL, PERMANENT IN SITU AMENDMENT CAP, AND DAM REMOVAL

4.6.1 Summary of RAA-4

RAA-4 includes the following activities:

- Removing sediment in the T&H Dam impoundment and former Lewis Chemical facility depositional area, which contain highly contaminated source material that is continuing to migrate downstream. Pre-design investigations may be necessary to clarify the extent of contamination.
- Removing the top three feet of remaining sediment over the full length of the Phase 1 Reach, which will address accessible sediment exceeding the RAA-4 cleanup level of 1 mg/kg.
- Removing additional sediment and underlying dense riverbed soil immediately upstream of the T&H Dam as necessary to establish a 10-foot horizontal to 1-foot vertical grade in the riverbed in advance of removing the T&H Dam.
- Constructing a permanent cap with an in situ amendment over the full length of the Phase 1 Reach.
- Backfilling of the full length of the Phase 1 Reach to stabilize the riverbed, adjacent floodplain soils, impacted abutting structures, minimize surface water elevation changes, and provide ecological habitat.
- Removing floodplain soil exceeding the RAA-4 cleanup level of 1 mg/kg.
- Conveying removed sediment and floodplain soil to a dedicated processing area.
- Dewatering sediment and excavated floodplain soil (as necessary).
- Transporting and disposing the dewatered sediment and soil off-site.
- Removing the T&H Dam.
- Restoring and stabilizing the impacted channel and floodplain soils.
- Restoring access, staging, and processing areas.
- Monitoring and maintenance.
- Implementing ICs as appropriate.

An overview of the areas targeted for sediment and floodplain soil under RAA-4 are illustrated in **Figure 11** and **Figure 13**, respectively.

4.6.2 Removal of Contaminated Sediment

4.6.2.1 Areas and Volumes of Sediment to be Removed

RAA-4 is anticipated to remove PCB-contaminated sediment from approximately 461,017 square feet of area throughout the Phase 1 Reach, as illustrated in **Figure 11**. The average dredge depth is approximately three feet, which results in a total volume of 50,900 cubic yards, as detailed in **Table 14**.

Excluding the T&H Dam impoundment and the former Lewis Chemical facility depositional area, the Phase 1 data suggest the majority of known PCBs are within upper three feet of sediment. The subsurface materials, according to historical boring logs, indicate that the subsurface materials are “dense” and “very dense” sand and gravel that could be either glacial till or stratified sand and gravel. Depth to bedrock varies based upon location. However, bedrock was encountered in some areas within the top foot of sediment. Several isolated pockets of highly concentrated PCB-contaminated sediment are at depths below the three-foot depth interval, and there is additional uncertainty in the depth of contamination, as illustrated in **Figures 12**, **14**, and **15**. However, the risk from contamination at depth to human health and the environment can be mitigated through containment.

4.6.2.2 Sediment Removal Procedures

Contaminated sediment removal will be performed in the same manner as described in RAA-2 and RAA-3.

4.6.2.3 Minimizing Risk Related to Resuspension, Release, and Residuals

The risk of dredging related resuspension, release, and residuals is comparable to RAA-2 and RAA-3. Best management practices to minimize risk will be performed in the same manner as described in RAA-2 and RAA-3.

4.6.3 Removal of Dense Riverbed Soil to Facilitate Dam Removal

4.6.3.1 Areas and Volume of Material to be Removed

Once the highly contaminated sediment in the T&H Dam impoundment is removed, approximately 2,000 cubic yards of consolidated riverbed soil will be dredged in order to remove the T&H Dam and to create a stable channel bottom slope (assumed 10-foot horizontal to 1-foot vertical for planning purposes) between the existing channel grades upstream and downstream of the T&H Dam. As necessary, significant reductions in surface water elevation will be minimized by creating a series of grade control riffles through the regraded channel and dam breach zone. Installation of riffles would improve river functioning, habitat, and could be designed to allow fish passage. Pre-design investigations may be necessary to clarify the extent of contamination.

4.6.3.2 Dense Riverbed Soil Removal Procedures

Riverbed soil beneath the T&H Dam sediment impoundment removal is anticipated to be performed in the same manner as described for contaminated sediment removal (Section 4.4.2.2). Pre-design investigations may be necessary to further evaluate and inform the best technology method to remove the dense riverbed soil.

4.6.4 Capping and Backfilling within the River Channel

4.6.4.1 Capping

After dredging, the construction of a reach-wide permanent cap over the full length of the Phase 1 Reach will occur. The objective of the cap is to prevent PCBs and COPCs that remain at depth from impacting the biologically active zone in the restored riverbed. For the purpose of this EE/CA, the cap has been designed using a Cap Sim model. The modeling results are documented in a memorandum in **Appendix G**.

Conceptually, the cap from top to bottom will consist of:

- A minimum of 3-inches of sand with two percent (2%) activated carbon ("isolation" layer) overlain by a sand filtration layer to mitigate loss of carbon amended sand. For costing purpose, the carbon amended "isolation" layer and sand filtration layer was assumed to have a 6-inch total thickness with 2% activated carbon added to the entire 6-inch layer. Actual cap design may vary but shall be designed to meet cleanup objectives.
- A 12-inch-thick stone armor layer to protect the underlying isolation layer from erosion. The material for this layer will have a median particle size of 4 inches, which will withstand a 500-year flood as described in the Cap Sim modeling results memorandum in **Appendix G.**
- A 9-inch-thick sand habitat restoration layer.

Inputs used in the Cap Sim model for the cap design were based on site-specific conditions, and include the following:

- The highest detected PCB concentration that will remain in place after dredging of three feet of sediment from the full Phase 1 Reach, based on data from the 2023 investigation.
- Porewater data for PCBs measured during the 2023 investigation.
- The bioturbation depth (seven centimeters [cm]) measured during the 2023 investigation.

- An upwelling Darcy velocity of 500 cm/year.[28] This parameter has not been measured at the Site, and is a moderate value assumed based on experience at other sites.

Grading and contouring of the cap are necessary to smooth the cap material into the riverbank to avoid abrupt changes that could lead to disruption. During the NTCRA design phase of the project when additional data are collected to support the design basis, the most appropriate and cost-effective capping method to stabilize sediment will be determined.

More information is available on the preliminary post-dredging cap design and modeling results, which are available in **Appendix G.**

4.6.4.2 Backfilling

Backfilling will occur throughout the entire Phase 1 Reach above the reach-wide cap to stabilize the riverbed, adjacent floodplain soils, impacted abutting structures, minimize surface water elevation changes, and provide ecological habitat.

Similar to RAA-3, a series of grade control riffles through the regraded channel and dam breach zone will be constructed to minimize reductions in surface water elevation due to dam removal.

4.6.5 Removal of Floodplain Soil

4.6.5.1 Areas and Volumes of Floodplain Soil to be Removed

RAA-4 is anticipated to remove contaminated soil from approximately 86,220 square feet of area throughout the Phase 1 Reach floodplain soils, as illustrated on **Figure 13.** As further detailed in the Data Evaluation Summary Memorandum – Phase 1, floodplain soils exceeded the RAA-4 cleanup level of 1 mg/kg in 75 of the 109 locations sampled. The average depth of contamination is estimated to be approximately 1.5 feet, which results in a total volume of 4,700 cubic yards, as detailed in **Table 14**. To prepare the areas for excavation, it is anticipated that approximately 7,722 linear feet of the floodplain soils may require vegetation and tree removal. EPA will seek consent for access prior to conducting work on any property.

4.6.5.2 Floodplain Soil Removal Procedures

Contaminated floodplain soil removal will be performed in the same manner as described in RAA-2 and RAA-3.

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[28] Darcy velocity is the rate at which groundwater moves through a porous medium, and it's sometimes referred to as the "upwelling velocity" when it's moving upward. It's calculated using Darcy's Law, which relates the volume of water flowing through a unit area to the hydraulic conductivity of the medium and the hydraulic gradient (change in head over distance).

4.6.6 Floodplain Restoration

Floodplain soil restoration will be performed in the same manner as described in RAA-2 and RAA-3.

4.6.7 Dewatering and Staging of Removed Sediment and Soil

The dewatering and staging of removed sediment and soil will be performed in the same manner as described in RAA-2 and RAA-3.

4.6.8 Transportation and Disposal of Dewatered Sediment and Soil

T&D of soil and dewatered sediment will be performed in the same manner as described in RAA-2 and RAA-3. As detailed in **Table 14**, RAA-4 soil removal volume estimates are 4,700 cubic yards, which are estimated to weigh approximately 7,100 tons. RAA-4 dredged sediment volume estimates are 50,900 cubic yards, which are estimated to weigh approximately 76,400 tons. Riverbed soil volume estimates are 2,000 cubic yards, which are estimated to weigh approximately 3,000 tons. Combined soil and dewatered sediment tonnage is estimated to be 84,400 tons. RAA-4 is estimated to require 2,800 truckloads of contaminated material transported off site to an EPA-approved disposal facility.

4.6.9 Removal of the T&H Dam

The removal of the T&H Dam will be performed in the same manner as described in RAA-3.

4.6.10 Monitoring and Maintenance

Amended-cap specific monitoring and maintenance will be necessary. The use of amendments may require an intensive monitoring effort during and shortly after placement operations and immediately after unusual events (e.g., severe storms), with a declining level of effort in future years if the remedy is performing as designed (EPA, 2005). Long-term monitoring will be necessary to ensure the integrity and continued effectiveness of the amended cap.

4.6.11 Institutional Controls

Institutional controls will be performed in the same manner as described in RAA-3.

4.6.12 Analysis of RAA-4

4.6.12.1 Effectiveness

RAA-4 is effective in achieving all RAOs. RAA-4 will greatly reduce risks to human health from PCBs and other COPCs in sediment and soil, including reducing the residential and recreational receptor's unacceptable cancer and non-cancer risks pertaining to direct contact with PCBs (RAO 1 and RAO 3). RAA-4 will also generally reduce risks to ecological receptors from PCBs and other COPCs in sediment and soil, (RAO 2 and RAO 4). RAA-4 will remediate the entire Phase 1

Reach sediment bed and replace it with clean materials as well as control potential riverbank and floodplain PCB sources by remediating the areas that exceed 1 mg/kg PCBs. Accordingly, RAA-4 will likely result in acceptable long-term risk to human health and the environment. RAA-4 will remove the potential for an uncontrolled release of contaminated sediment and eroding floodplain soils in the event of dam failure (RAO 5) because the dam will be removed. As sediment and eroding floodplain soils are prone to movement due to hydrodynamic forces, RAA-4 will prevent the transport of PCBs below the RAA-4 cleanup level to both remediated and unremediated areas (RAO 6).

The extent of the remedial investigation within the Phase 1 Reach characterizes about 63,231 cubic yards or 94,910 tons of sediment in total; the riverbed was characterized to an average depth of 3.85 feet. the Total PCB EPC for this volume is 1,425 mg/kg using the 95% UCL statistic. The total mass of PCBs in this volume is around 122,693 kilograms or 270,493 pounds. RAA-4 proposes to reduce this volume by 50,900 cubic yards or by 80%. RAA-4 removes 98,765 kilograms or 217,739 pounds of PCBs from the Neponset River. It is estimated that RAA-4 will lead to an 80% mass reduction of PCBs from within the Phase 1 Reach of the Neponset River Superfund Site.

RAA-4 will likely result in acceptable long-term risk to human health and the environment because the Phase 1 Reach sediment bed will be removed or stabilized beneath the reach-wide permanent cap with up to three feet of backfill. The reach-wide permanent cap will contain remaining PCBs exceeding the RAA-4 cleanup level that extend below the dredge depth. As discussed in Section 4.4.9, the implementation of waterway use restrictions and long-term monitoring will be necessary to protect the integrity and maintain the purpose of the cap in relation to any current and future uses of the Site.

In the short term, RAA-4 is effective in greatly reducing risk to human and ecological receptors by removing and stabilizing the contaminated sediment from the Phase 1 Reach. The risk of entrainment of source areas in the event of dam failure will be removed because the T&H Dam impoundment, former Lewis Chemical facility depositional area, and the T&H Dam will be removed. RAA-4 will also remove restrictions on the flow of the river, reduce the risk of upstream flooding, and improve fish passage.

RAA-4 presents short-term risks to workers during implementation of the removal action. General work near waterways and construction activities presents inherent and significant risk due to the nature of the work. RAA-4 will include on-water and floodplain soils removal work, operations near an active dam, dredging, excavation, vegetation and tree removal, processing and management of hazardous waste, and removal of the T&H Dam, which pose significant risks to construction workers. The use of a site-specific HASP and JHAs will be used to increase worker protectiveness. Only qualified contractors will be allowed to perform work for RAA-4. Continued monitoring and oversight of safety throughout implementation of RAA-4 will be necessary.

RAA-4 also presents short-term risks to the community and the environment during implementation of the removal action. The RAA-4 short-term risks include, but are not limited to:

- Significant temporary disturbance of the riverbed, floodplain soils, and associated ecosystems during the dredging, excavation, backfilling, and capping operations;
- Closure of the Phase 1 Reach to all recreational activities during dredging and floodplain soil removal and restoration work; and
- Increased truck traffic.

The use of traffic plans, restricted access areas, air monitoring, and community outreach and engagement will be used to increase protectiveness of the community.

RAA-4 would include limited treatment of water generated by sediment dredging and dewatering. Additional treatment processes, such as pretreatment, immobilization and solidification/stabilization, and particle size separation may be implemented during processing of contaminated sediment and floodplain soil. While it is not expected, ex situ treatment may be utilized if higher levels of lead or other metals are detected during pre-dredging in situ waste characterization sampling that result in exceedances of TCLP leachate limits to meet TSCA landfill requirements. This alternative will comply, to the extent practicable, with established ARARs. The potential chemical-specific, action-specific, and location-specific ARARs and TBCs are included in **Table 15-1, 15-2,** and **15-3**, respectively, and are summarized in Section 3.1. Location-specific ARARs include federal and state standards to protect floodplain and wetland/aquatic resources. RAA-4 will involve the alteration of floodplain and wetland/aquatic resources, including from dredging, excavation, and potential capping activities. Because significant levels of contamination exist in floodplain soils, EPA has determined that there is no practicable alternative to action within the floodplains. Mitigation measures will be required.

4.6.12.2 Implementability

Implementation of RAA-4 is technically feasible, although physical accessibility challenges are anticipated, as further discussed below. The majority of removal action support materials and services (e.g., barges, excavators, lined roll off trucks, HAZWOPER-trained personnel) are anticipated to be readily available to support the removal action. However, specialized equipment and personnel (e.g., an amphibious excavator and operator) may require additional lead time to obtain. Dredging, excavation, dewatering, and off-site T&D of contaminated sediment and soil are well-established removal action procedures and there are experienced

HAZWOPER-trained contractors capable of performing this work. RAA-4 does not involve the use of innovative or trial remedial technologies that would require specialized and/or limited services or materials.

Challenges to physical accessibility are anticipated due to the Site's location within in a densely populated residential, recreational, and commercial area, and there is limited available shoreline frontage on the river. Low water levels in areas of the river and bridge underpass access (there are four bridges throughout the Phase 1 Reach) may limit access by barges and require the use of specialized amphibious dredging and transportation equipment and/or the construction and eventual removal of gravel work roads in the river. A large staging, dewatering, access, load-out, and water processing area will be necessary to facilitate sediment and soil removal, which is anticipated to require four field seasons. Further, performing work near the active T&H Dam and MBTA tracks will present additional physical accessibility challenges. RAA-4 is administratively feasible, but coordination with property owners to obtain access will likely present administrative issues that will require time to resolve.

RAA-4 ICs (educational outreach, signage, waterway use restrictions, and land use and/or access restrictions) are anticipated to be technically and administratively implementable.

The length of time for RAA-4 is anticipated to be greater than one year due to the substantial efforts necessary to support the removal action, the assumption that dredging will take place during three field seasons, and the required restoration efforts following the action. A detailed conceptual schedule is provided in **Table 18-3**.

RAA-4 is not anticipated to impact the implementability of future investigations and response actions. State and community acceptance will be evaluated after the completion of the public comment period.

4.6.12.3 Cost Estimate

RAA-4 is estimated to cost approximately $78,400,000. A detailed cost estimate for RAA-4 is provided in **Table 17-4**.

5. COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares each of the NTCRA alternatives described and evaluated individually in Section 4. In accordance with EPA guidance for NTCRAs, the comparative analysis evaluates the relative performance of each alternative with respect to the three evaluation criteria: effectiveness, implementability, and cost (EPA, 1993). Although the "No Action" alternative does not meet the RAOs, it is used as a baseline for comparison with the other alternatives.

Key advantages and disadvantages of each alternative relative to one another are described below, along with key tradeoffs that may affect removal action selection.

5.1 EFFECTIVENESS

RAA-1 is not protective. RAA-2 provides limited overall protectiveness of human health or the environment in the short and long term. RAA-3 is anticipated to be protective of human health via direct contact risks in the short term; however, RAA-3 is not anticipated to be to be protective of human health via fish consumption risks. PCBs bioaccumulate in fish, and over time, this buildup of PCBs in tissues can reach levels far higher than those found in the surrounding environment. A full risk assessment will be conducted in the future; however, PCB-contaminated sediment up to 14 mg/kg would likely present a risk to human health and the environment via fish tissue consumption.

Additionally, ecological risks will continue to be unacceptable.[29] Both RAA-3 and RAA-4 are likely more effective than RAA-2 at addressing the long-term risk associated with potential contaminated sediment that may be under the dam foundation and other safety and health risks associated with the T&H Dam. RAA-3 and RAA-4 would also remove any potential for the dam to impair cleanup work downstream of the T&H Dam. Because RAA-4 fully remediates the sediment bed in the Phase 1 Reach, it addresses the unacceptable risk targeted by this removal action and is anticipated to be consistent with a final remedial action for the Phase 1 Reach, pending determinations in a final ROD.

In relation to short-term impacts, RAA-2 presents the least worker-related risk, community impacts, and shortest duration. RAA-3 presents more worker-related risk and community impacts than RAA-2 due to the additional volume of material necessary to ship off site and the removal of the T&H Dam. RAA-4 presents the greatest worker-related risk and community impacts due to the duration of the removal action. However, additional short-term impacts from the final remedy, when considered in combination with the short-term impacts from RAA-2 or RAA-3, would likely be more significant than the short-term impacts from RAA-4. Future

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[29] PCBs are bioaccumulative compounds and present significant risk relative to the fish consumption exposure pathway.

response actions are less likely to be required under RAA-4 because contaminated sediment and floodplain soil presenting a risk to human health and the environment will be removed or stabilized beneath a permanent cap.

RAA-4 is anticipated to be consistent with final remedy requirements. Performing a single comprehensive remedy will avoid duplication of efforts (if short-term actions are selected). Sedimentation will continue to occur over time, thus increasing the amount of sediment that will eventually need removed to address highly contaminated sediment, which is anticipated to significantly increase eventual remedy costs. RAA-2 and RAA-3 do not result in unacceptable risk and future action will be necessary. As such, the major community disturbances (i.e., truck traffic and noise) will occur again when a final remedy is selected.

In the short term, impacts to ecological communities in and adjacent to the Phase 1 Reach would be substantial during the construction work for RAAs 2, 3, and 4. Over the long-term, it is expected that the short-term ecological impacts would be mitigated. RAA-4 is designed to focus on the big picture restoration of the ecological health of the river and reuse opportunities and be a long-term remedy to prevent migration of contaminants downstream into the ecosystem and food web chain.

RAA-1 does not reduce the toxicity, mobility, or volume through treatment, as no treatment is involved. RAAs 2, 3, and 4 include limited treatment, including pretreatment, immobilization and solidification/stabilization, and particle size separation, and treatment of water generated by dewatering of sediment and floodplain soil. Since RAA-4 includes more dredging and dewatering, it has the highest levels of treatment.

The extent of the remedial investigation within the Phase 1 Reach characterizes about 63,231 cubic yards or 94,910 tons of sediment in total; the Total PCB EPC for this volume is 1,425 mg/kg using the 95% UCL statistic. RAA-1 offers no reduction in this volume. RAA-2 proposes to reduce this volume by 22,500 cubic yards or by 36%. RAA-3 proposes to reduce this volume by 27,400 cubic yards or by 44%. RAA-4 proposes to reduce this volume by 50,900 cubic yards or by 80%. RAA-4 removes about 98,765 kilograms or 217,739 pounds of PCBs from the Neponset River.

The extent of the remedial investigation within the Phase 1 Reach characterizes about 4,437 cubic yards of soil in total; the Total PCB EPC for this volume is separated into segments and tabulated in **Table 6.** RAA-1 offers no reduction in this volume. RAA-2 proposes to reduce this volume by 430 cubic yards or by 10%. RAA-3 proposes to reduce this volume by 1,000 cubic yards or by 23%. RAA-4 proposes to reduce this volume by 4,700 cubic yards, which is greater than the estimated volume of the soil that has been characterized by the remedial investigation.

There are no ARARs for RAA-1. Location-specific ARARs include federal and state standards to protect cultural and historical resources, and to protect floodplain and wetland/aquatic resources. RAAs 2, 3, and 4 would involve the alteration of floodplain and wetland/aquatic resources, including from dredging, excavation, and capping activities. Mitigation measures will be required. RAA-4 is considered the least environmentally damaging practicable alternative (LEDPA) for protecting wetland/aquatic habitat at the Phase 1 Reach of the Site because additional invasive dredging and excavation actions are not anticipated to be necessary in future response actions. Consistent with 44 CFR 9, EPA will issue a fact sheet soliciting public comment on its draft LEDPA finding and on its proposed plan to minimize harmful impacts on floodplain resources.

Action-specific ARARs pertaining to RAAs 2, 3, and 4 include TSCA regulations under 40 CFR 761.61(c) for the risk-based management PCB contaminated media. Risks from PCB-contaminated media would be addressed to differing degrees under the alternatives. As part of this EE/CA, EPA is making a draft TSCA determination that the recommended removal action alternative will not pose an unreasonable risk or injury to health or the environment, subject to conditions as outlined in Section 7.

5.2 IMPLEMENTABILITY

RAA-1 is the easiest to implement because there is no associated action. RAAs 2, 3, and 4 can all be implemented with existing technologies and equipment that are typically used for dredging, excavating, and dewatering of contaminated sediment and soil. Transportation equipment is available for the safe and compliant off-site transportation of the dewatered materials.

Physical accessibility and administrative challenges are anticipated under RAAs 2, 3, and 4. However, RAA-2 will be easier to implement in comparison to RAA-3 and RAA-4 because there is not a dam removal component. RAA-3 and RAA-4 include removal of the T&H dam and are anticipated to endure additional implementation challenges. Generally, implementation challenges are directly related to the amount of material managed (i.e., RAA-2 may fewer less administrative and physical access challenges than RAA-3. RAA-3 may have fewer administrative and physical access challenges than RAA-4). However, in the context of the overall Site response, implementability challenges associated with RAA-2 and RAA-3 may be greater than for RAA-4 due to the need to implement future response actions in the Phase 1 Reach under RAA-2 and RAA-3, during which similar technical and administrative challenges are expected. Additionally, RAA-2 and RAA-3 may interfere with potential future investigations and response actions if response actions are deemed necessary as resampling will likely be required and temporary caps may need removed.

Each of the RAA's ICs are anticipated to be implementable to a similar degree. None of the RAAs are anticipated to be completed within a one-year timeframe. State and community acceptance will be evaluated after the completion of the public comment period.

5.3 COST

The estimated 30-year net present worth costs for each of the RAA are:

▪ RAA-1: No Action (included for comparison purposes)	$0
▪ RAA-2: Hotspot removal and temporary containment	$29,900,000
▪ RAA-3: Targeted removal, temporary containment, and dam removal	$41,000,000
▪ RAA-4: Comprehensive removal, permanent in situ amendment cap, and dam removal	$78,400,000

RAA-1 has the lowest cost because there is no action. The cost of RAA-2, RAA-3, and RAA-4 increase relative to volume of sediment and floodplain soil removed and disposed of off-site. While RAA-4 has the highest costs, future costs associated with addressing the Phase 1 Reach will be minimal due to the comprehensiveness of this alternative. Under RAA-2 and RAA-3, future response actions will be required to address remaining risks. In addition, the temporary containment components of RAA-2 and RAA-3 are anticipated to result in additional costs to the future long-term remedial action due to their impact on future investigations and response actions. Due to the mobility of sediment during normal flow conditions, resampling will likely be required to delineate the future extent of contamination prior to the onset of any future remedial actions. Additionally, all costs relative to mobilization, construction of support infrastructure, and demobilization will be incurred again once a cleanup level reflective of acceptable long-term risk to human health and the environment is selected.[30] RAA-4 may be the most cost-effective in the long term in consideration of future response action costs necessary to address long-term risk.

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[30] Site preparation (i.e., mobilization costs) for the RAAs alone range from $5.1M - $7.5M.

6. STATUTORY LIMITS OF NON-TIME-CRITICAL REMOVAL ACTIONS

CERCLA Section 104(c)(1) and 40 CFR Section 300.415(b)(5) state that removal actions funded by the Hazardous Substance Superfund established by 26 U.S. Code § 9507 may not exceed $2 million or 12 months unless EPA determines that either of the following exemptions apply:

- There is an immediate risk to public health or welfare of the United States or the environment; continued response actions are immediately required to prevent, limit, or mitigate an emergency; and such assistance will not otherwise be provided on a timely basis (the "emergency exemption"); or
- Continued response action is otherwise appropriate and consistent with the remedial action to be taken (the "consistency exemption").

The three active removal action alternatives (RAAs 2, 3, and 4) described in this EE/CA all have estimated costs that exceed $2 million and will require greater than 12 months to complete. These statutory limits do not apply if the NTCRA is funded and implemented by potentially responsible parties. If the action proceeds fund-lead, both the emergency exemption and the consistency exemption apply.

PCBs and other COPC in sediment and floodplain soil pose an immediate risk to human health and the environment from exposure to contaminants by users of the Phase 1 Reach, which is in a densely populated and highly recreated area. Further, the risk is compounded by the potential for sudden and uncontrolled release of highly contaminated material from failure of the T&H Dam, which is currently rated in poor condition. If the NTCRA is not performed, remedial action to address these risks is not expected to take place for years, so assistance in mitigating these risks would not otherwise be provided on a timely basis. Therefore, the emergency exemption would apply to this action.

Implementation of RAA-4, the recommended removal action alternative, would be consistent with future remedial actions likely to be implemented at the Site, so the consistency exemption would also be appropriate if RAA-4 is selected.

7. RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based on the comparative analysis in Section 5, RAA-4 was selected as the recommended removal action alternative. RAA-4 represents the best balance between the evaluation criteria of effectiveness, implementability, and cost. RAA-4 is the only alternative that attains the RAOs. The additional cost for RAA-4, as opposed to RAAs 2 and 3, is not considered to be large enough to outweigh the completeness, permanence, and cost-effectiveness of RAA-4 in consideration of the long-term remedial strategy for the Site. In accordance with CERCLA Section 104(a)(2), RAA-4 would best contribute to the efficient performance of any long-term remedial action to be taken. If RAA-4 is chosen, the likelihood that EPA would need to have a significant mobilization during the remedial action to address any remaining threats in the Phase 1 Reach is minimal.

EPA is specifically requesting public comment concerning the following specific proposed findings and determinations, which are being made relative to specific requirements under the Clean Water Act, federal Floodplain Management and Wetland Protection regulations, and TSCA requirements.

- EPA has determined that because significant levels of contamination exist in sediments and soil within cleanup areas, there is no practicable alternative to conducting work in these wetlands or in the river. EPA has determined that the RAA-4 removal activities that impact waterways and wetlands are the least environmentally damaging practicable alternative due to the harmful impacts from contamination present in the aquatic environment and when taking into consideration the potential impacts of additional future response actions in the Phase 1 Reach that may be selected as part of a future final remedy. A one-time removal of contamination from the waterways, including in wetlands, is environmentally preferable in comparison to multiple remediation events, which are likely to be necessary following RAA-2 and RAA-3. RAA-4, which is anticipated to be consistent with a final remedy for the Phase 1 Reach, including wetlands along the reach, minimizes the repeated disturbance to wetland hydrology, vegetation, and habitat integrity. Site cleanup activities will be designed and implemented to minimize the destruction, loss, or degradation of these onsite wetlands and aquatic habitats and will preserve and enhance their beneficial values. Wetlands will be restored and/or replicated nearby consistent with the requirements of federal and state wetlands protection standards. If any wetlands are affected by excavation and fill replacement, wetlands to the extent practicable will be restored at the same surface elevation as pre-existing wetlands.
- RAA-4 includes activities that result in the occupancy and modification of wetlands and the 100- and 500-year floodplain. Before selecting a cleanup alternative, federal regulations at 44 CFR Part 9, implementing requirements under Executive Order 11988 (Floodplain Management) requires EPA to make a determination that there is no practicable alternative to the proposed actions within the wetlands and floodplain and to solicit public comment regarding proposed alterations to floodplain resources. EPA

has determined that there is no practicable alternative to occupancy and/or modification of portions of wetlands and floodplain in the immediate vicinity of the Site. However, EPA will minimize harmful impacts on floodplain resources to the extent practicable, and utilize best management practices, which will be determine during design of the removal action. Where floodplain soils are excavated, the floodplain and riverbanks will be reconstructed such that it is stable and resistant to erosion under normal and high flow conditions while also supporting future ecological habitat.

- EPA has determined that the PCB-contaminated sediment and floodplain soil meet the definition of a PCB remediation waste as defined under 40 CFR 761.3. Therefore, the PCB-contaminated sediment and soil are regulated for cleanup and disposal under federal regulations at 40 CFR Section 761. Under 40 CFR 761.61(c), EPA may authorize disposal of PCBs in a manner not otherwise prescribed, provided that EPA determines that the disposal will not pose an unreasonable risk of injury to health or the environment. Under the recommended removal action alternative, approximately 56,000 cubic yards of contaminated sediment and floodplain soil above the cleanup level of 1 mg/kg will be removed, dewatered, and disposed of off-site. The cleanup level was derived based on streamlined risk evaluations that concluded that PCBs in the Phase 1 Reach pose an unacceptable risk to human and ecological receptors from exposure to contaminated sediment and floodplain soil. EPA has made a draft determination that the recommended removal action alternative does not result in an unreasonable risk of injury to health or the environment as long as the following conditions are met:

    1. Compliance with water quality and turbidity performance standards specified in EPA-approved workplans are maintained.

    2. The channel is backfilled and/or capped with clean, suitable material of sufficient thickness to isolate the PCB remediation waste physically, chemically, and biologically from the surrounding benthic environment. A bathymetric survey shall be performed upon completion of the channel restoration.

    3. All caps are monitored to demonstrate their physical, chemical, and biological quality. This monitoring shall include bathymetric surveys, chemical sampling, and sediment camera work as appropriate. The frequency of this monitoring will be determined in an EPA-approved workplan.

    4. An annual report summarizing the cap monitoring shall be submitted to EPA beginning with placement of the cap material. This report shall include a summary discussion of all activities associated with the cap placement or cap monitoring, and shall include, if necessary, any recommendations for corrective action to maintain the physical, chemical, or biological quality of the cap.

    5. Corrective actions recommended in the annual reports, or alternatively, those required by EPA based on information in the annual reports, shall be implemented in a timely manner. Corrective actions may include, but are not limited to, installation of additional engineering controls or removal and disposal of PCB remediation waste

from the Site if information indicates that the remedy is not effective in isolating and/or controlling migration of PCBs from the Site.

6. The EPA shall coordinate with federal, state, and local entities to ensure that any as-built cap locations become included in all future navigational or waterway charts with any other required navigational or anchorage controls.
7. All dredged and excavated sediment and floodplain soil is disposed of in accordance with TSCA based on in situ PCB concentrations and not subject to dilution.
8. Engineering controls for the collection and management of liquids from dewatering of sediment and floodplain soils, surface water runoff, dust suppression water, and decontamination water shall be used during dredging, excavation, storage, dewatering, and decontamination activities to ensure that the PCB concentrations in any dewatered liquids, surface water runoff, dust suppression water, and decontamination water from the Site comply with applicable discharge requirements prior to discharge to a publicly owned treatment works or to surface water.
9. Decontamination procedures for excavation equipment and other moveable equipment and vehicles shall be established to ensure that equipment and vehicles are appropriately decontaminated prior to leaving each work area.
10. Engineering controls for dust suppression shall be used during excavation activities. An Air Quality Management and Monitoring Plan shall be developed that includes the following: means and methods used to perform the excavation and waste handling that minimizes airborne particulates; air monitoring procedures, parameters, and detection limits; air action levels; and corrective measures. Air monitoring and dust suppression measures for PCBs shall be maintained until all removal activities are complete, including dredging, excavation, capping, backfilling, and transport of PCB-contaminated sediment and soil.

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Table 14
Area, Volume, and Tonnage Summary For Each Removal Action Alternative
Phase 1 Reach, Lower Neponset River Superfund Site

Removal Action Alternative		Sediment				Riverbank Soil					Riverbed Soil[a]				Total (Rounded)	
		Area (ft^2)	Avg. Depth (ft)	Volume (yd^3)	Weight (Ton)	Length Along Riverbank (ft)	Area (ft^2)	Avg. Depth (ft)	Volume (yd^3)	Weight (Ton)	Area (ft^2)	Avg. Depth (ft)	Volume (yd^3)	Weight (Ton)	Volume (yd^3)	Weight (Ton)
RAA-1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RAA-2		224,325	2.7	22,500	33,800	820	8,315	1.5	430	650	-	-	-	-	22,900	34,400
RAA-3		299,868	2.5	27,400	41,100	1,979	20,325	1.4	1,000	1,500	9,420	7.5	2,600	3,900	31,000	46,500
RAA-4	Full Reach 1	443,443	3.0	49,300	74,000	7,722	86,220	1.5	4,700	7,100	9,420	5.7	2,000	3,000	56,000	84,000
	Additional at Lewis Chem.[b]	17,574	2.5	1,600	2,400											
	Total			50,900	76,400											

Notes: [a] Riverbed soil is the additional material to be removed for regrading the river channel upstream of the T&H Dam. The volume of this material is greaterfor RAA-3 than for RAA-4 because the depth of dredging prior to removal of the riverbed soil near the dam is greater for RAA-4 than for RAA-3.

[b] Additional dredging on the north side of the river adjacent to the former Lewis Chemical facility is included because of the elevated deposition that would remain after 3 ft of dredging in that area.

Table 15-1
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Chemical-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Chemical-Specific				
Federal				
Cancer Slope Factors (CSFs)	EPA Integrated Risk Information System	TBC	Guidance values used to evaluate the potential carcinogenic hazards caused by exposure to PCBs.	CSFs have been used to compute the individual cancer risk resulting from exposure to carcinogens in site media
Reference Doses (RfDs)	EPA Integrated Risk Information System	TBC	Guidance values used to evaluate the non-cancer hazards associated with exposure to PCBs.	RfDs have been used to characterize human health risks due to non-carcinogens in site media.
PCBs: Cancer Dose Response Assessment and Application in Environmental Mixtures (EPA 1996)	EPA/600/P-96/001F (National Center for Environmental Assessment, Office of Research and Development, September 1996)	TBC	Guidance describing EPA's reassessment regarding the carcinogenicity of PCBs	The guidance has been used in characterization of site risks.
Guidelines for Carcinogenic Risk Assessment (EPA, 2005)	EPA/630/P-03/001F (EPA Risk Assessment Forum, March 2005)	TBC	Framework and guidelines for assessing potential cancer risks from exposure to pollutants and other environmental agents.	Guidelines have been used in assessing risk.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (EPA Risk Assessment Forum, March 2005)	TBC	Guidance on issues related to assessing cancer risks associated with early-life exposures, including an adjustment for carcinogens acting through a mutagenic mode of action.	Guidance has been used in assessing risks.

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Location-Specific				
Federal				
Floodplain Management and Protection of Wetlands	44 CFR Part 9	Relevant and Appropriate	Federal Emergency Management Agency (FEMA) regulations set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands). These regulations prohibit activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use. These regulations require the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplains and require the avoidance of development within a floodplain wherever there is a practicable alternative.	If there is no practicable alternative method to work in federal jurisdictional wetlands, or 100-year or 500-year floodplains, then all practicable measures will be taken to minimize and mitigate any adverse impacts. Appropriate avoidance, minimization, mitigation, and/or restoration will be taken to the extent practicable. Public comment will be solicited on the proposed impacts to federal floodplain and wetland resources.
Clean Water Act Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material and regulations	33 USC § 1344 40 CFR Part 230-231 33 CFR 320-323	Applicable	Outlines requirements for the discharge of dredged or fill material into surface waters, including wetlands. Such discharges are not allowed if there are practicable alternatives with less adverse impact. Discharge cannot cause or contribute to violation of state water quality standards or toxic effluent standards or jeopardize threatened or endangered species; discharge cannot significantly degrade waters of U.S.; practicable steps must be taken to minimize and mitigate adverse impacts; and impacts on flood level, flood velocity, and flood storage capacity must be evaluated. Sets standards for restoration and mitigation required as a result of unavoidable impacts to aquatic resources. EPA must determine	Any removal action will comply with this ARAR to the extent practicable through appropriate avoidance, minimization, mitigation, and/or restoration. EPA shall determine that the selected alternative is the least environmentally damaging practicable alternative because (a) there is no practicable alternative method that will achieve cleanup objectives with less adverse impact and (b) all practicable measures would be taken to minimize and mitigate any adverse impacts from the work. Public comment will be solicited on EPA's draft LEDPA determination.

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) to protect wetland and aquatic resources.	
National Historic Preservation Act and regulations	54 USC § 300101 *et seq.* 36 CFR Part 800	Potentially Applicable	Establishes a requirement for federal agencies to take into account the effect of any federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places	If this removal action affects historic properties/structures subject to these requirements, activities will be coordinated with the state, tribal, and federal authorities and conducted in accordance with the substantive requirements of these regulations to the extent practicable.
Preservation of Historical and Archeological Data and regulations	54 USC § 312501 *et seq.* 43 CFR Part 7	Potentially Applicable	Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alterations of terrain as a result of a federal construction project or a federally licensed activity program.	If during the removal action, it is determined that this removal action may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archaeological data, EPA will notify state, tribal, or federal authorities and comply with the substantive requirements in the statute and regulations to the extent practicable.
Endangered Species Act and regulations	16 USC § 1531 *et seq.* 50 CFR 17.11-17.12 and Part 402	Potentially Applicable	Provides for protection and conservation of various species of fish, wildlife, and plants. Establishes requirements for actions to conserve endangered species within critical habitats upon which endangered species depend. If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. FWS or the National Marine Fisheries Service must be consulted.	Endangered species were not observed at the site during the site investigation. If, however, threatened or endangered species or critical habitat are identified, removal action will comply with the substantive requirements in the statute and regulations to the extent practicable.
Fish and Wildlife Coordination Act and regulations	16 USC 661 *et seq.* 40 CFR 2 6:302(g)	Applicable	Requires consideration of the effects of a proposed action on wetlands and areas affecting streams (including floodplains), as well as other protected habitats. Federal agencies must consult with USFWS prior to authorizing any modification of any stream or other water body and requires	This removal action will modify a water body as provided under the Act. Any removal activities subject to these provisions will comply with any substantive requirements to the extent practicable.

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			adequate consideration to protect fish and wildlife resources and their habitats.	
State				
Massachusetts Wetland Protection Act and regulations	MGL c. 131 § 40 310 CMR 10.00 (including but not limited to 10.51-10.60)	Applicable	These regulations set performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resources areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Any temporary disturbances of a wetland during removal or monitoring will be restored. Mitigation of impacts on wetlands will be addressed.
Public Waterfront Act Waterway and regulations	MGL c. 91, § 1.00 *et seq.* 310 CMR 9	Applicable	The statute establishes the State's ownership and management of submerged, intertidal, and filled tidal land and non-tidal rivers and streams throughout the State. Applicable regulatory provisions include Restrictions on Fill and Structures 9.32(l)(a)(2)(b)(4)(b); Preserving Water-Related Public Rights 9.35(1), (2)(a and b) and (3)(b), 3(a); Protecting Water Dependent Uses 9.36(3); Engineering and Construction Standards 9.37(l)(c); and Dredging and Dredged Material Disposal 9.40(2), (3)(a), (4).	Any placement of structures and fill, changes in use of existing licensed structures and fill, and dredging in state waterways will meet the substantive requirements of the statute and regulations, to the extent practicable
Massachusetts Clean Water Act; Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material	MGL c. 21, §§ 26-53 314 CMR 9.00 (including but not limited to 9.06 and 9.07)	Applicable	Regulates discharges of dredged or fill material to protect aquatic ecosystems.	The effects of removal activities on the aquatic ecosystem will be evaluated and avoided, and/or minimized. Compensatory mitigation will need to be performed as necessary to comply with this ARAR, to the extent practicable through appropriate avoidance, minimization and/or restoration.
Massachusetts Hazardous Waste	310 CMR 30.701	Applicable	This regulation sets forth criteria for siting hazardous facilities within land subject to flooding	To the extent any hazardous waste is generated during the removal activities, the waste will be

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Regulations, Location Standards for Land Subject to Flooding			(as defined under the Massachusetts Wetland Protection Act standards). Any new or expanded hazardous waste storage or treatment facility (which only receives hazardous waste from on-site sources), the active portion of which is located within the boundary of land subject to flooding from the statistical 100-year frequency storm, shall be flood-proofed. Flood-proofing shall be designed, constructed, operated, and maintained to prevent floodwaters from coming into contact with hazardous waste.	managed so that it will not impact floodplain resources. The removal action does not include disposal of hazardous waste on-site. These provisions will be potentially applicable for the temporary management of dredged materials before such materials are taken for off-site disposal.
Massachusetts Endangered Species Regulations	321 CMR 10.00 (including but not limited to 10.03, 10.04, 10.05, and 10.06)	Potentially Applicable	Requires action to regulate the impact to state listed endangered or threatened species or their habitats. Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.	If endangered species or habitats in the removal areas are identified, removal activities would be designed and implemented to avoid affects endangered or threatened species or their habitats to the extent practicable.
Massachusetts Antiquities Act; Massachusetts Historical Commission Regulations; Protection of Properties Included in the State Register of Historic Places	MGL c. 9, §§ 26-27C 950 CMR 70.00 and 71.00	Potentially Applicable	Projects must eliminate, limit, or mitigate adverse effects to properties listed in the State Register of Historic Places (historic and archaeological properties). Establishes coordination with the National Historic Preservation Act.	If during removal action activities, historic buildings and or structures are encountered, the substantive requirements in the statute and regulations will be complied with to the extent practicable.

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Action-Specific				
Federal				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC § 6904 *et seq.* 40 CFR Parts 260 to 262	Applicable	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. Dredged material may be subject to RCRA regulations if it contains a listed waste, or if it displays a hazardous waste characteristic, for example Toxicity Characteristic Leaching Procedure (TCLP) limits.	Any wastes generated by the removal action will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated material meeting characteristic hazardous waste standards will be managed and disposed of consistent with these requirements to the extent practicable.
Clean Water Act and National Pollution Discharge Elimination System (NPDES) Regulations	33 USC § 1342 40 CFR 122 (including but not limited to 122.3(d) and 122.44(a) and (e)) 40 CFR 125.1-125.3	Applicable	These standards include that point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards.	Any water generated during removal activities, including during dewatering of dredged sediment and riverbank soils, will be treated to meet these standards before discharge to surface waters.
Toxic Substances Control Act (TSCA) Regulations on cleanup of PCB Remediation Wastes	40 CFR 761.61(c)	Applicable	This section of the TSCA regulations provides risk-based cleanup and disposal options for PCB remediation waste based on the risks posed by the concentrations at which the PCBs are found through a TSCA determination. Requires demonstration that cleanup method will not pose an unreasonable risk of injury to human health or the environment.	The management and disposal of PCB remediation waste as part of the removal action will be in accordance with a TSCA risk-based determination, which finds that the removal will not pose an unreasonable risk of injury to human health or the environment provided certain conditions are met.
TSCA Regulations on Discharge of PCB-Containing Water	40 CFR 761.50 (a)(3)	Applicable	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 mg/L or discharge is in accordance with NPDES discharge limits.	Any discharge to navigable waters will comply with this provision to the extent practicable.

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
TSCA Regulations on Decontamination	40 CFR 761.79	Applicable	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and other types of surfaces.	To the extent the removal action involves decontamination activities, including of equipment and materials contaminated with PCBs during the removal action, these requirements will be complied with to the extent practicable.
Clean Air Act, Section 112(b)(1), National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	42 USC § 7412(b)(1) 40 CFR Part 61	Applicable	Establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Monitoring of air emissions during removal activities, including dredging, dewatering, and transportation will be performed to assess compliance with the substantive requirements of these standards to the extent practicable.
Clean Water Act Section 304(a) National Recommended Water Quality Criteria	National Recommended Water Quality Criteria: 002, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	To Be Considered	NRWQC are health-based criteria developed for chemical constituents in surface water. They have been developed to protect aquatic life and human health from harmful effects due to exposure to chemically impacted surface water. Performance standards to be used for monitoring surface water and sediment during removal activities.	This guidance will be considered in developing monitoring standards for removal activities that may impact surface water quality.
EPA Contaminated Sediment Remediation Guidance	EPA-540-R-05-012 OSWER 9355.0-85 (Dec. 2005)	To Be Considered	Guidance for making remedy decisions for contaminated sediment sites.	This guidance was considered in selecting the removal action and will be considered in addressing contaminated sediment during performance of the removal action, including during mechanical dredging, dewatering, and placement of contaminated sediments.
Guide to Management of Investigation-Derived Waste	EPA OSWER Publication 9345.3-03 FS (Jan. 1992)	To Be Considered	Management of Investigation-Derived Waste (IDW) must ensure protection of human health and the environment	This guidance will be considered to ensure IDW will be managed in a manner to protect human health and the environment.
State				

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Location-Specific				
Federal				
Floodplain Management and Protection of Wetlands	44 CFR Part 9	Relevant and Appropriate	Federal Emergency Management Agency (FEMA) regulations set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands). These regulations prohibit activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use. These regulations require the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplains and require the avoidance of development within a floodplain wherever there is a practicable alternative.	If there is no practicable alternative method to work in federal jurisdictional wetlands, or 100-year or 500-year floodplains, then all practicable measures will be taken to minimize and mitigate any adverse impacts. Appropriate avoidance, minimization, mitigation, and/or restoration will be taken to the extent practicable. Public comment will be solicited on the proposed impacts to federal floodplain and wetland resources.
Clean Water Act Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material and regulations	33 USC § 1344 40 CFR Part 230-231 33 CFR 320-323	Applicable	Outlines requirements for the discharge of dredged or fill material into surface waters, including wetlands. Such discharges are not allowed if there are practicable alternatives with less adverse impact. Discharge cannot cause or contribute to violation of state water quality standards or toxic effluent standards or jeopardize threatened or endangered species; discharge cannot significantly degrade waters of U.S.; practicable steps must be taken to minimize and mitigate adverse impacts; and impacts on flood level, flood velocity, and flood storage capacity must be evaluated. Sets standards for restoration and mitigation required as a result of unavoidable impacts to aquatic resources. EPA must determine	Any removal action will comply with this ARAR to the extent practicable through appropriate avoidance, minimization, mitigation, and/or restoration. EPA shall determine that the selected alternative is the least environmentally damaging practicable alternative because (a) there is no practicable alternative method that will achieve cleanup objectives with less adverse impact and (b) all practicable measures would be taken to minimize and mitigate any adverse impacts from the work. Public comment will be solicited on EPA's draft LEDPA determination.

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) to protect wetland and aquatic resources.	
National Historic Preservation Act and regulations	54 USC § 300101 *et seq.* 36 CFR Part 800	Potentially Applicable	Establishes a requirement for federal agencies to take into account the effect of any federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places	If this removal action affects historic properties/structures subject to these requirements, activities will be coordinated with the state, tribal, and federal authorities and conducted in accordance with the substantive requirements of these regulations to the extent practicable.
Preservation of Historical and Archeological Data and regulations	54 USC § 312501 *et seq.* 43 CFR Part 7	Potentially Applicable	Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alterations of terrain as a result of a federal construction project or a federally licensed activity program.	If during the removal action, it is determined that this removal action may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archaeological data, EPA will notify state, tribal, or federal authorities and comply with the substantive requirements in the statute and regulations to the extent practicable.
Endangered Species Act and regulations	16 USC § 1531 *et seq.* 50 CFR 17.11-17.12 and Part 402	Potentially Applicable	Provides for protection and conservation of various species of fish, wildlife, and plants. Establishes requirements for actions to conserve endangered species within critical habitats upon which endangered species depend. If a location contains a federal endangered or threatened species or its critical habitat, and an action may impact the species or its habitat, the U.S. FWS or the National Marine Fisheries Service must be consulted.	Endangered species were not observed at the site during the site investigation. If, however, threatened or endangered species or critical habitat are identified, removal action will comply with the substantive requirements in the statute and regulations to the extent practicable.
Fish and Wildlife Coordination Act and regulations	16 USC 661 *et seq.* 40 CFR 2 6:302(g)	Applicable	Requires consideration of the effects of a proposed action on wetlands and areas affecting streams (including floodplains), as well as other protected habitats. Federal agencies must consult with USFWS prior to authorizing any modification of any stream or other water body and requires	This removal action will modify a water body as provided under the Act. Any removal activities subject to these provisions will comply with any substantive requirements to the extent practicable.

Table 15-2

Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria

Phase 1 Reach – Lower Neponset River Superfund Site

Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			adequate consideration to protect fish and wildlife resources and their habitats.	
State				
Massachusetts Wetland Protection Act and regulations	MGL c. 131 § 40 310 CMR 10.00 (including but not limited to 10.51-10.60)	Applicable	These regulations set performance standards for dredging, filling, altering of inland wetland resource areas and sets buffer zones within 100 feet of vegetated wetland and 200 feet from a perennial stream. The standards include mitigation requirements for alteration of regulated wetland resources areas. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, and riverfront.	Any temporary disturbances of a wetland during removal or monitoring will be restored. Mitigation of impacts on wetlands will be addressed.
Public Waterfront Act Waterway and regulations	MGL c. 91, § 1.00 *et seq.* 310 CMR 9	Applicable	The statute establishes the State's ownership and management of submerged, intertidal, and filled tidal land and non-tidal rivers and streams throughout the State. Applicable regulatory provisions include Restrictions on Fill and Structures 9.32(l)(a)(2)(b)(4)(b); Preserving Water-Related Public Rights 9.35(1), (2)(a and b) and (3)(b), 3(a); Protecting Water Dependent Uses 9.36(3); Engineering and Construction Standards 9.37(l)(c); and Dredging and Dredged Material Disposal 9.40(2), (3)(a), (4).	Any placement of structures and fill, changes in use of existing licensed structures and fill, and dredging in state waterways will meet the substantive requirements of the statute and regulations, to the extent practicable
Massachusetts Clean Water Act; Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material	MGL c. 21, §§ 26-53 314 CMR 9.00 (including but not limited to 9.06 and 9.07)	Applicable	Regulates discharges of dredged or fill material to protect aquatic ecosystems.	The effects of removal activities on the aquatic ecosystem will be evaluated and avoided, and/or minimized. Compensatory mitigation will need to be performed as necessary to comply with this ARAR, to the extent practicable through appropriate avoidance, minimization and/or restoration.
Massachusetts Hazardous Waste	310 CMR 30.701	Applicable	This regulation sets forth criteria for siting hazardous facilities within land subject to flooding	To the extent any hazardous waste is generated during the removal activities, the waste will be

Table 15-2
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Location-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Regulations, Location Standards for Land Subject to Flooding			(as defined under the Massachusetts Wetland Protection Act standards). Any new or expanded hazardous waste storage or treatment facility (which only receives hazardous waste from on-site sources), the active portion of which is located within the boundary of land subject to flooding from the statistical 100-year frequency storm, shall be flood-proofed. Flood-proofing shall be designed, constructed, operated, and maintained to prevent floodwaters from coming into contact with hazardous waste.	managed so that it will not impact floodplain resources. The removal action does not include disposal of hazardous waste on-site. These provisions will be potentially applicable for the temporary management of dredged materials before such materials are taken for off-site disposal.
Massachusetts Endangered Species Regulations	321 CMR 10.00 (including but not limited to 10.03, 10.04, 10.05, and 10.06)	Potentially Applicable	Requires action to regulate the impact to state listed endangered or threatened species or their habitats. Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.	If endangered species or habitats in the removal areas are identified, removal activities would be designed and implemented to avoid affects endangered or threatened species or their habitats to the extent practicable.
Massachusetts Antiquities Act; Massachusetts Historical Commission Regulations; Protection of Properties Included in the State Register of Historic Places	MGL c. 9, §§ 26-27C 950 CMR 70.00 and 71.00	Potentially Applicable	Projects must eliminate, limit, or mitigate adverse effects to properties listed in the State Register of Historic Places (historic and archaeological properties). Establishes coordination with the National Historic Preservation Act.	If during removal action activities, historic buildings and or structures are encountered, the substantive requirements in the statute and regulations will be complied with to the extent practicable.

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Action-Specific				
Federal				
Resource Conservation and Recovery Act (RCRA) Subtitle C; Hazardous Waste Identification and Listing Regulations; Generator and Handler Requirements	42 USC § 6904 *et seq.* 40 CFR Parts 260 to 262	Applicable	Federal standards used to identify, manage, and dispose of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. Dredged material may be subject to RCRA regulations if it contains a listed waste, or if it displays a hazardous waste characteristic, for example Toxicity Characteristic Leaching Procedure (TCLP) limits.	Any wastes generated by the removal action will be analyzed under these standards to determine whether they are characteristic hazardous waste. Non-hazardous materials will be disposed appropriately. All contaminated material meeting characteristic hazardous waste standards will be managed and disposed of consistent with these requirements to the extent practicable.
Clean Water Act and National Pollution Discharge Elimination System (NPDES) Regulations	33 USC § 1342 40 CFR 122 (including but not limited to 122.3(d) and 122.44(a) and (e)) 40 CFR 125.1-125.3	Applicable	These standards include that point source discharge must meet technology-based effluent limitations (including those based on best available technology for toxic and non-conventional pollutants and those based on best conventional technology for conventional pollutants) and effluent limitations and conditions necessary to meet state water quality standards.	Any water generated during removal activities, including during dewatering of dredged sediment and riverbank soils, will be treated to meet these standards before discharge to surface waters.
Toxic Substances Control Act (TSCA) Regulations on cleanup of PCB Remediation Wastes	40 CFR 761.61(c)	Applicable	This section of the TSCA regulations provides risk-based cleanup and disposal options for PCB remediation waste based on the risks posed by the concentrations at which the PCBs are found through a TSCA determination. Requires demonstration that cleanup method will not pose an unreasonable risk of injury to human health or the environment.	The management and disposal of PCB remediation waste as part of the removal action will be in accordance with a TSCA risk-based determination, which finds that the removal will not pose an unreasonable risk of injury to human health or the environment provided certain conditions are met.
TSCA Regulations on Discharge of PCB-Containing Water	40 CFR 761.50 (a)(3)	Applicable	Prohibits discharge of water containing PCBs to navigable waters unless PCB concentration is < 3 mg/L or discharge is in accordance with NPDES discharge limits.	Any discharge to navigable waters will comply with this provision to the extent practicable.

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
TSCA Regulations on Decontamination	40 CFR 761.79	Applicable	Establishes decontamination standards and procedures for removing PCBs from water, organic liquids, and other types of surfaces.	To the extent the removal action involves decontamination activities, including of equipment and materials contaminated with PCBs during the removal action, these requirements will be complied with to the extent practicable.
Clean Air Act, Section 112(b)(1), National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	42 USC § 7412(b)(1) 40 CFR Part 61	Applicable	Establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	Monitoring of air emissions during removal activities, including dredging, dewatering, and transportation will be performed to assess compliance with the substantive requirements of these standards to the extent practicable.
Clean Water Act Section 304(a) National Recommended Water Quality Criteria	National Recommended Water Quality Criteria: 002, EPA-822-R-02-047, USEPA, Office of Water, Office of Science and Technology (Nov. 2002)	To Be Considered	NRWQC are health-based criteria developed for chemical constituents in surface water. They have been developed to protect aquatic life and human health from harmful effects due to exposure to chemically impacted surface water. Performance standards to be used for monitoring surface water and sediment during removal activities.	This guidance will be considered in developing monitoring standards for removal activities that may impact surface water quality.
EPA Contaminated Sediment Remediation Guidance	EPA-540-R-05-012 OSWER 9355.0-85 (Dec. 2005)	To Be Considered	Guidance for making remedy decisions for contaminated sediment sites.	This guidance was considered in selecting the removal action and will be considered in addressing contaminated sediment during performance of the removal action, including during mechanical dredging, dewatering, and placement of contaminated sediments.
Guide to Management of Investigation-Derived Waste	EPA OSWER Publication 9345.3-03 FS (Jan. 1992)	To Be Considered	Management of Investigation-Derived Waste (IDW) must ensure protection of human health and the environment	This guidance will be considered to ensure IDW will be managed in a manner to protect human health and the environment.
State				

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Massachusetts Surface Water Quality Standards	MGL c. 21, §§ 26-53 314 CMR 4.00 (including but not limited to 4.03, 4.04, 4.05, and 4.06)	Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected. Minimum water quality criteria required to sustain the designated uses of Massachusetts surface waters are established.	Any water discharged to surface waters from the removal action will be treated to meet the substantive discharge standards to the extent practicable.
Solid Waste Management Regulations	310 CMR 19.000	Applicable	Regulations for storage, transfer, processing, treatment, disposal, use and reuse of solid waste.	Any wastes generated by removal action activities that are determined to not be hazardous wastes will be managed in accordance with these regulations.
Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Waste	310 CMR 30.100	Applicable	Massachusetts is delegated to administer RCRA through its State regulations. These standards establish requirements for determining whether waste is hazardous in the state of Massachusetts. Section 30.105 provides that PCB waste that would be subject to hazardous waste regulation due to the presence of PCBs are exempt from the hazardous waste regulations provided certain conditions are met.	Any hazardous waste generated during the removal action will be analyzed under these standards to determine whether they are characteristic hazardous waste and managed in accordance with the substantive requirements of these regulations to the extent practicable. PCB Waste will be handled in accordance with the conditions set out in the TSCA Determination unless otherwise noted in this Table.
Massachusetts Hazardous Waste Rules – Requirements for Generators	310 CMR 30.300	Applicable	These regulations contain requirements for hazardous waste generators. The regulations apply to generators of sampling waste and also apply to the accumulation of waste prior to off-site disposal.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable
Massachusetts Hazardous Waste Rules – General standards for hazardous waste facilities	310 CMR 30.500	Relevant and Appropriate	These regulations establish standards for the treatment, storage, and disposal of hazardous waste. Section 30.501(3)(a) excepts facilities that treat, dispose, or store hazardous waste containing 50 ppm or more of PCBs if they are adequately regulated under TSCA regulation 40 CFR 761.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable.

Table 15-3
Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria
Phase 1 Reach – Lower Neponset River Superfund Site
Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Massachusetts Hazardous Waste Rules – Waste Piles	310 CMR 30.640	Applicable	310 CMR 30.641 through 30.649 prescribe managed in waste piles requirements for storage and treatment of hazardous waste in waste piles. Provides specifications for inter alia design and operations, monitoring and inspection, and closure and post-closure care.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable.
Massachusetts Hazardous Waste Rules - Groundwater Protection	310 CMR 30.660	Relevant and Appropriate	310 CMR 30.661 through 30.673 prescribe requirements for regulated units that receive hazardous waste, except for certain waste piles to protect groundwater.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable.
Massachusetts Hazardous Waste Rules - Use and Management of Containers	310 CMR 30.680	Applicable	Regulations applicable to owners and operators of facilities that use containers to store hazardous waste. 310 CMR 30.681 through 30.689 prescribe requirements for the use of containers, such as drums, to store hazardous waste. Provides specifications for, among other things, labelling and marking, management of containers, inspections and closure.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable.
Massachusetts Hazardous Waste Rules - Storage and Treatment in Tanks	310 CMR 30.690	Applicable	310 CMR 30.691 through 30.699 prescribe requirements for the use of tanks to store and treat hazardous waste. Provides specifications for, among other things, design and installation, containment and detection of leaks, general operating requirements, inspections, and closure and post-closure care.	Any hazardous waste generated during the removal action will be managed in accordance with the substantive requirements of these regulations to the extent practicable.
Massachusetts Ambient Air Quality Standards	310 CMR 6.00 (including but not limited to 6.04)	Applicable	These regulations establish primary and secondary standards for emissions of sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead. The purpose of the regulation is to prevent the occurrence of conditions of air pollution where such do not exist and to facilitate the abatement of conditions of air pollution where and when such occur.	Monitoring of air emissions during removal activities, including dredging, dewatering, transportation, and placement of contaminated sediment, will be performed to assess compliance with these standards and removal activities will be implemented to comply with the substantive requirements of these regulations to the

Table 15-3

Potential Applicable and Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Criteria

Phase 1 Reach – Lower Neponset River Superfund Site

Action-Specific ARARs

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
				extent practicable.
Air Pollution Control Regulations	310 CMR 7.00 (including but not limited to 7.06, 7.09, and 7.10)	Applicable	Sets primary and secondary standards for fugitive emissions, dusts and particulates. The regulations also set emission limits necessary to attain ambient air quality standards. The purpose of the regulations are to prevent the occurrence of conditions of air pollution where such do not exist and to facilitate the abatement of conditions of air pollution where and when such occur.	Removal activities will be implemented in accordance with the substantive requirements of these regulations to the extent practicable. Emission standards, including for dust, will be complied with during removal activities to the extent practicable.
MassDEP Guidance	Dam Removal and the Wetland Regulations, 2007	TBC	Provides guidance on permitting issues and review considerations associated with dam removal projects, especially as it relates to the Massachusetts Wetlands Protection Act.	To the extent the removal action includes the removal of the Tileston & Hollingsworth Dam, this guidance will be considered.
Massachusetts Executive Office of Energy and Environmental Affairs Guidance	Dam Removal in Massachusetts: A Basic Guide for Project Proponents, 2007	TBC	Provides guidance through the initial conceptualization of a project, the feasibility studies, and the permitting process, and includes a review of other regulatory requirements associated with dam removal.	To the extent the removal action includes the removal of the Tileston & Hollingsworth Dam, this guidance will be considered.
Massachusetts Fish Consumption Advisory	Massachusetts Department of Public Health, Freshwater Fish Consumption Advisory List (2024)	TBC	Advises the public on the following: “children under 12, pregnant women, nursing mothers, and women of childbearing age who may become pregnant: do not eat any fish; catch and release. All other people: do not eat American eel or white sucker; catch and release. Limit consumption of all other fish to two meals per month.”	This advisory will be considered in reference to biota consumption and actions to reduce fish consumption risks including institutional controls.

Table 16-1

PCB Remediation Treatment Technology Screening

PCB Remediation Treatment Technology	General Cost	General Efficiency	General Time Duration	General Toxic Byproducts	Overall Score
Phytoremediation	Low cost (+)	Effectiveness restriction by shallow distribution of plant roots	Long remediation and monitoring time	NA	+
Microbial degradation	Low cost (+)	Low (40-60%) (-)	A long-term period for bioremediation (-)	Less toxic byproducts (+)	NA
Chemical reagent	Additional expenses requirement for high concentrations (-)	High (78-99%) (+)	Short or medium time periods (+)	NA	+
Activated Carbon	Low cost materials (+)	High (73-89%) (+)	NA	None (+)	+ + +
Biofilm covered activated carbon	Low cost materials (+)	High (60-92%) (+)	Relatively short times required (+)	None (+)	+ + +
Supercritical water oxidation	High (-)	High (93-99%) (+)	NA	Sticky salts and non-sticky solids causing fouling, and erosion (-)	-
Nanoscale zero-valent iron (nZVI)	High (-)	High (84-98.3%) (+)	Short times required (+)	nZVI is toxic to bacteria and biota (-)	NA
nZVI particles combination with a second metal	High (-)	High (84-99%) (+)	Short times required (+)	NA	+
Electrokinetic remediation	NA	High (40-96%) (+)	NA	None (+)	++
Incineration	Very high (--)	Very high (>99.9%) (++)	Short time required (+)	Potential dioxin/furan formation without proper controls (--)	+

Table 16-1

PCB Remediation Treatment Technology Screening

PCB Remediation Treatment Technology	General Cost	General Efficiency	General Time Duration	General Toxic Byproducts	Overall Score
Thermal desorption	High (-)	High (95-99%) (+)	Short to medium time (+)	Requires offgas treatment (-)	+
Solvent extraction	Medium to high (-)	High (90-98%) (+)	Medium time required (+)	Residual solvents may remain (-)	+
Base catalyzed decomposition	High (-)	High (>98%) (+)	Medium time required (+)	Minimal if properly controlled (+)	++
Plasma arc treatment	Very high (--)	Very high (>99.9%) (++)	Short time required (+)	Minimal under proper operation (+)	++
Vitrification	Very high (--)	Very high (>99%) (++)	Medium time required (+)	Minimal with proper emissions control (+)	+
Combined electrokinetic bioremediation	Medium (-)	High (70-96%) (+)	Medium to long time (-)	None (+)	++
Enhanced soil washing with surfactants	Medium (-)	Medium to high (60-90%) (+)	Short time required (+)	Residual surfactants may remain (-)	+

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
No Action	No Action	Not Applicable	No Action	No action - sediment and floodplain soils left in place.	Yes
River Diversion	None – this is a support action.	Open Channel Diversion (intrusive)	Sheet pile would be installed along centerline of river. River flow diverted to ½ of river channel. Use of sheet pile to isolate sections of the riverbed, that can then be pumped dry.	Requires substantial penetration to install effectively. Cannot be placed in areas with boulders, shallow bedrock, or beneath bridges. Decrease in channel width may increase surrounding water velocity. Need to move system several times.	Yes
		Open Channel Diversion (non-intrusive)	River flow diverted to less than ½ of the channel using a series of diversions (*e.g.*, portable dams - inflatable cofferdam filled with site water to create a watertight barrier that holds back water and protects the workspace) to isolate sections of the riverbed that can then be pumped dry.	Relatively small rise in river will result in overtopping of barrier. Not practical for deeper water depths. Need to move system several times.	No
		Temporary Dam + Gravity-fed Pipe Bypass	River dammed and flow channeled into pipe placed in riverbed. Gravity conveys water to point downstream of active work area. to Isolates sections of the riverbed that can then be pumped dry.	River will need dammed to raise the water level to be channeled into the pipe. Debris floating down the river will require significant monitoring and will need to be dept out of diversion. Flooding of river area upstream is a concern because of the reduced capacity caused by the temporary dam. Can only be operated in times of relatively low flow. Need to move system several times.	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
		Temporary Dam + Bypass Pump/Piping	River dammed. Water pumped through piping placed above river channel on bank. Water discharged downstream of active work area. Isolates sections of the riverbed that can then be pumped dry.	Significant area needed for equipment. Debris floating down the river will require monitoring and will need to be kept out of diversion. Pump efficiency reduced at areas of high banks due to increased suction required, depending on where pumps can be located. Only bypass a portion of the Phase 1 Reach at any one time. Need to move system several times.	
		Alternate River Channel	Construction of a new river channel. Permanent diversion of the water body.	Large areas needed to stage equipment and construct a new diversion channel are not available along the majority of the Phase 1 Reach.	No
Removal	Excavation	Wet excavation (riverbed only)	Excavate sediment using standard excavation equipment without river diversion.	Not practicable in deep water. Need to construct access road from top of bank to riverbed for trucks and excavation equipment to remove material and perform restoration. Difficult at steep banks, if done from bank.	Yes
		Dry excavation (riverbed and riverbank)	Divert river, excavate using standard excavation equipment in the dry.	Dependent on river diversion for riverbed work. Substantial haul roads necessary.	Yes
	Dredging	Barge-mounted dredging (riverbed only)	Dredge using barge-mounted mechanical or hydraulic equipment.	Very large amount of water generated from dewatering of sediments and free water. Barge	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
				capacity would be limited by low bridges and shallow depth to water.	
Processing	Dewatering	Geotextile Tubes	Gravity dewatering in geotextile tubes. Can require long duration to achieve target solids content. Requires active collection and treatment of filtrate. Pretreatment with polymer is required for effective performance. Pretreatment with thickening may also be required. When target solids content is attained, tubes are cut open and dewatered material is excavated out.	Potentially Applicable. Increases the amount of land required for processing dredged sediment.	Yes
		Filter Press	Dewatering of dredged material by mechanical means. Provides effective dewatering but generally not suitable for large dredging operations because of limited capacity of filter presses and the need to keep up with high dredging rates	Potentially Applicable. Likely has insufficient capacity for the projected rate of sediment dredging.	Yes
		On-Site stockpiles	Saturated soils and sediments are encountered, they will be allowed to drain within the excavation limits by being placed in small piles for gravity dewatering or by draining directly from the excavator bucket suspended over the excavation area prior to being loaded into sealed vehicles for transport.	Requires adequate space. May have limited capacity.	Yes
Containment	Capping	Active/Reactive (Amended) Cap	Generally, includes amendments that are mixed into the capping materials or placed as separate layers to both isolate and treat contaminated sediment layers	Applicable – enhanced containment and/or treatment of contaminants within a cap may be necessary if contamination at depth remains in place.	Yes
		Conventional Cap	Conventional capping places sand or other natural materials directly over the contaminated sediment area. The cap has to	Potentially applicable. In rivers with high velocity, conventional capping faces significant challenges,	No

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
			be at least as thick as the large populations of burrowing benthic organisms to keep them from becoming contaminated. Also, current velocity, availability of capping materials, and the type of contamination present determine cap thickness, and the materials used. Typically, sand caps are used in low velocity waterways to protect them from scouring by strong (high energy) currents.	including potential cap erosion, displacement, and failure to effectively isolate contaminants. May not be effective if high concentrations of contaminants remain beneath the cap.	
		Armored Cap	Places an additional layer of stone or rip rap over a conventional cap to provide additional protection from high velocity currents.	Applicable – armored capping will protect the cap from high velocity currents and other disruptive forces. However, armored caps reduce the availability of suitable habitat for benthic organisms that rely on soft sediments or natural structures. Mitigation strategies implemented to off-set negative effects.	Yes
		Composite Cap	Places several layers of sand, rock, and geomembrane/ textile over the contaminated sediment to further isolate it. Geomembranes can be employed when there is a concern that advection by upward groundwater gradients or diffusion will carry contamination up into the clean cap area. Geomembranes are, however, problematic if anaerobic gas is generated from the underlying sediment.	Potentially applicable. In rivers with high velocity, conventional capping faces significant challenges, including potential cap erosion, displacement, and failure to effectively isolate contaminants. May not be effective if high concentrations of contaminants remain beneath the cap	Yes
	Cover	Vegetative Cover	Vegetation planted within and around sediment contamination to prevent future contamination.	Not effective based upon the extent and concentration levels of	No

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
				contamination. Insufficient protection for potential receptors.	
Treatment	In situ Biological Treatment	Phytoremediation	Biodegradation of organic pollutants in soil or groundwater and uptake into plant tissues through their roots followed by transformation by plant enzymes or direct volatilization into the atmosphere.	Not practical in sediment within the river channel. In soils, most of the studies suggested that the metabolism of PCBs by plants is only limited to tetra-chlorinated and lower congeners. High-chlorinated PCB congeners are usually more resistant to the metabolism process than the lower chlorinated congeners in most of the cases. As a result, the high-chlorinated PCB congeners accumulate in biomass and tend to release to the environment, when the process of plant decomposition occurs after the plants are dead. Limitations include significant long-term monitoring, loss of effectiveness due to slows in plant growth, and effectiveness can be restricted by plant root depth.	No
		Microbial Degradation via aerobic degradation	Microorganisms can use oxygen to breakdown the low-chlorine content PCBs. During the aerobic degradation, the benzene ring with less chlorines of the PCB molecular is destructed.	Lightly chlorinated PCB congeners, with three or less chlorine atoms per molecule, could be biodegraded by aerobic bacteria.	
		Microbial Degradation via anerobic dehalogenation	Organohalide respiration of PCBs is a biological process that potentially decreases the toxicity of PCBs through the removal of chlorines. During this process the chlorine substituent is replaced with hydrogen.	The anaerobic dechlorination of PCBs is a long-term, labor-intensive process with efficiencies specific and limited to target PCB and the bacterial species. Not all PCB	No

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
				congeners can be rapidly or even completely degraded. Highly chlorinated molecules can be degraded through the pathway of reductive dehalogenation resulting in 2–3 chlorine congeners as the major metabolites. Many aquatic environments are not suitable for the growth of aerobic microorganisms, because only the top layer of sediments is aerobic.	
	In Situ Chemical Treatment	Solvent Extraction	Solvent is injected into the sediments to extract contaminants from the sediment matrix. The solvent is recovered and is treated or destroyed. Containment structure to control migration of the solvent may be required during extraction.	Several implementability limitations including; difficulty in solvent application and effective distribution to all sediments to be treated, problems in monitoring of extraction effectiveness, and difficulty incomplete recovery of solvent after treatment.	No
		Chemical Dechlorination	Injections of reagents into sediment/soil to achieve dechlorination (i.e., chlorine molecules are removed from chlorinated compounds through the addition of a chemical reagent under alkaline conditions).	Challenges in reagent application and effective distribution in riverbed channel setting. When this technology is used to treat contaminants at high concentrations, excessive amounts of reagents are necessary. This technology is more impactful on soils due to high temperatures and strong acid and alkali conditions.	No
		Nanoscale zero-valent iron (nZVI) with single and secondary metal	Nzvi acts as a reducing agent, breaking down organic pollutants like PCBs through a process called in situ chemical reduction. nZVI, consisting of tiny iron particles (10-100	nZVI has been shown to effectively reduce PCB concentrations in contaminated soil and groundwater. May be implementable at the Lower	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
			nanometers), acts as a catalyst in the degradation of organic pollutants. It provides electrons to PCBs, which can be reduced and converted into less harmful forms, like less toxic byproducts or stable compounds.	Neponset River Site, particularly if groundwater serves as a possible source of recontamination to the sediment.	
	In Situ Physical Treatment	Adsorption through Activated Carbon application	Adsorption is a physical process where adsorbates are attracted onto the surface structure of activated carbon.	Activated carbon has been widely applied for PCB-contaminated soils and sediment to enhance PCB immobilization.	Yes
		Biofilm Covered Activated Carbon	This technology utilizes biofilms, microbial communities that adhere to surfaces, and activated carbon, a material with high surface area, to absorb and degrade pollutants.	Biofilm-covered activated carbon is being explored as a technology for bioremediation of Superfund sites, particularly for removing organic contaminants.	Yes
		Immobilization	Mixing of setting agents such as cement, quicklime, grout, as well as reagents, with sediment in place to solidify or fix contaminants in the matrix.	Several implementability limitations including; difficulty in setting agents and reagents application and effective distribution to all sediments to be treated, volume increase of riverbed, and release of reagents to water column during mixing.	No
		Electrokinetic remediation	Electrokinetics involves applying an electrical current to the subsurface to create movement of ions and facilitate contaminant removal. This can be used to enhance the delivery of chemicals (like in situ chemical oxidation) or microbes (in bioremediation).	It can be particularly effective in low-permeability soils, allowing for a more uniform distribution of amendments. While electrokinetics has some advantages, it's not a standalone solution for PCB cleanup, and its use for PCBs at Superfund sites is not as common as other techniques.	No
		Landfarming	Waste is carefully mixed with surface soil on a suitable tract of land. Microbes that can	Landfarming is generally not considered a suitable method for	No

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
	Ex Situ Biological Treatment		metabolize the waste may be added, along with nutrients. In some cases, a genetically engineered species of bacteria is used.	treating high concentrations of PCBs. Very high contaminant concentrations can be toxic to microorganisms, which are essential for the biodegradation process in landfarming. Additionally, PCBs are not readily biodegradable and may persist in the soil for extended periods. Temperature, weather, and material-dependent limitations. Significant land availability is necessary. Any vapors and runoff (or "leachate") need to be collected and treated appropriately.	
		Bioremediation	Excavated sediment/soil is placed in a lined above-ground treatment area and aerated following processing to enhance the degradation of organic contaminants by the indigenous microbial population.	Non-chlorinated hydrocarbons within the carbon chain lengths C6 to C14 are readily treatable. Non-chlorinated hydrocarbons with carbon chain lengths C15-C32 are treatable but require longer time periods to degrade. Chlorinated hydrocarbons and other more complex chains can be degraded but require detailed assessment and analysis to determine suitability. Not applicable to heavy metal contamination or chlorinated hydrocarbons. Temperature, weather, and material-dependent limitations. Significant land availability is necessary. Any vapors and runoff (or "leachate") need to be collected and treated appropriately.	No

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
	Ex Situ Physical Treatment	Extraction/ Washing	Generally, the primary application of extraction processes is to remove organic and, in some cases, metal contaminants from the sediment particles. “Sediment washing” is another term used to describe extraction processes, primarily when water may be a component of the solvent. In the extraction process, dredged or excavated material is slurried with a chemical solvent and cycled through a separator unit. The separator divides the slurry into the three following fractions: 1) particulate solids; 2) water; and 3) concentrated organic contaminants. The concentrated organics are removed from the separator for post-process treatment. Extraction or washing may also generate large volumes of contaminated wastewater that generally must be treated prior to discharge.	Sediment washing, while a potential method for removing PCBs from contaminated sediments, is not a universally practical or preferred approach for EPA Superfund sites. It's one of several treatment options, and its suitability depends on various site-specific factors.	No
		Immobilization or Solidification/Stabilization	Generally, immobilization, commonly referred to as solidification/stabilization, alters the physical and/or chemical characteristics of the sediment through the addition of binders, including cements and pozzolans. Immobilization technologies primarily work by changing the properties of the sediment so contaminants are less prone to leaching. Alteration of the physical character of the sediment to form a solid material, such as a cement matrix, reduces the accessibility of the contaminants to water and entraps the contaminated solids in a stable matrix.	The practicality of immobilization depends on various factors, including the extent and nature of PCB contamination, site-specific conditions, and cost-effectiveness. Immobilization techniques, while often less costly and easier to implement than destruction methods, may have lower long-term effectiveness and permanence. They may also be less effective in achieving significant reductions in PCB toxicity or volume. The addition of solidification materials may be	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
				necessary prior to off-site shipment if solidity requirements are not met.	
		Thermal Treatment via Supercritical Water Oxidation (SCWO)	A process that occurs in water at temperature and pressure above the mixture's thermodynamic critical point.	The SCWO process is particularly successful in treating hazardous industrial wastes and wastewaters. However, chlorine atoms from the biphenyl ring can produce hydrochloric acid during SCWO, which can corrode the system. Additionally, due to the low dielectric constant of supercritical water, both sticky salts and non-sticky solids are completely precipitated during SCWO. These salts deposit on equipment surfaces causing fouling, plugging, and erosion. Researchers have analyzed SCWO and conclude that the salts can accumulate on the surface of equipment requiring high-cost maintenance and other operational maintenance procedures.	No
		Vitrification	A thermal treatment process that transforms PCB-contaminated materials into a durable, glass-like state. It's used to reduce the toxicity and volume of contaminated materials, often achieving very high levels of PCB destruction and removal efficiency.	Vitrification has been used on other sediment sites. Vitrification generally has high destruction, removal efficiency, and volume reduction	Yes
		Particle Size Separation	Separation of the fine material from the coarse material by physical screening. Particle size separation may serve as a	May serve as an implementable pretreatment step prior to the	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
			pretreatment step prior to implementation of a treatment alternative. Many treatment processes require particle sizes of one centimeter or less for optimal operation.	selected treatment alternative (if applicable).	
		Effluent Treatment/ Residue Handling	Treatment of liquid, gas, or solid residues. Dredging or excavation may require management of several types of residual wastes from the pretreatment and operational treatment processes that include liquid and/or air/gas effluents from dewatering or other pretreatment /treatment processes, residual solids, and runoff/discharges.	Effluent / residue handling will be an a major consideration during selection, design, and implementation of dredging or excavation. Generally, these wastes can be handled through the use of conventional technologies for water, air, and solids treatment and disposal. However, the technical, cost, and regulatory requirements can be important considerations during the evaluation of dredging or excavation as a cleanup method.	Yes
		Incineration	Destruction of contaminants at high temperature.	Applicable only if combined RCRA Hazardous Waste and TSCA waste is generated. Very expensive.	No
		Base Catalyzed Decomposition (BCD)	The BCD process involves using a mixture of sodium hydroxide, a high boiling point hydrocarbon, and a catalyst to treat PCBs. The process aims to break down PCBs into less harmful substances.	Since the BCD process requires the use of specific reagents and catalysts, it is not feasible to implement directly at the original location of the contamination. BCD can be an effective method for reducing PCB concentrations in contaminated materials, potentially minimizing the need for disposal or further treatment.	Yes
Disposal	On-site Disposal	Water-based Confined Aquatic Disposal (CAD) Cell	A dredged material management approach that places dredged material in an	Dependent upon subsurface geological conditions, especially the depth to bedrock. In addition, when	No

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
			underwater space created by excavating material from the waterway bottom.	the width of the area in which the CAD cell is proposed is narrow, such as in a channel, the necessary side slopes for wall stability may limit the effective depth to which a CAD cell can be constructed. Evaluation of the effect of CAD cell excavation on aquifers or the transport of contaminants from groundwater flow also may be relevant in certain situations.	
		Land-based Confined Disposal Facility (CDF)	A facility constructed on dry land in which the dredged material is stored above the groundwater level, with an enclosing dike to confine the dredged material.	Requires adequate space. May have limited consolidation capacity. Constraints on disposition of materials may occur based upon hazardous waste classification.	No
	Off-site Disposal	Disposal at an existing permitted facility (or facilities).	Off-site disposal facilities are anticipated to be an effective means of managing the contaminated soil and sediments. Beneficial Reuse may be appropriate based upon contaminant levels	Yes	Yes
Institutional Controls (IC)	Land Use/Access Restrictions	Waterway restrictions	Administrative and legal tools to restrict or guide land and water use to protect human health and the environment at sites with residual contamination. These ICs supplement engineering controls and aim to minimize exposure to contamination, according to the EPA.	Applicable for restricting access to the Phase 1 Reach during removal action work. Long-term restrictions may be necessary to restrict certain intrusive uses where contamination remains under caps. Will not address ecological risk. These ICs supplement engineering controls and aim to minimize exposure to contamination.	Yes
		Deed Restriction	Legal documents and restrictions to limit access/exposures to contaminated sediment	Potentially applicable to limited areas of the site where the riverbank	Yes

Table 16-2
Site-specific Technology Screening

General Response Action	Remedial Technology	Process Option	Description	Screening Comments	Retained as Possible Technology
			and soil, and to inform future property owners/users of the restrictions.	is impacted by contamination. Will not address ecological risk.	
	Information Sharing	Signage	Signage at Superfund sites serve to inform the public about the presence of a contaminated site, provide information, and encourage responsible behavior to minimize exposure to hazards.	EPA intends to use signage throughout the Superfund process.	Yes
		Educational Outreach	Educational outreach about ICs at Superfund sites is used to inform the public about their purpose, how they work, and their role in protecting human health and the environment. ICs are non-engineered measures like zoning restrictions, public advisories, and property use limitations, which are used in conjunction with engineering controls to minimize exposure to contamination. Methods include sharing of educational materials at public meetings, community involvement plans, and partnerships with local organizations.	EPA intends to use educational outreach throughout the Superfund process.	Yes

TABLE 17-1

Summary of Estimated Costs
Engineering Evaluation/Cost Analysis
Phase 1 Reach - Lower Neponset River Superfund Site

Description		Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	**Capital Cost**				
1.1	Engineering, Site Prep, Permitting, Project Management	-	5,167,976	5,462,352	7,469,593
1.2	Hydraulic Dredging	-	4,020,000	4,520,000	8,074,000
1.3	Riverbank Soil Removal & Restoration	-	708,000	856,000	4,283,000
1.4	Dewatering and Water Treatment	-	9,775,000	10,395,000	15,732,000
1.5	Transportation and Disposal of Dewatered Sediment as a TSCA Waste	-	8,788,000	12,823,200	23,837,000
1.6	Transportation and Disposal of Dewatered Riverbed Soils	-	-	421,000	324,000
1.7	Transportation and disposal of riverbank soils	-	202,800	468,000	2,215,200
1.8	Backfilling/Capping	-	1,264,000	1,264,000	10,490,000
1.9	Dam Removal	-	-	4,807,385	5,015,000
	Total Capital Cost (rounded)	-	**29,926,000**	**41,017,000**	**77,440,000**
2	**30-Year Present Value of O&M Cost (rounded) 30-**	***TBD based on O&M of T&H Dam***	**-**	**-**	**932,000**
3	**Year NPV Total Cost (rounded)**		**29,900,000**	**41,000,000**	**78,400,000**

Table 17-2

Estimated Costs for Removal Action Alternative 2
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1	**Capital Cost**						
1.1	Engineering, Site Prep, Permitting, Project Management						
	Engineering, Design, Project Plans, and Permitting	2,270	HRS	$171	$388,355		
	Pilot Testing of Geotextile Tubes	1	LS	$15,000	$15,000		
	Surveying DCR land and other land to be used for staging, dewatering, water treatment, etc. including preparation of baseline plans.	48	HRS	$275	$13,200		
	Clearing of land to use for laydown/dewatering/material handling	8.5	Acre	$43,560	$370,260		
	Dense grade fill placed on access road and lay down area for leveling	120	tons	$55	$6,600		
	Office Trailer/Support Area Equipment (porta-john, hand wash, storage) Rental	24	Month	$1,500	$36,000		
	Temporary power install and removal to support area	1	LS	$25,000	$25,000		
	Legal and Administrative fees for site access	100	Hours	$500	$50,000		
	E&S controls (silt fencing, turbidity curtain, etc.) and security fencing	1	LS	$150,000	$150,000		
	Contractor project management and coordination	33	Month	$84,280	$2,777,032		
	Community air & noise monitoring	396	Day	$1,200	$475,200		
	Contingency (20%)				$861,329		
	Site Prep Total Capital Cost					**$5,167,976**	**$5,167,976**
1.2	Hydraulic Dredging						
	Mobilization of Dredging Equipment and Materials	2	LS	$75,100	$150,200		
	Rental of 8" HDPE pipeline - Year 1	6	Month	$36,750	$220,500		
	Rental of 8" HDPE pipeline - Year 2	1	Month	$18,375	$18,375		
	Purchase of pipeline floats	530	LS	$396	$209,880		
	Rental of barge-mounted self-priming dredge pump, excavator, cutter head and bucket attachment.	7	Month	$23,200	$162,400		
	Rental of excavators and other heavy equipment	7	Month	$34,000	$238,000		
	Barge Rental (shallow draft lift barge)	7	Month	$12,000	$84,000		
	Purchase of suction and discharge dredging hose	6	LS	$4,158	$24,948		
	Self-priming cutter head and bucket attachment for dense riverbed soil behind dam	1	Month	$6,000	$6,000		
	Setup and removal of slurry sediment conveyance pipeline	8,223	LF	$7	$57,558		
	Dredging operation labor including filling of geotextile tubes						
	Per Diem During Active Dredging (lodging, transportation, and meals)	6	Month	$175,225	$1,051,350		
	Oversight	6	Month	$55,440	$332,640		
	Post dredging sampling and Reporting	6	Month	$92,719	$556,313		
	Bathymetric Surveys	1	LS	$50,000	$50,000		
	Restoration of Staging area	3	LS	$20,000	$60,000		
	Contingency (20% of construction cost)	8.5	Acre	$15,000	$127,500		
		1	LS		$669,933		
	Hydraulic Dredging Total Capital Cost					**$4,020,000**	**$4,020,000**

Table 17-2

Estimated Costs for Removal Action Alternative 2
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.3	Riverbank Soil Removal & Restoration						
	Equipment rental (barges, excavators, push boats, trucks, etc.) for soil removal	1	Mnth	$45,500	$45,500		
	Consumables (fuel, oil grease, stockpile covers, etc.) Labor	3	Wk	$6,700	$20,100		
	for soil removal	3	Wk	$66,500	$199,500		
	Material loading area	1	LS	$21,950	$21,950		
	Equipment rental (barges, excavators, push boats, trucks, etc.) for riverbank restoration	1	Mnth	$50,000	$50,000		
	Construction materials for restoration (geotextile, stone, topsoil, plantings, etc.)	1	LS	$47,514	$47,514		
	Consumables (fuel, oil grease, etc.)	3	WK	$1,900	$5,700		
	Labor for riverbank restoration	3	WK	$66,500	$199,500		
	Contingency (20%)	1	LS		$117,953		
	Riverbank Soil Removal Total Capital Cost					**$708,000**	**$708,000**
1.4	Dewatering and Water Treatment						
	Dewatering Containment Basin Construction (Including labor)	1	LS	$730,856	$730,856		
	Feed Manifold for Geotextile Tubes	1	LS	$77,750	$77,750		
	Geotextile Tubes	1	LS	$164,302	$164,302		
	Waterproof tarp cover over geotextile tubes	1	LS	$127,818	$127,818		
	Sediment thickener, polymer feed system and pumps to fill geotubes	6	Mo	$74,000	$444,000		
	Polymer for thickening	135,200	lbs	$3.11	$420,472		
	Loadout of dewatered sediment	1	LS	$950,574	$950,574		
	Containment Area for Water Treatment	1	LS	$118,820	$118,820		
	Filtrate Treatment Equipment (filters, carbon vessels, carbon)	21	Mo	$36,208	$774,274		
	Water Treatment Pumps, Tanks, Piping	21	Mo	$9,075	$194,068		
	Water Treatment Electrical, Instrumentation, Controls	1	LS	$250,000	$250,000		
	Treatment Media Chanegout & Disposal	90	tons	$260	$23,400		
	Setup of Equipment	800	Hr	$150	$120,000		
	Operations - During Active Dredging	6	Month	$210,700	$1,264,200		
	Operations - Post-Dredging Dewatering	15	Month	$116,100	$1,741,500		
	Per Diem During Active Dredging (lodging, transportation, and meals)	6	Month	$49,280	$295,680		
	Per Diem During Post-Dredging Dewatering (lodging, transportation, and meals)	15	Month	$24,640	$369,600		
	Winterization	1	LS	$78,817	$78,817		
	Contingency (20%)				$1,629,226		
	Dewatering and Water Treatment Total Capital Cost					**$9,775,000**	**$9,775,000**
1.5	**Transportation and disposal of dewatered sediment as a TSCA Waste**	33,800	tons	$260	$8,788,000		
	Total T&D of TSCA Waste					**$8,788,000**	**$8,788,000**
1.6	**Transportation and disposal of dewatered riverbed soils (none for RAA-2 because dam is not being removed)**	-	tons	$90	$0		
	Contingency (20%)				$0		
	Total T&D of dewatered riverbed soil					**$0**	**$0**

Table 17-2

Estimated Costs for Removal Action Alternative 2
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.7	**Transportation and disposal of riverbank soils**	650	Tons	$260	$169,000		
	Contingency (20%)				$33,800		
	Total T&D of dewatered riverbed soil					**$202,800**	**$202,800**
1.8	Backfilling of Riverbed to Stabilize Bank as Necessary						
	Equipment Cost for placment via Telebelt Equipment Cost	-	Mo	$142,640	$0		
	for placment via Excavator	2	Mo	$70,590	$141,180		
	Import fill sampling	1	LS	$9,350	$9,350		
	Backfill material - Sand	2,481	Tons	$32	$79,382		
	Backfill material - GAC (average 2% mixture with sand)	-	Tons	$4,500	$0		
	Backfill material - Armor stone - riprap	8,434	Tons	$34	$290,564		
	Backfill Installation - Labor for Telebelt Placement Backfill	-	Mnth	$206,400	$0		
	Installation - Labor for Excavator Placement Contingency	2	Mnth	$266,600	$533,200		
	(20%)				$210,735		
1.9	***Backfilling and Capping System Total Capital Cost***					**$1,264,000**	**$1,264,000**
1.10	**Dam Repair -** Dam Removal - Cost for Alternative 4 in 2021 GEI Report, adjusted for inflation to 2024. Includes 25%contingency in GEI Cost Analysis	-	LS	$7,085,000	$0	**$0**	**$0**
2	***Operation & Maintenance After Removal Action Cost***						
2.1	There are no operations and maintenance costs for this alternative.						**$0**
3	**Summary**						
3.1	Capital Cost (Site work, Dredging & Dewatering, Water Treatment, Dam Repair, Backfilling)					**$29,926,000**	**$29,926,000**
3.2	O&M Cost					**$0**	**$0**
4	**30 Year NPW Total Cost of Alternative 4 (rounded)**						**$29,900,000**

Table 17-3

Estimated Costs for Removal Action Alternative 3
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1	**Capital Cost**						
1.1	Engineering, Site Prep, Permitting, Project Management						
	Engineering, Design, and Permitting	2,450	HRS	$171	$419,150		
	Pilot Testing of Geotextile Tubes	1	LS	$15,000	$15,000		
	Surveying DCR land and other land to be used for staging, dewatering, water treatment, etc. including preparation of baseline plans.	48	HRS	$275	$13,200		
	Clearing of land to use for laydown/dewatering/material handling	8.5	Acre	$43,560	$370,260		
	Dense grade fill placed on access road and lay down area for leveling	120	tons	$55	$6,600		
	Office Trailer/Support Area Equipment (porta-john, hand wash, storage) Rental	28	Month	$1,500	$42,000		
	Temporary power install and removal to support area	1	LS	$25,000	$25,000		
	Legal and Administrative fees for site access	100	Hours	$500	$50,000		
	E&S controls (silt fencing, turbidity curtain, etc.) and security fencing	1	LS	$150,000	$150,000		
	Contractor project management and coordination Community air & noise monitoring during dredging and loadout of dewatered sediment	33	Month	$84,280	$2,801,950		
		549	Day	$1,200	$658,800		
	Contingency (20%)				$910,392		
	Site Prep Total Capital Cost					**$5,462,352**	**$5,462,352**
1.2	Hydraulic Dredging						
	Mobilization of Dredging Equipment and Materials	2	LS	$75,100	$150,200		
	Rental of 8" HDPE pipeline Yr 1	6	Month	$36,750	$220,500		
	Rental of 8" HDPE pipeline Yr 2	2	Month	$18,375	$36,750		
	Purchase of pipeline floats	530	LS	$396	$209,880		
	Rental of barge-mounted self-priming dredge pump with powered cutter head suspended from excavator.	8	Month	$23,200	$185,600		
	Rental of excavators and other heavy equipment	8	Month	$34,000	$272,000		
	Barge Rental (shallow draft lift barge)	8	Month	$12,000	$96,000		
	Purchase of suction and discharge dredging hose	6	EA	$4,158	$24,948		
	Self-priming cutter head and bucket attachment for dense riverbed soil behind dam	2	Month	$6,000	$12,000		
	Setup and removal of slurry sediment conveyance pipeline	8,223	LF	$7	$57,558		
	Dredging operation labor including filling of geotextile tubes Per	7	Month	$175,225	$1,226,575		
	Diem During Active Dredging (lodging, transportation, and meals) Oversight	7	Month	$55,440	$388,080		
	Post dredging sampling and reporting	7	Month	$92,719	$649,031		
	Bathymetric Surveys	1	LS	$50,000	$50,000		
	Restoration of staging area	3	LS	$20,000	$60,000		
	Contingency (20% of construction cost)	8.5	Acre	$15,000	$127,500		
		1	LS		$753,324		
	Hydraulic Dredging Total Capital Cost					**$4,520,000**	**$4,520,000**

Table 17-3

Estimated Costs for Removal Action Alternative 3
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.3	Riverbank Soil Removal & Restoration						
	Equipment rental (barges, excavators, push boats, trucks, etc.) for soil removal	2	Mnth	$45,500	$91,000		
	Consumables (fuel, oil grease, stockpile covers, etc.) Labor for	5	Wk	$6,700	$33,500		
	soil removal	5	Wk	$66,500	$332,500		
	Material loading area	1	LS	$21,950	$21,950		
	Equipment rental (barges, excavators, push boats, trucks, etc.) for riverbank restoration	1	Mnth	$50,000	$50,000		
	Construction materials for restoration (geotextile, stone, topsoil, plantings, etc.)	1	LS	$47,514	$47,514		
	Consumables (fuel, oil grease, etc.)	2	WK	$1,900	$3,800		
	Labor for riverbank restoration	2	WK	$66,500	$133,000		
	Contingency (20%)	1	LS		$142,653		
	Riverbank Soil Removal Total Capital Cost					**$856,000**	**$856,000**
1.4	Dewatering and Water Treatment						
	Dewatering Containment Basin Construction (Including labor)	1	LS	$730,856	$730,856		
	Feed Manifold for Geotextile Tubes	1	LS	$77,750	$77,750		
	Geotextile Tubes	1	LS	$193,283	$193,283		
	Waterproof tarp cover over geotextile tubes	1	LS	$127,818	$127,818		
	Sediment thickener, polymer feed system and pumps to fill geotubes	7	Mo	$74,000	$518,000		
	Polymer for thickening	164,400	lbs	$3.11	$511,284		
	Loadout of dewatered sediment	1	LS	$1,150,692	$1,150,692		
	Containment Area for Water Treatment	1	LS	$118,820	$118,820		
	Filtrate Treatment Equipment (filters, carbon vessels, carbon)	21	Mo	$36,208	$776,660		
	Water Treatment Pumps, Tanks, Piping	21	Mo	$9,075	$194,667		
	Water Treatment Electrical, Instrumentation, Controls Treatment	1	LS	$250,000	$250,000		
	Media Chanegout & Disposal	90	tons	$260	$23,400		
	Setup of Equipment	800	Hr	$150	$120,000		
	Operations - During Active Dredging	7	Month	$210,700	$1,474,900		
	Operations - Post-Dredging Dewatering	14	Month	$116,100	$1,625,400		
	Per Diem During Active Dredging (lodging, transportation, and meals)	7	Month	$49,280	$344,960		
	Per Diem During Post-Dredging Dewatering (lodging, transportation, and meals)	14	Month	$24,640	$344,960		
	Winterization	1	LS	$78,817	$78,817		
	Contingency (20%)				$1,732,453		
	Dewatering and Water Treatment Total Capital Cost					**$10,395,000**	**$10,395,000**
1.5	**Transportation and disposal of dewatered sediment as a TSCA Waste**	41,100	tons	$260	$10,686,000		
	Contingency (20%)				$2,137,200		
	Total T&D of TSCA Waste					**$12,823,200**	**$12,823,200**
1.6	**Transportation and disposal of dewatered riverbed soils**	3,900	tons	$90	$351,000		
	Contingency (20%)				$70,200		
	Total T&D of dewatered riverbed soil					**$421,000**	**$421,000**

Table 17-3

Estimated Costs for Removal Action Alternative 3
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.7	**Transportation and disposal of riverbank soils**	1,500	Tons	$260	$390,000		
	Contingency (20%)				$78,000		
	Total T&D of dewatered riverbed soil					**$468,000**	**$468,000**
1.8	Backfilling of Riverbed to Stabilize Bank as Necessary						
	Equipment Cost for placment via Telebelt Equipment Cost	-	Mo	$142,640	$0		
	for placment via Excavator	2	Mo	$70,590	$141,180		
	Import fill sampling	1	LS	$9,350	$9,350		
	Backfill material - Sand	2,481	Tons	$32	$79,382		
	Backfill material - GAC (average 2% mixture with sand)	-	Tons	$34	$0		
	Backfill material - Armor stone - riprap	8,434	Tons	$34	$290,564		
	Backfill Installation - Labor for Telebelt Placement Backfill	-	Mnth	$206,400	$0		
	Installation - Labor for Excavator Placement Contingency	2	Mnth	$266,600	$533,200		
	(20%)				$210,735		
1.9	***Backfilling and Capping System Total Capital Cost***					**$1,264,000**	**$1,264,000**
1.10	**Dam Removal** - Cost for Alternative 4 in 2021 GEI Report, adjusted for inflation to 2024. Includes 25% contingency	1	LS	$4,807,385	$4,807,385	**$4,807,385**	**$4,807,385**
2	***Operation & Maintenance After Removal Action Cost***						
2.1	There are no operations and maintenance costs for this alternative.					**$0**	**$0**
3	**Summary**						
3.1	Capital Cost (Site work, Dredging & Dewatering, Water Treatment, Dam Removal, Backfilling)					**$41,017,000**	**$41,017,000**
3.2	O&M Cost					**$0**	**$0**
4	**30 Year NPW Total Cost of Alternative 4 (rounded)**						**$41,000,000**

Table 17-4

Estimated Costs for Removal Action Alternative 4
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1	**Capital Cost**						
1.1	Engineering, Site Prep, Permitting, Project Management						
	Engineering, Design, and Permitting	2,730	HRS	$171	$467,053		
	Pilot Testing of Geotextile Tubes	1	LS	$15,000	$15,000		
	Surveying DCR land and other land to be used for staging, dewatering, water treatment, etc. including preparation of baseline plans.	48	HRS	$275	$13,200		
	Clearing of land to use for laydown/dewatering/material handling	8.5	Acre	$43,560	$370,260		
	Dense grade fill placed on access road and lay down area for leveling	120	tons	$55	$6,600		
	Office Trailer/Support Area Equipment (porta-john, hand wash, storage) Rental	38	Month	$1,500	$57,000		
	Temporary power install and removal to support area	1	LS	$25,000	$25,000		
	Legal and Administrative fees for site access	100	Hours	$500	$50,000		
	E&S controls (silt fencing, turbidity curtain, etc.) and security fencing	1	LS	$150,000	$150,000		
	Contractor project management and coordination	46	Month	$84,280	$3,887,290		
	Community air & noise monitoring during dredging and loadout of dewatered sediment	1,053	Day	$1,200	$1,263,600		
	Contingency (20%)				$1,164,590		
	Site Prep Total Capital Cost					**$7,469,593**	**$7,469,593**
1.2	Hydraulic Dredging						
	Mobilization of Dredging Equipment and Materials	3	LS	$75,100	$225,300		
	Rental of 8" HDPE pipeline Yr 1	6	Mnth	$36,750	$220,500		
	Rental of 8" HDPE pipeline Yr 2	5	Mnth	$25,725	$128,625		
	Rental of 8" HDPE pipeline Yr 3	3	Mnth	$14,700	$44,100		
	Purchase of pipeline floats	530	EA	$396	$209,880		
	Rental of barge-mounted self-priming dredge pump with powered cutter head suspended from excavator.	14	Mnth	$23,200	$324,800		
	Rental of excavators and other heavy equipment	14	Mnth	$34,000	$476,000		
	Barge Rental (shallow draft lift barge)	14	Mnth	$12,000	$168,000		
	Purchase of suction and discharge dredging hose	7	EA	$4,158	$29,106		
	Self-priming cutter head and bucket attachment for dense riverbed soil behind dam	2	Mnth	$6,000	$12,000		
	Consumables (fuel, oil grease, stockpile covers, etc.) Setup and	14	Mnth	$27,950	$391,300		
	removal of slurry sediment conveyance pipeline	8,223	LF	$7	$57,558		
	Dredging operation labor including filling of geotextile tubes	13	Mnth	$175,225	$2,277,925		
	Per Diem During Active Dredging (lodging, transportation, and meals)	13	Mnth	$55,440	$720,720		
	Oversight	13	Mnth	$92,719	$1,205,344		
	Post dredging sampling and reporting	1	LS	$50,000	$50,000		
	Bathymetric Surveys	3	LS	$20,000	$60,000		
	Restoration of staging area	8.5	Acre	$15,000	$127,500		
	Contingency (20% of construction cost)	1	LS		$1,345,732		
	Hydraulic Dredging Total Capital Cost					**$8,074,000**	**$8,074,000**

Table 17-4

Estimated Costs for Removal Action Alternative 4
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.3	Riverbank Soil Removal & Restoration ***(Based on 1 mg/kg PCBs for High Occupancy and 4 mg/kg PCBs for Low Occupancy. Will change if the cleanup levels change)***						
	Equipment rental (barges, excavators, push boats, trucks, etc.) for soil removal	4	Mnth	$45,500	$182,000		
	Consumables (fuel, oil grease, stockpile covers, etc.) Labor for	16	Wk	$6,700	$107,200		
	soil removal	16	Wk	$83,300	$1,332,800		
	Material loading area	1	LS	$21,950	$21,950		
	Equipment rental (barges, excavators, push boats, trucks, etc.) for riverbank restoration	4	Mnth	$50,000	$200,000		
	Construction materials for restoration (geotextile, stone, topsoil, plantings, etc.)	1	LS	$447,422	$447,422		
	Consumables (fuel, oil grease, etc.)	15	WK	$1,900	$28,500		
	Labor for riverbank restoration	15	WK	$83,300	$1,249,500		
	Contingency (20%)	1	LS		$713,874		
	Riverbank Soil Removal Total Capital Cost					**$4,283,000**	**$4,283,000**
1.4	Dewatering and Water Treatment						
	Dewatering Containment Basin Construction (Including labor)	1	LS	$779,043	$779,043		
	Feed Manifold for Geotextile Tubes	1	LS	$77,750	$77,750		
	Geotextile Tubes	1	LS	$339,060	$339,060		
	Waterproof tarp cover over geotextile tubes	1	LS	$9,000	$9,000		
	Sediment thickener, polymer feed system and pumps to fill geotubes	13	Mnth	$4,320	$56,160		
	Polymer for thickening	305,600	lbs	$3.11	$950,416		
	Loadout of dewatered sediment	1	LS	$2,118,387	$2,118,387		
	Containment Area for Water Treatment	1	LS	$118,820	$118,820		
	Filtrate Treatment Equipment (filters, carbon vessels, carbon)	34	Mo	$36,208	$1,240,747		
	Water Treatment Pumps, Tanks, Piping	34	Mo	$9,075	$310,988		
	Water Treatment Electrical, Instrumentation, Controls Treatment	1	LS	$250,000	$250,000		
	Media Chanegout & Disposal	90	tons	$260	$23,400		
	Setup of Equipment	800	Hr	$150	$120,000		
	Operations - During Active Dredging	13	Mnth	$210,700	$2,739,100		
	Operations - Post-Dredging Dewatering	21	Mnth	$116,100	$2,438,100		
	Per Diem During Active Dredging (lodging, transportation, and meals)	13	Mnth	$55,440	$720,720		
	Per Diem During Post-Dredging Dewatering (lodging, transportation, and meals)	20	Mnth	$36,960	$739,200		
	Winterization	1	LS	$78,817	$78,817		
	Contingency (20%)	1	LS		$2,621,941		
	Dewatering and Water Treatment Total Capital Cost					**$15,732,000**	**$15,732,000**
1.5	**Transportation and disposal of dewatered sediment as a TSCA Waste**	76,400	tons	$260	$19,864,000		
	Contingency (20%)				$3,972,800		
	Total T&D of TSCA Waste					**$23,837,000**	**$23,837,000**
1.6	**Transportation and disposal of dewatered riverbed soils**	3,000	tons	$90	$270,000		
	Contingency (20%)				$54,000		
	Total T&D of dewatered riverbed soil					**$324,000**	**$324,000**

Table 17-4

Estimated Costs for Removal Action Alternative 4
Phase 1 Reach - Lower Neponset River Superfund Site

	Item	Quantity	Unit	Unit Price	Cost	Subtotals	Present Value
1.7	**Transportation and disposal of riverbank soils**	7,100	Tons	$260	$1,846,000		
	Contingency (20%)				$369,200		
	Total T&D of dewatered riverbed soil					**$2,215,200**	**$2,215,200**
1.8	Backfilling/Capping of Riverbed (3 Mobilizations)						
	Mobilization/Demobilization	3	EA	$46,000	$138,000		
	Equipment Cost for placment via Telebelt Equipment	3	Mnth	$170,640	$511,920		
	Cost for placment via Excavator/Slurry Import fill	6	Mnth	$163,040	$978,240		
	sampling	1	LS	$120,959	$120,959		
	Cap material - Sand	31,607	Tons	$32	$1,011,436		
	Cap material - GAC (average 2% mixture with sand) Cap	244	Tons	$4,500	$1,099,725		
	material - Armor stone - riprap	28,803	Tons	$34	$992,271		
	Cap Installation - Labor for Telebelt Placement Cap	3	Mnth	$378,400	$1,135,200		
	Installation - Labor for Slurry Placement Bathymetric	6	Mnth	$452,360	$2,714,160		
	Surveys	2	LS	$20,000	$40,000		
	Contingency (20%)				$1,748,382		
1.9	***Backfilling and Capping System Total Capital Cost***					**$10,490,000**	**$10,490,000**
1.10	**Dam Removal** - Cost for Alternative 4 in 2021 GEI Report, adjusted for inflation to 2024. Includes 25% contingency in GEI Cost Analysis	1	LS	$4,807,000	$4,807,000		
	T&D of TSCA dam removal waste	800	Tons	$260	$208,000		
	Total dam removal and T&D					**$5,015,000**	**$5,015,000**
2	***Operation & Maintenance After Removal Action Cost***						
2.1	Annual inspection to verify integrity of cap including sampling of habitat restoration layer for PCBs.	30	Years	$47,544			**$931,883**
3	**Summary**						
3.1	Capital Cost (Site work, Dredging & Dewatering, Water Treatment, Dam Removal, Backfilling)					**$77,440,000**	**$77,440,000**
3.2	30-Year Net Present Value of O&M Cost @ 3% Discount Rate (Rounded)						**$932,000**
4	**30 Year NPV Total Cost of Alternative 4 (rounded)**						**$78,400,000**

Table 18-1
Estimated Schedules for Removal Action Alternatives 2
Phase 1 Reach
Lower Neponset River Superfund Site

Project Start: 9/1/2026

TASK	Calendar Days	START	END
Estimated Schedule for Removal Action Alternative 2			
Planning, Permitting	90	9/1/26	11/30/26
Mobilization, Site Clearing	62	11/30/26	1/31/27
Delivery, Setup, & Comissioning of Dewatering and Water Tmnt. Equip.	42	1/31/27	3/14/27
Riverbank Soil Removal	21	3/14/27	4/4/27
Restore River Banks	28	4/4/27	5/2/27
Dredge Sediment (Mobilization 1)	135	4/11/27	8/24/27
Dewatering of Sediment & Water Tmnt. Decon/ Demob at Completion	607	4/11/27	12/8/28
Backfilling to stabilize remediated areas (as necessary) - Mobilization 1	131	4/25/27	9/3/27
Off-site T&D of dewatered sediment (From Mobilization 1)	135	1/1/28	5/15/28
Dredge Sediment (Mobilization 2)	37	5/15/28	6/21/28
Backfilling to stabilize remediated areas (as necessary) - Mobilization 2	33	5/29/28	7/1/28
Off-site T&D of dewatered sediment (From Mobilization 2)	37	11/1/28	12/8/28
Restore Staging Area and remove river access ramp(s)	60	4/1/29	5/31/29

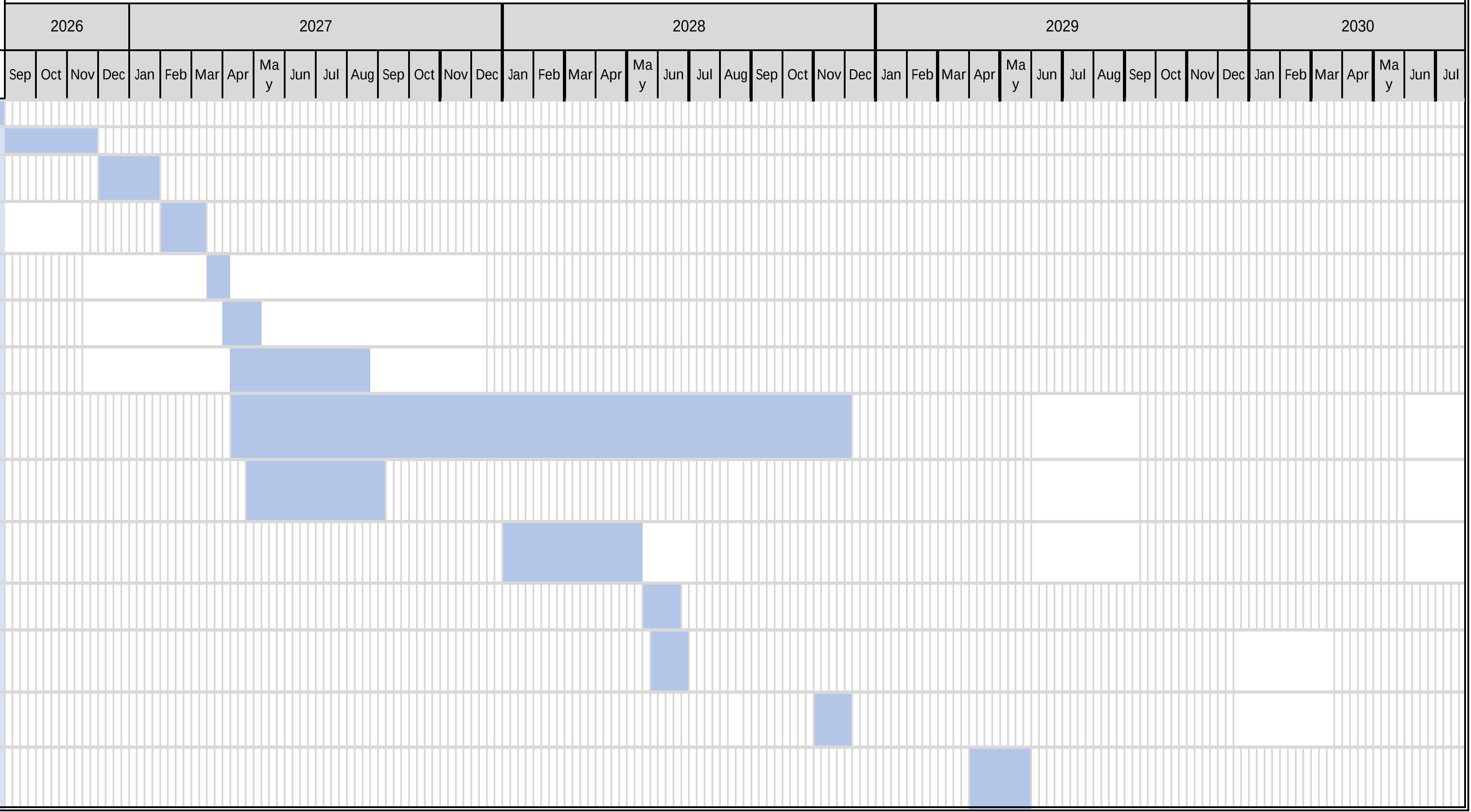


Table 18-2

Estimated Schedules for Removal Action Alternatives 3

Phase 1 Reach

Lower Neponset River Superfund Site

Project Start: 9/1/2026

TASK	Calendar Days	START	END
Estimated Schedule for Removal Action Alternative 3			
Planning, Permitting	90	9/1/26	11/30/26
Mobilization, Site Clearing	62	11/30/26	1/31/27
Delivery, Setup, & Comissioning of Dewatering and Water Tmnt. Equip.	42	1/31/27	3/14/27
Riverbank Soil Removal	60	3/14/27	5/13/27
Restore River Banks	60	5/13/27	7/12/27
Dredge Sediment (Mobilization 1)	135	4/11/27	8/24/27
Dewatering of Sediment. Decon/ Demobilization of Water Treatment Equipment after Dewatering is Complete	651	4/11/27	1/21/29
Backfilling to stabilize remediated areas/Capping (as necessary) - Mobilization 1	131	4/25/27	9/3/27
Off-site T&D of dewatered sediment (From Mobilization 1)	180	1/1/28	5/15/28
Dredge Sediment (Mobilization 2)	65	5/15/28	7/19/28
Backfilling to stabilize remediated areas/Capping (as necessary) - Mobilization 2	61	5/29/28	7/29/28
Removal/Repair of the T&H Dam including Transportation & Disposal of Demolition Debris	120	7/19/28	11/16/28
Off-site T&D of dewatered sediment (From Mobilization 2)	51	12/1/28	1/21/29
Restore Staging Area and remove river access ramp(s)	69	4/1/29	6/9/29

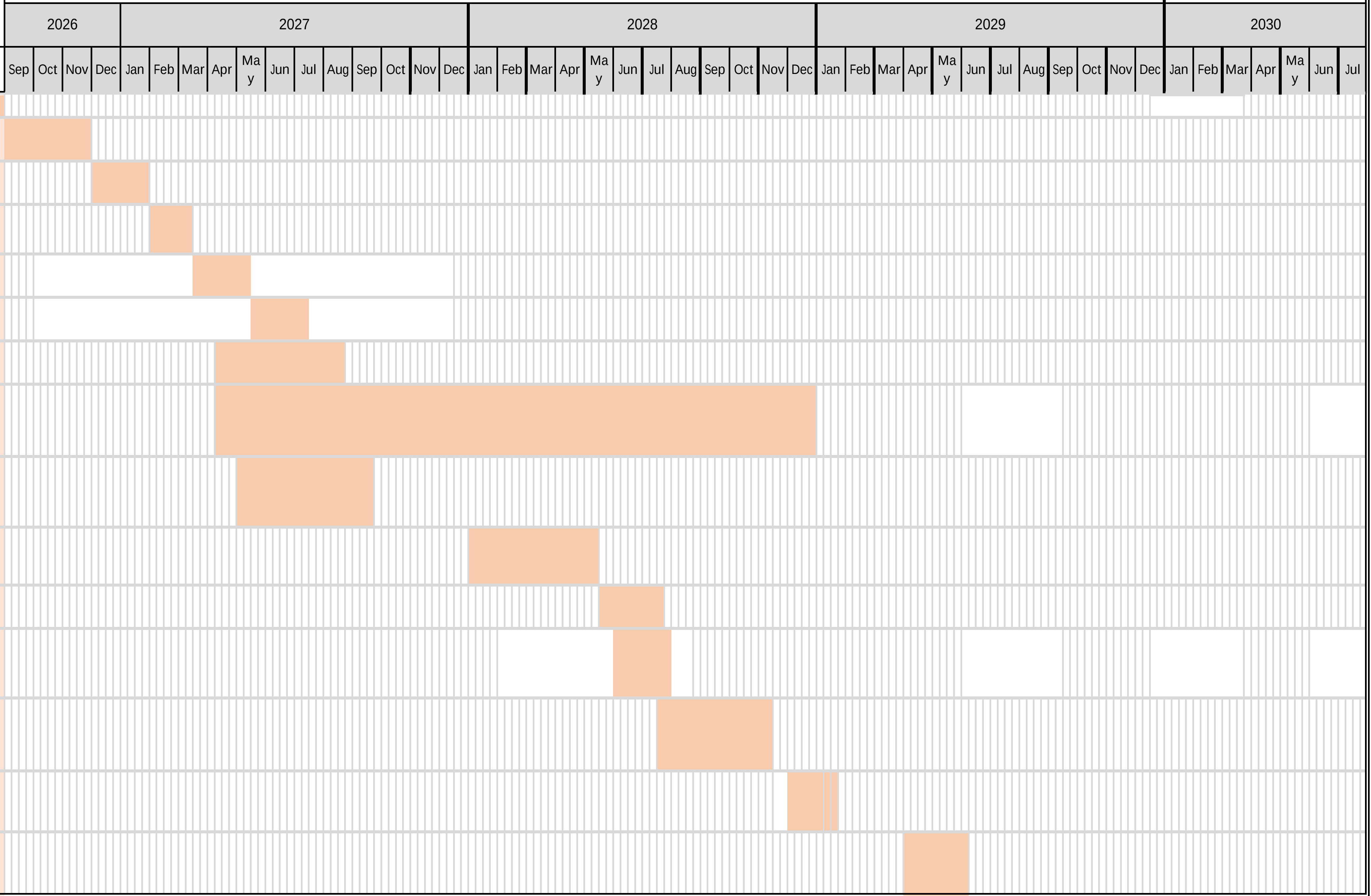
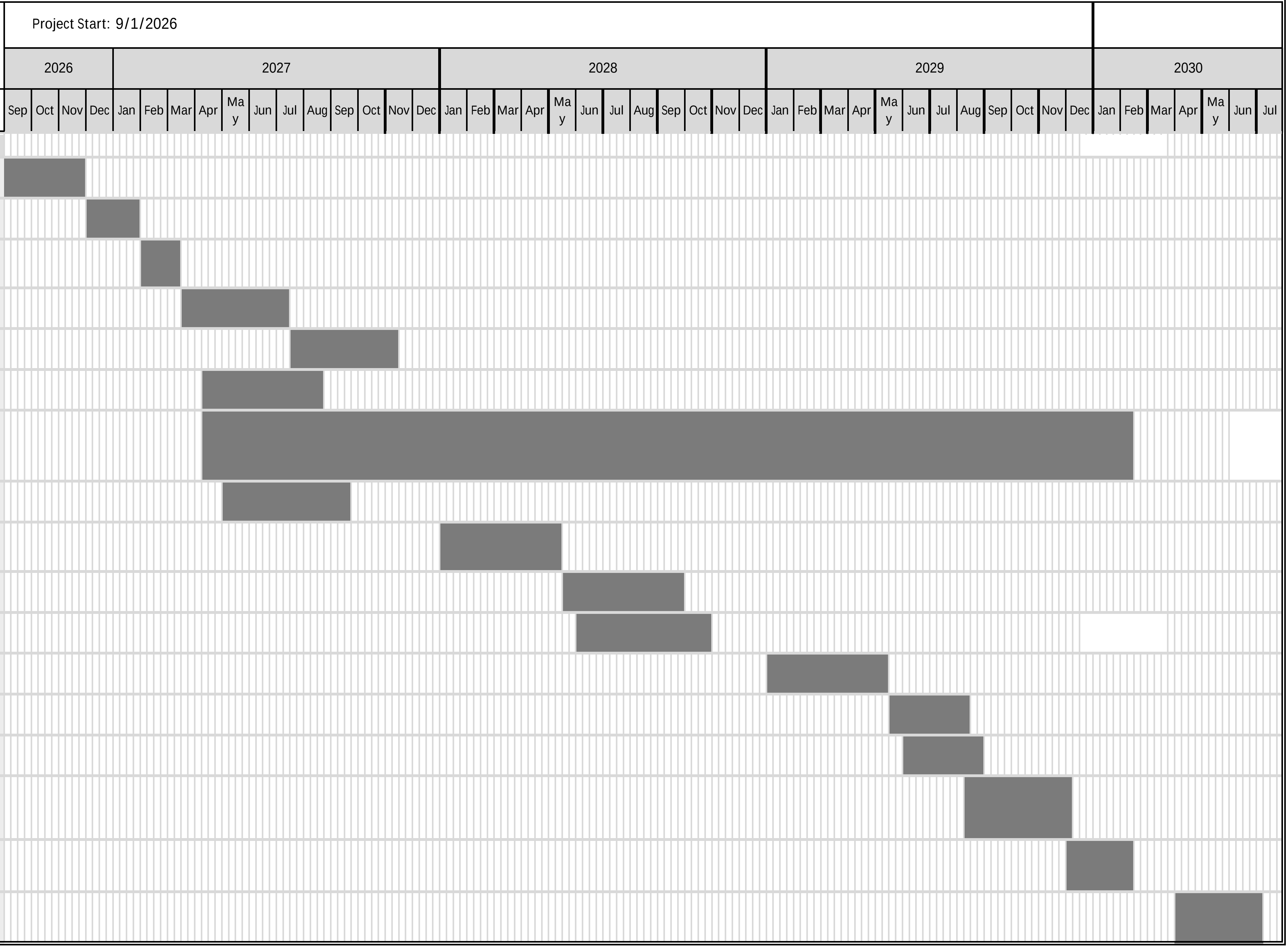


Table 18-3
Estimated Schedules for Removal Action Alternatives 4
Phase 1 Reach
Lower Neponset River Superfund Site

TASK	Calendar Days	START	END
Estimated Schedule for Removal Action Alternative 4			
Planning, Permitting	90	9/1/26	11/30/26
Mobilization, Site Clearing	62	11/30/26	1/31/27
Delivery, Setup, & Comissioning of Dewatering and Water Tmnt. Equip.	42	1/31/27	3/14/27
Riverbank Soil Removal	120	3/14/27	7/12/27
Restore River Banks	120	7/12/27	11/9/27
Dredge Sediment (Mobilization 1)	135	4/11/27	8/24/27
Dewatering of Sediment. Decon/ Demobilization of Water Treatment Equipment after Dewatering is Complete	1040	4/11/27	2/14/30
Cap Construction - Mobilization 1	144	5/2/27	9/23/27
Off-site T&D of dewatered sediment (From Mobilization 1)	135	1/1/28	5/15/28
Dredge Sediment (Mobilization 2)	135	5/15/28	9/27/28
Cap Construction - Mobilization 2	151	5/29/28	10/27/28
Off-site T&D of dewatered sediment (From Mobilization 2)	135	1/1/29	5/16/29
Dredge Sediment (Mobilization 3)	87	5/16/29	8/11/29
Cap Construction - Mobilization 3	93	5/30/29	8/31/29
Removal/Repair of the T&H Dam including Transportation & Disposal of Demolition Debris	120	8/11/29	12/9/29
Off-site T&D of dewatered sediment (From Mobilization 3)	75	12/1/29	2/14/30
Restore Staging Area and remove river access ramp(s)	96	4/1/30	7/6/30



FIGURES

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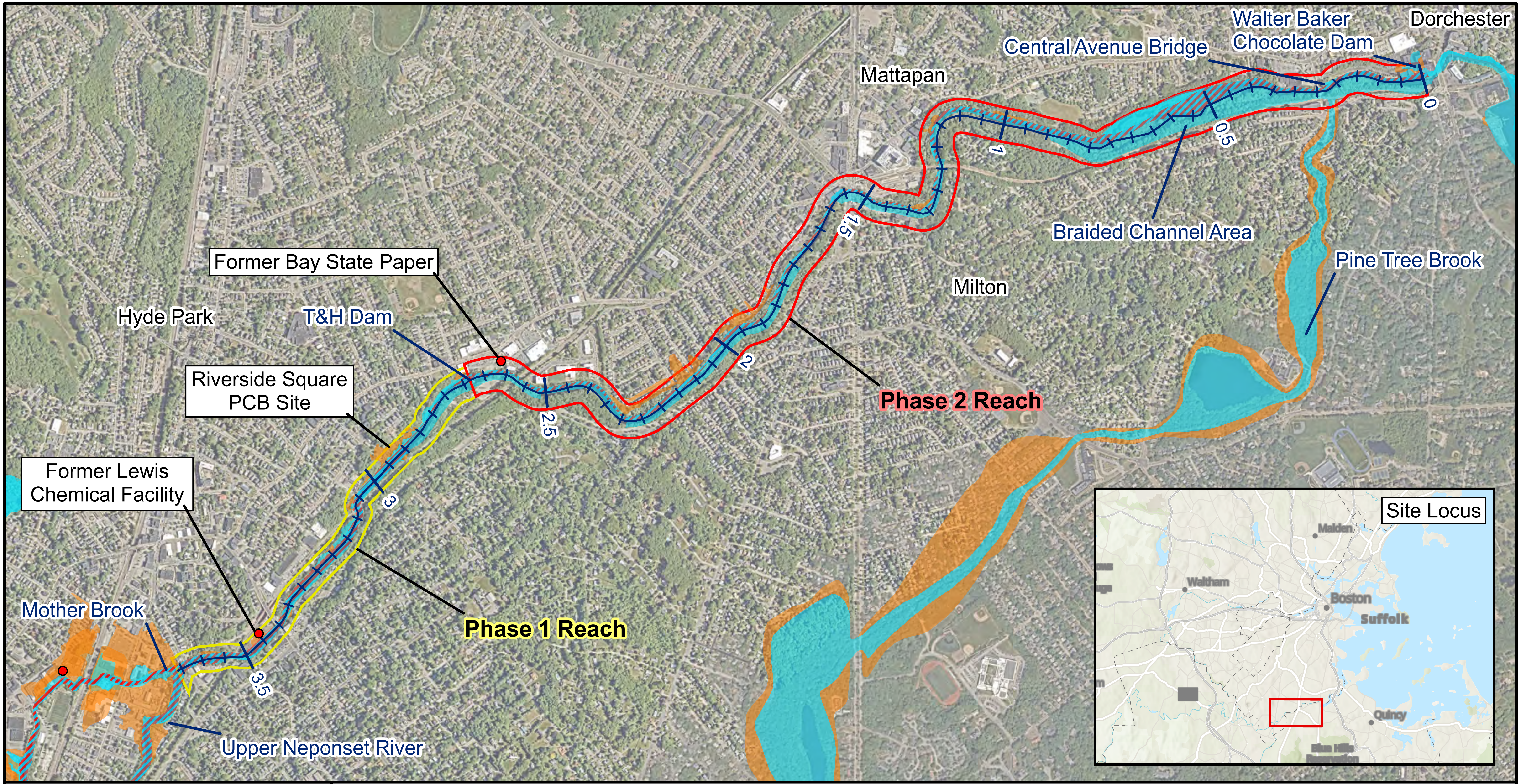

Figure 1
Lower Neponset River Superfund Site Overview

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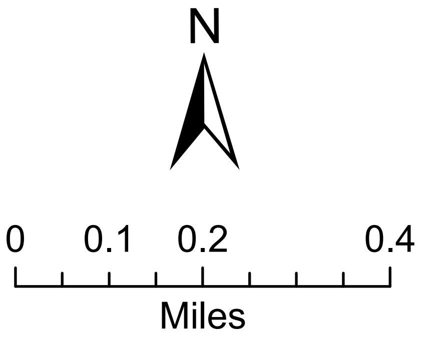

Legend

- — LNR River Miles
- ● Suspected Source of PCB Contamination to the Site
- ▭ Phase 1 Reach
- ▭ Phase 2 Reach
- 🟦 FEMA 100 Year Flood Zone
- ▨ Regulatory Floodway
- 🟧 FEMA 500 Year Flood Zone

Boston College Campus GIS, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS, Esri, CGIAR, USGS, Maxar, Nearmap

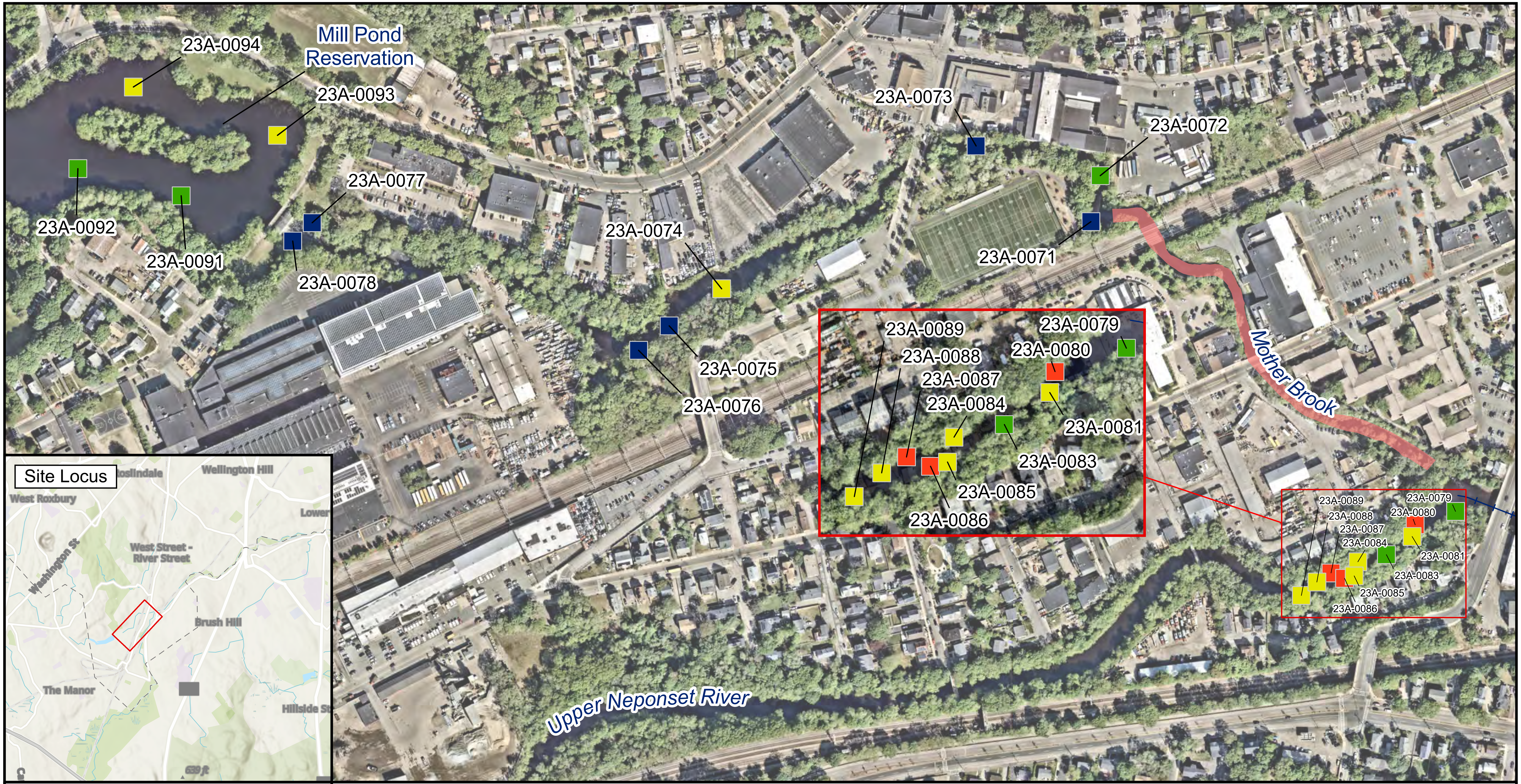

Figure 2
Total PCBs in
Background Sediment

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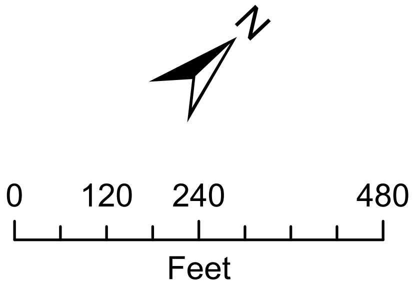

Legend

Total PCB Concentration (mg/kg)

- 🟦 Below 0.055 mg/kg
- 🟩 0.055 mg/kg - 0.170 mg/kg
- 🟨 0.170 mg/kg - 0.510 mg/kg
- 🟥 Above 0.510 mg/kg

🟥 other Brook cleanup

Notes:
Depth interval for reference samples is 0.0 ft - 0.5 ft.

Values presented in the legend represent the 25th, 50th, and 75th percentiles of results from the Phase 1 reference locations.

Esri, NASA, NGA, USGS, Boston College Campus GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS, Maxar, Microsoft, Nearmap

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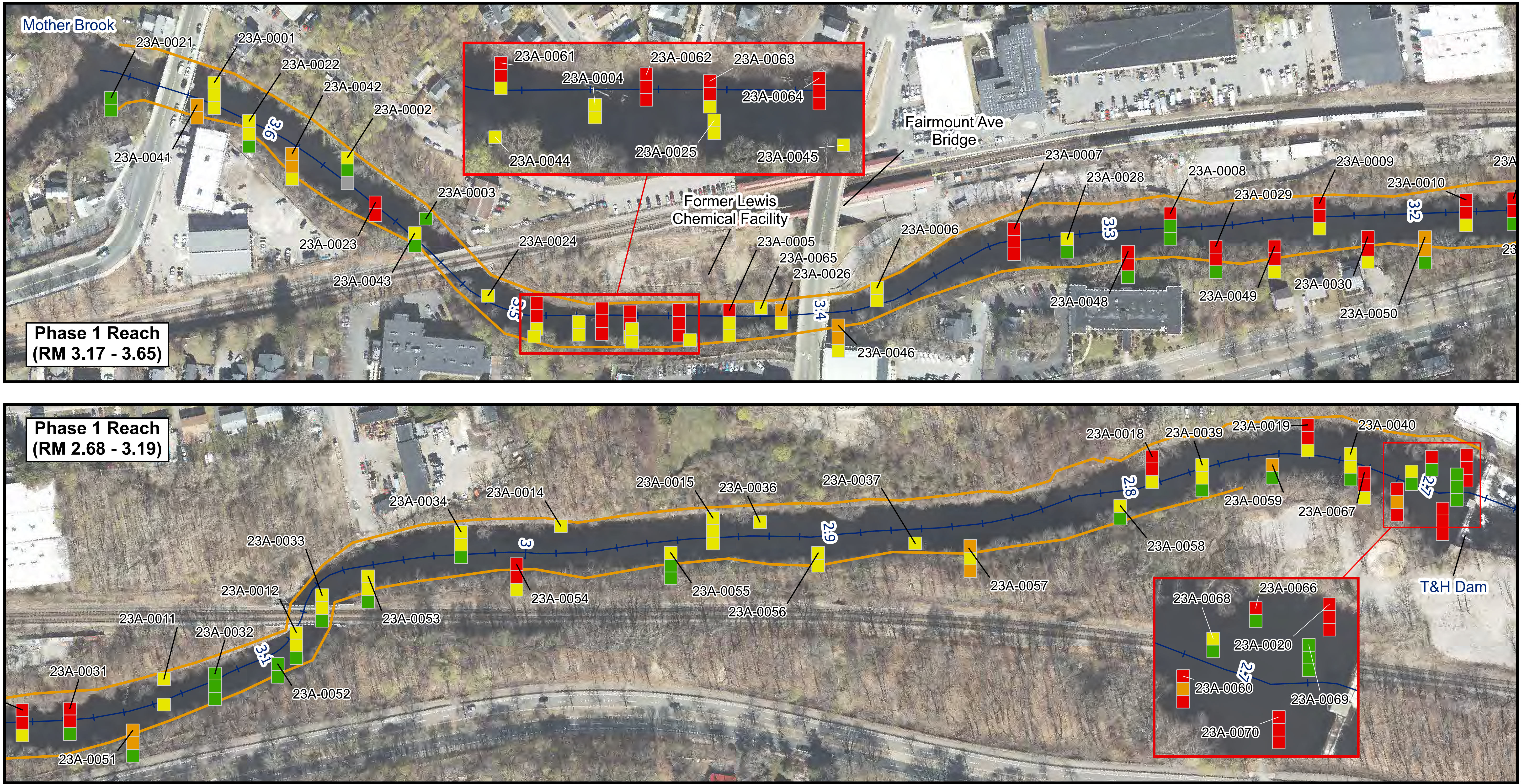

Figure 3
Total PCBs in Phase
1 Reach Sediment

AECOM

N

0 75 150 300
Feet

Legend

— LNR River Miles

— Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Concentration (mg/kg)

- ▨ Not Detected
- 🟩 < 1.00 mg/kg
- 🟨 < 25.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- ☐ 0 ft - 0.5 ft below surface
- ☐ 0.5 ft - 3.0 ft. below surface
- ☐ 3.0 ft - 6.0 ft below surface

*Actual sample depth intervals vary at each sample location. If fewer than 3 depths are shown, deeper samples were not obtained.

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Figure 4
Total PCBs in Phase 1
Reach Floodplain Soils

AECOM

N

0 75 150 300
Feet

Legend
- LNR River Miles
- 100 Year Floodplain (FEMA)
- Ordinary High Water Mark (2023 Wetland Survey)
- Delineated Wetlands (2023 Wetland Survey)
- ● Wetland Flag (2023 Wetland Survey)
- Intermittent Streams

Total PCBs Conc. (mg/kg)
- ⬜ Not Detected
- 🟩 < 1.0 mg/kg
- 🟨 < 25.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*
- 0 ft - 1.0 ft below surface
- 1.0 ft - 4.0 ft. below surface

*Actual sample depth intervals vary at each sample location. If only one depth is shown, a deeper sample was not obtained.

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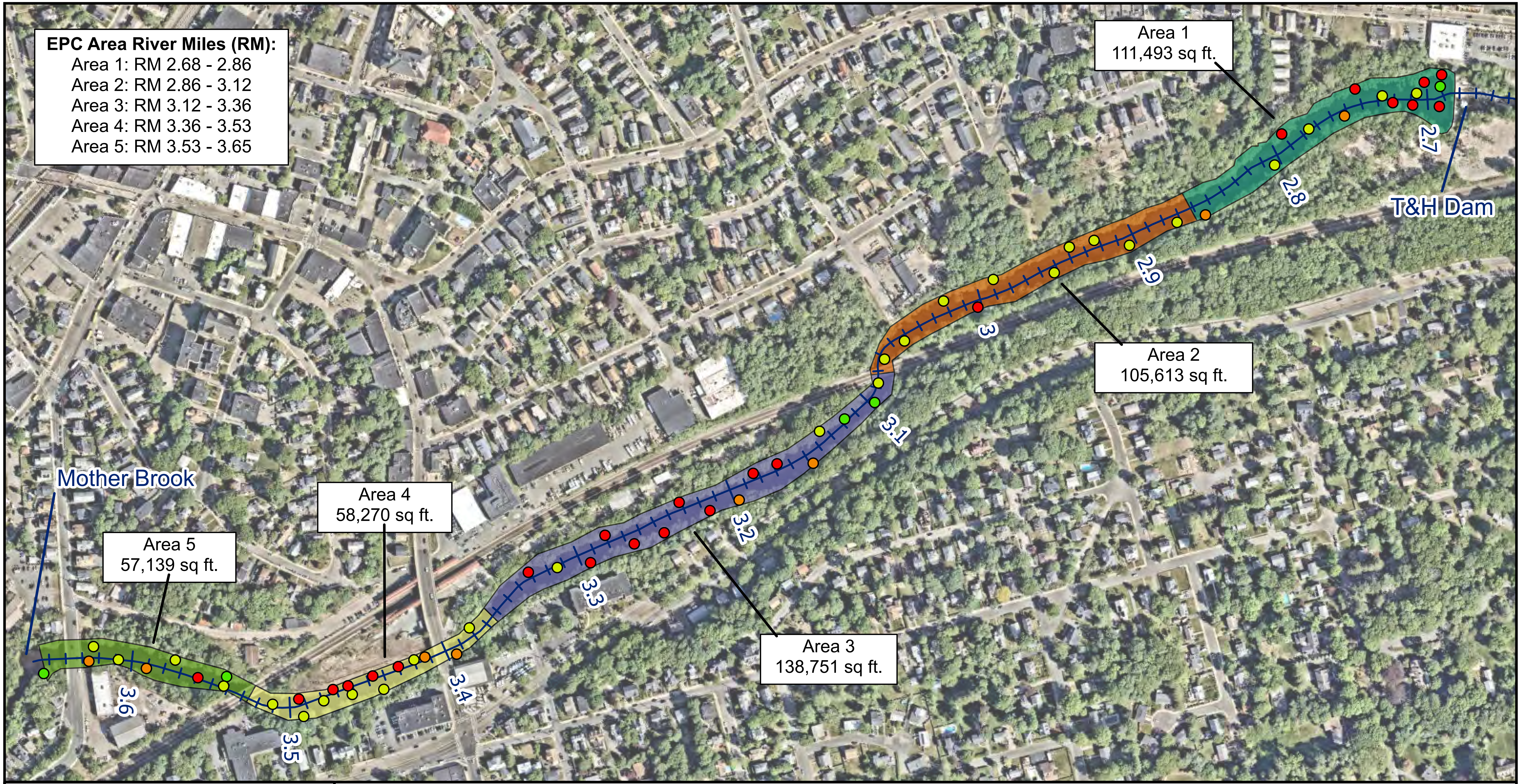

EPC Area River Miles (RM):

Area 1: RM 2.68 - 2.86
Area 2: RM 2.86 - 3.12
Area 3: RM 3.12 - 3.36
Area 4: RM 3.36 - 3.53
Area 5: RM 3.53 - 3.65

Figure 5
Sediment Exposure Point
Concentration Areas

AECOM

N

0 150 300 600
Feet

Legend

— LNR River Miles

Phase 1 Area
- 🟩 Area 1
- 🟧 Area 2
- 🟪 Area 3
- 🟨 Area 4
- 🟩 Area 5

Sediment Total PCB Conc.
- 🟢 < 1 mg/kg
- 🟡 < 25 mg/kg
- 🟠 < 100 mg/kg
- 🔴 ≥ 100.0 mg/kg

Note: PCB results show maximum concentration found in boring. All sediment removal areas are defined by the OHWM from the 2023 wetland delineation survey.

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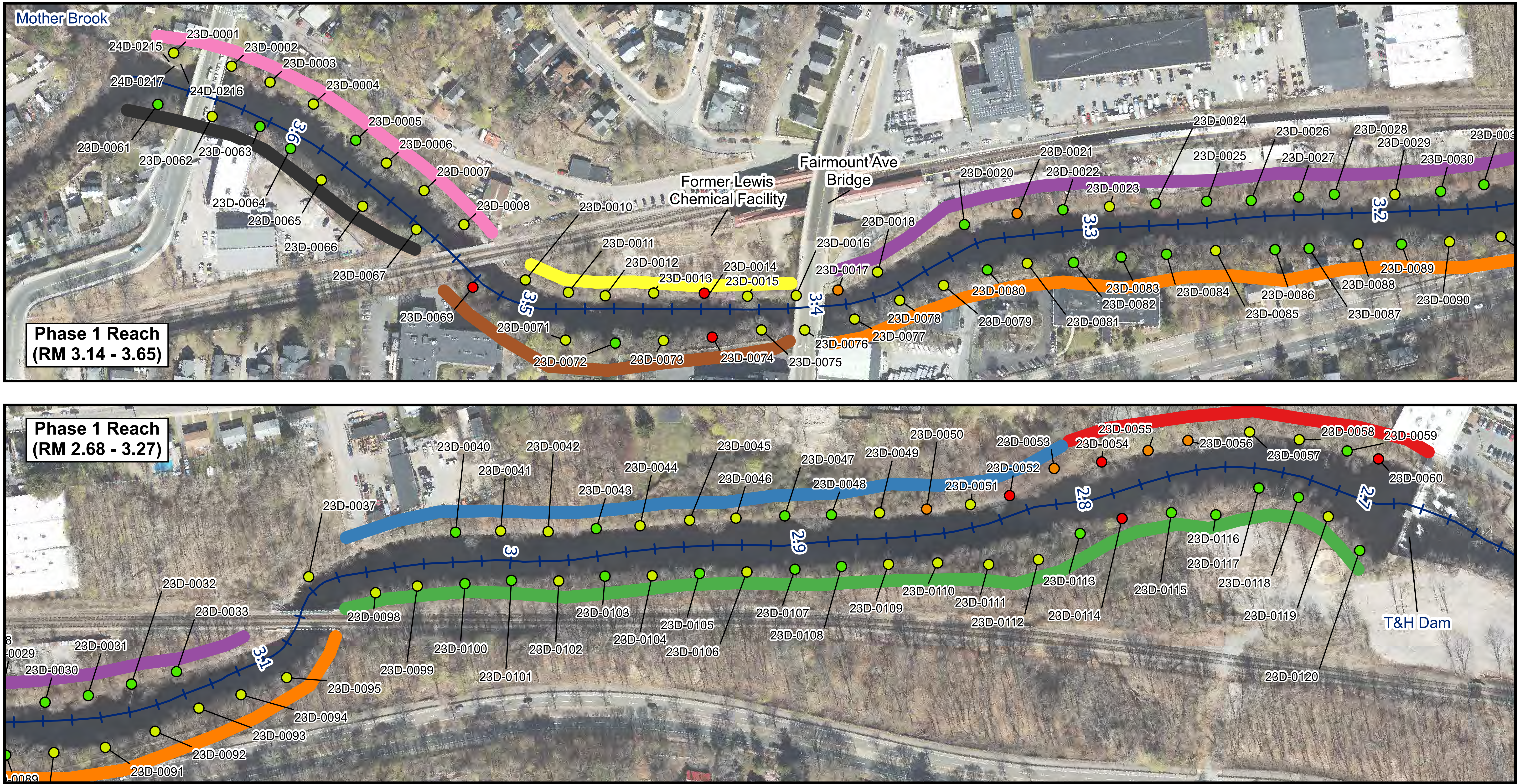

Figure 6
Floodplain Soil Exposure
Point Concentration Areas

AECOM

N

0 75 150 300
Feet

Legend

— LNR River Miles

Soil Total PCBs Concentration

- ● < 1.00 mg/kg
- ● < 25.0 mg/kg
- ● < 100.0 mg/kg
- ● ≥ 100.0 mg/kg

EPC Segment

🟥	1
🟦	2
🟩	3
🟪	4
🟧	5
🟨	6
🟫	7
▬	8
⬛	9

Note: PCB results show maximum concentration found in boring.

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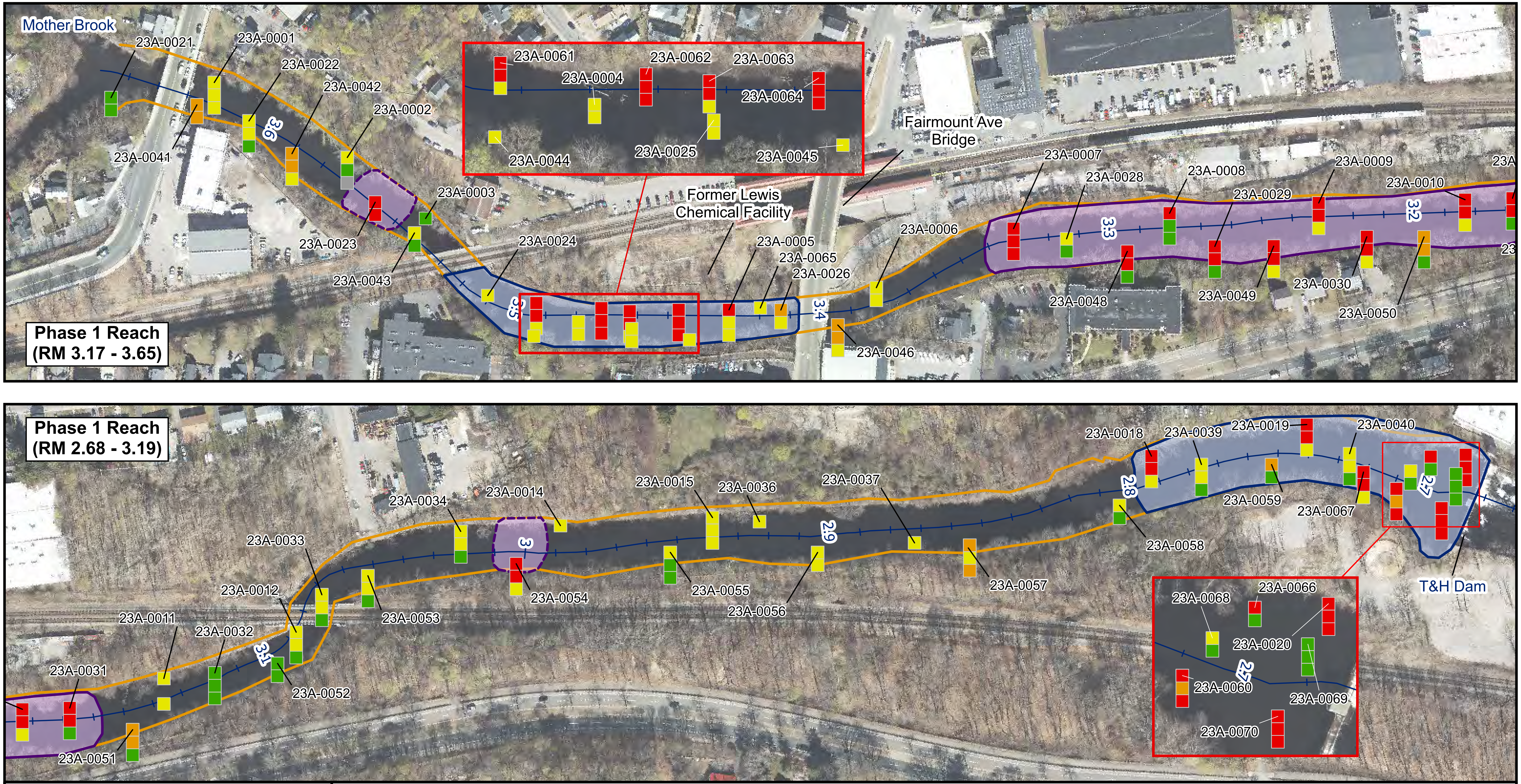

Figure 7
RAA-2 Sediment Removal Areas

0 75 150 300
Feet

Removal Areas

- Remove PTW sediment (> 100 mg/kg PCBs) bank to bank
- Remove PTW sediment based on pre-design investigations
- Remove sediment bank to bank in Contaminated Source Areas
- LNR River Miles
- Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Conc. (mg/kg)

- ⬜ Not Detected
- 🟩 < 1.00 mg/kg
- 🟨 < 25.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- 0 ft - 0.5 ft below surface
- 0.5 ft - 3.0 ft. below surface
- 3.0 ft - 6.0 ft below surface

*Actual sample depth intervals vary at each sample location. If fewer than 3 depths are shown, deeper samples were not obtained.

Path: C:\Users\BorgogniN\AECOM\USEPA RAF Contracts - 60703400_F0007_Lower_Neponset_River\900_CAD_GIS\920_GIS\NB_EECA\NB_EECA_RemovalAreas\NB_EECA_RemovalAreas.aprx

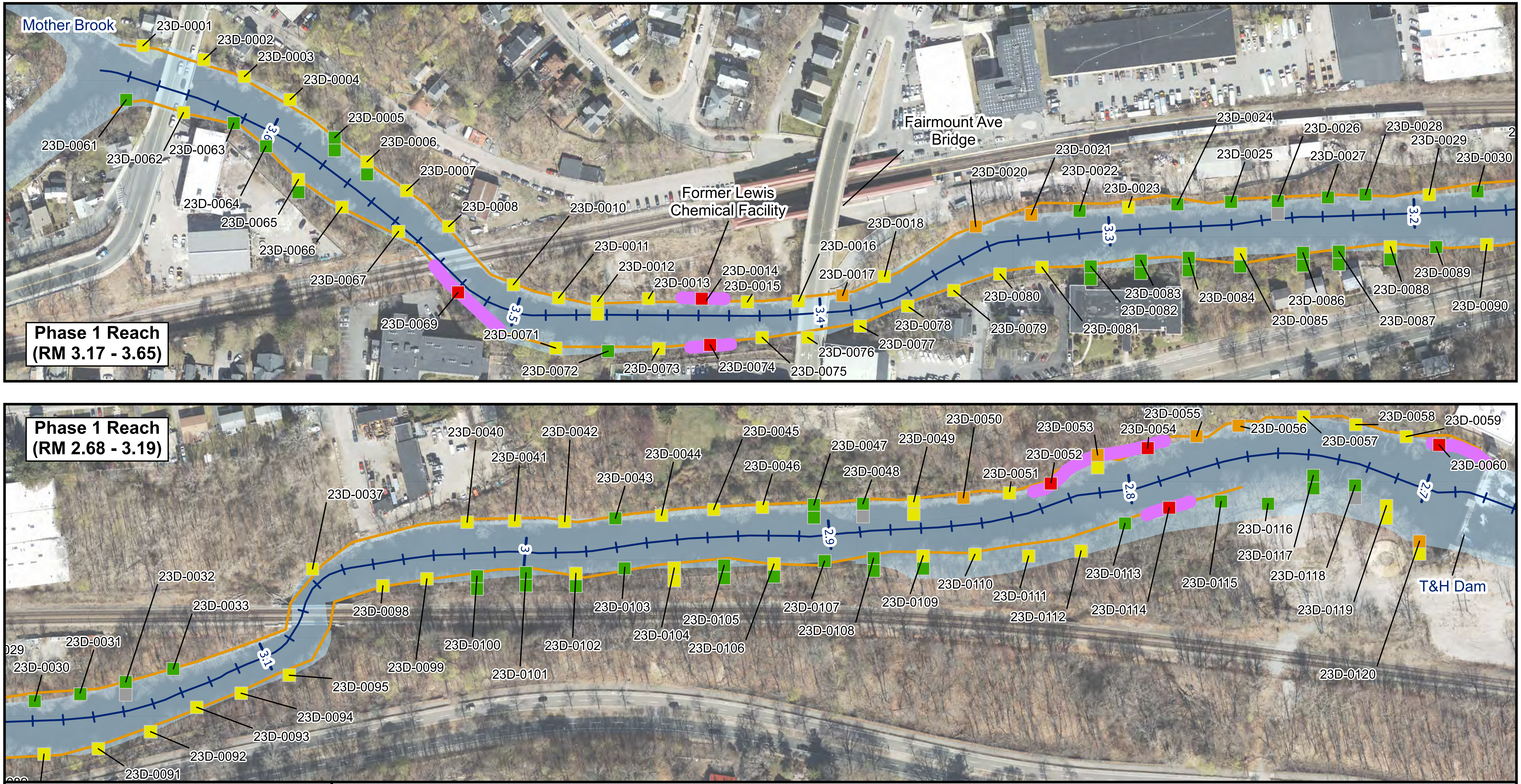

Figure 8
RAA-2 Floodplain Soil
Removal Areas

AECOM

Legend

- 🟪 Riverbank Soil Removal Area
- — LNR River Miles
- ▭ 100 Year Floodplain (FEMA)
- — Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Conc. (mg/kg)

- ◼ Not Detected
- 🟩 < 1.0 mg/kg
- 🟨 < 25.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- ☐ 0 ft - 1.0 ft below surface
- ☐ 1.0 ft - 4.0 ft. below surface

Note: Riverbank soil removal areas were defined by locations of floodplain soil samples.

*Actual sample depth intervals vary at each sample location. If only one depth is shown, a deeper sample was not obtained.

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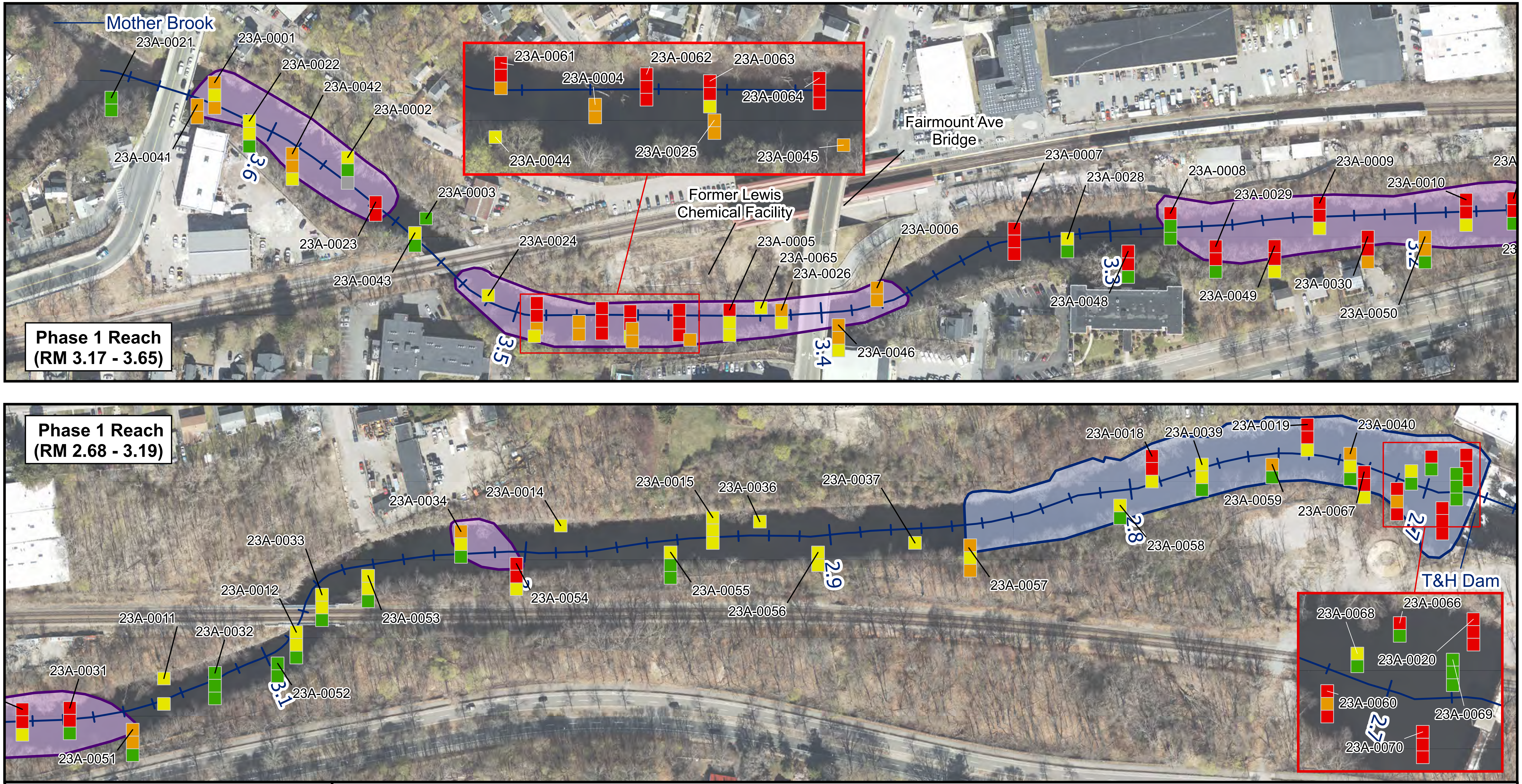

Figure 9
RAA-3 Sediment Removal Areas

AECOM

N

0 75 150 300
Feet

Legend

- ▭ Remove all sediment that exceeds 14 mg/kg PCBs.
- ▭ Remove all sediment that exceeds 14 mg/kg PCBs plus additional sediment and riverbed soil as required to remove T&H Dam.
- — LNR River Miles

Total PCBs Conc. (mg/kg)

- ⬜ Not Detected
- 🟩 < 1.00 mg/kg
- 🟨 < 14.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- ⬜ 0 ft - 0.5 ft below surface
- ⬜ 0.5 ft - 3.0 ft. below surface
- ⬜ 3.0 ft - 6.0 ft below surface

*Actual sample depth intervals vary at each sample location. If fewer than 3 depths are shown, deeper samples were not obtained.

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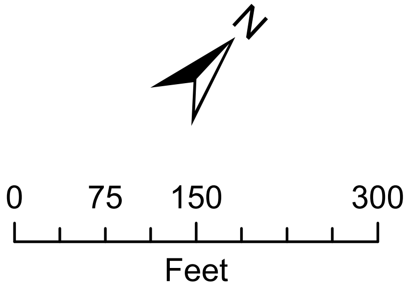
Figure 10
RAA-3 Floodplain Soil Removal Areas

AECOM



Legend

Riverbank Soil Removal Area
LNR River Miles
100 Year Floodplain (FEMA)
Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Conc. (mg/kg)

- ⬜ Not Detected
- 🟩 < 1.0 mg/kg
- 🟨 < 14.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- 0 ft - 1.0 ft below surface
- 1.0 ft - 4.0 ft. below surface

Note: Riverbank soil removal areas were defined by locations of floodplain soil samples.

*Actual sample depth intervals vary at each sample location. If only one depth is shown, a deeper sample was not obtained.

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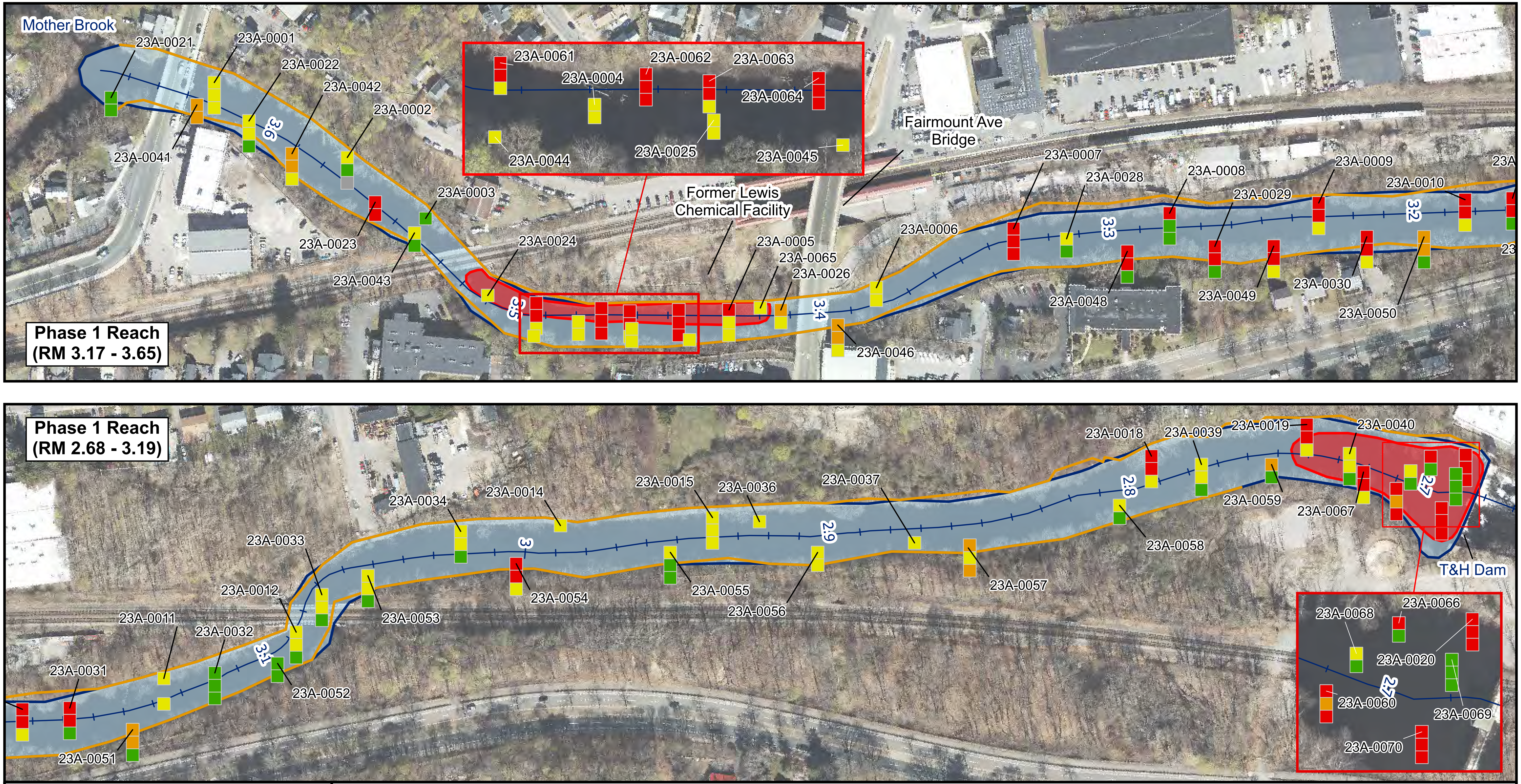

Figure 11
RAA-4 Sediment Removal Areas

AECOM

N

0 75 150 300
Feet

Legend

Removal Areas

- ▭ Remove all sediment bank to bank to a depth of 3 ft.
- 🟥 Dredging to deeper than 3 ft.
- — LNR River Miles
- — Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Conc. (mg/kg)

- ⬜ Not Detected
- 🟩 < 1.00 mg/kg
- 🟨 < 25.0 mg/kg
- 🟧 < 100.0 mg/kg
- 🟥 ≥ 100.0 mg/kg

Nominal Depth Interval*

- 0 ft - 0.5 ft below surface
- 0.5 ft - 3.0 ft. below surface
- 3.0 ft - 6.0 ft below surface

*Actual sample depth intervals vary at each sample location. If fewer than 3 depths are shown, deeper samples were not obtained.

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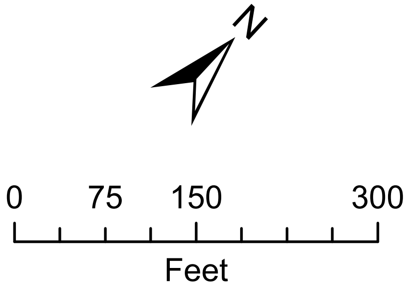
Figure 12
RAA-4 Post Dredging PCBs in Sediment and Extent of Riverbed Cap

AECOM



Legend

🟥 PCBs >1 mg/kg detected below 3 ft dredge depth. Depths noted indicate the maximum depths of the sediment cores taken.

● PCBs > 1 mg/kg detected at deepest sample (vibracore refusal depth). Deepest sample less than the maximum dredge depth. Deeper contamination may be present.*

🟥 Dredging to deeper than 3 ft.

▭ Extent of Area of Sorptive Cap

Note:
All PCBs concentrations come from 2023 sampling data.

*Samples deeper than 3 feet were not collected due to refusal/accessibility.

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Figure 13
RAA-4 Floodplain Soil Removal Areas

AECOM

N

0 75 150 300
Feet

Legend

- Riverbank Soil Removal Area (>1 mg/kg PCBs)
- LNR River Miles
- 100 Year Floodplain (FEMA)
- Ordinary High Water Mark (2023 Wetland Survey)

Total PCBs Conc. (mg/kg)

⬜	Not Detected
🟩	< 1.0 mg/kg
🟨	< 4.0 mg/kg
🟧	< 100.0 mg/kg
🟥	≥ 100.0 mg/kg

Nominal Depth Interval*

⬜	0 ft - 1.0 ft below surface
⬜	1.0 ft - 4.0 ft. below surface

Note: Riverbank soil removal areas were defined by locations of floodplain soil samples.

*Actual sample depth intervals vary at each sample location. If only one depth is shown, a deeper sample was not obtained.

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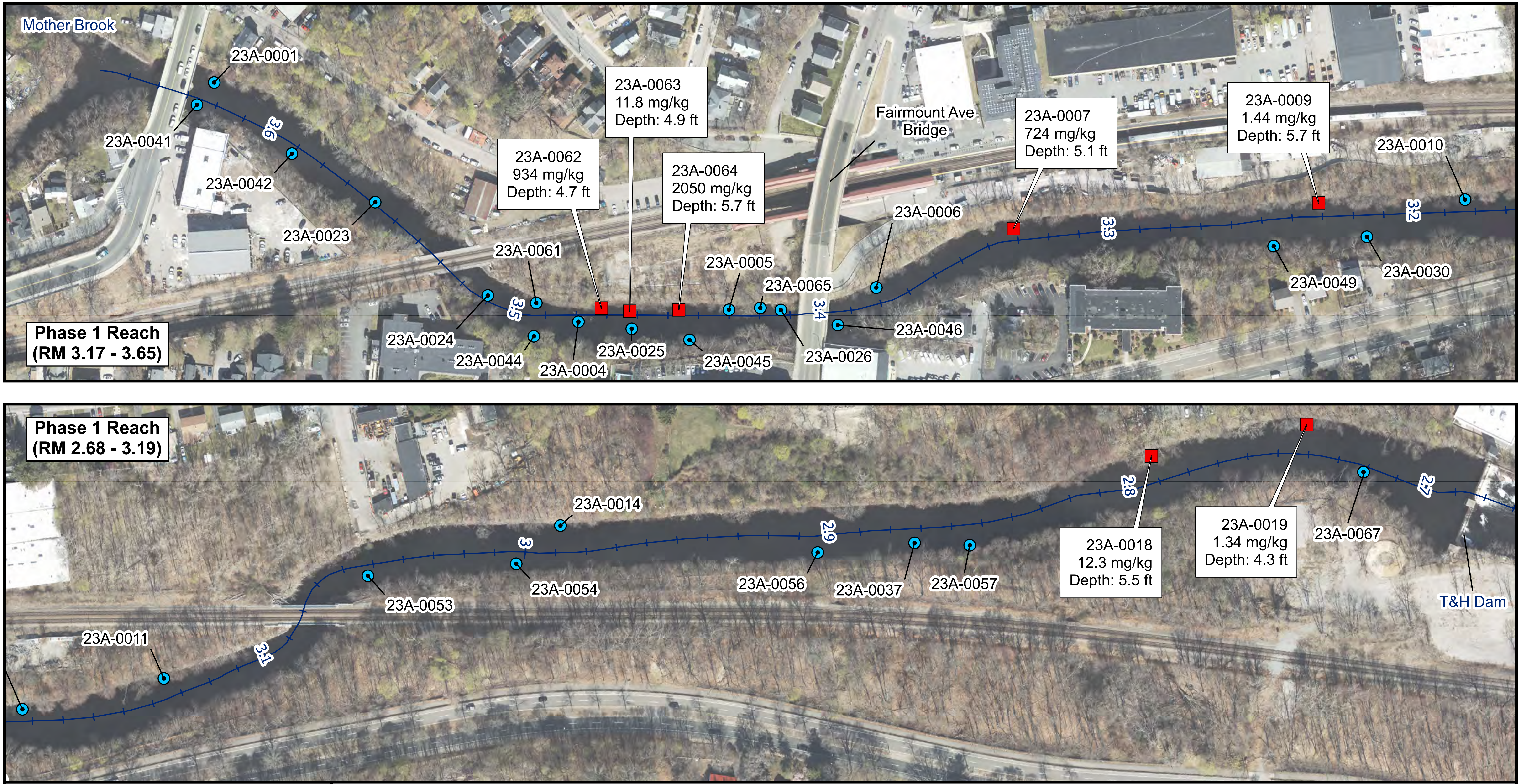

Figure 14
Total PCBs in Sediment Below 4 foot Dredge Depth

AECOM

Legend

🟥 PCBs >1 mg/kg detected below 4 feet. Depths noted indicate the maximum depth of the sediment core at each location.

● PCBs > 1 mg/kg detected at deepest sample interval. The bottom of the deepest sample interval is less than 4 feet. Deeper contamination may be present.*

Note:
All PCBs concentrations come from 2023 sampling data.

*Samples deeper than 4 feet were not collected at that coring location due to refusal/accessibility.

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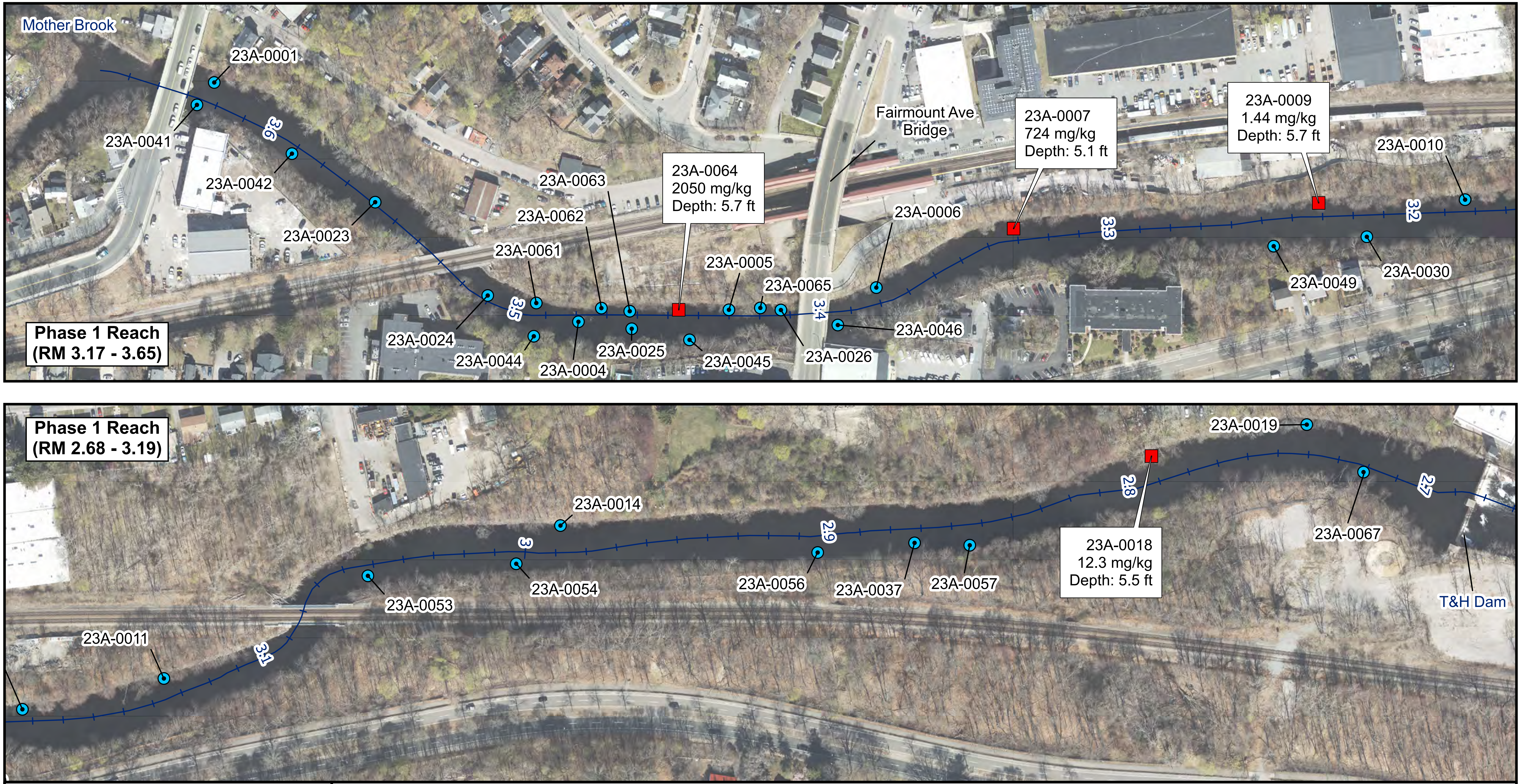

Figure 15
Total PCBs in Sediment Below 5 foot Dredge Depth

AECOM

N

0 75 150 300
Feet

Legend

🟥 PCBs >1 mg/kg detected below 5 feet. Depths noted indicate the maximum depth of the sediment core at each location.

● PCBs > 1 mg/kg detected at deepest sample interval. The bottom of the deepest sample interval is less than 5 feet. Deeper contamination may be present.*

Note:
All PCBs concentrations come from 2023 sampling data.

*Samples deeper than 5 feet were not collected at the coring location due to refusal/accessibility.

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Conceptual Cross Section of Riverbed Cap for RAA-4 [1]

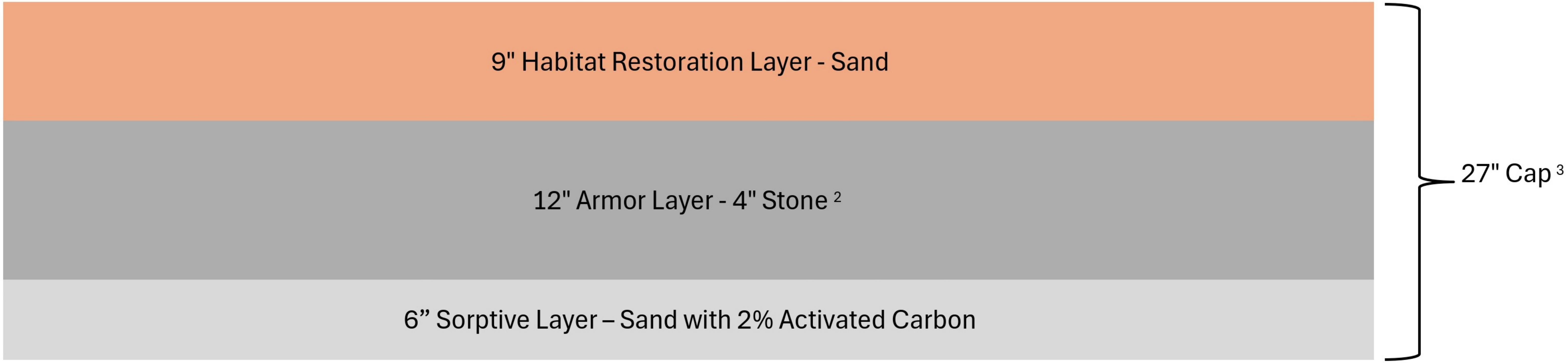


Figure 16
RAA-4 Conceptual Cross Section
of In Situ Amendment Cap

AECOM

Notes:

1. This preliminary schematic is not a final design and is only intended to be used to inform the Phase 1 NTCRA EECA.

2. Armor stone D50 sized using the Isbash formula and the HEC-RAS modeled 500-year storm channel velocity (~7 ft/s). Areas with greater velocities may require larger stone (greater than 6") for armoring.

3. In some areas, the dredge depth is greater than the cap thickness shown on this figure. In those cases, additional backfill will be placed beneath the stone armor layer as necessary such that the final riverbed elevation is approximately the same as the pre-dredging condition. This does not apply to the zone immediately upstream of the T&H Dam, where the riverbed channel will be lowered to provide an approximately 1:10 slope of the riverbed to accommodate dam removal or the depositional area adjacent to the former Lewis Chemical facility where additional volume may need removed.

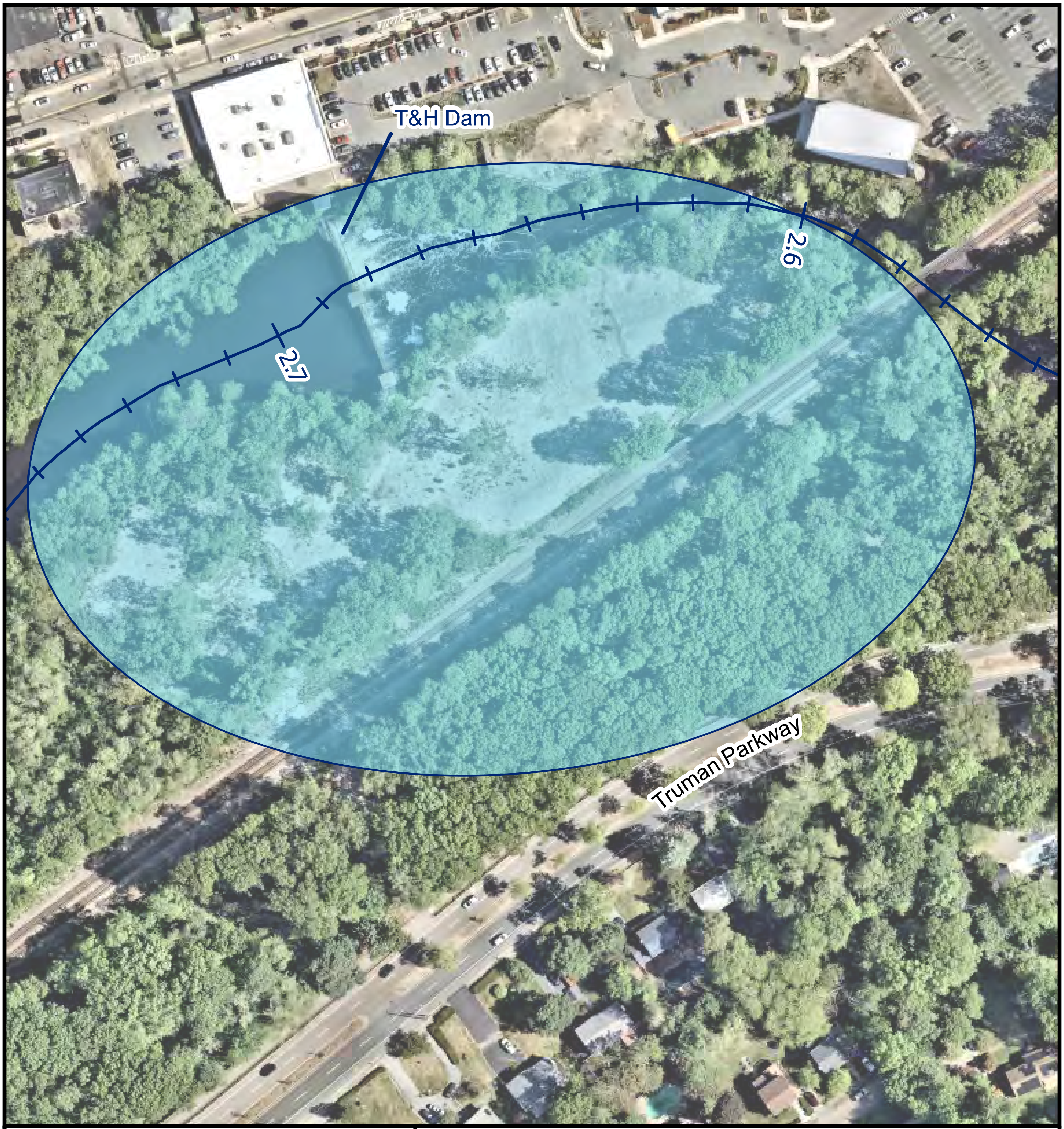
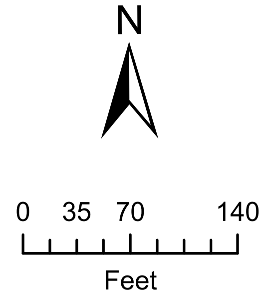


Figure 17
Conceptual Staging and Loadout Area

AECOM



Legend

—	LNR River Miles
▭	Staging Area

Maxar, Microsoft, Nearmap

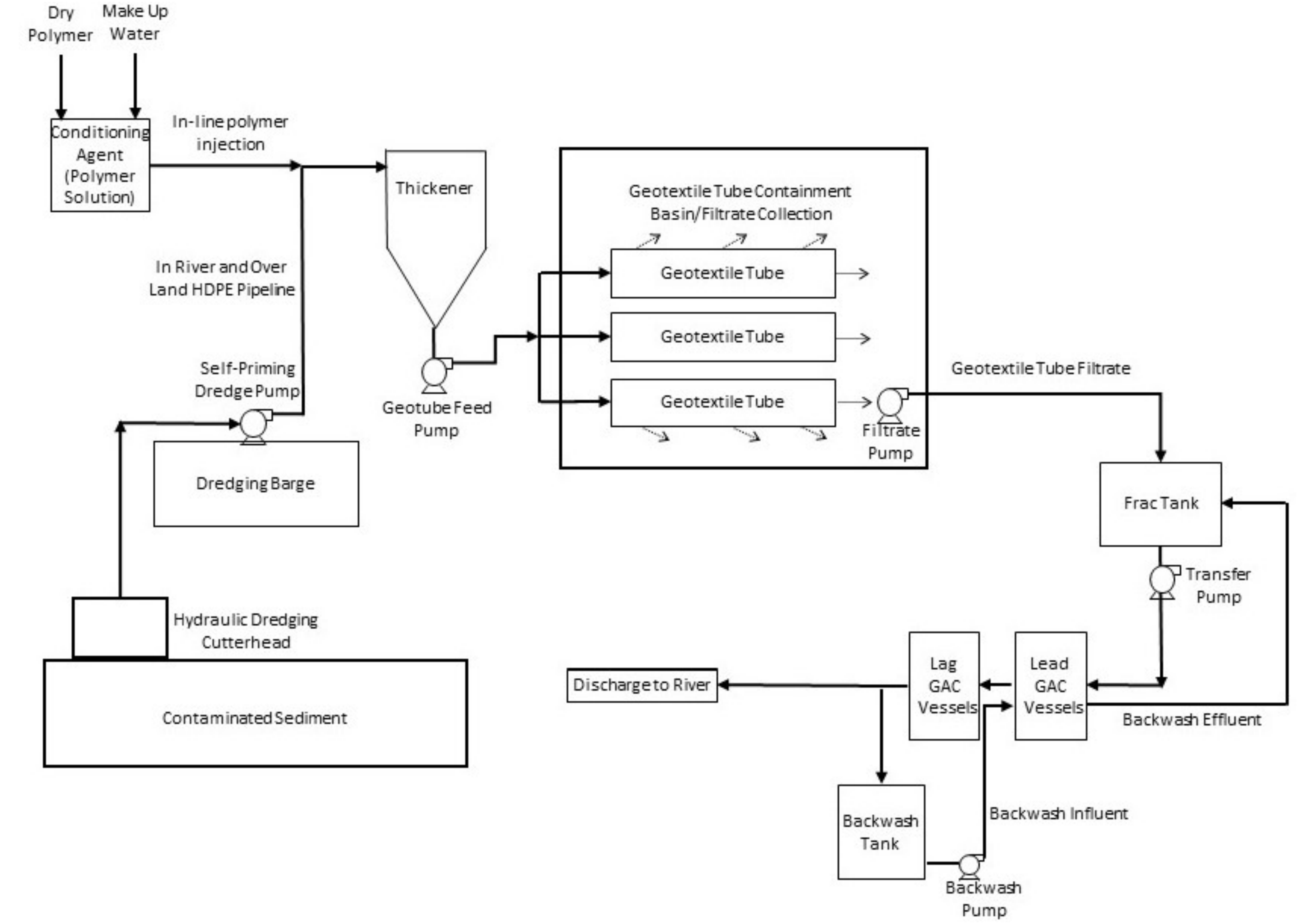
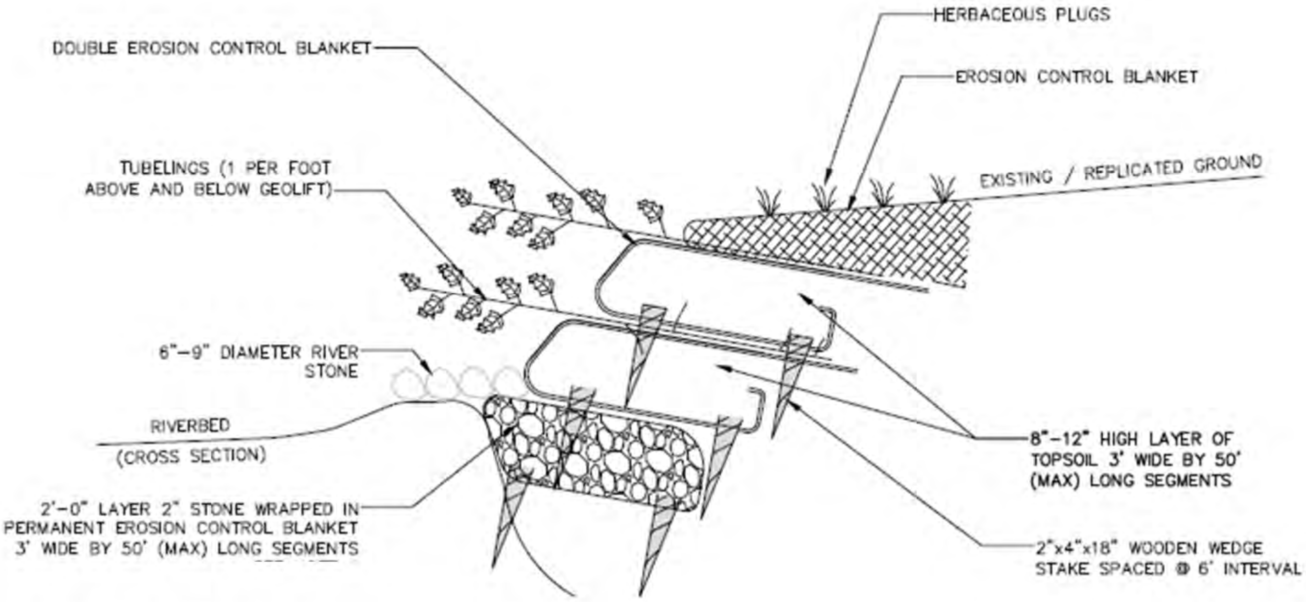
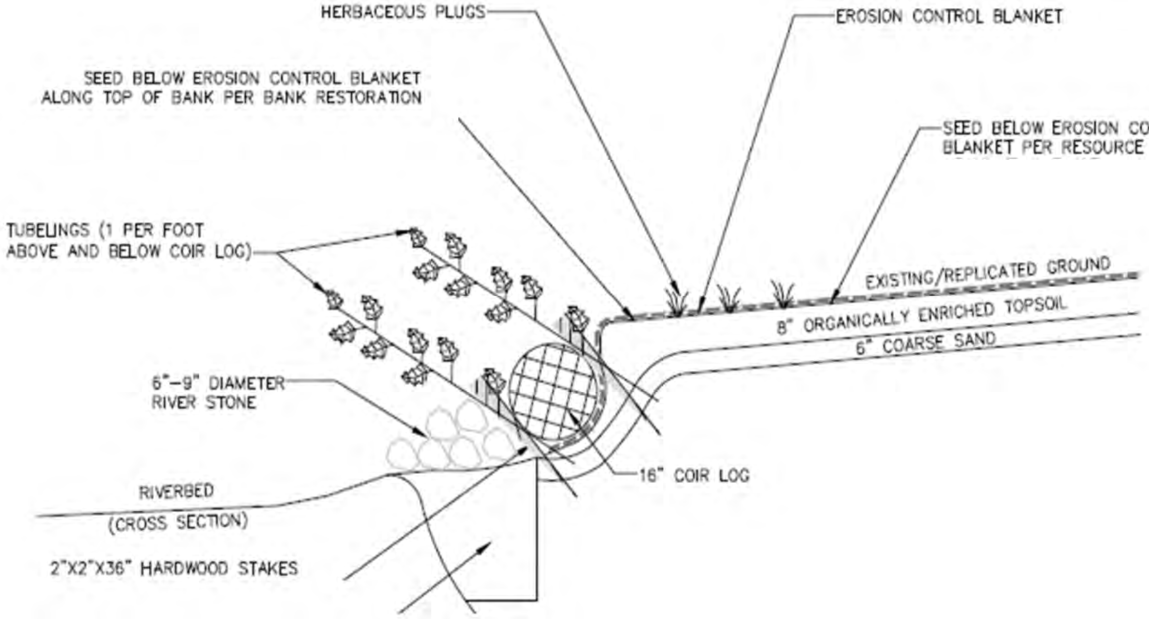


Figure 18
Conceptual Dewatering
Process Flow Diagram

AECOM



VEGETATED GEOLIFTS



VEGETATED COIR LOG WITH RIVER STONE

Figure 19
Conceptual Riverbank
Stabilization Measures

APPENDICES

APPENDIX A

APPROVAL TO PERFORM AN EE/CA FOR A NTCRA AT THE LOWER NEPONSET RIVER SUPERFUND SITE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 Post Office Square, Suite 100
Boston, MA 02109-3912

DATE: **See E-Signature Block Below**

SUBJ: Approval to Perform an EE/CA for a NTCRA at the Lower Neponset River Superfund Site, Boston and Milton, Massachusetts

FROM: Natalie Burgo, Remedial Project Manager
Massachusetts Superfund Section

TO: Bryan Olson, Director, Superfund and Emergency Management Division
EPA Region 1

I. Purpose

The purpose of this memorandum is to request and document your approval to authorize the expenditure of federal funds to conduct an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) in the vicinity of the Tileston & Hollingsworth (T&H) dam and impoundment at the Lower Neponset River Superfund Site (the "Site") in Boston and Milton, Massachusetts. Based on investigations conducted by the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MADEP), EPA has determined that there has been and continues to be a release into the environment of hazardous substances which may present an imminent and substantial danger to public health or welfare.

Because the NTCRA may require funding in excess of $6 million, EPA Region 1 has consulted with OSRTI prior to regional authorization of this Approval Memorandum.

II. Site Background

A. Site Description and History

Description: 3.7-mile stretch of the Lower Neponset River
City and State: Boston and Milton, Massachusetts
County: Suffolk
EPA ID: MAN000102204
SSID: 01PX
Final NPL Listing: Federal Register / Vol. 87, No. 51 / Wednesday, March 16, 2022
Start of Site (confluence coordinates): 42.251785, -71.123205
End of Site (Walter Baker Chocolate Dam coordinates): 42.270765, -71.068818

The Neponset River, like most urban rivers in the Northeast, has a long industrial history. Industrialization and subsequent urbanization began in the Neponset River Basin as early as the 1630s. By the mid-1700s, the Neponset River drained one of the most heavily industrialized drainage basins in the Nation, draining parts of and areas adjacent to, the city of Boston and the Town of Milton. Recognized as the second watershed to be industrialized in the United States, the Neponset River has a complex history of contamination from both point and non-point sources. Used historically for hydro-powered factories, the Neponset River has been home to countless riverfront industrial land use ventures, many of which historically discharged directly into the river.

A byproduct of this early industrialization along the river was the need for hydro-powered dams to meet abutting mills' power production requirements. The Tileston and Hollingsworth dam and the Walter Baker Chocolate dam remain on the Lower Neponset River within the Site boundary, both of which contain polychlorinated biphenyl (PCB) contaminated sediment impoundments. The former purpose of the T&H dam was to provide a source of water for the mill on the south bank. By written agreement, the Massachusetts Department of Conservation and Recreation (DCR) maintained the pond level at El 42.3 Boston City Base (BCB) so that water was available for use by the mill. Since the closing and demolition of the mill, the dam's purpose is no longer obvious, but the agreement still exists. The gates have significant section loss such that they can only retain water at around El. 39 BCB. Both dams are classified as Class II (significant) hazard potential dams and were deemed in overall poor condition as of 2021. Poor condition as defined by the Commonwealth of Massachusetts Office of Dam Safety Phase I Formal Dam Inspection Report Format and Submission Requirements are when "significant structural, operation and maintenance deficiencies are clearly recognized for normal loading conditions".

The Site is comprised of a 3.7-mile segment of the Neponset River, referred to as the Lower Neponset River Site, and contains PCB-contaminated sediment and potentially additional contaminants of concern. The Site begins at the confluence of the Neponset River & Mother Brook and flows 3.7 miles downstream to the Walter Baker Chocolate Dam, as illustrated in the Lower Neponset River Superfund Site map enclosed at the end of this memorandum. The Site drains directly into the Neponset River Estuary, a subembayment of Boston Harbor. Because this estuary supports anadromous fish habitat and shell fisheries, it has been designated by the Commonwealth of Massachusetts as an Area of Critical Environmental Concern. A fish advisory throughout the Site, and upstream of the Site, was initially issued in 1995 by the Massachusetts Department of Public Health (MA DPH) and remains in effect today for the consumption of American Eel and White Sucker due to PCBs and dichloro-diphenyl-trichloroethane (DDT).

The Site is bordered by residential, commercial, industrial, and public parcels of land, including the Neponset River Greenway. Seven active kayak and canoe launches are utilized along the Site. There are portions along the northern and southern banks of the Lower Neponset River that are lined by residential properties adjacent to the banks of the river. An estimated 73,336 and 423,686 people reside within 1 radial mile and 4 radial miles of the Site, respectively. There is one school, MATCH Community Day Charter Public School with an enrollment of approximately 650 students per year, located within 500 feet of the Site. In addition, there are several daycare and/or pre-K facilities located within 500 feet of Site, collectively serving hundreds of infants, toddlers, and young children.

Numerous PCB-contaminated sediment erosion and deposition areas have been documented along the riverbed channel. The deposition areas include but are not limited to the Walter Baker Chocolate Dam impoundment, the Braided Channel, and the Tiles & Hollingsworth (T&H) Dam impoundment areas. Numerous wetland areas are also located within and along the 3.7-mile riverbed segment of the Site. The majority of the wetland acreage is within the Braided Channel, but there is wetland frontage along the majority of the edge of the riverbed channel. There are no state and/or federally designated endangered species habitats known to be located on the Site.

There are several sites within the river basin which have been identified by previous investigations as having formerly used, stored, or had releases of PCBs and are likely to have contributed to the sediment contamination plume; numerous other sites which may have used, stored, or had releases of PCBs within the river basin and may have contributed PCB contamination to the sediment contamination plume; and still other potential sites, sources, and/or releases, which have not yet been identified, but based on the long, complex, urban and industrial history of the area along the Neponset River and within the river basin, are likely to exist and potentially have contributed to the PCB-contaminated sediment. The EPA Lower Neponset River Superfund Site Fund-Lead RI/FS Determination memorandum dated May 10, 2022, documents EPA's search activities relating to the potential liability/viability of various potentially responsible parties (PRPs) at the Site, as discussed further in Section VI of this memorandum.

On October 27, 2015, MADEP requested that the EPA evaluate the Lower Neponset River for potential listing on the National Priorities List (NPL). In 2017-2018, as part of the EPA Site Investigation, 163 samples were collected and analyzed from the Site. Based on the comparison of sediment reference sample levels to the elevated concentrations of PCB Compounds (both PCB Aroclors and Total PCBs) detected in the 2017 and 2018 Site Investigation sediment/source samples, a release of the hazardous substance PCBs to sediment and the surface water pathway was documented, which are at least partially attributable to the Site. In addition, the data documents that the wetlands and fishery within and along the banks of the Lower Neponset River have or are likely to have been impacted by PCB contamination.

There has been significant public involvement at this Site. Community groups have been advocating for action on the Site for years. On September 9, 2021, EPA Region 1 proposed the Site to the NPL. Eighteen comments were received during the public comment period for the proposed listing of the Site. There were no comments against the listing and the majority of comments showed strong support. On March 16, 2022, the Site was included in the final listing of NPL sites. The public announcement of the NPL listing received substantial media coverage. The EPA event announcing the listing was also attended by U.S. Representatives Ayana Pressley and Stephen Lynch, U.S. Senator Elizabeth Warren, and Boston Mayor Michelle Wu, who all expressed strong support for the inclusion of the Site on the NPL.

B. Nature and Extent of Contamination

The impacts to the Lower Neponset River Superfund Site and surrounding community have been documented through several studies performed by United States Army Corps of Engineers (USACE), the United States Geological Survey (USGS), MADEP, DCR, and EPA. The key finding of these studies are:

- PCB concentrations significantly increased in sediment core samples collected downstream of the confluence of Mother Brook and the Neponset River.

- PCB concentrations measured in riverine fish, both whole and fillets, were above concentrations (2,000 ng/g) considered by the EPA to be safe for consumption of fish by both wildlife and humans.

- Some measured and estimated concentrations of dissolved PCBs were above EPA's continuous chronic criterion for dissolved PCBs (14 mg/L); concentrations above this criterion could cause harm to humans, wildlife, and fish, if exposed over long enough period of time.

- Bottom-sediment samples analyzed for 31 elements had element concentrations generally higher than background concentrations in New England rivers, streams, and estuarine environments. Concentrations were higher than levels considered toxic to benthic organisms or bottom-dwelling insects and worms that form the base of the food chain.

- In 2002, bottom-sediment volumes were estimated by USGS at 620,000 cubic feet (22,960 cubic yards) in the T&H Dam impoundment; 790,000 cubic feet (29,260 cubic yards) in the Braided Channel area; and 210,000 cubic feet (7,780 cubic yards) in the Baker Dam impoundment.

- Maximum depositional sediment thickness impounded by the T&H dam decreased from 9.7 feet in 2002 to 4.8 feet in 2021.

- In 2018, the highest concentration of Total PCBs (congener analysis) at 11,000 milligrams per kilogram (mg/kg) was collected from the T&H Dam impoundment.

- During the 2017 – 2019 EPA PA/SI, all sediment samples submitted for PCB congener analysis were detected at significant levels above background/reference concentrations, ranging from 8 to 2,821 times the reference concentration of 3.9 mg/kg.

Utilizing congener analysis, PCB concentrations in sediment throughout the Site range from non-detect to 11,000 mg/kg. Utilizing aroclor analysis, the maximum PCB concentration collected from a fluvial deposition area along the northern bank of the Site was 2,000 mg/kg. The ongoing, uncontrolled erosion, diffusion, resuspension, and transportation of PCB-contaminated sediment is a significant source of PCB loading to the Lower Neponset River resulting in further transportation of sediment downstream.

PCBs have bioaccumulated in fish as indicated by tissue sampling. The Neponset River is a fishery as well as a widely utilized recreational resource for the surrounding communities. Sediment and surface water discharge from the Baker Dam into the Neponset River Estuary, a subembayment of Boston Harbor. This segment of the Neponset River is designated an Area of Critical Environmental Concern (sensitive environment) as well as a Class SB surface water body. Class

SB waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation.

III. Threat to Public Health, Welfare, or the Environment

Consistent with Section 300.415(b)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), EPA considered the following factors in determining whether a removal action is appropriate for the Site, including:

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants:

PCBs are a hazardous substance, as that term is defined by Section 101(14) of CERCLA, 40 C.F.R. § 9601(14). PCBs are also listed as a priority pollutant under Section 307 of the Clean Water Act, as set forth in 40 C.F.R. § 116.4 Table A. The EPA has determined that PCBs are a probable human carcinogen. These chemicals have the potential to biomagnify, which means that they have the potential to increase in concentration as they are transferred from one link in the food chain to another.

Although the 1995 MDPH advisory is still in effect, the fish consumption advisory is simply that, an advisory. Fishing has been observed throughout the Site. The most significant outcome of the preliminary ecological and human health risk assessments is the conclusion that fish consumption is the primary exposure pathway for receptors that may be at risk from PCBs within media of the Lower Neponset River. Therefore, the key to reducing exposure and potential risks to important receptors (e.g., fish-eating birds, fish-eating wildlife, and humans) is to reduce PCB concentrations in the fish tissue consumed by these receptors. The greatest factor controlling PCB levels in fish is the concentration of PCBs in surface sediment and the water column where fish and their prey come in contact with or ingest PCBs.

Uncontrolled PCB-contaminated sediment behind the T&H dam continues to migrate downstream. In 2002, the USGS determined that the maximum measured sediment thickness was 9.7 feet on the right side of the T&H dam sediment impoundment. The maximum sediment thickness in this area decreased from 9.7 feet in 2002 to 4.8 feet in 2021.

Finally, sediment samples with concentrations of PCBs ranging from non-detect to 2,000 mg/kg have been collected in publicly accessible locations upstream of the T&H dam and have been preliminary identified as potential hotspot locations. Due to the direct contact risk, the NTCRA will evaluate several response alternatives to mitigate this risk.

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems:

The Site is a Clean Water Act (CWA) protected water body with approximately 7.7 acres of wetlands. The Site discharges directly into the Neponset River Estuary Area of Critical Environmental Concern (sensitive ecosystem). According to the Massachusetts Division of Marine Fisheries (DMF), the Neponset River supports valuable anadromous fish populations including one of the largest smelt runs in Massachusetts Bay. Blueback herring and American shad utilize the area directly downstream of the Site for spawning purposes. Additionally, numerous dish species enter the Neponset River estuary as season migrants for feeding purposes, with striped bass, bluefish and winter flounder considered significant for commercial and recreational purposes. As a result of erosion and sediment transport processes, highly contaminated sediment throughout the Site continue to pose a risk of migration and uncontrolled release to the sensitive ecosystems directly downstream from the Baker Dam (end of the current Site boundary).

(iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release:

There are no drums, tanks, or other bulk storage containers at the Site.

(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate:

The T&H Dam impoundment has PCB levels up to 11,000 mg/kg and 2,000 mg/kg in a fluvial deposition area upstream of the T&H dam. As explained above, sediment and fluvial deposition areas located instream or near the river's edge are susceptible to erosion and scouring. During high water events, increases in river velocity create conditions that may potentially result in additional releases of PCBs to the Lower Neponset River and downstream of the Site.

Further, if the T&H dam were to fail, impounded contaminated sediment impounded will migrate to the downstream riverbed sediment, riverbanks and wetlands. This may also require EPA to conduct response actions to address either human health threats related to direct exposure to residents and recreational users of riverbanks and wetlands or exacerbated ecological threats at areas where responses may not otherwise be necessary.

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released:

Heavy spring rains and/or summer storms increase stream volume and flow velocity, which could potentially lead to increased scouring and erosion of the river bottom and riverbanks. All these forces cause an increase in the volume and extent of PCB contamination in the Lower Neponset River.

Site changes or vulnerabilities include gradual climate-related changes, such as seasonal changes in precipitation or temperatures and increasing risk of floods and intensity of rain events that have the potential to cause hazardous substances or pollutants or contaminants to migrate or be released.

(vi) Threat of fire or explosion:

There is not a threat of fire nor explosion at the Site documented at this time.

(vii) The availability of other appropriate federal or state response mechanisms to respond to the release:

State and local response mechanisms are not available to respond to this release. Therefore, the EPA Region 1 remedial program is requesting approval to perform an EE/CA for a NTCRA at the Lower Neponset River Superfund Site to evaluate alternatives for response measures to address the threat of release of PCB-contaminated sediment. Evaluating alternatives for response measures prior to future high flow periods will allow for the determination if a NTCRA is warranted, which may provide additional protection to the Lower Neponset River and downstream ecosystems.

(viii) Other situations or factors that may pose threats to public health or welfare or the environment:

In addition to the factors discussed above, EPA also considered the: (1) time-sensitivity of the response; (2) the complexity of both the problems to be addressed and the action to be taken; and (3) the comprehensiveness of the proposed action.

Ten of the twelve EJScreen application's Environmental Justice (EJ) Indexes are above the 80th percentile for the state average level, thus Region 1 considers the Site to be located within multiple communities with potential EJ concerns.

The Site intersects or abuts three census tracts that are also identified as disadvantaged by the White House Council on Environmental Quality's (CEQ) Climate and Economic Justice Screening Tool (CEJST), thus expenditure of federal funds on the Site aligns with the Justice40 Initiative.

The MADEP fully supports development of an EE/CA and an early action at this Site.

This removal is designated as *non-time-critical* because more than six months of planning time will be required prior to initiation of on-site activities. Prior to the actual performance of a NTCRA at this Site, Section 300.415(b)(4) of the NCP requires that an EE/CA be performed to weigh different response options.

IV. Endangerment Determination

Actual or threatened releases of hazardous substances (e.g., PCBs, dioxins, heavy metals, etc.) from this Site, if not addressed, may present an imminent and substantial endangerment to public health, welfare, or the environment. In accordance with the Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA, OSWER Directive 9360.0-34 (August 19, 1993), an endangerment determination by an EPA risk assessor will be included in the EE/CA based on sampling data collected at the Site.

V. Scope of the EE/CA

The purpose of the EE/CA is to evaluate alternatives for response measures to address the threat of release and migration of PCB-contaminated sediment from the T&H dam impoundment and hotspots upstream of the T&H dam.

The EE/CA will consider three alternatives which meet the following general removal action objectives:

- Prevent, to the extent practicable, the migration and uncontrolled release of highly contaminated PCB-sediment from the T&H dam impoundment and hotspot fluvial deposition areas.
- Implement the response action in a manner that considers how the future decisions regarding the T&H dam (no change, repair, remove, replace) will impact sediment fate and transport throughout the Site.
- Implement the response action in a manner that will minimize, to the extent practical, impacts to the densely populated and / or identified environmental justice communities.

Pursuant to EPA guidance on EE/CAs, alternatives will be evaluated based upon effectiveness, implementability, cost and compliance with Applicable or Relevant and Appropriate Requirements (ARARs) to the extent practicable. It is estimated that any alternatives to address PCB-contaminated material may exceed $2 million dollars and therefore will be evaluated to determine their consistency with future remedial actions at the Site.

In developing the range of alternatives to be evaluated in the EE/CA, EPA will, pursuant to Section 300.415(d) of the NCP, consider actions that shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the releases concerned, as well as other relevant guidance.

VI. Enforcement Strategy

The EPA Lower Neponset River Superfund Site Fund-Lead RI/FS Determination memorandum dated May 10, 2022 documents EPA's search activities relating to the potential liability/viability of various potentially responsible parties (PRPs) at the Site.

VII. Estimated Costs

Costs associated with the preparation of the EE/CA(s) described above are expected to be approximately $340,000. Preliminary alternative estimates will be fully developed as part of the EE/CA and will consider treatment methods to address the principal threats posed by the Site, where practicable.

The EE/CA for the proposed NTCRA at the Site will be performed by EPA as a fund lead response action. Therefore, federal funds for the performance of an EE/CA are requested at this time. As noted above in Section VI, the PRP Search will continue to be updated as additional information becomes available. As described above, given time constraints for the RI/FS start, the environmental justice concerns in abutting communities, and the inability of noticed parties to coalesce in a time-efficient manner to reach agreement, the Region has decided not to pursue the PRPs at this time to conduct or finance this action and is recommending funding for the performance of an EE/CA to support the proposed NTCRA.

VIII. Headquarters Consultation

In accordance with the national guidance document, use of Non-Time-Critical Removal Authority in Superfund Response Actions dated February 14, 2000, EPA Region 1 consulted with the Office of Superfund Remediation and Technology Innovation (OSRTI) based on the anticipated cost of the NTCRA being greater than $6 million. OSRTI has conferred with the Office of Site Remediation Enforcement (OSRE) and has indicated OSRTI support for performing an EE/CA at the Lower Neponset River Superfund Site.

IX. Recommendation

Ongoing investigations have determined that there has been a release of hazardous substances to the environment. Additionally, conditions at the Site meet the NCP Section 300.415(b) criteria for a removal. Consistent with Section 104(b) of CERCLA and NCP Section 300.415(b)(4), further investigation is necessary to plan and direct the future removal action. Approval of this request to perform an EE/CA at the Lower Neponset River Superfund Site is recommended. The total estimated cost to perform the EE/CA is approximately $340,000.

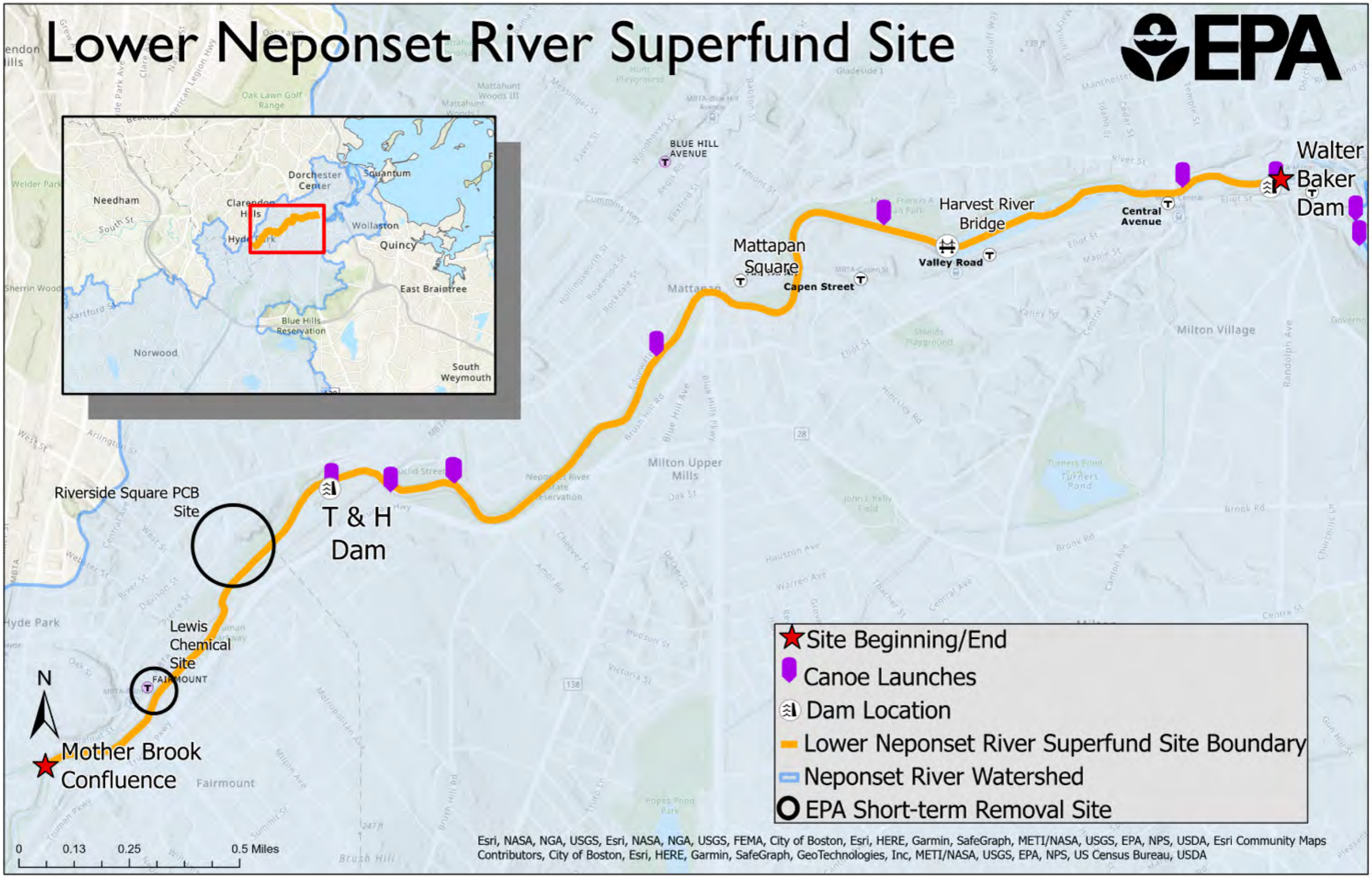
Approved:

____
Bryan Olson, Director
Superfund and Emergency Management Division

Concurrence:

____
Larry Douchand, Director
Office of Superfund Remediation and Technology Innovation

Enclosure: Lower Neponset River Superfund Site Map



Lower Neponset River Superfund Site

Esri, NASA, NGA, USGS, Esri, NASA, NGA, USGS, FEMA, City of Boston, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri Community Maps Contributors, City of Boston, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

APPENDIX B

HYDRAULICS AND SEDIMENT STABILITY ANALYSIS

AECOM
250 Apollo Drive
Chelmsford, MA 01824

978.905.2100 tel

DRAFT FINAL Memorandum

To	Frederick R. Symmes	Page	1
CC	Mike Gardner; Kristine Carbonneau		
Subject	Hydraulics and Sediment Stability Analysis		
From	Kathryn Teske, Nathan Borgogni		
Date	03/04/2025		

1.0 Overview and Purpose

AECOM performed a hydraulics and sediment stability analysis in the upper one-mile stretch (Phase 1 Reach) of the Lower Neponset River Superfund Site (Site). The purpose of the analysis is to inform the Engineering Evaluation/Cost Analysis (EE/CA) for the Phase 1 Reach. The EE/CA will support a potential non-time critical removal action (NTCRA) of sediment contaminated with polychlorinated biphenyls (PCBs), primarily impounded behind the Tileston and Hollingsworth (T&H) Dam and other hotspots within the Phase 1 Reach.

Considering the NTCRA alternatives evaluated in the EE/CA may include both dam repair or dam removal, the analysis was performed for both dam in place (dam up) and dam removed (dam down) scenarios. An understanding of where contaminated sediment is stable or erosional is needed to assess potential remedial action boundaries for both dam scenarios. AECOM developed a HEC-RAS hydraulic model to approximate riverine conditions for both scenarios. The hydraulic model results were then used in the sediment stability calculations to identify areas of soft sediment at risk of being transported downstream.

2.0 Hydrology and Hydraulics

The Lower Neponset River (LNR) Superfund Site begins at the confluence of LNR and Mother Brook and ends at the Walter Baker Dam, a total of approximately 3.7 miles of the LNR. The Neponset River drains approximately 101 square miles of land and flows approximately 29 miles from its headwaters in Foxboro, MA into the Neponset River Estuary downstream of the Walter Baker Dam. The Neponset River is then tidally influenced for approximately another 3 miles and ultimately discharges to Dorchester Bay.

2.1. Data Sources and Previous Studies

The Neponset River is a Zone AE regulated floodway with an effective Flood Insurance Study (FIS) dating 1977. The Neponset River peak flows determined by FEMA in the 1977 FIS for the Town of Milton, MA are summarized in **Table 2-1**. The peak flows were determined by a flood frequency analysis using data collected by U.S. Geological Survey (USGS) stream gauging station #0110500 at Norwood, MA, with a record of approximately 38 years (1939 to 1977).

Table 2-1. Flood Insurance Study (FIS) Peak Flows (FEMA, 2016)

Location	**Peak Flows** (cubic feet per second)			
	10-year (10% chance annual occurrence)	**50-year** (2% chance annual occurrence)	**100-year** (1% chance annual occurrence)	**500-year** (0.2% chance annual occurrence)
Walter Baker Dam[1]	2,450	3,410	3,730	4,750

[1] Located approximately 2.7 miles downstream of the T&H Dam.

Since the 1977 FIS, additional hydrologic and hydraulic analyses have been conducted on the Neponset River within the Site, primarily to evaluate dam removal and stream restoration alternatives. The more recent flood frequency analyses have been performed using longer periods of record from USGS Gage #0110500 and gage data from additional gages, including USGS Gage #011055566 (Neponset River at Milton Village, MA), USGS Gage #01105500 (East Brank Neponset River at Canton, MA), and USGS Gage #01104200 (Charles River at Wellesley, MA). The data and methods of these studies are summarized in **Table 2-2**.

The flows produced by these studies were found to be comparable to the 1977 FIS peak flows. The most recent hydrologic study was performed by GEI in 2021 using data from USGS Gage #011055566 located within the Site upstream of the Walter Baker Dam and USGS Gage #01105000 in Norwood, MA. GEI computed peak discharges comparable to the 1977 FIS, recommending the use of the FIS peak flows with no further hydrologic analysis needed. The FIS peak flows were used in the hydraulic analysis of extreme flood events.

Table 2-2. Previous Hydraulic Studies of the Neponset River

Citation	Study Area	Study Objective
(GEI Consultants, 2021)	Fairmont Avenue Bridge to upstream of Blue Hills Parkway	Evaluated alternatives to repair or remove the T&H dam using a 1D HEC-RAS model.
(Kleinschmidt, 2011)	Fowl Meadow (1.35 miles upstream of Mother Brook Confluence) to downstream of Walter Baker Dam	Evaluated impact of T&H dam removal on upstream water surface profiles using a 1D HEC-RAS model.
(Milone & MacBroom, Inc., 2008)	Upstream of Paul's Bridge to downstream of Walter Baker Dam	Updated the 2006 1D HEC-RAS model to further analyze restoration and remedial alternatives.
(Milone & MacBroom, Inc., 2008)	Upstream of Paul's Bridge to downstream of Walter Baker Dam	Evaluated various Neponset River restoration and remedial alternatives using a 1D HEC-RAS model.
(FIA, 1977)	Upstream of Paul's Bridge to downstream of Walter Baker Dam	Effective Flood Insurance Study (FIS) performed using USACE's HEC-2 model.

In addition to evaluating extreme flood events, AECOM evaluated spring flow conditions using monthly flow data retrieved from USGS Gage #011055566 (USGS, 2024). The recorded mean monthly flows (1996 to 2023) were average for each month and are provided in **Table 2-3**. The average mean April flow (550 cubic feet per second (cfs)) was used in the hydraulic analysis to model spring flow conditions.

Table 2-3. Average Mean Monthly Fow Records from USGS Gage Neponset River at Milton Village, MA (USGS Gage #011055566)

Month	Average Mean Monthly Flow (cubic feet per second)
January	367
February	382
March	521
April	550[1]
May	325
June	280
July	162
August	106
September	115
October	172
November	239
December	376

[1] HEC RAS modeled spring flow condition.

2.2. Hydraulic Model Development

AECOM reviewed the available studies summarized in **Table 2-2** to inform the the hydraulic model and the selection of model boundary conditions for the analysis. AECOM obtained the 2011 Kleinschmidt and 2021 GEI HEC-RAS models. The 2011 model extends from Fowl Meadow (2.35 miles upstream of the T&H Dam) to downstream of the Walter Baker Dam, and the 2021 model extends from just downstream of the Fairmont Avenue Bridge to 0.25 miles upstream of Blue Hills Parkway Bridge.

AECOM constructed a 1D HEC-RAS model using model geometries developed by other consultants, bathymetric survey data, field observations, and Google imagery. The previous models were georeferenced with stream centerlines that routed through overbank areas indicating poor alignment. AECOM replaced the stream centerline with the Site thalweg and realigned the cross-sections to utilize channel profiles from previous studies in areas not covered by recent survey. The channel geometry of the Phase 1 Reach was updated based on the 2023 bathymetric and LiDAR surveys, while the Phase 2 Reach channel geometry was developed using the 2011 and 2021 HEC-RAS model geometries. All bridges within the model domain were input based on structural data provided in the Kleinschmidt and GEI models then supplemented and confirmed with field observation and Google imagery. The updated HEC-RAS model covers the extent of the Site from the Mother Brook confluence to the Walter Baker Dam.

The T&H Dam geometry was taken directly from the GEI model, including gate dimensions and elevations, which was based on the most recent dam survey conducted in 2021. AECOM developed two HEC-RAS model geometries to represent T&H Dam both in place and removed. For the in place scenario, it was assumed that the gates are eroded/removed with a crest elevation of 30.3 ft, NAVD88. For the removed scenario, the inline structure was removed from the model with no changes made to the channel geometry. Both scenarios were simulated under steady-state using the FIS peak flows (**Table 2-1**) and the average mean April flow (**Table 2-3**).

2.3. Hydraulic Model Results

The results of the 1D, steady state HEC-RAS model indicate that dam removal would minimally impact flood elevations upstream of the T&H Dam. Additionally, water surface elevations in the Neponset River directly downstream of the T&H Dam are not impacted by dam removal. The modeled steady-state water surface elevations are summarized in **Table 2-4**.

Table 2-4. Modeled Steady-State Water Surface Elevations at the Tileston and Hollingsworth Dam

Event	Modeled Inflow (cubic feet per second)	Headwater Elevation (ft, NAVD88)		Tailwater Elevation (ft, NAVD88)	
		Dam in place[1]	Dam removed[2]	Dam in place[1]	Dam removed[2]
Mean April	550	31.60	29.54	29.50	29.50
10-year	2,450	33.91	33.65	33.60	33.60
50-year	3,410	35.29	35.13	35.07	35.07
100-year	3,730	35.74	35.59	35.53	35.53
500-year	4,750	37.12	36.97	36.91	36.91

[1] Modeled as gates removed with a crest elevation of 30.3 ft NAVD88 (GEI Consultants, 2021).
[2] Modeled as dam full removed with no changes to channel grading.

Under mean April flow, the removal of the T&H Dam will draw down the Neponset River approximately 2.1 feet at the dam. A plot of the Phase 1 Reach mean April water surface for the dam in place and dam removed scenarios is included as **Figure 1**. The drop in water surface elevation has a minor impact on the extent of inundation, as shown in **Figure 2**. This is to be expected given the narrow floodplain and steep banks of the Phase 1 Reach.

For more extreme flow scenarios (i.e. 100-year or 500-year storm flows), removal of the T&H Dam has less of an impact on stream hydraulics (i.e. water surface elevations, velocities). Under the 100-year and 500-year storm flows, the removal of the T&H Dam will draw down the Neponset River approximately 0.15 feet at the dam. The greatest channel velocities were modeled under the 500-year storm flows, and the velocities are comparable for both the in place and removed scenarios as shown in **Figure 3** and **Figure 4**. The mean and maximum channel velocities modeled with in place scenario are 5.27 feet per second (ft/s) and 8.16 ft/s, respectively. The mean and maximum channel velocities with removed scenario are 5.23 ft/s and 8.27 ft/s, respectively. As noted, the hydraulic analysis was performed for dam in place (gates removed or eroded) and dam removed. Additional analysis would be required to determine water surface elevations for other dam configuration, such as gate repair or partial dam removal.

HEC-RAS calculates shear stress (τ) based on the hydraulic radius ($\bar{R}$), friction slope ($\bar{S_f}$), and the specific weight of water (γ_w) as shown in *Equation 1* (Brunner, 2010).

$$\tau = \gamma_w \bar{R} \bar{S_f} \qquad \textit{Equation 1}$$

The bed shear stress generated by the HEC-RAS model along the Phase 1 Reach were used in the sediment stability analysis detailed in the following section.

3.0 Sediment Stability Analysis

The sediment stability analysis outlined in this section was performed using the model results for the 100-year and 500-year flood event. These events were evaluated as the worst-case scenario with the greatest risk for contaminated sediment erosion and migration downstream.

3.1. Methodology

The results of the HEC-RAS model were used to compute sediment stability following the methodology developed by Albert F. Shields, which considers the size of granular particles and the shear stress exerted on them by the flow of water (Sheilds, Ott, & van Uchelen, 1936). In accordance with this methodology, the degree of sediment mobilization can be determined by calculating the dimensionless sediment entrainment (F_s) for a given particle size under specified flow conditions, and comparing it to the dimensionless Shield's parameter (Ψ_{C*}) (Sheilds, Ott, & van Uchelen, 1936). This method was applied to the Phase 1 Reach at each sediment sample location using the surficial grain size data (top 0.5 feet) and the HEC-RAS modeled bed shear stress.

For each sediment sample collected in the Phase 1 Reach, a 50th percentile diameter (D_{50}) was calculated from the laboratory sieve analysis grain size distribution and used as a representative mean particle diameter (d) in the following equations. Note that the sediment stability analysis was done using the surficial sediment samples only and is limited to the top 0.5 feet of sediment.

At each sample location, the shear stress velocity (u_{*C}) was computed using the modeled bed shear stress (τ) and the density of water (ρ_w) (*Equation 2*). The density of water was assumed to be a constant value of 62.4 lb/ft^3.

$$u_{*C} = \sqrt{\frac{\tau}{\rho_w}} \qquad \text{Equation 2}$$

The dimensionless granular Reynold's Number (Re^*) was computed using the sediment sample D_{50} for the particle diameter (d), the computed shear stress velocity, and the kinematic viscosity of water (ν) (*Equation 3*). The kinematic viscosity was assumed to be a constant value of 3.81E-7 ft^2/s.

$$Re^* = \frac{u_{*C} d}{\nu} \qquad \text{Equation 3}$$

The entrainment function gives the ratio of the shear pressure exerted on the particle by the water to the resistive forces of the particle. At each sample location, the entrainment (F_s) was calculated using *Equation 4*. A particle density (ρ_s) of 165.4 lb/ft^3 and a gravitational acceleration (g) of 32.2 ft/s^2 were used.

$$F_s = \frac{\tau}{(\rho_s - \rho_w) g d} \qquad \text{Equation 4}$$

To evaluate the sediment stability of a particle, the computed entrainment is compared to the dimensionless Shields Parameter (Ψ_{C*}). As described in Shields et al., this parameter is similar to entrainment but relies on the critical bottom shear stress (τ_C), where the forces exerted by the flow of water overcome the resistance of the particle. The Shields Parameter formula is shown in *Equation 5*. The Shields Parameter can also be plotted against the granular Reynold's Number to give the theoretical Sheilds Curve; this curve depicts the threshold of particle movement and is shown in **Figure 5**.

$$\Psi_{C*} = \frac{\tau_C}{(\rho_s - \rho_w)gd}$$ Equation 5

The calculation of the critical shear stress is computationally rigorous. A simpler way to arrive at the dimensionless Sheilds Parameter is to use an empirical derivation based on the granular Reynold' Number. This derivation was performed by Guo and the American Society of Civil Engineers (Guo & M.ASCE, 2020); the formula is plotted in **Figure 6** (*Equation 6*):

$$\Psi_{C*} = \frac{1}{\left(\frac{14}{3}\right)Re^{*} + 4} - \frac{1}{\left(\frac{2}{3}\right)Re^{*} + 18} + \frac{1}{18}$$ Equation 6

With the empirical model presented above, the Shields Parameter and the entrainment function can be calculated for each sample location. These two values can then be compared to arrive at a numerical indicator of sediment stability. As the Shields Parameter acts as the threshold for incipient motion, if the entrainment function is greater than the Shields Parameter, the particle has the potential to become unstable and migrate downstream. The magnitude of this difference gives a degree of instability, where larger departures from the threshold can indicate full suspension in the water column, as opposed to flow along the riverbed.

3.2. Results and Discussion

The stability methodology was performed for each sample site in the Phase-1 Reach of the Lower Neponset River where grain size data was available. A representative graphical result for the 500-year flood event under both dam scenarios is included as **Figure 6.** Generally, sediment stability decreases as the flow intensity increases; the results of this analysis indicate that areas stable under normal flow conditions have the potential for movement under 100-year and 500-year flood conditions. This is a logical result as more intense storms will produce higher flows and theremore more shear stress on the channel sediment in the river. The results of the sediment stsability analysis for the 100-year and 500-year flood event are mapped in **Figure 7** and **8**, respectively.

While differing flow conditions led to different stability outcomes in the Lower Neponset River, no significant changes in sediment stability were noted after the removal of the T&H Dam.

3.3. Limitations and Uncertainty

The stability analysis was performed using a 1-D HEC RAS model run under steady state conditions. The steady-state model does not capture the potential variability in shear stress under real-world unsteady flow conditions. Additionally, HEC RAS interpolates model results between 1D cross-sections to create 2D shear stress results which were used in the sediment stability calculations. Therefore, uncertainty may be present in the calculated entrainment for each soil sample. To address the potential uncertainty in the analysis, the analysis was performed for the 100-year and 500-year storm. The extreme flow conditions provide a more conservative estimate of areas susceptible to instability.

4.0 References

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Figures

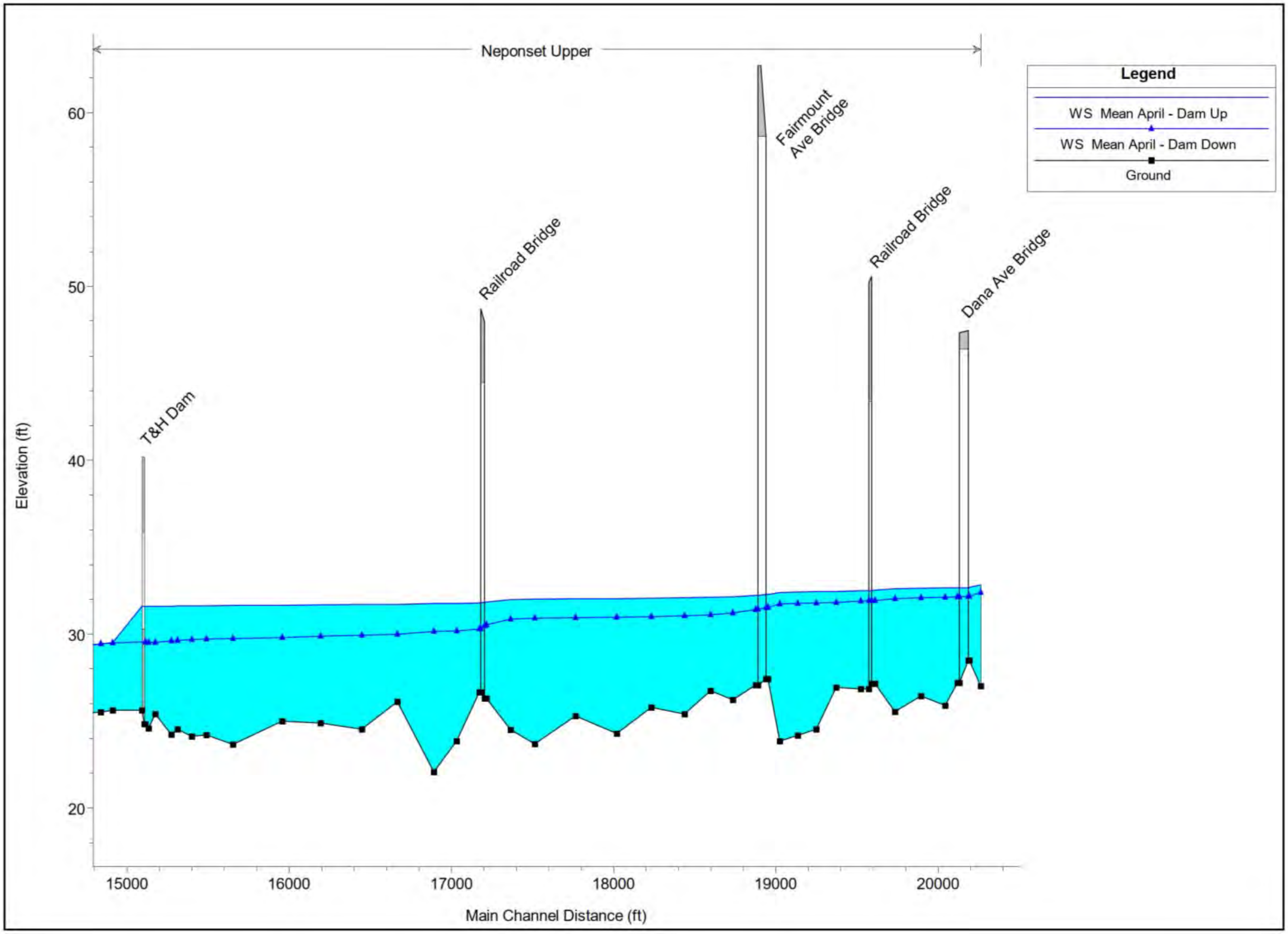


Figure 1. Water Surface Elevation Profiles for Mean April Flow in the Phase 1 Reach

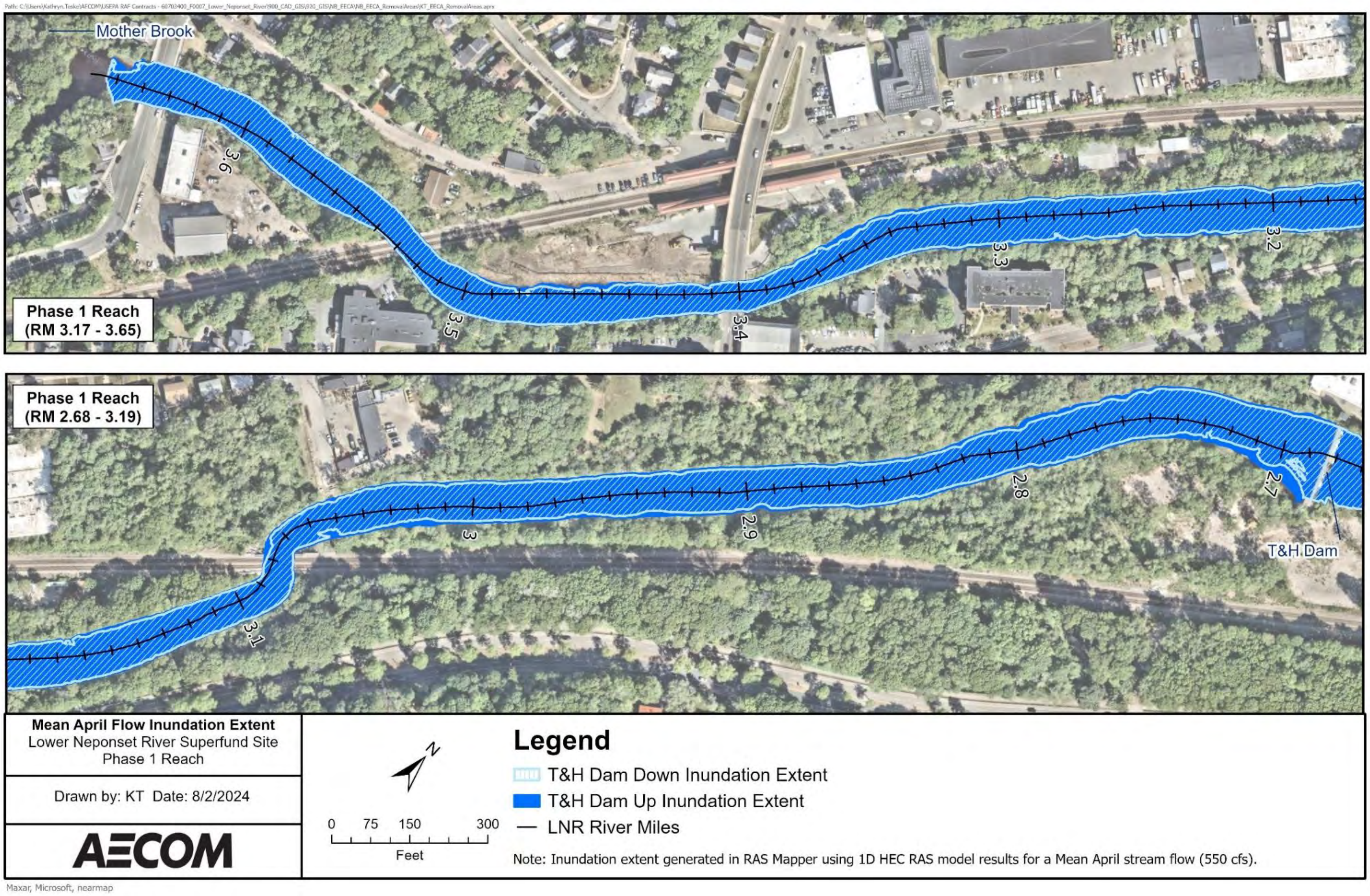
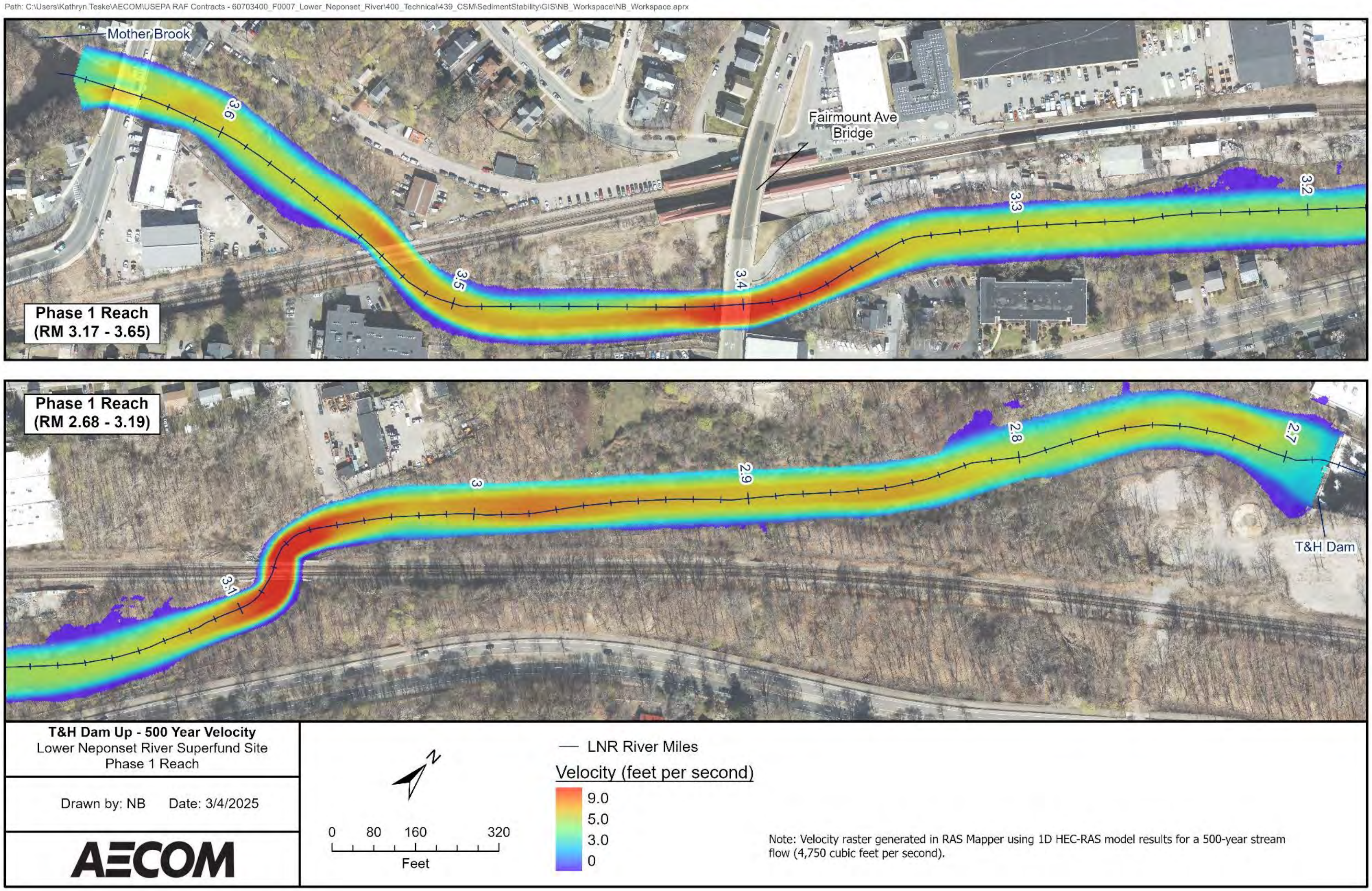
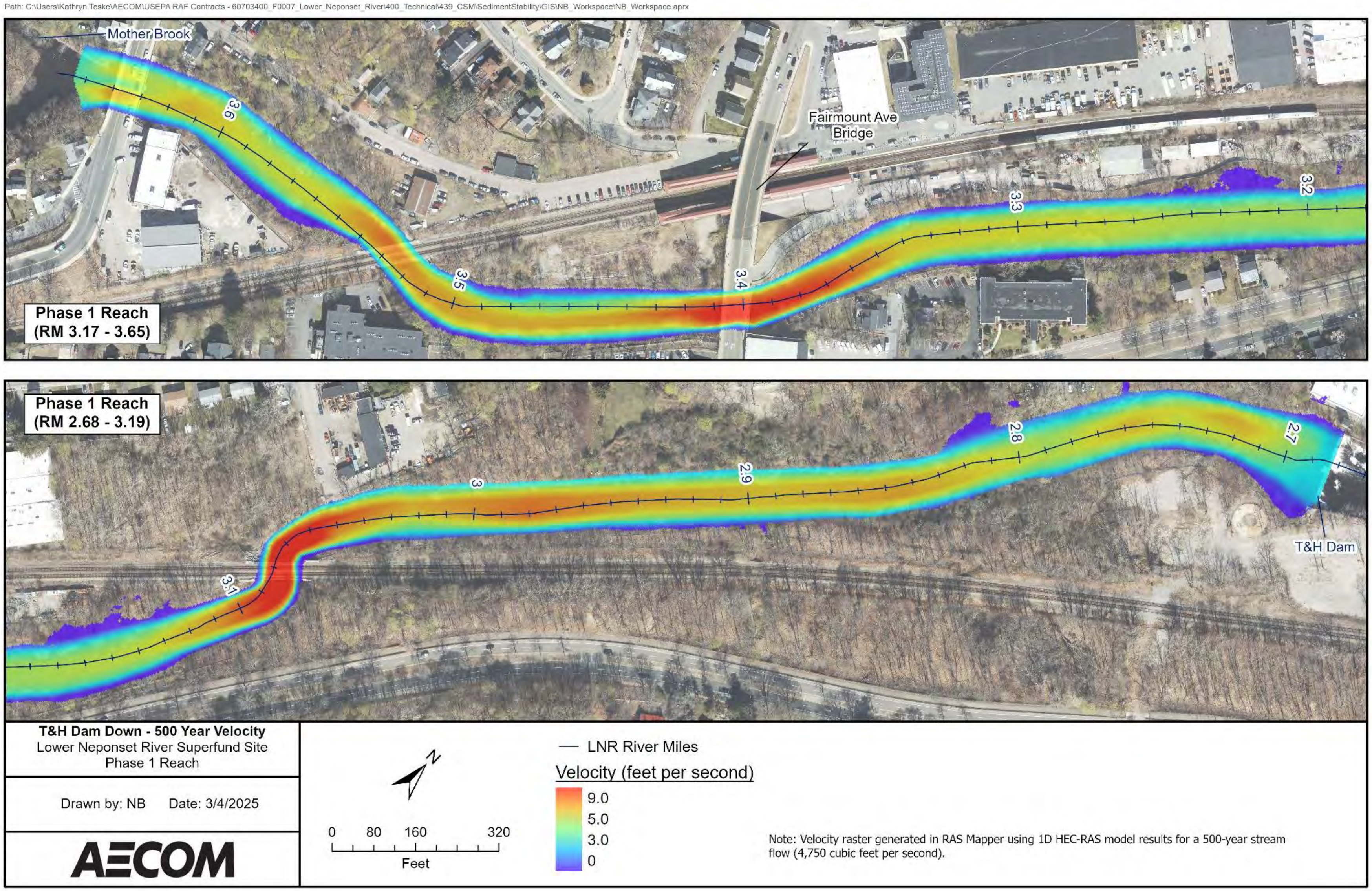


Figure 2. Inundation Extent for Mean April Flow in the Phase 1 Reach



Note: Velocity raster generated in RAS Mapper using 1D HEC-RAS model results for a 500-year stream flow (4,750 cubic feet per second).

Figure 3. 500-Year Peak Flow Velocities in the Phase 1 Reach with T&H Dam in Place



Note: Velocity raster generated in RAS Mapper using 1D HEC-RAS model results for a 500-year stream flow (4,750 cubic feet per second).

Figure 4. 500-Year Peak Flow Velocities in the Phase 1 Reach with T&H Dam Removed

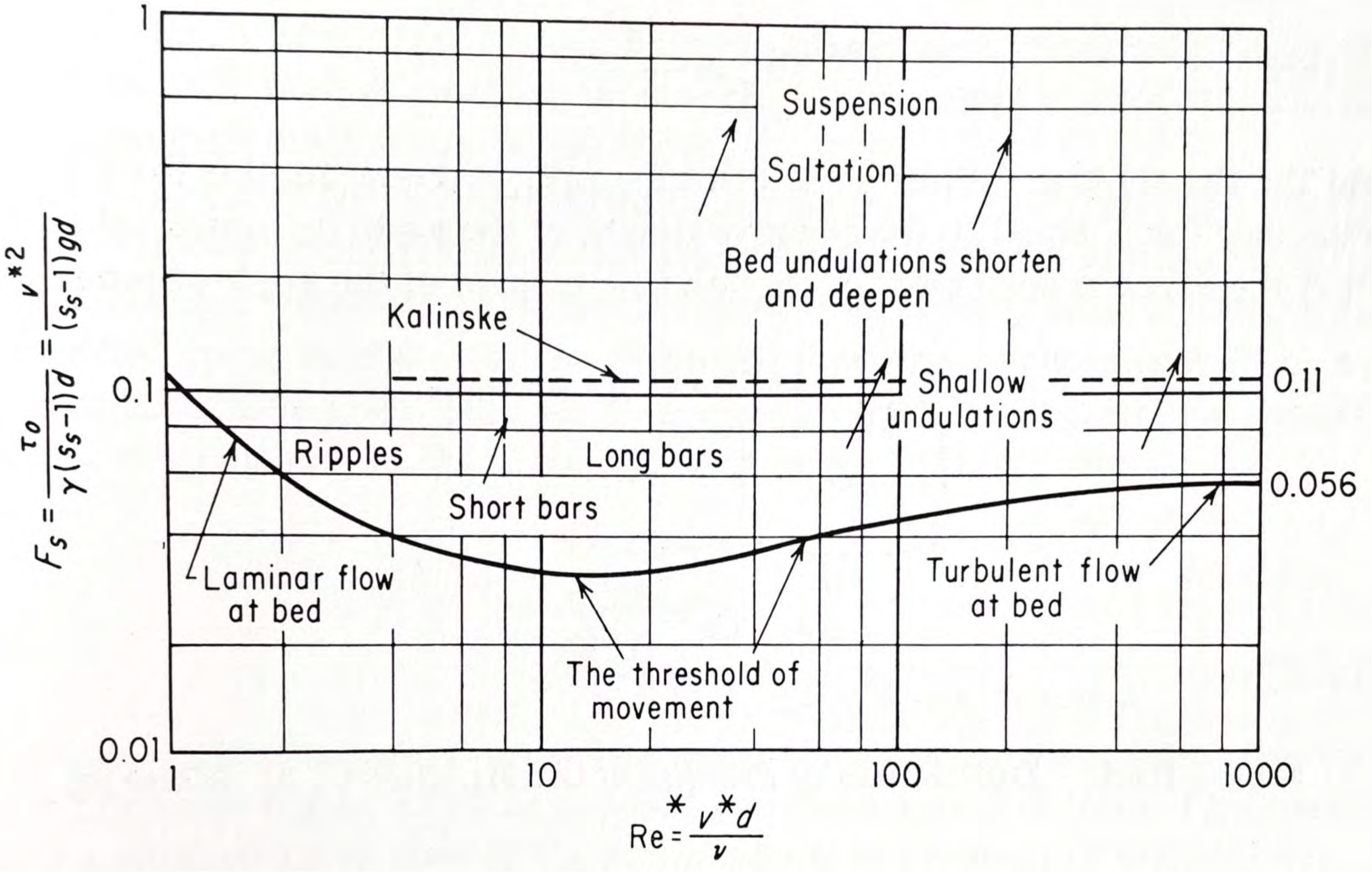


Figure 5. Shield's Diagram

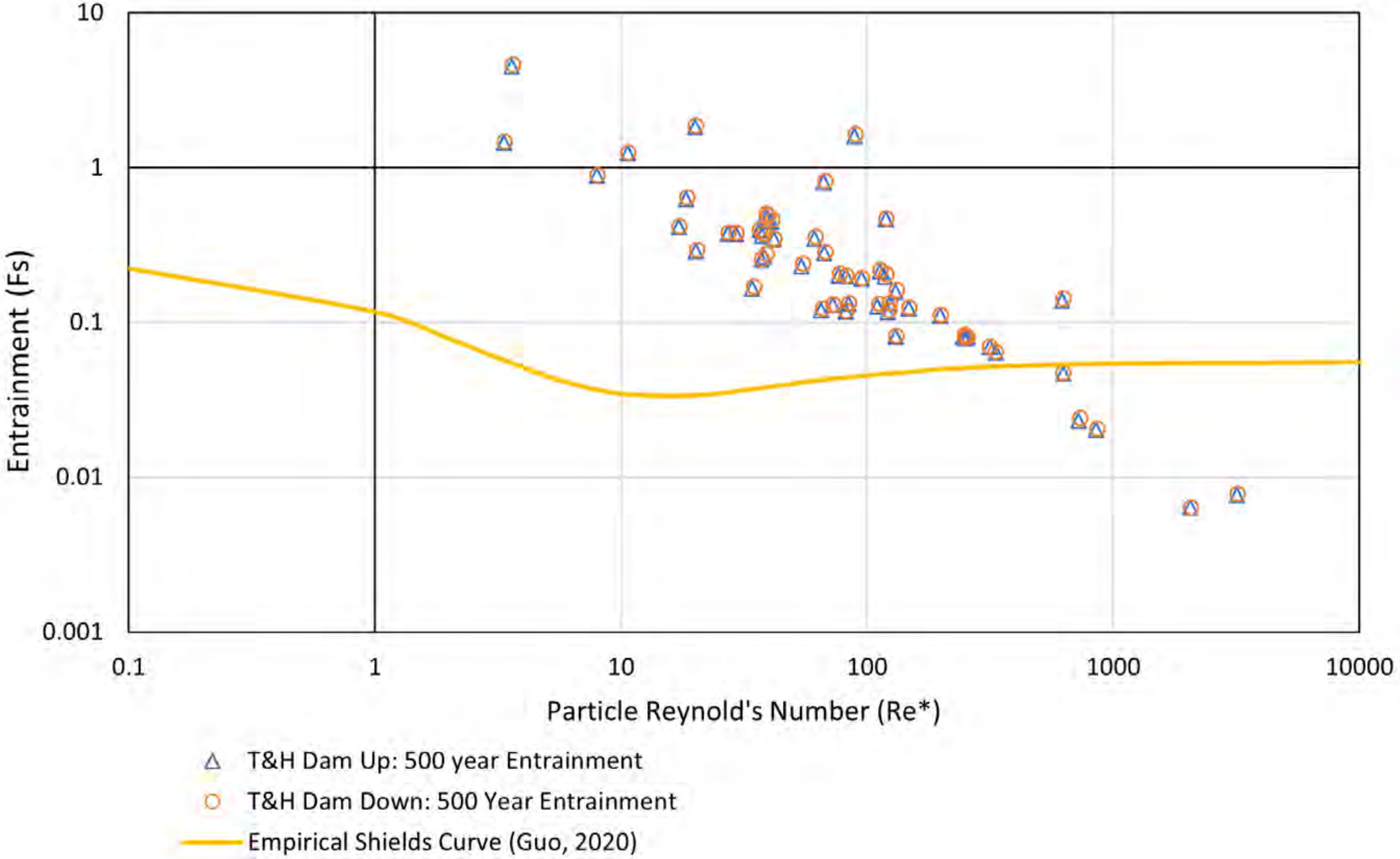


Figure 6. Phase 1 Sediment Stability Diagram for a 500-year Flood Event

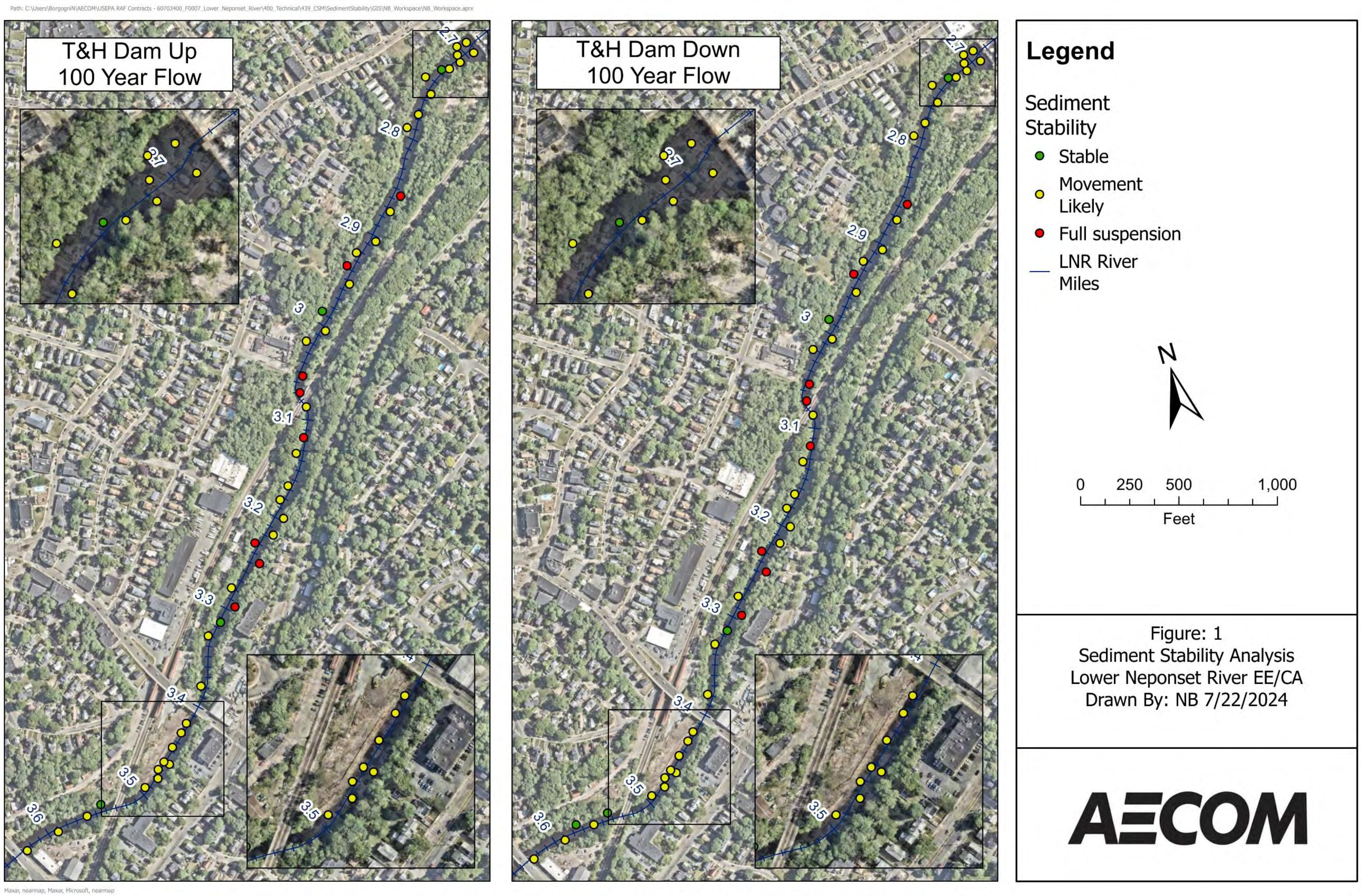


Figure 7. Sediment Stability Results for 100-year Flood Conditions

Figure 8. Sediment Stability Results for 500-year Flood Conditions

APPENDIX C

TILESTON AND HOLLINGSWORTH (T&H) DAM – DOCUMENT REVIEW AND STABILITY EVALUATION

AECOM
250 Apollo Drive
Chelmsford, MA 01824

978.905.2100 tel

Memorandum

To	Frederick R. Symmes	Page	1
CC	Kristine Carbonneau		
Subject	Tileston and Hollingsworth (T&H) Dam – Document Review and Stability Evaluation		
From	Shane Lyons, Mike Gardner		
Date	02/27/2024 (Updated 8/14/2024 and 12/04/2024)		

1.0 Overview and Purpose

AECOM performed a document review and stability evaluation of the Tileston and Hollingsworth (T&H) Dam located in the Lower Neponset River Superfund Site (Site). The purpose of this evaluation is to inform the Removal Action Alternatives outlined in the Engineering Evaluation/Cost Analysis (EE/CA) for the Phase 1 Reach. The EE/CA will support a potential non-time critical removal action (NTCRA) of sediment contaminated with polychlorinated biphenyls (PCBs), primarily impounded behind the T&H Dam and other hotspots within the Phase 1 Reach.

2.0 Dam Description and Condition Summary

The T&H Dam is an intermediate-sized, Significant (Class II) hazard potential dam located in Milton, Massachusetts. The concrete sills are founded on bedrock and vary in height depending on the bedrock elevation between 9.1 and 15.1 feet tall and are 19.5 feet wide on the north section and 14.4 feet wide on the south section (GEI, 2021).

The dam has been judged to be in poor condition because it can no longer maintain the headwater elevation. It is 165 feet long and 12 feet high with two bascule gates that are each 70 feet long and 4.3 feet high. The dam was used for power generation prior to the 1950s.

In 2021 GEI performed analyses on the T&H dam to check for overturning stability, bearing pressure, and sliding stability and concluded that the existing stability of the dam is adequate and does not need to be upgraded for stability reasons (GEI, 2021). However, their inspection noted numerous deficiencies with various substructures of the dam. GEI gave ratings of the conditions of each substructure, but in general they concluded the following:

- The gates and their components were noted to be in poor to extremely poor condition.
- The electrical components of the dam were noted to be in fair to poor condition.
- The concrete structures of the dam were noted to be of fair or sound condition besides the right spillway which was in poor condition.
- The steel walkway was noted to be in fair condition.

3.0 Dam Removal/Repair Options

The GEI Report (2021) discussed four options. Each option fully repairs or addresses the deficiencies of the dam.

- Replace Gates in Kind
- Replace Gates with Obermeyer Gates
- Remove Gates
- Remove Dam

Options 1 and 2 are essentially the same but with different types of gates. These options make repairs to the dam that keep the dam fully operational. They will involve minor repairs to the steel walkway, concrete control structures and major repairs to the concrete sill, training wall, the electrical and mechanical systems, and the water intake vault. Low to moderate annual maintenance costs on the gates will be incurred. These options will have a moderate to long lifespan depending on the materials selected and will not allow for fish passage.

Option 3 involves demolition of the gates, the steel walkway, and the center pier to the top of the concrete sill, removal of electrical and mechanical equipment, and major repairs to the concrete sill, the training wall, and the water intake vault. This option will incur low maintenance costs on the concrete of the dam and will have a long lifespan. Including a fish ladder in this option would allow for fish passage.

Option 4 is demolition/removal of the gates, the steel walkway, the center pier to the top of the concrete sill, and 80 feet of the concrete sill in the center of the dam, while repairing the remaining sill on either side and the training walls. This option will incur very low maintenance costs related to maintaining the training walls and concrete sections adjacent to them and will have a long lifespan. Fish will be able to move freely upon the removal of the center of the dam. Dredging was not included in this option, but it will be required to connect the upstream and downstream channel bottom at a stable grade.

An Environmental Restoration Report and Environmental Assessment conducted by Milone and MacBroom in 2006, recommended one alternative, along with four secondary alternatives (Milone & MacBroom, 2006).

- Alternative T3b – Full Dam Removal with Full Dredging
- Alternative T3d* – Partial Dam Removal with Containment Wall and In Situ Cap
  **Recommended Alternative*
- Alternative T4c – Partial Dam Removal with Rock Ramp @ 4% Slope
- Alternative T5 – Bypass Channel
- Alternative T6b – Partial Length Channel Relocation

Alternative T3b is essentially the same as GEI Option 4, except that it specifies all sediments to be dredged and relocated to an on-site or off-site disposal area. This option will provide excellent habitat connectivity, substrate diversification, water velocities, and improved water quality but will incur high costs of sediment disposal and would necessitate the replanting of the exposed riverbank.

Alternative T3d is similar to GEI Option 3 in that the gates would be removed. However, this alternative also removes the left side of the dam. A containment wall along the right bank would be constructed of steel sheeting or concrete to hold the bulk of the excavated sediments in place, allowing for in situ stabilization and capping. This option was determined to share most of the benefits with Alternative T3b but lower costs due to stabilizing the sediments in place. Therefore, this was Milone & MacBroom's recommended alternative.

Alternative T4c consists of removing the gates, reducing the spillway elevation by cutting down the top of the concrete sill, and constructing a rock ramp with a 4% slope at the left spillway. The sediment would be left in place and capped. This option would retain a reduced pool area and depth above the dam while still allowing fish to pass.

Alternative T5 consists of constructing a man-made bypass channel measuring around 1,500 ft in length around the dam to allow fish passage. The sediment would be left in place and capped. This alternative meets the basic goals and objectives of the project but maintaining the existing sediment and habitat conditions upstream is not ideal.

Alternative T6b consists of relocating the channel around the dam in the space surrounding the existing channel. The new channel would be around 1,500 ft long and the sediment would be capped in place. It would require a new dual track railroad bridge or multiple large diameter culverts under the railroad. While it would allow for the T&H dam to be inactivated and serve only as a retaining wall to contain the capped sediment, the railroad bridge or culverts would be a significant budget item and require extensive coordination and planning to implement.

4.0 Findings

Based on the previous inspections and the available information, the dam appears to be stable geotechnically (i.e., the concrete sill supporting the gate structures is stable for global overturning, bearing pressure, and sliding) and removing sediment impounded behind the dam would not compromise the geotechnical stability of the dam.

The structural (i.e., stability of specific gate system components) deficiencies in the dam that were noted in the GEI report will need to be addressed in any remedial alternative that proposes maintaining it in place. Notably, portions of the steel gate structures have failed and need to be removed or replaced, localized voids under the concrete sill be grouted, the spalling and cracks in the concrete structures be repaired, and the expansion joints be sealed. Failure of the remaining steel gate structures, currently retaining water above the dam, could result in release of the sediment impounded behind the dam.

The previous reports did not provide an estimate of the lifespan of the concrete sill besides saying that the option of removing the gates would have a "long lifespan" (GEI, 2021). However, it was noted that for Alternative T3d that the life expectancy of the containment system of the sediment would likely be on the order of 20 or more years (Milone & MacBroom, 2006).

As outlined for Option 2 in the GEI report, the dam could be repaired and become fully operational by replacing the gate structures with steel gates articulated with pneumatic rubber bladders, installing new mechanical and electrical equipment, and repairing the concrete sill. AECOM concurs with GEI's analysis showing that Option 2 costs for dam repair would be higher than the costs for dam removal (Option 4).

5.0 References

GEI Consultants. (2021). *Tileston and Hollingsworth Dam, Phase II Inspection and Investigation Report.* Milton and Boston, MA: Massachusetts Department of Conservation and Recreation.

Milone & MacBroom, I. (2006). Environmental Restoration Report and Environmental Assessment Neponset River Fish Passage and Habitat Restoration Project, Neponset River Basin, Milton and Boston, Massachusetts. Massachusetts Department of Fish and Game.

APPENDIX D

STREAMLINED RISK EVALUATIONS

FINAL

STREAMLINED RISK EVALUATION IN SEDIMENT

LOWER NEPONSET RIVER SUPERFUND SITE
BOSTON, MASSACHUSETTS

Prepared For:

U.S. ENVIRONMENTAL PROTECTION AGENCY
5 Post Office Square
Boston, MA 02109-3912

Prepared By:

AECOM
1 Federal Street, 8th Floor
Boston, MA 02110

September 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
AECOM	AECOM Technical Services, Inc.
AUFs	rea use factors
BERA	baseline ERA
bml	below mudline
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
CWMN	Community Water Monitoring Network
DAF	dermal absorption fraction
DDT	dichlorodiphenyltrichloroethane
ED	exposure duration
EE/CA	engineering evaluation and cost analysis
ELCR	Excess Lifetime Cancer Risk
EPC	exposure point concentration
ERA	ecological risk assessment
g/day	grams per day
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IPaC	Information for Planning and Consultation
IRIS	Integrated Risk Information System
kg	kilogram
LNR	Lower Neponset River
LOAEL	Lowest Observed Adverse Effects Level
MDPH	Massachusetts Department of Public Health
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/kgBW/day	milligram per kilogram body weight per day
NAVD 88	North American Vertical Datum of 1988
NCP	National Continency Plan
NOAEL	No Observed Adverse Effects Level
non-DLC	non-dioxin like congeners
NTCRA	non-time critical removal action
PCBs	polychlorinated biphenyls
PCB-TEQ	PCB toxicity equivalence
PECs	probable effect concentrations

RAOs	remedial action objectives
RBA	relative bioavailability factor
RfD	reference dose
RI/FS	Remedial Investigation/Feasibility Study
RMLs	Removal Management Levels
SLERA	screening level ERA
SPI	sediment profile imaging
SRE	Streamlined Risk Evaluation
START	Superfund Technical Assessment & Response Team
T&H	Tileston and Hollingsworth
TCDD	2,3,7,8-tetrachloro-dibenzo-p-dioxin
TDD	total daily dose
TECs	threshold effect concentrations
TEFs	toxic equivalency factors
TOC	total organic carbon
TRVs	toxicity reference values
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United Stated Geological Survey
WHO	World Health Organization

1. INTRODUCTION

This report presents the results of the Streamlined Risk Evaluation (SRE) conducted for the Lower Neponset River (LNR). The Lower Neponset River Superfund Site consists of a 3.7-mile section of the Neponset River between its confluence with Mother Brook (in Hyde Park, Massachusetts) and the Walter Baker Dam (in Dorchester/Milton, Massachusetts) (see Figure 1). The SRE was conducted to support the engineering evaluation and cost analysis (EE/CA) for a potential non-time critical removal action (NTCRA) in the upper one mile stretch of the LNR Site, referred to as the Phase 1 reach, located between the confluence of Mother Brook and the Neponset River and the Tileston and Hollingsworth (T&H) Dam (see Figure 2). Based on existing reports, this reach of the LNR has been found to include locations where primary and secondary source areas exist and have the potential to constitute a public health risk. The EE/CA is focused on sediment contaminated with polychlorinated biphenyls (PCBs), primarily impounded behind the T&H Dam, and other hot spots within the upper one-mile reach (United States Environmental Protection Agency [USEPA] 2023a). Therefore, PCBs are evaluated as the single chemical of potential concern (COPC) in the SRE. Focusing the SRE on the primary contaminant at a site is consistent with USEPA’s NTCRA guidance (USEPA 1993a).

The SRE was performed to identify current or potential exposures that could be prevented by the implementation of a NTCRA. The principal human exposure pathway of concern evaluated in the SRE was direct contact with river sediment. Sediment data from the 2023 investigation in the Phase 1 reach were used in the risk calculations. Consumption of LNR fish was also evaluated as it can be an important exposure pathway at sediment sites with bioaccumulative compounds such as PCBs. Historical fish tissue data (collected in 2003 and 2005) were used in the SRE in a screening level analysis to support the NTCRA because more recent fish tissue data are not available. Fish tissue data will be collected in Fall 2024. The fish tissue to be collected in 2024 will be used for the sitewide risk assessments that will be conducted in the future. In addition to evaluating human health risk, a screening-level ecological risk assessment was performed for the SRE which involved comparison to sediment benchmarks and food web modeling.

The results of the SRE will be used to the selection of a remedial alternative for the Phase 1 reach that addresses the remedial action objectives (RAOs) presented in the EE/CA. The data from activities conducted in the Phase 1 reach will also be used to support the comprehensive Remedial Investigation/Feasibility Study (RI/FS) for the 3.7-mile Site, which will include baseline human health and ecological risk assessments.

2. SITE SETTING

A detailed Site description, history, and conceptual site model (CSM) for the Site is presented in AECOM Technical Services, Inc. (AECOM, 2024a). The following provides a brief overview of land uses and the ecological setting relevant to the SRE.

2.1 LAND USES

An estimated 49,682 people live within a half-mile of the Site, 92,913 people within one mile, and 472,244 people within four miles of the Site (USEPA 2023b). Land ownership of the properties abutting the Site is 79% public and 21% privately owned land (USEPA 2023b). Public land ownership consists of the City of Boston, the Massachusetts Bay Transit Authority, the Department of Conservation and Recreation (formerly known as the Metropolitan District Commission prior to 2003), the Town of Milton Conservation Commission, and the Town of Milton Parks Department (USEPA 2023b).

Public access to the Site is unrestricted except in areas where private properties block walking access to the river. Within the 3.7 mile Site there are eight public canoe and/or kayak launches, 1.5 miles of developed recreational multi-use walking/biking trails, and seven recreation areas that border the river. The public access points and recreational areas within and close to the Site are shown in Figure 3. The Phase 1 reach is accessible by canoe or kayak from two boat launches, one at Francis D. Martini Memorial Shell Park on the Upper Neponset River, about 0.6 miles upstream of the confluence with the Mother Brook, and another at Mill Pond Reservation on the Mother Brook, about 0.8 miles upstream of the confluence with the Neponset River. Public parks located within the Phase 1 reach include Blake Estates Urban Wild, West Street Park, and Doyle Playground.

USEPA conducted a reuse assessment for the Site with a goal of identifying reasonably anticipated future land uses to provide guidance for cleanup decision making and inform land use planning activities. The Reuse Assessment Report provides background information and identifies current land use, ownership, and demographic considerations (USEPA, 2023b). Overall, current land use and zoning designations at the Site and surrounding areas are expected to continue with limited future land use changes at vacant and underused areas. Master future plans for the Site anticipate expanded trail networks, increased number of parks, and the creation of easier access to the river, open space, and recreation opportunities (USEPA 2023b). Removal of the T&H Dam, which is in poor condition (GEI 2021), is under consideration and would provide public safety, environmental, and restoration benefits. One concern associated with the dam removal is that if a dam failure occurred, PCBs and other contaminants in sediment could be mobilized and migrate downstream posing a risk to downstream receptors.

2.2 ENVIRONMENTAL SETTING

The segment of the Neponset River within the Phase 1 reach is designated a Class B surface water body (310 CMR 4.06). Class B waters are designated for primary and secondary contact recreation and are a habitat for fish, other aquatic life, and wildlife, for their reproduction, migration, growth, and other critical functions.

The Neponset River drains approximately 101 square miles of land and flows approximately 29 miles from its headwaters in Foxboro, MA into the Neponset River Estuary downstream of the Walter Baker Dam. The Neponset River is then tidally influenced for approximately another 3 miles, and ultimately discharges into Dorchester Bay.

2.2.1 Fauna Observed

As described in AECOM (2024a) and in Milone & MacBroom, Inc. (2006) and summarized in the table below, a variety of terrestrial, aquatic, and aquatic-dependent species have been observed during investigations of the river.

FISH	
American eel	*Anguilla rostrata*
Blue gill	*Lepomis macrochirus*
Brook trout	*Salvelinus fontinalis*
Brown bullhead	*Ameiurus nebulosus*
Brown trout	*Salmo trutta*
Chain pickerel	*Esox niger*
Common carp	*Cyprinus carpio*
Fallfish	*Semotilus corporalis*
Largemouth bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Tessellated darter	*Etheostoma olmstedi*
White sucker	*Catostomus commersoni*
BIRDS	
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristis*
American robin	*Turdus migratorius*
Belted kingfisher	*Megaceryle alcyon*
Blue jay	*Cyanocitta cristata*
Canada goose	*Branta canadensis*
Common grackle	*Quiscalus quiscula*
Cormorant	*Phalacrocorax carbo*
Gray catbird	*Dumetella carolinensis*
Great blue heron	*Ardea herodias*
Mallard duck	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Starling	*Sturnus vulgaris*

MAMMALS	
American Beaver	*Castor canadensis*
Chipmunk	*Tamias striatus*
Eastern cottontail	*Sylvilagus floridanus*
Grey squirrel	*Sciurus carolinensis*
Mole	*Scalopus sp.*
Northern Racoon	*Procyon lotor*
Rat	*Rattus norvegicus*
Skunk	*Mephitis mephitis*
Weasel	*Mustela nivalis*
White-tailed deer	*Odocoileus virginianus*
REPTILES AND AMPHIBIANS	
Common water snake	*Nerodia sipedon*
Eastern garter snake	*Thamnophis sirtalis sirtalis*
American toad	*Anaxyrus americanus*
Bull frog	*Lithobates catesbeianus*
Common snapping turtle	*Chelydra serpentina*
Green frog	*Rana clamitans*
Painted turtle	*Chrysemys picta*
Spring peeper	*Pseudacris crucifer*
INVERTEBRATES	
Bumblebee	*Bombus spp.*
Caddisflies	*Order Trichoptera*
Damselflies	*Sub-order Zygoptera*
Dragonflies	*Sub-order Anisoptera*
Honeybee	*Apis mellifera*
Mayflies	*Order Ephemeroptera*
Mosquitoes	*Family Culicidae*
Stoneflies	*Order Plecoptera*

2.2.2 Wetland Survey

In October 2017, Superfund Technical Assessment & Response Team (START) personnel conducted an on-site reconnaissance/wetland survey for the entire Lower Neponset River study area. Large wetland areas within the study area along the Neponset River were observed including palustrine emergent shrub and forested wetland areas. Most of the wetland acreage is within the braided channel, but wetland frontage was noted along most of the edge of riverbed channel. USEPA wetland specialists and START personnel estimated 4 to 5 miles of wetland frontage along the 3.7 mile Site (Weston 2019). Downstream of the Walter Baker dam begins the 1,300-acre Neponset River Estuary Area of Critical Environmental Concern (ACEC). This ACEC separates the coastal estuary from the inland freshwater portion of the Neponset River.

2.2.3 Other Field Surveys

Between March and June 2023, AECOM and its subcontractors conducted reconnaissance activities within the Phase 1 reach of the Site. The reconnaissance activities included a geospatial survey, a sediment profile imaging (SPI) survey, and a wetland survey which included documentation of vegetation and wildlife usage. Results of the Phase 1 reach reconnaissance activities are provided in the Site Reconnaissance Summary (AECOM 2023a). Each is briefly described below.

Geospatial Survey. Between March 30th and April 2nd, 2023, Ocean Surveys, Inc. conducted the geospatial survey and documented the width of the river channel to range from approximately 60 feet to 200 feet within the Phase 1 reach. The water surface elevation during the time of surveys was documented to be between 33.5-33.7 feet North American Vertical Datum of 1988 (NAVD 88) and the deepest portions of the river were recorded at 23 feet NAVD 88.

SPI Survey. Between June 19th and June 21st, 2023, Integral conducted the SPI survey at 18 locations within the Phase 1 reach of the Site. The equipment did not penetrate the sediment at 46 additional locations due to woody or other debris, hard bottoms, and steep channel slopes so images were not collected. A wide range of natural and anthropogenic materials were observed in the sediment including silt, sand, gravel, cobble, and large and small wood debris, leaf litter, bricks, metal, and bottles in various combinations. Hard bottom locations were widespread; however, there were also pockets of unconsolidated sediments, sands, and silts, scattered throughout the Phase 1 reach. Biological features observed in the sediment included burrows and feeding voids created by subsurface deposit feeders.

Wetland Survey. Between June 26th and June 29th, 2023, AECOM conducted wetland and ecological evaluations for the Phase 1 reach [1]. Much of the environment within the Phase 1

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[1] Approximately 400 feet of the south bank near the T&H Dam was not included in the wetland survey due to access limitations.

study corridor was influenced by past residential, commercial, and industrial development; however, green and forested areas were noted upslope of the riverbanks throughout much of the study corridor. The wetland scientists noted banks heavily armored with boulders in many locations and water elevations controlled by the T&H Dam. AECOM delineated two palustrine forested/scrub shrub wetlands along the northwest bank, one palustrine forested wetland along the southeast bank, and two intermittent streams.

During the evaluation, vegetation and wildlife species observations (including evidence of species presence, such as tracks and scat) were documented. Wetland functions and values assessments for the three wetlands indicated that that all three provide cover and food sources for wildlife. Vegetation observed within the riverine environment of the Phase 1 reach included red maple (*Acer rubrum*), river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), cottonwood (*Populus spp.*), red oak (*Quercus rubra*), silky dogwood (*Cornus amomum*), honeysuckle, buttonbush (*Cephalanthus occidentialis*), multiflora rose (*Rosa multiflora*), glossy buckthorn (*Frangula alnus*), poison ivy (*Toxicodendron radicans*), jewelweed (*Impatiens capensis*), smartweeds (*Persicaria spp*.), sedges (*Carex spp.*), fox grape (*Vitis labrusca*), and greenbrier (*Smilax spp.*). Wildlife observed in and around the river and riverine environment of the Phase 1 reach included nine birds, ten mammals, and three invertebrates (or evidence of their use). Among these 22 species, those likely to forage in the river include cormorant (*Phalacrocorax carbo*), American beaver (*Castor canadensis*), and northern racoon (*Procyon lotor*).

3. DATA EVALUATION

This section describes the data used in both the human health and ecological SRE. The summary statistics and exposure point concentrations (EPCs) calculated to support the SRE are also described.

3.1 DATA USED IN SRE

AECOM collected 157 sediment samples (excluding field duplicates) within the Phase 1 reach in June 2023. Figure 2 presents the sample locations. Surface sediment samples were collected from 0 to 0.5 feet below mudline (bml). Subsurface sediment samples were collected from 0.5 feet bml to a maximum of 6.2 feet bml. Samples were analyzed for PCB congeners using USEPA Method 1628[2]. Data were validated in accordance with the Quality Assurance Project Plan for the RI/FS for the Lower Neponset River Superfund Site (AECOM 2023b). The full data set, validation memoranda, and laboratory data are reported in the Phase 1 Data Evaluation Summary Memorandum (AECOM 2024b).

Fish tissue data were not collected during Phase 1 activities but will be collected from the full 3.7-mile stretch of the LNR Site in Fall 2024 under Phase 2; therefore, fish tissue data collected by the United Stated Geological Survey (USGS, Breault 2014) were used in the SRE to provide screening level information on potential risks to support the NTCRA and to provide a comparison point for the Phase 2 data. White sucker were collected in August 2003 and September 2005 from the T&H and Walter Baker impoundments. The Walter Baker impoundment is outside of the Phase 1 reach but was included in the SRE for comparative purposes. Eight fish were combined into one composite sample from each impoundment on each date. The fish collected in 2005 were skinned and filleted prior to analysis. Fish collected in 2003 were analyzed whole, but after removal of stomach and intestinal content to reduce bias from recently ingested bottom sediment (Breault 2014). The two fillet and two whole body tissue samples were analyzed for PCB congeners using high resolution gas chromatography

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[2] Sediment samples were also analyzed for a larger suite of chemicals, including volatile organic compounds, semi-volatile organic compounds, dioxins and furans, metals, and cyanide as reported in the Data Evaluation Memorandum (AECOM 2024b). These data will be evaluated in the baseline human health risk assessment to be conducted following Phase 2 activities.

mass spectrometry. As discussed in Section 6.2, there are uncertainties associated with the use of the historical data. The sitewide risk assessments will incorporate the fish tissue data to be collected in 2024.

3.2 DATA REDUCTION

Total PCBs were calculated for each sediment and fish tissue sample as the sum of detected congeners. For fish tissue, a second estimate of total PCBs was calculated as described below to account for coplanar congeners that may enrich in biological tissues.

The group of 209 PCB congeners includes 12 coplanar congeners that are considered to have potential dioxin-like effects (USEPA 2010). The World Health Organization’s 2005 (Van den Berg et al. 2006) mammalian toxic equivalency factors (TEFs), which were adopted by USEPA (2010), were used to calculate a toxicity weighted concentration for each of the coplanar PCB congeners. For each sample, the concentration of PCB toxicity equivalence (PCB-TEQ) was calculated by summing the toxicity weighted concentration for each detected congener. The concentration of total PCBs in each fish tissue sample was calculated as the sum of detected non-dioxin like congeners (non-DLC) and PCB-TEQ. Except for PCB-169 in the whole-body fish tissue sample from the Walter Baker impoundment, DLCs were detected in fish tissue. The single non-detect was treated as a zero in the PCB-TEQ calculation.

For sample locations where a duplicate sample was also collected, the duplicate sample results were processed after calculation of the totals described above but prior to the calculation of summary statistics. Duplicates were resolved as follows:

- When both the primary and duplicate were detected, their average was used to represent the sample concentration (USEPA 2009);
- When both the primary and duplicate were non-detects, the sample with the lower limit of detection was used; and
- When only one of the pair was reported as detected, the detected result was used.

Table 1 presents the total PCB concentrations for each sediment sample and Table 2 presents the total PCB, PCB-TEQ, and total non-DLC PCB concentrations for each fish tissue sample.

Summary statistics and derivation of EPCs are discussed below.

3.2.1 Summary Statistics by Exposure Area and Depth

Five sediment exposure areas were defined within the Phase 1 reach, as indicated in Figure 2. Each exposure area is about 0.2 miles in length. The exposure areas were developed to support the analysis of remedial alternatives for the EE/CA, as indicated below:

- Area 1: Zone upstream of the T&H Dam, where sediments impounded by the dam may be subject to increased mobilization if the dam is breached or removed;
- Area 2: Upstream of Area 1 and near Riverside Square area;
- Area 3: From railroad bridge upstream of Area 2 to the area adjacent to and immediately downstream of Lewis Chemical;
- Area 4: Adjacent to and immediately downstream of the planned park at the former Lewis Chemical area; and
- Area 5: Upstream of Lewis Chemical to the confluence with Mother Brook, which is the upstream extent of the Phase 1 Area and the Lower Neponset River Superfund Site.

For the human and ecological receptors evaluated in the SRE, sediment exposure is expected to be limited to surface sediment (0 to 0.5 feet bml). However, to support the evaluation of remedial alternatives, a second evaluation including deeper sediment was also considered in the SRE (0 to the maximum sediment sample depth of 6.2 feet bml). Table 1 identifies the applicable exposure area and depth for each sample.

For each exposure area, summary statistics were calculated for both surface sediment and all sediment. Summary statistics were also calculated reach-wide (i.e., the five areas above combined). The summary statistics include the frequency of detection and the minimum, maximum, and arithmetic mean detected concentrations. Summary statistics for sediment are presented in Table 3. Summary statistics were not calculated for fish tissue due to limited sample size.

3.2.2 Exposure Point Concentrations

EPCs were calculated for total PCBs in surface sediment and all sediment as the 95 percent (%) upper confidence limit (UCL) on the arithmetic mean concentration (USEPA 2002) per exposure area and depth. USEPA's ProUCL software (USEPA 2022) was used for the UCL calculations. Detection limits for results reported as not detected were entered into the software without adjustment; ProUCL uses statistical methods to evaluate non-detects versus simple substitution (e.g., one-half detection limit). EPCs for sediment are presented in Table 3. In three cases where ProUCL recommended a UCL greater than the maximum detect, a statistician reviewed the data distribution and ProUCL output and recommended an appropriate UCL consistent with ProUCL guidance (USEPA 2022). The details are provided in the footnotes of Table 3. It is further noted that while the reach-wide UCL for all sediment does not exceed the maximum detection, it is over 10 times higher than the reach-wide mean. ProUCL identifies the dataset as lognormal and recommended the H-UCL, which is sensitive to a few very low or very high values (USEPA 2022). Therefore, the reach-wide UCL for all sediment may be skewed high due to a few samples with very high concentrations (e.g., subsurface sediment samples near the former Lewis Chemical facility with total PCB concentrations above 1000 milligrams per kilogram [mg/kg]). Attachment A presents the ProUCL output files.

Because only one sample of fillet and whole-body fish tissue is available from the two impoundments, screening level EPCs are equal to the detected concentration of total PCBs for each tissue type and impoundment, as presented in Table 2.

4. HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment (HHRA) for the SRE was conducted in accordance with the National Continency Plan (NCP; USEPA 1994), USEPA risk assessment guidance (USEPA 1989), and NTCRA guidance (USEPA 1993a). The HHRA followed USEPA's four step HHRA paradigm (USEPA 1989), focusing on PCBs, the primary COPC in sediment.

- Data Evaluation and COPC Selection
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

4.1 COPC SELECTION

The data evaluation step was discussed in Section 3. As noted previously, PCBs are selected as the COPC for this SRE.

4.2 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the magnitude, frequency, duration, and routes of current and reasonably anticipated future human exposure to PCBs in sediment in the Phase 1 reach of the LNR.

The extent of a receptor's exposure is estimated by identifying exposure scenarios that describe the potential pathways of exposure to PCBs and the specific activities and behaviors of individuals that might lead to contact with PCBs in the environment. This section describes the human health exposure pathways evaluated in the SRE, presents the methods and assumptions used to quantify potential exposures. EPCs were discussed in Section 3.2.3.

4.2.1 Exposure Pathways

The Massachusetts Department of Public Health (MDPH) indicates that it is safe to use LNR for activities such as walking, biking, boating, rowing, kayaking, and visiting parks/playgrounds; however, certain activities such as swimming or wading are not considered safe, in part due to levels of fecal coliform. According to MassDEP (2002), excessive levels of fecal coliforms are a pervasive water quality problem in the Neponset River Basin. The Neponset River Watershed Association's Community Water Monitoring Network (CWMN) monitors water quality in the Neponset River Watershed. Results from water sampling performed by CWMN inform the USEPA's Water Quality Report Card. According to the 2022 Neponset River Report Card the Lower Neponset River is 70.9% in compliance with Massachusetts bacterial standards for water-based recreation (Neponset River Watershed Association 2023). In other words, the Lower Neponset River was unsuitable for swimming or boating approximately 30% of the time within the two-year period due to elevated bacteria levels.

Recreational users and nearby residents (children and adults) may be exposed to PCBs by incidental ingestion and dermal contact with river sediment. Recreational users were selected as the representative receptor group for evaluation in the SRE, which includes local residents who use the river for recreation. The primary exposure depth is surface sediment (0 – 0.5 feet), however, exposure to sediment from all depths (down to approximately 6 feet) was also evaluated to provide additional information for the EE/CA remedial alternatives evaluation.

Anglers may fish in the LNR as fishing is not prohibited. There is a fish consumption advisory for the river due to PCBs and dichlorodiphenyltrichloroethane (DDT). The advisory recommends that children under 12, pregnant women, nursing mothers, and women that may become pregnant not eat any fish caught from the Neponset River between the Hollingsworth & Vose Dam in Walpole and the Walter Baker Dam. All persons should not eat any American eel or white sucker from this area and should limit consumption of all other freshwater fish from this area to no more than two meals per month (MDPH 2022). However, these advisories may not be followed and anglers who consume their catch may be exposed to PCBs in fish tissue.

4.2.2 Quantification of Potential Exposures

To estimate human health risk from PCBs at the Site, it is necessary to estimate the potential exposure dose. The exposure dose is estimated for each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of COPC concentrations in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose (intake). The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kgBW/day) (USEPA 1989).

Exposure doses are defined differently for potential carcinogenic and noncarcinogenic effects. The standardized equations for estimating a receptor’s intake (both chronic and lifetime) are presented in Table 4 (sediment) and Table 5 (fish consumption). The exposure assumptions used in the equations are discussed in Section 4.2.3 and chemical specific parameters are described in Section 4.2.4.

4.2.3 Exposure Assumptions

Exposure assumptions for recreational users potentially exposed to sediment are presented in Table 4, and exposure assumptions for recreational anglers are presented in Table 5. The exposure assumptions are described below.

4.2.3.1 Direct Contact with Sediment

It was assumed that a recreational user may contact surface sediment via incidental ingestion and dermal contact three days per week for the six warmest months of the year (78 days per year). Default residential assumptions were applied for body weight (80 kg adult, 15 kg child) and exposure duration (20 years adult, 6 years child) (USEPA 2014).

It was assumed that the adult ingests 100 milligrams of sediment per day (mg/day) and the child ingests 200 mg/day. These rates are the recommended upper percentile daily soil ingestion rates for the general population for adult and child (USEPA 2017) and are USEPA’s default rates for residential soil and are expected to be conservative for sediment (USEPA 2014).

Consistent with USEPA’s default assumption for residential soil (USEPA 2014), the recreational adult’s hands, forearms, lower legs, and head and the child’s hands, forearms, lower legs, head, and feet are assumed to contact sediment. Body surface areas and sediment to skin adherence factors were calculated in Attachment B based on data presented in USEPA guidance (USEPA 2004, 2011). The adherence data used are representative of exposures to wet soil and sediment (i.e., reed gatherers for adults and children playing in wet soil).

4.2.3.2 Fish Consumption

Adult anglers are assumed to consume fish caught from the LNR, as well as to share that catch with household members, including children. As with the recreational user, default residential assumptions were applied for body weight (80 kg adult, 15 kg child) and exposure duration (20 years adult, 6 years child) (USEPA 2014).

The MassDEP identifies a default fish consumption rate of 32 grams per day (g/day) for adults and 16 g/day for children (MassDEP 2008). The default consumption rate is based on the agency's review of creel angler studies, USEPA guidance, default rates used by other states, and published peer reviewed studies (MassDEP 2008). The fish consumption rate equates to consuming approximately one fish meal (8 ounces) per week, which MassDEP (2008) indicates is consistent with "a full and unrestricted use of the fish resource". MassDEP assumes that children eat about one-half the amount of fish as adults, based on review of United States Department of Agriculture data. The fish consumption rates are annualized, and therefore, exposure frequency is set to 365 days per year.

The use of MassDEP's default rate of 32 g/day for the LNR is expected to be conservative, given the urban nature of the river and limited sportfish habitat. Identification of a site-specific fish consumption rate will be addressed in the baseline human health risk assessment and pending the results of the RI and Phase 2 fish tissue sampling.

4.2.4 Chemical-Specific Parameters

Chemical specific parameters for sediment direct contact include the relative bioavailability factor (RBA) and the dermal absorption fraction (DAF), as presented in Table 6. Cooking loss is a chemical specific parameter for fish consumption. These parameters are discussed below.

RBA. The RBA represents the ratio between the fraction of chemical absorbed by humans from the environmental medium and the fraction absorbed by test subjects from the dose-response study medium. The RBA for PCBs is assumed to be 100% (1).

DAF. The DAF accounts for absorption of chemicals through the skin. The default DAF of 14% (0.14) provided in USEPA (2004) was used to evaluate absorption from dermal exposure to PCBs in sediment.

A cooking loss factor accounts for chemical in fish tissue that is lost during the preparation and cooking process and thus not consumed by the receptor. Published cooking loss factors for PCBs in fish range from zero to 74% loss (AECOM 2012). For the SRE, a cooking loss factor of 0% was conservatively used.

4.3 TOXICITY ASSESSMENT

The purpose of the toxicity (dose-response) assessment is to identify the types of adverse health effects a chemical may potentially cause and to define the relationship between the dose of a chemical and the likelihood or magnitude of an adverse effect (response) (USEPA 1989).

Adverse effects are classified by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are typically defined by USEPA for oral exposure and for exposure by inhalation. Because of the scarcity of toxicological data and established values for the dermal route of exposure, oral toxicity values are used to assess dermal exposures, with appropriate adjustment for differences in absorption (USEPA 2004).

The toxicity values for the SRE were selected following the USEPA's hierarchy guidance (USEPA 2003):

- Tier 1: USEPA's Integrated Risk Information System (IRIS).
- Tier 2: Provisional Peer-Reviewed Toxicity Values obtained from USEPA via the USEPA National Center for Environmental Assessment in Cincinnati, Ohio.
- Tier 3: Other sources of dose-response values will be selected in accordance with

> USEPA guidance (USEPA, 2013) and include, but are not limited to, California Environmental Protection Agency's Office of Environmental Health and Hazard Assessment Toxicity Criteria Database, Minimal Risk Levels published by the Agency for Toxic Substances and Disease Registry, and the Health Effects Assessment Summary Tables.

For total PCBs and total non-DLC PCBs, toxicity values for total PCBs were used. PCB-TEQ was evaluated using toxicity values for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD). The toxicity values are discussed below.

4.3.1 Noncancer Toxicity Values

Chemicals with known or potential noncarcinogenic effects are assumed to have a dose below which no adverse effect occurs or, conversely, above which an adverse effect may be seen. This dose is called the threshold dose. The threshold dose can be estimated based on laboratory studies or human epidemiological data. USEPA applies uncertainty factors to the threshold dose to account for uncertainties such as using animal studies, extrapolating from a less than lifetime to a lifetime exposure, protecting sensitive subpopulations, and others. The threshold dose is divided by the uncertainty factors to derive a reference dose (RfD). An RfD provides reasonable certainty that no noncarcinogenic health effects are expected to occur even if daily exposures were to occur at the RfD level for a lifetime. RfDs and exposure doses are expressed in units of mg/kgBW/day. The lower the RfD value, the lower is the assumed threshold for effects, and the greater the assumed toxicity.

USEPA has not developed an oral RfD for PCBs as a class [3]; however, USEPA has conducted threshold effect assessments for the following PCB mixtures: Aroclor 1254, 1016, and 1248 (USEPA 2024). The USEPA provides an oral RfD of 2E-05 mg/kgBW/day for Aroclor 1254 and an oral RfD of 7E-05 mg/kgBW/day for Aroclor 1016. The RfD for Aroclor 1254 was selected as the RfD for total PCBs. PCB-TEQ is evaluated using the RfD for TCDD of 7E-10 mg/kgBW/day (USEPA 2024). Table 7 presents the noncancer toxicity factors used in the SRE, all of which were obtained from IRIS.

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[3] An IRIS assessment of the potential noncarcinogenic effects of PCB mixtures is currently underway and is in the draft development stage (https://iris.epa.gov/Document/&deid=237359).

4.3.2 Cancer Toxicity Values

PCBs are classified by USEPA (1986) as a Class B2 carcinogens indicating sufficient evidence of carcinogenicity in animals with inadequate or lack for evidence in humans. Chemicals with cancer effects are generally assumed to have no lower-bound threshold for effects. The potency estimate for oral and dermal exposure, called a cancer slope factor (CSF) is expressed in units of (mg/kgBW/day)$^{-1}$; the higher the CSF, the greater the carcinogenic potential.

USEPA provides three tiers of oral CSFs on IRIS for evaluation of total PCBs present in environmental media: 1) high risk and persistence, 2) low risk and persistence, and 3) lowest risk and persistence (USEPA 2024). The choice of CSF depends on the route and medium of exposure and PCB chlorine content (USEPA 2024). The upper-bound and central-estimate oral CSFs of 2 (mg/kgBW/day)$^{-1}$ and 1 (mg/kgBW/day)$^{-1}$, respectively, are recommended by USEPA for food chain exposure (i.e., fish and shellfish consumption) and sediment ingestion. The upper bound estimate was used for total PCBs and total non-DLC PCBs. The CSF for TCDD was used for PCB TEQ. Table 8 presents the cancer toxicity factors used in the SRE. The total PCB CSF was obtained from IRIS and the TCDD CSF was obtained from CalEPA (2024).

4.3.3 Gastrointestinal Absorption Efficiency

As there are no dermal dose-response values available for PCBs, oral dose-response values were used to evaluate dermal exposures to sediment. The equation for calculating dermal absorption gives rise to an absorbed dose, making it necessary to adjust the oral toxicity factor to account for an absorbed rather than an administered dose. This adjustment accounts for the absorption efficiency in the critical study that forms the basis of the RfD or CSF. For example, in the case where oral absorption in the critical study is essentially complete (i.e., 100%), the absorbed dose is equivalent to the administered dose, and therefore no adjustment is necessary. USEPA (2004 Exhibit 4-1) provides recommended adjustment factors for oral dose-response values. For organic chemicals such as PCBs, no adjustment is considered necessary since their gastrointestinal absorption is generally high. Therefore, the oral toxicity values are used to estimate dermal exposure without adjustment.

4.4 HUMAN HEALTH RISK CHARACTERIZATION

Risk characterization is the process in which the toxicity information (Section 4.4) is integrated with quantitative estimates of human exposure derived in the Exposure Assessment (Section 4.2). The result is a quantitative estimate of the likelihood that humans will experience any adverse health effects given the exposure assumptions made. Two general types of health risk are characterized for each potential exposure pathway considered: potential carcinogenic risk and potential noncarcinogenic hazard. Potential carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (2014), is assumed to be 70 years.[4] Potential noncarcinogenic hazard is evaluated by averaging exposure over the total exposure period. The combined adult/child age group was used to calculate carcinogenic risk, and noncarcinogenic hazards were calculated separately for the adult and child age groups.

Cancer risks are estimated as the Excess Lifetime Cancer Risk (ELCR), which is the incremental probability of an individual developing cancer over a lifetime due to pathway-specific exposure to carcinogenic chemicals. The risk estimate for oral and dermal exposures is the lifetime average daily intake multiplied by the CSF. Under the NCP (USEPA 1994), cumulative cancer risk levels are evaluated in relation to USEPA's cumulative cancer risk management range of 1E-04 to 1E-06. Estimated upper bound cumulative ELCRs less than 1E-06 are not considered significant, and cumulative cancer risk levels greater than 1E-04 generally require remedial and/or risk management actions (USEPA 1991). For evaluating the need for removal actions, USEPA uses 1E-04 as the single chemical risk level for deriving Removal Management Levels (RMLs)[5]. Therefore, this SRE uses 1E 04 to identify risks that may warrant a removal action.

For noncarcinogens, the risk assessment methodology generally assumes that the biological effects of noncarcinogenic chemicals occur only after a threshold dose is exceeded. Such hazards were evaluated for oral and dermal exposures by calculating the ratio of the daily intake

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[4] More up-to-date "lifetimes" of 75 years (males), 80 years (females), and 78 years (males and females) are provided in the USEPA's updated Exposure Factors Handbook (2011), which would lower cancer risk estimates by approximately 10% (males and females combined). However, USEPA is re-considering the appropriateness of updating this factor for purposes of calculating lifetime average daily dose, and the standard default exposure assumption for lifetime remains 70 years (USEPA 2014).

[5] https://www.epa.gov/risk/regional-removal-management-levels-rmls-users-guide

during the exposure period to the RfD, as follows: intake / RfD. This ratio is the hazard quotient (HQ). The hazard index (HI) is the sum of HQs from multiple pathways, media, or COPCs. A cumulative HI greater than 1 per target organ is defined as the benchmark level of concern for potential noncarcinogenic health effects (USEPA 1991). Because PCBs are the only COPCs evaluated in this SRE, a target organ specific HI was not calculated. USEPA provides RMLs at HQs of 1 and 3, indicating that an HQ of 3 is considered a reasonable risk level for RMLs based on the uncertainties associated with the RfD estimate, which can span an order of magnitude. Therefore, this SRE uses an HI of 3 to identify noncarcinogenic hazards that may warrant a removal action.

The calculation of daily intakes, potential cancer risks, and noncancer HI is presented in Attachment C. The risk characterization results for the recreational user and the recreational angler are discussed below and are compared to a cancer risk level of 1E-04 and an HI of 3.

4.4.1 Recreational User

A recreational user (child and adult) is assumed to contact surface sediment in the LNR while doing activities such as wading, swimming, boating, rowing, and kayaking. ELCR and HI were calculated for surface sediment for the five sediment areas identified in Section 3.2.1, as well as reach-wide. In a second analysis, ELCR and HI were calculated assuming exposure to both surface and subsurface sediment to provide more information for the remedial alternatives analysis; recreators are not typically exposed to deeper sediment. Table 9 presents the ELCR and HI for each of these scenarios, which are also summarized below. For exposure to surface sediment, ELCR ranges from 2E-05 (Area 2) to 2E-04 (Area 4), and HI ranges from 1 to 31, as indicated below; yellow highlighting indicates ELCR greater than 1E-04 or HI greater than 3. For exposure to all sediment, cancer risks and noncancer hazards are higher due to generally higher levels of PCBs in deeper sediment.

	SUMMARY OF SEDIMENT DIRECT CONTACT PCB RISKS AND HAZARDS		
EXPOSURE POINT	**ELCR (CHILD/ADULT)**	**HI (CHILD)**	**HI (ADULT)**
Surface Sediment			
Area 1	7E-05	12	2
Area 2	2E-05	4	1
Area 3	1E-04	27	4
Area 4	2E-04	31	5

EXPOSURE POINT	SUMMARY OF SEDIMENT DIRECT CONTACT PCB RISKS AND HAZARDS		
	ELCR (CHILD/ADULT)	HI (CHILD)	HI (ADULT)
Area 5	6E-05	12	2
Reach-wide	1E-04	20	3
All Sediment			
Area 1	2E-04	37	6
Area 2	5E-05	9	2
Area 3	2E-04	35	6
Area 4	5E-04	93	16
Area 5	6E-05	10	2
Reach-wide	2E-03	304	51

Notes:
Yellow highlighting indicates ELCR greater than 1E-04 or HI greater than 3.
ELCR – excess lifetime cancer risk
HI – hazard index
PCB – polychlorinated biphenyl

4.4.2 Recreational Angler

A recreational angler (child and adult) is assumed to consume fish caught from the LNR. Screening level potential risks and hazards were calculated using white sucker fillet tissue from the T&H impoundment and the Walter Baker impoundment. The ELCR and the HI for PCBs were calculated two ways, as described in Section 3.2, for total PCBs and for the sum of PCB-TEQ and total non-DLC PCBs. The ELCR exceeds 1E-04 and the HI exceeds 3 for both impoundments and calculation methods, as shown in Table 10 and indicated below in yellow highlighting.

SCENARIO	SUMMARY OF SCREENING LEVEL PCB FISH CONSUMPTION RISKS AND HAZARDS		
	ELCR (CHILD/ADULT)	HI (CHILD)	HI (ADULT)
Tileston and Hollingsworth Impoundment			
Total PCBs	1E-03	186	70
PCB TEQ+ total non-DLC PCBs	2E-03	219	82
Walter Baker Impoundment			
Total PCBs	1E-03	131	49
PCB TEQ+ total non-DLC PCBs	2E-03	159	60

Notes:
Yellow highlighting indicates ELCR greater than 1E-04 or HI greater than 3.
DLC – dioxin-like congener
ELCR – excess lifetime cancer risk
HI – hazard index
PCB – polychlorinated biphenyl
TEQ – toxicity equivalence

5. ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) for the SRE was conducted in accordance with USEPA guidance, primarily Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997). USEPA's eight-step approach for conducting ERAs includes a screening level ERA (SLERA) (Steps 1 and 2) followed, when necessary, by a baseline ERA (BERA) (Steps 3 through 8).

The SLERA is intended as a conservative evaluation of the data and site conditions designed to focus further risk assessment activities on the most important stressors and exposure pathways and eliminate stressors and exposure pathways without potential for risk. The SLERA has limited capacity to assess the likelihood or magnitude of ecological risks. Therefore, if potential risks are identified, they are assessed in the more complex and site-specific BERA.

The ecological evaluation for the SRE is not intended to help identify whether further risk assessment activities are warranted; rather the evaluation is intended to help decide whether to take a cleanup action and assess what exposures need to be addressed by the action (USEPA 1993a). Therefore, this ERA includes elements of the SLERA and the BERA (e.g., use of 95% UCLs, and low effect toxicity values).

5.1 PROBLEM FORMULATION

The purpose of the screening-level problem formulation is to present the current understanding of the Site based on past Site activities, known hazards, and recent ecological characterization. This information is used to develop a CSM and is later analyzed to determine whether there are complete or potentially complete exposure pathways from known sources. A detailed Site description, history, and CSM for the Site is presented in AECOM (2024a).

5.1.1 Potential Ecological Receptors

A variety of ecological receptors are expected to be present within the Lower Neponset River. Based on the environmental setting described in Section 2.2, the Phase 1 reach includes wetlands and river habitat that may be used by fish, amphibians, reptiles, (e.g., turtles), aquatic and benthic invertebrates, and birds and mammals foraging on these receptors as prey items.

However, the Phase 1 reach is located in a densely populated urban setting with residential, commercial, and industrial development throughout the watershed. Although portions of the riverbanks are bordered by patches of wetlands, other areas contain rip-rap erosion control features that may limit access to the river for some wildlife (e.g., limited access for small mammals or shallow water for wading birds). Debris within the river and hard-bottom substrates may limit the presence of aquatic vegetation or benthic invertebrates that serve as the base of the food chain for fish and other ecological receptors.

A desktop review was conducted for information regarding the potential presence of habitat for threatened, endangered, or other special concern species at the Site. According to the Massachusetts Natural Heritage and Endangered Species Program GIS database, there are no priority habitats of state-protected rare wildlife occurring in wetland areas in the Site (Mass GIS 2023). To identify federal listed species with the potential for exposure to PCBs at the Site, the United States Fish and Wildlife Service (USFWS) online Information for Planning and Consultation (IPaC) system (USFWS 2024) was queried for a list of federal endangered, threatened, proposed, or candidate species and designated critical habitats that may occur in the vicinity. The IPaC query identified the following two federally listed species as potentially present near the Site:

- Northern Long-eared Bat (*Myotis septentrionalis*) - federally endangered species
- Monarch Butterfly (*Danaus plexippus*) - candidate species

The northern long-eared bat roosts in cavities or crevices of live or dead trees and hibernates in caves or mines. The monarch butterfly is found in fields and other open areas with herbaceous vegetation. Caterpillars feed only on milkweed (*Asclepias spp.*). Adults feed on nectar of milkweed and other flowering plants. The developed areas surrounding the river do not provide suitable habitat for these species; however, open areas and riparian wooded habitat adjacent to the river may provide limited habitat.

While the river supports a variety fish and other aquatic life, the ecological receptor groups of greatest concern for exposure to PCBs in sediment and the food chain consist of benthic invertebrates and piscivorous wildlife feeding in the aquatic habitats of the Phase 1 reach.

Although infaunal successional stages could not be determined at most locations during the SPI survey, relatively high-order benthic communities appear to be present in some areas. Benthic invertebrates are directly exposed to PCBs within the surface sediment horizon. Invertebrates may also ingest sediment and food items containing PCBs. Available sediment benchmarks do not distinguish between these particular exposure routes but consider direct toxicity to benthic invertebrates due to sediment exposure.

A variety of birds and mammals have been observed during investigations of the river. Due to the bioaccumulative nature of PCBs, birds and mammals that ingest prey items such as fish, amphibians, or benthic invertebrates likely to be exposed to higher concentrations of PCBs than herbivores consuming vegetation. Birds and mammals may be exposed to PCBs in sediment via incidental ingestion while foraging and via ingestion of prey items (e.g., shellfish, amphibians, fish) that have bioaccumulated PCBs from the sediment and water column. PCB exposure may also occur via ingestion of surface water, but this level of exposure is expected to be much lower than exposure through the diet. Birds and mammals such as heron or mink may consume larger fish contaminated by PCBs that have consumed smaller fish contaminated by PCBs; therefore, these piscivorous receptors are typically exposed to the highest levels of PCBs in the diet.

5.1.2 PCB Fate and Transport

As described in Section 1, the EE/CA and this SRE are focused on sediment contaminated with PCBs within the Phase 1 reach (USEPA 2023a). Therefore, total PCBs are evaluated as the single ecological COPC in the SRE.

PCBs have low water solubility and adhere to sediment particles rather than freely dissolving in water or volatilizing to air. Their hydrophobic nature means that PCBs are usually associated with the organic carbon fractions of sediments (i.e., they concentrate in organic rich sediment, as opposed to sandy sediment) and they accumulate in fatty biological tissue. When organisms consume PCB-containing sediment or prey items, some of the PCBs become associated with the lipid fraction of the organism. This process results in some of the PCBs biomagnifying or increasing in concentration as PCBs are consumed by higher trophic level organisms, rather than being lost from the organism. Consequently, the greatest ecological risk associated with PCBs is not generally direct toxicity to sediment dwelling organisms or fish directly exposed to PCBs in sediment, but animals higher in the food chain that prey upon these organisms.

5.1.3 Assessment and Measurement Endpoints

Assessment endpoints describe the characteristics of an ecosystem that have an intrinsic environmental value that is to be protected (e.g., protection of warm-water fish community). Typically, assessment endpoints and receptors are selected for their potential exposure, ecological significance, economic importance, and/or societal relevance. Since assessment endpoints often cannot be measured directly, measures of effect are typically surrogate endpoints used to provide a quantitative measure for evaluating potential effects of chemicals. The measurement endpoints should represent the same exposure pathway(s) and mechanisms of toxicity as the assessment endpoints to be relevant and useful. The assessment and measurement endpoints considered for this ERA are presented below:

Assessment Endpoint 1 - Survival, growth, and reproduction of benthic invertebrate communities.

> **Measurement Endpoint 1 -** Comparison of sediment concentrations of PCBs to sediment screening values. Concentrations greater than the screening values are considered indicative of a potential for ecological risks.

Assessment Endpoint 2 - Protection and maintenance of a vertebrate wildlife community consuming a piscivorous diet.

> **Measurement Endpoint 2 -** Comparison of calculated total daily dose (TDD) for avian and mammalian receptors from exposure to PCBs in sediment and contaminated prey items (i.e. fish) to PCB toxicity reference values (TRVs). Doses greater than the TRVs are considered indicative of a potential for ecological risks.

5.2 ECOLOGICAL EXPOSURE AND EFFECTS ASSESSMENT

This phase is based on the CSM developed in the problem formulation and characterizes potential ecological exposures and corresponding effects. The ecological exposure assessment involves the identification of potential exposure pathways and an evaluation of the magnitude of exposure by identified ecological receptors. The ecological effects assessment describes the potential adverse effects to ecological receptors from exposure to PCBs in environmental media.

Benthic invertebrates and piscivorous birds and mammals were identified as the ecological receptors of greatest concern for exposure to PCBs in the Phase 1 reach and are the focus of this ERA.

5.2.1 Ecological Exposure Assessment

Typically, a SLERA would evaluate maximum detected concentrations to identify ecological COPCs. Since PCBs have already been identified as the COPC for the SRE, the ecological evaluations for benthic invertebrates and wildlife considered the sediment EPCs based on 95% UCLs. The calculation of EPCs is described in Section 3.2.2.

Exposure to PCBs for benthic invertebrates and wildlife was evaluated for five exposure areas and on a reach-wide basis. Exposure areas considered in the ERA are described in Section 3.2.1. Two sediment horizons were considered: surface sediment (0 to 0.5 feet bml) and all sediment which included surface and subsurface sediment samples collected between 0 and 6.2 feet bml. The surface horizon is the most relevant depth for evaluating potential risks to ecological receptors as this is the horizon where most biological activity occurs. The evaluation of deeper sediment was included to support the evaluation of remedial alternatives. Sediment EPCs used in the ERA are presented in Table 10, 11, 13, and 14 and are consistent with the sediment EPCs identified in Table 3 and used in the HHRA.

A food web model was used to assess risks to mammals and birds due to PCB exposure via bioaccumulation due to ingestion of fish and sediment. The food web model used the sediment EPCs as well as available PCB data for fish tissue. As indicated in Table 2, two whole body white sucker samples were available from the two impoundments sampled by Breault (2014); the higher of the two results was used in the food web model as a screening level EPC. As indicated in Tables 13 and 14, the same screening level fish tissue EPCs were used across all the food web model evaluations.

The great blue heron (*Ardea herodias*) and mink (*Mustela vison*) were selected as representative piscivorous species for evaluation in the food web model. The great blue heron occupies a variety of aquatic habitats where small fish are abundant in shallow areas. Fish are preferred prey, but they also feed on amphibians, reptiles, insects, crustaceans, birds, and mammals (USEPA, 1993b). The mink is the most abundant and widespread carnivorous mammal in North America. They feed on aquatic prey such as fish, frogs, and invertebrates. Mink are active year-round and are found in a variety of aquatic habitats including rivers, streams, lakes, and swamps (USEPA, 1993b). Mink are often chosen as a surrogate species for mammalian piscivores at PCB sites because they are particularly sensitive to PCBs. The selection of these two receptors allows the evaluation of piscivorous exposure pathways within the river.

Exposure assumptions (e.g., body weights, food ingestion rates, relative consumption of food items, foraging range, exposure duration, etc.) for the selected wildlife species are provided in Table 12. In general, these values were obtained from the USEPA's Wildlife Exposure Factors Handbook (USEPA 1993b). Allometric equations (Nagy 2001) were used to estimate food ingestion rates. Both receptors were assumed to consume a 100% fish diet with incidental sediment ingesting during foraging.

To estimate potential dietary exposure, a TDD was estimated for each species based on the following factors: concentrations of the PCBs in the fish that the species would consume, sediment PCB concentrations and estimated amounts of sediment that would be incidentally ingested, the relative amount of different food items in its diet (assumed 100% fish), body weight, exposure duration (ED), species-specific area use factors (AUFs), and food ingestion rates. The ED represents the portion of the year that the receptor is exposed to the Site (e.g., may be modified by migration). An AUF is defined as the ratio of the area of the receptors home range to the size of the exposure area.

The TDDs for the two representative species were modeled from measured Phase 1 PCB concentrations in sediment and whole white sucker tissue collected from the T&H impoundment in 2003 and 2005 by USGS (Breault 2014). The following generalized equation was used to evaluate the TDD from each source (i.e., prey item, incidental sediment ingestion):

$$\text{TDD} = \underline{(\text{Tissue or Media Concentration x Ingestion Rate x ED x AUF})}$$

Receptor Body Weight

5.2.2 Ecological Effects Assessment

The ecological effects evaluation is an investigation of the relationship between the exposure to a chemical and the potential for adverse effects resulting from exposure. For benthic invertebrates, receptor- and media-specific ecological benchmarks are used to evaluate the potential for adverse effects. For wildlife, a food web model is used to estimate ingested PCB doses which are compared to literature-based TRVs.

Benthic invertebrates may potentially be exposed to PCBs from direct contact with surface sediments. Sediment data for Total PCBs were evaluated through comparisons with literature-derived toxicity thresholds. Bulk sediment EPCs were compared to available threshold effect concentrations (TECs) and probable effect concentrations (PECs) identified by USEPA Region 4 (2018) for use in ERAs. These Total PCB benchmarks represent consensus-based effect concentrations derived by MacDonald et al. (2000) that are associated with concentrations below which adverse effects on the benthic community are not expected (i.e., the TEC) or above which an adverse effect on the community is likely (i.e., the PEC). The bulk sediment TEC and PEC benchmarks are provided in Table 10.

Finkelstein, et al. (2017) highlights the importance of considering how the bioavailability and toxicity of PCBs to benthic invertebrates may be influenced by sediment organic carbon and suggests an equilibrium partitioning-based approach, rather than a comparison to a bulk sediment benchmark. Therefore, the average total organic carbon (TOC) concentration in each data set (e.g., exposure area and sediment horizon) was used to assess the potential level of injury (based on crustacean survival and reproduction data) to the benthic community from PCBs based on dose-response values provided in Finkelstein, et al. (2017). The results of the equilibrium partitioning-based evaluation are provided in Table 11 with supporting documentation provided in Attachment D.

For wildlife, TRVs can be defined as the daily dose of a constituent that is considered protective of wildlife (mammals and birds) populations or individuals. The dose is expressed in milligram per kilogram body weight per day (mg/kgBW/day). The No Observed Adverse Effects Level

(NOAEL)-based TRVs represent non-hazardous exposure levels for the wildlife species evaluated, while the Lowest Observed Adverse Effects Level (LOAEL)-based TRVs represent potential exposure levels at which adverse effects may become evident.

TRVs were identified in a review conducted by USEPA Region 5 (Chapman 2003) that selected TRVs based on species known to be sensitive to PCBs. The avian TRVs were based on dose-response data for chickens exposed to Aroclors 1242, 1248, or 1254 in multiple hatchability studies and the mammalian TRVs were based on reproduction endpoints from studies with mink exposed to Aroclors 1242 or 1254. The recommended LOAEL-based TRVs represented the dose associated with a 25% decrease in an endpoint response compared to a control group and the NOAEL-based TRV represented a 10% decrease. Given the known sensitivity of these species to PCBs, the use of these TRVs is expected to represent a conservative approach that is protective of avian and mammalian receptors that may forage in the river. The NOAEL and LOAEL-based food web models for surface sediment and all sediment are presented in Table 13 and Table 14, respectively.

5.2.3 ERA Calculations

HQs were calculated for PCBs in each exposure area and sediment data set by dividing the EPC or TDD by the relevant sediment benchmark or TRV using the following formula:

$$\text{HQ} = \text{Sediment EPC} \div \text{Sediment Benchmark}$$

$$\text{HQ} = \text{TDD} \div \text{TRV}$$

For the equilibrium partitioning-based evaluation for the benthic invertebrates, the EPC associated with the benthic injury sediment benchmark was used to identify the percent benthic injury based on a ‘look-up table’ presented by in Finkelstein, et al. (2017).

5.3 ECOLOGICAL RISK CHARACTERIZATION

In risk characterization, the results of the exposure and effects assessment were analyzed and interpreted to determine the likelihood of adverse environmental effects. Risks were evaluated for the benthic invertebrate community in direct contact with the sediment and for piscivorous wildlife (great blue heron and mink) consuming whole fish with incidental sediment ingestion.

Benthic invertebrates were first evaluated based on comparisons of sediment EPCs to bulk sediment benchmarks. As indicated in Table 10, HQs based on both TEC and PEC comparisons were greater than 1 for all exposure areas and for surface sediment and all sediment (combined surface and subsurface sediment). HQs in the surface horizon are most relevant to current benthic invertebrate exposures in the Phase 1 reach. HQs based on the PEC in surface sediment ranged from 24.9 in Area 2 to 216 in Area 4. HQs based on the PEC in all sediment ranged from 64.3 in Area 2 to 2108 in the reach-wide area. Concentrations above the PEC indicate that adverse effects on the community are likely based on PCB exposure in both surface and subsurface horizons. Most benthic invertebrates are unlikely to be exposed to sediments below 0.5 feet bml; therefore, the "all sediment" exposure scenario represents a hypothetical assessment as benthic exposures to deeper sediments are not realistic under current conditions.

As an additional evaluation for the benthic community, sediment EPCs were compared to equilibrium partitioning-based sediment benchmarks to estimate the level of injury to the benthic community. This approach considers that PCBs may bind to TOC in sediment and be less bioavailable and toxic to invertebrates than would be predicted by bulk sediment comparisons. The results of this evaluation are presented in Table 11 with supporting materials provided in Attachment D. The predicted percent benthic injury in the surface sediment ranged from 54% in Area 2 to 98% in Area 4 and in all sediment ranged from 92% in Area 2 to 100% in Area 4 and reach-wide.

Piscivorous birds and mammals were evaluated using a food web model that considered incidental sediment ingestion (modeled based on sediment EPCs) and a 100% fish diet (modeled based on fish tissue data collected by USGS from the T&H impoundment). AUFs were applied since the size of the exposure areas was smaller than the home ranges for the great blue heron and mink; therefore, these receptors would forage outside any individual exposure area. The great blue heron was assumed to be migratory, and the mink was assumed to be present and foraging all year, so EDs of 0.67 and 1.0 were applied, respectively. Table 12 summarizes the basis for the AUFs, EDs, and other wildlife exposure factors considered in the food web model.

Table 13 presents the results of the food web model based on surface sediment and the whole body screening level fish EPC. As shown in Table 13, NOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, 3, 4 and for the mink and great blue heron reach-wide. LOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, 3, and for the mink and great blue heron reach-wide. HQs were higher in the “all sediment” evaluation presented in Table 14. As shown in Table 14, NOAEL and LOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, 3, 4 and reach-wide with a maximum HQ of 36.3 (compared to a maximum HQ of 8.1 in the surface sediment model). For the great blue heron, NOAEL-based HQs greater than 1 were calculated for Area 3 and reach-wide and a LOAEL-based HQ greater than 1 was calculated reach-wide (Table 14).

6. UNCERTAINTY EVALUATION

The objective of the uncertainty evaluation is to discuss the assumptions made within the SRE that may influence the risk assessment results and conclusions. Although it is not practical to account for all sources of uncertainty, it is important to identify the major elements of uncertainty in the risk assessment. Within the risk assessment process, assumptions must be made due to both variability and uncertainty in risk assessment parameters, such as receptor exposure patterns and toxicity of chemicals. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk assessment process. Risk assessment methodology requires that conservative assumptions be made throughout the risk assessment to ensure that risks are not underestimated. Therefore, when all the assumptions and approaches are combined, it is more likely that risks are overestimated rather than underestimated.

Key sources of uncertainty in the SRE are discussed below for the human health and ecological risk assessments.

6.1 EXPOSURE TO SUBSURFACE SEDIMENT

Recreational users of the LNR are expected to contact surface sediment while boating, wading, fishing, etc. Most ecological receptors are also only expected to be exposed to the top 6 inches of the sediment surface. For the SRE, an additional analysis assuming contact with deeper sediment was performed to support the evaluation of remedial alternatives. The analysis of deeper sediment indicates a higher level of potential risk for both human health and ecological receptors, as summarized below.

HHRA. Potential cancer risks and hazards calculated under the deep sediment scenario are at least an order of magnitude higher than the surface sediment only scenario. The extent of human exposure to deeper sediment is uncertain and the potential risks associated with exposure to deeper sediment are likely to overestimate actual recreational exposures.

ERA. HQs calculated under the deeper sediment scenario are consistently higher than the HQs calculated under the more realistic surface sediment only scenario. The potential risks associated with the subsurface sediment scenario are an overestimate of actual exposures as ecological receptors are not expected to be exposed to sediments below 0.5 feet bml and these results should be viewed as informational only.

6.2 USE OF HISTORICAL FISH TISSUE DATA

The white sucker data used in the SRE are approximately 20 years old; more recent data are not yet available but will be collected during Phase 2 activities. Therefore, it is unknown whether the white sucker fillet data used in the HHRA and the whole-body white sucker data used in the SLERA food web model are representative of current conditions.

As shown in Table 2, only one fillet and one whole body sample is available from the T&H impoundment and one of each tissue type from the Walter Baker impoundment. The only species collected was white sucker. The fillet sample from each impoundment was used as the fish tissue EPC for the HHRA and the maximum whole-body concentration was used as the fish tissue EPC for all the ecological food web model evaluations. Therefore, the findings of the HHRA for fish consumption and the ecological food web models are considered screening level due to uncertainty in the historical fish tissue data.

Fish tissue concentrations remain a data gap to be filled under Phase 2.

6.3 EVALUATION OF PCBS ONLY

The NTCRA and thus the SRE focused on PCBs, as it is the primary contaminant in the LNR. This assumption is supported by a review of the Phase 1 data (AECOM 2024b), which indicates PCBs are widespread and of high concentration in some areas. The purpose of the SRE is to determine if an NTRCA is warranted to address risks. Potentially unacceptable risks for PCBs exist to varying extents in all areas of the Phase 1 reach; inclusion of other COPCs in the SRE would increase risks and would not alter the conclusion that a removal action is warranted. This includes the presence of dioxins and furans in sediment. A review of the Phase 1 data indicates that focusing on PCBs for the EE/CA will not leave behind areas with elevated levels of dioxins and furans.

6.4 BIOAVAILABILITY OF PCBS

Chemical analyses typically measure the total concentrations of constituents rather than the bioavailable form that can exert toxicity. Both the HHRA and the ERA assumed that the entire fraction of PCBs measured in sediment and fish tissue is bioavailable and toxic. This is likely a conservative assumption since PCBs are known to bind to organic carbon, thus reducing the bioavailable fraction. The use of the total concentrations of PCBs to estimate exposure likely overestimates risk when compared to toxicological benchmarks derived from more bioavailable and toxic forms.

6.5 SOURCE OF FISH IN DIET

The HHRA assumed that the recreational angler obtains 100% of recreationally caught fish from the LNR and consumes an eight-ounce meal of LNR fish each week all year round. Anglers are more likely to obtain fish from multiple waterbodies and may not consume all catch. Therefore, the potential risks associated with fish consumption may be overestimated.

Both mink and great blue heron consume varied diets that include fish, as well as shellfish, amphibians, invertebrates, and other prey items. The assumption of an exclusive fish diet based on the white sucker data may over or underestimate risks. If the mink and heron were to consume fish species higher in the food chain than the white sucker (e.g., largemouth bass), then the use of only the white sucker data may underestimate risks to the receptors. If the heron and mink consume a more mixed carnivorous diet, it is unknow whether the overall dietary dose of PCBs would be higher or lower than with only the white sucker data. Collection of fish tissue and shellfish tissue data remain a data gap to be filled under Phase 2.

6.6 USE OF THIRD TIER TOXICITY FACTOR IN HHRA

The source of the TCDD cancer toxicity factor used to evaluate cancer risk for PCB-TEQ is CalEPA, which is considered a third-tier source of toxicity factors (USEPA 2003). Third-tier toxicity values have not necessarily been reviewed or verified by USEPA as have toxicity values published on IRIS. However, CalEPA conducts peer review on its published toxicity factors and the CalEPA TCDD cancer toxicity factor is used to calculate USEPA's Regional

Screening Levels. The use of the CalEPA TCDD cancer toxicity factor is likely a minor source of uncertainty.

6.7 USE OF WHO (2005) TEFS

The World Health Organization (WHO) reevaluated the TEFs for dioxins, furans, and dioxin-like PCB congeners in 2022 (DeVito et al. 2024). The revised TEFs are based on an updated relative potency database and data analysis methods. The authors note that application of the 2022 TEFs will tend to result in lower TEQs than the 2005 TEFs. However, the USEPA has not adopted the 2022 TEFs at this time, and therefore, the 2005 TEFs were used which is likely a minor source of uncertainty.

6.8 BASIS OF EQUILIBRIUM PARTITIONING-BASED APPROACH

The invertebrate studies that serve as the toxicological basis for the aqueous and sediment dose–response curves considered by Finkelstein, et al. (2017) included data for Aroclor 1254, Aroclor 1248, and Aroclor 1242; therefore the ‘look-up’ table based on Aroclor 1254 is most applicable to mixtures of these Aroclors. The authors also indicated that Aroclor 1260 was expected to be as toxic as Aroclor 1254 and Aroclor 1248 in chronic lifecycle testing with crustaceans. These Aroclors have historically been detected above background concentrations in sediments at the Site, along with Aroclors 1221 and Aroclor 1232 (AECOM 2024a). The Phase 1 total PCB concentrations are based on the sum of congeners and include congeners beyond those expected to be present in Aroclor 1260, Aroclor 1254, Aroclor 1248, and Aroclor 1242. Therefore, there is some uncertainty associated with applying an equilibrium partitioning-based benchmark based on selected Aroclors to a data set that contains a wider selection of PCBs. Given that Aroclor 1260, Aroclor 1254, Aroclor 1248, and Aroclor 1242 were frequently detected in previous sediment samples collected from the Site, it is likely that the total PCB concentration measured in Phase 1 includes these Aroclors and the Phase 1 total PCB results can be compared to the equilibrium partitioning-based benchmark.

6.9 SELECTION OF WILDLIFE TRVS

The avian and mammalian TRVs were based on controlled studies with two species (chicken and mink) known to be sensitive to PCBs. This approach is unlikely to underestimate wildlife risks but may overestimate risks if the species present in the river are less sensitive to PCBs. For example, a field study monitoring reproductive success of black-crowned night herons (*Nycticorax nycticorax*) found no relationship between reproduction and PCB concentrations between nests at a reference location and Baltimore Harbor (Rattner, et al. 2001). The highest dietary exposure showed no adverse effects but can be used to derive NOAEL- and LOAEL-based TRVs of 0.25 and 2.5 mg/kgBW/day. This LOAEL-based TRV is five times higher than the LOAEL-based avian TRV used in the SRE food web model. In addition, use of data from a wading bird study may be more applicable to site conditions than data from chicken studies.

Although mink are more sensitive to PCBs than other mammals, there is variability in mink responses among different studies. Studies feeding mink field-contaminated fish result in higher TRVs than laboratory controlled dietary studies considered by Chapman (2003). Bursian et al. (2013) evaluated the reproductive effects of feeding farm-raised mink on diets containing PCB-contaminated common carp and Atlantic herring from the upper Hudson River. The results from that study can be used to derive NOAEL- and LOAEL-based TRVs of 0.15 and 0.27 mg/kgBW/day that are two to three times higher than the mammalian TRVs used in the SRE food web model. Similar work with mink and PCB-containing fish from the Housatonic River (Bursian, et al., 2006) would result in higher TRVs than the Hudson River study. Use of mink as a representative mammalian piscivore may be applicable within the river, but the selected TRV may be overly conservative relative to actual field exposures and effects for mink.

7. SUMMARY OF KEY FINDINGS

The SRE evaluated risks to human and ecological receptors from exposure to PCBs in sediment and fish in the one-mile Phase 1 reach of the LNR (Figure 2). The SRE was conducted in accordance with applicable USEPA guidance using conservative assumptions and approaches. Sediment risks were calculated on a reach-wide basis and for five exposure areas each about 0.2 miles in length, as follows:

- Area 1: Zone upstream of the T&H Dam, where sediment impounded by the dam may be subject to increased mobilization if the dam is breached or removed;
- Area 2: Upstream of Area 1 and near Riverside Square area;
- Area 3: From railroad bridge upstream of Area 2 to the area adjacent to and immediately downstream of Lewis Chemical;
- Area 4: Adjacent to and immediately downstream of the planned park at the former Lewis Chemical area; and
- Area 5: Upstream of Lewis Chemical to the confluence with Mother Brook, which is the upstream extent of the Phase 1 Area and the Lower Neponset River Superfund Site.

A summary of the human health and ecological risks are presented below.

7.1 SUMMARY OF HUMAN HEALTH RISKS

Potential risks and hazards were calculated for a recreational user who contacts sediment and an angler who consumes LNR fish. Tables 8 and 9 present the results of the SRE for the recreational user and recreational angler, respectively. The risks were compared to a target cancer risk of 1E-04, which is the upper end of USEPA’s acceptable risk range of 1E-06 to 1E-04 and a noncancer HQ of 3, consistent with USEPA’s derivation of RMLs.

Potential cancer risks for the recreational user exposed to surface sediment by incidental ingestion and dermal contact range from 2E-05 to 2E-04. Only surface sediment in Area 4 poses a risk greater than 1E-04. Noncancer hazards are above 3 for surface sediment in all exposure areas for the child and Areas 3 and 4 for the adult (Table 8). The potential risks from exposure to all sediment was also evaluated to provide additional information for the EE/CA remedial alternatives evaluation, however, direct contact with deeper sediment during recreational activities is not expected to occur. The potential risks from contact with all sediment are about an order of magnitude higher than surface sediment risks.

Based on limited historical fish tissue data, screening level fish consumption risks for the adult angler and child fish consumer exceed 1E-04 and a HQ of 3 for white sucker fillet from both impoundments (Table 9). Additional fish tissue data will be collected as part of Phase 2 of the remedial investigation and will be used in the sitewide risk assessments.

7.2 SUMMARY OF ECOLOGICAL RISKS

Risks were evaluated for the benthic invertebrate community in direct contact with the sediment and for piscivorous wildlife (great blue heron and mink) that consume whole fish with incidental sediment ingestion.

Benthic invertebrates were evaluated based on comparisons to bulk sediment benchmarks and equilibrium partitioning-based benchmarks adjusted to the area and depth-specific average total organic carbon. HQs above 1 based on bulk sediment benchmark comparisons were calculated for surface and all sediment in all exposure areas (Table 10). The equilibrium partitioning-based evaluation predicted percent benthic injury levels for the benthic invertebrate community ranging from 54% to 98% in surface sediment and 92% to 100% in all sediment across the exposure areas and reach-wide (Table 11).

Piscivorous wildlife were evaluated using a food web model that assumed an exclusive diet of fish with incidental sediment ingestion. Whole body white sucker data collected from the T&H impoundment (Breault 2014) were used to represent the fish tissue concentration of PCBs in all exposure areas evaluated in the food web model. HQs were calculated using both NOAEL and LOAEL-based TRVs. For surface sediment exposures, NOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, 3, 4 and for the mink and great blue heron reach-wide and LOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, and 3, and for the mink and great blue heron reach-wide (Table 13). HQs were higher in the “all sediment” evaluation, however, as previously noted, these HQs are for informational purposes given the limited potential for receptor exposures to deeper sediment (Table 14). As shown in Table 14, NOAEL and LOAEL-based HQs greater than 1 were calculated for the mink in Areas 1, 2, 3, 4 and reach-wide with a maximum HQ of 36.3 (compared to a maximum HQ of 8.1 in the surface sediment model). For the great blue heron, NOAEL-based HQs greater than 1 were calculated for Area 3 and reach-wide and a LOAEL-based HQ greater than 1 was calculated reach-wide in the "all sediment" food web model.

7.3 CONCLUSIONS

The SRE indicates that there are unacceptable risks for both human and ecological receptors exposed to PCBs in surface sediment in all five exposure areas as well as reach-wide. The highest risks for surface sediment were found in Areas 3 and 4. The SRE also found unacceptable risks for human and ecological receptors exposed to PCBs in subsurface sediments in all five areas as well as reach-wide. However, there is greater uncertainty in these risk estimates given the limited potential for exposure to deeper sediment. Consumption of LNR fish was also found to pose unacceptable risks, although the available fish tissue data are limited and approximately 20 years old. Current fish tissue data will be collected from the LNR Site in Fall 2024 as part of the Phase 2 investigation and will be used in the sitewide risk assessments.

In summary, the SRE findings indicate that PCBs in sediment in the Phase 1 reach warrant remediation under a NTCRA.

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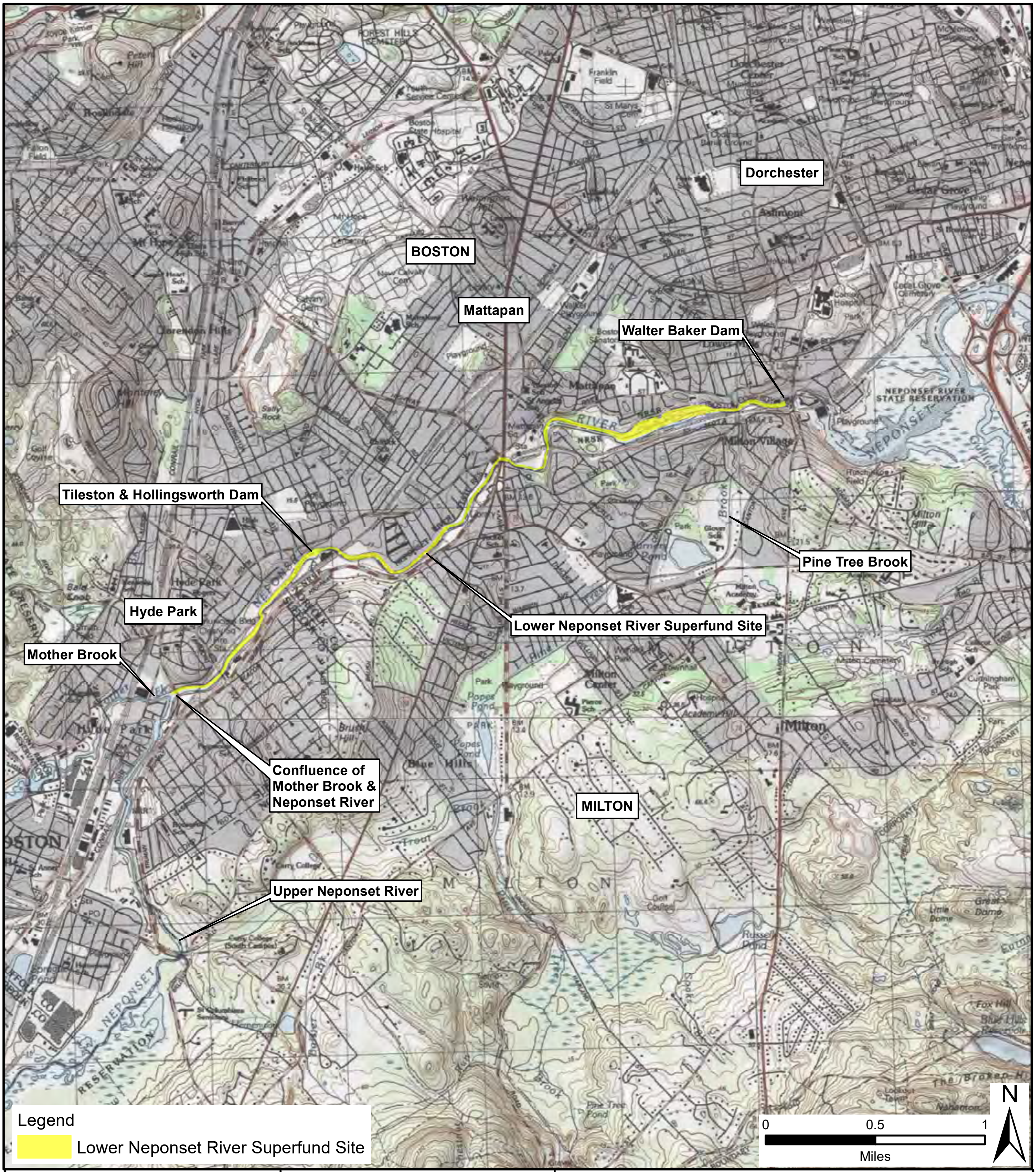
FIGURES



AECOM

Drawn: JB 03/12/2024

Approved: KT 03/12/2024

Project #: 60703400

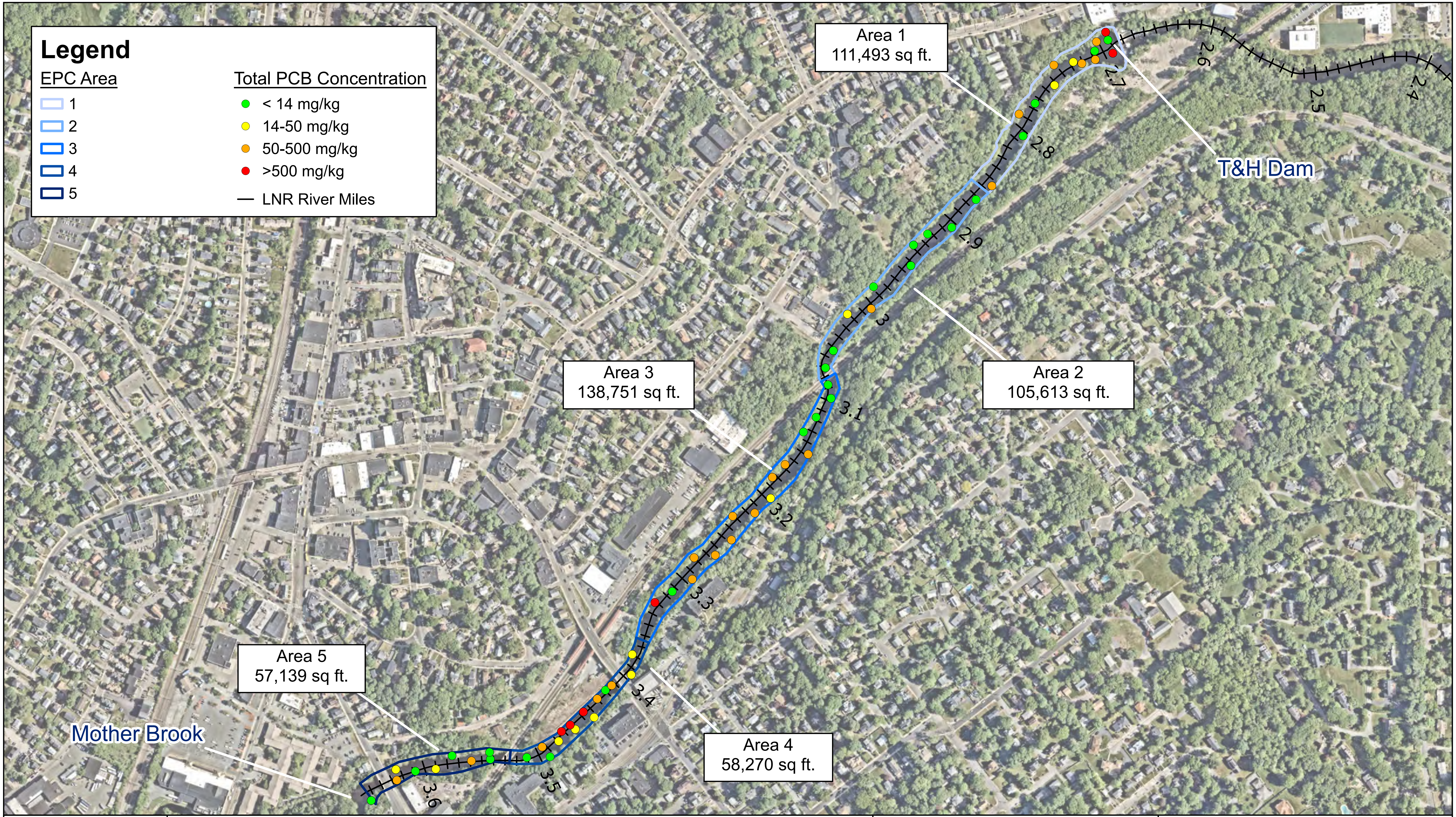
Map Location

FIGURE 1
REGIONAL LOCATION MAP

LOWER NEPONSET RIVER

BOSTON, MASSACHUSETTS

C:\Users\BorgogniN\AECOM\USEPA RAF Contracts - 60703400_F0007_Lower_Neponset_River\900_CAD_GIS\920_GIS\NB_EECA\NB_EECA_RemovalAreas\NB_EECA_RemovalAreas.aprx



AECOM

Note: Units are in mg/kg; results show maximum concentration found in each boring.

EPC Area River Miles (RM):
Area 1: RM 2.68 - 2.86
Area 2: RM 2.86 - 3.12
Area 3: RM 3.12 - 3.36
Area 4: RM 3.36 - 3.53
Area 5: RM 3.53 - 3.65

Lower Neponset River Superfund Site

Exposure Point Concentration (EPC) Areas and Phase 1 Sediment Results

DATE: 07/2024
DRWN: NB
SCALE: 1:4,800
FIGURE 2

AECOM

Drawn: NB 03/14/2024
Approved: KT 03/14/2024
Project #: 60703400

Legend

Canoe Launch Point

● Parks within and in close proximity to Site

🟩 Recreational Areas

🟨 Lower Neponset River Superfund Site

🟦 Site Dam

N

0 1,500 3,000
Feet

FIGURE 3
PUBLIC ACCESS POINTS

LOWER NEPONSET RIVER

BOSTON, MASSACHUSETTS

TABLES

Table 1
Total PCBs in Phase 1 Reach
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Area	Horizon	Location	Depth (feet bgs)	Sample Date	Total PCBs (a) (mg/kg)
Area 1	Surface	23A-0018-PLC1	0 -- 0.5	6/23/2023	13
Area 1	Subsurface	23A-0018-PLC1	0.5 -- 4.4	6/23/2023	231
Area 1	Subsurface	23A-0018-PLC1	4.4 -- 5.5	6/23/2023	12.3
Area 1	Surface	23A-0019-B2C2	0 -- 0.5	6/23/2023	15.2
Area 1	Subsurface	23A-0019-B2C2	0.5 -- 3.1	6/23/2023	317
Area 1	Subsurface	23A-0019-B2C2	3.1 -- 4.3	6/23/2023	1.34
Area 1	Surface	23A-0020-PLC1	0 -- 0.5	6/22/2023	28.7
Area 1	Subsurface	23A-0020-PLC1	0.5 -- 2.3	6/22/2023	631
Area 1	Subsurface	23A-0020-PLC1	2.3 -- 4	6/22/2023	580
Area 1	Surface	23A-0039-PLC1	0 -- 0.5	6/23/2023	2.01
Area 1	Subsurface	23A-0039-PLC1	0.5 -- 2	6/23/2023	2.86
Area 1	Subsurface	23A-0039-PLC1	2 -- 3	6/23/2023	0.105
Area 1	Surface	23A-0040-PLC1	0 -- 0.5	6/23/2023	16.1
Area 1	Subsurface	23A-0040-PLC1	0.5 -- 1.4	6/23/2023	12.2
Area 1	Subsurface	23A-0040-PLC1	1.4 -- 5.6	6/23/2023	0.00572
Area 1	Surface	23A-0057-PLC1	0 -- 0.5	6/24/2023	4.61
Area 1	Subsurface	23A-0057-PLC1	0.5 -- 1.5	6/24/2023	2.8
Area 1	Subsurface	23A-0057-PLC1	1.5 -- 2.5	6/24/2023	80.3
Area 1	Surface	23A-0058-PLC1	0 -- 0.5	6/24/2023	3.49
Area 1	Subsurface	23A-0058-PLC2	0.5 -- 2	6/24/2023	0.498
Area 1	Surface	23A-0059-PLC1	0 -- 0.5	6/23/2023	42.5
Area 1	Subsurface	23A-0059-PLC1	0.5 -- 1.2	6/23/2023	0.628
Area 1	Surface	23A-0060-PLC1	0 -- 0.5	6/23/2023	2.87
Area 1	Subsurface	23A-0060-PLC1	0.5 -- 2	6/23/2023	38.6
Area 1	Subsurface	23A-0060-PLC1	2 -- 3.6	6/23/2023	406
Area 1	Surface	23A-0066-PLC1	0 -- 0.5	6/24/2023	187
Area 1	Subsurface	23A-0066-PLC1	0.5 -- 1.7	6/24/2023	0.901
Area 1	Surface	23A-0067-PLC1	0 -- 0.5	6/23/2023	4.79
Area 1	Subsurface	23A-0067-PLC1	0.5 -- 2.3	6/23/2023	451
Area 1	Subsurface	23A-0067-PLC1	2.3 -- 2.9	6/23/2023	1.22
Area 1	Surface	23A-0068-PLC2	0 -- 0.5	6/22/2023	1.22
Area 1	Subsurface	23A-0068-PLC2	0.5 -- 0.9	6/22/2023	0.506
Area 1	Surface	23A-0069-PLC1	0 -- 0.5	6/22/2023	0.51
Area 1	Subsurface	23A-0069-PLC1	0.5 -- 3.4	6/22/2023	0.259
Area 1	Subsurface	23A-0069-PLC1	3.4 -- 6	6/22/2023	0.0123
Area 1	Surface	23A-0070-PLC1	0 -- 0.5	6/23/2023	10.1
Area 1	Subsurface	23A-0070-PLC1	0.5 -- 2.3	6/23/2023	192
Area 1	Subsurface	23A-0070-PLC1	2.3 -- 4.2	6/23/2023	853
Area 2	Surface	23A-0014-PLC2	0 -- 0.5	6/25/2023	1.85
Area 2	Surface	23A-0015-PLC1	0 -- 0.5	6/24/2023	6.02
Area 2	Subsurface	23A-0015-PLC1	0.5 -- 1.5	6/24/2023	13.9
Area 2	Subsurface	23A-0015-PLC1	1.5 -- 2.9	6/24/2023	5.18
Area 2	Surface	23A-0033-B2C1	0 -- 0.5	6/26/2023	11.5
Area 2	Subsurface	23A-0033-B2C1	0.5 -- 1.7	6/26/2023	3.5
Area 2	Subsurface	23A-0033-B2C1	1.7 -- 2.7	6/26/2023	0.0539
Area 2	Surface	23A-0034-PLC1	0 -- 0.5	6/25/2023	14.3
Area 2	Subsurface	23A-0034-PLC1	0.5 -- 1.4	6/25/2023	4.6
Area 2	Subsurface	23A-0034-PLC1	1.4 -- 2.4	6/25/2023	0.266
Area 2	Surface	23A-0036-PLC3	0 -- 0.5	6/24/2023	3.94
Area 2	Surface	23A-0037-B2C1	0 -- 0.5	6/24/2023	1.58
Area 2	Surface	23A-0053-B1C1	0 -- 0.5	6/25/2023	5.55
Area 2	Subsurface	23A-0053-B1C1	0.5 -- 3.2	6/25/2023	8.93
Area 2	Subsurface	23A-0053-B1C1	3.2 -- 5.7	6/25/2023	0.0475
Area 2	Surface	23A-0054-PLC2	0 -- 0.5	6/25/2023	44.7
Area 2	Subsurface	23A-0054-PLC2	0.5 -- 1.5	6/25/2023	321
Area 2	Subsurface	23A-0054-PLC2	1.5 -- 3	6/25/2023	1.53
Area 2	Surface	23A-0055-B1C1	0 -- 0.5	6/25/2023	1.63
Area 2	Subsurface	23A-0055-B1C1	0.5 -- 2.1	6/25/2023	0.0152
Area 2	Subsurface	23A-0055-B1C1	2.1 -- 3.4	6/25/2023	0.00854
Area 2	Surface	23A-0056-PLC1	0 -- 0.5	6/24/2023	0.173
Area 2	Subsurface	23A-0056-PLC1	0.5 -- 2	6/24/2023	3.91

Table 1
Total PCBs in Phase 1 Reach
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Area	Horizon	Location	Depth (feet bgs)	Sample Date	Total PCBs (a) (mg/kg)
Area 3	Surface	23A-0007-PLC1	0 -- 0.5	6/27/2023	10.9
Area 3	Subsurface	23A-0007-PLC1	0.5 -- 1.7	6/27/2023	699
Area 3	Subsurface	23A-0007-PLC1	1.7 -- 5.1	6/27/2023	724
Area 3	Surface	23A-0008-PLC1	0 -- 0.5	6/27/2023	275
Area 3	Subsurface	23A-0008-PLC1	0.5 -- 3	6/27/2023	0.133
Area 3	Subsurface	23A-0008-PLC1	3 -- 6.2	6/27/2023	0.169
Area 3	Surface	23A-0009-PLC1	0 -- 0.5	6/27/2023	44.6
Area 3	Subsurface	23A-0009-PLC1	0.5 -- 3	6/27/2023	235
Area 3	Subsurface	23A-0009-PLC1	3 -- 5.7	6/27/2023	1.44
Area 3	Surface	23A-0010-PLC1	0 -- 0.5	6/26/2023	21.9
Area 3	Subsurface	23A-0010-PLC1	0.5 -- 1.5	6/26/2023	376
Area 3	Subsurface	23A-0010-PLC1	1.5 -- 3.4	6/26/2023	1.24
Area 3	Surface	23A-0011-B1C1	0 -- 0.5	6/26/2023	6.43
Area 3	Subsurface	23A-0011-B1C1	2.9 -- 3.6	6/26/2023	2.23
Area 3	Surface	23A-0012-PLC1	0 -- 0.5	6/26/2023	5.71
Area 3	Subsurface	23A-0012-PLC1	0.5 -- 1.7	6/26/2023	1.55
Area 3	Subsurface	23A-0012-PLC1	1.7 -- 3	6/26/2023	0.201
Area 3	Surface	23A-0028-PLC2	0 -- 0.5	6/27/2023	1.04
Area 3	Subsurface	23A-0028-PLC2	0.5 -- 1.7	6/27/2023	0.105
Area 3	Surface	23A-0029-PLC1	0 -- 0.5	6/27/2023	5.16
Area 3	Subsurface	23A-0029-PLC1	0.5 -- 3.3	6/27/2023	213
Area 3	Subsurface	23A-0029-PLC1	3.3 -- 5.8	6/27/2023	0.437
Area 3	Surface	23A-0030-PLC1	0 -- 0.5	6/27/2023	37.4
Area 3	Subsurface	23A-0030-PLC1	0.5 -- 1.8	6/27/2023	490
Area 3	Subsurface	23A-0030-PLC1	1.8 -- 2.8	6/27/2023	14.7
Area 3	Surface	23A-0031-PLC1	0 -- 0.5	6/26/2023	143
Area 3	Subsurface	23A-0031-PLC1	0.5 -- 1.5	6/26/2023	439
Area 3	Subsurface	23A-0031-PLC1	1.5 -- 3.4	6/26/2023	0.624
Area 3	Surface	23A-0032-PLC1	0 -- 0.5	6/26/2023	0.361
Area 3	Subsurface	23A-0032-PLC1	0.5 -- 1.7	6/26/2023	0.0438
Area 3	Subsurface	23A-0032-PLC1	1.7 -- 3	6/26/2023	0.395
Area 3	Surface	23A-0048-PLC1	0 -- 0.5	6/27/2023	1.68
Area 3	Subsurface	23A-0048-PLC1	0.5 -- 3.2	6/27/2023	219
Area 3	Subsurface	23A-0048-PLC1	3.2 -- 5	6/27/2023	0.191
Area 3	Surface	23A-0049-B2C1	0 -- 0.5	6/27/2023	176
Area 3	Subsurface	23A-0049-B2C1	0.5 -- 2.2	6/27/2023	381
Area 3	Subsurface	23A-0049-B2C1	2.2 -- 3.2	6/27/2023	1.33
Area 3	Surface	23A-0050-B2C1	0 -- 0.5	6/27/2023	28
Area 3	Subsurface	23A-0050-B2C1	0.5 -- 2.7	6/27/2023	33.3
Area 3	Subsurface	23A-0050-B2C1	2.7 -- 3.2	6/27/2023	0.215
Area 3	Surface	23A-0051-PLC1	0 -- 0.5	6/26/2023	45.8
Area 3	Subsurface	23A-0051-PLC1	0.5 -- 2.2	6/26/2023	66.9
Area 3	Subsurface	23A-0051-PLC1	2.2 -- 3.4	6/26/2023	0.646
Area 3	Surface	23A-0052-PLC1	0 -- 0.5	6/26/2023	0.11
Area 3	Subsurface	23A-0052-PLC1	0.5 -- 1.9	6/26/2023	0.0489
Area 4	Surface	23A-0004-B2C1	0 -- 0.5	6/28/2023	3.63
Area 4	Subsurface	23A-0004-B2C1	0.5 -- 1.4	6/28/2023	19.4
Area 4	Surface	23A-0005-PLC1	0 -- 0.5	6/28/2023	411
Area 4	Subsurface	23A-0005-PLC1	0.5 -- 1.5	6/28/2023	12.4
Area 4	Subsurface	23A-0005-PLC1	1.5 -- 2	6/28/2023	4.04
Area 4	Surface	23A-0006-PLC2	0 -- 0.5	6/28/2023	4.48
Area 4	Subsurface	23A-0006-PLC2	0.5 -- 1.8	6/28/2023	16.9
Area 4	Surface	23A-0024-PLC2	0 -- 0.5	6/28/2023	2.93
Area 4	Surface	23A-0025-B1C1	0 -- 0.5	6/28/2023	8.82
Area 4	Subsurface	23A-0025-B1C1	0.5 -- 1.3	6/28/2023	20.8
Area 4	Surface	23A-0026-B1C1	0 -- 0.5	6/28/2023	99.9
Area 4	Subsurface	23A-0026-B1C1	0.5 -- 1.6	6/28/2023	9.48
Area 4	Surface	23A-0044-PLC1	0 -- 0.5	6/28/2023	1.3
Area 4	Surface	23A-0045-PLC3	0 -- 0.5	6/28/2023	16.6
Area 4	Surface	23A-0046-PLC2	0 -- 0.5	6/28/2023	34.3
Area 4	Subsurface	23A-0046-PLC2	0.5 -- 1.4	6/28/2023	34.1

Table 1
Total PCBs in Phase 1 Reach
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Area	Horizon	Location	Depth (feet bgs)	Sample Date	Total PCBs (a) (mg/kg)
Area 4	Subsurface	23A-0046-PLC2	1.4 -- 2.4	6/28/2023	11.3
Area 4	Surface	23A-0061-PLC1	0 -- 0.5	6/28/2023	8.16
Area 4	Subsurface	23A-0061-PLC1	0.5 -- 1.7	6/28/2023	200
Area 4	Subsurface	23A-0061-PLC1	1.7 -- 2.7	6/28/2023	14.7
Area 4	Surface	23A-0062-PLC1	0 -- 0.5	6/28/2023	437
Area 4	Subsurface	23A-0062-PLC1	0.5 -- 3	6/28/2023	807
Area 4	Subsurface	23A-0062-PLC1	3 -- 4.7	6/28/2023	934
Area 4	Surface	23A-0063-PLC1	0 -- 0.5	6/29/2023	8.45
Area 4	Subsurface	23A-0063-PLC1	0.5 -- 3.7	6/29/2023	2340
Area 4	Subsurface	23A-0063-PLC1	3.7 -- 4.9	6/29/2023	11.8
Area 4	Surface	23A-0064-PLC1	0 -- 0.5	6/29/2023	12.7
Area 4	Subsurface	23A-0064-PLC1	0.5 -- 3.7	6/29/2023	635
Area 4	Subsurface	23A-0064-PLC1	3.7 -- 5.7	6/29/2023	1750
Area 4	Surface	23A-0065-PLC1	0 -- 0.5	6/29/2023	3.85
Area 5	Surface	23A-0001-PLC1	0 -- 0.5	6/29/2023	4.07
Area 5	Subsurface	23A-0001-PLC1	0.5 -- 1.7	6/29/2023	13.6
Area 5	Subsurface	23A-0001-PLC1	1.7 -- 2.3	6/29/2023	15.2
Area 5	Surface	23A-0002-PLC2	0 -- 0.5	6/29/2023	2.51
Area 5	Subsurface	23A-0002-PLC2	0.5 -- 3.1	6/29/2023	0.0325
Area 5	Subsurface	23A-0002-PLC2	3.1 -- 6	6/29/2023	0.000159 U
Area 5	Surface	23A-0003-PLC1	0 -- 0.5	6/29/2023	0.169
Area 5	Surface	23A-0021-PLC1	0 -- 0.5	6/29/2023	0.228
Area 5	Subsurface	23A-0021-PLC1	0.5 -- 1.5	6/29/2023	0.0507
Area 5	Surface	23A-0022-PLC1	0 -- 0.5	6/29/2023	4.18
Area 5	Subsurface	23A-0022-PLC1	0.5 -- 2.8	6/29/2023	2.37
Area 5	Subsurface	23A-0022-PLC1	2.8 -- 4	6/29/2023	0.26
Area 5	Surface	23A-0023-B2C2	0 -- 0.5	6/29/2023	74.9
Area 5	Subsurface	23A-0023-B2C2	0.5 -- 1.7	6/29/2023	151
Area 5	Surface	23A-0041-PLC1	0 -- 0.5	6/29/2023	15.5
Area 5	Subsurface	23A-0041-PLC1	0.5 -- 1	6/29/2023	68.6
Area 5	Surface	23A-0042-PLC1	0 -- 0.5	6/29/2023	0.523
Area 5	Subsurface	23A-0042-PLC1	0.5 -- 1.9	6/29/2023	39.2
Area 5	Subsurface	23A-0042-PLC1	1.9 -- 2.7	6/29/2023	7.08
Area 5	Surface	23A-0043-PLC1	0 -- 0.5	6/29/2023	8.97
Area 5	Subsurface	23A-0043-PLC1	0.5 -- 1.6	6/29/2023	0.371

Notes:

U - Not detected.

(a) Sum of detected congeners.

Table 2
Total PCBs in White Sucker
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

		White Sucker			
		Tileston and Hollingsworth Impoundment		Walter Baker Impoundment	
Chemical	Units	Fillet	Whole	Fillet	Whole
Total PCBs	mg/kg ww	3.49	6.89	2.45	4.08
Total non-DLC PCBs	mg/kg ww	3.44	6.79	2.4	4.03
PCB-TEQ	mg/kg ww	2.35E-05	6.84E-05	2.02E-05	4.27E-05

Notes:
DLC - Dioxin-like compound.
mg/kg ww - Milligrams per kilogram wet weight.
TEQ - Toxicity Equivalence.
USGS - United States Geological Survey.
TEF - Toxicity Equivalence Factor.

(a) Total PCBs calculated from white sucker (Catostomus commersoni) fillets collected from the Tileston and Hollingsworth and Walter Baker Impoundments of the Lower Neponset River (Breault 2014; Table 12).

(b) Sum of the individual PCB-TEQs of the DLC PCBs. Individual PCB-TEQs were calculated based on the world health organization 2005 recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of dioxins and dioxin-like chemicals from the data set in Breault 2014, Table 12.

(c) Sum of Non-DCL PCBs calculated from the data set in Breault 2014, Table 12.

Breault, R. F., 2014. Concentrations, Loads, and Sources of Polychlorinated Biphenyls, Neponset River and Neponset River Estuary, Eastern Massachusetts. USGS Scientific Investigations Report 2011-5004. June 2014.

Table 3
Values Used for Daily Intake Calculations - Sediment
Reasonable Maximum Exposure
Streamlined Human Health Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point(s)	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Incidental Ingestion	Recreational	Adult	Exposure Area 1 through 5	CS	Chemical Concentration in Sediment	Chemical Specific	mg/kg	--	Intake (mg/kg-day) =
	User		and Sitewide	IR	Ingestion Rate	100	mg/day	USEPA 2014 (1)	CS x IR x EF x ED x CF x FI x RBA
				EF	Exposure Frequency	78	days/yr	(2)	BW x AT
				ED	Exposure Duration	20	years	USEPA, 2014	
				FI	Fraction Ingested from Site	1	unitless	(3)	
				CF	Conversion Factor	1.00E-06	kg/mg	--	
				RBA	Relative Bioavailability Factor	Chemical Specific	unitless	--	
				BW	Body Weight	80	kg	USEPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	7,300	days	USEPA, 2014	ATnc = ED (year) x 365 days/year
		Child	Exposure Area 1 through 5	CS	Chemical Concentration in Sediment	Chemical Specific	mg/kg	--	Intake (mg/kg-day) =
			and Sitewide	IR	Ingestion Rate	200	mg/day	USEPA 2014 (1)	CS x IR x EF x ED x CF x FI x RBA
				EF	Exposure Frequency	78	days/yr	(2)	BW x AT
				ED	Exposure Duration	6	years	USEPA, 2014	
				FI	Fraction Ingested from Site	1	unitless	(3)	
				CF	Conversion Factor	1.00E-06	kg/mg	--	
				RBA	Relative Bioavailability Factor	chemical Specific	unitless	--	
				BW	Body Weight	15	kg	USEPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	2,190	days	USEPA, 2014	ATnc = ED (year) x 365 days/year
Dermal	Recreational	Adult	Exposure Area 1 through 5	CS	Chemical Concentration in Sediment	Chemical Specific	mg/kg	--	Intake (mg/kg-day) =
	User		and Sitewide	SA	Surface Area	6,032	cm^2	USEPA 2014 (7)	CS x SA x AF x ABS x EV x EF x ED x CF
				AF	Adherence Factor	0.2	mg/cm^2-event	USEPA 2004 (4)	BW x AT
				ABS	Dermal absorption fraction	Chemical Specific	unitless	--	
				EV	Event Frequency	1	event/day	(5)	
				EF	Exposure Frequency	78	days/yr	(2)	
				ED	Exposure Duration	20	years	USEPA, 2014	
				CF	Conversion Factor	1.00E-06	kg/mg	--	
				BW	Body Weight	80	kg	USEPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	7,300	days	USEPA, 2014	ATnc = ED (year) x 365 days/year
		Child	Exposure Area 1 through 5	CS	Chemical Concentration in Sediment	Chemical Specific	mg/kg	--	Intake (mg/kg-day) =
			and Sitewide	SA	Surface Area	2,373	cm^2	USEPA 2014 (8)	CS x SA x AF x ABS x EV x EF x ED x CF
				AF	Adherence Factor	0.3	mg/cm^2-event	USEPA 2004 (6)	BW x AT
				ABS	Dermal absorption fraction	Chemical Specific	unitless	--	
				EV	Event Frequency	1	event/day	(5)	
				EF	Exposure Frequency	78	days/yr	(2)	
				ED	Exposure Duration	6	years	USEPA, 2014	
				CF	Conversion Factor	1.00E-06	kg/mg	--	
				BW	Body Weight	15	kg	USEPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	2,190	days	USEPA, 2014	ATnc = ED (year) x 365 days/year

Table 3
Values Used for Daily Intake Calculations - Sediment
Reasonable Maximum Exposure
Streamlined Human Health Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point(s)	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name

Notes:
-- - Not Applicable.
< - Less than.
RME - Reasonable Maximum Exposure.
USEPA - United States Environmental Protection Agency.
(1) In the absence of ingestion rates specific to sediment, used the recommended upper percentile daily soil ingestion rates for children and adults (as applicable) (USEPA, 2017; Table 5-1).
(2) Assumes a recreational receptor may contact sediment 3 days per week during the 6 warmest months of the year.
(3) Assumes 100 percent of sediment ingested is from the associated area, based on professional judgment.
(4) Surface area-weighted adherence rate for reed gatherers (USEPA, 2004).
(5) Professional judgement; assumes one event per day.
(6) Surface area-weighted adherence rate for children playing in wet soil (USEPA, 2004).
(7) Represents the weighted mean surface area for male and female adults (USEPA, 2011; Table 7-12 and 7-13). Assumes contact with sediment by hands, forearms, lower legs, and head.
(8) Represents the weighted mean surface area for males and females ages 0 to <6 years old (USEPA, 2011; Table 7-2). Assumes contact with sediment by head, hands, forearms, lower legs, and feet.

Sources:
USEPA, 2004. Risk Assessment Guidance for Superfund. Part E, Supplemental Guidance for Dermal Risk Assessment. Final. EPA/540/R/99/005.
USEPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. February 6, 2014. Revised September 2015.

Table 4
Values Used for Daily Intake Calculations - Fish Tissue
Reasonable Maximum Exposure
Streamlined Human Health Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe:	Current/Future
Medium:	Fish Tissue
Exposure Medium:	Fillet

Exposure Route	Receptor Population	Receptor Age	Exposure Point(s)	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational Angler	Adult	Tileston and Hollingsworth and Walter Baker Impoundments	CS	Chemical Concentration in Fish	Chemical Specific	mg/kg	--	Intake (mg/kg/day) = $\frac{CS \times IR \times EF \times ED \times FI \times (1-Loss)}{BW \times AT}$
				IR	Ingestion Rate	0.032	kg/day	MassDEP, 2008	
				EF	Exposure Frequency	365	days/year	(1)	
				ED	Exposure Duration	20	years	U.S. EPA, 2014	
				FI	Fraction Ingested from Source	1	unitless	(2)	
				Loss	Cooking Loss	0	unitless	(3)	
				BW	Body Weight	80	kg	U.S. EPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	7,300	days	USEPA, 2014	ATnc = ED (year) x 365 days/year
		Child	Tileston and Hollingsworth and Walter Baker Impoundments	CS	Chemical Concentration in Fish	Chemical Specific	mg/kg	--	Intake (mg/kg/day) = $\frac{CS \times IR \times EF \times ED \times FI \times (1-Loss)}{BW \times AT}$
				IR	Ingestion Rate	0.016	kg/day	MassDEP, 2008	
				EF	Exposure Frequency	365	days/year	(1)	
				ED	Exposure Duration	6	years	USEPA, 2014 (4)	
				FI	Fraction Ingested from Source	1	unitless	(2)	
				Loss	Cooking Loss	0	unitless	(3)	
				BW	Body Weight	15	kg	U.S. EPA, 2014	
				ATc	Averaging Time - cancer	25,550	days	USEPA, 2014	ATc = Lifetime (70 years) x 365 days/year
				ATnc	Averaging Time - noncancer	2,190	days	USEPA, 2014	ATnc = ED (year) x 365 days/year

Notes:
-- - Not Applicable.

RME - Reasonable Maximum Exposure.

SRE - Streamlined Risk Evaluation.

USEPA - United States Environmental Protection Agency.

(1) Consistent with the fish ingestion rate being used, which is annualized over a 365 day per year period.

(2) Professional judgment. For SRE, conservatively assumed that 100% of the total amount of fish ingested is obtained from the study area (versus fish from other sources).

(3) It is conservatively assumed that there is no loss of chemical during preparation or cooking.

(4) Children younger than 1 year old are not considered to consume fish. However, an exposure duration of 6 years is conservatively used.

Sources:

MassDEP, 2008. Default Fish Ingestion Rates and Exposure Assumptions for Human Health Risk Assessments, Technical Update. December 2008.

USEPA, 1989. Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. February 6, 2014. Revised September 2015.

Table 5
Default Absorption Factors for COPCs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Chemicals of Potential Concern	CAS Number	Oral - Sediment Absorption Adjustment Factor		Dermal - Sediment Absorption Fraction	
		Default		Default	
Total PCBs	1336-36-3	1	(a)	0.14	(b)

Notes:
CAS - Chemical Abstracts Service.
COPC - Chemical of Potential Concern.
PCB - Polychlorinated Biphenyls.
USEPA - United States Environmental Protection Agency.

(a) Absorption is assumed to be 100% (absorption factor = 1) (USEPA Risk Assessment Guidance for Superfund (RAGS), Part A, 1989; USEPA Regional Screening Level (RSL) Table, May 2024).
(b) USEPA, 2004. Risk Assessment Guidance for Superfund. Vol. 1, Part E. July, 2004. Exhibit 3-4.
Consistent with the approach used by the USEPA Regional Screening Level (RSL) table (May 2024).

Table 6
Non-Cancer Toxicity Data For COPCs - Oral/Dermal
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Chemical of Potential Concern	CAS Number	Chronic/ Subchronic	Chronic Oral Reference Dose (mg/kg-day)	Oral Absorption Efficiency for Dermal (a)	Absorbed Chronic RfD for Dermal (b) (mg/kg-day)	Study Animal	Study Method	Primary Target Organ/System	Critical Endpoint	Combined Uncertainty/ Modifying Factors	Confidence Level	RfD: Target Organ(s)		RfD Tier (g)
												Source	Date (f)	
Total PCBs	1336-36-3	Chronic	2.00E-05 (c)	--	2.00E-05	Monkey	Oral: Capsule	Ocular/eye, Nails, Immune	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased antibody response to sheep erythrocytes	300	Medium	IRIS	6/2024	Tier 1
PCB-TEQ	PCB-TEQ	Chronic	7.00E-10 (d)	--	7.00E-10	Human	Epidemiological	Reproductive, Developmental	Decreased sperm count and motility in men / Increased thyroid stimulating hormone in neonates	30	High	IRIS	6/2024	Tier 1
Total Non-DLC PCBs	PCB-Non-DLC	(e)	2.00E-05 (c)	--	2.00E-05	Monkey	Oral: Capsule	Ocular/eye, Nails, Immune	Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased antibody response to sheep erythrocytes	300	Medium	IRIS	6/2024	Tier 1

Notes:
"--" - No adjustment necessary.
$ABS_{(GI)}$ - Fraction of contaminant absorbed in gastrointestinal tract (dimensionless).
CAS - Chemical Abstracts Service.
COPC - Chemical of Potential Concern.
DLC - Dioxin-like congener.
IRIS - Integrated Risk Information System, an online computer database of toxicological information (https://www.epa.gov/iris).
mg/kg-day - Milligrams per Kilogram per day.
OSWER - Office of Solid Waste and Emergency Response.
PCB - Polychlorinated Biphenyls.
RfD - Reference Dose.
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin.
TEQ - Toxicity Equivalence.
USEPA - United States Environmental Protection Agency.

(a) USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1, Part E, Supplemental Guidance for Dermal Risk Assessment. Exhibit 4-1. Where USEPA, 2004 does not recommend adjustments, no value is listed.
(b) Oral RfD multiplied by ABS_{GI}. Where the gastrointestinal absorption is greater than or equal to 50%, Dermal RfD = Oral RfD.
(c) Value for Aroclor 1254 is used to evaluate the noncarcinogenic hazard of total PCBs.
(d) The IRIS reference dose for TCDD is used to evaluate PCB-TEQ.
(e) The chronic non cancer toxicity values for total PCBs are used to evaluate Total Non-DLC PCBs.
(f) Reflects the date associated with the source of the toxicity information. For online databases (IRIS) the date reflects the date on which the information was obtained from the online source.
(g) USEPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5, 2003. IRIS values are considered Tier 1.

Table 7
Cancer Toxicity Data For COPCs - Oral/Dermal
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Chemical of Potential Concern	CAS Number	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$		Oral Absorption Efficiency for Dermal (a)	Absorbed Dermal Cancer Slope Factor (b) (mg/kg-day)$^{-1}$		Study Animal	Study Method	Weight of Evidence/ Cancer Guideline Description (c)	Classification System	Oral CSF/WOE		CSF Tier (h)
											Source(s)	Date (g)	
Total PCBs	1336-36-3	2.00E+00	(d)	--	2.00E+00		Rat	Oral: Diet	B2	1986	IRIS	6/2024	Tier 1
PCB-TEQ	PCB-TEQ	1.30E+05	(e)	--	1.30E+05	(e)	Mouse	Oral: Gavage	B2	1986	CalEPA	6/2024	Tier 3
Total Non-DLC PCBs	PCB-Non-DLC	2.00E+00	(f)	--	2.00E+00	(f)	Rat	Oral: Diet	B2	1986	IRIS	6/2024	Tier 1

Notes:
"--" - No adjustment necessary.
$ABS_{(GI)}$ - Fraction of contaminant absorbed in gastrointestinal tract (dimensionless).
DLC - Dioxin-like congener.
CalEPA - California Environmental Protection Agency. Toxicity Criteria Database. https://oehha.ca.gov/chemicals
CAS - Chemical Abstracts Service.
COPC - Chemical of Potential Concern.
CSF - Cancer Slope Factor.
IRIS - Integrated Risk Information System, an online computer database of toxicological information (https://www.epa.gov/iris).
mg/kg-day - Milligrams per Kilogram per day.
OSWER - Office of Solid Waste and Emergency Response.
PCB - Polychlorinated Biphenyls.
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin.
TEQ - Toxicity Equivalence.
WOE - Weight-of-Evidence.
USEPA - United States Environmental Protection Agency.

(a) USEPA, 2004. Risk Assessment Guidance for Superfund. Volume 1, Part E, Supplemental Guidance for Dermal Risk Assessment. Exhibit 4-1. Where USEPA, 2004 does not recommend adjustments, no value is listed.
(b) Oral CSF divided by ABS_{GI}. Where the gastrointestinal absorption is greater than or equal to 50%, Dermal CSF = Oral CSF.
(c) Some chemicals are classified under the 1986 system, while others have been classified under the 2005 system:

1986 Classifications	2005 Classifications
Group A: Carcinogenic to Humans.	Carcinogenic: Carcinogenic to Humans
Group B: Probably Carcinogenic to Humans:	Likely Carcinogenic: Likely to be Carcinogenic to Humans
B1: Based on limited human evidence.	Suggestive Evidence: Suggestive Evidence of Carcinogenic Potential
B2: Based on animal evidence.	Inadequate: Information Inadequate Information to Assess Carcinogenic Potential
Group C: Possibly Carcinogenic to Humans	Not Likely Carcinogenic: Not Likely to be Carcinogenic to Humans
Group D: Not Classifiable as to Human Carcinogenicity.	
Group E: Evidence of Non-carcinogenicity for Humans	

(d) Value for PCBs, total (high risk & persistence/upper bound) is used for total PCBs.
(e) Consistent with the hierarchy used in USEPA's development of Regional Screening Levels (May, 2024), the CalEPA cancer slope factor for TCDD is used to evaluate PCB-TEQ.
(f) The cancer toxicity values for total PCBs are used to evaluate Total Non-DLC PCBs.
(g) Reflects the date associated with the source of the toxicity information. For online databases (IRIS and CalEPA) the date reflects the date on which the information was obtained from the online source.
(h) USEPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 9285.7-53. December 5, 2003. IRIS values are considered Tier 1 and CalEPA values are considered Tier 3 values. Selection of Tier 3 values followed the hierarchy put forth in USEPA's Tier 3 Toxicity Value White Paper, OSWER 9285.7-86, May 16, 2013.

Table 8
Summary of Cancer Risks and Non-cancer Hazard Indexes - Recreational User
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Medium	Exposure Medium	Exposure Point	Chemical	CAS	Cancer Risk	Non-Carcinogenic Hazard Index	
					Recreational User	Recreational User	
					(Lifetime, Child/Adult)	(Child)	(Adult)
Sediment (a)	Surface Sediment	Exposure Area 1	Total PCBs	1336-36-3	7E-05	12	2
		Exposure Area 2	Total PCBs	1336-36-3	2E-05	4	1
		Exposure Area 3	Total PCBs	1336-36-3	1E-04	27	4
		Exposure Area 4	Total PCBs	1336-36-3	2E-04	31	5
		Exposure Area 5	Total PCBs	1336-36-3	6E-05	12	2
		Reach-wide	Total PCBs	1336-36-3	1E-04	20	3
	All Sediment	Exposure Area 1	Total PCBs	1336-36-3	2E-04	37	6
		Exposure Area 2	Total PCBs	1336-36-3	5E-05	9	2
		Exposure Area 3	Total PCBs	1336-36-3	2E-04	35	6
		Exposure Area 4	Total PCBs	1336-36-3	5E-04	93	16
		Exposure Area 5	Total PCBs	1336-36-3	6E-05	10	2
		Reach-wide	Total PCBs	1336-36-3	2E-03	304	51

Notes

Shaded indicates Cancer Risk > 1E-04 or Hazard Index > 3.

-- - Not applicable.

> - Greater than.

CAS - Chemical Abstracts Service.

COPC - Contaminant of potential concern.

PCB - Polychlorinated Biphenyls.

(a) The Streamlined Risk Evaluation (SRE) focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).

Table 9
Summary of Cancer Risks and Non-cancer Hazard Indexes- Recreational Angler
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Medium	Exposure Medium	Exposure Point	Chemical	CAS	Cancer Risk Recreational Angler (Lifetime, Child/Adult)	Non-Carcinogenic Hazard Index Recreational Angler (Child)	(Adult)
Fish Tissue - White Sucker	Fillet	Tileston and Hollingsworth Impoundment	Total PCBs	1336-36-3	1E-03	186	70
			PCB-TEQ	PCB-TEQ	6E-04	36	13
			Total Non-DLC PCBs	PCB-Non-DLC	1E-03	183	69
			PCB TEQ+ Non-DLC PCBs (a)		2E-03	219	82
		Walter Baker Impoundment	Total PCBs	1336-36-3	1E-03	131	49
			PCB-TEQ	PCB-TEQ	5E-04	31	12
			Total Non-DLC PCBs	PCB-Non-DLC	1E-03	128	48
			PCB TEQ+ Non-DLC PCBs (a)		2E-03	159	60

Notes

Shaded indicates Cancer Risk > 1E-04 or Hazard Index > 3.

-- - Not applicable.

> - Greater than.

CAS - Chemical Abstracts Service.

COPC - Contaminant of potential concern.

DLC - Dioxin-like compound.

PCB - Polychlorinated Biphenyls.

TEQ - Toxicity Equivalence.

(a) Sum of PCB-TEQ and Total Non-DLC PCBs cancer risks and hazard quotients.

Table 10
Comparison of Sediment EPCs for PCBs Against Ecological Sediment Benchmarks
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Exposure Area and Sediment Horizon	Total PCB EPC (mg/kg)	Statistic	Ecological Sediment Benchmark (mg/kg) (a)		Hazard Quotient (b)	
			TEC	PEC	TEC	PEC
Surface Sediment (c,d)						
Exposure Area 1	57.6	95% UCL	0.0598	0.676	**963**	**85.1**
Exposure Area 2	16.8	95% UCL	0.0598	0.676	**282**	**24.9**
Exposure Area 3	125	95% UCL	0.0598	0.676	**2084**	**184**
Exposure Area 4	146	95% UCL	0.0598	0.676	**2445**	**216**
Exposure Area 5	56.1	95% UCL	0.0598	0.676	**939**	**83.0**
Reach-wide	91.5	95% UCL	0.0598	0.676	**1530**	**135**
All Sediment (c,e)						
Exposure Area 1	176	95% UCL	0.0598	0.676	**2935**	**260**
Exposure Area 2	43.5	95% UCL	0.0598	0.676	**727**	**64.3**
Exposure Area 3	164	95% UCL	0.0598	0.676	**2749**	**243**
Exposure Area 4	434	95% UCL	0.0598	0.676	**7249**	**641**
Exposure Area 5	48.4	95% UCL	0.0598	0.676	**809**	**71.6**
Reach-wide	1425	95% UCL	0.0598	0.676	**23829**	**2108**

Notes:

EPC - Exposure Point Concentration (see Table 1 for details).
HQ - Hazard Quotient.
Max - Maximum Concentration.
mg/kg - Milligrams per kilogram.
PEC - Probable Effect Concentration.
TEC - Threshold Effect Concentration.
UCL - Upper Confidence Limit.

(a) Sediment benchmarks protective of benthic invertebrates were obtained from USEPA (2018). Benchmarks represent consensus-based sediment quality guidelines derived by MacDonald, et al (2000).

(b) Hazard quotients calculated as EPC / sediment benchmark. HQs equal to or greater than 1 are shown in boldface text.

(c) The Streamlined Risk Evaluation (SRE) focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).

(d) Surface sediment includes samples collected from the top 0.5 foot. Exposure areas 1-5 shown in Figure 2.

(e) All sediment includes surface and subsurface samples.

Table 11
Evaluation of Estimated Benthic Injury Based on PCBs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Horizon	Surface Sediment (0-0.5 ft)						All Sediment (all depths)					
Area	**Exposure Area 1**	**Exposure Area 2**	**Exposure Area 3**	**Exposure Area 4**	**Exposure Area 5**	**Reach-wide**	**Exposure Area 1**	**Exposure Area 2**	**Exposure Area 3**	**Exposure Area 4**	**Exposure Area 5**	**Reach-wide**
Average Total Organic Carbon (%)	13.0	6.8	9.9	4.7	2.2	8.0	6.3	3.7	5.0	3.6	1.7	4.5
Average Fraction Organic Carbon (OC)	0.13	0.068	0.099	0.047	0.022	0.080	0.063	0.037	0.050	0.036	0.017	0.045
PCB Exposure Point Concentration (EPC) (mg/kg)	57.6	16.8	125	146	56.1	91.5	176	43.5	164	434	48.4	1425
Predicted Percent Benthic Injury at EPC (a)	*74*	*54*	*93*	*98*	*97*	*91*	*98*	*92*	*98*	*100*	*98*	*100*

Notes:

EPC - Exposure Point Concentration (see Table 1 for details).

OC - Organic Carbon.

(a) Value represents the percent benthic injury for the invertebrate community at the area-specific PCB EPC and average total OC as predicted by Finkelstein, et al (2017).
See Attachment D for area-specific results.

Table 12
Wildlife Exposure Parameters for Food Web Modeling
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Receptor Species	Body Weight (kg)	Assumed Diet Fraction of Diet as %; Amount as kg_{ww}/day	Food Ingestion Rate (kg_{dw}/day)	Food Ingestion Rate (kg_{ww}/day)	Incidental Ingestion Fraction of Diet as %; Amount as kg_{dw}/day	Home Range (ha)	Exposure Duration (unitless)
		Fish			Sediment		
Piscivores							
Great Blue Heron (*Ardea herodias*)	2.336 (a)	100% (b) 0.5812	0.1453 (c)	0.5812 (d)	5% (e) 0.0073	4.5 (f)	0.67 (g)
Mink (*Mustela vison*)	0.852 (a)	100% (b) 0.1702	0.0425 (c)	0.1702 (d)	9.4% (e) 0.0040	14.1 (f)	1 (g)

General Notes:

Food ingestion rates are wet weight for food items and dry weight for sediment/soil ingestion. As needed, rate may be converted.

See individual organism notes for source, units, and conversion.

Moisture content assumed to be 75% for Fish (USEPA, 1993).

AUF - Area Use Factor.
BW - Body Weight.
dw - Dry Weight.
FIR - Food Ingestion Rate.
ha - hectare.
kg - kilogram
mg - milligram.
WW - Wet Weight.

Notes for Great Blue Heron (*Ardea herodias*):

(a) Average body weight of adult male and female herons (USEPA, 1993b).
(b) Diet assumed to be exclusively fish.
(c) Food ingestion rate calculated using algorithm for carnivorous birds developed by Nagy, 2001 [FIR (g_{dw}/day) = $0.849*BW^{0.663}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Incidental Sediment Ingestion Rate was estimated as 5% of the daily food ingestion rate.
(f) Average feeding territory size based on studies conducted in freshwater marsh and estuary in Oregon (USEPA, 1993b).
(g) Great blue heron assumed to be migratory and present for 8 months of the year (March to October; USEPA, 1993b).

Notes for Mink (*Mustela vison*):

(a) Average summer and fall body weight of adult male and female mink from Montana (USEPA, 1993b).
(b) Diet assumed to be exclusively fish.
(c) Food ingestion rate calculated using algorithm for carnivorous mammals developed by Nagy, 2001 [FIR (g_{dw}/day) = $0.153*BW^{0.834}$].
(d) Dry weight food ingestion rate converted to wet weight food ingestion rate:

$$FIR_{ww} = \text{Sum } \{[(\text{Proportion of food}_i \text{ in diet}) \times (FIR_{dw})] / (1\text{-moisture content}_i)\}$$

(e) Incidental Sediment Ingestion Rate was estimated as 9.4% of the daily food ingestion rate. Raccoon soil ingestion rate used as a surrogate for the mink (USEPA, 1993b).
(f) Mean home range size from study in Montana (USEPA, 1993b).
(g) Mink assumed to be present and actively foraging year-round.

Exposure Area	Exp. Area Size (Hectares)	AUF Great Blue Heron	AUF Mink
1	1.0	0.23	0.073
2	0.98	0.22	0.070
3	1.3	0.29	0.091
4	0.54	0.12	0.038
5	0.53	0.12	0.038
Reach-wide	4.4	0.97	0.31

AUF = Exposure Area Size / Home Range. If home range is larger than the exposure area, then AUF = 1.

Table 13
Food Web Modeling Results - Surface Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Representative Receptor	Exposure Parameters (a)					Exposure Point Concentration (b)		Potential Daily Dose (mg/kg BW/day) (c)			Toxicity Reference Values (mg/kg BW/day) (d)		Hazard Quotients (e)	
	Area Use Factor	Exposure Duration	Body Weight (kg)	Food Ingestion Rate (kg_{ww}/day)	Incidental Sediment Ingestion Rate (kg_{dw}/day)	Sediment (mg/kg $_{dw}$)	Fish (mg/kg $_{ww}$)	Diet [Fish]	Incidental Ingestion [Sediment]	Total Daily Dose [Fish + Sediment]	NOAEL	LOAEL	HQ_{NOAEL}	HQ_{LOAEL}
Exposure Area 1 - Surface Sediment														
Great Blue Heron	0.23	0.67	2.3	0.58	0.0073	57.6	6.9	0.26	0.027	0.29	0.40	0.50	0.73	0.58
Mink	0.073	1	0.85	0.17	0.0040	57.6	6.9	0.10	0.020	0.12	0.069	0.082	**1.8**	**1.5**
Exposure Area 2 - Surface Sediment														
Great Blue Heron	0.22	0.67	2.3	0.58	0.0073	16.8	6.9	0.25	0.0076	0.26	0.40	0.50	0.64	0.51
Mink	0.070	1	0.85	0.17	0.0040	16.8	6.9	0.096	0.0055	0.10	0.069	0.082	**1.5**	**1.2**
Exposure Area 3 - Surface Sediment														
Great Blue Heron	0.29	0.67	2.3	0.58	0.0073	125	6.9	0.33	0.074	0.40	0.40	0.50	1.0	0.80
Mink	0.091	1	0.85	0.17	0.0040	125	6.9	0.13	0.053	0.18	0.069	0.082	**2.6**	**2.2**
Exposure Area 4 - Surface Sediment														
Great Blue Heron	0.12	0.67	2.3	0.58	0.0073	146	6.9	0.14	0.036	0.17	0.40	0.50	0.44	0.35
Mink	0.038	1	0.85	0.17	0.0040	146	6.9	0.053	0.026	0.08	0.069	0.082	**1.1**	0.97
Exposure Area 5 - Surface Sediment														
Great Blue Heron	0.12	0.67	2.3	0.58	0.0073	56.1	6.9	0.13	0.014	0.15	0.40	0.50	0.37	0.30
Mink	0.038	1	0.85	0.17	0.0040	56.1	6.9	0.052	0.010	0.062	0.069	0.082	0.90	0.75
Reach-wide Exposure Area - Surface Sediment														
Great Blue Heron	0.97	0.67	2.3	0.58	0.0073	91.5	6.9	1.1	0.18	1.3	0.40	0.50	**3.2**	**2.6**
Mink	0.31	1	0.85	0.17	0.0040	91.5	6.9	0.43	0.13	0.56	0.069	0.082	**8.1**	**6.8**

Notes:

BW - Body Weight.

DW - Dry Weight.

EPC - Exposure Point Concentration.

HQ_{LOAEL} - LOAEL-based Hazard Quotient.

HQ_{NOAEL} - NOAEL-based Hazard Quotient.

kg - kilogram.

LOAEL - Lowest Observed Adverse Effects Level.

mg - milligram.

NOAEL - No Observed Adverse Effects Level.

TRV - Toxicity Reference Value.

WW - Wet Weight.

$$\text{Total Daily Dose (TDD)} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] \times ED \times AUF}{BW}$$

Where:
BW = Body Weight (kg)
IR_f = Ingestion rate of food (kg/day ww)
IR_s = Incidental ingestion rate of sediment (kg/day dw)
C_f = Concentration of PCBs in food (mg/kg ww)
C_s= Concentration of PCBs in sediment (mg/kg dw)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range, etc,... relative to the size of exposure area)

(a) See Table 11 for wildlife exposure parameters.

(b) See Table 1 for sediment EPC and Table 2 for fish EPC. Fish tissue EPC represents the detected whole-body white sucker PCB concentration from within the Tileston-Hollingsworth Impoundment (Breault, 2014).

(c) Potential total daily dose calculated based on ingestion rates and EPCs using formula in the box shown above.

(d) Toxicity reference values based on recommendations in a review conducted by USEPA Region 5 (Chapman 2003). Food ingestion rate of 0.137 kg/day and body weight of 1 kg assumed to convert mink dietary value to a dose-based TRV.

(e) Hazard quotient calculated as the total daily dose / TRV. HQs greater than 1 are shown with shading and boldface text.

Table 14
Food Web Modeling Results - All Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Representative Receptor	Exposure Parameters (a)					Exposure Point Concentration (b)		Potential Daily Dose (mg/kg BW/day) (c)			Toxicity Reference Values (mg/kg BW/day) (d)		Hazard Quotients (e)	
	Area Use Factor	Exposure Duration	Body Weight (kg)	Food Ingestion Rate (kg_{ww}/day)	Incidental Sediment Ingestion Rate (kg_{dw}/day)	Sediment (mg/kg $_{dw}$)	Fish (mg/kg $_{ww}$)	Diet [Fish]	Incidental Ingestion [Sediment]	Total Daily Dose [Fish + Sediment]	NOAEL	LOAEL	HQ_{NOAEL}	HQ_{LOAEL}
Exposure Area 1 - All Sediment														
Great Blue Heron	0.23	0.67	2.3	0.58	0.0073	176	6.9	0.26	0.08	0.35	0.40	0.50	0.87	0.69
Mink	0.073	1	0.85	0.17	0.0040	176	6.9	0.10	0.06	0.16	0.069	0.082	**2.3**	**2.0**
Exposure Area 2 - All Sediment														
Great Blue Heron	0.22	0.67	2.3	0.58	0.0073	43.5	6.9	0.25	0.020	0.27	0.40	0.50	0.67	0.54
Mink	0.070	1	0.85	0.17	0.0040	43.5	6.9	0.096	0.014	0.11	0.069	0.082	**1.6**	**1.3**
Exposure Area 3 - All Sediment														
Great Blue Heron	0.29	0.67	2.3	0.58	0.0073	164	6.9	0.33	0.10	0.43	0.40	0.50	**1.1**	0.85
Mink	0.091	1	0.85	0.17	0.0040	164	6.9	0.13	0.07	0.20	0.069	0.082	**2.8**	**2.4**
Exposure Area 4 - All Sediment														
Great Blue Heron	0.12	0.67	2.3	0.58	0.0073	434	6.9	0.14	0.11	0.25	0.40	0.50	0.61	0.49
Mink	0.038	1	0.85	0.17	0.0040	434	6.9	0.053	0.08	0.13	0.069	0.082	**1.9**	**1.6**
Exposure Area 5 - All Sediment														
Great Blue Heron	0.12	0.67	2.3	0.58	0.0073	48.4	6.9	0.13	0.012	0.15	0.40	0.50	0.37	0.29
Mink	0.038	1	0.85	0.17	0.0040	48.4	6.9	0.052	0.009	0.060	0.069	0.082	0.88	0.74
Reach-wide Exposure Area - All Sediment														
Great Blue Heron	0.97	0.67	2.3	0.58	0.0073	1425	6.9	1.1	2.9	4.0	0.40	0.50	**10.0**	**8.0**
Mink	0.31	1	0.85	0.17	0.0040	1425	6.9	0.43	2.1	2.5	0.069	0.082	**36.3**	**30.5**

Notes:

BW - Body Weight.
DW - Dry Weight.
EPC - Exposure Point Concentration.
HQ_{LOAEL} - LOAEL-based Hazard Quotient.
HQ_{NOAEL} - NOAEL-based Hazard Quotient.

kg - kilogram.
LOAEL - Lowest Observed Adverse Effects Level.
mg - milligram.
NOAEL - No Observed Adverse Effects Level.
TRV - Toxicity Reference Value.
WW - Wet Weight.

Total Daily Dose (TDD) = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] \times ED \times AUF}{BW}$

Where:
BW = Body Weight (kg)
IR_f = Ingestion rate of food (kg/day ww)
IR_s = Incidental ingestion rate of sediment (kg/day dw)
C_f = Concentration of PCBs in food (mg/kg ww)
C_s= Concentration of PCBs in sediment (mg/kg dw)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range, etc,... relative to the size of exposure area)

(a) See Table 11 for wildlife exposure parameters.

(b) See Table 1 for sediment EPC and Table 2 for fish EPC. Fish tissue EPC represents the detected whole-body white sucker PCB concentration from within the Tileston-Hollingsworth Impoundment (Breault, 2014).

(c) Potential total daily dose calculated based on ingestion rates and EPCs using formula in the box shown above.

(d) Toxicity reference values based on recommendations in a review conducted by USEPA Region 5 (Chapman 2003). Food ingestion rate of 0.137 kg/day and body weight of 1 kg assumed to convert mink dietary value to a dose-based TRV.

(e) Hazard quotient calculated as the total daily dose / TRV. HQs greater than 1 are shown with shading and boldface text.

Attachment A - ProUCL Output

UCL Statistics for Data Sets with Non-Detects			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 6/14/2024 1:43:39 PM		
From File	ProUCL Input - Sediment.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-1_surface)			
General Statistics			
Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	1
Minimum	0.51	Mean	23.72
Maximum	187	Median	7.445
SD	48.48	Std. Error of Mean	12.96
Coefficient of Variation	2.044	Skewness	3.379
Normal GOF Test			
Shapiro Wilk Test Statistic	0.493	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.825	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.263	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	46.67	95% Adjusted-CLT UCL (Chen-1995)	57.53
		95% Modified-t UCL (Johnson-1978)	48.62
Gamma GOF Test			
A-D Test Statistic	0.683	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.789	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.241	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.548	k star (bias corrected MLE)	0.478
Theta hat (MLE)	43.27	Theta star (bias corrected MLE)	49.58
nu hat (MLE)	15.35	nu star (bias corrected)	13.4
MLE Mean (bias corrected)	23.72	MLE Sd (bias corrected)	34.3
		Approximate Chi Square Value (0.05)	6.159
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	5.521
Assuming Gamma Distribution			
95% Approximate Gamma UCL	51.59	95% Adjusted Gamma UCL	57.56
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.895	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.117	**Lilliefors Lognormal GOF Test**	

10% Lilliefors Critical Value	0.208	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-0.673	Mean of logged Data	2.024
Maximum of Logged Data	5.231	SD of logged Data	1.54
Assuming Lognormal Distribution			
95% H-UCL	123.8	90% Chebyshev (MVUE) UCL	50.85
95% Chebyshev (MVUE) UCL	64.26	97.5% Chebyshev (MVUE) UCL	82.87
99% Chebyshev (MVUE) UCL	119.4		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	45.03	95% BCA Bootstrap UCL	62.57
95% Standard Bootstrap UCL	44.52	95% Bootstrap-t UCL	123.1
95% Hall's Bootstrap UCL	123.1	95% Percentile Bootstrap UCL	47.84
90% Chebyshev(Mean, Sd) UCL	62.59	95% Chebyshev(Mean, Sd) UCL	80.2
97.5% Chebyshev(Mean, Sd) UCL	104.6	99% Chebyshev(Mean, Sd) UCL	152.6
Suggested UCL to Use			
95% Adjusted Gamma UCL	57.56		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-2_surface)			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.173	Mean	9.124
Maximum	44.7	Median	4.745
SD	13.31	Std. Error of Mean	4.208
Coefficient of Variation	1.458	Skewness	2.536
Normal GOF Test			
Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.781	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level	
Data appear Approximate Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	

95% Student's-t UCL	16.84	95% Adjusted-CLT UCL (Chen-1995)	19.65
		95% Modified-t UCL (Johnson-1978)	17.4
Gamma GOF Test			
A-D Test Statistic	0.303	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.76	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.167	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.277	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.708	k star (bias corrected MLE)	0.562
Theta hat (MLE)	12.88	Theta star (bias corrected MLE)	16.22
nu hat (MLE)	14.16	nu star (bias corrected)	11.25
MLE Mean (bias corrected)	9.124	MLE Sd (bias corrected)	12.17
		Approximate Chi Square Value (0.05)	4.736
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	4.027
Assuming Gamma Distribution			
95% Approximate Gamma UCL	21.67	95% Adjusted Gamma UCL	25.48
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-1.754	Mean of logged Data	1.359
Maximum of Logged Data	3.8	SD of logged Data	1.526
Assuming Lognormal Distribution			
95% H-UCL	109.3	90% Chebyshev (MVUE) UCL	25.83
95% Chebyshev (MVUE) UCL	32.9	97.5% Chebyshev (MVUE) UCL	42.71
99% Chebyshev (MVUE) UCL	61.99		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	16.05	95% BCA Bootstrap UCL	19.98
95% Standard Bootstrap UCL	15.86	95% Bootstrap-t UCL	30.53
95% Hall's Bootstrap UCL	40.76	95% Percentile Bootstrap UCL	16.8
90% Chebyshev(Mean, Sd) UCL	21.75	95% Chebyshev(Mean, Sd) UCL	27.47
97.5% Chebyshev(Mean, Sd) UCL	35.4	99% Chebyshev(Mean, Sd) UCL	50.99
Suggested UCL to Use			
95% Student's-t UCL	16.84		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			

When a data set follows an approximate distribution passing only one of the GOF tests,			
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-3_surface)			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	0.11	Mean	50.19
Maximum	275	Median	16.4
SD	79.04	Std. Error of Mean	19.76
Coefficient of Variation	1.575	Skewness	2.054
Normal GOF Test			
Shapiro Wilk Test Statistic	0.675	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.248	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	84.83	95% Adjusted-CLT UCL (Chen-1995)	93.54
		95% Modified-t UCL (Johnson-1978)	86.52
Gamma GOF Test			
A-D Test Statistic	0.257	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.811	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.429	k star (bias corrected MLE)	0.39
Theta hat (MLE)	117	Theta star (bias corrected MLE)	128.7
nu hat (MLE)	13.72	nu star (bias corrected)	12.48
MLE Mean (bias corrected)	50.19	MLE Sd (bias corrected)	80.36
		Approximate Chi Square Value (0.05)	5.547
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	5.03
Assuming Gamma Distribution			
95% Approximate Gamma UCL	113	95% Adjusted Gamma UCL	124.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.906	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.121	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.196	Data appear Lognormal at 10% Significance Level	

Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-2.207	Mean of logged Data	2.399
Maximum of Logged Data	5.617	SD of logged Data	2.232
Assuming Lognormal Distribution			
95% H-UCL	2257	90% Chebyshev (MVUE) UCL	261.9
95% Chebyshev (MVUE) UCL	340.2	97.5% Chebyshev (MVUE) UCL	448.9
99% Chebyshev (MVUE) UCL	662.5		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	82.7	95% BCA Bootstrap UCL	93.68
95% Standard Bootstrap UCL	82.07	95% Bootstrap-t UCL	115.7
95% Hall's Bootstrap UCL	90.98	95% Percentile Bootstrap UCL	84.7
90% Chebyshev(Mean, Sd) UCL	109.5	95% Chebyshev(Mean, Sd) UCL	136.3
97.5% Chebyshev(Mean, Sd) UCL	173.6	99% Chebyshev(Mean, Sd) UCL	246.8
Suggested UCL to Use			
95% Adjusted Gamma UCL	124.6		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-4_surface)			
General Statistics			
Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	1.3	Mean	75.22
Maximum	437	Median	8.635
SD	150	Std. Error of Mean	40.09
Coefficient of Variation	1.994	Skewness	2.179
Normal GOF Test			
Shapiro Wilk Test Statistic	0.534	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.825	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.263	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	146.2	95% Adjusted-CLT UCL (Chen-1995)	166.1

		95% Modified-t UCL (Johnson-1978)	150.1
Gamma GOF Test			
A-D Test Statistic	1.481	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.813	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.298	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.245	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.4	k star (bias corrected MLE)	0.362
Theta hat (MLE)	187.9	Theta star (bias corrected MLE)	207.7
nu hat (MLE)	11.21	nu star (bias corrected)	10.14
MLE Mean (bias corrected)	75.22	MLE Sd (bias corrected)	125
		Approximate Chi Square Value (0.05)	4.029
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	3.533
Assuming Gamma Distribution			
95% Approximate Gamma UCL	189.3	95% Adjusted Gamma UCL	215.9
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.895	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.208	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	0.262	Mean of logged Data	2.677
Maximum of Logged Data	6.08	SD of logged Data	1.789
Assuming Lognormal Distribution			
95% H-UCL	593.1	90% Chebyshev (MVUE) UCL	149.4
95% Chebyshev (MVUE) UCL	191.3	97.5% Chebyshev (MVUE) UCL	249.5
99% Chebyshev (MVUE) UCL	363.7		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	141.2	95% BCA Bootstrap UCL	169.5
95% Standard Bootstrap UCL	140.4	95% Bootstrap-t UCL	437.5
95% Hall's Bootstrap UCL	541.5	95% Percentile Bootstrap UCL	142.3
90% Chebyshev(Mean, Sd) UCL	195.5	95% Chebyshev(Mean, Sd) UCL	250
97.5% Chebyshev(Mean, Sd) UCL	325.6	99% Chebyshev(Mean, Sd) UCL	474.1
Suggested UCL to Use			
95% Student's-t UCL	146.2		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-5_surface)			
General Statistics			
Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	0.169	Mean	12.34
Maximum	74.9	Median	4.07
SD	23.98	Std. Error of Mean	7.994
Coefficient of Variation	1.944	Skewness	2.768
Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,			
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,			
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).			
The Chebyshev UCL often results in gross overestimates of the mean.			
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.			
Normal GOF Test			
Shapiro Wilk Test Statistic	0.56	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.764	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.316	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	27.2	95% Adjusted-CLT UCL (Chen-1995)	33.37
		95% Modified-t UCL (Johnson-1978)	28.43
Gamma GOF Test			
A-D Test Statistic	0.401	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.783	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Gamma Statistics			
k hat (MLE)	0.433	k star (bias corrected MLE)	0.363
Theta hat (MLE)	28.51	Theta star (bias corrected MLE)	34.03
nu hat (MLE)	7.789	nu star (bias corrected)	6.526
MLE Mean (bias corrected)	12.34	MLE Sd (bias corrected)	20.49
		Approximate Chi Square Value (0.05)	1.914
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	1.434
Assuming Gamma Distribution			
95% Approximate Gamma UCL	42.06	95% Adjusted Gamma UCL	56.14
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**	

10% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.149	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.252	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Note GOF tests may be unreliable for small sample sizes			
Lognormal Statistics			
Minimum of Logged Data	-1.778	Mean of logged Data	1.011
Maximum of Logged Data	4.316	SD of logged Data	2.012
Assuming Lognormal Distribution			
95% H-UCL	1235	90% Chebyshev (MVUE) UCL	39.36
95% Chebyshev (MVUE) UCL	51.25	97.5% Chebyshev (MVUE) UCL	67.75
99% Chebyshev (MVUE) UCL	100.2		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	25.49	95% BCA Bootstrap UCL	35.49
95% Standard Bootstrap UCL	24.68	95% Bootstrap-t UCL	92.41
95% Hall's Bootstrap UCL	76.13	95% Percentile Bootstrap UCL	27.22
90% Chebyshev(Mean, Sd) UCL	36.32	95% Chebyshev(Mean, Sd) UCL	47.18
97.5% Chebyshev(Mean, Sd) UCL	62.26	99% Chebyshev(Mean, Sd) UCL	91.88
Suggested UCL to Use			
Recommendation cannot be provided			
Recommendations are not available due to the sample size and skew of the input data.			
Consult with a statistician to evaluate the adequacy of your data to support your objectives or explore alternative estimation methods.			
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

Surface Sediment - Reach Wide

UCL Statistics for Data Sets with Non-Detects			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 7/8/2024 2:47:07 PM		
From File	ProUCL - Sediment Input Updated 7_8_24_b.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg)			
General Statistics			
Total Number of Observations	63	Number of Distinct Observations	63
		Number of Missing Observations	1
Minimum	0.11	Mean	37.95
Maximum	437	Median	6.43
SD	86.31	Std. Error of Mean	10.87
Coefficient of Variation	2.275	Skewness	3.485
Normal GOF Test			
Shapiro Wilk Test Statistic	0.476	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk P Value	0	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.129	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	56.1	95% Adjusted-CLT UCL (Chen-1995)	60.93
		95% Modified-t UCL (Johnson-1978)	56.9
Gamma GOF Test			
A-D Test Statistic	2.851	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.839	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.12	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.405	k star (bias corrected MLE)	0.396
Theta hat (MLE)	93.73	Theta star (bias corrected MLE)	95.79
nu hat (MLE)	51.01	nu star (bias corrected)	49.92
MLE Mean (bias corrected)	37.95	MLE Sd (bias corrected)	60.29
		Approximate Chi Square Value (0.05)	34.69
Adjusted Level of Significance	0.0462	Adjusted Chi Square Value	34.4
Assuming Gamma Distribution			
95% Approximate Gamma UCL	54.59	95% Adjusted Gamma UCL	55.07
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk P Value	0.485	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.0674	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.102	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-2.207	Mean of logged Data	2.014
Maximum of Logged Data	6.08	SD of logged Data	1.894
Assuming Lognormal Distribution			
95% H-UCL	91.52	90% Chebyshev (MVUE) UCL	85.93
95% Chebyshev (MVUE) UCL	105.9	97.5% Chebyshev (MVUE) UCL	133.7
99% Chebyshev (MVUE) UCL	188.1		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	55.83	95% BCA Bootstrap UCL	63.13
95% Standard Bootstrap UCL	55.99	95% Bootstrap-t UCL	66.16
95% Hall's Bootstrap UCL	63.65	95% Percentile Bootstrap UCL	57.93
90% Chebyshev(Mean, Sd) UCL	70.57	95% Chebyshev(Mean, Sd) UCL	85.35
97.5% Chebyshev(Mean, Sd) UCL	105.9	99% Chebyshev(Mean, Sd) UCL	146.1

Suggested UCL to Use

95% H-UCL	91.52		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,
then contact a statistician to correctly calculate UCLs.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

All Sediment by Exposure Area

UCL Statistics for Data Sets with Non-Detects			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 6/14/2024 1:46:31 PM		
From File	ProUCL Input - Sediment_a.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-1_combined)			
General Statistics			
Total Number of Observations	38	Number of Distinct Observations	37
		Number of Missing Observations	1
Minimum	0.00572	Mean	109.1
Maximum	853	Median	7.445
SD	208.9	Std. Error of Mean	33.89
Coefficient of Variation	1.914	Skewness	2.208
Normal GOF Test			
Shapiro Wilk Test Statistic	0.599	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.916	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.362	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.165	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	166.3	95% Adjusted-CLT UCL (Chen-1995)	177.9
		95% Modified-t UCL (Johnson-1978)	168.4
Gamma GOF Test			
A-D Test Statistic	1.376	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.876	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.157	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.264	k star (bias corrected MLE)	0.261
Theta hat (MLE)	413.4	Theta star (bias corrected MLE)	418.7
nu hat (MLE)	20.06	nu star (bias corrected)	19.81
MLE Mean (bias corrected)	109.1	MLE Sd (bias corrected)	213.8
		Approximate Chi Square Value (0.05)	10.71
Adjusted Level of Significance	0.0434	Adjusted Chi Square Value	10.44
Assuming Gamma Distribution			
95% Approximate Gamma UCL	201.9	95% Adjusted Gamma UCL	207.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.947	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.097	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.13	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-5.164	Mean of logged Data	2.026
Maximum of Logged Data	6.749	SD of logged Data	2.965
Assuming Lognormal Distribution			
95% H-UCL	7842	90% Chebyshev (MVUE) UCL	1174
95% Chebyshev (MVUE) UCL	1536	97.5% Chebyshev (MVUE) UCL	2037
99% Chebyshev (MVUE) UCL	3022		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	164.9	95% BCA Bootstrap UCL	177.1
95% Standard Bootstrap UCL	163.8	95% Bootstrap-t UCL	192.6
95% Hall's Bootstrap UCL	175.7	95% Percentile Bootstrap UCL	164.5
90% Chebyshev(Mean, Sd) UCL	210.8	95% Chebyshev(Mean, Sd) UCL	256.9
97.5% Chebyshev(Mean, Sd) UCL	320.8	99% Chebyshev(Mean, Sd) UCL	446.4

Suggested UCL to Use			
95% H-UCL	7842		
Recommended UCL exceeds the maximum observation			
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-2_combined)			
General Statistics			
Total Number of Observations	23	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	0.00854	Mean	19.75
Maximum	321	Median	3.91
SD	66.35	Std. Error of Mean	13.83
Coefficient of Variation	3.36	Skewness	4.646
Normal GOF Test			
Shapiro Wilk Test Statistic	0.302	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.881	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.446	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.209	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	43.5	95% Adjusted-CLT UCL (Chen-1995)	56.82
		95% Modified-t UCL (Johnson-1978)	45.74
Gamma GOF Test			
A-D Test Statistic	1.319	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.853	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.238	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.197	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.292	k star (bias corrected MLE)	0.283
Theta hat (MLE)	67.52	Theta star (bias corrected MLE)	69.71
nu hat (MLE)	13.45	nu star (bias corrected)	13.03
MLE Mean (bias corrected)	19.75	MLE Sd (bias corrected)	37.1
		Approximate Chi Square Value (0.05)	5.914
Adjusted Level of Significance	0.0389	Adjusted Chi Square Value	5.569
Assuming Gamma Distribution			
95% Approximate Gamma UCL	43.51	95% Adjusted Gamma UCL	46.21
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.928	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.165	Data Not Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-4.763	Mean of logged Data	0.615
Maximum of Logged Data	5.771	SD of logged Data	2.56
Assuming Lognormal Distribution			
95% H-UCL	750.9	90% Chebyshev (MVUE) UCL	94.33
95% Chebyshev (MVUE) UCL	123	97.5% Chebyshev (MVUE) UCL	162.8
99% Chebyshev (MVUE) UCL	241.1		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	42.5	95% BCA Bootstrap UCL	71.98
95% Standard Bootstrap UCL	42.55	95% Bootstrap-t UCL	271.8

95% Hall's Bootstrap UCL	138.1	95% Percentile Bootstrap UCL	47.03
90% Chebyshev(Mean, Sd) UCL	61.25	95% Chebyshev(Mean, Sd) UCL	80.05
97.5% Chebyshev(Mean, Sd) UCL	106.1	99% Chebyshev(Mean, Sd) UCL	157.4
Suggested UCL to Use			
95% Student's-t UCL	43.5		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-3_combined)			
General Statistics			
Total Number of Observations	45	Number of Distinct Observations	45
		Number of Missing Observations	1
Minimum	0.0438	Mean	104.6
Maximum	724	Median	5.71
SD	186.4	Std. Error of Mean	27.79
Coefficient of Variation	1.783	Skewness	2.071
Normal GOF Test			
Shapiro Wilk Test Statistic	0.63	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.926	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.153	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	151.2	95% Adjusted-CLT UCL (Chen-1995)	159.4
		95% Modified-t UCL (Johnson-1978)	152.7
Gamma GOF Test			
A-D Test Statistic	1.605	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.884	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.176	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.145	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.256	k star (bias corrected MLE)	0.254
Theta hat (MLE)	408.8	Theta star (bias corrected MLE)	412.4
nu hat (MLE)	23.02	nu star (bias corrected)	22.82
MLE Mean (bias corrected)	104.6	MLE Sd (bias corrected)	207.7
		Approximate Chi Square Value (0.05)	12.95
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	12.71
Assuming Gamma Distribution			
95% Approximate Gamma UCL	184.2	95% Adjusted Gamma UCL	187.8
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.953	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.118	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.12	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-3.128	Mean of logged Data	1.883
Maximum of Logged Data	6.585	SD of logged Data	3.038
Assuming Lognormal Distribution			
95% H-UCL	7352	90% Chebyshev (MVUE) UCL	1294
95% Chebyshev (MVUE) UCL	1690	97.5% Chebyshev (MVUE) UCL	2241
99% Chebyshev (MVUE) UCL	3322		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			

Nonparametric Distribution Free UCLs			
95% CLT UCL	150.3	95% BCA Bootstrap UCL	160.7
95% Standard Bootstrap UCL	151	95% Bootstrap-t UCL	171.1
95% Hall's Bootstrap UCL	164.4	95% Percentile Bootstrap UCL	153.1
90% Chebyshev(Mean, Sd) UCL	187.9	95% Chebyshev(Mean, Sd) UCL	225.7
97.5% Chebyshev(Mean, Sd) UCL	278.1	99% Chebyshev(Mean, Sd) UCL	381
Suggested UCL to Use			
95% H-UCL	7352		
Recommended UCL exceeds the maximum observation			
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-4_combined)			
General Statistics			
Total Number of Observations	30	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	1.3	Mean	262.5
Maximum	2340	Median	15.65
SD	551.3	Std. Error of Mean	100.6
Coefficient of Variation	2.1	Skewness	2.745
Normal GOF Test			
Shapiro Wilk Test Statistic	0.547	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.9	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.361	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.185	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	433.5	95% Adjusted-CLT UCL (Chen-1995)	481.9
		95% Modified-t UCL (Johnson-1978)	441.9
Gamma GOF Test			
A-D Test Statistic	2.743	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.848	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.303	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.173	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.324	k star (bias corrected MLE)	0.314
Theta hat (MLE)	809.7	Theta star (bias corrected MLE)	836
nu hat (MLE)	19.45	nu star (bias corrected)	18.84
MLE Mean (bias corrected)	262.5	MLE Sd (bias corrected)	468.4
		Approximate Chi Square Value (0.05)	9.998
Adjusted Level of Significance	0.041	Adjusted Chi Square Value	9.627
Assuming Gamma Distribution			
95% Approximate Gamma UCL	494.5	95% Adjusted Gamma UCL	513.6
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.939	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.215	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.146	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	0.262	Mean of logged Data	3.469
Maximum of Logged Data	7.758	SD of logged Data	2.109
Assuming Lognormal Distribution			
95% H-UCL	1485	90% Chebyshev (MVUE) UCL	622.5
95% Chebyshev (MVUE) UCL	794.6	97.5% Chebyshev (MVUE) UCL	1033
99% Chebyshev (MVUE) UCL	1502		

Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	428	95% BCA Bootstrap UCL	512.4
95% Standard Bootstrap UCL	427.3	95% Bootstrap-t UCL	582.5
95% Hall's Bootstrap UCL	607	95% Percentile Bootstrap UCL	444.3
90% Chebyshev(Mean, Sd) UCL	564.4	95% Chebyshev(Mean, Sd) UCL	701.2
97.5% Chebyshev(Mean, Sd) UCL	891	99% Chebyshev(Mean, Sd) UCL	1264
Suggested UCL to Use			
95% Student's-t UCL	433.5		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-5_combined)			
General Statistics			
Total Number of Observations	21	Number of Distinct Observations	21
Number of Detects	20	Number of Non-Detects	1
Number of Distinct Detects	20	Number of Distinct Non-Detects	1
Minimum Detect	0.0325	Minimum Non-Detect	1.5900E-4
Maximum Detect	151	Maximum Non-Detect	1.5900E-4
Variance Detects	1428	Percent Non-Detects	4.762%
Mean Detects	20.44	SD Detects	37.79
Median Detects	4.125	CV Detects	1.849
Skewness Detects	2.626	Kurtosis Detects	7.317
Mean of Logged Detects	1.071	SD of Logged Detects	2.486
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.601	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.868	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.352	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.223	Detected Data Not Normal at 1% Significance Level	
Detected Data Not Normal at 1% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	19.47	KM Standard Error of Mean	8.106
90KM SD	36.21	95% KM (BCA) UCL	33.56
95% KM (t) UCL	33.45	95% KM (Percentile Bootstrap) UCL	33.72
95% KM (z) UCL	32.8	95% KM Bootstrap t UCL	48.5
90% KM Chebyshev UCL	43.79	95% KM Chebyshev UCL	54.8
97.5% KM Chebyshev UCL	70.09	99% KM Chebyshev UCL	100.1
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.43	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.835	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.138	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.209	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.346	k star (bias corrected MLE)	0.328
Theta hat (MLE)	59.06	Theta star (bias corrected MLE)	62.41
nu hat (MLE)	13.84	nu star (bias corrected)	13.1
Mean (detects)	20.44		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	19.47
Maximum	151	Median	4.07
SD	37.1	CV	1.906
k hat (MLE)	0.315	k star (bias corrected MLE)	0.302
Theta hat (MLE)	61.71	Theta star (bias corrected MLE)	64.43

nu hat (MLE)	13.25	nu star (bias corrected)	12.69
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (12.69, α)	5.685	Adjusted Chi Square Value (12.69, β)	5.327
95% Gamma Approximate UCL	43.46	95% Gamma Adjusted UCL	46.37
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	19.47	SD (KM)	36.21
Variance (KM)	1311	SE of Mean (KM)	8.106
k hat (KM)	0.289	k star (KM)	0.28
nu hat (KM)	12.14	nu star (KM)	11.74
theta hat (KM)	67.34	theta star (KM)	69.64
80% gamma percentile (KM)	29.3	90% gamma percentile (KM)	57.87
95% gamma percentile (KM)	91.07	99% gamma percentile (KM)	178.1
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (11.74, α)	5.057	Adjusted Chi Square Value (11.74, β)	4.723
95% KM Approximate Gamma UCL	45.2	95% KM Adjusted Gamma UCL	48.39
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.117	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.176	Detected Data appear Lognormal at 10% Significance Level	
Detected Data appear Lognormal at 10% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	19.47	Mean in Log Scale	0.779
SD in Original Scale	37.1	SD in Log Scale	2.768
95% t UCL (assumes normality of ROS data)	33.43	95% Percentile Bootstrap UCL	33.56
95% BCA Bootstrap UCL	38.37	95% Bootstrap t UCL	45.91
95% H-UCL (Log ROS)	3007		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	0.603	KM Geo Mean	1.828
KM SD (logged)	3.156	95% Critical H Value (KM-Log)	6.189
KM Standard Error of Mean (logged)	0.707	95% H-UCL (KM -Log)	20981
KM SD (logged)	3.156	95% Critical H Value (KM-Log)	6.189
KM Standard Error of Mean (logged)	0.707		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	19.47	Mean in Log Scale	0.57
SD in Original Scale	37.1	SD in Log Scale	3.336
95% t UCL (Assumes normality)	33.43	95% H-Stat UCL	59633
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Gamma Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM Adjusted Gamma UCL	48.39		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

All Sediment - Reach Wide

UCL Statistics for Data Sets with Non-Detects			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 7/8/2024 2:52:00 PM		
From File	ProUCL - Sediment Input Updated 7_8_24_c.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg)			
General Statistics			
Total Number of Observations	157	Number of Distinct Observations	152
		Number of Missing Observations	2
Number of Detects	156	Number of Non-Detects	1
Number of Distinct Detects	151	Number of Distinct Non-Detects	1
Minimum Detect	0.00572	Minimum Non-Detect	1.5900E-4
Maximum Detect	2340	Maximum Non-Detect	1.5900E-4
Variance Detects	84684	Percent Non-Detects	0.637%
Mean Detects	112.8	SD Detects	291
Median Detects	7.62	CV Detects	2.581
Skewness Detects	4.69	Kurtosis Detects	28.11
Mean of Logged Detects	1.932	SD of Logged Detects	2.838
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.456	**Normal GOF Test on Detected Observations Only**	
1% Shapiro Wilk P Value	0	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.0825	Detected Data Not Normal at 1% Significance Level	
Detected Data Not Normal at 1% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	112	KM Standard Error of Mean	23.16
90KM SD	289.3	95% KM (BCA) UCL	154.4
95% KM (t) UCL	150.4	95% KM (Percentile Bootstrap) UCL	153.7
95% KM (z) UCL	150.1	95% KM Bootstrap t UCL	162.9
90% KM Chebyshev UCL	181.5	95% KM Chebyshev UCL	213
97.5% KM Chebyshev UCL	256.7	99% KM Chebyshev UCL	342.5
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	6.082	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.892	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.195	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.0823	Detected Data Not Gamma Distributed at 5% Significance Level	
Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.254	k star (bias corrected MLE)	0.253
Theta hat (MLE)	444.5	Theta star (bias corrected MLE)	445.6
nu hat (MLE)	79.15	nu star (bias corrected)	78.96
Mean (detects)	112.8		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.00572	Mean	112
Maximum	2340	Median	7.08
SD	290.2	CV	2.59
k hat (MLE)	0.251	k star (bias corrected MLE)	0.25
Theta hat (MLE)	446.5	Theta star (bias corrected MLE)	447.4
nu hat (MLE)	78.8	nu star (bias corrected)	78.63
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (78.63, α)	59.2	Adjusted Chi Square Value (78.63, β)	59.04
95% Gamma Approximate UCL	148.8	95% Gamma Adjusted UCL	149.2
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	112	SD (KM)	289.3
Variance (KM)	83686	SE of Mean (KM)	23.16
k hat (KM)	0.15	k star (KM)	0.151
nu hat (KM)	47.1	nu star (KM)	47.53
theta hat (KM)	747	theta star (KM)	740.1
80% gamma percentile (KM)	122.9	90% gamma percentile (KM)	332.6
95% gamma percentile (KM)	615.5	99% gamma percentile (KM)	1435

Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (47.53, α)	32.71	Adjusted Chi Square Value (47.53, β)	32.59
95% KM Approximate Gamma UCL	162.8	95% KM Adjusted Gamma UCL	163.4
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.968	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk P Value	0.0291	Detected Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.059	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.0653	Detected Data appear Lognormal at 10% Significance Level	
Detected Data appear Approximate Lognormal at 10% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	112	Mean in Log Scale	1.88
SD in Original Scale	290.2	SD in Log Scale	2.901
95% t UCL (assumes normality of ROS data)	150.4	95% Percentile Bootstrap UCL	152.5
95% BCA Bootstrap UCL	160	95% Bootstrap t UCL	161.3
95% H-UCL (Log ROS)	1239		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	1.864	KM Geo Mean	6.448
KM SD (logged)	2.945	95% Critical H Value (KM-Log)	4.51
KM Standard Error of Mean (logged)	0.236	95% H-UCL (KM -Log)	1425
KM SD (logged)	2.945	95% Critical H Value (KM-Log)	4.51
KM Standard Error of Mean (logged)	0.236		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	112	Mean in Log Scale	1.859
SD in Original Scale	290.2	SD in Log Scale	2.97
95% t UCL (Assumes normality)	150.4	95% H-Stat UCL	1559
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Lognormal Distributed at 10% Significance Level			
Suggested UCL to Use			
KM H-UCL	1425		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

UCL Statistics for Data Sets with Non-Detects			
User Selected Options			
Date/Time of Computation	ProUCL 5.2 6/21/2024 2:09:17 PM		
From File	ProUCL Input - Sediment w Subsurface_b.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-1_subsurface)			
General Statistics			
Total Number of Observations	24	Number of Distinct Observations	24
		Number of Missing Observations	0
Minimum	0.00572	Mean	159
Maximum	853	Median	7.53
SD	248.7	Std. Error of Mean	50.77
Coefficient of Variation	1.564	Skewness	1.549
Normal GOF Test			
Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.884	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.311	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.205	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	246	95% Adjusted-CLT UCL (Chen-1995)	259.6
		95% Modified-t UCL (Johnson-1978)	248.7
Gamma GOF Test			
A-D Test Statistic	0.853	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.882	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.197	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.196	Data Not Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.236	k star (bias corrected MLE)	0.234
Theta hat (MLE)	674.5	Theta star (bias corrected MLE)	679.3
nu hat (MLE)	11.31	nu star (bias corrected)	11.23
MLE Mean (bias corrected)	159	MLE Sd (bias corrected)	328.6
		Approximate Chi Square Value (0.05)	4.726
Adjusted Level of Significance	0.0392	Adjusted Chi Square Value	4.432
Assuming Gamma Distribution			
95% Approximate Gamma UCL	377.8	95% Adjusted Gamma UCL	402.9
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.162	Data appear Lognormal at 10% Significance Level	
Data appear Approximate Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-5.164	Mean of logged Data	2.027
Maximum of Logged Data	6.749	SD of logged Data	3.578
Assuming Lognormal Distribution			
95% H-UCL	760875	90% Chebyshev (MVUE) UCL	4712
95% Chebyshev (MVUE) UCL	6254	97.5% Chebyshev (MVUE) UCL	8394
99% Chebyshev (MVUE) UCL	12598		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	242.5	95% BCA Bootstrap UCL	259.2
95% Standard Bootstrap UCL	240	95% Bootstrap-t UCL	264.6
95% Hall's Bootstrap UCL	248.2	95% Percentile Bootstrap UCL	245.5
90% Chebyshev(Mean, Sd) UCL	311.3	95% Chebyshev(Mean, Sd) UCL	380.3
97.5% Chebyshev(Mean, Sd) UCL	476	99% Chebyshev(Mean, Sd) UCL	664.1

Suggested UCL to Use			
95% Adjusted Gamma UCL	402.9		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
When a data set follows an approximate distribution passing only one of the GOF tests,			
it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-2_subsurface)			
General Statistics			
Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	0.00854	Mean	27.92
Maximum	321	Median	3.5
SD	88.16	Std. Error of Mean	24.45
Coefficient of Variation	3.158	Skewness	3.592
Normal GOF Test			
Shapiro Wilk Test Statistic	0.348	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.814	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.486	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.271	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	71.5	95% Adjusted-CLT UCL (Chen-1995)	94.16
		95% Modified-t UCL (Johnson-1978)	75.56
Gamma GOF Test			
A-D Test Statistic	0.999	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.864	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.263	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.261	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.221	k star (bias corrected MLE)	0.221
Theta hat (MLE)	126.6	Theta star (bias corrected MLE)	126.4
nu hat (MLE)	5.734	nu star (bias corrected)	5.744
MLE Mean (bias corrected)	27.92	MLE Sd (bias corrected)	59.4
		Approximate Chi Square Value (0.05)	1.511
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	1.224
Assuming Gamma Distribution			
95% Approximate Gamma UCL	106.2	95% Adjusted Gamma UCL	131
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.889	Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.215	Data appear Lognormal at 10% Significance Level	
Data appear Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-4.763	Mean of logged Data	0.0434
Maximum of Logged Data	5.771	SD of logged Data	3.074
Assuming Lognormal Distribution			
95% H-UCL	64799	90% Chebyshev (MVUE) UCL	126
95% Chebyshev (MVUE) UCL	167	97.5% Chebyshev (MVUE) UCL	223.8
99% Chebyshev (MVUE) UCL	335.4		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			

95% CLT UCL	68.14	95% BCA Bootstrap UCL	101.4
95% Standard Bootstrap UCL	67.7	95% Bootstrap-t UCL	873.9
95% Hall's Bootstrap UCL	429	95% Percentile Bootstrap UCL	76.71
90% Chebyshev(Mean, Sd) UCL	101.3	95% Chebyshev(Mean, Sd) UCL	134.5
97.5% Chebyshev(Mean, Sd) UCL	180.6	99% Chebyshev(Mean, Sd) UCL	271.2
Suggested UCL to Use			
95% Student's-t UCL	71.5		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-3_subsurface)			
General Statistics			
Total Number of Observations	29	Number of Distinct Observations	29
		Number of Missing Observations	1
Minimum	0.0438	Mean	134.5
Maximum	724	Median	1.44
SD	220.5	Std. Error of Mean	40.95
Coefficient of Variation	1.639	Skewness	1.592
Normal GOF Test			
Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.898	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.332	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.189	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	204.2	95% Adjusted-CLT UCL (Chen-1995)	214.8
		95% Modified-t UCL (Johnson-1978)	206.2
Gamma GOF Test			
A-D Test Statistic	1.961	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.894	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.267	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.18	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.22	k star (bias corrected MLE)	0.22
Theta hat (MLE)	613	Theta star (bias corrected MLE)	612.2
nu hat (MLE)	12.73	nu star (bias corrected)	12.75
MLE Mean (bias corrected)	134.5	MLE Sd (bias corrected)	287
		Approximate Chi Square Value (0.05)	5.723
Adjusted Level of Significance	0.0407	Adjusted Chi Square Value	5.443
Assuming Gamma Distribution			
95% Approximate Gamma UCL	299.7	95% Adjusted Gamma UCL	315.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.937	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.148	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-3.128	Mean of logged Data	1.598
Maximum of Logged Data	6.585	SD of logged Data	3.406
Assuming Lognormal Distribution			
95% H-UCL	89786	90% Chebyshev (MVUE) UCL	2220
95% Chebyshev (MVUE) UCL	2937	97.5% Chebyshev (MVUE) UCL	3931
99% Chebyshev (MVUE) UCL	5884		
Nonparametric Distribution Free UCL Statistics			

Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	201.9	95% BCA Bootstrap UCL	214.6
95% Standard Bootstrap UCL	200.3	95% Bootstrap-t UCL	224.3
95% Hall's Bootstrap UCL	207.2	95% Percentile Bootstrap UCL	203.7
90% Chebyshev(Mean, Sd) UCL	257.4	95% Chebyshev(Mean, Sd) UCL	313
97.5% Chebyshev(Mean, Sd) UCL	390.3	99% Chebyshev(Mean, Sd) UCL	542
Suggested UCL to Use			
95% Student's-t UCL	204.2		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-4_subsurface)			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	4.04	Mean	426.3
Maximum	2340	Median	20.1
SD	711.8	Std. Error of Mean	178
Coefficient of Variation	1.67	Skewness	1.863
Normal GOF Test			
Shapiro Wilk Test Statistic	0.666	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.248	Data Not Normal at 1% Significance Level	
Data Not Normal at 1% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	738.3	95% Adjusted-CLT UCL (Chen-1995)	807.6
		95% Modified-t UCL (Johnson-1978)	752.1
Gamma GOF Test			
A-D Test Statistic	1.465	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.827	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.31	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.231	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	0.355	k star (bias corrected MLE)	0.33
Theta hat (MLE)	1202	Theta star (bias corrected MLE)	1293
nu hat (MLE)	11.35	nu star (bias corrected)	10.55
MLE Mean (bias corrected)	426.3	MLE Sd (bias corrected)	742.3
		Approximate Chi Square Value (0.05)	4.291
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	3.846
Assuming Gamma Distribution			
95% Approximate Gamma UCL	1049	95% Adjusted Gamma UCL	1170
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk Lognormal GOF Test**	
10% Shapiro Wilk Critical Value	0.906	Data Not Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.261	**Lilliefors Lognormal GOF Test**	
10% Lilliefors Critical Value	0.196	Data Not Lognormal at 10% Significance Level	
Data Not Lognormal at 10% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	1.396	Mean of logged Data	4.163
Maximum of Logged Data	7.758	SD of logged Data	2.175
Assuming Lognormal Distribution			
95% H-UCL	10141	90% Chebyshev (MVUE) UCL	1366
95% Chebyshev (MVUE) UCL	1772	97.5% Chebyshev (MVUE) UCL	2334

99% Chebyshev (MVUE) UCL	3439		
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution			
Nonparametric Distribution Free UCLs			
95% CLT UCL	719	95% BCA Bootstrap UCL	790.8
95% Standard Bootstrap UCL	707.3	95% Bootstrap-t UCL	979.4
95% Hall's Bootstrap UCL	955.1	95% Percentile Bootstrap UCL	725.6
90% Chebyshev(Mean, Sd) UCL	960.2	95% Chebyshev(Mean, Sd) UCL	1202
97.5% Chebyshev(Mean, Sd) UCL	1538	99% Chebyshev(Mean, Sd) UCL	2197
Suggested UCL to Use			
95% Student's-t UCL	738.3		
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Conc (Total PCB Congeners (For Risk Assessment)|mg/kg) (lnr-epc-area-5_subsurface)			
General Statistics			
Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.0325	Minimum Non-Detect	1.5900E-4
Maximum Detect	151	Maximum Non-Detect	1.5900E-4
Variance Detects	2146	Percent Non-Detects	8.333%
Mean Detects	27.07	SD Detects	46.32
Median Detects	7.08	CV Detects	1.711
Skewness Detects	2.302	Kurtosis Detects	5.454
Mean of Logged Detects	1.12	SD of Logged Detects	2.914
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**	
1% Shapiro Wilk Critical Value	0.792	Detected Data Not Normal at 1% Significance Level	
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**	
1% Lilliefors Critical Value	0.291	Detected Data Not Normal at 1% Significance Level	
Detected Data Not Normal at 1% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	24.81	KM Standard Error of Mean	13
90KM SD	42.94	95% KM (BCA) UCL	48.51
95% KM (t) UCL	48.16	95% KM (Percentile Bootstrap) UCL	47.01
95% KM (z) UCL	46.2	95% KM Bootstrap t UCL	91.94
90% KM Chebyshev UCL	63.82	95% KM Chebyshev UCL	81.48
97.5% KM Chebyshev UCL	106	99% KM Chebyshev UCL	154.2
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.238	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.817	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.314	k star (bias corrected MLE)	0.289
Theta hat (MLE)	86.17	Theta star (bias corrected MLE)	93.64
nu hat (MLE)	6.911	nu star (bias corrected)	6.36
Mean (detects)	27.07		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	24.81
Maximum	151	Median	4.725
SD	44.85	CV	1.807
k hat (MLE)	0.273	k star (bias corrected MLE)	0.26

Theta hat (MLE)	91.01	Theta star (bias corrected MLE)	95.42
nu hat (MLE)	6.544	nu star (bias corrected)	6.241
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (6.24, α)	1.764	Adjusted Chi Square Value (6.24, β)	1.427
95% Gamma Approximate UCL	87.78	95% Gamma Adjusted UCL	108.6
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	24.81	SD (KM)	42.94
Variance (KM)	1844	SE of Mean (KM)	13
k hat (KM)	0.334	k star (KM)	0.306
nu hat (KM)	8.014	nu star (KM)	7.344
theta hat (KM)	74.31	theta star (KM)	81.09
80% gamma percentile (KM)	38.24	90% gamma percentile (KM)	73.01
95% gamma percentile (KM)	112.8	99% gamma percentile (KM)	215.9
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (7.34, α)	2.361	Adjusted Chi Square Value (7.34, β)	1.954
95% KM Approximate Gamma UCL	77.18	95% KM Adjusted Gamma UCL	93.28
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**	
10% Shapiro Wilk Critical Value	0.876	Detected Data appear Lognormal at 10% Significance Level	
Lilliefors Test Statistic	0.159	**Lilliefors GOF Test**	
10% Lilliefors Critical Value	0.231	Detected Data appear Lognormal at 10% Significance Level	
Detected Data appear Lognormal at 10% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	24.81	Mean in Log Scale	0.529
SD in Original Scale	44.85	SD in Log Scale	3.451
95% t UCL (assumes normality of ROS data)	48.07	95% Percentile Bootstrap UCL	47.2
95% BCA Bootstrap UCL	57.58	95% Bootstrap t UCL	92.7
95% H-UCL (Log ROS)	3364312		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	0.298	KM Geo Mean	1.347
KM SD (logged)	3.81	95% Critical H Value (KM-Log)	9.033
KM Standard Error of Mean (logged)	1.153	95% H-UCL (KM -Log)	61304651
KM SD (logged)	3.81	95% Critical H Value (KM-Log)	9.033
KM Standard Error of Mean (logged)	1.153		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	24.81	Mean in Log Scale	0.24
SD in Original Scale	44.85	SD in Log Scale	4.125
95% t UCL (Assumes normality)	48.07	95% H-Stat UCL	1.169E+9
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Gamma Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM Bootstrap t UCL	91.94	95% Hall's Bootstrap	61304651
The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.			
Please verify the data were collected from random locations.			
If the data were collected using judgmental or other non-random methods,			
then contact a statistician to correctly calculate UCLs.			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

Attachment B - Calculation of Body Surface Area Exposed and Sediment Adherence Factor

Attachment B Table 1
Calculation of Body Surface Area Exposed and Sediment Adherence Factor for Adult Recreational Receptor
Streamlined Human Health Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Adult (21 years and older)			
	Mean Body Surface Area for Adult		Average of Males and Females
	Male	Female	
Body Part	m^2	m^2	cm^2
Head	0.136	0.114	1,250
Forearms	0.148	0.11139 (a)	1,297
Hands	0.107	0.089	980
Lower legs	0.268	0.233	2,505
		forearms, hands, lower legs, and head =	**6,032**

Adult Recreational			
Body Part	**Body Surface Area Exposed to Sediment** (cm^2)	**Soil Loading Rate (b)** (mg/cm^2)	**Total Sediment Mass** (mg)
Head	1,250	0.03 (d)	38
Forearms	1,297	0.036 (c)	47
Hands	980	0.66	647
Lower Legs	2,505	0.16 (c)	401
Total	**6,032**	–	1,132
Area-Weighted Adherence Factor (mg/cm^2) = Sediment mass/Surface area =			**0.2**

Notes:

EFH - 2011 Edition of the Exposure Factors Handbook (USEPA, 2011).

(a) In accordance with USEPA 2014 OSWER Directive on Recommended Default Exposure Factors (USEPA, 2014), the female forearms and upper arms surface areas were calculated as follows:

Female arms [0.237] x (Male forearm/Male arms) [0.47]

Female arms [0.237] x (Male upper arms/Male arms) [0.55]

(b) Data from USEPA (2011) Table 7-20. Geometric mean of values for reed gatherers.

(c) Reed gatherer data for forearms and lower legs are not available. Therefore, arm and leg data are used as a proxy.

(d) Reed gatherer data for head not available. Therefore, construction worker value used as a proxy.

Attachment C – Human Health Risk Calculations (RAGS Part D Table 7s and 9s)

RAGS D Table 7-1
Calculation of Chemical Cancer Risks - Adult/Child Recreational User
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age (Cancer): Lifetime

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Cancer Risk Calculations (Lifetime, Child/Adult)					
						Value	Units	Intake/Exposure Concentration		CSF		ADAF (b)	Cancer Risk
								Value	Units	Value	Units		
Sediment (a)	Surface Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	5.76E+01	mg/kg	1.85E-05	mg/kg-day	2.00E+00	kg-day/mg		3.69E-05
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	5.40E-06	mg/kg-day	2.00E+00	kg-day/mg		1.08E-05
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	3.99E-05	mg/kg-day	2.00E+00	kg-day/mg		7.99E-05
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	4.69E-05	mg/kg-day	2.00E+00	kg-day/mg		9.37E-05
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	1.80E-05	mg/kg-day	2.00E+00	kg-day/mg		3.60E-05
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	2.93E-05	mg/kg-day	2.00E+00	kg-day/mg		5.87E-05
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	5.76E+01	mg/kg	1.44E-05	mg/kg-day	2.00E+00	kg-day/mg		2.89E-05
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	4.22E-06	mg/kg-day	2.00E+00	kg-day/mg		8.44E-06
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	3.12E-05	mg/kg-day	2.00E+00	kg-day/mg		6.25E-05
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	3.66E-05	mg/kg-day	2.00E+00	kg-day/mg		7.33E-05
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	1.41E-05	mg/kg-day	2.00E+00	kg-day/mg		2.81E-05
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	2.29E-05	mg/kg-day	2.00E+00	kg-day/mg		4.59E-05
	All Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	1.76E+02	mg/kg	5.63E-05	mg/kg-day	2.00E+00	kg-day/mg		1.13E-04
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	1.39E-05	mg/kg-day	2.00E+00	kg-day/mg		2.79E-05
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	5.27E-05	mg/kg-day	2.00E+00	kg-day/mg		1.05E-04
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	1.39E-04	mg/kg-day	2.00E+00	kg-day/mg		2.78E-04
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	1.55E-05	mg/kg-day	2.00E+00	kg-day/mg		3.10E-05
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	4.57E-04	mg/kg-day	2.00E+00	kg-day/mg		9.14E-04
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	1.76E+02	mg/kg	4.40E-05	mg/kg-day	2.00E+00	kg-day/mg		8.80E-05
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	1.09E-05	mg/kg-day	2.00E+00	kg-day/mg		2.18E-05
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	4.12E-05	mg/kg-day	2.00E+00	kg-day/mg		8.24E-05
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	1.09E-04	mg/kg-day	2.00E+00	kg-day/mg		2.17E-04
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	1.21E-05	mg/kg-day	2.00E+00	kg-day/mg		2.43E-05
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	3.57E-04	mg/kg-day	2.00E+00	kg-day/mg		7.14E-04

Notes:
ADAF - Age-Dependent Adjustment Factor.
CAS - Chemical Abstracts Service.
CSF - Cancer Slope Factor.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
(a) The SRE focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).
(b) Age-Dependent Adjustment Factor (ADAF) is used for chemicals with a mutagenic mode of action for carcinogenesis.
Total PCBs are not a mutagenic compound; therefore, the cancer risk is not adjusted by the ADAF.

RAGS D Table 7-2
Calculation of Chemical Non-Cancer Hazards - Child Recreational User
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age (Noncancer): Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Noncancer Hazard Calculations (Child)				
						Value	Units	Intake/Exposure Concentration Value	Intake/Exposure Concentration Units	RfD Value	RfD Units	Hazard Quotient
Sediment (a)	Surface Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	5.76E+01	mg/kg	1.64E-04	mg/kg-day	2.00E-05	mg/kg-day	8.20E+00
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	4.80E-05	mg/kg-day	2.00E-05	mg/kg-day	2.40E+00
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	3.55E-04	mg/kg-day	2.00E-05	mg/kg-day	1.78E+01
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	4.17E-04	mg/kg-day	2.00E-05	mg/kg-day	2.08E+01
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	1.60E-04	mg/kg-day	2.00E-05	mg/kg-day	8.00E+00
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	2.61E-04	mg/kg-day	2.00E-05	mg/kg-day	1.30E+01
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	5.76E+01	mg/kg	8.17E-05	mg/kg-day	2.00E-05	mg/kg-day	4.09E+00
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	2.39E-05	mg/kg-day	2.00E-05	mg/kg-day	1.20E+00
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	1.77E-04	mg/kg-day	2.00E-05	mg/kg-day	8.85E+00
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	2.08E-04	mg/kg-day	2.00E-05	mg/kg-day	1.04E+01
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	7.97E-05	mg/kg-day	2.00E-05	mg/kg-day	3.99E+00
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	1.30E-04	mg/kg-day	2.00E-05	mg/kg-day	6.50E+00
	All Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	1.76E+02	mg/kg	5.00E-04	mg/kg-day	2.00E-05	mg/kg-day	2.50E+01
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	1.24E-04	mg/kg-day	2.00E-05	mg/kg-day	6.20E+00
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	4.68E-04	mg/kg-day	2.00E-05	mg/kg-day	2.34E+01
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	1.24E-03	mg/kg-day	2.00E-05	mg/kg-day	6.18E+01
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	1.38E-04	mg/kg-day	2.00E-05	mg/kg-day	6.89E+00
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	4.06E-03	mg/kg-day	2.00E-05	mg/kg-day	2.03E+02
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	1.76E+02	mg/kg	2.49E-04	mg/kg-day	2.00E-05	mg/kg-day	1.25E+01
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	6.18E-05	mg/kg-day	2.00E-05	mg/kg-day	3.09E+00
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	2.33E-04	mg/kg-day	2.00E-05	mg/kg-day	1.17E+01
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	6.16E-04	mg/kg-day	2.00E-05	mg/kg-day	3.08E+01
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	6.87E-05	mg/kg-day	2.00E-05	mg/kg-day	3.44E+00
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	2.02E-03	mg/kg-day	2.00E-05	mg/kg-day	1.01E+02

Notes:
CAS - Chemical Abstracts Service.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
RfD - Reference Dose.
(a) The SRE focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).

RAGS D Table 7-3
Calculation of Chemical Non-Cancer Hazards - Adult Recreational User
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age (Noncancer): Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Noncancer Hazard Calculations				
						Value	Units	Intake/Exposure Concentration		RfD		Hazard Quotient
								Value	Units	Value	Units	
Sediment (a)	Surface Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	5.76E+01	mg/kg	1.54E-05	mg/kg-day	2.00E-05	mg/kg-day	7.69E-01
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	4.50E-06	mg/kg-day	2.00E-05	mg/kg-day	2.25E-01
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	3.33E-05	mg/kg-day	2.00E-05	mg/kg-day	1.66E+00
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	3.91E-05	mg/kg-day	2.00E-05	mg/kg-day	1.95E+00
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	1.50E-05	mg/kg-day	2.00E-05	mg/kg-day	7.50E-01
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	2.44E-05	mg/kg-day	2.00E-05	mg/kg-day	1.22E+00
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	5.76E+01	mg/kg	2.60E-05	mg/kg-day	2.00E-05	mg/kg-day	1.30E+00
		Exposure Area 2		Total PCBs	1336-36-3	1.68E+01	mg/kg	7.60E-06	mg/kg-day	2.00E-05	mg/kg-day	3.80E-01
		Exposure Area 3		Total PCBs	1336-36-3	1.25E+02	mg/kg	5.62E-05	mg/kg-day	2.00E-05	mg/kg-day	2.81E+00
		Exposure Area 4		Total PCBs	1336-36-3	1.46E+02	mg/kg	6.60E-05	mg/kg-day	2.00E-05	mg/kg-day	3.30E+00
		Exposure Area 5		Total PCBs	1336-36-3	5.61E+01	mg/kg	2.53E-05	mg/kg-day	2.00E-05	mg/kg-day	1.27E+00
		Reach-wide		Total PCBs	1336-36-3	9.15E+01	mg/kg	4.13E-05	mg/kg-day	2.00E-05	mg/kg-day	2.06E+00
	All Sediment	Exposure Area 1	Ingestion	Total PCBs	1336-36-3	1.76E+02	mg/kg	4.69E-05	mg/kg-day	2.00E-05	mg/kg-day	2.34E+00
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	1.16E-05	mg/kg-day	2.00E-05	mg/kg-day	5.81E-01
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	4.39E-05	mg/kg-day	2.00E-05	mg/kg-day	2.20E+00
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	1.16E-04	mg/kg-day	2.00E-05	mg/kg-day	5.79E+00
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	1.29E-05	mg/kg-day	2.00E-05	mg/kg-day	6.46E-01
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	3.81E-04	mg/kg-day	2.00E-05	mg/kg-day	1.90E+01
		Exposure Area 1	Dermal	Total PCBs	1336-36-3	1.76E+02	mg/kg	7.92E-05	mg/kg-day	2.00E-05	mg/kg-day	3.96E+00
		Exposure Area 2		Total PCBs	1336-36-3	4.35E+01	mg/kg	1.96E-05	mg/kg-day	2.00E-05	mg/kg-day	9.81E-01
		Exposure Area 3		Total PCBs	1336-36-3	1.64E+02	mg/kg	7.42E-05	mg/kg-day	2.00E-05	mg/kg-day	3.71E+00
		Exposure Area 4		Total PCBs	1336-36-3	4.34E+02	mg/kg	1.96E-04	mg/kg-day	2.00E-05	mg/kg-day	9.78E+00
		Exposure Area 5		Total PCBs	1336-36-3	4.84E+01	mg/kg	2.18E-05	mg/kg-day	2.00E-05	mg/kg-day	1.09E+00
		Reach-wide		Total PCBs	1336-36-3	1.43E+03	mg/kg	6.43E-04	mg/kg-day	2.00E-05	mg/kg-day	3.21E+01

Notes:
CAS - Chemical Abstracts Service.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
RfD - Reference Dose.
(a) The SRE focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).

RAGS D Table 7-4
Calculation of Chemical Cancer Risks and Non-Cancer Hazards - Adult/Child Recreational Angler
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational Angler
Receptor Age (Cancer): Lifetime

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Cancer Risk Calculations (Lifetime, Child/Adult)					
						Value	Units	Intake/Exposure Concentration		CSF		ADAF (a)	Cancer Risk
								Value	Units	Value	Units		
Fish Tissue - White Sucker	Fillet	Tileston and Hollingsworth Impoundment	Ingestion	Total PCBs	1336-36-3	3.49E+00	mg/kg	7.18E-04	mg/kg-day	2.00E+00	kg-day/mg		1.44E-03
				PCB-TEQ	PCB-TEQ	2.35E-05	mg/kg	4.83E-09	mg/kg-day	1.30E+05	kg-day/mg		6.28E-04
				Total Non-DLC PCBs	PCB-Non-DLC	3.44E+00	mg/kg	7.08E-04	mg/kg-day	2.00E+00	kg-day/mg		1.42E-03
				PCB TEQ+ Non-DLC PCBs (b)									2.04E-03
		Walter Baker Impoundment		Total PCBs	1336-36-3	2.45E+00	mg/kg	5.04E-04	mg/kg-day	2.00E+00	kg-day/mg		1.01E-03
				PCB-TEQ	PCB-TEQ	2.02E-05	mg/kg	4.16E-09	mg/kg-day	1.30E+05	kg-day/mg		5.40E-04
				Total Non-DLC PCBs	PCB-Non-DLC	2.40E+00	mg/kg	4.94E-04	mg/kg-day	2.00E+00	kg-day/mg		9.87E-04
				PCB TEQ+ Non-DLC PCBs (b)									1.53E-03

Notes:
ADAF - Age-Dependent Adjustment Factor.
CAS - Chemical Abstracts Service.
CSF - Cancer Slope Factor.
DLC - Dioxin-like compound.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
TEQ - Toxicity Equivalence.

(a) Age-Dependent Adjustment Factor (ADAF) is used for chemicals with a mutagenic mode of action for carcinogenesis.
Total PCBs are not a mutagenic compound; therefore, the cancer risk is not adjusted by the ADAF.
(b) Sum of PCB-TEQ and Total Non-DLC PCBs cancer risks.

RAGS D Table 7-5
Calculation of Chemical Non-Cancer Hazards - Child Recreational Angler
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational Angler
Receptor Age (Noncancer): Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Noncancer Hazard Calculations (Child)				
						Value	Units	Intake/Exposure Concentration		RfD		Hazard Quotient
								Value	Units	Value	Units	
Fish Tissue - White Sucker	Fillet	Tileston and Hollingsworth Impoundment	Ingestion	Total PCBs	1336-36-3	3.49E+00	mg/kg	3.72E-03	mg/kg-day	2.00E-05	mg/kg-day	1.86E+02
				PCB-TEQ	PCB-TEQ	2.35E-05	mg/kg	2.51E-08	mg/kg-day	7.00E-10	mg/kg-day	3.58E+01
				Total Non-DLC PCBs	PCB-Non-DLC	3.44E+00	mg/kg	3.67E-03	mg/kg-day	2.00E-05	mg/kg-day	1.83E+02
				PCB TEQ+ Non-DLC PCBs (a)								2.19E+02
		Walter Baker Impoundment	Ingestion	Total PCBs	1336-36-3	2.45E+00	mg/kg	2.61E-03	mg/kg-day	2.00E-05	mg/kg-day	1.31E+02
				PCB-TEQ	PCB-TEQ	2.02E-05	mg/kg	2.15E-08	mg/kg-day	7.00E-10	mg/kg-day	3.08E+01
				Total Non-DLC PCBs	PCB-Non-DLC	2.40E+00	mg/kg	2.56E-03	mg/kg-day	2.00E-05	mg/kg-day	1.28E+02
				PCB TEQ+ Non-DLC PCBs (a)								1.59E+02

Notes:
CAS - Chemical Abstracts Service.
DLC - Dioxin-like compound.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
RfD - Reference Dose.
TEQ - Toxicity Equivalence.

(a) Sum of PCB-TEQ and Total Non-DLC PCBs hazard quotients.

RAGS D Table 7-6
Calculation of Chemical Non-Cancer Hazards - Adult Recreational Angler
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational Angler
Receptor Age (Noncancer): Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical	CAS	EPC		Noncancer Hazard Calculations				
						Value	Units	Intake/Exposure Concentration		RfD		Hazard Quotient
								Value	Units	Value	Units	
Fish Tissue - White Sucker	Fillet	Tileston and Hollingsworth Impoundment	Ingestion	Total PCBs	1336-36-3	3.49E+00	mg/kg	1.40E-03	mg/kg-day	2.00E-05	mg/kg-day	6.98E+01
				PCB-TEQ	PCB-TEQ	2.35E-05	mg/kg	9.40E-09	mg/kg-day	7.00E-10	mg/kg-day	1.34E+01
				Total Non-DLC PCBs	PCB-Non-DLC	3.44E+00	mg/kg	1.38E-03	mg/kg-day	2.00E-05	mg/kg-day	6.88E+01
				PCB TEQ+ Non-DLC PCBs (a)								8.22E+01
		Walter Baker Impoundment	Ingestion	Total PCBs	1336-36-3	2.45E+00	mg/kg	9.80E-04	mg/kg-day	2.00E-05	mg/kg-day	4.90E+01
				PCB-TEQ	PCB-TEQ	2.02E-05	mg/kg	8.08E-09	mg/kg-day	7.00E-10	mg/kg-day	1.15E+01
				Total Non-DLC PCBs	PCB-Non-DLC	2.40E+00	mg/kg	9.60E-04	mg/kg-day	2.00E-05	mg/kg-day	4.80E+01
				PCB TEQ+ Non-DLC PCBs (a)								5.95E+01

Notes:
CAS - Chemical Abstracts Service.
DLC - Dioxin-like compound.
EPC - Exposure Point Concentration.
kg - Kilogram.
mg - Milligram.
PCB - Polychlorinated Biphenyls.
RfD - Reference Dose.
TEQ - Toxicity Equivalence.

(a) Sum of PCB-TEQ and Total Non-DLC PCBs hazard quotients.

RAGS D Table 9-1
Summary of Receptor Risks and Hazards for COPCs - Recreational User
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age (cancer):	Lifetime
Receptor Age (Noncancer):	Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical	CAS	Carcinogenic Risk Cancer Risk Calculations (Lifetime, Child/Adult)			Non-Carcinogenic Hazard Quotient (Child)				Non-Carcinogenic Hazard Quotient (Adult)			
					Ingestion	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Exposure Routes Total
Sediment (a)	Surface Sediment	Exposure Area 1	Total PCBs	1336-36-3	3.69E-05	2.89E-05	7E-05	Ocular, Nails, Immune	8.20E+00	4.09E+00	1E+01	Ocular, Nails, Immune	7.69E-01	1.30E+00	2E+00
		Exposure Area 2	Total PCBs	1336-36-3	1.08E-05	8.44E-06	2E-05	Ocular, Nails, Immune	2.40E+00	1.20E+00	4E+00	Ocular, Nails, Immune	2.25E-01	3.80E-01	6E-01
		Exposure Area 3	Total PCBs	1336-36-3	7.99E-05	6.25E-05	1E-04	Ocular, Nails, Immune	1.78E+01	8.85E+00	3E+01	Ocular, Nails, Immune	1.66E+00	2.81E+00	4E+00
		Exposure Area 4	Total PCBs	1336-36-3	9.37E-05	7.33E-05	2E-04	Ocular, Nails, Immune	2.08E+01	1.04E+01	3E+01	Ocular, Nails, Immune	1.95E+00	3.30E+00	5E+00
		Exposure Area 5	Total PCBs	1336-36-3	3.60E-05	2.81E-05	6E-05	Ocular, Nails, Immune	8.00E+00	3.99E+00	1E+01	Ocular, Nails, Immune	7.50E-01	1.27E+00	2E+00
		Reach-wide	Total PCBs	1336-36-3	5.87E-05	4.59E-05	1E-04	Ocular, Nails, Immune	1.30E+01	6.50E+00	2E+01	Ocular, Nails, Immune	1.22E+00	2.06E+00	3E+00
	All Sediment	Exposure Area 1	Total PCBs	1336-36-3	1.13E-04	8.80E-05	2E-04	Ocular, Nails, Immune	2.50E+01	1.25E+01	4E+01	Ocular, Nails, Immune	2.34E+00	3.96E+00	6E+00
		Exposure Area 2	Total PCBs	1336-36-3	2.79E-05	2.18E-05	5E-05	Ocular, Nails, Immune	6.20E+00	3.09E+00	9E+00	Ocular, Nails, Immune	5.81E-01	9.81E-01	2E+00
		Exposure Area 3	Total PCBs	1336-36-3	1.05E-04	8.24E-05	2E-04	Ocular, Nails, Immune	2.34E+01	1.17E+01	4E+01	Ocular, Nails, Immune	2.20E+00	3.71E+00	6E+00
		Exposure Area 4	Total PCBs	1336-36-3	2.78E-04	2.17E-04	5E-04	Ocular, Nails, Immune	6.18E+01	3.08E+01	9E+01	Ocular, Nails, Immune	5.79E+00	9.78E+00	2E+01
		Exposure Area 5	Total PCBs	1336-36-3	3.10E-05	2.43E-05	6E-05	Ocular, Nails, Immune	6.89E+00	3.44E+00	1E+01	Ocular, Nails, Immune	6.46E-01	1.09E+00	2E+00
		Reach-wide	Total PCBs	1336-36-3	9.14E-04	7.14E-04	2E-03	Ocular, Nails, Immune	2.03E+02	1.01E+02	3E+02	Ocular, Nails, Immune	1.90E+01	3.21E+01	5E+01

Notes

CAS - Chemical Abstracts Service.

COPC - Contaminant of potential concern.

PCB - Polychlorinated Biphenyls.

(a) The SRE focused on sediment in the Phase 1 reach which covers the stretch between the Tileston and Hollingsworth dam and the confluence with Mother Brook (approximately river miles 2.7 to 3.7).

RAGS D Table 9-2
Summary of Receptor Risks and Hazards for COPCs - Recreational Angler
Reasonable Maximum Exposure
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Scenario Timeframe: Current/Future
Receptor Population: Recreational Angler
Receptor Age (cancer): Lifetime
Receptor Age (Noncancer): Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical	CAS	Carcinogenic Risk Cancer Risk Calculations (Lifetime, Child/Adult)		Non-Carcinogenic Hazard Quotient (Child)			Non-Carcinogenic Hazard Quotient (Adult)		
					Ingestion	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Exposure Routes Total
Fish Tissue - White Sucker	Fillet	Tileston and Hollingsworth Impoundment	Total PCBs	1336-36-3	1.44E-03	1E-03	Ocular, Nails, Immune	1.86E+02	2E+02	Ocular, Nails, Immune	6.98E+01	7E+01
			PCB-TEQ	PCB-TEQ	6.28E-04	6E-04	Reproductive, Developmental	3.58E+01	4E+01	Reproductive, Developmental	1.34E+01	1E+01
			Total Non-DLC	PCB-Non-DLC	1.42E-03	1E-03	Ocular, Nails, Immune	1.83E+02	2E+02	Ocular, Nails, Immune	6.88E+01	7E+01
			PCB TEQ+ Non-DLC PCBs (a)		2.04E-03	2E-03	Ocular, Nails, Immune	2.19E+02	2E+02	Ocular, Nails, Immune	8.22E+01	8E+01
		Walter Baker Impoundment	Total PCBs	1336-36-3	1.01E-03	1E-03	Ocular, Nails, Immune	1.31E+02	1E+02	Ocular, Nails, Immune	4.90E+01	5E+01
			PCB-TEQ	PCB-TEQ	5.40E-04	5E-04	Reproductive, Developmental	3.08E+01	3E+01	Reproductive, Developmental	1.15E+01	1E+01
			Total Non-DLC	PCB-Non-DLC	9.87E-04	1E-03	Ocular, Nails, Immune	1.28E+02	1E+02	Ocular, Nails, Immune	4.80E+01	5E+01
			PCB TEQ+ Non-DLC PCBs (a)		1.53E-03	2E-03	Ocular, Nails, Immune	1.59E+02	2E+02	Ocular, Nails, Immune	5.95E+01	6E+01

Notes

CAS - Chemical Abstracts Service.
COPC - Contaminant of potential concern.
DLC - Dioxin-like compound.
PCB - Polychlorinated Biphenyls.
TEQ - Toxicity Equivalence.

(a) Sum of PCB-TEQ and Total Non-DLC PCBs cancer risks and hazard quotients.

Attachment D – Supporting Documentation for Equilibrium Partitioning-based Evaluation of Potential Benthic Injury

Attachment D Table 1
Area-Specific Estimates of Benthic Injury Based on PCBs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Horizon	**Surface Sediment (0-0.5 ft)**						**All Sediment (all depths)**					
Area	**Exposure Area 1**	**Exposure Area 2**	**Exposure Area 3**	**Exposure Area 4**	**Exposure Area 5**	**Reach-wide**	**Exposure Area 1**	**Exposure Area 2**	**Exposure Area 3**	**Exposure Area 4**	**Exposure Area 5**	**Reach-wide**
Average Total Organic Carbon (%)	13	6.8	9.9	4.7	2.2	8.0	6.3	3.7	5.0	3.6	1.7	4.5
Average Fraction Organic Carbon (OC)	0.13	0.068	0.099	0.047	0.022	0.080	0.063	0.037	0.050	0.036	0.017	0.045
PCB Exposure Point Concentration (EPC) (mg/kg)	57.6	16.8	125	146	56.1	91.5	176	43.5	164	434	48.4	1425
Predicted Percent Benthic Injury at EPC (a)	***74***	***54***	***93***	***98***	***97***	***91***	***98***	***92***	***98***	***100***	***98***	***100***

Notes:

EPC - Exposure Point Concentration (see Table 1 of the Streamlined Risk Evaluation for details).

OC - Organic Carbon (see Table 2 of this Attachment for data and averages).

(a) Value represents the percent benthic injury for the invertebrate community at the area-specific PCB EPC and average total OC as predicted by Finkelstein, et al (2017).

Supporting Calculations for Benthic Injury Sediment Benchmarks - Orange shading below indicates benchmark is exceeded by the PCB EPC (predicted percent injury is identified above for each area and sediment data set)

From Finkelstein et al (2017) Table 5		**Benthic Injury Sediment Benchmark (mg/kg) Adjusted Based on Fraction Organic Carbon from each Area and Sediment Data Set** **Benthic Injury Sediment Benchmark (mg/kg) = Aroclor 1254 Benchmark (mg/kg OC) x Fraction OC**											
Benthic Injury (%)	**Aroclor 1254 Benchmark Applied to Total PCBs (mg/kg OC)**	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
0.20	3.30	0.43	0.22	0.33	0.16	0.07	0.26	0.21	0.12	0.17	0.12	0.06	0.15
0.21	3.49	0.45	0.24	0.35	0.16	0.08	0.28	0.22	0.13	0.17	0.13	0.06	0.16
0.23	3.70	0.48	0.25	0.37	0.17	0.08	0.30	0.23	0.14	0.19	0.13	0.06	0.17
0.25	3.91	0.51	0.27	0.39	0.18	0.09	0.31	0.25	0.14	0.20	0.14	0.07	0.18
0.27	4.14	0.54	0.28	0.41	0.19	0.09	0.33	0.26	0.15	0.21	0.15	0.07	0.19
0.30	4.38	0.57	0.30	0.43	0.21	0.10	0.35	0.28	0.16	0.22	0.16	0.07	0.20
0.33	4.64	0.60	0.32	0.46	0.22	0.10	0.37	0.29	0.17	0.23	0.17	0.08	0.21
0.35	4.91	0.64	0.33	0.49	0.23	0.11	0.39	0.31	0.18	0.25	0.18	0.08	0.22
0.38	5.20	0.68	0.35	0.51	0.24	0.11	0.42	0.33	0.19	0.26	0.19	0.09	0.23
0.42	5.50	0.72	0.37	0.54	0.26	0.12	0.44	0.35	0.20	0.28	0.20	0.09	0.25
0.46	5.82	0.76	0.40	0.58	0.27	0.13	0.47	0.37	0.22	0.29	0.21	0.10	0.26
0.50	6.16	0.80	0.42	0.61	0.29	0.14	0.49	0.39	0.23	0.31	0.22	0.10	0.28
0.54	6.52	0.85	0.44	0.65	0.31	0.14	0.52	0.41	0.24	0.33	0.23	0.11	0.29
0.59	6.91	0.90	0.47	0.68	0.32	0.15	0.55	0.44	0.26	0.35	0.25	0.12	0.31
0.64	7.31	0.95	0.50	0.72	0.34	0.16	0.58	0.46	0.27	0.37	0.26	0.12	0.33
0.69	7.74	1.01	0.53	0.77	0.36	0.17	0.62	0.49	0.29	0.39	0.28	0.13	0.35
0.75	8.19	1.06	0.56	0.81	0.38	0.18	0.66	0.52	0.30	0.41	0.29	0.14	0.37
0.82	8.67	1.13	0.59	0.86	0.41	0.19	0.69	0.55	0.32	0.43	0.31	0.15	0.39
0.89	9.17	1.19	0.62	0.91	0.43	0.20	0.73	0.58	0.34	0.46	0.33	0.16	0.41
0.97	9.71	1.26	0.66	0.96	0.46	0.21	0.78	0.61	0.36	0.49	0.35	0.17	0.44
1.05	10.28	1.34	0.70	1.02	0.48	0.23	0.82	0.65	0.38	0.51	0.37	0.17	0.46
1.14	10.88	1.41	0.74	1.08	0.51	0.24	0.87	0.69	0.40	0.54	0.39	0.18	0.49
1.24	11.51	1.50	0.78	1.14	0.54	0.25	0.92	0.73	0.43	0.58	0.41	0.20	0.52
1.35	12.19	1.58	0.83	1.21	0.57	0.27	0.98	0.77	0.45	0.61	0.44	0.21	0.55
1.47	12.90	1.68	0.88	1.28	0.61	0.28	1.03	0.81	0.48	0.65	0.46	0.22	0.58
1.59	13.65	1.77	0.93	1.35	0.64	0.30	1.09	0.86	0.51	0.68	0.49	0.23	0.61
1.73	14.45	1.88	0.98	1.43	0.68	0.32	1.16	0.91	0.53	0.72	0.52	0.25	0.65
1.88	15.30	1.99	1.04	1.51	0.72	0.34	1.22	0.96	0.57	0.77	0.55	0.26	0.69
2.04	16.19	2.10	1.10	1.60	0.76	0.36	1.30	1.02	0.60	0.81	0.58	0.28	0.73
2.22	17.14	2.23	1.17	1.70	0.81	0.38	1.37	1.08	0.63	0.86	0.62	0.29	0.77
2.41	18.14	2.36	1.23	1.80	0.85	0.40	1.45	1.14	0.67	0.91	0.65	0.31	0.82
2.62	19.20	2.50	1.31	1.90	0.90	0.42	1.54	1.21	0.71	0.96	0.69	0.33	0.86
2.84	20.32	2.64	1.38	2.01	0.96	0.45	1.63	1.28	0.75	1.02	0.73	0.35	0.91
3.08	21.51	2.80	1.46	2.13	1.01	0.47	1.72	1.36	0.80	1.08	0.77	0.37	0.97
3.34	22.77	2.96	1.55	2.25	1.07	0.50	1.82	1.43	0.84	1.14	0.82	0.39	1.02

Attachment D Table 1
Area-Specific Estimates of Benthic Injury Based on PCBs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Supporting Calculations for Benthic Injury Sediment Benchmarks - Orange shading below indicates benchmark is exceeded by the PCB EPC (predicted percent injury is identified above for each area and sediment data set)

From Finkelstein et al (2017) Table 5		Benthic Injury Sediment Benchmark (mg/kg) Adjusted Based on Fraction Organic Carbon from each Area and Sediment Data Set											
Benthic Injury (%)	Aroclor 1254 Benchmark Applied to Total PCBs (mg/kg OC)	Benthic Injury Sediment Benchmark (mg/kg) = Aroclor 1254 Benchmark (mg/kg OC) x Fraction OC											
		Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
3.63	24.10	3.13	1.64	2.39	1.13	0.53	1.93	1.52	0.89	1.21	0.87	0.41	1.08
3.93	25.51	3.32	1.73	2.53	1.20	0.56	2.04	1.61	0.94	1.28	0.92	0.43	1.15
4.27	27.00	3.51	1.84	2.67	1.27	0.59	2.16	1.70	1.00	1.35	0.97	0.46	1.22
4.62	28.58	3.72	1.94	2.83	1.34	0.63	2.29	1.80	1.06	1.43	1.03	0.49	1.29
5.01	30.25	3.93	2.06	2.99	1.42	0.67	2.42	1.91	1.12	1.51	1.09	0.51	1.36
5.43	32.01	4.16	2.18	3.17	1.50	0.70	2.56	2.02	1.18	1.60	1.15	0.54	1.44
5.88	33.88	4.40	2.30	3.35	1.59	0.75	2.71	2.13	1.25	1.69	1.22	0.58	1.52
6.36	35.87	4.66	2.44	3.55	1.69	0.79	2.87	2.26	1.33	1.79	1.29	0.61	1.61
6.88	37.96	4.93	2.58	3.76	1.78	0.84	3.04	2.39	1.40	1.90	1.37	0.65	1.71
7.44	40.18	5.22	2.73	3.98	1.89	0.88	3.21	2.53	1.49	2.01	1.45	0.68	1.81
8.05	42.53	5.53	2.89	4.21	2.00	0.94	3.40	2.68	1.57	2.13	1.53	0.72	1.91
8.69	45.01	5.85	3.06	4.46	2.12	0.99	3.60	2.84	1.67	2.25	1.62	0.77	2.03
9.38	47.65	6.19	3.24	4.72	2.24	1.05	3.81	3.00	1.76	2.38	1.72	0.81	2.14
10.13	50.43	6.56	3.43	4.99	2.37	1.11	4.03	3.18	1.87	2.52	1.82	0.86	2.27
10.92	53.38	6.94	3.63	5.28	2.51	1.17	4.27	3.36	1.98	2.67	1.92	0.91	2.40
11.77	56.50	7.35	3.84	5.59	2.66	1.24	4.52	3.56	2.09	2.83	2.03	0.96	2.54
12.67	59.80	7.77	4.07	5.92	2.81	1.32	4.78	3.77	2.21	2.99	2.15	1.02	2.69
13.64	63.30	8.23	4.30	6.27	2.98	1.39	5.06	3.99	2.34	3.17	2.28	1.08	2.85
14.66	67.00	8.71	4.56	6.63	3.15	1.47	5.36	4.22	2.48	3.35	2.41	1.14	3.02
15.75	70.91	9.22	4.82	7.02	3.33	1.56	5.67	4.47	2.62	3.55	2.55	1.21	3.19
16.90	75.06	9.76	5.10	7.43	3.53	1.65	6.00	4.73	2.78	3.75	2.70	1.28	3.38
18.11	79.44	10.33	5.40	7.86	3.73	1.75	6.36	5.00	2.94	3.97	2.86	1.35	3.57
19.40	84.09	10.93	5.72	8.32	3.95	1.85	6.73	5.30	3.11	4.20	3.03	1.43	3.78
20.75	89.00	11.57	6.05	8.81	4.18	1.96	7.12	5.61	3.29	4.45	3.20	1.51	4.01
22.17	94.20	12.25	6.41	9.33	4.43	2.07	7.54	5.93	3.49	4.71	3.39	1.60	4.24
23.66	99.71	12.96	6.78	9.87	4.69	2.19	7.98	6.28	3.69	4.99	3.59	1.70	4.49
25.22	105.54	13.72	7.18	10.45	4.96	2.32	8.44	6.65	3.90	5.28	3.80	1.79	4.75
26.84	111.71	14.52	7.60	11.06	5.25	2.46	8.94	7.04	4.13	5.59	4.02	1.90	5.03
28.53	118.24	15.37	8.04	11.71	5.56	2.60	9.46	7.45	4.37	5.91	4.26	2.01	5.32
30.28	125.15	16.27	8.51	12.39	5.88	2.75	10.01	7.88	4.63	6.26	4.51	2.13	5.63
32.09	132.46	17.22	9.01	13.11	6.23	2.91	10.60	8.34	4.90	6.62	4.77	2.25	5.96
33.95	140.20	18.23	9.53	13.88	6.59	3.08	11.22	8.83	5.19	7.01	5.05	2.38	6.31
35.87	148.40	19.29	10.09	14.69	6.97	3.26	11.87	9.35	5.49	7.42	5.34	2.52	6.68
37.83	157.07	20.42	10.68	15.55	7.38	3.46	12.57	9.90	5.81	7.85	5.65	2.67	7.07
39.84	166.25	21.61	11.31	16.46	7.81	3.66	13.30	10.47	6.15	8.31	5.99	2.83	7.48
41.87	175.97	22.88	11.97	17.42	8.27	3.87	14.08	11.09	6.51	8.80	6.33	2.99	7.92
43.94	186.26	24.21	12.67	18.44	8.75	4.10	14.90	11.73	6.89	9.31	6.71	3.17	8.38
46.02	197.14	25.63	13.41	19.52	9.27	4.34	15.77	12.42	7.29	9.86	7.10	3.35	8.87
48.13	208.67	27.13	14.19	20.66	9.81	4.59	16.69	13.15	7.72	10.43	7.51	3.55	9.39
50.23	220.86	28.71	15.02	21.87	10.38	4.86	17.67	13.91	8.17	11.04	7.95	3.75	9.94
52.34	233.77	30.39	15.90	23.14	10.99	5.14	18.70	14.73	8.65	11.69	8.42	3.97	10.52
54.44	247.44	32.17	16.83	24.50	11.63	5.44	19.80	15.59	9.16	12.37	8.91	4.21	11.13
56.52	261.90	34.05	17.81	25.93	12.31	5.76	20.95	16.50	9.69	13.10	9.43	4.45	11.79
58.58	277.21	36.04	18.85	27.44	13.03	6.10	22.18	17.46	10.26	13.86	9.98	4.71	12.47
60.61	293.41	38.14	19.95	29.05	13.79	6.46	23.47	18.48	10.86	14.67	10.56	4.99	13.20
62.60	310.56	40.37	21.12	30.75	14.60	6.83	24.84	19.57	11.49	15.53	11.18	5.28	13.98
64.56	328.71	42.73	22.35	32.54	15.45	7.23	26.30	20.71	12.16	16.44	11.83	5.59	14.79
66.46	347.93	45.23	23.66	34.45	16.35	7.65	27.83	21.92	12.87	17.40	12.53	5.91	15.66

Attachment D Table 1
Area-Specific Estimates of Benthic Injury Based on PCBs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Supporting Calculations for Benthic Injury Sediment Benchmarks - Orange shading below indicates benchmark is exceeded by the PCB EPC (predicted percent injury is identified above for each area and sediment data set)

From Finkelstein et al (2017) Table 5		**Benthic Injury Sediment Benchmark (mg/kg) Adjusted Based on Fraction Organic Carbon from each Area and Sediment Data Set**											
Benthic Injury (%)	**Aroclor 1254 Benchmark Applied to Total PCBs (mg/kg OC)**	**Benthic Injury Sediment Benchmark (mg/kg) = Aroclor 1254 Benchmark (mg/kg OC) x Fraction OC**											
		Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
68.31	368.26	47.87	25.04	36.46	17.31	8.10	29.46	23.20	13.63	18.41	13.26	6.26	16.57
70.11	389.79	50.67	26.51	38.59	18.32	8.58	31.18	24.56	14.42	19.49	14.03	6.63	17.54
71.85	412.57	53.63	28.05	40.84	19.39	9.08	33.01	25.99	15.27	20.63	14.85	7.01	18.57
73.52	436.68	56.77	29.69	43.23	20.52	9.61	34.93	27.51	16.16	21.83	15.72	7.42	19.65
75.13	462.21	60.09	31.43	45.76	21.72	10.17	36.98	29.12	17.10	23.11	16.64	7.86	20.80
76.67	489.23	63.60	33.27	48.43	22.99	10.76	39.14	30.82	18.10	24.46	17.61	8.32	22.02
78.15	517.82	67.32	35.21	51.26	24.34	11.39	41.43	32.62	19.16	25.89	18.64	8.80	23.30
79.55	548.09	71.25	37.27	54.26	25.76	12.06	43.85	34.53	20.28	27.40	19.73	9.32	24.66
80.89	580.12	75.42	39.45	57.43	27.27	12.76	46.41	36.55	21.46	29.01	20.88	9.86	26.11
82.16	614.03	79.82	41.75	60.79	28.86	13.51	49.12	38.68	22.72	30.70	22.11	10.44	27.63
83.36	649.92	84.49	44.19	64.34	30.55	14.30	51.99	40.94	24.05	32.50	23.40	11.05	29.25
84.50	687.91	89.43	46.78	68.10	32.33	15.13	55.03	43.34	25.45	34.40	24.76	11.69	30.96
85.57	728.12	94.66	49.51	72.08	34.22	16.02	58.25	45.87	26.94	36.41	26.21	12.38	32.77
86.58	770.68	100.19	52.41	76.30	36.22	16.95	61.65	48.55	28.52	38.53	27.74	13.10	34.68
87.53	815.72	106.04	55.47	80.76	38.34	17.95	65.26	51.39	30.18	40.79	29.37	13.87	36.71
88.42	863.40	112.24	58.71	85.48	40.58	18.99	69.07	54.39	31.95	43.17	31.08	14.68	38.85
89.26	913.87	118.80	62.14	90.47	42.95	20.11	73.11	57.57	33.81	45.69	32.90	15.54	41.12
90.04	967.28	125.75	65.78	95.76	45.46	21.28	77.38	60.94	35.79	48.36	34.82	16.44	43.53
90.77	1023.82	133.10	69.62	101.36	48.12	22.52	81.91	64.50	37.88	51.19	36.86	17.40	46.07
91.45	1083.66	140.88	73.69	107.28	50.93	23.84	86.69	68.27	40.10	54.18	39.01	18.42	48.76
92.09	1147.00	149.11	78.00	113.55	53.91	25.23	91.76	72.26	42.44	57.35	41.29	19.50	51.62
92.68	1214.05	157.83	82.56	120.19	57.06	26.71	97.12	76.49	44.92	60.70	43.71	20.64	54.63
93.24	1285.01	167.05	87.38	127.22	60.40	28.27	102.80	80.96	47.55	64.25	46.26	21.85	57.83
93.75	1360.12	176.82	92.49	134.65	63.93	29.92	108.81	85.69	50.32	68.01	48.96	23.12	61.21
94.22	1439.62	187.15	97.89	142.52	67.66	31.67	115.17	90.70	53.27	71.98	51.83	24.47	64.78
94.67	1523.76	198.09	103.62	150.85	71.62	33.52	121.90	96.00	56.38	76.19	54.86	25.90	68.57
95.08	1612.82	209.67	109.67	159.67	75.80	35.48	129.03	101.61	59.67	80.64	58.06	27.42	72.58
95.46	1707.10	221.92	116.08	169.00	80.23	37.56	136.57	107.55	63.16	85.36	61.46	29.02	76.82
95.81	1806.87	234.89	122.87	178.88	84.92	39.75	144.55	113.83	66.85	90.34	65.05	30.72	81.31
96.13	1912.49	248.62	130.05	189.34	89.89	42.07	153.00	120.49	70.76	95.62	68.85	32.51	86.06
96.44	2024.27	263.16	137.65	200.40	95.14	44.53	161.94	127.53	74.90	101.21	72.87	34.41	91.09
96.72	2142.59	278.54	145.70	212.12	100.70	47.14	171.41	134.98	79.28	107.13	77.13	36.42	96.42
96.97	2267.83	294.82	154.21	224.52	106.59	49.89	181.43	142.87	83.91	113.39	81.64	38.55	102.05
97.21	2400.38	312.05	163.23	237.64	112.82	52.81	192.03	151.22	88.81	120.02	86.41	40.81	108.02
97.43	2540.68	330.29	172.77	251.53	119.41	55.89	203.25	160.06	94.01	127.03	91.46	43.19	114.33
97.63	2689.19	349.59	182.86	266.23	126.39	59.16	215.14	169.42	99.50	134.46	96.81	45.72	121.01
97.82	2846.37	370.03	193.55	281.79	133.78	62.62	227.71	179.32	105.32	142.32	102.47	48.39	128.09
97.99	3012.74	391.66	204.87	298.26	141.60	66.28	241.02	189.80	111.47	150.64	108.46	51.22	135.57
98.15	3188.83	414.55	216.84	315.69	149.88	70.15	255.11	200.90	117.99	159.44	114.80	54.21	143.50
98.30	3375.22	438.78	229.51	334.15	158.64	74.25	270.02	212.64	124.88	168.76	121.51	57.38	151.88
98.43	3572.51	464.43	242.93	353.68	167.91	78.60	285.80	225.07	132.18	178.63	128.61	60.73	160.76
98.56	3781.32	491.57	257.13	374.35	177.72	83.19	302.51	238.22	139.91	189.07	136.13	64.28	170.16
98.67	4002.34	520.30	272.16	396.23	188.11	88.05	320.19	252.15	148.09	200.12	144.08	68.04	180.11
98.78	4236.27	550.72	288.07	419.39	199.10	93.20	338.90	266.89	156.74	211.81	152.51	72.02	190.63
98.88	4483.88	582.90	304.90	443.90	210.74	98.65	358.71	282.48	165.90	224.19	161.42	76.23	201.77
98.97	4745.97	616.98	322.73	469.85	223.06	104.41	379.68	299.00	175.60	237.30	170.85	80.68	213.57
99.05	5023.37	653.04	341.59	497.31	236.10	110.51	401.87	316.47	185.86	251.17	180.84	85.40	226.05
99.13	5316.99	691.21	361.56	526.38	249.90	116.97	425.36	334.97	196.73	265.85	191.41	90.39	239.26

Attachment D Table 1
Area-Specific Estimates of Benthic Injury Based on PCBs in Sediment
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Supporting Calculations for Benthic Injury Sediment Benchmarks - Orange shading below indicates benchmark is exceeded by the PCB EPC (predicted percent injury is identified above for each area and sediment data set)

From Finkelstein et al (2017) Table 5		Benthic Injury Sediment Benchmark (mg/kg) Adjusted Based on Fraction Organic Carbon from each Area and Sediment Data Set											
Benthic Injury (%)	Aroclor 1254 Benchmark Applied to Total PCBs (mg/kg OC)	Benthic Injury Sediment Benchmark (mg/kg) = Aroclor 1254 Benchmark (mg/kg OC) x Fraction OC											
		Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide	Exposure Area 1	Exposure Area 2	Exposure Area 3	Exposure Area 4	Exposure Area 5	Reach-wide
99.20	5627.77	731.61	382.69	557.15	264.51	123.81	450.22	354.55	208.23	281.39	202.60	95.67	253.25
99.26	5956.72	774.37	405.06	589.72	279.97	131.05	476.54	375.27	220.40	297.84	214.44	101.26	268.05
99.32	6304.88	819.63	428.73	624.18	296.33	138.71	504.39	397.21	233.28	315.24	226.98	107.18	283.72
99.38	6673.40	867.54	453.79	660.67	313.65	146.81	533.87	420.42	246.92	333.67	240.24	113.45	300.30
99.43	7063.47	918.25	480.32	699.28	331.98	155.40	565.08	445.00	261.35	353.17	254.28	120.08	317.86
99.47	7476.32	971.92	508.39	740.16	351.39	164.48	598.11	471.01	276.62	373.82	269.15	127.10	336.43
99.51	7913.31	1028.73	538.11	783.42	371.93	174.09	633.06	498.54	292.79	395.67	284.88	134.53	356.10
99.55	8375.85	1088.86	569.56	829.21	393.66	184.27	670.07	527.68	309.91	418.79	301.53	142.39	376.91
99.59	8865.41	1152.50	602.85	877.68	416.67	195.04	709.23	558.52	328.02	443.27	319.15	150.71	398.94
99.62	9383.61	1219.87	638.09	928.98	441.03	206.44	750.69	591.17	347.19	469.18	337.81	159.52	422.26
99.65	9932.08	1291.17	675.38	983.28	466.81	218.51	794.57	625.72	367.49	496.60	357.55	168.85	446.94
99.68	10512.60	1366.64	714.86	1040.75	494.09	231.28	841.01	662.29	388.97	525.63	378.45	178.71	473.07
99.71	11127.07	1446.52	756.64	1101.58	522.97	244.80	890.17	701.01	411.70	556.35	400.57	189.16	500.72
99.73	11777.44	1531.07	800.87	1165.97	553.54	259.10	942.20	741.98	435.77	588.87	423.99	200.22	529.98
99.75	12465.85	1620.56	847.68	1234.12	585.89	274.25	997.27	785.35	461.24	623.29	448.77	211.92	560.96
99.77	13194.47	1715.28	897.22	1306.25	620.14	290.28	1055.56	831.25	488.20	659.72	475.00	224.31	593.75
99.79	13965.68	1815.54	949.67	1382.60	656.39	307.24	1117.25	879.84	516.73	698.28	502.76	237.42	628.46
99.81	14781.99	1921.66	1005.18	1463.42	694.75	325.20	1182.56	931.27	546.93	739.10	532.15	251.29	665.19
99.82	15645.99	2033.98	1063.93	1548.95	735.36	344.21	1251.68	985.70	578.90	782.30	563.26	265.98	704.07

Source: Finkelstein, K., N. Beckvar, and T. Dillon. 2017. Benthic Injury Dose-Response Models for Polychlorinated Biphenyl-Contaminated Sediment Using Equilibrium Partitioning. Environmental Toxicology and Chemistry, Vol. 36, No. 5, pp. 1311–1329.

Attachment D Table 2
Total Organic Carbon in Phase 1 Sediments
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Location	Area	Horizon	Date Collected	Depth	Total Organic Carbon (mg/kg)	Area and Horizon	Average Total Organic Carbon	
							(mg/kg)	(%)
23A-0018-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-4.4	58000	LNR-EPC-Area-1_Subsurface	29000	2.9
23A-0018-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	4.4-5.5	5400	LNR-EPC-Area-1_All	63000	6.3
23A-0019-B2C2	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-3.1	53000			
23A-0019-B2C2	LNR-EPC-Area-1	Subsurface	6/23/2023	3.1-4.3	430			
23A-0020-PLC1	LNR-EPC-Area-1	Subsurface	6/22/2023	0.5-2.3	2800			
23A-0020-PLC1	LNR-EPC-Area-1	Subsurface	6/22/2023	2.3-4	4100			
23A-0039-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-2	2000			
23A-0039-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	2-3	480			
23A-0040-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-1.4	16000			
23A-0040-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	1.4-5.6	350			
23A-0057-PLC1	LNR-EPC-Area-1	Subsurface	6/24/2023	0.5-1.5	15000			
23A-0057-PLC1	LNR-EPC-Area-1	Subsurface	6/24/2023	1.5-2.5	510			
23A-0058-PLC2	LNR-EPC-Area-1	Subsurface	6/24/2023	0.5-2	2600			
23A-0059-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-1.2	3200			
23A-0060-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-2	18000			
23A-0060-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	2-3.6	72000			
23A-0066-PLC1	LNR-EPC-Area-1	Subsurface	6/24/2023	0.5-1.7	570			
23A-0067-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-2.3	38000			
23A-0067-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	2.3-2.9	11000			
23A-0068-PLC2	LNR-EPC-Area-1	Subsurface	6/22/2023	0.5-0.9	1900			
23A-0069-PLC1	LNR-EPC-Area-1	Subsurface	6/22/2023	0.5-3.4	37000			
23A-0069-PLC1	LNR-EPC-Area-1	Subsurface	6/22/2023	3.4-6	630			
23A-0070-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	0.5-2.3	180000			
23A-0070-PLC1	LNR-EPC-Area-1	Subsurface	6/23/2023	2.3-4.2	170000			
23A-0018-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	210000	LNR-EPC-Area-1_Surface	130000	13.0
23A-0019-B2C2	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	140000			
23A-0020-PLC2	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	100000			
23A-0039-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	2900			
23A-0040-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	150000			
23A-0057-PLC1	LNR-EPC-Area-1	Surface	6/24/2023	0-0.5	160000			
23A-0059-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	100000			
23A-0060-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	220000			
23A-0066-PLC1	LNR-EPC-Area-1	Surface	6/24/2023	0-0.5	22000			
23A-0067-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	170000			
23A-0068-PLC2	LNR-EPC-Area-1	Surface	6/22/2023	0-0.5	4900			
23A-0069-PLC1	LNR-EPC-Area-1	Surface	6/22/2023	0-0.5	39000			
23A-0070-PLC1	LNR-EPC-Area-1	Surface	6/23/2023	0-0.5	310000			
23A-0015-PLC1	LNR-EPC-Area-2	Subsurface	6/24/2023	0.5-1.5	87000	LNR-EPC-Area-2_Subsurface	14000	1.4
23A-0015-PLC1	LNR-EPC-Area-2	Subsurface	6/24/2023	1.5-2.9	2400	LNR-EPC-Area-2_All	37000	3.7
23A-0033-B2C1	LNR-EPC-Area-2	Subsurface	6/26/2023	0.5-1.7	8900			
23A-0033-B2C1	LNR-EPC-Area-2	Subsurface	6/26/2023	1.7-2.7	350			
23A-0034-PLC1	LNR-EPC-Area-2	Subsurface	6/25/2023	0.5-1.4	1800			
23A-0034-PLC1	LNR-EPC-Area-2	Subsurface	6/25/2023	1.4-2.4	1200			
23A-0053-B1C1	LNR-EPC-Area-2	Subsurface	6/25/2023	0.5-3.2	12000			
23A-0053-B1C1	LNR-EPC-Area-2	Subsurface	6/25/2023	3.2-5.7	380			
23A-0054-PLC2	LNR-EPC-Area-2	Subsurface	6/25/2023	0.5-1.5	47000			
23A-0054-PLC2	LNR-EPC-Area-2	Subsurface	6/25/2023	1.5-3	740			
23A-0055-B1C1	LNR-EPC-Area-2	Subsurface	6/25/2023	0.5-2.1	1700			
23A-0055-B1C1	LNR-EPC-Area-2	Subsurface	6/25/2023	2.1-3.4	1500			
23A-0056-PLC1	LNR-EPC-Area-2	Subsurface	6/24/2023	0.5-2	12000			
23A-0014-PLC2	LNR-EPC-Area-2	Surface	6/25/2023	0-0.5	6800	LNR-EPC-Area-2_Surface	68000	6.8
23A-0015-PLC1	LNR-EPC-Area-2	Surface	6/24/2023	0-0.5	190000			
23A-0033-B2C1	LNR-EPC-Area-2	Surface	6/26/2023	0-0.5	34000			
23A-0034-PLC1	LNR-EPC-Area-2	Surface	6/25/2023	0-0.5	31000			
23A-0036-PLC3	LNR-EPC-Area-2	Surface	6/24/2023	0-0.5	33000			
23A-0037-B2C1	LNR-EPC-Area-2	Surface	6/24/2023	0-0.5	61000			
23A-0053-B1C1	LNR-EPC-Area-2	Surface	6/25/2023	0-0.5	160000			
23A-0054-PLC2	LNR-EPC-Area-2	Surface	6/25/2023	0-0.5	96000			
23A-0055-B1C1	LNR-EPC-Area-2	Surface	6/25/2023	0-0.5	5500			
23A-0056-PLC1	LNR-EPC-Area-2	Surface	6/24/2023	0-0.5	64000			

Attachment D Table 2
Total Organic Carbon in Phase 1 Sediments
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Location	Area	Horizon	Date Collected	Depth	Total Organic Carbon (mg/kg)	Area and Horizon	Average Total Organic Carbon	
							(mg/kg)	(%)
23A-0007-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-1.7	75000	LNR-EPC-Area-3_Subsurface	27000	2.7
23A-0007-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	1.7-5.1	67000	LNR-EPC-Area-3_All	50000	5.0
23A-0008-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-3	580			
23A-0008-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	3-6.2	690			
23A-0009-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-3	72000			
23A-0009-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	3-5.7	1300			
23A-0010-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-1.5	200000			
23A-0010-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	1.5-3.4	710			
23A-0011-B1C1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-2.9	70000			
23A-0011-B1C1	LNR-EPC-Area-3	Subsurface	6/26/2023	2.9-3.6	600			
23A-0012-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-1.7	640			
23A-0012-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	1.7-3	740			
23A-0028-PLC2	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-1.7	400			
23A-0029-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-3.3	50000			
23A-0029-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	3.3-5.8	320			
23A-0030-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-1.8	100000			
23A-0030-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	1.8-2.8	920			
23A-0031-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-1.5	19000			
23A-0031-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	1.5-3.4	290			
23A-0032-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-1.7	1000			
23A-0032-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	1.7-3	800			
23A-0048-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-3.2	58000			
23A-0048-PLC1	LNR-EPC-Area-3	Subsurface	6/27/2023	3.2-5	440			
23A-0049-B2C1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-2.2	36000			
23A-0049-B2C1	LNR-EPC-Area-3	Subsurface	6/27/2023	2.2-3.2	270			
23A-0050-B2C1	LNR-EPC-Area-3	Subsurface	6/27/2023	0.5-2.7	13000			
23A-0050-B2C1	LNR-EPC-Area-3	Subsurface	6/27/2023	2.7-3.2	500			
23A-0051-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-2.2	29000			
23A-0051-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	2.2-3.4	1000			
23A-0052-PLC1	LNR-EPC-Area-3	Subsurface	6/26/2023	0.5-1.9	540			
23A-0007-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	30000	LNR-EPC-Area-3_Surface	99000	9.9
23A-0008-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	45000			
23A-0009-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	120000			
23A-0010-PLC1	LNR-EPC-Area-3	Surface	6/26/2023	0-0.5	360000			
23A-0011-B1C1	LNR-EPC-Area-3	Surface	6/26/2023	0-0.5	1700			
23A-0012-PLC1	LNR-EPC-Area-3	Surface	6/26/2023	0-0.5	5500			
23A-0028-PLC2	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	16000			
23A-0029-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	380000			
23A-0030-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	16000			
23A-0031-PLC1	LNR-EPC-Area-3	Surface	6/26/2023	0-0.5	34000			
23A-0032-PLC1	LNR-EPC-Area-3	Surface	6/26/2023	0-0.5	1100			
23A-0048-PLC1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	240000			
23A-0049-B2C1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	81000			
23A-0050-B2C1	LNR-EPC-Area-3	Surface	6/27/2023	0-0.5	53000			
23A-0004-B2C1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.4	13000	LNR-EPC-Area-4_Subsurface	28000	2.8
23A-0005-PLC1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.5	3300	LNR-EPC-Area-4_All	36000	3.6
23A-0006-PLC2	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.8	15000			
23A-0025-B1C1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.3	14000			
23A-0026-B1C1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.6	5200			
23A-0046-PLC2	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.4	7100			
23A-0046-PLC2	LNR-EPC-Area-4	Subsurface	6/28/2023	1.4-2.4	820			
23A-0061-PLC1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-1.7	37000			
23A-0061-PLC1	LNR-EPC-Area-4	Subsurface	6/28/2023	1.7-2.7	980			
23A-0062-PLC1	LNR-EPC-Area-4	Subsurface	6/28/2023	0.5-3	39000			
23A-0062-PLC1	LNR-EPC-Area-4	Subsurface	6/28/2023	3-4.7	2800			
23A-0063-PLC1	LNR-EPC-Area-4	Subsurface	6/29/2023	0.5-3.7	75000			
23A-0063-PLC1	LNR-EPC-Area-4	Subsurface	6/29/2023	3.7-4.9	1600			
23A-0064-PLC1	LNR-EPC-Area-4	Subsurface	6/29/2023	0.5-3.7	150000			
23A-0064-PLC1	LNR-EPC-Area-4	Subsurface	6/29/2023	3.7-5.7	58000			
23A-0004-B2C1	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	18000	LNR-EPC-Area-4_Surface	47000	4.7
23A-0005-PLC1	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	24000			
23A-0006-PLC2	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	120000			
23A-0025-B1C1	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	9000			
23A-0046-PLC2	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	6600			
23A-0061-PLC1	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	52000			
23A-0062-PLC1	LNR-EPC-Area-4	Surface	6/28/2023	0-0.5	30000			
23A-0063-PLC1	LNR-EPC-Area-4	Surface	6/29/2023	0-0.5	41000			
23A-0064-PLC1	LNR-EPC-Area-4	Surface	6/29/2023	0-0.5	160000			
23A-0065-PLC1	LNR-EPC-Area-4	Surface	6/29/2023	0-0.5	12000			

Attachment D Table 2
Total Organic Carbon in Phase 1 Sediments
Streamlined Risk Evaluation
Lower Neponset River Superfund Site
Boston, Massachusetts

Location	Area	Horizon	Date Collected	Depth	Total Organic Carbon (mg/kg)	Area and Horizon	Average Total Organic Carbon	
							(mg/kg)	(%)
23A-0001-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-1.7	14000	LNR-EPC-Area-5_Subsurface	13000	1.3
23A-0001-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	1.7-2.3	36000	LNR-EPC-Area-5_All	17000	1.7
23A-0002-PLC2	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-3.1	230			
23A-0002-PLC2	LNR-EPC-Area-5	Subsurface	6/29/2023	3.1-6	250			
23A-0021-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-1.5	560			
23A-0022-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-2.8	4200			
23A-0022-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	2.8-4	340			
23A-0023-B2C2	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-1.7	18000			
23A-0042-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-1.9	52000			
23A-0043-PLC1	LNR-EPC-Area-5	Subsurface	6/29/2023	0.5-1.6	2700			
23A-0001-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	3100	LNR-EPC-Area-5_Surface	22000	2.2
23A-0002-PLC2	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	14000			
23A-0003-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	310			
23A-0021-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	4800			
23A-0023-B2C2	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	19000			
23A-0041-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	97000			
23A-0042-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5	16000			
23A-0043-PLC1	LNR-EPC-Area-5	Surface	6/29/2023	0-0.5				
						LNR-EPC-Reach-wide_Surface	80000	8.0
						LNR-EPC-Reach-wide_All	45000	4.5

Surface sediment includes samples collected from the top 0.5 foot.
Subsurface sediment includes samples collected deeper than the top 0.5 foot.
All sediment includes surface and subsurface samples.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square, Suite 100
BOSTON, MA 02109-3912

TECHNICAL MEMORANDUM
To: Natalie Burgo, Tristan Pluta
From: Matthew LeFauve, Ph.D.; Bart Hoskins
Date: March 25, 2025
RE: Streamlined Ecological Risk Evaluation of Polychlorinated Biphenyls in Soil for the Lower Neponset River Superfund Site

Background:

The purpose of this technical memorandum is to present a streamlined ecological risk evaluation (SRE) for soils within the FEMA 100-year floodplain at the Lower Neponset River Superfund Site (the Site). The Site is a 3.7-mile segment of the Neponset River between its confluence with Mother Brook in Hyde Park, Massachusetts (MA), downstream to the Walter Chocolate Baker Dam in Dorchester and Milton, MA. This SRE is focused on the most upstream mile of the Site, referred to as the Phase 1 Reach, which is located between the Mother Brook and Neponset River confluence and the Tileston and Hollingsworth (T&H) Dam.

A SRE is intermediate in scope between a limited risk evaluation undertaken for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions. Consistent with the EPA's *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (EPA, 1993), streamlined risk evaluations were conducted for the Phase 1 Reach to justify a removal action and identify current or potential exposures that could be prevented.

The SREs are focused on PCBs, which were identified as the primary contaminants at the Site. This assumption is supported by a review of the Phase 1 data, which indicates PCBs are widespread and of high concentration in some areas. PCB-specific preliminary removal goals for the Phase 1 Reach were developed to support the selection of cleanup levels. As noted in EPA guidance, "[s]ince removal and remedial action cleanup levels may differ, all early action decisions should consider the possible long-term action and corresponding cleanup levels" (EPA, 1993). Accordingly, the preliminary removal goals were developed to support the development of RAA cleanup levels in consideration of the future remedial action and potential corresponding cleanup levels.[1]

Below, **Table 1** includes a list of definitions for the parameters used in the risk evaluation and **Table 2** provides the formulas used in the risk evaluation.

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[1] The preliminary removal goals developed for this EE/CA and are not intended to preclude the development of future preliminary remediation goals during the remedial process.

Table 1. Definitions

Acronym	Definition	Units
bw	Body Weight	kg
COC	Contaminant of Concern	mg/kg
COPC	Contaminant of Potential Concern	mg/kg
dw	Dry Weight	kg
ED	Exposure Duration	years
EF	Exposure Frequency	days/year
FIR	Food Intake Rate	kg/day
HQ	Hazard Quotient	Unitless
LOAEL	Lowest Observed Adverse Effect Level	mg/kg
PRG	Preliminary Removal Goal	mg/kg
TDD	Total Daily Dose	$(mg/kg_{bw}/day)$
TRV	Toxicity Reference Value	$(mg/kg_{dw}/day)$
ww	Wet Weight	kg

Table 2. Formulas

Term	Formula
Total Daily Dose (TDD)	$\text{Total Daily Dose} = \frac{\sum([IR_f \times C_f] + [IR_s \times C_s] \times ED \times AUF}{\text{Average Body Weight}}$ Where: IR_f = Ingestion rate of food (kg/day) IR_s = Incidental ingestion rate of soil or sediment (kg/day) C_f = Concentration of COPC is food (mg/kg) C_s = Concentration of COPC is sediment or soil (mg/kg) ED = Exposure Duration (fraction of time receptor spends within exposure area) AUF = Area use factor (exposure area/home range)

Risk Evaluation

In ecological risk assessment, it is not possible to directly evaluate risks to all individual species and populations in an ecosystem, therefore, surrogate species were selected to represent omnivorous birds and mammals. The American Robin (*Turdus migratorius*) was selected to estimate risks to omnivorous birds, and the Short-tailed Shrew (*Blarina brevicauda*) was selected to represent omnivorous mammals. These species are commonly used to represent the omnivorous feeding guilds in risk assessments throughout New England. While other terrestrial species may be used in an ecological SRE, the American Robin and the Short-tailed Shrew are well suited to evaluate the risk from bioaccumulating and biomagnifying contaminants such as PCBs.

Risks to omnivorous wildlife were evaluated using a food web model that assumed a mixed diet of plants and invertebrates for an avian model and plants, invertebrates, and small mammals for a mammalian model both with incidental soil ingestion. Dietary intake data and soil to ingestion media (plants, invertebrates, and mammal) (LANL, 2017; Nagy, 2001; Sample et al., 1998) were used to represent the concentration of PCBs evaluated in the food web model. **Table 3** provides the average body weight of the representative ecological receptors and the average daily food intake rate (FIR).

Table 4 provides the toxicity reference values (TRVs) for the lowest observable adverse effect level (LOAEL) on a known and observable endpoint for total PCB exposure for receptors in literature.

Table 3. Body Weight and Food Ingestion Rate

Receptor Species	Average Body Weight (kg)	Food Ingestion Rate (kg_{dw}/day)
American Robin	0.081 [a,b]	0.0120 [c]
Short-Tailed Shrew	0.0168 [a,b]	0.0022 [c]

Note:
*Dietary assumption is in % (kg_{ww}/day).
**Incidental soil ingestion is in % (kg_{dw}/day).
General Information: See individual organism references for sources, units, and conversions. Moisture content of food items is assumed to be 84% for soil invertebrates and 85% for terrestrial plants (USEPA, 1993).

[a] Range for adult body weights listed by USEPA (1993).
[b] Average body weight was used to determine conservative ingestion rates for this evaluation.
[c] Food ingestion rate was calculated using the algorithm for insectivorous birds (FIR (g_{dw}/day) = 0.0540*BW^$^{0.705}$) & mammals (FIR (g_{dw}/day) = 0.373*BW^$^{0.622}$) developed by Nagy (2001) using average body weight.

Table 4. Toxicity Reference Values

COPC	TRV (mg/kg_{bw}/day)	Endpoint	Effect	Timeframe	Species	Primary Reference
Total PCBs	**1.8**	LOAEL	Reproduction	Chronic	Pheasant	Sample et al., 1996
Total PCBs	**0.68**	LOAEL	Reproduction	Chronic	Mouse	Sample et al., 1996

Note:
Toxicity reference values were established from the literature.

Estimation of Exposure

The Phase 1 Reach of the Site is bordered by a nearly continuous forested riparian corridor, which provides habitat for a variety of bird and mammal species. Accordingly, this SRE of PCBs in soil was performed reach wide. For purposes of ecological risk to the Robin and Shrew, the riparian corridor can be treated as a single unit because from a suitable habitat standpoint,there is no meaningful distinction between exposure areas for either species. Nonetheless, estimation of potential ecological risk was also conducted for the nine exposure areas along the Phase 1 Reach, similar to the human health SRE for soil, to estimate potential ecological risks from exposure.

The risk models for Short-tailed Shrew and American Robin each require a soil concentration value to be used, which is referred to as the Exposure Point Concentration (EPC). EPA recommends calculation of the 95% upper confidence limit (UCL) on the arithmetic mean concentration for estimation of risk. The 95% UCL for total PCBs for each exposure area was calculated using ProUCL (version 5.2) and is displayed in **Table 5** below. For both species, food chain models were used to estimate a daily dose of PCBs through ingestion of food and incidental soil ingestion during foraging. These estimated doses were compared with (i.e., divided by) Toxicity Reference Values (TRVs) developed from feeding studies to represent a Lowest Observable Adverse Effect Level (LOAEL) dose. The resulting value is a unitless Hazard Quotient (HQ). HQs indicate if a contaminant and exposure pathway pose potential adverse ecological risks. A HQ greater than 1 indicates that there is potential for unacceptable risk for effects to occur with how much a specific ecological receptor is exposed to the contaminant with known toxicity effects.

HQs were calculated based on the LOAEL toxicity reference values. As demonstrated in **Table 5**, HQs above 1 were calculated for all exposure areas for the shrew and for exposure areas 1, 2, 3, 4, 6, 7, 8 for the robin. It is noted that for multiple exposure areas of soil data including exposure areas 1, 6, 7, and 9, there are fewer than 10 samples included in the calculation of the 95% UCL, which increases uncertainty of the risk estimates for these areas.

Table 5. Exposure Point Concentrations for PCBs in Soil and Associated LOAEL-Based HQ

Exposure Areas	Exposure Point Concentrations of PCBs (mg/kg)	Short-tailed Shrew HQ	American Robin HQ
Exposure Area 1	101	112.9	13.8
Exposure Area 2	56.14	62.7	7.7
Exposure Area 3	18.27	20.4	2.5
Exposure Area 4	18.69	20.9	2.6
Exposure Area 5	3.68	4.1	0.5
Exposure Area 6	202	225.7	27.7
Exposure Area 7	315.2	352.2	43.2
Exposure Area 8	9.60	10.7	1.3
Exposure Area 9	7.10	7.9	1.0

Note:
Highlighted results exceed HQ of 1 for ecological receptors in that Exposure Area.

Calculation of Preliminary Removal Goals

Table 6 provides a list of assumptions on life history traits of the representative ecological receptors used to generate the preliminary removal goals. **Table 7** provides the preliminary removal goal calculations that result in an acceptable risk (LOAEL-Based HQ of 1) to the representative ecological receptors. For this reason, preliminary removal goals were calculated to provide a target range to protective of both omnivorous mammals and omnivorous birds. Exposure to contaminant loads greater than 0.89mg/kg for the short-tailed shrew and 7.3mg/kg for the American robin have potential to induce unacceptable ecological risk with the known toxicity of total PCBs. Maintaining an environmental concentration closer to total exposure values resulting in an HQ of 1 for the short-tailed shrew reduces the likelihood that there will be unacceptable risk to that ecological receptor from contaminant loads greater than the LOAEL.

Table 6. Assumptions for Preliminary Removal Goal Calculations

ASSUMPTIONS FOR THE AMERICAN ROBIN		
Average Body Weight (kg)		0.081
Exposure Duration (assumes winter migration out of area for November through February)		0.67
Area Use Factor		1
Soil Consumption Rate (kg_{dw}/day)	0.9% of FIR	0.00011
Terrestrial Plant Consumption Rate (kg_{ww}/day)	63% of FIR	0.0502
Soil Invt. Consumption Rate (kg_{ww}/day)	37% of FIR	0.0277

ASSUMPTIONS FOR THE SHORT-TAILED SHREW		
Average Body Weight (kg)		0.0168
Exposure Duration		1
Area Use Factor		1
Soil Consumption Rate (kg_{dw}/day)	0.9% of FIR	0.000019
Terrestrial Plant Consumption Rate (kg_{ww}/day)	5% of FIR	0.00072
Soil Invt. Consumption Rate (kg_{ww}/day)	87% of FIR	0.01173
Small Mammal Consumption Rate (kg_{ww}/day)	8% of FIR	0.00054

Note:

Assumptions are from Nagy, 2001.

Table 7: Calculations and HQ-derived Preliminary Removal Goals for the American Robin

Supporting Calculations for Derivation of Preliminary Removal Goals										
COC	**Selected Soil Preliminary Removal Goal for the American Robin (mg/kg)**	**Media Concentrations**			**Potential Daily Dose (mg/kg$_{bw}$/day)**				LOAEL-Based TRV (mg/kg$_{dw}$/day)	LOAEL-Based HQ
		Soil (mg/kg$_{dw}$)	Terrestrial Plant (mg/kg$_{ww}$)	Soil Invertebrate (mg/kg$_{ww}$)	Soil	Terrestrial Plant	Soil Invertebrate	Total Daily Dose		
Total PCBs	**7.3**	7.3	0.0095	7.8	0.0065	0.0039	1.8	1.8	1.8	1

Table 8: Calculations and HQ-derived Preliminary Removal Goals for the Short-tailed Shrew

Supporting Calculations for Derivation of Preliminary Removal Goals												
COC	**Selected Soil Preliminary Removal Goal for the Short-tailed Shrew (mg/kg)**	**Media Concentrations**				**Potential Daily Dose (mg/kg$_{bw}$/day)**					LOAEL-Based TRV (mg/kg$_{dw}$/day)	LOAEL-Based HQ
		Soil (mg/kg$_{dw}$)	Terrestrial Plant (mg/kg$_{ww}$)	Soil Invertebrate (mg/kg$_{ww}$)	Small Mammal (mg/kg$_{ww}$)	Soil	Terrestrial Plant	Soil Invertebrate	Small Mammal	Total Daily Dose		
Total PCBs	**0.89**	0.89	0.0012	0.95	0.28	0.001	0.000049	0.666	0.00914	0.68	0.68	1

Note:

The selected preliminary removal goals in **Table 7** and **Table 8** (7.3 mg/kg for the American Robin and 0.89 mg/kg for the Short-tailed Shrew) is the soil concentration corresponding to an HQ of 1 using a LOAEL-based TRV with the TRV=TDD.

Conclusion

The preliminary removal goal range generated for the Short-tailed Shrew and American Robin are based on a HQ of 1 and are calculated using a total daily dose from exposures to the total PCB concentration in the soils within the Phase 1 Reach of the Lower Neponset River Superfund Site. The HQ of 1 TDD calculations result in a TDD of 0.89 mg/kg for the Short-tailed Shrew and a TDD of 7.3mg/kg for the American Robin. Terrestrial birds and mammals are foraging on food items across the Phase 1 Reach riparian areas and therefore the selection of a removal cleanup goal reflective of the omnivorous mammal would reduce the potential for unacceptable risk to ecological receptors. Additionally, consistent with the EPA's *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*, consideration of the possible long-term action and corresponding cleanup levels are recommended.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square, Suite 100
BOSTON, MA 02109-3912

TECHNICAL MEMORANDUM
To: Tristan Pluta, Natalie Burgo
From: Courtney Carroll
Date: March 10, 2025
RE: Streamlined Human Health Risk Evaluation of Polychlorinated Biphenyls (PCBs) in Soil for the Lower Neponset River Superfund Site

Background:

The purpose of this technical memorandum is to present a streamlined human health risk evaluation (SRE) for soils within the FEMA 100-year floodplain at the Lower Neponset River Superfund Site (the Site). The Site is a 3.7-mile segment of the Neponset River between its confluence with Mother Brook in Hyde Park, Massachusetts (MA), downstream to the Walter Chocolate Baker Dam in Dorchester and Milton, MA. This SRE is focused on the most upstream mile of the Site, referred to as the Phase 1 Reach, which is located between the Mother Brook and Neponset River confluence and the Tileston and Hollingsworth (T&H) Dam.

Am SRE is intermediate in scope between a limited risk evaluation undertaken for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions. Consistent with the EPA's *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (EPA, 1993), streamlined risk evaluations were conducted for the Phase 1 Reach to justify a removal action and identify current or potential exposures that could be prevented.

The SREs are focused on PCBs, which were identified as the primary contaminants at the Site. This assumption is supported by a review of the Phase 1 data, which indicates PCBs are widespread and of high concentration in some areas. PCB-specific preliminary removal goals for the Phase 1 Reach were developed to support the selection of cleanup levels. In this SRE, a range of human health preliminary removal goals were calculated based upon a range of target cancer risk levels (TCR) and target hazard quotients (THQ) based upon direct contact (incidental ingestion and dermal contact) exposure pathways. A noted in EPA guidance, "[s]ince removal and remedial action cleanup levels may differ, all early action decisions should consider the possible long-term action and corresponding cleanup levels" (EPA, 1993). Accordingly, the preliminary removal goals were developed to support the development of RAA cleanup levels in consideration of the future remedial action and potential corresponding cleanup levels.[1]

Below, **Table 1** includes a list of definitions for the parameters used in the risk evaluation and **Table 2** provides the formulas used in the risk evaluation.

---

[1] The preliminary removal goals developed for this EE/CA and are not intended to preclude the development of future preliminary remediation goals during the remedial process.

Table 1. Definitions

Acronym	Definition	Units
ABS	Absorption Factor (chemical specific)	unitless
ADD	Average Daily Dose (non-cancer)	mg/kg/day
AF	Adherence Factor	mg/cm^2-event
AT- C	Averaging Time - cancer	days
AT- NC	Averaging Time - non-cancer	days
BW	Body Weight	kg
CF	Conversion Factor	kg/mg
CS	Concentration in soil	mg/kg
CSF	Cancer Slope Factor	per mg/kg/day
ED	Exposure Duration	years
EF	Exposure Frequency	days/year
EV	Event Frequency	events/day
FI	Fraction ingested	unitless
HQ	Hazard Quotient	unitless
ILCR	Increased Lifetime Cancer Risk	unitless
IR	Intake Rate	mg/day
LADD	Lifetime Average Daily Dose (cancer)	mg/kg/day
RBA	Relative Bioavailability	unitless
RfD	Reference Dose	mg/kg/day
SA	Skin Surface Area	cm^2

Table 2. Formulas

Term	Formula
Ingestion Intake	Intake (mg/kg-day) = $\frac{CS \times IR \times EF \times ED \times CF \times FI \times RBA}{BW \times AT}$
Dermal Intake	Intake (mg/kg-day) = $\frac{CS \times SA \times AF \times ABS \times EV \times EF \times ED \times CF}{BW \times AT}$
HQ	HQ = ADD / RfD
ILCR	ILCR = CSF x LADD

The Phase 1 Reach is bordered by residential, recreational, commercial, and industrial properties with approximately 8,229 people living within 0.25 miles of the Site. There are approximately 30 residential properties within 250 feet of the Phase 1 Reach. Accordingly, this SRE of PCBs in soil was performed for nine exposure areas along the Phase 1 Reach to estimate potential human health risks from exposure associated with recreational activities that may occur. A residential scenario is also included in the risk evaluation due to the proximity of residential properties to the riverbanks.

Estimation of Exposure:

In risk assessment, to evaluate the magnitude of potential human exposures, the concentrations of PCBs in soil must be estimated. An estimate of this concentration is referred to as an Exposure Point Concentration (EPC). EPA recommends calculation of the 95% upper confidence limit (UCL) on the arithmetic mean concentration for estimation of risk. The 95% UCL for total PCBs for each exposure area was calculated using ProUCL (version 5.2) and is displayed in **Table 3** below. It is noted that for multiple in exposure areas 1, 6, 7, and 9, there are fewer than 10 samples included in the calculation of the 95% UCL, which increases uncertainty of the risk estimates for these areas.

Table 3. Exposure Point Concentrations for Total PCBs in Soil

Exposure Areas	Exposure Point Concentrations of PCBs (mg/kg)
Exposure Area 1	101
Exposure Area 2	56.14
Exposure Area 3	18.27
Exposure Area 4	18.69
Exposure Area 5	3.68
Exposure Area 6	49.99
Exposure Area 7	103.9
Exposure Area 8	9.60
Exposure Area 9	7.10

Risk Evaluation:

Risk calculations for PCBs in soil were calculated for the nine exposure areas of the Site using the EPCs obtained from ProUCL for both a recreational and a residential scenario. The risk calculations combine estimates of exposure with toxicity data to develop estimates of non-cancer health hazards and cancer risks. The exposure and toxicity assumptions used in the risk calculations are presented in **Table 4** below.

Table 4. Exposure and Toxicity Assumptions

Exposure Assumptions Recreator	Parameter	units	Reference
Ingestion Rate Child Resident/Recreator	200	mg/kg	USEPA 2014
Ingestion Rate Adult Resident/Recreator	100	mg/kg	USEPA 2014
Skin Surface Area Child Resident/Recreator	2,373	cm^2	USEPA 2014
Skin Surface Area Adult Resident/Recreator	6,032	cm^2	USEPA 2014
Adherence Factor Child Recreator	0.3	mg/cm^2-event	USEPA 2004
Adherence Factor Child Resident	0.2	mg/cm^2-event	USEPA 2004
Adherence Factor Adult Recreator	0.2	mg/cm^2-event	USEPA 2004
Adherence Factor Adult Resident	0.07	mg/cm^2-event	USEPA 2004
Absorption Factor PCBs	0.14	unitless	Chemical specific
Event Frequency	1	events/day	Professional judgment
Fraction Ingested	1	unitless	Professional judgment

Exposure Frequency Recreator	78	days/year	Assumes a recreational receptor may contact sediment 3 days per week during the 6 warmest months of the year.
Exposure Frequency Resident	350	days/year	USEPA 2014
Exposure Duration Child	6	years	USEPA 2014
Exposure Duration Adult	20	years	USEPA 2014
Body Weight Child	15	kg	USEPA 2014
Body Weight Adult	80	kg	USEPA 2014
Averaging time (cancer)	25,550	days	USEPA 2014
Averaging time (non-cancer)	2,190	days	USEPA 2014
Conversion Factor	1E-06	kg/mg	--
Relative Bioavailability	1E+00	unitless	Chemical specific
Reference Dose (non-cancer)	2E-05	mg/kg-day	IRIS
Cancer Slope Factor (cancer)	2E+00	per mg/kg/day	IRIS

Increased Lifetime Cancer Risks (ILCRs) are quantified as a probability (*e.g.* one in one million, or 1E-06) of getting cancer over a lifetime due to exposure related to the Site. An ILCR of 1E-04 (one in 10,000 or 1E-04) is the upper EPA cancer risk limit at Superfund sites. Cancer risk of 1E-04 is consistent with EPA's derivation of RMLs, therefore a cancer risk above 1E-04 is considered unacceptable for this risk evaluation. Potential carcinogenic risk is evaluated by averaging exposure over a normal human lifetime, which, based on USEPA guidance (2014), is assumed to be 70 years. The combined adult/child age group was used to calculate carcinogenic risk for recreator and resident.

Non-cancer risk was estimated for a child and adult for recreator and resident; however, only the results for child recreator and resident for non-cancer are presented in the results summary below because the child is the most conservative receptor. Non-cancer risk is quantified as a Hazard Quotient (HQ) which is the ratio of the exposure dose divided by the oral Reference Dose (RfD). A HQ of 3 is consistent with EPA's derivation of RMLs, therefore a HQ above 3 is considered unacceptable for this risk evaluation.

The toxicity factors for total PCBs were those for "high-risk" PCBs as designated in EPA's Integrated Risk Information System (IRIS). These toxicity factors are the same as those recommended for Aroclor 1254. The oral cancer slope factor (CSF) is 2.0 per mg/kg/day. The oral Reference Dose (RfD) is 2.0 x 10^{-5} mg/kg/day for non-cancer. These values are current as of 2025.

The results of the risk evaluation for PCBs in soil for the nine exposure areas of the Site are presented below in **Table 5** and **Table 6**. Additionally, the risk calculations are also provided in Excel as an attachment. Highlighted results in **Table 5** and **Table 6** indicate values that exceed EPA TCR of 1E-04 or THQ of 3. The risk results show that for the recreator scenario soil concentrations of PCBs exceed a HQ of 3 for multiple exposure areas of the Site including exposure areas 1, 2, 3, 4, 6 and 7. No risk criteria were exceeded for exposure areas 5, 8, and 9 for the recreational scenario. Risk results for the resident indicate that multiple exposure areas exceed a HQ of 3 including 1, 2, 3, 4, 6, 7, 8, and 9. Additionally, exposure areas 1, 2, and 7 exceed an ILCR of 1E-04 for the residential scenario. Exposure areas 5 does not exceed an ILCR of 1E-04 or the RML HQ of 3 for the residential receptor. The results of the risk evaluation indicate that there is potential for adverse effects from exposure to PCBs in soil for both the recreator and resident scenarios for multiple exposure areas throughout the Phase 1 Reach. Further discussion of these results and how they relate to other site-specific information will be discussed in the EE/CA.

Table 5. Recreator Estimated Risk Results for Total PCBs in Soil

Exposure Areas	Exposure Point Concentration	Child HQ	ILCR (lifetime, child/adult)
1	101	**22**	1E-04 (1 in 10,000)
2	56.14	**12**	6E-05 (6 in 100,000)
3	18.27	**4**	2E-05 (2 in 100,000)
4	18.69	**4**	2E-05 (2 in 100,000)
5	3.68	1	4E-06 (4 in 1,000,000)
6	49.99	**11**	6E-05 (6 in 100,000)
7	103.9	**22**	1E-04 (1 in 10,000)
8	9.60	2	1E-05 (1 in 100,000)
9	7.10	2	8E-06 (8 in 1,000,000)

Note:
Risk results are rounded to nearest whole number.
Highlighted results exceed a TCR of 1E-04 or THQ of 3.

Table 6. Residential Estimated Risk Results for Total PCBs in Soil

Exposure Areas	Exposure Point Concentration	Child HQ	ILCR (lifetime, child/adult)
Exposure Area 1	101	86	3E-04 (3 in 10,000)
Exposure Area 2	56.14	48	2E-04 (2 in 10,000)
Exposure Area 3	18.27	16	6E-05 (6 in 100,000)
Exposure Area 4	18.69	16	6E-05 (6 in 100,000)
Exposure Area 5	3.68	3	1E-05 (1 in 100,000)
Exposure Area 6	49.99	43	1E-04 (1 in 10,000)
Exposure Area 7	103.9	88	3E-04 (3 in 10,000)
Exposure Area 8	9.60	8	3E-05 (3 in 100,000)
Exposure Area 9	7.10	6	2E-05 (2 in 100,000)

Note:
Risk results are rounded to nearest whole number.
Highlighted results exceed a TCR of 1E-04 or THQ of 3.

Calculation of Preliminary Removal Goals:

Provided below in **Table 7** and **Table 8** are risk-based preliminary removal goal calculations for total PCBs in soil. **Table 7** provides risk-based preliminary removal goals for a recreational user while **Table 8** provides risk-based preliminary removal goals for a resident. The preliminary removal goals for recreator were calculated using the EPA RSL/RML calculator in a site-specific mode with the exposure and toxicity assumptions provided in **Table 4**. For the residential receptor, the EPA RSL/RML calculator was used with all default exposure assumptions and toxicity values, which are also listed in **Table 4**.

Table 7. Calculation of Recreational Risk-Based Soil Preliminary Removal Goals for Total PCBs

Endpoint	Units	Total PCB preliminary removal goals – Soil Recreational Receptor (Ingestion and Direct Contact)			
Target Cancer Risk:		**1E-04**	**1E-04**	**1E-05**	**1E-06**
Target Hazard Quotient:		**3**	**1**	**1**	**1**
Cancer based preliminary removal goal (lifetime, adult/child)	mg/kg	87	87	9	1
Noncancer based preliminary removal goal (child)	mg/kg	15	5	5	5
Selected preliminary removal goal (lower of cancer/noncancer)	mg/kg	**15**	**5**	**5**	**1**

Note:

*preliminary removal goals are rounded to nearest whole number.

**preliminary removal goals are calculated using EPA RSL/RML calculator https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

Table 8. Calculation of Residential Risk-Based Soil Preliminary Removal Goals for Total PCBs

Endpoint	Units	Total PCB Preliminary Removal Goals – Soil Residential Receptor (Ingestion and Direct Contact)			
Target Cancer Risk:		**1E-04**	**1E-04**	**1E-05**	**1E-06**
Target Hazard Quotient:		**3**	**1**	**1**	**1**
Cancer based preliminary removal goals (lifetime, adult/child)	mg/kg	24	24	2	0.2
Noncancer based preliminary removal goals (child)	mg/kg	4	1	1	1
Selected preliminary removal goals (lower of cancer/noncancer)	mg/kg	**4**	**1**	**1**	**0.2**

Note:

*preliminary removal goals are rounded to nearest whole number

**preliminary removal goals are calculated using EPA RSL/RML calculator https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

Conclusion

The preliminary removal goal range generated for the residential and recreational receptors were calculated based upon a range of TCR levels and THQs based upon direct contact (incidental ingestion and dermal contact) exposure pathways. Throughout the Phase 1 Reach are numerous properties used for recreational and residential use, and consistent with the EPA's *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*, consideration of the possible long-term action and corresponding cleanup levels are recommended.

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APPENDIX E

EVALUATION OF REMAINING CONSTITUENTS IN PHASE 1 REACH SEDIMENT

AECOM
250 Apollo Drive
Chelmsford, MA 01824

Project name:
Phase 1 Reach – Lower Neponset River
Superfund Site

Project ref:
60703400

To:
Frederick R. Symmes, Weston Solutions, Inc.

From:
Maxwell Reis
Gemma Kirkwood
Betsy Ruffle
Sandy Paulsen

CC:
Kristine Carbonneau, AECOM
Mike Gardner, AECOM

Date:
April 4, 2025

Memo

Subject: Evaluation of Contaminants of Potential Concern Remaining in the Phase 1 Reach Sediment Post-NTCRA - Lower Neponset River

Overview and Purpose

Using the full Phase 1 sediment data set, which is available in the Data Evaluation Summary Memorandum – Phase 1 (AECOM, 2024a), AECOM conducted an evaluation to determine whether contaminants with elevated concentrations in sediment are likely to remain following implementation of the selected non-time critical removal action (NTCRA) alternative. This evaluation included all Phase 1 sediment analytes except for polychlorinated biphenyls (PCBs) and dioxins/furans. PCBs are the primary contaminants of concern (COCs) of the engineering evaluation/cost assessment (EE/CA), which is based upon the extent and level of risk associated with PCBs throughout the Phase 1 Reach. Dioxins/furans were not included per the Streamlined Risk Evaluation Report (AECOM, 2024b), which states that focusing on PCBs for the EE/CA would incorporate areas with elevated levels of dioxins and furans, based on a review of the Phase 1 data. The objective of the evaluation presented in this memorandum is to determine if remaining contaminants of potential concern (COPCs) may continue to pose a potential risk to human health and the environment following the completion of the selected removal action alternative (RAA).

Evaluation

Identify Contaminants of Potential Concern

The first part of this evaluation includes the following screening steps to identify COPCs:

1. Identify which analytes are detected in the Phase 1 Reach in 5% or more of samples;
2. Identify which analytes are at or above the human health and/or ecological Project Action Limit (PAL) established in the project Quality Assurance and Project Plan (QAPP)[1] in at least one sample; and
3. Identify which analytes are present at concentrations at or above the maximum concentration in background area sediment.

The initial screening is shown in **Table 1** and resulted in 46 COPCs.

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[1] PALs were updated, as needed, to reflect the latest USEPA Regional Screening Levels (RSLs) (November 2024).

It is important to note the baseline risk assessment is not complete, and the presence of COPCs above background concentrations and/or the PALs is not indicative of unacceptable risk.

Outcome of Sediment Samples Post-NTCRA

The EE/CA identifies three actionable RAAs that abate and stabilize PCB-contaminated sediment to varying degrees.[2] The outcomes of sediment samples after the completion of each respective RAA (*i.e.,* if the sample depth interval will be removed, stabilized with a carbon amended cap, or remain in place) are presented in **Table 2.** The outcomes of the samples for each RAA were based on the following:

- RAA 2 – Under this alternative, there are three types of sediment removal areas: Category 1) areas with principal threat waste (PTW) sediment (> 100 milligrams per kilogram [mg/kg] PCBs) that will be removed bank to bank, Category 2) areas of sediment with more isolated PCB exceedances of 100 mg/kg that may require pre-design investigation prior to final delineation of the sediment removal, and Category 3) “Contaminant Source Areas”, namely the Former Lewis Chemical Facility and the Tileston and Hollingsworth (T&H) Dam impoundment. The assumption is made that samples with PCBs < 100 mg/kg will remain in place in areas described by Categories 1 and 2. For areas described by Category 3, it is possible that the outcomes of pre-design investigations could result in some sample locations with PCBs <100 mg/kg remaining in place. However, for the purposes of this analysis, it is assumed that no samples will remain in place in “Contaminated Source Areas”. RAA-2 does not include stabilization of COCs or COPCs remaining in place with a carbon-amended cap.

- RAA 3 – Under this alternative, target dredge depths used for volume and cost estimating were used for each sediment sample location. This analysis assumes that for sample locations that are not in the vicinity of the T&H Dam, any samples with end depths below the target dredge depth remain in place. For locations in the vicinity of the T&H Dam (23A-0019, 23A-0020, 23A-0040, 23A-0059, 23A-0060, 23A-0066, 23A-0067, 23A-0068, 23A-0069, 23A-0070) it is assumed that no samples will remain in place due to the additional dredging that will be conducted as required to remove the T&H Dam. RAA-3 does not include stabilization of COCs or COPCs remaining in place with a carbon-amended cap.

- RAA 4 – Under this alternative, sediment samples will be dredged to 3 feet throughout Reach 1. For this analysis, it is assumed that samples with end depths that are at or shallower than 3 ft will be removed. For locations in the vicinity of the T&H Dam (23A-0019, 23A-0020, 23A-0040, 23A-0059, 23A-0060, 23A-0066, 23A-0067, 23A-0068, 23A-0069, 23A-0070) it is assumed that no samples will remain in place due to the additional dredging that will be conducted for dam removal. Additionally, sediment core locations adjacent to the Former Lewis Chemical Facility with samples that are deeper than 3 ft (23A-0062, 23A-0063, 23A-0064) will be removed to the full sample depth as additional excavation is required in this area. RAA-4 includes a carbon-amended cap throughout Reach 1 that will stabilize COCs and COPCs remaining in place.

Concentration of COPCs in Sediment Samples Remaining in Place Post-NTCRA

For RAA-2 and RAA-3, concentrations of COPCs for sediment samples that will remain in place post NTCRA are shown in **Tables 3 and 4,** respectively. The tables include a comparison of the concentrations with the human health and ecological PALs and the maximum concentration detected in background sediment. In the tables, concentrations that are at or above the maximum concentration detected in background area sediment are highlighted in yellow, concentrations that are at or above the human health PAL are underlined, and concentrations that are at or above the ecological PAL are italicized.

For RAA-4 a carbon-amended cap will be included throughout Reach 1 that will cover any sediment that remains in place. During the design phase, the final configuration of the cap (thickness and % amendment) will be

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[2] The fourth alternative, RAA-1, is not included in this evaluation because it is a “no action” alternative used for comparison purposes.

specified to isolate (i.e., stabilize) any COPCs that remain in sediment following dredging under RAA-4. Consequently, there will be no COPCs remaining under this alternative for the purposes of this evaluation as they will be removed or “stabilized”. As such, a table presenting the concentrations of COPCs that will remain in place post-NTCRA for RAA-4 is not provided herein.

Summary

Table 5 presents a summary of the COPCs for RAA-2 and RAA-3, including the number of detections at or above the maximum detected concentration within reference areas and PALs. It is important to note the baseline risk assessment is not complete, and the presence of COPCs above background area concentrations and/or the PALs is not indicative of unacceptable risk. However, the tally or “count” of COPC detections above background area concentrations and/or the PALs are summarized below for each RAA for informational purposes. A summary is provided below for RAA-2 and RAA-3.

Under RAA-2, 78 samples above background area concentrations and/or the PALs will remain in place after implementation of the RAA. For those samples:

- Concentrations are below the maximum detected concentration in background areas in all samples that remain in place for 9 of 46 COPCs. Detected concentrations are at or above the maximum detected concentration in background areas in ten samples or fewer for the remaining COPCs, with the exception of nickel (18 samples), vanadium (14 samples), delta BHC (49 samples), endrin (26 samples), gamma BHC (45 samples), heptachlor epoxide (24 samples), 1-methylnaphthalene (28), 2-methylnaphthalene (43 samples), acenaphthene (41 samples), acenaphthylene (47 samples), fluorene (46 samples), and phenol (14 samples).

- Concentrations are below the human health PAL in all samples that remain in place for 32 out of 46 COPCs. Detected concentrations are at or above the human health PAL in ten samples or fewer for the remaining COPCs, with the exception of aluminum (18 samples), arsenic (78 samples), cadmium (11 samples), chromium (78 samples), cobalt (77 samples), delta BHC (47 samples), and gamma BHC (15 samples).

- Concentrations are below the ecological PAL in all samples that remain in place for 13 out of 46 COPCs. Detected concentrations are at or above the ecological PAL in ten samples or fewer for the remaining COPCs, with the exception of barium (66 samples), copper (19 samples), lead (30 samples), mercury (19 samples), zinc (18 samples), gamma BHC (25 samples), p,p’-DDT (38 samples), acenaphthene (21 samples), acenaphthylene (18 samples), anthracene (13 samples), benzo(a)anthracene (18 samples), chrysene (13 samples), fluoranthene (13 samples), phenanthrene (14 samples), and acetone (13 samples).

Under RAA-3, 62 samples above background area concentrations and/or the PALs will remain in place after implementation of the RAA. For those samples:

- Concentrations are below the maximum detected concentration in background areas in all samples that remain in place for 14 of 46 COPCs. Detected concentrations are at or above the maximum detected concentration in background areas in ten samples or fewer for the remaining COPCs, with the exception of nickel (16 samples), vanadium (12 samples), delta BHC (35 samples), endrin (17 samples), gamma BHC (35 samples), heptachlor epoxide (17 samples), 1-methylnaphthalene (18 samples), 2-methylnaphthalene (31 samples), acenaphthene (29 samples), acenaphthylene (35 samples), and fluorene (33 samples).

- Concentrations are below the human health PAL in all samples that remain in place for 33 out of 46 COPCs. Detected concentrations are at or above the human health PAL in ten samples or fewer for the remaining COPCs, with the exception of aluminum (15 samples), arsenic (62 samples), chromium (62), cobalt (62 samples), and delta BHC (33 samples).

- Concentrations are below the ecological PAL in all samples that remain in place for 14 out of 46 COPCs. Detected concentrations are at or above the ecological PAL in ten samples of fewer for the remaining COPCs, with the exception of barium (48 samples), lead (17 samples), mercury (11 samples), gamma BHC (18 samples), and p,p'-DDT (25 samples).

References

- AECOM, 2024a. Technical memorandum: Data Evaluation Summary Memorandum – Phase 1. Lower Neponset River Superfund Site. Technical Memorandum. November 2024.
- AECOM, 2024b. Final Streamlined Risk Evaluation, Lower Neponset River Superfund Site, Boston, Massachusetts. September 2024.

Tables

Table 1. COPC Screening of Phase 1 Reach Sediment

Group	Analyte	Samples within Phase 1 Reach	Detections within Phase 1 Reach	Frequency of Detection within Phase 1 Reach (%)	Human Health PAL (mg/kg)	Ecological PAL (mg/kg)	Maximum Detection Within Phase 1 Reach (mg/kg)	Number of Human Health PAL Exceedances	Number of Ecological PAL Exceedances	Maximum Detection in Background Areas (mg/kg)	Is Maximum Detection Within Phase 1 Reach > Maximum Detection in Background Areas?	COPC?
Cyanide	CYANIDE	159	10	6.3	2.4		3.8	1		1.8	Yes	Y
Metals	Aluminum	158	158	100.0	7700	25000	18000	37	0	13000	Yes	Y
Metals	Antimony	158	37	23.4	3.1	2	14	5	26	1.3	Yes	Y
Metals	Arsenic	158	158	100.0	0.68	9.8	42	158	3	12	Yes	Y
Metals	Barium	158	158	100.0	1500	20	330	0	134	320	Yes	Y
Metals	Cadmium	158	97	61.4	0.71	1	4.3	64	51	2.4	Yes	Y
Metals	Chromium, Total	158	158	100.0	0.95	43.4	170	158	43	100	Yes	Y
Metals	Cobalt	158	158	100.0	2.3	50	25	154	0	12	Yes	Y
Metals	Copper	158	158	100.0	310	31.6	260	0	72	170	Yes	Y
Metals	Lead	158	158	100.0	200	35.8	490	33	92	310	Yes	Y
Metals	Mercury	158	129	81.6	2.3	0.18	3.2	6	77	0.91	Yes	Y
Metals	Nickel	158	158	100.0	140	22.7	150	1	9	18	Yes	Y
Metals	Silver	158	104	65.8	39	1	2.7	0	16	0.48	Yes	Y
Metals	Thallium	158	16	10.1	0.078		0.18	153		0.14	Yes	Y
Metals	Vanadium	158	158	100.0	39		55	15		31	Yes	Y
Metals	Zinc	158	158	100.0	2300	121	1200	0	69	410	Yes	Y
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	155	109	70.3	0.00038		0.28	152			Yes	Y
Pesticides	ENDOSULFAN SULFATE	155	39	25.2	38	0.0007	0.022	0	144		Yes	Y
Pesticides	ENDRIN	155	79	51.0	1.9	0.00222	0.043	0	101		Yes	Y
Pesticides	GAMMA BHC (LINDANE)	155	107	69.0	0.0057	0.0024	0.98	70	93		Yes	Y
Pesticides	HEPTACHLOR EPOXIDE	155	68	43.9	0.07	0.00247	0.29	4	71		Yes	Y
Pesticides	P,P'-DDT (4,4'-DDT)	155	124	80.0	1.9	0.001	0.22	0	129	0.012	Yes	Y
SVOCs	1-Methylnaphthalene	157	74	47.1	0.018	0.141	0.39	15	4		Yes	Y
SVOCs	2-Methylnaphthalene	157	107	68.2	24	0.0202	0.52	0	16		Yes	Y
SVOCs	Acenaphthene	157	95	60.5	360	0.0067	2.7	0	70		Yes	Y
SVOCs	ACENAPHTHYLENE	157	107	68.2	360	0.0059	0.27	0	70		Yes	Y
SVOCs	ANTHRACENE	157	114	72.6	1800	0.057	12	0	22	3	Yes	Y
SVOCs	BENZO(A)ANTHRACENE	158	144	91.1	1.1	0.108	15	6	43	8.5	Yes	Y
SVOCs	Benzo(K)Fluoranthene	157	135	86.0	11	0.24	4.6	0	10	2.8	Yes	Y
SVOCs	CARBAZOLE	157	11	7.0	240	0.069	0.98	0	155		Yes	Y
SVOCs	CHRYSENE	158	142	89.9	110	0.166	9.9	0	26	8	Yes	Y
SVOCs	Dibenzofuran	157	14	8.9	7.8	0.51	2.1	0	22		Yes	Y
SVOCs	DIMETHYL PHTHALATE	157	12	7.6	5100	0.678	0.37	0	7		Yes	Y
SVOCs	FLUORANTHENE	158	143	90.5	240	0.423	35	0	25	16	Yes	Y
SVOCs	FLUORENE	157	105	66.9	240	0.077	7.6	0	12		Yes	Y
SVOCs	Naphthalene	157	131	83.4	2	0.176	0.88	0	4	0.79	Yes	Y
SVOCs	PHENANTHRENE	159	141	88.7	1800	0.204	42	0	32	9	Yes	Y
SVOCs	PHENOL	157	27	17.2	1900	0.175	0.3	0	132		Yes	Y
VOCs	1,1-Dichloroethane	140	8	5.7	3.6	0.02	0.26	0	14		Yes	Y
VOCs	ACETONE	140	114	81.4	7000	0.065	1.1	0	63	0.54	Yes	Y
VOCs	CARBON DISULFIDE	140	30	21.4	77	0.0078	0.031	0	43	0.0074	Yes	Y
VOCs	CIS-1,2-DICHLOROETHYLENE	140	12	8.6	6.3	0.432	4.2	0	2	0.0021	Yes	Y
VOCs	Tetrachloroethylene (PCE)	140	9	6.4	8.1	0.002	0.56	0	139		Yes	Y
VOCs	Toluene	140	8	5.7	490	0.01	0.046	0	44		Yes	Y
VOCs	Trichloroethylene (TCE)	140	9	6.4	0.41	0.078	0.23	0	1	0.0013	Yes	Y
VOCs	Vinyl Chloride	140	10	7.1	0.059	0.482	1.4	3	2		Yes	Y

Notes:
COPC - contaminant of potential concern
FOD - frequency of detect
mg/kg - milligram per kilogram
PAL - project action limit
SVOC - semi-volatile organic compound
VOC - volatile organic compound
An analyte was identified as a COPC if the frequency of detection within the Phase 1 reach was 5% or more, if at least one sample within the Phase 1 reach was at or above the human health and/or ecological PAL, and if the maxmum detection within the Phase 1 reach was at or above the maximum detection in reference areas.
Summary statistics are based on the average of parent and duplicate pairs with the exception of SVOCs.
If the reportable results for SVOCs were based on the same method for the parent and duplicate sample the results were averaged.
If the reportable results for SVOCs were based on different methods for the parent and duplicate sample both results were included in the summary statistics.

Table 2. Outcome of Phase 1 Reach Sediment Sample Location

Location	Sample	Depth Interval	Remedial Action Alternative 2	Remedial Action Alternative 3	Remedial Action Alternative 4
23A-0001-PLC1	23A-0001-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0001-PLC1	23A-0001-PLC1-BS	0.5 - 1.7 ft	Remains in Place	Removed	Removed
23A-0001-PLC1	23A-0001-PLC1-CS	1.7 - 2.3 ft	Remains in Place	Removed	Removed
23A-0002-PLC2	23A-0002-PLC2-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0002-PLC2	23A-0002-PLC2-BS	0.5 - 3.1 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0002-PLC2	23A-0002-PLC2-CS	3.1 - 6 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0003-PLC1	23A-0003-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0004-B2C1	23A-0004-B2C1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0004-B2C1	23A-0004-B2C1-BS	0.5 - 1.4 ft	Removed	Removed	Removed
23A-0005-PLC1	23A-0005-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0005-PLC1	23A-0005-PLC1-BS	0.5 - 1.5 ft	Removed	Remains in Place	Removed
23A-0005-PLC1	23A-0005-PLC1-CS	1.5 - 2 ft	Removed	Remains in Place	Removed
23A-0006-PLC2	23A-0006-PLC2-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0006-PLC2	23A-0006-PLC2-BS	0.5 - 1.8 ft	Remains in Place	Removed	Removed
23A-0007-PLC1	23A-0007-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0007-PLC1	23A-0007-PLC1-BS	0.5 - 1.7 ft	Removed	Removed	Removed
23A-0007-PLC1	23A-0007-PLC1-CS	1.7 - 5.1 ft	Removed	Removed	Remains in Place (Stabilized, Capped)
23A-0008-PLC1	23A-0008-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0008-PLC1	23A-0008-PLC1-BS	0.5 - 3 ft	Remains in Place	Remains in Place	Removed
23A-0008-PLC1	23A-0008-PLC1-CS	3 - 6.2 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0009-PLC1	23A-0009-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0009-PLC1	23A-0009-PLC1-BS	0.5 - 3 ft	Removed	Removed	Removed
23A-0009-PLC1	23A-0009-PLC1-CS	3 - 5.7 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0010-PLC1	23A-0010-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0010-PLC1	23A-0010-PLC1-BS	0.5 - 1.5 ft	Removed	Removed	Removed
23A-0010-PLC1	23A-0010-PLC1-CS	1.5 - 3.4 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0011-B1C1	23A-0011-B1C1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0011-B1C1	23A-0011-B1C1-BS	0.5 - 2.9 ft	Remains in Place	Remains in Place	Removed
23A-0011-B1C1	23A-0011-B1C1-CS	2.9 - 3.6 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0012-PLC1	23A-0012-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0012-PLC1	23A-0012-PLC1-BS	0.5 - 1.7 ft	Remains in Place	Remains in Place	Removed
23A-0012-PLC1	23A-0012-PLC1-CS	1.7 - 3 ft	Remains in Place	Remains in Place	Removed
23A-0014-PLC2	23A-0014-PLC2-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0015-PLC1	23A-0015-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0015-PLC1	23A-0015-PLC1-BS	0.5 - 1.5 ft	Remains in Place	Remains in Place	Removed
23A-0015-PLC1	23A-0015-PLC1-CS	1.5 - 2.9 ft	Remains in Place	Remains in Place	Removed
23A-0018-PLC1	23A-0018-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0018-PLC1	23A-0018-PLC1-BS	0.5 - 4.4 ft	Removed	Removed	Remains in Place (Stabilized, Capped)
23A-0018-PLC1	23A-0018-PLC1-CS	4.4 - 5.5 ft	Removed	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0019-B2C2	23A-0019-B2C2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0019-B2C2	23A-0019-B2C2-BS	0.5 - 3.1 ft	Removed	Removed	Removed
23A-0019-B2C2	23A-0019-B2C2-CS	3.1 - 4.3 ft	Removed	Removed	Removed
23A-0020-PLC1	23A-0020-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0020-PLC1	23A-0020-PLC2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0020-PLC1	23A-0020-PLC1-BS	0.5 - 2.3 ft	Removed	Removed	Removed
23A-0020-PLC1	23A-0020-PLC1-CS	2.3 - 4 ft	Removed	Removed	Removed
23A-0021-PLC1	23A-0021-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0021-PLC1	23A-0021-PLC1-BS	0.5 - 1.5 ft	Remains in Place	Remains in Place	Removed
23A-0022-PLC1	23A-0022-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0022-PLC1	23A-0022-PLC1-BS	0.5 - 2.8 ft	Remains in Place	Remains in Place	Removed
23A-0022-PLC1	23A-0022-PLC1-CS	2.8 - 4 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0023-B2C2	23A-0023-B2C2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0023-B2C2	23A-0023-B2C2-BS	0.5 - 1.7 ft	Removed	Removed	Removed
23A-0024-PLC2	23A-0024-PLC2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0025-B1C1	23A-0025-B1C1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0025-B1C1	23A-0025-B1C1-BS	0.5 - 1.3 ft	Removed	Removed	Removed
23A-0026-B1C1	23A-0026-B1C1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0026-B1C1	23A-0026-B1C1-BS	0.5 - 1.6 ft	Removed	Remains in Place	Removed
23A-0028-PLC2	23A-0028-PLC2-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0028-PLC2	23A-0028-PLC2-BS	0.5 - 1.7 ft	Remains in Place	Remains in Place	Removed
23A-0029-PLC1	23A-0029-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0029-PLC1	23A-0029-PLC1-BS	0.5 - 3.3 ft	Removed	Removed	Remains in Place (Stabilized, Capped)
23A-0029-PLC1	23A-0029-PLC1-CS	3.3 - 5.8 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0030-PLC1	23A-0030-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0030-PLC1	23A-0030-PLC1-BS	0.5 - 1.8 ft	Removed	Removed	Removed
23A-0030-PLC1	23A-0030-PLC1-CS	1.8 - 2.8 ft	Remains in Place	Removed	Removed
23A-0031-PLC1	23A-0031-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0031-PLC1	23A-0031-PLC1-BS	0.5 - 1.5 ft	Removed	Removed	Removed
23A-0031-PLC1	23A-0031-PLC1-CS	1.5 - 3.4 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0032-PLC1	23A-0032-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0032-PLC1	23A-0032-PLC1-BS	0.5 - 1.7 ft	Remains in Place	Remains in Place	Removed
23A-0032-PLC1	23A-0032-PLC1-CS	1.7 - 3 ft	Remains in Place	Remains in Place	Removed
23A-0033-B2C1	23A-0033-B2C1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0033-B2C1	23A-0033-B2C1-BS	0.5 - 1.7 ft	Remains in Place	Remains in Place	Removed
23A-0033-B2C1	23A-0033-B2C1-CS	1.7 - 2.7 ft	Remains in Place	Remains in Place	Removed
23A-0034-PLC1	23A-0034-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0034-PLC1	23A-0034-PLC1-BS	0.5 - 1.4 ft	Remains in Place	Remains in Place	Removed
23A-0034-PLC1	23A-0034-PLC1-CS	1.4 - 2.4 ft	Remains in Place	Remains in Place	Removed
23A-0036-PLC3	23A-0036-PLC3-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0037-B2C1	23A-0037-B2C1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0039-PLC1	23A-0039-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0039-PLC1	23A-0039-PLC1-BS	0.5 - 2 ft	Removed	Remains in Place	Removed
23A-0039-PLC1	23A-0039-PLC1-CS	2 - 3 ft	Removed	Remains in Place	Removed
23A-0040-PLC1	23A-0040-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0040-PLC1	23A-0040-PLC1-BS	0.5 - 1.4 ft	Removed	Removed	Removed
23A-0040-PLC1	23A-0040-PLC1-CS	1.4 - 5.6 ft	Removed	Removed	Removed
23A-0041-PLC1	23A-0041-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0041-PLC1	23A-0041-PLC1-BS	0.5 - 1 ft	Remains in Place	Removed	Removed
23A-0042-PLC1	23A-0042-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0042-PLC1	23A-0042-PLC1-BS	0.5 - 1.9 ft	Remains in Place	Removed	Removed
23A-0042-PLC1	23A-0042-PLC1-CS	1.9 - 2.7 ft	Remains in Place	Remains in Place	Removed
23A-0043-PLC1	23A-0043-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0043-PLC1	23A-0043-PLC1-BS	0.5 - 1.6 ft	Remains in Place	Remains in Place	Removed
23A-0044-PLC1	23A-0044-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0045-PLC3	23A-0045-PLC3-AS	0 - 0.5 ft	Removed	Removed	Removed

Table 2. Outcome of Phase 1 Reach Sediment Sample Location

Location	Sample	Depth Interval	Remedial Action Alternative 2	Remedial Action Alternative 3	Remedial Action Alternative 4
23A-0046-PLC2	23A-0046-PLC2-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0046-PLC2	23A-0046-PLC2-BS	0.5 - 1.4 ft	Remains in Place	Removed	Removed
23A-0046-PLC2	23A-0046-PLC2-CS	1.4 - 2.4 ft	Remains in Place	Remains in Place	Removed
23A-0048-PLC1	23A-0048-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0048-PLC1	23A-0048-PLC1-BS	0.5 - 3.2 ft	Removed	Removed	Remains in Place (Stabilized, Capped)
23A-0048-PLC1	23A-0048-PLC1-CS	3.2 - 5 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0049-B2C1	23A-0049-B2C1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0049-B2C1	23A-0049-B2C1-BS	0.5 - 2.2 ft	Removed	Removed	Removed
23A-0049-B2C1	23A-0049-B2C1-CS	2.2 - 3.2 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0050-B2C1	23A-0050-B2C1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0050-B2C1	23A-0050-B2C1-BS	0.5 - 2.7 ft	Remains in Place	Removed	Removed
23A-0050-B2C1	23A-0050-B2C1-CS	2.7 - 3.2 ft	Remains in Place	Removed	Remains in Place (Stabilized, Capped)
23A-0051-PLC1	23A-0051-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0051-PLC1	23A-0051-PLC1-BS	0.5 - 2.2 ft	Remains in Place	Removed	Removed
23A-0051-PLC1	23A-0051-PLC1-CS	2.2 - 3.4 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0052-PLC1	23A-0052-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0052-PLC1	23A-0052-PLC1-BS	0.5 - 1.9 ft	Remains in Place	Remains in Place	Removed
23A-0053-B1C1	23A-0053-B1C1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0053-B1C1	23A-0053-B1C1-BS	0.5 - 3.2 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0053-B1C1	23A-0053-B1C1-CS	3.2 - 5.7 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0054-PLC2	23A-0054-PLC2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0054-PLC2	23A-0054-PLC2-BS	0.5 - 1.5 ft	Removed	Removed	Removed
23A-0054-PLC2	23A-0054-PLC2-CS	1.5 - 3 ft	Remains in Place	Remains in Place	Removed
23A-0055-B1C1	23A-0055-B1C1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0055-B1C1	23A-0055-B1C1-BS	0.5 - 2.1 ft	Remains in Place	Remains in Place	Removed
23A-0055-B1C1	23A-0055-B1C1-CS	2.1 - 3.4 ft	Remains in Place	Remains in Place	Remains in Place (Stabilized, Capped)
23A-0056-B2C1	23A-0056-PLC1-AS	0 - 0.5 ft	Remains in Place	Remains in Place	Removed
23A-0056-B2C1	23A-0056-PLC1-BS	0.5 - 2 ft	Remains in Place	Remains in Place	Removed
23A-0057-PLC2	23A-0057-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0057-PLC2	23A-0057-PLC1-BS	0.5 - 1.5 ft	Remains in Place	Removed	Removed
23A-0057-PLC2	23A-0057-PLC1-CS	1.5 - 2.5 ft	Remains in Place	Removed	Removed
23A-0058-PLC1	23A-0058-PLC1-AS	0 - 0.5 ft	Remains in Place	Removed	Removed
23A-0058-PLC1	23A-0058-PLC2-BS	0.5 - 2 ft	Remains in Place	Remains in Place	Removed
23A-0059-PLC1	23A-0059-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0059-PLC1	23A-0059-PLC1-BS	0.5 - 1.2 ft	Removed	Removed	Removed
23A-0059-PLC1	23A-0059-PLC1-CS	1.2 - 2 ft	Removed	Removed	Removed
23A-0060-PLC1	23A-0060-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0060-PLC1	23A-0060-PLC1-BS	0.5 - 2 ft	Removed	Removed	Removed
23A-0060-PLC1	23A-0060-PLC1-CS	2 - 3.6 ft	Removed	Removed	Removed
23A-0061-PLC1	23A-0061-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0061-PLC1	23A-0061-PLC1-BS	0.5 - 1.7 ft	Removed	Removed	Removed
23A-0061-PLC1	23A-0061-PLC1-CS	1.7 - 2.7 ft	Removed	Removed	Removed
23A-0062-PLC1	23A-0062-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0062-PLC1	23A-0062-PLC1-BS	0.5 - 3 ft	Removed	Removed	Removed
23A-0062-PLC1	23A-0062-PLC1-CS	3 - 4.7 ft	Removed	Removed	Removed
23A-0063-PLC1	23A-0063-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0063-PLC1	23A-0063-PLC1-BS	0.5 - 3.7 ft	Removed	Removed	Removed
23A-0063-PLC1	23A-0063-PLC1-CS	3.7 - 4.9 ft	Removed	Remains in Place	Removed
23A-0064-PLC1	23A-0064-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0064-PLC1	23A-0064-PLC1-BS	0.5 - 3.7 ft	Removed	Removed	Removed
23A-0064-PLC1	23A-0064-PLC1-CS	3.7 - 5.7 ft	Removed	Removed	Removed
23A-0065-PLC1	23A-0065-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0066-PLC1	23A-0066-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0066-PLC1	23A-0066-PLC1-BS	0.5 - 1.7 ft	Removed	Removed	Removed
23A-0067-PLC1	23A-0067-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0067-PLC1	23A-0067-PLC1-BS	0.5 - 2.3 ft	Removed	Removed	Removed
23A-0067-PLC1	23A-0067-PLC1-CS	2.3 - 2.9 ft	Removed	Removed	Removed
23A-0068-PLC2	23A-0068-PLC2-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0068-PLC2	23A-0068-PLC2-BS	0.5 - 0.9 ft	Removed	Removed	Removed
23A-0069-PLC1	23A-0069-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0069-PLC1	23A-0069-PLC1-BS	0.5 - 3.4 ft	Removed	Removed	Removed
23A-0069-PLC1	23A-0069-PLC1-CS	3.4 - 6 ft	Removed	Removed	Removed
23A-0070-PLC1	23A-0070-PLC1-AS	0 - 0.5 ft	Removed	Removed	Removed
23A-0070-PLC1	23A-0070-PLC1-BS	0.5 - 2.3 ft	Removed	Removed	Removed
23A-0070-PLC1	23A-0070-PLC1-CS	2.3 - 4.2 ft	Removed	Removed	Removed

Notes

Samples that will remain in place after completion of each remedial action alternative are highlighted in yellow.

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0001-PLC1	23A-0001-PLC1	23A-0001-PLC1	23A-0002-PLC2	23A-0002-PLC2	23A-0002-PLC2	23A-0003-PLC1
					Sample Name	23A-0001-PLC1-AS	23A-0001-PLC1-BS	23A-0001-PLC1-CS	23A-0002-PLC2-AS	23A-0002-PLC2-BS	23A-0002-PLC2-CS	23A-0003-PLC1-AS
					Sample Date	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 1.7 ft	1.7 - 2.3 ft	0 - 0.5 ft	0.5 - 3.1 ft	3.1 - 6 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		R	R	0.83 J-	R	R	R	R
Metals	Aluminum	mg/kg	13000	7700	25000	3200	4100	3300	4400	5300	4600	7100
Metals	Antimony	mg/kg	1.3	3.1	2	0.89	< 0.94 U	< 0.98 U	< 1.3 U	< 0.90 U	< 1.0 U	< 0.91 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.8 J	7.7 J+	3.3 J	2.9 J+	2.0 J	1.2 J	2.7 J
Metals	Barium	mg/kg	320	1500	20	*56*	*210*	*29*	*40*	*27*	*21*	*44*
Metals	Cadmium	mg/kg	2.4	0.71	1	0.30 J	0.57	0.22 J	0.28 J	< 0.45 U	< 0.52 U	< 0.45 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	18 JEB	20 EB	34 JEB	20 EB	11	7.9	20 JEB
Metals	Cobalt	mg/kg	12	2.3	50	6.0	4.9	3.9	5.9	4.8	3.9	8.2
Metals	Copper	mg/kg	170	310	31.6	*52 J*	*51 J*	*60 J*	25 J	9.6 J	7.3 J	22 J
Metals	Lead	mg/kg	310	200	35.8	*74*	*310*	*97*	*38*	3.5	3.1	8.5
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.075 J	0.094 J	0.087 J	*0.23*	< 0.11 U	< 0.10 U	0.022 J
Metals	Nickel	mg/kg	18	140	22.7	14 J	12	17 J	9.5	8.4	6.6	20 J
Metals	Silver	mg/kg	0.48	39	1	0.071 J	0.21 J	*1.5*	*1.4*	0.11 J	< 0.52 U	0.13 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.42 U	< 0.47 U	< 0.49 U	< 0.63 U	< 0.45 U	< 0.52 U	< 0.45 U
Metals	Vanadium	mg/kg	31	39		25	31 J	12	16 J	16 J	12 J	22
Metals	Zinc	mg/kg	410	2300	121	*220 JEB*	*340 EB*	*170 JEB*	89 EB	19	15	39 JEB
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0075 J	0.02 J	0.028 J	0.00037 J	< 0.0019 U	< 0.0019 U	< 0.0019 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0039 UJ	*0.0019 J+*	< 0.0039 U	< 0.0055 U	< 0.0037 U	< 0.0038 U	< 0.0037 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0039 UJ	< 0.0039 U	*0.0084 J*	< 0.0055 U	< 0.0037 U	< 0.0038 U	< 0.0037 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.0027 J*	< 0.0020 U	*0.02 J*	< 0.0028 U	< 0.0019 U	< 0.0019 U	0.00049 J
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0020 UJ	*0.0033 J*	< 0.0020 U	0.0012 J	< 0.0019 U	< 0.0019 U	< 0.0019 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0037 J*	*0.0086 J*	*0.0077 J*	0.00058 J	< 0.0037 UJ	< 0.0038 UJ	< 0.0037 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0089 EB	< 0.2 U	*0.39*	< 0.0054 U	< 0.0037 U	< 0.0038 U	< 0.0037 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0080 EB	< 0.2 U	*0.52*	< 0.0054 U	< 0.0037 U	< 0.0038 U	< 0.0037 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	*0.048*	*0.12 J*	*1.6*	0.0016 J	< 0.0037 U	< 0.0038 U	0.0016 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	*0.036*	*0.27*	*0.097 J*	0.0015 J	< 0.0037 U	< 0.0038 U	0.0024 J
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	*0.13*	*0.8*	*2.3*	< 0.0054 U	< 0.0037 U	< 0.0038 U	0.0039
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	*0.48*	*1.6*	*4.7*	0.0060	0.00077 J	< 0.0038 J	0.022
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.13	*0.51*	*1.5 J-*	0.0069	0.00079 J	< 0.0038 U	0.01
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.39 U	*0.076 J*	*0.36 J*	< 0.54 U	< 0.37 U	< 0.38 U	< 0.37 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	*0.44*	*1.5*	*3.8*	0.0098	0.00094 J	< 0.0038 J	0.019
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.2 U	0.085 J	*1.2*	< 0.28 U	< 0.19 U	< 0.2 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.2 U	0.053 J	0.23	< 0.28 U	< 0.19 U	< 0.2 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	*0.89*	*3.6*	*10*	0.02	< 0.0037 U	< 0.0038 U	0.037
SVOCs	FLUORENE	mg/kg		240	0.077	0.056	*0.4*	*1.6*	< 0.0054 U	< 0.0037 U	< 0.0038 U	0.0012 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0079 EB	< 0.2 U	*0.88*	0.0020 JEB	< 0.0037 U	< 0.0038 U	0.0017 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	*0.71*	*3.8*	*11*	0.0071	< 0.0037 U	< 0.0038 U	0.018
SVOCs	PHENOL	mg/kg		1900	0.175	0.045 J	0.069 J	0.16 J	< 0.54 U	< 0.37 U	< 0.38 U	< 0.37 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	ACETONE	mg/kg	0.54	7000	0.065		*0.071*		< 0.024 UJ	< 0.011 UJ	< 0.011 UJ	
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	Toluene	mg/kg		490	0.01		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	
VOCs	Vinyl Chloride	mg/kg		0.059	0.482		< 0.0069 U		< 0.012 U	< 0.0054 U	< 0.0054 U	

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0006-PLC2	23A-0006-PLC2	23A-0008-PLC1	23A-0008-PLC1	23A-0009-PLC1	23A-0010-PLC1	23A-0011-B1C1
					Sample Name	23A-0006-PLC2-AS	23A-0006-PLC2-BS	23A-0008-PLC1-BS	23A-0008-PLC1-CS	23A-0009-PLC1-CS	23A-0010-PLC1-CS	23A-0011-B1C1-AS
					Sample Date	6/28/2023	6/28/2023	6/27/2023	6/27/2023	6/27/2023	6/26/2023	6/26/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 1.8 ft	0.5 - 3 ft	3 - 6.2 ft	3 - 5.7 ft	1.5 - 3.4 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		0.93 J-	< 0.62 U	< 0.56 U	< 0.62 U	< 0.59 U	< 0.53 U	0.26 J
Metals	Aluminum	mg/kg	13000	7700	25000	4600	3600	10000	12000	10000	4700	6200
Metals	Antimony	mg/kg	1.3	3.1	2	< 2.6 U	< 0.85 U	< 1.1 U	< 0.94 U	< 0.82 U	0.059 J	1.5
Metals	Arsenic	mg/kg	12	0.68	9.8	4.9	1.5	5.3	4.0	3.8	1.6 J	8.6
Metals	Barium	mg/kg	320	1500	20	*95*	*27*	*51*	*49*	*40*	*26 J*	*130*
Metals	Cadmium	mg/kg	2.4	0.71	1	0.94 J	0.22 J	< 0.55 U	< 0.47 U	0.082 J	< 0.45 U	*1.9*
Metals	Chromium, Total	mg/kg	100	0.95	43.4	38	11	22	25	20	15	*59*
Metals	Cobalt	mg/kg	12	2.3	50	8.0	3.7	10	15	10	5.8	11
Metals	Copper	mg/kg	170	310	31.6	*48*	*36*	16	19	17	13	*69*
Metals	Lead	mg/kg	310	200	35.8	*110*	*110*	7.0	8.5	8.1	11	*150*
Metals	Mercury	mg/kg	0.91	2.3	0.18	*0.47 J-*	0.12	< 0.10 U	< 0.12 U	< 0.11 U	0.028 J	*0.84*
Metals	Nickel	mg/kg	18	140	22.7	10	7.9	19	*25*	19	10	13
Metals	Silver	mg/kg	0.48	39	1	0.35 J	0.11 J	< 0.55 U	< 0.47 U	< 0.41 U	< 0.45 U	0.48 J
Metals	Thallium	mg/kg	0.14	0.078		< 1.3 U	< 0.43 U	< 0.55 U	< 0.47 U	< 0.41 U	< 0.45 U	< 0.49 U
Metals	Vanadium	mg/kg	31	39		18	9.8	34	34	27	22	31
Metals	Zinc	mg/kg	410	2300	121	*240 J*	83 J	37 J	60 J	47 J	35	*290*
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0034 J	0.046	< 0.0019 U	< 0.0021 U	0.00080 J	0.00096 J	< 0.0079 UJ
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0099 UJ	< 0.0042 U	< 0.0038 U	< 0.0041 U	< 0.0040 U	< 0.0036 U	< 0.015 UJ
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0099 UJ	*0.0041 J*	< 0.0038 U	< 0.0041 U	0.00039 J	0.00034 J	< 0.015 UJ
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0051 UJ	*0.024 J*	< 0.0019 U	< 0.0021 U	*0.0024 J*	*0.0042 J*	< 0.0079 UJ
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0051 UJ	< 0.0022 U	< 0.0019 U	< 0.0021 U	< 0.0020 U	< 0.0019 U	< 0.0079 UJ
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0018 J*	*0.014 J+*	< 0.0038 U	< 0.0041 U	*0.0010 J*	< 0.0036 U	< 0.015 UJ
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0022 JEB	0.0058 JEB	< 0.0038 U	< 0.0041 U	< 0.0040 U	< 0.0036 U	< 0.015 UJ
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0099 UJ	0.0069 JEB	< 0.0038 U	< 0.0041 U	0.0011 JEB	< 0.0036 U	0.0036 JEB
SVOCs	Acenaphthene	mg/kg		360	0.0067	0.0057 J	*0.023*	< 0.0038 U	< 0.0041 U	< 0.0040 U	< 0.0036 UJ	0.0047 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0027 J	*0.017*	< 0.0038 U	< 0.0041 U	0.0028 J+	< 0.0036 U	< 0.015 UJ
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0033 J	*0.06*	< 0.0038 U	< 0.0041 U	0.0016 J+	< 0.0036 U	< 0.015 UJ
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.036 JEB	*0.28 EB*	0.00080 JEB	< 0.0041 U	0.014 JEB	0.0021 JEB	0.012 JEB
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.016 JEB	0.12 EB	< 0.0038 U	< 0.0041 U	0.0066 JEB	< 0.0036 U	0.012 JEB
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.99 UJ	< 0.42 U	< 0.38 U	< 0.41 U	< 0.4 U	< 0.36 U	< 1.5 UJ
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.033 JEB	*0.26 EB*	< 0.0038 U	< 0.0041 U	0.015 JEB	0.0019 JEB	0.021 JEB
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.51 UJ	< 0.22 U	< 0.19 U	< 0.21 U	< 0.2 U	< 0.19 U	< 0.79 UJ
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.51 UJ	< 0.22 U	< 0.19 U	< 0.21 U	< 0.2 U	< 0.19 U	< 0.79 UJ
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.088 JEB	*0.56*	0.0011 JEB	< 0.0041 U	0.019 JEB	0.0039 EB	0.047 JEB
SVOCs	FLUORENE	mg/kg		240	0.077	0.0052 JEB	0.026 EB	< 0.0038 U	< 0.0041 U	0.0014 JEB	< 0.0036 U	< 0.015 UJ
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0037 JEB	0.03 JEB	< 0.0038 U	< 0.0041 U	0.0017 JEB	0.0044 EB	0.021 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.053 J	*0.37*	< 0.0038 U	< 0.0041 U	0.011 J+	0.0015 J	0.016 J
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.99 UJ	0.082 J	< 0.38 U	< 0.41 U	< 0.4 U	< 0.36 U	< 1.5 UJ
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.013 UJ	< 0.0056 UJ	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	ACETONE	mg/kg	0.54	7000	0.065	*0.15 J*	0.017	0.018 J+	0.025 J+	< 0.014 U	0.017	*0.29 J*
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.013 UJ	< 0.0056 UJ	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	0.0086 J	0.0052 J-	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	*0.0029 J*	*0.025 J-*	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	Toluene	mg/kg		490	0.01	< 0.013 UJ	< 0.0056 UJ	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	0.0028 J	0.0035 J	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.013 UJ	< 0.0056 UJ	< 0.0052 U	< 0.0072 U	< 0.0072 U	< 0.0046 U	< 0.027 UJ

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0011-B1C1	23A-0011-B1C1	23A-0012-PLC1	23A-0012-PLC1	23A-0012-PLC1	23A-0014-PLC2	23A-0015-PLC1
					Sample Name	23A-0011-B1C1-BS	23A-0011-B1C1-CS	23A-0012-PLC1-AS	23A-0012-PLC1-BS	23A-0012-PLC1-CS	23A-0014-PLC2-AS	23A-0015-PLC1-AS
					Sample Date	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/25/2023	6/24/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0.5 - 2.9 ft	2.9 - 3.6 ft	0 - 0.5 ft	0.5 - 1.7 ft	1.7 - 3 ft	0 - 0.5 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 1.1 U	< 0.53 U	< 0.55 U	< 0.58 U	< 0.61 U	< 0.61 U	< 0.49 U
Metals	Aluminum	mg/kg	13000	7700	25000	8300	4500	3200	10000	17000	3300	6000
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.7 U	< 0.95 U	< 0.98 U	< 0.98 U	< 1.1 U	< 0.97 U	1.6
Metals	Arsenic	mg/kg	12	0.68	9.8	6.1	2.0	1.8	2.2	2.0	9.5 J	6.6 J
Metals	Barium	mg/kg	320	1500	20	*86*	*40*	*31*	*56*	*80*	*23*	*110*
Metals	Cadmium	mg/kg	2.4	0.71	1	*2.8*	< 0.48 U	0.10 J	< 0.49 U	< 0.57 U	< 0.48 U	*1.6*
Metals	Chromium, Total	mg/kg	100	0.95	43.4	*79*	21	15	31	36	9.0 JEB	*53 JEB*
Metals	Cobalt	mg/kg	12	2.3	50	6.2	6.4	4.8	11	13	5.3 J	11 J
Metals	Copper	mg/kg	170	310	31.6	*100*	22	18	23	25	27 J	*64 J*
Metals	Lead	mg/kg	310	200	35.8	*270*	5.1	29	15	8.9	*69*	*130*
Metals	Mercury	mg/kg	0.91	2.3	0.18	*2.1*	0.035 J	0.078 J	0.11	0.055 J	0.046 J	*0.71*
Metals	Nickel	mg/kg	18	140	22.7	15	18	9.0	20	*27*	7.3 J	15 J
Metals	Silver	mg/kg	0.48	39	1	*1.2*	< 0.48 U	0.14 J	0.049 J	0.046 J	< 0.48 U	0.43 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.85 U	< 0.48 U	< 0.49 U	< 0.49 U	< 0.57 U	< 0.48 U	0.071 J
Metals	Vanadium	mg/kg	31	39		31	24	15	42	48	9.7	26
Metals	Zinc	mg/kg	410	2300	121	*280*	33	50	75	58	49 J	*310 J*
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0056 J	0.0011 J	0.00096 J	0.00084 J	< 0.0021 U	0.0019 J	< 0.0063 UJ
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0074 U	< 0.0037 U	0.00029 J	< 0.0039 U	< 0.0041 U	< 0.0041 U	< 0.012 UJ
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0074 U	< 0.0037 U	0.00046 J	< 0.0039 U	< 0.0041 U	0.00027 J	< 0.012 UJ
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.013 J*	0.00093 J	*0.0040 J*	0.0010 J	< 0.0021 U	*0.0046 J*	< 0.0063 UJ
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	0.0017 J+	< 0.0019 U	0.00069 J	0.00039 J	< 0.0021 U	< 0.0021 U	< 0.0063 UJ
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0055 J+*	0.00080 J	*0.0019 J*	0.00044 J	< 0.0041 U	*0.0014 J*	*0.0020 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0074 U	< 0.0037 U	0.0057 EB	0.0013 JEB	< 0.0041 U	0.0031 J	< 0.012 UJ
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0074 U	< 0.0037 U	0.0059 EB	0.0015 JEB	< 0.0041 U	0.0039 J	< 0.012 UJ
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0074 U	< 0.0037 U	*0.012*	0.0015 J+	< 0.0041 U	*0.0098 J*	0.0050 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0021 J	0.0019 J	*0.048*	0.0024 J+	< 0.0041 U	0.0030 J	< 0.012 UJ
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0074 U	0.0016 J	*0.096*	0.0027 J+	< 0.0041 U	0.017	0.013 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.012 JEB	0.0079 EB	*0.18 EB*	0.015 JEB	< 0.0041 U	0.074	0.057 J
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0073 JEB	0.0029 JEB	0.061 EB	0.0052 JEB	< 0.0041 U	0.035	0.028 J
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.74 U	< 0.37 U	< 0.38 U	< 0.39 U	< 0.41 U	< 0.41 U	< 1.2 UJ
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0093 JEB	0.0071 EB	0.14 EB	0.011 JEB	< 0.0041 U	0.076	0.064 J
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.38 U	< 0.19 U	0.039 J	< 0.2 U	< 0.21 U	< 0.21 U	< 0.63 UJ
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.38 U	< 0.19 U	< 0.19 U	< 0.2 U	< 0.21 U	< 0.21 U	< 0.63 UJ
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.019 JEB	0.019 EB	*0.46*	0.021 JEB	< 0.0041 U	0.19	0.15 J
SVOCs	FLUORENE	mg/kg		240	0.077	0.0018 JEB	< 0.0037 U	0.055 EB	0.0014 JEB	< 0.0041 U	0.011	0.0055 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0041 JEB	0.00093 JEB	0.014 EB	0.013 JEB	< 0.0041 U	0.022 EB	0.0040 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.0085	0.0048	*0.47*	0.012 J+	< 0.0041 U	0.12	0.063 J
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.74 U	< 0.37 U	< 0.38 U	0.08 J	< 0.41 U	< 0.41 U	< 1.2 UJ
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	ACETONE	mg/kg	0.54	7000	0.065	*0.16*	0.0064 J	< 0.011 U	0.028	0.013	0.022 J+	*0.39 JEB*
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	0.0034	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	Toluene	mg/kg		490	0.01	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U	< 0.0063 U	< 0.017 UJ

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0015-PLC1	23A-0015-PLC1	23A-0021-PLC1	23A-0021-PLC1	23A-0022-PLC1	23A-0022-PLC1	23A-0022-PLC1
					Sample Name	23A-0015-PLC1-BS	23A-0015-PLC1-CS	23A-0021-PLC1-AS	23A-0021-PLC1-BS	23A-0022-PLC1-AS	23A-0022-PLC1-BS	23A-0022-PLC1-CS
					Sample Date	6/24/2023	6/24/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0.5 - 1.5 ft	1.5 - 2.9 ft	0 - 0.5 ft	0.5 - 1.5 ft	0 - 0.5 ft	0.5 - 2.8 ft	2.8 - 4 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 1.2 U	< 0.55 U	R	R	0.28 J-	R	R
Metals	Aluminum	mg/kg	13000	7700	25000	4500	3200	4800	6000	5300	5100	4700
Metals	Antimony	mg/kg	1.3	3.1	2	< 2.2 U	< 0.88 U	< 0.93 U	< 1.0 U	< 0.93 U	< 0.96 U	< 0.83 U
Metals	Arsenic	mg/kg	12	0.68	9.8	4.4 J	1.8 J	1.3 J	0.91 J+	1.2 J+	1.1 J+	0.70 J+
Metals	Barium	mg/kg	320	1500	20	*80*	*30*	*23*	11	12	8.5	6.2
Metals	Cadmium	mg/kg	2.4	0.71	1	< 1.1 U	< 0.44 U	0.16 J	0.14 J	< 0.47 U	< 0.48 U	< 0.42 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	29 JEB	9.9 JEB	15 JEB	9.3 EB	14 EB	9.4 EB	6.7 EB
Metals	Cobalt	mg/kg	12	2.3	50	6.2 J	4.1 J	5.6	5.1	3.8	3.6	4.3
Metals	Copper	mg/kg	170	310	31.6	*41 J*	9.3 J	17 J	14 J	16 J	14 J	12 J
Metals	Lead	mg/kg	310	200	35.8	*71*	12	*74*	7.5	*68*	15	4.0
Metals	Mercury	mg/kg	0.91	2.3	0.18	*0.53*	0.061 J	0.073 J	0.022 J	0.061 J	0.065 J	< 0.10 U
Metals	Nickel	mg/kg	18	140	22.7	10 J	6.7 J	9.6 J	8.3	9.6	6.8	6.9
Metals	Silver	mg/kg	0.48	39	1	0.21 J	< 0.44 U	0.051 J	< 0.52 U	0.033 J	< 0.48 U	< 0.42 U
Metals	Thallium	mg/kg	0.14	0.078		< 1.1 U	< 0.44 U	< 0.47 U	< 0.52 U	< 0.47 U	< 0.48 U	< 0.42 U
Metals	Vanadium	mg/kg	31	39		19	9.6	17	15 J	10 J	9.7 J	8.3 J
Metals	Zinc	mg/kg	410	2300	121	*260 J*	42 J	50 JEB	23 EB	44 EB	33 EB	37 EB
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.00071 J	0.0017 J	< 0.0020 UJ	< 0.0019 U	0.0051 J	0.0070 J	0.00040 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0080 U	< 0.0036 U	< 0.0040 UJ	< 0.0036 U	< 0.0036 U	< 0.0036 U	< 0.0036 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0080 U	< 0.0036 U	< 0.0040 UJ	< 0.0036 U	0.0015 J	0.0021 J	< 0.0036 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.0021 J	*0.0059 J*	< 0.0020 UJ	< 0.0019 U	*0.0030 J*	0.0023 J	< 0.0018 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0041 U	< 0.0019 U	< 0.0020 UJ	< 0.0019 U	0.0021 J	*0.0040 J*	0.00031 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0011 J*	*0.0014 J*	0.00051 J-	0.00013 J	*0.0048 J*	*0.0096 J*	0.00089 J
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0017 J	< 0.0036 U	0.0028 JEB	< 0.0037 U	0.0037 EB	0.0026 JEB	< 0.0036 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0031 J	0.0011 J	0.0036 JEB	0.00096 JEB	0.0051 EB	0.0033 JEB	< 0.0036 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	0.0021 J	0.0013 J	*0.015*	0.0023 J	*0.0089 J*	0.0064 J	0.0010 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0032 J	0.0036	0.0023 J	0.0016 J	*0.0098*	*0.0088*	0.0018 J
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0054 J	0.0050	0.018	0.0052	0.02	0.02	0.0032 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.04	0.032	0.08	0.013	0.094	0.079	0.0092
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.021	0.012	0.034	0.0051	0.028	0.027	0.0035 J
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.8 U	< 0.36 U	< 0.4 U	< 0.37 U	< 0.36 U	< 0.36 U	< 0.36 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.052	0.027	0.062	0.011	0.089	0.07	0.0076
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.41 U	< 0.19 U	< 0.2 U	< 0.19 U	< 0.19 U	< 0.19 U	< 0.18 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.41 U	< 0.19 U	< 0.2 U	0.1 J	0.13 J	0.053 J	0.12 J
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.099	0.046	0.17	0.028	0.22	0.15	0.016
SVOCs	FLUORENE	mg/kg		240	0.077	0.0027 J	0.0021 J	0.013	0.0026 J	0.011	0.0070	0.0013 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.031 EB	0.0019 JEB	0.0072 EB	0.0018 JEB	0.0070 JEB	0.0045 JEB	0.0011 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.036	0.021	0.12	0.022	0.12	0.066	0.0098
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.8 U	< 0.36 U	< 0.4 U	< 0.37 U	< 0.36 U	0.065 J	< 0.36 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.013 UJ	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	*0.63 JEB*	0.011 JEB		< 0.012 U	< 0.012 UJ	0.014 J+	< 0.01 U
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.013 UJ	0.0010 J		< 0.0061 U	< 0.0060 U	0.0025 J	0.0041 J
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.013 UJ	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.013 U	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U
VOCs	Toluene	mg/kg		490	0.01	< 0.013 U	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.013 U	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.013 UJ	< 0.0048 U		< 0.0061 U	< 0.0060 U	< 0.0058 U	< 0.0052 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0028-PLC2	23A-0028-PLC2	23A-0029-PLC1	23A-0030-PLC1	23A-0031-PLC1	23A-0032-PLC1	23A-0032-PLC1
					Sample Name	23A-0028-PLC2-AS	23A-0028-PLC2-BS	23A-0029-PLC1-CS	23A-0030-PLC1-CS	23A-0031-PLC1-CS	23A-0032-PLC1-AS	23A-0032-PLC1-BS
					Sample Date	6/27/2023	6/27/2023	6/27/2023	6/27/2023	6/26/2023	6/26/2023	6/26/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 1.7 ft	3.3 - 5.8 ft	1.8 - 2.8 ft	1.5 - 3.4 ft	0 - 0.5 ft	0.5 - 1.7 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.59 U	< 0.53 U	< 0.55 U	< 0.53 U	< 0.63 U	< 0.53 U	< 0.61 U
Metals	Aluminum	mg/kg	13000	7700	25000	3600	6100	3500	2800	13000	6800	18000
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.92 U	< 0.96 U	< 0.96 U	< 1.0 U	< 1.1 U	< 0.90 U	< 0.84 U
Metals	Arsenic	mg/kg	12	0.68	9.8	1.4	2.5	1.5 J	1.4 J	3.6	2.6	5.8
Metals	Barium	mg/kg	320	1500	20	17	*28*	9.6 J	*32 J*	*60*	*39*	*91*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.46 U	< 0.48 U	< 0.48 U	0.17 J	< 0.55 U	< 0.45 U	< 0.42 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	8.9	13	8.2	18	22	17	34
Metals	Cobalt	mg/kg	12	2.3	50	3.4	6.8	4.7	6.7	13	6.6	13
Metals	Copper	mg/kg	170	310	31.6	13	22	13	11	19	14	20
Metals	Lead	mg/kg	310	200	35.8	15	9.3	4.9	9.9	11	11	9.9
Metals	Mercury	mg/kg	0.91	2.3	0.18	< 0.12 U	< 0.10 U	< 0.096 U	0.029 J	0.060 J	0.030 J	0.025 J
Metals	Nickel	mg/kg	18	140	22.7	7.2	18	9.3	11	*24*	12	*25*
Metals	Silver	mg/kg	0.48	39	1	0.18 J	< 0.48 U	< 0.48 U	0.056 J	< 0.55 U	0.041 J	< 0.42 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.46 U	< 0.48 U	< 0.48 U	< 0.51 U	< 0.55 U	< 0.45 U	< 0.42 U
Metals	Vanadium	mg/kg	31	39		11	21	13	19	41	23	46
Metals	Zinc	mg/kg	410	2300	121	32 J	29 J	24	33	58	48	51 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0014 J	< 0.0018 U	0.00064 J	0.018 J	0.00028 J	< 0.0018 U	< 0.0021 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0041 U	< 0.0036 U	< 0.0037 U	*0.00085 J*	< 0.0042 U	< 0.0036 U	< 0.0040 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0041 U	< 0.0036 U	< 0.0037 U	*0.0023 J*	< 0.0042 U	< 0.0036 U	< 0.0040 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.00092 J	R	0.00046 J	*0.021 J*	0.00049 J	< 0.0018 U	< 0.0021 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	0.0018 J	< 0.0018 U	< 0.0019 U	*0.0049 J*	0.00037 J	< 0.0018 U	< 0.0021 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0013 J*	0.00034 J	0.00039 J	*0.0086 J+*	0.00029 J	0.00031 J	< 0.0040 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.057 EB	< 0.0036 U	0.0022 JEB	< 0.0037 U	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	*0.066 EB*	< 0.0036 U	0.0024 JEB	< 0.0037 U	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	*0.13*	< 0.0036 U	0.0020 J	< 0.0037 UJ	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	*0.024*	0.0013 J+	0.0054	0.0033 J	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	*0.18*	0.0016 J+	0.0053	0.0023 J	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	*0.46 J-*	0.0070 EB	0.017 EB	0.014 EB	0.0010 JEB	0.0023 JEB	< 0.0040 U
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.12 JEB	0.0029 JEB	0.0087 EB	0.0059 EB	< 0.0042 U	0.0010 JEB	< 0.0040 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.41 U	< 0.36 U	< 0.37 U	< 0.37 U	< 0.42 U	< 0.21 U	< 0.4 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	*0.3 EB*	0.0061 EB	0.014 EB	0.012 EB	0.00094 JEB	0.0019 JEB	< 0.0040 U
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	0.11 J	< 0.18 U	< 0.19 U	< 0.19 U	< 0.22 U	< 0.11 U	< 0.21 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.21 U	< 0.18 U	< 0.19 U	< 0.19 U	< 0.22 U	< 0.11 U	< 0.21 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	*1.3*	0.0094 EB	0.021 EB	0.027 EB	0.0017 JEB	0.0038 JEB	< 0.0040 U
SVOCs	FLUORENE	mg/kg		240	0.077	*0.16 EB*	< 0.0036 U	0.0030 JEB	0.0017 JEB	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.097 EB	< 0.0036 U	0.0028 JEB	0.0030 JEB	< 0.0042 U	0.0043 EB	< 0.0040 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	*1.4*	0.0062 J+	0.012	0.013	0.0013 J	0.0012 J	< 0.0040 U
SVOCs	PHENOL	mg/kg		1900	0.175	0.054 J	< 0.36 U	< 0.37 U	< 0.37 U	< 0.42 U	< 0.21 U	< 0.4 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.0093 U		< 0.013 U	0.0078 J	< 0.013 U	< 0.011 U	< 0.014 U
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0046 U		< 0.0067 U	< 0.0068 U	< 0.0064 U	< 0.0056 U	< 0.0070 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0032-PLC1	23A-0033-B2C1	23A-0033-B2C1	23A-0033-B2C1	23A-0034-PLC1	23A-0034-PLC1	23A-0034-PLC1
					Sample Name	23A-0032-PLC1-CS	23A-0033-B2C1-AS	23A-0033-B2C1-BS	23A-0033-B2C1-CS	23A-0034-PLC1-AS	23A-0034-PLC1-BS	23A-0034-PLC1-CS
					Sample Date	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/25/2023	6/25/2023	6/25/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	1.7 - 3 ft	0 - 0.5 ft	0.5 - 1.7 ft	1.7 - 2.7 ft	0 - 0.5 ft	0.5 - 1.4 ft	1.4 - 2.4 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.63 U	< 1.0 U	< 0.57 U	< 0.55 U	0.36 J	< 0.53 U	< 0.57 U
Metals	Aluminum	mg/kg	13000	7700	25000	15000	5000	6200	13000 EB	2500	7600 EB	10000
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.3 U	< 1.9 U	< 1.1 U	< 0.84 UJ	< 1.1 U	< 0.82 UJ	< 1.1 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.2	6.6	1.2	1.6	4.9	1.7	2.0
Metals	Barium	mg/kg	320	1500	20	*57*	*97*	*51*	*78*	*41*	*53*	*75*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.64 U	0.95	< 0.53 U	< 0.42 U	0.51 J	< 0.41 U	< 0.57 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	25	30 EB	18 EB	30 EB	16 EB	16 EB	20 EB
Metals	Cobalt	mg/kg	12	2.3	50	12	8.8	8.0	12	4.4	6.5	8.3
Metals	Copper	mg/kg	170	310	31.6	17	*55*	16	22	29	14	15
Metals	Lead	mg/kg	310	200	35.8	7.6	*74*	7.2	8.2	*49*	23	7.1
Metals	Mercury	mg/kg	0.91	2.3	0.18	< 0.11 U	*0.18 J*	0.057 J	< 0.096 U	0.085 J	0.028 J	< 0.10 U
Metals	Nickel	mg/kg	18	140	22.7	21	*24*	15	21	12	11	16
Metals	Silver	mg/kg	0.48	39	1	< 0.64 U	0.16 J	< 0.53 U	< 0.42 U	0.065 J	< 0.41 U	< 0.57 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.64 U	< 0.93 U	< 0.53 U	0.17 J	< 0.54 U	0.065 J	< 0.57 U
Metals	Vanadium	mg/kg	31	39		39	18	27	37	12	21	28
Metals	Zinc	mg/kg	410	2300	121	47 J	*160*	33	50	*460*	40	35
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0022 U	0.0013 J	0.00090 J	< 0.0019 U	0.011 J	0.0016 J	< 0.0020 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0043 U	< 0.0070 U	< 0.0040 U	< 0.0037 U	*0.00080 J*	< 0.0037 U	< 0.0039 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0043 U	< 0.0070 U	< 0.0040 U	< 0.0037 U	0.0013 J	< 0.0037 U	< 0.0039 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0022 U	0.0017 J	0.0014 J	< 0.0019 U	*0.012 J*	*0.0045 J*	< 0.0020 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0022 U	< 0.0036 U	0.00047 J	< 0.0019 U	*0.0031 J*	< 0.0019 U	< 0.0020 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	< 0.0043 U	0.00071 J	0.00082 J	0.00011 J	*0.0069*	*0.0011 J*	< 0.0039 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0043 U	0.012 EB	< 0.0040 UJ	< 0.0037 U	0.0072	< 0.0037 U	< 0.0039 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0043 U	0.015 EB	< 0.0040 UJ	< 0.0037 U	0.0098	0.0012 J	< 0.0039 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0043 U	*0.069*	< 0.0040 UJ	< 0.0037 U	*0.015*	< 0.0037 U	< 0.0039 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0043 U	0.0044 J	< 0.0040 UJ	< 0.0037 U	*0.0092*	< 0.0037 U	< 0.0039 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0043 U	*0.068*	< 0.0040 UJ	< 0.0037 U	0.03	< 0.0037 U	< 0.0039 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	< 0.0043 U	*0.27 EB*	0.0012 JEB	< 0.0037 U	*0.13*	0.0019 J	0.0022 J
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	< 0.0043 U	0.075 JEB	R	< 0.0037 U	0.04 J-	0.00097 J	< 0.0039 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.43 U	< 0.7 U	< 0.4 U	< 0.37 U	< 0.41 U	< 0.37 U	< 0.24 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	< 0.0043 U	*0.28 EB*	0.0010 JEB	< 0.0037 U	0.11	0.0020 J	0.0016 J
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.22 U	< 0.36 U	< 0.2 U	< 0.19 U	< 0.21 U	< 0.19 U	< 0.12 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.22 U	< 0.36 U	< 0.2 U	< 0.19 U	< 0.21 U	< 0.19 U	< 0.12 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	< 0.0043 U	*0.43 EB*	0.0025 JEB	< 0.0037 U	0.3	0.0039	0.0034 J
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0043 U	0.069 EB	< 0.0040 UJ	< 0.0037 U	0.017	< 0.0037 U	< 0.0039 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	< 0.0043 U	0.025 EB	0.0047 JEB	< 0.0037 U	0.027 EB	0.015 EB	< 0.0039 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	< 0.0043 U	*0.81*	0.0023 J-	< 0.0037 U	0.2	0.0019 J	0.0019 J
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.43 U	< 0.7 U	< 0.4 U	< 0.37 U	< 0.41 U	< 0.37 U	< 0.24 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.015 U	0.038	0.0092 J	< 0.01 U	*0.15 J+*	0.014 J+	0.015 EB
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	0.0015 J	< 0.0054 U	< 0.0063 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0057 U	< 0.0054 U	< 0.0063 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0036-PLC3	23A-0037-B2C1	23A-0041-PLC1	23A-0041-PLC1	23A-0042-PLC1	23A-0042-PLC1	23A-0042-PLC1
					Sample Name	23A-0036-PLC3-AS	23A-0037-B2C1-AS	23A-0041-PLC1-AS	23A-0041-PLC1-BS	23A-0042-PLC1-AS	23A-0042-PLC1-BS	23A-0042-PLC1-CS
					Sample Date	6/24/2023	6/24/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/29/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0.5 - 1 ft	0 - 0.5 ft	0.5 - 1.9 ft	1.9 - 2.7 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.91 U	< 1.0 U	R	R	R	R	R
Metals	Aluminum	mg/kg	13000	7700	25000	2900	2800	5700	7600	2800	4800	4800
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.4 U	< 1.8 U	< 1.7 U	1.3	< 0.90 U	*7.9*	< 0.81 U
Metals	Arsenic	mg/kg	12	0.68	9.8	3.3 J	3.3 J	6.8 J+	6.5 J	2.1 J+	*42*	1.9 J+
Metals	Barium	mg/kg	320	1500	20	*51*	*29*	*53*	*45*	17	*23*	5.8
Metals	Cadmium	mg/kg	2.4	0.71	1	0.75	< 0.92 U	*1.7*	*1.5*	0.37 J	*4.0*	0.11 J
Metals	Chromium, Total	mg/kg	100	0.95	43.4	23 JEB	8.5 JEB	*59 EB*	*47 JEB*	11 EB	*170 EB*	11 EB
Metals	Cobalt	mg/kg	12	2.3	50	6.2 J	6.3 J	8.1	6.9	8.0	25	4.1
Metals	Copper	mg/kg	170	310	31.6	28 J	13 J	*85 J*	*57 J*	13 J	*260 J*	16 J
Metals	Lead	mg/kg	310	200	35.8	*54*	22	*200*	*210*	26	*280*	11
Metals	Mercury	mg/kg	0.91	2.3	0.18	*0.35*	*0.20*	*0.82*	*0.91*	0.13	*1.1*	0.049 J
Metals	Nickel	mg/kg	18	140	22.7	6.3 J	8.6 J	17	14 J	12	*150*	6.8
Metals	Silver	mg/kg	0.48	39	1	0.15 J	< 0.92 U	0.48 J	0.47 J	0.081 J	0.45 J	0.057 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.70 U	< 0.92 U	< 0.85 U	< 0.56 U	< 0.45 U	< 0.80 U	< 0.41 U
Metals	Vanadium	mg/kg	31	39		12	6.7	24 J	21	8.2 J	23 J	17 J
Metals	Zinc	mg/kg	410	2300	121	*140 J*	110 J	*280 EB*	*170 JEB*	70 EB	*490 EB*	30 EB
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.00048 J	< 0.0037 U	0.0061	0.023 J	0.00091 J-	0.03 J	
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0063 U	< 0.0072 U	*0.00084 J*	< 0.0055 U	< 0.0044 UJ	< 0.0060 U	
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0063 U	< 0.0072 U	0.00085 J	*0.0084 J+*	0.00051 J	0.0018 J	
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.00087 J	< 0.0037 U	*0.0027 J*	*0.0064 J*	< 0.0023 UJ	*0.012 J*	
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0032 U	0.0021 J	< 0.0036 U	< 0.0028 U	< 0.0023 UJ	*0.0047 J*	
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	0.00081 J	*0.0023 J*	*0.0056 J*	*0.0088 J+*	*0.0025 J*	*0.0092 J*	
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0063 U	< 0.0072 U	0.0018 JEB	0.0047 JEB	0.0077 EB	0.0048 JEB	0.0013 JEB
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0025 J	0.0027 J	0.0018 JEB	0.0048 JEB	0.0097 EB	0.0075 EB	0.0017 JEB
SVOCs	Acenaphthene	mg/kg		360	0.0067	0.0013 J	< 0.0072 U	0.0050 J	*0.015*	*0.036 J*	*0.013 J*	0.0027 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0063 U	< 0.0072 U	0.0030 J	*0.0087*	*0.022*	*0.01*	0.0025 J
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0015 J	0.0031 J	0.0039 J	0.049	*0.097*	0.029	0.0020 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.014	0.017	0.023	*0.15*	*0.29*	*0.14*	0.019
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0080	0.011	0.015	0.062	0.12	0.051	0.01
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.63 U	< 0.72 U	< 0.69 U	< 0.55 U	< 0.44 U	< 0.61 U	< 0.38 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.018	0.022	0.024	0.12	*0.27*	0.13	0.019
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.32 U	< 0.37 U	< 0.36 U	< 0.28 U	< 0.23 U	< 0.31 U	< 0.2 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.32 U	< 0.37 U	< 0.36 U	0.37	0.14 J	0.18 J	< 0.2 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.036	0.047	0.063	0.33	*0.68*	0.32	0.045
SVOCs	FLUORENE	mg/kg		240	0.077	0.0014 J	0.0015 J	0.0043 J	0.023	0.038	0.015	0.0021 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.023 EB	0.028 EB	0.0035 JEB	0.0073 EB	0.0095 JEB	0.0075 JEB	0.0027 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.019	0.018	0.038	0.18	*0.47*	0.12	0.015
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.63 U	< 0.72 U	< 0.69 U	0.089 J	0.065 J	< 0.61 U	< 0.38 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.021 U		*0.5*		0.035 J	*0.31*	
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.011 U		*0.03*		< 0.0061 U	*0.0096*	
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	
VOCs	Toluene	mg/kg		490	0.01	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.011 U		< 0.012 U		< 0.0061 U	< 0.0075 U	

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0043-PLC1	23A-0043-PLC1	23A-0046-PLC2	23A-0046-PLC2	23A-0046-PLC2	23A-0048-PLC1	23A-0049-B2C1
					Sample Name	23A-0043-PLC1-AS	23A-0043-PLC1-BS	23A-0046-PLC2-AS	23A-0046-PLC2-BS	23A-0046-PLC2-CS	23A-0048-PLC1-CS	23A-0049-B2C1-CS
					Sample Date	6/29/2023	6/29/2023	6/28/2023	6/28/2023	6/28/2023	6/27/2023	6/27/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 1.6 ft	0 - 0.5 ft	0.5 - 1.4 ft	1.4 - 2.4 ft	3.2 - 5 ft	2.2 - 3.2 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		0.39 J-	R	R	R	R	< 0.53 U	< 0.54 U
Metals	Aluminum	mg/kg	13000	7700	25000	3100	3800	3100	2800	3600	3800	4400
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.84 U	< 1.1 U	< 0.90 U	< 1.1 U	< 0.95 U	< 1.1 U	< 0.77 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.2 J	1.8 J+	1.2	1.9	1.2	1.7	1.2 J
Metals	Barium	mg/kg	320	1500	20	*27*	*24*	12	*20*	*21*	*20*	12 J
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.42 U	< 0.54 U	0.24 J	0.45 J	0.094 J	< 0.53 U	< 0.39 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	10 JEB	8.6 EB	5.2	4.6	7.0	8.0	12
Metals	Cobalt	mg/kg	12	2.3	50	4.3	4.0	2.0	2.4	3.3	4.4	4.6
Metals	Copper	mg/kg	170	310	31.6	28 J	8.0 J	23	28	24	9.0	9.0
Metals	Lead	mg/kg	310	200	35.8	32	5.2	*89*	*320*	*79*	4.4	9.8
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.12	0.024 J	0.073 J-	0.16 J-	0.082 J-	< 0.11 U	< 0.096 U
Metals	Nickel	mg/kg	18	140	22.7	7.4 J	6.4	5.7	6.7	5.5	6.9	6.8
Metals	Silver	mg/kg	0.48	39	1	*1.8*	0.47 J	0.077 J	0.061 J	< 0.47 U	< 0.53 U	0.046 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.42 U	< 0.54 U	< 0.45 U	< 0.55 U	< 0.47 U	< 0.53 U	< 0.39 U
Metals	Vanadium	mg/kg	31	39		15	10 J	4.4	6.6	7.3	9.7	12
Metals	Zinc	mg/kg	410	2300	121	67 JEB	28 EB	57 J	*150 J*	41 J	22 J	25
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0020 U	0.00046 J	0.0038 J	0.077 J	0.02 J	< 0.0019 U	0.0035 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0039 U	< 0.0037 U	< 0.0042 UJ	*0.0018 J*	< 0.0038 UJ	< 0.0036 U	< 0.0038 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0039 U	< 0.0037 U	0.00051 J	< 0.0039 UJ	0.0012 J	< 0.0036 U	0.00066 J
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.0010 J	< 0.0019 U	< 0.0022 UJ	*0.014 J*	< 0.0019 UJ	< 0.0019 U	*0.0024 J*
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0020 U	0.00061 J	< 0.0022 UJ	< 0.0020 UJ	*0.0032 J*	< 0.0019 U	0.00059 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.011*	*0.0012 J*	*0.0026 J*	*0.0074 J*	*0.0048 J*	< 0.0036 U	*0.0011 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0092 EB	0.00087 JEB	0.0032 J	0.0080 J	0.015 J	< 0.0036 U	< 0.0037 UJ
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0098 EB	0.00094 JEB	0.0034 JEB	0.012 JEB	*0.021 JEB*	< 0.0036 U	0.00096 JEB
SVOCs	Acenaphthene	mg/kg		360	0.0067	*0.033*	0.0019 J	*0.0085 J*	*0.034 J*	*0.039 J*	< 0.0036 U	0.0014 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	*0.014*	0.0019 J	*0.13 J*	*0.03 J*	*0.032 J*	0.0026 J	0.0037
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	*0.086*	0.0023 J	*0.14 J*	*0.063 J*	*0.1 J*	0.0027 J	0.0050 J-
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	*0.21*	0.015	*0.42 J*	*0.52 J*	*0.37 J*	0.02 EB	0.027 EB
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.074	0.0086	0.16 J	0.17 J	0.1 J	0.0073 EB	0.011 EB
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.39 U	< 0.37 U	< 0.42 UJ	< 0.39 UJ	< 0.38 UJ	< 0.36 U	< 0.37 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	*0.17*	0.016	*0.31 J*	*0.43 J*	*0.22 J*	0.015 EB	0.027 EB
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.2 U	< 0.19 U	< 0.22 UJ	< 0.2 UJ	0.044 J	< 0.19 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.2 U	0.057 J	< 0.22 UJ	< 0.2 UJ	< 0.19 UJ	< 0.19 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	*0.48*	0.031	*0.83 J*	*1.2 J*	*0.7 J*	0.034 EB	0.048 JEB
SVOCs	FLUORENE	mg/kg		240	0.077	0.042	0.0015 J	0.043 J	0.05 J	0.058 J	0.00093 JEB	0.0031 JEB
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.015 EB	0.0020 JEB	0.011 JEB	0.018 JEB	0.029 JEB	0.0010 JEB	0.0020 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	*0.44*	0.018	*0.32 J*	*0.72 J*	*0.55 J*	0.012	0.021 J-
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.39 U	< 0.37 U	0.05 J	0.061 J	< 0.38 UJ	< 0.36 U	< 0.37 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02		< 0.0071 U		< 0.0061 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065		< 0.014 U		0.025	0.024	< 0.0081 U	0.0053 J
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078		< 0.0071 U		0.0025 J	0.0020 J	< 0.0041 U	< 0.0047 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432		< 0.0071 U		< 0.0061 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002		< 0.0071 U		< 0.0061 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Toluene	mg/kg		490	0.01		< 0.0071 U		< 0.0061 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078		< 0.0071 U		< 0.0061 U	0.0016 J	< 0.0041 U	< 0.0047 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482		< 0.0071 U		< 0.0061 U	< 0.0060 U	< 0.0041 U	< 0.0047 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0050-B2C1	23A-0050-B2C1	23A-0050-B2C1	23A-0051-PLC1	23A-0051-PLC1	23A-0051-PLC1	23A-0052-PLC1
					Sample Name	23A-0050-B2C1-AS	23A-0050-B2C1-BS	23A-0050-B2C1-CS	23A-0051-PLC1-AS	23A-0051-PLC1-BS	23A-0051-PLC1-CS	23A-0052-PLC1-AS
					Sample Date	6/27/2023	6/27/2023	6/27/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 2.7 ft	2.7 - 3.2 ft	0 - 0.5 ft	0.5 - 2.2 ft	2.2 - 3.4 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.79 U	< 0.64 U	< 0.62 U	< 0.69 U	< 0.78 U	< 0.55 U	< 0.54 U
Metals	Aluminum	mg/kg	13000	7700	25000	1500	3800	11000	5300	8000	7800	3800
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.2 U	< 1.2 U	< 1.1 U	0.62 J	< 1.5 U	< 0.94 U	< 0.91 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.7 J	3.1 J	3.9	3.1 J	4.0 J	2.7 J	1.2
Metals	Barium	mg/kg	320	1500	20	*33 J*	*43 J*	*66*	*55 J*	*60 J*	*58 J*	18
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.60 U	0.51 J	< 0.53 U	0.64	0.53 J	0.11 J	< 0.46 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	17	19	30	35	*45*	12	8.9
Metals	Cobalt	mg/kg	12	2.3	50	3.2	6.5	14	6.3	6.5	7.0	4.8
Metals	Copper	mg/kg	170	310	31.6	23	*32*	19	*39*	*48*	15	10
Metals	Lead	mg/kg	310	200	35.8	*120*	*140*	12	*89*	*110*	11	5.9
Metals	Mercury	mg/kg	0.91	2.3	0.18	*0.18*	*0.18*	< 0.12 U	*0.56*	*0.81*	0.027 J	< 0.10 U
Metals	Nickel	mg/kg	18	140	22.7	7.0	8.5	*25*	10	12	10	7.6
Metals	Silver	mg/kg	0.48	39	1	0.054 J	0.14 J	< 0.53 U	0.19 J	0.21 J	< 0.47 U	< 0.46 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.60 U	< 0.61 U	< 0.53 U	< 0.59 U	< 0.76 U	< 0.47 U	< 0.46 U
Metals	Vanadium	mg/kg	31	39		9.2	24	38	20	26	24	19
Metals	Zinc	mg/kg	410	2300	121	82	100	61 J	110	120	29	47 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0054 J	0.01 J	< 0.0021 U	0.0046 J	0.0063 J	0.00084 J	
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	0.00038 J	*0.0014 J*	< 0.0042 U	< 0.0047 U	*0.00071 J*	< 0.0037 U	
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00070 J	0.0010 J	< 0.0042 U	0.0015 J	*0.0024 J*	0.00040 J	
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.0096 J+*	*0.023*	0.00072 J	*0.011 J*	*0.015 J*	0.00092 J	
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	*0.0028 J*	< 0.0023 U	< 0.0021 U	0.0013 J	*0.0029 J*	< 0.0019 U	
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0033 J*	*0.0045 J*	< 0.0042 U	*0.0033 J+*	*0.0061 J*	0.00051 J	
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0020 JEB	0.011 EB	< 0.0042 U	< 0.0047 U	< 0.0053 U	< 0.0037 U	< 0.0038 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0032 JEB	0.018 EB	< 0.0042 U	0.0011 JEB	0.0013 JEB	< 0.0037 U	< 0.0038 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	*0.0081 J*	*0.033 J*	< 0.0042 U	0.0019 J	0.0016 J	< 0.0037 UJ	< 0.0038 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	*0.0065*	*0.0099*	< 0.0042 U	0.0033 J	0.0020 J	0.0019 J	0.0015 J
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.016	0.033	< 0.0042 U	0.0051	0.0019 J	0.0013 J	0.0012 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	*0.15 EB*	*0.24 EB*	0.0012 JEB	0.02 EB	0.014 EB	0.0081 EB	0.0045 EB
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.055 EB	0.069 EB	< 0.0042 U	0.0086 EB	0.0083 EB	0.0029 JEB	0.0020 JEB
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.53 U	< 0.44 U	< 0.42 U	< 0.47 U	< 0.53 U	< 0.37 U	< 0.38 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.16 EB	*0.2 EB*	< 0.0042 U	0.022 EB	0.016 EB	0.0066 EB	0.0044 EB
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.27 U	< 0.23 U	< 0.21 U	< 0.24 U	< 0.27 U	< 0.19 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.27 U	< 0.23 U	< 0.21 U	< 0.24 U	< 0.27 U	< 0.19 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.28 EB	0.42	0.0032 JEB	0.033 EB	0.033 EB	0.013 EB	0.0094 EB
SVOCs	FLUORENE	mg/kg		240	0.077	0.0075 EB	0.041 EB	< 0.0042 U	0.0019 JEB	0.0014 JEB	< 0.0037 U	< 0.0038 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.017 EB	0.044 EB	< 0.0042 U	0.0021 JEB	0.0077 EB	0.00085 JEB	< 0.0038 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.14	*0.35*	< 0.0042 U	0.02	0.015	0.0050	0.0038
SVOCs	PHENOL	mg/kg		1900	0.175	0.11 J	0.055 J	< 0.42 U	< 0.47 U	< 0.53 U	< 0.37 U	< 0.38 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	ACETONE	mg/kg	0.54	7000	0.065	*0.17*	0.038			0.062	< 0.011 U	
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	Toluene	mg/kg		490	0.01	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.01 U	< 0.0065 U			< 0.0076 U	< 0.0055 U	

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0052-PLC1	23A-0053-B1C1	23A-0053-B1C1	23A-0053-B1C1	23A-0054-PLC2	23A-0055-B1C1	23A-0055-B1C1
					Sample Name	23A-0052-PLC1-BS	23A-0053-B1C1-AS	23A-0053-B1C1-BS	23A-0053-B1C1-CS	23A-0054-PLC2-CS	23A-0055-B1C1-AS	23A-0055-B1C1-BS
					Sample Date	6/26/2023	6/25/2023	6/25/2023	6/25/2023	6/25/2023	6/25/2023	6/25/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	0.5 - 1.9 ft	0 - 0.5 ft	0.5 - 3.2 ft	3.2 - 5.7 ft	1.5 - 3 ft	0 - 0.5 ft	0.5 - 2.1 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.57 U	< 0.48 U	< 0.64 U	< 0.53 U	< 0.59 U	< 0.56 U	< 0.59 U
Metals	Aluminum	mg/kg	13000	7700	25000	7600	5200 EB	5200	4400	10000 EB	3700	10000
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.0 U	1.2 J	< 0.87 U	< 0.81 U	< 1.0 UJ	< 0.94 U	< 1.2 U
Metals	Arsenic	mg/kg	12	0.68	9.8	1.3	5.2	1.7	0.81	1.4	1.5 J	2.6 J
Metals	Barium	mg/kg	320	1500	20	*41*	*84*	*22*	*22*	*69*	19	*75*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.50 U	*1.4*	0.14 J	< 0.40 U	< 0.51 U	< 0.47 U	< 0.59 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	20	33 EB	8.5 EB	9.6 EB	21 EB	8.7 JEB	26 JEB
Metals	Cobalt	mg/kg	12	2.3	50	7.3	11	3.4	4.4	8.9	5.1 J	9.0 J
Metals	Copper	mg/kg	170	310	31.6	14	*50*	15	8.3	18	8.0 J	18 J
Metals	Lead	mg/kg	310	200	35.8	6.5	*96*	*40*	3.4	7.8	8.9	7.2
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.075 J	*0.51*	0.037 J	< 0.092 U	< 0.11 U	0.043 J	< 0.11 U
Metals	Nickel	mg/kg	18	140	22.7	15	10	7.8	7.8	15	7.2 J	18 J
Metals	Silver	mg/kg	0.48	39	1	< 0.50 U	0.25 J	0.057 J	< 0.40 U	< 0.51 U	< 0.47 U	< 0.59 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.50 U	< 0.49 U	< 0.44 U	< 0.40 U	0.097 J	< 0.47 U	0.15 J
Metals	Vanadium	mg/kg	31	39		27	21	8.4	15	29	10	31
Metals	Zinc	mg/kg	410	2300	121	35	*250*	68	18	42	30 J	41 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0019 U	< 0.0070 UJ	0.0042 J	< 0.0019 U	0.00051 J	0.0018 J	< 0.0021 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0038 U	< 0.014 UJ	< 0.0043 U	< 0.0036 U	< 0.0040 U	< 0.0037 U	< 0.0041 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0038 U	0.0018 J	< 0.0043 U	< 0.0036 U	< 0.0040 U	< 0.0037 U	< 0.0041 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0019 U	0.0012 J	*0.0083 J*	< 0.0019 U	0.0013 J	0.0011 J	< 0.0021 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0019 U	< 0.0070 UJ	< 0.0022 U	< 0.0019 U	< 0.0021 U	< 0.0019 U	< 0.0021 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	< 0.0038 U	*0.0028 J*	*0.0020 J*	< 0.0036 U	0.00035 J	*0.0012 J*	< 0.0041 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0038 U	< 0.014 UJ	< 0.22 U	< 0.0036 U	< 0.0040 U	< 0.0037 U	< 0.0041 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0038 U	0.0044 J	*0.048 J*	< 0.0036 U	< 0.0040 U	< 0.0037 U	< 0.0041 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0038 U	< 0.014 UJ	*0.37*	< 0.0036 U	< 0.0040 U	0.00089 J	< 0.0041 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.00080 J	< 0.014 UJ	< 0.22 U	< 0.0036 U	< 0.0040 U	0.0024 J	< 0.0041 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0038 U	0.0028 J	*0.57*	< 0.0036 U	0.00094 J	0.0032 J	< 0.0041 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.0019 JEB	0.018 J	*1.5*	< 0.0036 U	0.0032 J	0.019	< 0.0041 U
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	< 0.0038 U	0.012 J	*0.53*	< 0.0036 U	0.0014 J	0.0089	< 0.0041 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.38 U	< 1.4 UJ	*0.15 J*	< 0.36 U	< 0.4 U	< 0.37 U	< 0.41 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0014 JEB	0.026 J	*1.2*	< 0.0036 U	0.0037 J	0.019	< 0.0041 U
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.19 U	< 0.7 UJ	0.17 J	< 0.19 U	< 0.21 U	< 0.19 U	< 0.21 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.19 U	< 0.7 UJ	< 0.22 U	< 0.19 U	< 0.21 U	< 0.19 U	< 0.21 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.0030 JEB	0.05 J	*3.2*	< 0.0036 U	0.0064	0.043	< 0.0041 U
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0038 U	< 0.014 UJ	*0.33*	< 0.0036 U	< 0.0040 U	0.0012 J	< 0.0041 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	< 0.0038 U	0.054 JEB	0.14 J	< 0.0036 U	< 0.0040 U	0.00096 JEB	< 0.0041 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.0022 J	0.015 J	*2.6*	< 0.0036 U	0.0033 J	0.016	< 0.0041 U
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.38 U	< 1.4 UJ	0.098 J	< 0.36 U	< 0.4 U	< 0.37 U	< 0.41 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.0085 J	*0.46 J*	0.013 J+	< 0.012 U	0.014 J+	0.0093 J+	< 0.012 U
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0060 U	0.0027 J	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U	< 0.0062 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0055-B1C1	23A-0056-B2C1	23A-0056-B2C1	23A-0057-PLC2	23A-0057-PLC2	23A-0057-PLC2	23A-0058-PLC1
					Sample Name	23A-0055-B1C1-CS	23A-0056-PLC1-AS	23A-0056-PLC1-BS	23A-0057-PLC1-AS	23A-0057-PLC1-BS	23A-0057-PLC1-CS	23A-0058-PLC1-AS
					Sample Date	6/25/2023	6/24/2023	6/24/2023	6/24/2023	6/24/2023	6/24/2023	6/24/2023
					Sample Type	N	N	N	N	N	N	N
					Depth Interval	2.1 - 3.4 ft	0 - 0.5 ft	0.5 - 2 ft	0 - 0.5 ft	0.5 - 1.5 ft	1.5 - 2.5 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL							
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.58 U	< 0.99 U	< 0.51 U	< 1.5 U	< 0.59 U	< 0.56 U	< 0.57 U
Metals	Aluminum	mg/kg	13000	7700	25000	12000	6600 EB	5100 EB	4800 EB	4200 EB	9400 EB	6500 EB
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.1 U	< 1.4 UJ	< 0.78 UJ	< 2.7 UJ	< 0.82 UJ	< 0.99 UJ	< 1.1 UJ
Metals	Arsenic	mg/kg	12	0.68	9.8	2.8 J	6.5	2.3	4.6	2.1	1.4	3.8
Metals	Barium	mg/kg	320	1500	20	*95*	*74*	*36*	*60*	*39*	*82*	*25*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.53 U	*1.7*	< 0.39 U	< 1.4 U	< 0.41 U	< 0.50 U	< 0.56 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	30 JEB	*54 EB*	14 EB	33 EB	12 EB	9.5 EB	11 EB
Metals	Cobalt	mg/kg	12	2.3	50	11 J	6.5	5.0	6.2	4.4	3.9	11
Metals	Copper	mg/kg	170	310	31.6	21 J	*75*	13	*40*	15	12	13
Metals	Lead	mg/kg	310	200	35.8	8.1	*220*	11	*74*	18	4.8	18
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.021 J	*0.94*	0.027 J	*0.44*	0.090 J	< 0.097 U	< 0.12 U
Metals	Nickel	mg/kg	18	140	22.7	*23 J*	*23*	9.9	9.4	6.4	7.5	8.9
Metals	Silver	mg/kg	0.48	39	1	< 0.53 U	0.58 J	< 0.39 U	0.26 J	< 0.41 U	< 0.50 U	< 0.56 U
Metals	Thallium	mg/kg	0.14	0.078		0.18 J	< 0.71 U	0.054 J	< 1.4 U	< 0.41 U	< 0.50 U	< 0.56 U
Metals	Vanadium	mg/kg	31	39		36	26	15	17	11	15	13
Metals	Zinc	mg/kg	410	2300	121	49 J	*190*	28	*160*	47	18	43
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0020 U	0.0096 J	0.0016 J	< 0.0054 U	0.00083 J	< 0.0019 U	0.0052 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0039 U	*0.0015 J*	< 0.0035 U	< 0.011 U	< 0.0040 U	< 0.0037 U	< 0.0038 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0039 U	< 0.0067 U	0.00022 J	< 0.011 U	0.00045 J	< 0.0037 U	< 0.0038 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0020 U	*0.018 J*	*0.0029 J*	< 0.0054 U	0.0015 J	< 0.0019 U	0.0019 J
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0020 U	0.0015 J	< 0.0018 U	< 0.0054 U	0.00037 J	< 0.0019 U	< 0.0020 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	< 0.0039 U	< 0.0067 U	0.00057 J	0.00071 J	0.00070 J	< 0.0037 U	*0.0032 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0039 U	< 0.0067 U	0.00081 J	< 0.011 U	< 0.0040 UJ	< 0.0037 U	< 0.0038 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0039 U	0.0021 J	0.00095 J	0.0031 J	0.0016 J-	< 0.0037 U	0.0014 J
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0039 U	< 0.0067 U	< 0.0035 U	< 0.011 U	< 0.0040 UJ	< 0.0037 U	< 0.0038 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0039 U	< 0.0067 U	0.0031 J	< 0.011 U	< 0.0040 UJ	< 0.0037 U	< 0.0038 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0039 U	< 0.0067 U	0.0027 J	< 0.011 U	< 0.0040 UJ	< 0.0037 U	0.00085 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	< 0.0039 U	0.0057 J	0.017	0.0037 J	0.0068 J-	< 0.0037 U	0.0059
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	< 0.0039 U	0.0026 J	0.0056	0.0035 J	0.0054 J-	< 0.0037 U	0.0033 J
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.39 U	< 0.67 U	< 0.35 U	< 1.1 U	< 0.4 U	< 0.37 U	< 0.38 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	< 0.0039 U	0.0044 J	0.016	0.0058 J	0.0098 J-	< 0.0037 U	0.0058
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.2 U	< 0.34 U	< 0.18 U	< 0.54 U	< 0.21 U	< 0.19 U	< 0.2 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.2 U	< 0.34 U	< 0.18 U	< 0.54 U	< 0.21 U	< 0.19 U	< 0.2 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	< 0.0039 U	0.0094	0.039	0.011	0.02 J-	< 0.0037 U	0.013
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0039 U	< 0.0067 U	0.00092 J	< 0.011 U	< 0.0040 UJ	< 0.0037 U	< 0.0038 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	< 0.0039 U	0.027 EB	0.0017 JEB	0.043 EB	0.018 JEB	< 0.0037 U	0.016 EB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	< 0.0039 U	0.0035 J	0.011	0.0048 J	0.0060 J-	< 0.0037 U	0.0054
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.39 U	< 0.67 U	< 0.35 U	< 1.1 U	< 0.4 U	< 0.37 U	< 0.38 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.013 J+	*0.26 EB*	0.023 JEB	*0.38 EB*	0.017 EB	0.0068 JEB	0.035 EB
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.014 U	< 0.0066 U	< 0.0059 U	< 0.0062 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

					Location	23A-0058-PLC1
					Sample Name	23A-0058-PLC2-BS
					Sample Date	6/24/2023
					Sample Type	N
					Depth Interval	0.5 - 2 ft
Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL	
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.54 U
Metals	Aluminum	mg/kg	13000	7700	25000	4400 EB
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.1 UJ
Metals	Arsenic	mg/kg	12	0.68	9.8	1.6
Metals	Barium	mg/kg	320	1500	20	*22*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.54 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	10 EB
Metals	Cobalt	mg/kg	12	2.3	50	6.6
Metals	Copper	mg/kg	170	310	31.6	10
Metals	Lead	mg/kg	310	200	35.8	7.4
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.028 J
Metals	Nickel	mg/kg	18	140	22.7	7.5
Metals	Silver	mg/kg	0.48	39	1	< 0.54 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.54 U
Metals	Vanadium	mg/kg	31	39		15
Metals	Zinc	mg/kg	410	2300	121	24
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0035 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0036 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00096 J
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.0013 J
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	0.0014 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0019 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0036 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0036 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0036 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0036 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0024 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.0090
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0036
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.36 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0091
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.022
SVOCs	FLUORENE	mg/kg		240	0.077	0.00098 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.00082 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.012
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.36 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0042 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.012 EB
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0042 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0042 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0042 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0042 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0042 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0042 U

Table 3. Comparison of Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA2

Notes:
Detected concentrations are shown with bold text.
Detected concentrations that are at or above the maximum concentration detected in background area sediment are highlighted in yellow, detected concentrations that are at or above the human health PAL are underlined, and detected concentrations that are at or above the ecological PAL are italicized.
The average is shown for parent and duplicate pairs.
COPC - contaminant of potential concern
mg/kg - milligram per kilogram
PAL - project action limit
SVOC - semi-volatile organic compound
VOC - volatile organic compound
Qualifiers:
B - Indicates the analyte is detected in the associated blank as well as in the sample.
E - Indicates compounds whose concentrations exceed the calibration range of the instrument.
J - The analyte wa
the approximat
J- -The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential low bias.
J+ - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential high bias.
JN - The analyte was tentatively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0002-PLC2	23A-0002-PLC2	23A-0002-PLC2	23A-0003-PLC1	23A-0005-PLC1	23A-0005-PLC1	23A-0008-PLC1	23A-0008-PLC1
					Sample Name	23A-0002-PLC2-AS	23A-0002-PLC2-BS	23A-0002-PLC2-CS	23A-0003-PLC1-AS	23A-0005-PLC1-BS	23A-0005-PLC1-CS	23A-0008-PLC1-BS	23A-0008-PLC1-CS
					Sample Date	6/29/2023	6/29/2023	6/29/2023	6/29/2023	6/28/2023	6/28/2023	6/27/2023	6/27/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0.5 - 3.1 ft	3.1 - 6 ft	0 - 0.5 ft	0.5 - 1.5 ft	1.5 - 2 ft	0.5 - 3 ft	3 - 6.2 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		R	R	R	R	< 0.63 U	< 0.55 U	< 0.56 U	< 0.62 U
Metals	Aluminum	mg/kg	13000	7700	25000	4400	5300	4600	7100	2700	4600	10000	12000
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.3 U	< 0.90 U	< 1.0 U	< 0.91 U	*14*	*4.2*	< 1.1 U	< 0.94 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.9 J+	2.0 J	1.2 J	2.7 J	1.4 J	1.0 J	5.3	4.0
Metals	Barium	mg/kg	320	1500	20	*40*	*27*	*21*	*44*	18 J	*34 J*	*51*	*49*
Metals	Cadmium	mg/kg	2.4	0.71	1	0.28 J	< 0.45 U	< 0.52 U	< 0.45 U	0.20 J	0.16 J	< 0.55 U	< 0.47 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	20 EB	11	7.9	20 JEB	10	11	22	25
Metals	Cobalt	mg/kg	12	2.3	50	5.9	4.8	3.9	8.2	5.3	4.5	10	15
Metals	Copper	mg/kg	170	310	31.6	25 J	9.6 J	7.3 J	22 J	21	16	16	19
Metals	Lead	mg/kg	310	200	35.8	*38*	3.5	3.1	8.5	*420*	*210*	7.0	8.5
Metals	Mercury	mg/kg	0.91	2.3	0.18	*0.23*	< 0.11 U	< 0.10 U	0.022 J	0.075 J	0.064 J	< 0.10 U	< 0.12 U
Metals	Nickel	mg/kg	18	140	22.7	9.5	8.4	6.6	20 J	7.9	9.9	19	*25*
Metals	Silver	mg/kg	0.48	39	1	*1.4*	0.11 J	< 0.52 U	0.13 J	0.070 J	< 0.51 U	< 0.55 U	< 0.47 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.63 U	< 0.45 U	< 0.52 U	< 0.45 U	< 0.54 U	< 0.51 U	< 0.55 U	< 0.47 U
Metals	Vanadium	mg/kg	31	39		16 J	16 J	12 J	22	12	12	34	34
Metals	Zinc	mg/kg	410	2300	121	89 EB	19	15	39 JEB	73	37	37 J	60 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.00037 J	< 0.0019 U	< 0.0019 U	< 0.0019 U	0.03	0.015 J	< 0.0019 U	< 0.0021 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0055 U	< 0.0037 U	< 0.0038 U	< 0.0037 U	< 0.0043 U	< 0.0037 U	< 0.0038 U	< 0.0041 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0055 U	< 0.0037 U	< 0.0038 U	< 0.0037 U	< 0.0043 U	0.0013 J	< 0.0038 U	< 0.0041 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0028 U	< 0.0019 U	< 0.0019 U	0.00049 J	*0.0069 J*	*0.0058 J*	< 0.0019 U	< 0.0021 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	0.0012 J	< 0.0019 U	< 0.0019 U	< 0.0019 U	< 0.0022 U	*0.0040 J*	< 0.0019 U	< 0.0021 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	0.00058 J	< 0.0037 UJ	< 0.0038 UJ	< 0.0037 U	*0.016 J*	*0.0052*	< 0.0038 U	< 0.0041 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0054 U	< 0.0037 U	< 0.0038 U	< 0.0037 U	0.0013 JEB	< 0.0037 U	< 0.0038 U	< 0.0041 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0054 U	< 0.0037 U	< 0.0038 U	< 0.0037 U	0.0018 JEB	0.00078 JEB	< 0.0038 U	< 0.0041 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	0.0016 J	< 0.0037 U	< 0.0038 U	0.0016 J	0.0036 J	0.0022 J	< 0.0038 U	< 0.0041 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0015 J	< 0.0037 U	< 0.0038 U	0.0024 J	*0.0069*	0.0052	< 0.0038 U	< 0.0041 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0054 U	< 0.0037 U	< 0.0038 U	0.0039	0.0063	0.0066	< 0.0038 U	< 0.0041 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.0060	0.00077 J	< 0.0038 J	0.022	0.059 JEB	0.054	0.00080 JEB	< 0.0041 U
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0069	0.00079 J	< 0.0038 U	0.01	0.036 JEB	0.026	< 0.0038 U	< 0.0041 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.54 U	< 0.37 U	< 0.38 U	< 0.37 U	< 0.43 U	< 0.37 U	< 0.38 U	< 0.41 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0098	0.00094 J	< 0.0038 J	0.019	0.065 JEB	0.054	< 0.0038 U	< 0.0041 U
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.28 U	< 0.19 U	< 0.2 U	< 0.19 U	< 0.22 U	< 0.19 U	< 0.19 U	< 0.21 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.28 U	< 0.19 U	< 0.2 U	< 0.19 U	< 0.22 U	< 0.19 U	< 0.19 U	< 0.21 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.02	< 0.0037 U	< 0.0038 U	0.037	0.21 EB	0.1	0.0011 JEB	< 0.0041 U
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0054 U	< 0.0037 U	< 0.0038 U	0.0012 J	0.0056 EB	0.0027 J	< 0.0038 U	< 0.0041 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0020 JEB	< 0.0037 U	< 0.0038 U	0.0017 JEB	0.0077 EB	0.0026 JEB	< 0.0038 U	< 0.0041 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.0071	< 0.0037 U	< 0.0038 U	0.018	0.11	0.039	< 0.0038 U	< 0.0041 U
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.54 U	< 0.37 U	< 0.38 U	< 0.37 U	< 0.43 U	< 0.37 U	< 0.38 U	< 0.41 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.012 U	< 0.0054 U	< 0.0054 U		*0.021*		< 0.0052 U	< 0.0072 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.024 UJ	< 0.011 UJ	< 0.011 UJ		< 0.011 U		0.018 J+	0.025 J+
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.012 U	< 0.0054 U	< 0.0054 U		0.0022 J		< 0.0052 U	< 0.0072 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.012 U	< 0.0054 U	< 0.0054 U		0.28 J		< 0.0052 U	< 0.0072 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.012 U	< 0.0054 U	< 0.0054 U		*0.086*		< 0.0052 U	< 0.0072 U
VOCs	Toluene	mg/kg		490	0.01	< 0.012 U	< 0.0054 U	< 0.0054 U		< 0.0056 U		< 0.0052 U	< 0.0072 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.012 U	< 0.0054 U	< 0.0054 U		0.013 J		< 0.0052 U	< 0.0072 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.012 U	< 0.0054 U	< 0.0054 U		0.019 J-		< 0.0052 U	< 0.0072 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0009-PLC1	23A-0010-PLC1	23A-0011-B1C1	23A-0011-B1C1	23A-0011-B1C1	23A-0012-PLC1	23A-0012-PLC1	23A-0012-PLC1
					Sample Name	23A-0009-PLC1-CS	23A-0010-PLC1-CS	23A-0011-B1C1-AS	23A-0011-B1C1-BS	23A-0011-B1C1-CS	23A-0012-PLC1-AS	23A-0012-PLC1-BS	23A-0012-PLC1-CS
					Sample Date	6/27/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/26/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	3 - 5.7 ft	1.5 - 3.4 ft	0 - 0.5 ft	0.5 - 2.9 ft	2.9 - 3.6 ft	0 - 0.5 ft	0.5 - 1.7 ft	1.7 - 3 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.59 U	< 0.53 U	0.26 J	< 1.1 U	< 0.53 U	< 0.55 U	< 0.58 U	< 0.61 U
Metals	Aluminum	mg/kg	13000	7700	25000	10000	4700	6200	8300	4500	3200	10000	17000
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.82 U	0.059 J	1.5	< 1.7 U	< 0.95 U	< 0.98 U	< 0.98 U	< 1.1 U
Metals	Arsenic	mg/kg	12	0.68	9.8	3.8	1.6 J	8.6	6.1	2.0	1.8	2.2	2.0
Metals	Barium	mg/kg	320	1500	20	*40*	*26 J*	*130*	*86*	*40*	*31*	*56*	*80*
Metals	Cadmium	mg/kg	2.4	0.71	1	0.082 J	< 0.45 U	*1.9*	*2.8*	< 0.48 U	0.10 J	< 0.49 U	< 0.57 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	20	15	*59*	*79*	21	15	31	36
Metals	Cobalt	mg/kg	12	2.3	50	10	5.8	11	6.2	6.4	4.8	11	13
Metals	Copper	mg/kg	170	310	31.6	17	13	*69*	*100*	22	18	23	25
Metals	Lead	mg/kg	310	200	35.8	8.1	11	*150*	*270*	5.1	29	15	8.9
Metals	Mercury	mg/kg	0.91	2.3	0.18	< 0.11 U	0.028 J	*0.84*	*2.1*	0.035 J	0.078 J	0.11	0.055 J
Metals	Nickel	mg/kg	18	140	22.7	19	10	13	15	18	9.0	20	*27*
Metals	Silver	mg/kg	0.48	39	1	< 0.41 U	< 0.45 U	0.48 J	*1.2*	< 0.48 U	0.14 J	0.049 J	0.046 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.41 U	< 0.45 U	< 0.49 U	< 0.85 U	< 0.48 U	< 0.49 U	< 0.49 U	< 0.57 U
Metals	Vanadium	mg/kg	31	39		27	22	31	31	24	15	42	48
Metals	Zinc	mg/kg	410	2300	121	47 J	35	*290*	*280*	33	50	75	58
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.00080 J	0.00096 J	< 0.0079 UJ	0.0056 J	0.0011 J	0.00096 J	0.00084 J	< 0.0021 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0040 U	< 0.0036 U	< 0.015 UJ	< 0.0074 U	< 0.0037 U	0.00029 J	< 0.0039 U	< 0.0041 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00039 J	0.00034 J	< 0.015 UJ	< 0.0074 U	< 0.0037 U	0.00046 J	< 0.0039 U	< 0.0041 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.0024 J*	*0.0042 J*	< 0.0079 UJ	*0.013 J*	0.00093 J	*0.0040 J*	0.0010 J	< 0.0021 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0020 U	< 0.0019 U	< 0.0079 UJ	0.0017 J+	< 0.0019 U	0.00069 J	0.00039 J	< 0.0021 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0010 J*	< 0.0036 U	< 0.015 UJ	*0.0055 J+*	0.00080 J	*0.0019 J*	0.00044 J	< 0.0041 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0040 U	< 0.0036 U	< 0.015 UJ	< 0.0074 U	< 0.0037 U	0.0057 EB	0.0013 JEB	< 0.0041 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0011 JEB	< 0.0036 U	0.0036 JEB	< 0.0074 U	< 0.0037 U	0.0059 EB	0.0015 JEB	< 0.0041 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0040 U	< 0.0036 UJ	0.0047 J	< 0.0074 U	< 0.0037 U	*0.012*	0.0015 J+	< 0.0041 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0028 J+	< 0.0036 U	< 0.015 UJ	0.0021 J	0.0019 J	*0.048*	0.0024 J+	< 0.0041 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0016 J+	< 0.0036 U	< 0.015 UJ	< 0.0074 U	0.0016 J	*0.096*	0.0027 J+	< 0.0041 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.014 JEB	0.0021 JEB	0.012 JEB	0.012 JEB	0.0079 EB	*0.18 EB*	0.015 JEB	< 0.0041 U
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0066 JEB	< 0.0036 U	0.012 JEB	0.0073 JEB	0.0029 JEB	0.061 EB	0.0052 JEB	< 0.0041 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.4 U	< 0.36 U	< 1.5 UJ	< 0.74 U	< 0.37 U	< 0.38 U	< 0.39 U	< 0.41 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.015 JEB	0.0019 JEB	0.021 JEB	0.0093 JEB	0.0071 EB	0.14 EB	0.011 JEB	< 0.0041 U
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.2 U	< 0.19 U	< 0.79 UJ	< 0.38 U	< 0.19 U	0.039 J	< 0.2 U	< 0.21 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.2 U	< 0.19 U	< 0.79 UJ	< 0.38 U	< 0.19 U	< 0.19 U	< 0.2 U	< 0.21 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.019 JEB	0.0039 EB	0.047 JEB	0.019 JEB	0.019 EB	*0.46*	0.021 JEB	< 0.0041 U
SVOCs	FLUORENE	mg/kg		240	0.077	0.0014 JEB	< 0.0036 U	< 0.015 UJ	0.0018 JEB	< 0.0037 U	0.055 EB	0.0014 JEB	< 0.0041 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0017 JEB	0.0044 EB	0.021 JEB	0.0041 JEB	0.00093 JEB	0.014 EB	0.013 JEB	< 0.0041 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.011 J+	0.0015 J	0.016 J	0.0085	0.0048	*0.47*	0.012 J+	< 0.0041 U
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.4 U	< 0.36 U	< 1.5 UJ	< 0.74 U	< 0.37 U	< 0.38 U	0.08 J	< 0.41 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.014 U	0.017	*0.29 J*	*0.16*	0.0064 J	< 0.011 U	0.028	0.013
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0072 U	< 0.0046 U	< 0.027 UJ	0.0034	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0072 U	< 0.0046 U	< 0.027 UJ	< 0.012 U	< 0.0056 U	< 0.0056 U	< 0.0061 U	< 0.0065 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0014-PLC2	23A-0015-PLC1	23A-0015-PLC1	23A-0015-PLC1	23A-0018-PLC1	23A-0021-PLC1	23A-0021-PLC1	23A-0022-PLC1
					Sample Name	23A-0014-PLC2-AS	23A-0015-PLC1-AS	23A-0015-PLC1-BS	23A-0015-PLC1-CS	23A-0018-PLC1-CS	23A-0021-PLC1-AS	23A-0021-PLC1-BS	23A-0022-PLC1-AS
					Sample Date	6/25/2023	6/24/2023	6/24/2023	6/24/2023	6/23/2023	6/29/2023	6/29/2023	6/29/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	0 - 0.5 ft	0 - 0.5 ft	0.5 - 1.5 ft	1.5 - 2.9 ft	4.4 - 5.5 ft	0 - 0.5 ft	0.5 - 1.5 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.61 U	< 0.49 U	< 1.2 U	< 0.55 U	< 0.57 U	R	R	0.28 J-
Metals	Aluminum	mg/kg	13000	7700	25000	3300	6000	4500	3200	3200	4800	6000	5300
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.97 U	1.6	< 2.2 U	< 0.88 U	< 0.80 U	< 0.93 U	< 1.0 U	< 0.93 U
Metals	Arsenic	mg/kg	12	0.68	9.8	9.5 J	6.6 J	4.4 J	1.8 J	1.8	1.3 J	0.91 J+	1.2 J+
Metals	Barium	mg/kg	320	1500	20	*23*	*110*	*80*	*30*	17	*23*	11	12
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.48 U	*1.6*	< 1.1 U	< 0.44 U	0.095 J	0.16 J	0.14 J	< 0.47 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	9.0 JEB	*53 JEB*	29 JEB	9.9 JEB	9.2 EB	15 JEB	9.3 EB	14 EB
Metals	Cobalt	mg/kg	12	2.3	50	5.3 J	11 J	6.2 J	4.1 J	3.3	5.6	5.1	3.8
Metals	Copper	mg/kg	170	310	31.6	27 J	*64 J*	*41 J*	9.3 J	11	17 J	14 J	16 J
Metals	Lead	mg/kg	310	200	35.8	*69*	*130*	*71*	12	24	*74*	7.5	*68*
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.046 J	*0.71*	*0.53*	0.061 J	0.073 J	0.073 J	0.022 J	0.061 J
Metals	Nickel	mg/kg	18	140	22.7	7.3 J	15 J	10 J	6.7 J	4.8	9.6 J	8.3	9.6
Metals	Silver	mg/kg	0.48	39	1	< 0.48 U	0.43 J	0.21 J	< 0.44 U	< 0.40 U	0.051 J	< 0.52 U	0.033 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.48 U	0.071 J	< 1.1 U	< 0.44 U	< 0.40 U	< 0.47 U	< 0.52 U	< 0.47 U
Metals	Vanadium	mg/kg	31	39		9.7	26	19	9.6	7.4	17	15 J	10 J
Metals	Zinc	mg/kg	410	2300	121	49 J	*310 J*	*260 J*	42 J	34	50 JEB	23 EB	44 EB
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0019 J	< 0.0063 UJ	0.00071 J	0.0017 J	0.01 J	< 0.0020 UJ	< 0.0019 U	0.0051 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0041 U	< 0.012 UJ	< 0.0080 U	< 0.0036 U	*0.00092 J*	< 0.0040 UJ	< 0.0036 U	< 0.0036 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00027 J	< 0.012 UJ	< 0.0080 U	< 0.0036 U	*0.0026 J*	< 0.0040 UJ	< 0.0036 U	0.0015 J
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.0046 J*	< 0.0063 UJ	0.0021 J	*0.0059 J*	*0.013 J*	< 0.0020 UJ	< 0.0019 U	*0.0030 J*
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0021 U	< 0.0063 UJ	< 0.0041 U	< 0.0019 U	< 0.0020 U	< 0.0020 UJ	< 0.0019 U	0.0021 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0014 J*	*0.0020 J*	*0.0011 J*	*0.0014 J*	*0.011 J*	0.00051 J-	0.00013 J	*0.0048 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0031 J	< 0.012 UJ	0.0017 J	< 0.0036 U	0.0011 J	0.0028 JEB	< 0.0037 U	0.0037 EB
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0039 J	< 0.012 UJ	0.0031 J	0.0011 J	0.0019 J	0.0036 JEB	0.00096 JEB	0.0051 EB
SVOCs	Acenaphthene	mg/kg		360	0.0067	*0.0098 J*	0.0050 J	0.0021 J	0.0013 J	0.00089 J	*0.015*	0.0023 J	*0.0089 J*
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0030 J	< 0.012 UJ	0.0032 J	0.0036	0.0037 J	0.0023 J	0.0016 J	*0.0098*
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.017	0.013 J	0.0054 J	0.0050	0.0024 J	0.018	0.0052	0.02
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.074	0.057 J	0.04	0.032	0.021	0.08	0.013	0.094
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.035	0.028 J	0.021	0.012	0.014	0.034	0.0051	0.028
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.41 U	< 1.2 UJ	< 0.8 U	< 0.36 U	< 0.38 U	< 0.4 U	< 0.37 U	< 0.36 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.076	0.064 J	0.052	0.027	0.017	0.062	0.011	0.089
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.21 U	< 0.63 UJ	< 0.41 U	< 0.19 U	< 0.2 U	< 0.2 U	< 0.19 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.21 U	< 0.63 UJ	< 0.41 U	< 0.19 U	< 0.2 U	< 0.2 U	0.1 J	0.13 J
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.19	0.15 J	0.099	0.046	0.038	0.17	0.028	0.22
SVOCs	FLUORENE	mg/kg		240	0.077	0.011	0.0055 J	0.0027 J	0.0021 J	0.0015 J	0.013	0.0026 J	0.011
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.022 EB	0.0040 JEB	0.031 EB	0.0019 JEB	0.0072 EB	0.0072 EB	0.0018 JEB	0.0070 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.12	0.063 J	0.036	0.021	0.012	0.12	0.022	0.12
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.41 U	< 1.2 UJ	< 0.8 U	< 0.36 U	< 0.38 U	< 0.4 U	< 0.37 U	< 0.36 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0063 U	< 0.017 UJ	< 0.013 UJ	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.022 J+	*0.39 JEB*	*0.63 JEB*	0.011 JEB	0.018 JEB		< 0.012 U	< 0.012 UJ
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0063 U	< 0.017 UJ	< 0.013 UJ	0.0010 J	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0063 U	< 0.017 UJ	< 0.013 UJ	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0063 U	< 0.017 UJ	< 0.013 U	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0063 U	< 0.017 UJ	< 0.013 U	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0063 U	< 0.017 UJ	< 0.013 U	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0063 U	< 0.017 UJ	< 0.013 UJ	< 0.0048 U	< 0.0061 U		< 0.0061 U	< 0.0060 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0022-PLC1	23A-0022-PLC1	23A-0026-B1C1	23A-0028-PLC2	23A-0029-PLC1	23A-0031-PLC1	23A-0032-PLC1	23A-0032-PLC1
					Sample Name	23A-0022-PLC1-BS	23A-0022-PLC1-CS	23A-0026-B1C1-BS	23A-0028-PLC2-BS	23A-0029-PLC1-CS	23A-0031-PLC1-CS	23A-0032-PLC1-AS	23A-0032-PLC1-BS
					Sample Date	6/29/2023	6/29/2023	6/28/2023	6/27/2023	6/27/2023	6/26/2023	6/26/2023	6/26/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	0.5 - 2.8 ft	2.8 - 4 ft	0.5 - 1.6 ft	0.5 - 1.7 ft	3.3 - 5.8 ft	1.5 - 3.4 ft	0 - 0.5 ft	0.5 - 1.7 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		R	R	< 0.56 U	< 0.53 U	< 0.55 U	< 0.63 U	< 0.53 U	< 0.61 U
Metals	Aluminum	mg/kg	13000	7700	25000	5100	4700	4400	6100	3500	13000	6800	18000
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.96 U	< 0.83 U	< 0.79 U	< 0.96 U	< 0.96 U	< 1.1 U	< 0.90 U	< 0.84 U
Metals	Arsenic	mg/kg	12	0.68	9.8	1.1 J+	0.70 J+	0.98	2.5	1.5 J	3.6	2.6	5.8
Metals	Barium	mg/kg	320	1500	20	8.5	6.2	11	*28*	9.6 J	*60*	*39*	*91*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.48 U	< 0.42 U	0.098 J	< 0.48 U	< 0.48 U	< 0.55 U	< 0.45 U	< 0.42 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	9.4 EB	6.7 EB	4.0	13	8.2	22	17	34
Metals	Cobalt	mg/kg	12	2.3	50	3.6	4.3	2.5	6.8	4.7	13	6.6	13
Metals	Copper	mg/kg	170	310	31.6	14 J	12 J	25	22	13	19	14	20
Metals	Lead	mg/kg	310	200	35.8	15	4.0	22	9.3	4.9	11	11	9.9
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.065 J	< 0.10 U	0.078 J	< 0.10 U	< 0.096 U	0.060 J	0.030 J	0.025 J
Metals	Nickel	mg/kg	18	140	22.7	6.8	6.9	4.7	18	9.3	*24*	12	*25*
Metals	Silver	mg/kg	0.48	39	1	< 0.48 U	< 0.42 U	< 0.39 U	< 0.48 U	< 0.48 U	< 0.55 U	0.041 J	< 0.42 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.48 U	< 0.42 U	< 0.39 U	< 0.48 U	< 0.48 U	< 0.55 U	< 0.45 U	< 0.42 U
Metals	Vanadium	mg/kg	31	39		9.7 J	8.3 J	5.1	21	13	41	23	46
Metals	Zinc	mg/kg	410	2300	121	33 EB	37 EB	67 J	29 J	24	58	48	51 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0070 J	0.00040 J	0.0089 J	< 0.0018 U	0.00064 J	0.00028 J	< 0.0018 U	< 0.0021 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0036 U	< 0.0036 U	< 0.0038 U	< 0.0036 U	< 0.0037 U	< 0.0042 U	< 0.0036 U	< 0.0040 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.0021 J	< 0.0036 U	0.0015 J	< 0.0036 U	< 0.0037 U	< 0.0042 U	< 0.0036 U	< 0.0040 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.0023 J	< 0.0018 U	*0.0053 J*	R	0.00046 J	0.00049 J	< 0.0018 U	< 0.0021 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	*0.0040 J*	0.00031 J	< 0.0020 U	< 0.0018 U	< 0.0019 U	0.00037 J	< 0.0018 U	< 0.0021 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0096 J*	0.00089 J	*0.0060*	0.00034 J	0.00039 J	0.00029 J	0.00031 J	< 0.0040 U
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	0.0026 JEB	< 0.0036 U	0.0065 EB	< 0.0036 U	0.0022 JEB	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.0033 JEB	< 0.0036 U	0.0083 EB	< 0.0036 U	0.0024 JEB	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	0.0064 J	0.0010 J	*0.033*	< 0.0036 U	0.0020 J	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	*0.0088*	0.0018 J	*0.021*	0.0013 J+	0.0054	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.02	0.0032 J	0.051	0.0016 J+	0.0053	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.079	0.0092	*0.16 JEB*	0.0070 EB	0.017 EB	0.0010 JEB	0.0023 JEB	< 0.0040 U
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.027	0.0035 J	0.064 JEB	0.0029 JEB	0.0087 EB	< 0.0042 U	0.0010 JEB	< 0.0040 U
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.36 U	< 0.36 U	< 0.38 U	< 0.36 U	< 0.37 U	< 0.42 U	< 0.21 U	< 0.4 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.07	0.0076	0.13 EB	0.0061 EB	0.014 EB	0.00094 JEB	0.0019 JEB	< 0.0040 U
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.19 U	< 0.18 U	< 0.2 U	< 0.18 U	< 0.19 U	< 0.22 U	< 0.11 U	< 0.21 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	0.053 J	0.12 J	< 0.2 U	< 0.18 U	< 0.19 U	< 0.22 U	< 0.11 U	< 0.21 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.15	0.016	0.41	0.0094 EB	0.021 EB	0.0017 JEB	0.0038 JEB	< 0.0040 U
SVOCs	FLUORENE	mg/kg		240	0.077	0.0070	0.0013 J	0.034 EB	< 0.0036 U	0.0030 JEB	< 0.0042 U	< 0.0036 U	< 0.0040 U
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0045 JEB	0.0011 JEB	0.017 EB	< 0.0036 U	0.0028 JEB	< 0.0042 U	0.0043 EB	< 0.0040 U
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.066	0.0098	*0.22*	0.0062 J+	0.012	0.0013 J	0.0012 J	< 0.0040 U
SVOCs	PHENOL	mg/kg		1900	0.175	0.065 J	< 0.36 U	< 0.38 U	< 0.36 U	< 0.37 U	< 0.42 U	< 0.21 U	< 0.4 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0058 U	< 0.0052 U	< 0.0057 U		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.014 J+	< 0.01 U	0.027 J+		< 0.013 U	< 0.013 U	< 0.011 U	< 0.014 U
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	0.0025 J	0.0041 J	0.0011 J		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0058 U	< 0.0052 U	0.018		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0058 U	< 0.0052 U	0.0018 J		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0058 U	< 0.0052 U	< 0.0057 U		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0058 U	< 0.0052 U	0.0044 J		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0058 U	< 0.0052 U	0.011		< 0.0067 U	< 0.0064 U	< 0.0056 U	< 0.0070 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0032-PLC1	23A-0033-B2C1	23A-0033-B2C1	23A-0033-B2C1	23A-0034-PLC1	23A-0034-PLC1	23A-0036-PLC3	23A-0037-B2C1
					Sample Name	23A-0032-PLC1-CS	23A-0033-B2C1-AS	23A-0033-B2C1-BS	23A-0033-B2C1-CS	23A-0034-PLC1-BS	23A-0034-PLC1-CS	23A-0036-PLC3-AS	23A-0037-B2C1-AS
					Sample Date	6/26/2023	6/26/2023	6/26/2023	6/26/2023	6/25/2023	6/25/2023	6/24/2023	6/24/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	1.7 - 3 ft	0 - 0.5 ft	0.5 - 1.7 ft	1.7 - 2.7 ft	0.5 - 1.4 ft	1.4 - 2.4 ft	0 - 0.5 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.63 U	< 1.0 U	< 0.57 U	< 0.55 U	< 0.53 U	< 0.57 U	< 0.91 U	< 1.0 U
Metals	Aluminum	mg/kg	13000	7700	25000	15000	5000	6200	13000 EB	7600 EB	10000	2900	2800
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.3 U	< 1.9 U	< 1.1 U	< 0.84 UJ	< 0.82 UJ	< 1.1 U	< 1.4 U	< 1.8 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.2	6.6	1.2	1.6	1.7	2.0	3.3 J	3.3 J
Metals	Barium	mg/kg	320	1500	20	*57*	*97*	*51*	*78*	*53*	*75*	*51*	*29*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.64 U	0.95	< 0.53 U	< 0.42 U	< 0.41 U	< 0.57 U	0.75	< 0.92 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	25	30 EB	18 EB	30 EB	16 EB	20 EB	23 JEB	8.5 JEB
Metals	Cobalt	mg/kg	12	2.3	50	12	8.8	8.0	12	6.5	8.3	6.2 J	6.3 J
Metals	Copper	mg/kg	170	310	31.6	17	*55*	16	22	14	15	28 J	13 J
Metals	Lead	mg/kg	310	200	35.8	7.6	*74*	7.2	8.2	23	7.1	*54*	22
Metals	Mercury	mg/kg	0.91	2.3	0.18	< 0.11 U	*0.18 J*	0.057 J	< 0.096 U	0.028 J	< 0.10 U	*0.35*	*0.20*
Metals	Nickel	mg/kg	18	140	22.7	21	*24*	15	21	11	16	6.3 J	8.6 J
Metals	Silver	mg/kg	0.48	39	1	< 0.64 U	0.16 J	< 0.53 U	< 0.42 U	< 0.41 U	< 0.57 U	0.15 J	< 0.92 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.64 U	< 0.93 U	< 0.53 U	0.17 J	0.065 J	< 0.57 U	< 0.70 U	< 0.92 U
Metals	Vanadium	mg/kg	31	39		39	18	27	37	21	28	12	6.7
Metals	Zinc	mg/kg	410	2300	121	47 J	*160*	33	50	40	35	*140 J*	110 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0022 U	0.0013 J	0.00090 J	< 0.0019 U	0.0016 J	< 0.0020 U	0.00048 J	< 0.0037 U
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0043 U	< 0.0070 U	< 0.0040 U	< 0.0037 U	< 0.0037 U	< 0.0039 U	< 0.0063 U	< 0.0072 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0043 U	< 0.0070 U	< 0.0040 U	< 0.0037 U	< 0.0037 U	< 0.0039 U	< 0.0063 U	< 0.0072 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0022 U	0.0017 J	0.0014 J	< 0.0019 U	*0.0045 J*	< 0.0020 U	0.00087 J	< 0.0037 U
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0022 U	< 0.0036 U	0.00047 J	< 0.0019 U	< 0.0019 U	< 0.0020 U	< 0.0032 U	0.0021 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	< 0.0043 U	0.00071 J	0.00082 J	0.00011 J	*0.0011 J*	< 0.0039 U	0.00081 J	*0.0023 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0043 U	0.012 EB	< 0.0040 UJ	< 0.0037 U	< 0.0037 U	< 0.0039 U	< 0.0063 U	< 0.0072 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0043 U	0.015 EB	< 0.0040 UJ	< 0.0037 U	0.0012 J	< 0.0039 U	0.0025 J	0.0027 J
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0043 U	*0.069*	< 0.0040 UJ	< 0.0037 U	< 0.0037 U	< 0.0039 U	0.0013 J	< 0.0072 U
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0043 U	0.0044 J	< 0.0040 UJ	< 0.0037 U	< 0.0037 U	< 0.0039 U	< 0.0063 U	< 0.0072 U
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0043 U	*0.068*	< 0.0040 UJ	< 0.0037 U	< 0.0037 U	< 0.0039 U	0.0015 J	0.0031 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	< 0.0043 U	*0.27 EB*	0.0012 JEB	< 0.0037 U	0.0019 J	0.0022 J	0.014	0.017
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	< 0.0043 U	0.075 JEB	R	< 0.0037 U	0.00097 J	< 0.0039 U	0.0080	0.011
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.43 U	< 0.7 U	< 0.4 U	< 0.37 U	< 0.37 U	< 0.24 U	< 0.63 U	< 0.72 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	< 0.0043 U	*0.28 EB*	0.0010 JEB	< 0.0037 U	0.0020 J	0.0016 J	0.018	0.022
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.22 U	< 0.36 U	< 0.2 U	< 0.19 U	< 0.19 U	< 0.12 U	< 0.32 U	< 0.37 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.22 U	< 0.36 U	< 0.2 U	< 0.19 U	< 0.19 U	< 0.12 U	< 0.32 U	< 0.37 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	< 0.0043 U	*0.43 EB*	0.0025 JEB	< 0.0037 U	0.0039	0.0034 J	0.036	0.047
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0043 U	0.069 EB	< 0.0040 UJ	< 0.0037 U	< 0.0037 U	< 0.0039 U	0.0014 J	0.0015 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	< 0.0043 U	0.025 EB	0.0047 JEB	< 0.0037 U	0.015 EB	< 0.0039 U	0.023 EB	0.028 EB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	< 0.0043 U	*0.81*	0.0023 J-	< 0.0037 U	0.0019 J	0.0019 J	0.019	0.018
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.43 U	< 0.7 U	< 0.4 U	< 0.37 U	< 0.37 U	< 0.24 U	< 0.63 U	< 0.72 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.015 U	0.038	0.0092 J	< 0.01 U	0.014 J+	0.015 EB	< 0.021 U	
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	Toluene	mg/kg		490	0.01	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0073 U	< 0.01 U	< 0.0047 U	< 0.0052 U	< 0.0054 U	< 0.0063 U	< 0.011 U	

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0039-PLC1	23A-0039-PLC1	23A-0042-PLC1	23A-0043-PLC1	23A-0043-PLC1	23A-0046-PLC2	23A-0048-PLC1	23A-0049-B2C1
					Sample Name	23A-0039-PLC1-BS	23A-0039-PLC1-CS	23A-0042-PLC1-CS	23A-0043-PLC1-AS	23A-0043-PLC1-BS	23A-0046-PLC2-CS	23A-0048-PLC1-CS	23A-0049-B2C1-CS
					Sample Date	6/23/2023	6/23/2023	6/29/2023	6/29/2023	6/29/2023	6/28/2023	6/27/2023	6/27/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	0.5 - 2 ft	2 - 3 ft	1.9 - 2.7 ft	0 - 0.5 ft	0.5 - 1.6 ft	1.4 - 2.4 ft	3.2 - 5 ft	2.2 - 3.2 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.51 U	< 0.55 U	R	0.39 J-	R	R	< 0.53 U	< 0.54 U
Metals	Aluminum	mg/kg	13000	7700	25000	2100	3400	4800	3100	3800	3600	3800	4400
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.0 U	< 1.0 U	< 0.81 U	< 0.84 U	< 1.1 U	< 0.95 U	< 1.1 U	< 0.77 U
Metals	Arsenic	mg/kg	12	0.68	9.8	0.95	1.1	1.9 J+	2.2 J	1.8 J+	1.2	1.7	1.2 J
Metals	Barium	mg/kg	320	1500	20	13	19	5.8	*27*	*24*	*21*	*20*	12 J
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.51 U	< 0.52 U	0.11 J	< 0.42 U	< 0.54 U	0.094 J	< 0.53 U	< 0.39 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	7.0 EB	7.9 EB	11 EB	10 JEB	8.6 EB	7.0	8.0	12
Metals	Cobalt	mg/kg	12	2.3	50	2.7	3.7	4.1	4.3	4.0	3.3	4.4	4.6
Metals	Copper	mg/kg	170	310	31.6	10	11	16 J	28 J	8.0 J	24	9.0	9.0
Metals	Lead	mg/kg	310	200	35.8	15	6.8	11	32	5.2	*79*	4.4	9.8
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.021 J	< 0.099 U	0.049 J	0.12	0.024 J	0.082 J-	< 0.11 U	< 0.096 U
Metals	Nickel	mg/kg	18	140	22.7	4.5	6.9	6.8	7.4 J	6.4	5.5	6.9	6.8
Metals	Silver	mg/kg	0.48	39	1	< 0.51 U	< 0.52 U	0.057 J	*1.8*	0.47 J	< 0.47 U	< 0.53 U	0.046 J
Metals	Thallium	mg/kg	0.14	0.078		< 0.51 U	< 0.52 U	< 0.41 U	< 0.42 U	< 0.54 U	< 0.47 U	< 0.53 U	< 0.39 U
Metals	Vanadium	mg/kg	31	39		7.8	13	17 J	15	10 J	7.3	9.7	12
Metals	Zinc	mg/kg	410	2300	121	32	24	30 EB	67 JEB	28 EB	41 J	22 J	25
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.0027 J	< 0.0019 U		< 0.0020 U	0.00046 J	0.02 J	< 0.0019 U	0.0035 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	0.00024 J	< 0.0037 U		< 0.0039 U	< 0.0037 U	< 0.0038 UJ	< 0.0036 U	< 0.0038 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00024 J	< 0.0037 U		< 0.0039 U	< 0.0037 U	0.0012 J	< 0.0036 U	0.00066 J
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	*0.0035 J*	0.00019		0.0010 J	< 0.0019 U	< 0.0019 UJ	< 0.0019 U	*0.0024 J*
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0018 U	< 0.0019 U		< 0.0020 U	0.00061 J	*0.0032 J*	< 0.0019 U	0.00059 J
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	*0.0016 J*	< 0.0037 U		*0.011*	*0.0012 J*	*0.0048 J*	< 0.0036 U	*0.0011 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0035 U	< 0.0037 U	0.0013 JEB	0.0092 EB	0.00087 JEB	0.015 J	< 0.0036 U	< 0.0037 UJ
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	0.00086 J	< 0.0037 U	0.0017 JEB	0.0098 EB	0.00094 JEB	*0.021 JEB*	< 0.0036 U	0.00096 JEB
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0035 U	< 0.0037 U	0.0027 J	*0.033*	0.0019 J	*0.039 J*	< 0.0036 U	0.0014 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.00099 J	< 0.0037 U	0.0025 J	*0.014*	0.0019 J	*0.032 J*	0.0026 J	0.0037
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0019 J	< 0.0037 U	0.0020 J	*0.086*	0.0023 J	*0.1 J*	0.0027 J	0.0050 J-
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.0069	< 0.0037 U	0.019	*0.21*	0.015	*0.37 J*	0.02 EB	0.027 EB
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0070	< 0.0037 U	0.01	0.074	0.0086	0.1 J	0.0073 EB	0.011 EB
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.35 U	< 0.37 U	< 0.38 U	< 0.39 U	< 0.37 U	< 0.38 UJ	< 0.36 U	< 0.37 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0059	< 0.0037 U	0.019	*0.17*	0.016	*0.22 J*	0.015 EB	0.027 EB
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.18 U	< 0.19 U	< 0.2 U	< 0.2 U	< 0.19 U	0.044 J	< 0.19 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.18 U	< 0.19 U	< 0.2 U	< 0.2 U	0.057 J	< 0.19 UJ	< 0.19 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.013	< 0.0037 U	0.045	*0.48*	0.031	*0.7 J*	0.034 EB	0.048 JEB
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0035 U	< 0.0037 U	0.0021 J	0.042	0.0015 J	0.058 J	0.00093 JEB	0.0031 JEB
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.0095 EB	0.0063 EB	0.0027 JEB	0.015 EB	0.0020 JEB	0.029 JEB	0.0010 JEB	0.0020 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.0055	< 0.0037 U	0.015	*0.44*	0.018	*0.55 J*	0.012	0.021 J-
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.35 U	< 0.37 U	< 0.38 U	< 0.39 U	< 0.37 U	< 0.38 UJ	< 0.36 U	< 0.37 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0042 U	< 0.0048 U			< 0.0071 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	0.02 EB	0.0060 JEB			< 0.014 U	0.024	< 0.0081 U	0.0053 J
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0042 U	< 0.0048 U			< 0.0071 U	0.0020 J	< 0.0041 U	< 0.0047 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0042 U	< 0.0048 U			< 0.0071 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0042 U	< 0.0048 U			< 0.0071 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0042 U	< 0.0048 U			< 0.0071 U	< 0.0060 U	< 0.0041 U	< 0.0047 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0042 U	< 0.0048 U			< 0.0071 U	0.0016 J	< 0.0041 U	< 0.0047 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0042 U	< 0.0048 U			< 0.0071 U	< 0.0060 U	< 0.0041 U	< 0.0047 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0051-PLC1	23A-0052-PLC1	23A-0052-PLC1	23A-0053-B1C1	23A-0053-B1C1	23A-0053-B1C1	23A-0054-PLC2	23A-0055-B1C1
					Sample Name	23A-0051-PLC1-CS	23A-0052-PLC1-AS	23A-0052-PLC1-BS	23A-0053-B1C1-AS	23A-0053-B1C1-BS	23A-0053-B1C1-CS	23A-0054-PLC2-CS	23A-0055-B1C1-AS
					Sample Date	6/26/2023	6/26/2023	6/26/2023	6/25/2023	6/25/2023	6/25/2023	6/25/2023	6/25/2023
					Sample Type	N	N	N	N	N	N	N	N
					Depth Interval	2.2 - 3.4 ft	0 - 0.5 ft	0.5 - 1.9 ft	0 - 0.5 ft	0.5 - 3.2 ft	3.2 - 5.7 ft	1.5 - 3 ft	0 - 0.5 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL								
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.55 U	< 0.54 U	< 0.57 U	< 0.48 U	< 0.64 U	< 0.53 U	< 0.59 U	< 0.56 U
Metals	Aluminum	mg/kg	13000	7700	25000	7800	3800	7600	5200 EB	5200	4400	10000 EB	3700
Metals	Antimony	mg/kg	1.3	3.1	2	< 0.94 U	< 0.91 U	< 1.0 U	1.2 J	< 0.87 U	< 0.81 U	< 1.0 UJ	< 0.94 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.7 J	1.2	1.3	5.2	1.7	0.81	1.4	1.5 J
Metals	Barium	mg/kg	320	1500	20	*58 J*	18	*41*	*84*	*22*	*22*	*69*	19
Metals	Cadmium	mg/kg	2.4	0.71	1	0.11 J	< 0.46 U	< 0.50 U	*1.4*	0.14 J	< 0.40 U	< 0.51 U	< 0.47 U
Metals	Chromium, Total	mg/kg	100	0.95	43.4	12	8.9	20	33 EB	8.5 EB	9.6 EB	21 EB	8.7 JEB
Metals	Cobalt	mg/kg	12	2.3	50	7.0	4.8	7.3	11	3.4	4.4	8.9	5.1 J
Metals	Copper	mg/kg	170	310	31.6	15	10	14	*50*	15	8.3	18	8.0 J
Metals	Lead	mg/kg	310	200	35.8	11	5.9	6.5	*96*	*40*	3.4	7.8	8.9
Metals	Mercury	mg/kg	0.91	2.3	0.18	0.027 J	< 0.10 U	0.075 J	*0.51*	0.037 J	< 0.092 U	< 0.11 U	0.043 J
Metals	Nickel	mg/kg	18	140	22.7	10	7.6	15	10	7.8	7.8	15	7.2 J
Metals	Silver	mg/kg	0.48	39	1	< 0.47 U	< 0.46 U	< 0.50 U	0.25 J	0.057 J	< 0.40 U	< 0.51 U	< 0.47 U
Metals	Thallium	mg/kg	0.14	0.078		< 0.47 U	< 0.46 U	< 0.50 U	< 0.49 U	< 0.44 U	< 0.40 U	0.097 J	< 0.47 U
Metals	Vanadium	mg/kg	31	39		24	19	27	21	8.4	15	29	10
Metals	Zinc	mg/kg	410	2300	121	29	47 J	35	*250*	68	18	42	30 J
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		0.00084 J		< 0.0019 U	< 0.0070 UJ	0.0042 J	< 0.0019 U	0.00051 J	0.0018 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0037 U		< 0.0038 U	< 0.014 UJ	< 0.0043 U	< 0.0036 U	< 0.0040 U	< 0.0037 U
Pesticides	ENDRIN	mg/kg		1.9	0.00222	0.00040 J		< 0.0038 U	0.0018 J	< 0.0043 U	< 0.0036 U	< 0.0040 U	< 0.0037 U
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	0.00092 J		< 0.0019 U	0.0012 J	*0.0083 J*	< 0.0019 U	0.0013 J	0.0011 J
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0019 U		< 0.0019 U	< 0.0070 UJ	< 0.0022 U	< 0.0019 U	< 0.0021 U	< 0.0019 U
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	0.00051 J		< 0.0038 U	*0.0028 J*	*0.0020 J*	< 0.0036 U	0.00035 J	*0.0012 J*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0037 U	< 0.0038 U	< 0.0038 U	< 0.014 UJ	< 0.22 U	< 0.0036 U	< 0.0040 U	< 0.0037 U
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0037 U	< 0.0038 U	< 0.0038 U	0.0044 J	*0.048 J*	< 0.0036 U	< 0.0040 U	< 0.0037 U
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0037 UJ	< 0.0038 U	< 0.0038 U	< 0.014 UJ	*0.37*	< 0.0036 U	< 0.0040 U	0.00089 J
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	0.0019 J	0.0015 J	0.00080 J	< 0.014 UJ	< 0.22 U	< 0.0036 U	< 0.0040 U	0.0024 J
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0.0013 J	0.0012 J	< 0.0038 U	0.0028 J	*0.57*	< 0.0036 U	0.00094 J	0.0032 J
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0.0081 EB	0.0045 EB	0.0019 JEB	0.018 J	*1.5*	< 0.0036 U	0.0032 J	0.019
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0.0029 JEB	0.0020 JEB	< 0.0038 U	0.012 J	*0.53*	< 0.0036 U	0.0014 J	0.0089
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.37 U	< 0.38 U	< 0.38 U	< 1.4 UJ	*0.15 J*	< 0.36 U	< 0.4 U	< 0.37 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0.0066 EB	0.0044 EB	0.0014 JEB	0.026 J	*1.2*	< 0.0036 U	0.0037 J	0.019
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.19 U	< 0.19 U	< 0.19 U	< 0.7 UJ	0.17 J	< 0.19 U	< 0.21 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.19 U	< 0.19 U	< 0.19 U	< 0.7 UJ	< 0.22 U	< 0.19 U	< 0.21 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0.013 EB	0.0094 EB	0.0030 JEB	0.05 J	*3.2*	< 0.0036 U	0.0064	0.043
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0037 U	< 0.0038 U	< 0.0038 U	< 0.014 UJ	*0.33*	< 0.0036 U	< 0.0040 U	0.0012 J
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	0.00085 JEB	< 0.0038 U	< 0.0038 U	0.054 JEB	0.14 J	< 0.0036 U	< 0.0040 U	0.00096 JEB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	0.0050	0.0038	0.0022 J	0.015 J	*2.6*	< 0.0036 U	0.0033 J	0.016
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.37 U	< 0.38 U	< 0.38 U	< 1.4 UJ	0.098 J	< 0.36 U	< 0.4 U	< 0.37 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.011 U		0.0085 J	*0.46 J*	0.013 J+	< 0.012 U	0.014 J+	0.0093 J+
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	Toluene	mg/kg		490	0.01	< 0.0055 U		< 0.0060 U	0.0027 J	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0055 U		< 0.0060 U	< 0.023 UJ	< 0.0054 U	< 0.0062 U	< 0.0052 U	< 0.0055 U

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

					Location	23A-0055-B1C1	23A-0055-B1C1	23A-0056-B2C1	23A-0056-B2C1	23A-0058-PLC1	23A-0063-PLC1
					Sample Name	23A-0055-B1C1-BS	23A-0055-B1C1-CS	23A-0056-PLC1-AS	23A-0056-PLC1-BS	23A-0058-PLC2-BS	23A-0063-PLC1-CS
					Sample Date	6/25/2023	6/25/2023	6/24/2023	6/24/2023	6/24/2023	6/29/2023
					Sample Type	N	N	N	N	N	N
					Depth Interval	0.5 - 2.1 ft	2.1 - 3.4 ft	0 - 0.5 ft	0.5 - 2 ft	0.5 - 2 ft	3.7 - 4.9 ft
Group	COPC	Units	Maximum Detection within Background	Human Health PAL	Ecological PAL						
Cyanide	CYANIDE	mg/kg	1.8	2.4		< 0.59 U	< 0.58 U	< 0.99 U	< 0.51 U	< 0.54 U	< 0.56 U
Metals	Aluminum	mg/kg	13000	7700	25000	10000	12000	6600 EB	5100 EB	4400 EB	3100
Metals	Antimony	mg/kg	1.3	3.1	2	< 1.2 U	< 1.1 U	< 1.4 UJ	< 0.78 UJ	< 1.1 UJ	< 1.0 U
Metals	Arsenic	mg/kg	12	0.68	9.8	2.6 J	2.8 J	6.5	2.3	1.6	1.5
Metals	Barium	mg/kg	320	1500	20	*75*	*95*	*74*	*36*	*22*	*30*
Metals	Cadmium	mg/kg	2.4	0.71	1	< 0.59 U	< 0.53 U	*1.7*	< 0.39 U	< 0.54 U	0.24 J
Metals	Chromium, Total	mg/kg	100	0.95	43.4	26 JEB	30 JEB	*54 EB*	14 EB	10 EB	9.4 EB
Metals	Cobalt	mg/kg	12	2.3	50	9.0 J	11 J	6.5	5.0	6.6	2.9
Metals	Copper	mg/kg	170	310	31.6	18 J	21 J	*75*	13	10	14
Metals	Lead	mg/kg	310	200	35.8	7.2	8.1	*220*	11	7.4	*38*
Metals	Mercury	mg/kg	0.91	2.3	0.18	< 0.11 U	0.021 J	*0.94*	0.027 J	0.028 J	*2.1*
Metals	Nickel	mg/kg	18	140	22.7	18 J	*23 J*	*23*	9.9	7.5	4.7
Metals	Silver	mg/kg	0.48	39	1	< 0.59 U	< 0.53 U	0.58 J	< 0.39 U	< 0.54 U	0.060 J
Metals	Thallium	mg/kg	0.14	0.078		0.15 J	0.18 J	< 0.71 U	0.054 J	< 0.54 U	< 0.50 U
Metals	Vanadium	mg/kg	31	39		31	36	26	15	15	5.9
Metals	Zinc	mg/kg	410	2300	121	41 J	49 J	*190*	28	24	*170 JEB*
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		< 0.0021 U	< 0.0020 U	0.0096 J	0.0016 J	0.0035 J	0.014 J
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	< 0.0041 U	< 0.0039 U	*0.0015 J*	< 0.0035 U	< 0.0036 U	*0.0015 J*
Pesticides	ENDRIN	mg/kg		1.9	0.00222	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.00022 J	0.00096 J	*0.0037 J*
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	< 0.0021 U	< 0.0020 U	*0.018 J*	*0.0029 J*	0.0013 J	*0.057 J*
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	< 0.0021 U	< 0.0020 U	0.0015 J	< 0.0018 U	0.0014 J	*0.017 J*
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.00057 J	*0.0019 J*	*0.016 J+*
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.00081 J	< 0.0036 U	0.0038 EB
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	< 0.0041 U	< 0.0039 U	0.0021 J	0.00095 J	< 0.0036 U	0.0047 EB
SVOCs	Acenaphthene	mg/kg		360	0.0067	< 0.0041 U	< 0.0039 U	< 0.0067 U	< 0.0035 U	< 0.0036 U	*0.01 J-*
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.0031 J	< 0.0036 U	0.0052 J-
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.0027 J	0.0024 J	0.016 J-
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	< 0.0041 U	< 0.0039 U	0.0057 J	0.017	0.0090	0.1
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	< 0.0041 U	< 0.0039 U	0.0026 J	0.0056	0.0036	0.042 J-
SVOCs	CARBAZOLE	mg/kg		240	0.069	< 0.41 U	< 0.39 U	< 0.67 U	< 0.35 U	< 0.36 U	< 0.38 U
SVOCs	CHRYSENE	mg/kg	8	110	0.166	< 0.0041 U	< 0.0039 U	0.0044 J	0.016	0.0091	0.11
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	< 0.21 U	< 0.2 U	< 0.34 U	< 0.18 U	< 0.19 U	< 0.19 U
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	< 0.21 U	< 0.2 U	< 0.34 U	< 0.18 U	< 0.19 U	< 0.19 U
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	< 0.0041 U	< 0.0039 U	0.0094	0.039	0.022	0.23
SVOCs	FLUORENE	mg/kg		240	0.077	< 0.0041 U	< 0.0039 U	< 0.0067 U	0.00092 J	0.00098 J	0.013 J-
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	< 0.0041 U	< 0.0039 U	0.027 EB	0.0017 JEB	0.00082 JEB	0.024 EB
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	< 0.0041 U	< 0.0039 U	0.0035 J	0.011	0.012	0.16
SVOCs	PHENOL	mg/kg		1900	0.175	< 0.41 U	< 0.39 U	< 0.67 U	< 0.35 U	< 0.36 U	< 0.38 U
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	*0.074*
VOCs	ACETONE	mg/kg	0.54	7000	0.065	< 0.012 U	0.013 J+	*0.26 EB*	0.023 JEB	0.012 EB	0.025
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	0.0013 J
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	*2.7*
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	*0.029*
VOCs	Toluene	mg/kg		490	0.01	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	*0.046 J*
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	0.0060 J
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	< 0.0062 U	< 0.0058 U	< 0.01 U	< 0.0064 U	< 0.0042 U	*1.4*

Table 4. Comparison Sediment Samples Remaining In Place To Reference Area Concentrations and PALs - RAA3

Notes:
Detected concentrations are shown with bold text.
Detected concentrations that are at or above the maximum concentration detected in background area sediment are highlighted in yellow, detected concentrations that are at or above the human health PAL are underlined, and detected concentrations that are at or above the ecological PAL are italicized.
The average is shown for parent and duplicate pairs.
COPC - contaminant of potential concern
mg/kg - milligram per kilogram
PAL - project action limit
SVOC - semi-volatile organic compound
VOC - volatile organic compound
Qualifiers:
B - Indicates the analyte is detected in the associated blank as well as in the sample.
E - Indicates compounds whose concentrations exceed the calibration range of the instrument.
J - The analyte wa
the approxima
J- -The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential low bias.
J+ - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential high bias.
JN - The analyte was tentatively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Table 5. Samples Remaining in Place with COPCs Above Reference Area Concentrations or PALs

Group	COPC	Units	Maximum Detection within Reference Areas	Human Health PAL	Ecological PAL	Remedial Action Alternative 2			Remedial Action Alternative 3		
						Detections At or Above Maximum Detection within Background Areas	Detections At or Above Human Health PAL	Detections At or Above Ecological PAL	Detections At or Above Maximum Detection within Background Areas	Detections At or Above Human Health PAL	Detections At or Above Ecological PAL
Cyanide	CYANIDE	mg/kg	1.8	2.4		0	0	0	0	0	0
Metals	Aluminum	mg/kg	13000	7700	25000	5	18	0	5	15	0
Metals	Antimony	mg/kg	1.3	3.1	2	4	1	1	4	2	2
Metals	Arsenic	mg/kg	12	0.68	9.8	1	78	1	0	62	0
Metals	Barium	mg/kg	320	1500	20	0	0	66	0	0	48
Metals	Cadmium	mg/kg	2.4	0.71	1	2	11	8	1	7	5
Metals	Chromium, Total	mg/kg	100	0.95	43.4	1	78	8	0	62	4
Metals	Cobalt	mg/kg	12	2.3	50	8	77	0	6	62	0
Metals	Copper	mg/kg	170	310	31.6	1	0	19	0	0	7
Metals	Lead	mg/kg	310	200	35.8	2	7	30	1	4	17
Metals	Mercury	mg/kg	0.91	2.3	0.18	4	0	19	3	0	11
Metals	Nickel	mg/kg	18	140	22.7	18	1	9	16	0	7
Metals	Silver	mg/kg	0.48	39	1	7	0	4	5	0	3
Metals	Thallium	mg/kg	0.14	0.078		3	4	0	3	4	0
Metals	Vanadium	mg/kg	31	39		14	5	0	12	5	0
Metals	Zinc	mg/kg	410	2300	121	2	0	18	0	0	9
Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg		0.00038		49	47	0	35	33	0
Pesticides	ENDOSULFAN SULFATE	mg/kg		38	0.0007	10	0	8	5	0	3
Pesticides	ENDRIN	mg/kg		1.9	0.00222	26	0	5	17	0	2
Pesticides	GAMMA BHC (LINDANE)	mg/kg		0.0057	0.0024	45	15	25	35	8	18
Pesticides	HEPTACHLOR EPOXIDE	mg/kg		0.07	0.00247	24	0	8	17	0	4
Pesticides	P,P'-DDT (4,4'-DDT)	mg/kg	0.012	1.9	0.001	1	0	38	2	0	25
SVOCs	1-Methylnaphthalene	mg/kg		0.018	0.141	28	2	1	18	0	0
SVOCs	2-Methylnaphthalene	mg/kg		24	0.0202	43	0	4	31	0	2
SVOCs	Acenaphthene	mg/kg		360	0.0067	41	0	21	29	0	10
SVOCs	ACENAPHTHYLENE	mg/kg		360	0.0059	47	0	18	35	0	7
SVOCs	ANTHRACENE	mg/kg	3	1800	0.057	0	0	13	0	0	5
SVOCs	BENZO(A)ANTHRACENE	mg/kg	8.5	1.1	0.108	0	3	18	0	1	6
SVOCs	Benzo(K)Fluoranthene	mg/kg	2.8	11	0.24	0	0	3	0	0	1
SVOCs	CARBAZOLE	mg/kg		240	0.069	3	0	3	1	0	1
SVOCs	CHRYSENE	mg/kg	8	110	0.166	0	0	13	0	0	4
SVOCs	Dibenzofuran	mg/kg		7.8	0.51	6	0	1	3	0	0
SVOCs	DIMETHYL PHTHALATE	mg/kg		5100	0.678	10	0	0	5	0	0
SVOCs	FLUORANTHENE	mg/kg	16	240	0.423	0	0	13	0	0	5
SVOCs	FLUORENE	mg/kg		240	0.077	46	0	4	33	0	1
SVOCs	Naphthalene	mg/kg	0.79	2	0.176	1	0	1	0	0	0
SVOCs	PHENANTHRENE	mg/kg	9	1800	0.204	1	0	14	0	0	6
SVOCs	PHENOL	mg/kg		1900	0.175	14	0	0	3	0	0
VOCs	1,1-Dichloroethane	mg/kg		3.6	0.02	0	0	0	2	0	2
VOCs	ACETONE	mg/kg	0.54	7000	0.065	1	0	13	1	0	6
VOCs	CARBON DISULFIDE	mg/kg	0.0074	77	0.0078	2	0	2	0	0	0
VOCs	CIS-1,2-DICHLOROETHYLENE	mg/kg	0.0021	6.3	0.432	2	0	0	3	0	1
VOCs	Tetrachloroethylene (PCE)	mg/kg		8.1	0.002	2	0	2	3	0	2
VOCs	Toluene	mg/kg		490	0.01	1	0	0	2	0	1
VOCs	Trichloroethylene (TCE)	mg/kg	0.0013	0.41	0.078	3	0	0	4	0	0
VOCs	Vinyl Chloride	mg/kg		0.059	0.482	0	0	0	3	1	1

Notes:

COPC - contaminant of potential concern
mg/kg - milligram per kilogram
PAL - project action limit
SVOC - semi-volatile organic compound
VOC - volatile organic compound
Sample counts use the average for parent and duplicate pairs.

APPENDIX F

EVALUATION OF SEDIMENT THICKNESS WITH RESPECT TO HISTORIC DREDGE DESIGN PLANS

AECOM
250 Apollo Drive
Chelmsford, MA 01824

978.905.2100 tel

Memorandum - Phase 1 Sediment Thickness

To	Frederick R. Symmes	Page	1
CC	Kristine Carbonneau		
Subject	Evaluation of Sediment Thickness with Respect to Historic MDC Dredge Design Plans		

From	Kathryn Teske, Andrew Ricci
Date	12/04/2024

1.0 Overview and Purpose

AECOM performed a sediment thickness analysis in the upper one-mile stretch (Phase 1 Reach) of the Lower Neponset River Superfund Site. For this analysis, AECOM compared project field data to historic dredge design plans from the MDC[1] Neponset River Flood Control Project. The purpose of the analysis is to inform the Engineering Evaluation/Cost Analysis (EE/CA) for the Phase 1 Reach on volume of sediment. The EE/CA will support a potential non-time critical removal action (NTCRA) of sediment contaminated with polychlorinated biphenyls (PCBs), both impounded behind the Tileston and Hollingsworth (T&H) Dam and other areas within the Phase 1 Reach.

2.0 Sediment Thickness Analysis

2.1. Phase 1 Investigations

The 2023 Phase 1 investigations conducted by Ocean Surveys Inc. (OSI) included bathymetric survey, sediment coring, and sediment probing (AECOM, 2023; AECOM, 2024). The bathymetric survey of the Phase 1 reach was conducted in March/April 2023. Sediment cores were collected using vibracore sediment sampling to a target depth of 6 feet; Where the sediment core length is less than the target 6 feet, the core length is interpreted as sediment thickness. Probing was achieved using ergonomic jet probes to displace loose sediment with pressurized water. Probing refusal was attributed to presence of underlying rock or consolidated soils, and the probing refusal depths are interpreted as sediment thickness.

As noted, the sediment probing and sediment coring data provide an approximate sediment thickness at the probe and core locations within the Phase 1 Reach. This analysis is performed to determine if additional insight can be gained from the 1964 MDC pre-dredge design plans which have the potential to

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[1] Metropolitan District Commission (MDC) is known as the Massachusetts Department of Conservation and Recreation (DCR) since 2003.

be a baseline demarking the (then) river bottom, identifying areas of sediment accumulation and quantifying sediment volumes in the Phase 1 Reach.

2.2. 1964 Channel Surface Model

The MDC Neponset River Flood Control Project involved multiple dredge contracts along the Neponset River channel. The work done under the 1964 dredge contract included widening and deepening the Neponset River channel from the T&H dam to upstream of the Tuman Highway crossing in Milton. To AECOM's knowledge, no additional dredge work has been conducted in the Phase 1 reach since the 1964 dredge contract. The 1964 dredge plans are included as Attachment A to this memo. AECOM digitized the 1964 dredge plans and georeferenced them to the existing channel alignment using aerial imagery and key site features. The georeferenced plans were used to create a surface model along the Phase 1 reach representing the idealized channel bottom shown in the 1964 plans. This surface model was generated using channel elevations, slope, and bottom width indicated in the plans. The 1964 proposed channel within the Phase 1 reach is defined by invert elevations of 25.5 ft, NAVD 88[2] (32.0 ft, BCB[3]) in the T&H dam impoundment and 27.7 ft, NAVD 88 (34.2 ft, BCB) at the Mother Brook Confluence, with a constant channel slope of 0.055%.

3.0 Results and Discussion

AECOM compared the 1964 channel surface model to the Phase 1 reach bathymetry and core depths. Assuming that the pre-dredge 1964 channel surface is representative of the post-dredge channel bottom, the two surfaces were used to approximate a change in bed elevation (delta) between 1964 post dredge condition and the current channel bathymetry. The delta (i.e., theoretical sediment accumulation since 1964) was then compared to the measured sediment thickness at the sediment coring and probing locations. The results are summarized in **Table 1**. Note that locations outside the limits of the 1964 channel surface model are excluded.

There are many limitations to using the 1964 plans as a reference for the historic bottom of channel. Firstly, the 1964 MDC plans present an idealized, uniformly sloped channel and are not as-built drawings of the actual dredging performed. As such, the 1964 channel surface model used in this analysis is not a reference for the post-dredge channel bottom. Additionally, the purpose of the 1964 dredge work was to widen and deepen the channel for flood mitigation purposes, not to remove sediment.

Regardless, there is no consistent trend between the measured sediment thickness and the computed delta (difference between the existing bathymetry and the 1964 channel surface model). At most coring and probing locations, the measured sediment thickness in the 2023 field investigation is greater than the computed delta, as shown in **Table 1**. Of the 66 sediment coring locations within the limits of the 1964 channel surface model, 56 locations had core lengths greater than the computed delta. Of the 14 sediment probing locations within the limits of the 1964 channel surface model, 11 locations had probing depths greater than the computed delta. This is not unexpected given the limitations of using the historic design plans; however, it is evidence that the 1964 channel surface model should not be used as reference for the bottom of sediment for sediment volume estimates as it would likely result in a gross underestimate of the actual sediment volume. For the purpose of estimating sediment volumes for the EE/CA, AECOM recommends the use of the sediment coring and probing data. This evaluation was

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[2] Norther American Vertical Datum 1988 (NAVD 88).

[3] Boston City Base (BCB). BCB datum approximately 6.46 ft below NAVD 88 according to Appendix A-2 of the 1996 Mass Highway Survey Manual.

performed in part to address EPA’s interest in the usability ot the 1964 channel surface model for computation of sediment deposition.

4.0 References

AECOM. (2023). *Lower Neponset River Superfind Site: Final Site Reconnaissance Summary Memorandum.*

AECOM. (2024). *Lower Neponset River Superfind Site: Data Evaluation Summary Memorandum - Phase 1.*

Table

Table 1. Results of the Sediment Thickness Analysis

Phase 1 Reach
Lower Neponset River
Boston, Massachusetts

Location ID (a)	Easting (ft) (b)	Northing (ft) (b)	River Mile	Sediment Thickness (ft) (c)	[1] 1964 Design Surface Elevation (ft) (d)	[2] 2023 Bathy Survey Elevation (ft) (d)	Delta=[2]-[1] (ft)
Phase 1 Reach Sediment Coring Locations							
23A-0070-PLC1	761575.6	2920347.26	2.69	4.2	25.5	29.4	3.9
23A-0070-PLC2	761578.56	2920346.41	2.69	3.6	25.5	29.4	3.9
23A-0060-PLC1	761495.76	2920318.11	2.71	6.0	25.5	29.9	4.4
23A-0060-PLC2	761496.77	2920317.11	2.71	4.0	25.5	30.0	4.5
23A-0068-PLC2	761492.7	2920357.38	2.71	1.5	25.5	26.0	0.4
23A-0068-PLC4	761492.12	2920353.91	2.71	1.3	25.5	25.9	0.4
23A-0067-PLC1	761434.54	2920300.38	2.72	2.9	25.5	27.1	1.6
23A-0040-PLC1	761395.22	2920307.18	2.73	5.6	25.5	26.0	0.5
23A-0059-PLC1	761309.79	2920201.18	2.75	2.0	25.5	25.0	-0.5
23A-0039-PLC1	761221.27	2920118.42	2.78	2.7	25.5	25.0	-0.5
23A-0058-PLC1	761166.39	2919970.11	2.8	2.0	25.5	25.9	0.3
23A-0057-PLC2	761024.63	2919742.81	2.85	2.5	25.7	27.4	1.7
23A-0037-B2C1	760952.24	2919680.58	2.87	0.5	25.7	25.4	-0.3
23A-0056-B2C1	760841.49	2919553.9	2.9	2.0	25.8	27.6	1.8
23A-0036-PLC3	760731.68	2919524.12	2.92	1.0	25.8	25.6	-0.3
23A-0055-B1C1	760655.54	2919379.85	2.95	3.4	25.9	25.5	-0.5
23A-0055-B1C2	760655.54	2919379.85	2.95	2.2	25.9	25.5	-0.5
23A-0054-PLC2	760474.82	2919183.47	3	3.5	26.1	27.3	1.3
23A-0054-PLC3	760474.03	2919179.22	3	3.0	26.1	28.1	2.0
23A-0054-PLC4	760474.03	2919179.22	3	3.0	26.1	28.1	2.0
23A-0053-B1C1	760302.09	2918992.98	3.05	6.0	26.2	29.6	3.4
23A-0033-B2C1	760266.39	2918914.72	3.07	3.0	26.2	25.3	-0.9
23A-0033-B2C3	760263.07	2918914.71	3.07	0.5	26.2	24.5	-1.7
23A-0012-PLC1	760278.18	2918837.26	3.09	3.0	26.3	27.3	1.1
23A-0012-PLC2	760278.18	2918837.26	3.09	0.8	26.3	27.3	1.1
23A-0052-PLC1	760291.73	2918775.71	3.1	1.9	26.3	24.5	-1.8
23A-0032-PLC1	760224	2918689.64	3.12	3.5	26.4	25.0	-1.4
23A-0011-B1C1	760166.26	2918622.44	3.13	4.0	26.4	29.0	2.6
23A-0051-PLC1	760187.43	2918521.01	3.15	3.4	26.4	28.1	1.7
23A-0031-PLC1	760082.41	2918474.12	3.17	3.4	26.5	27.0	0.5
23A-0010-PLC1	760024.37	2918416.35	3.18	3.7	26.5	27.6	1.1
23A-0050-B2C1	760016.64	2918320.79	3.2	3.2	26.6	27.8	1.3
23A-0030-PLC1	759944.34	2918253.43	3.22	3.0	26.6	26.7	0.1
23A-0009-PLC1	759843.67	2918239.14	3.23	5.7	26.7	29.4	2.8
23A-0009-PLC2	759845.49	2918238.66	3.23	5.5	26.7	28.7	2.0
23A-0049-B2C1	759838.04	2918131.51	3.25	3.2	26.7	28.8	2.1
23A-0029-PLC1	759764.14	2918061.6	3.27	5.8	26.7	28.3	1.5
23A-0048-PLC1	759659.77	2917951.83	3.29	5.5	26.8	28.5	1.6
23A-0028-PLC2	759568.29	2917896.08	3.31	1.1	26.9	26.0	-0.9
23A-0007-PLC1	759489.38	2917846.24	3.33	5.1	26.9	30.0	3.1
23A-0006-PLC2	759386.09	2917609.68	3.38	1.8	27.0	29.0	1.9
23A-0046-PLC1	759381.81	2917516.97	3.39	0.3	27.1	27.5	0.4
23A-0046-PLC2	759381.81	2917516.97	3.39	2.4	27.1	27.5	0.4
23A-0026-B1C1	759292.28	2917468.62	3.41	1.6	27.1	28.9	1.8
23A-0065-PLC1	759263.92	2917446.97	3.42	0.5	27.1	28.9	1.7
23A-0005-PLC1	759226.54	2917407.47	3.43	2.0	27.2	28.0	0.9
23A-0064-PLC1	759163.26	2917348.11	3.45	5.2	27.2	31.5	4.3
23A-0064-PLC2	759163.64	2917349.16	3.45	5.7	27.2	31.4	4.2
23A-0025-B1C1	759126.41	2917268.74	3.46	1.0	27.3	25.4	-1.9
23A-0025-B1C2	759127.96	2917269.64	3.46	0.5	27.3	25.4	-1.8
23A-0063-PLC1	759103.16	2917288.47	3.46	4.7	27.3	31.7	4.4
23A-0063-PLC2	759103.82	2917287.2	3.46	4.9	27.3	31.5	4.2
23A-0062-PLC1	759063.79	2917258.87	3.47	5.0	27.3	31.5	4.2
23A-0004-B2C1	759050.93	2917214.56	3.48	1.4	27.3	27.5	0.2
23A-0061-PLC1	758975.69	2917188.36	3.49	2.7	27.3	30.7	3.4
23A-0061-PLC2	758977.04	2917187.36	3.49	2.6	27.3	30.3	3.0
23A-0024-PLC2	758905.59	2917140.46	3.51	0.5	27.4	27.6	0.2
23A-0003-PLC1	758736.25	2917164.17	3.54	0.5	27.5	27.0	-0.5
23A-0043-PLC1	758739.4	2917132.68	3.54	1.6	27.5	27.0	-0.5
23A-0023-B2C1	758652.01	2917124.86	3.56	0.5	27.5	26.3	-1.2
23A-0023-B2C2	758653.41	2917125.11	3.56	1.7	27.5	26.5	-1.0
23A-0002-PLC2	758565.3	2917148.51	3.58	6.0	27.5	29.6	2.1
23A-0042-PLC1	758491.12	2917087.92	3.59	2.7	27.6	28.6	1.0
23A-0022-PLC1	758398.24	2917078.33	3.61	4.0	27.6	28.4	0.7

23A-0001-PLC1	758309.05	2917085.81	3.62	2.3	27.7	29.7	2.1
23A-0041-PLC1	758313.67	2917037.16	3.63	1.0	24.2	27.8	3.6
Phase 1 Reach Probing Locations (e)							
JP-0207	761573.6	2920388.53	2.69	2.2	25.5	25.9	0.4
JP-0210	761498.09	2920364.84	2.71	2.5	25.5	25.3	-0.2
JP-0213	761419.94	2920328.47	2.72	0.3	25.5	26.1	0.5
JP-0215	760305.09	2918972.23	3.06	11.3	26.2	29.4	3.2
JP-0029	759767.65	2918063.54	3.27	5.0	26.7	28.0	1.2
JP-0048	759659.77	2917951.83	3.29	5.4	26.8	28.5	1.6
JP-0007	759489.38	2917846.24	3.33	5.5	26.9	30.0	3.1
JP-0205	759331.02	2917447.38	3.41	2.0	27.1	29.2	2.0
JP-0204	759285.97	2917400.6	3.42	1.0	27.2	29.4	2.2
JP-0203	759184.48	2917377.81	3.44	5.2	27.2	31.6	4.4
JP-0200	759137.04	2917323.47	3.45	5.3	27.2	31.3	4.1
JP-0201	759164.22	2917349.1	3.45	6.5	27.2	31.4	4.2
JP-0061	758975.69	2917188.36	3.49	4.5	27.3	30.7	3.4
JP-0002	758566.57	2917147.72	3.57	6.7	27.5	29.4	1.8

Notes

(a) Locations outside the 1964 surface model excluded.

(b) The horizontal datum is North American Datum 1983 Massachusetts State Plain 2001 Feet.

(c) Sediment core lengths and probing refusal depths interpreted as sediment thickness.

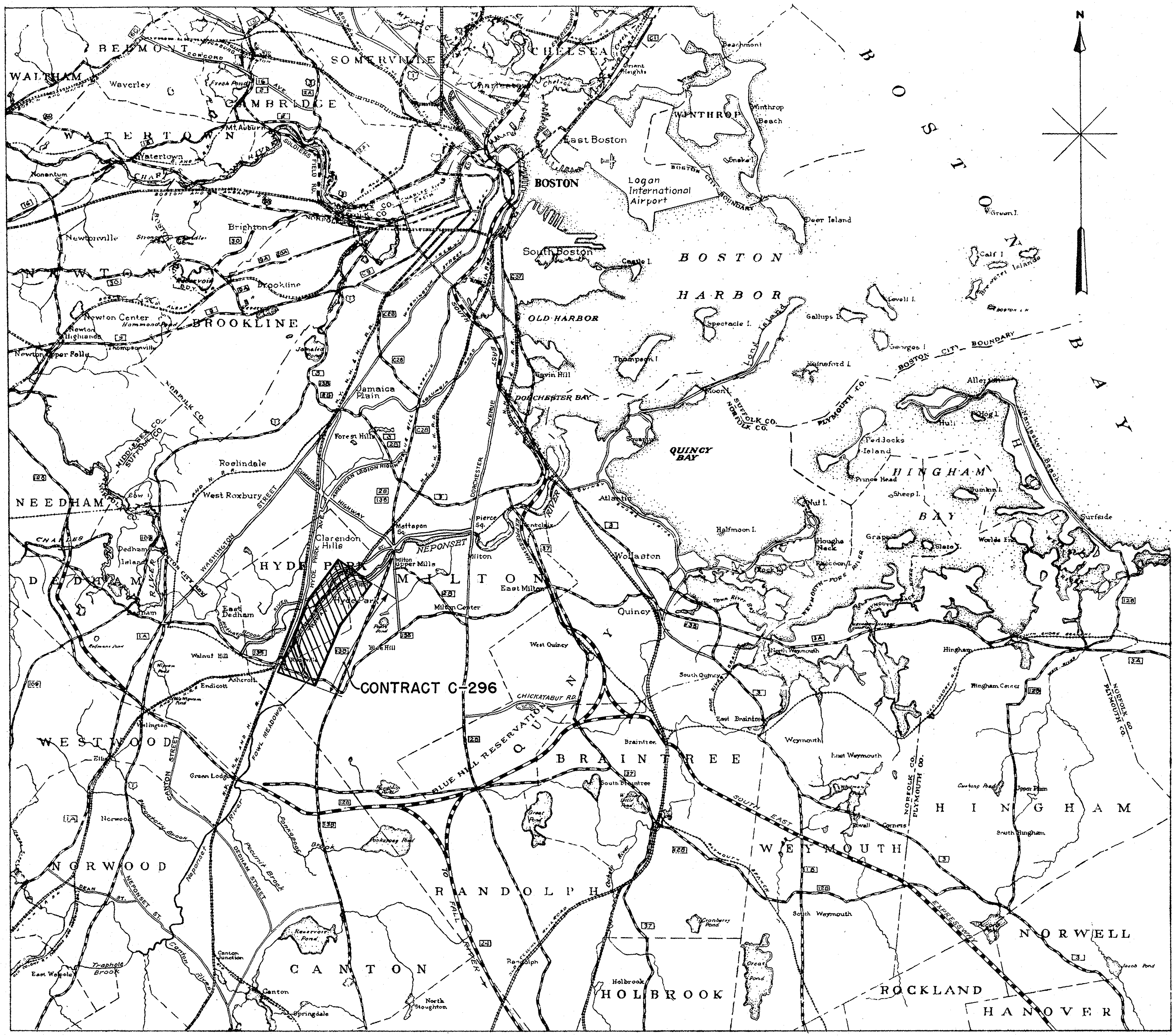
(d) The vertical datum is in North American Vertical Datum 1988.

(e) Probing locations JP-0002, JP-0007, JP-0008, JP-0009, JP-0029, JP-0048, and JP-0061 were in the vicinity of sediment sampling locations 23A-0002, 23A-

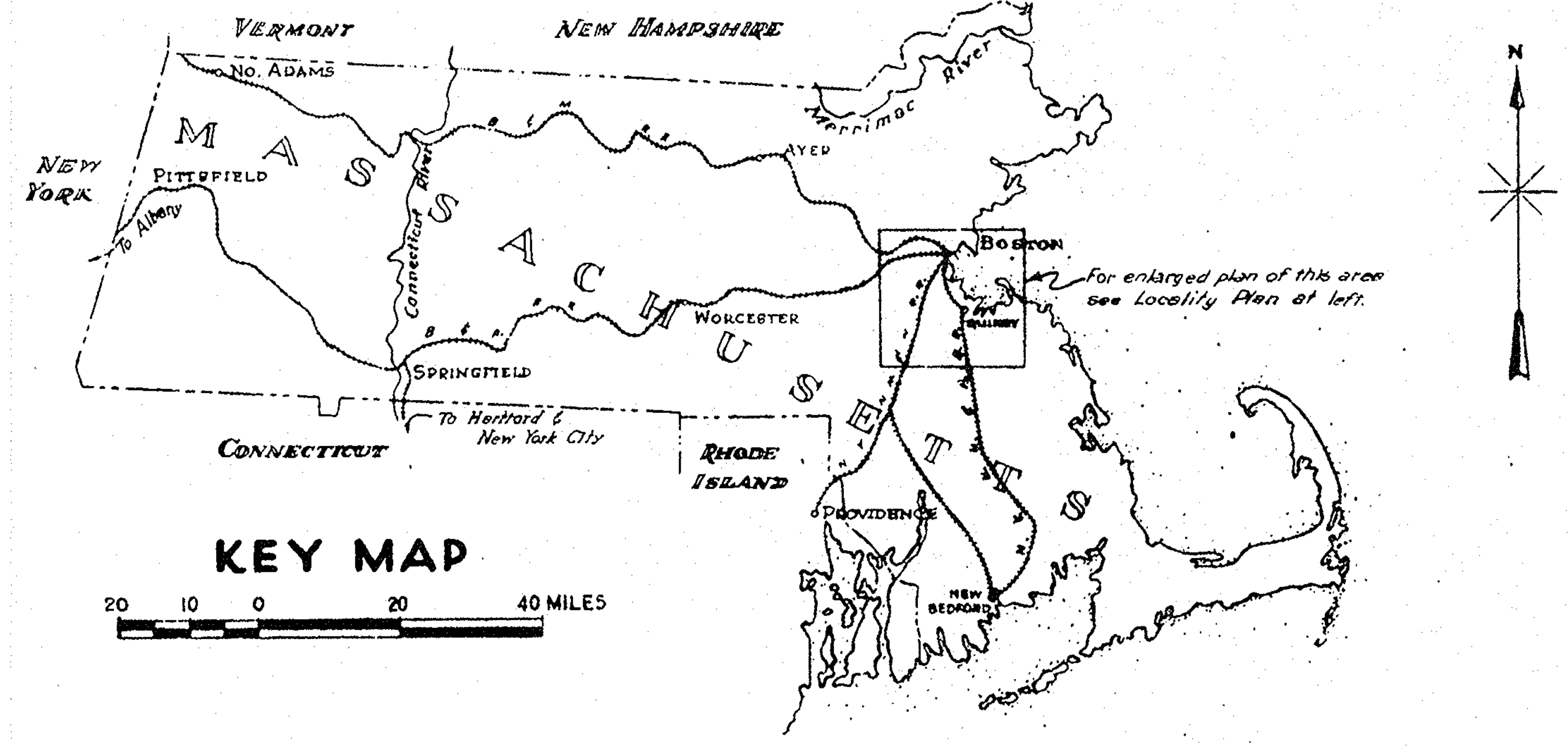
Attachment A

MDC Neponset River Flood Control Project 1964 Dredge Plans

CONTRACT C-296 SHEET 1
40 SHEETS IN SET



LOCALITY PLAN



KEY MAP

LEGEND

- County Line
- Town Line
- Federal Route Numbers
- State Route Numbers
- Unnumbered Roads
- Railroads
- Shore Line

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION — CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
KEY MAP AND LOCALITY PLAN

SCALES AS SHOWN
JUNE 15, 1964

①

DRAWN K.W.H.
TRACED K.W.H.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8 U

ACC. 59201

CONTRACT C-296 SHEET 2
40 SHEETS IN SET

For detailed plans of outlined areas, see sheets indicated.

PLAN

200 100 0 200 400FT.

PROFILE

SCALES: Hor. 1"= 200'
Vert. 1"= 5'

Notes:

Elevations, Boston City Base.

Co-ordinates and bearings are on the Massachusetts Geodetic Survey System.

Locations, dimensions and elevations of all existing underground structures shown on these sheets are approximate only, and the Commission does not warrant the plot to be even approximately correct.

Additional details of real estate acquired by the Commission for the purposes of this Contract are on file in the Office of the Engineer.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
GENERAL PLAN AND PROFILE – SHEET I
SCALES AS SHOWN
JUNE 15, 1964

②

DRAWN K.W.H.
TRACED K.W.H.
CHECKED J.C.

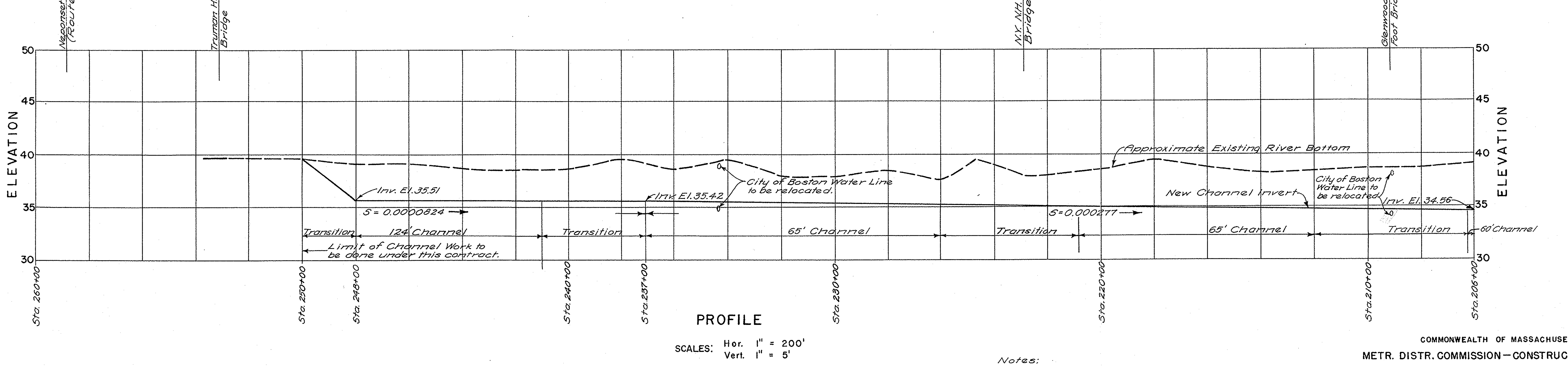
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C – 296 10.8U

ACC. 59202

CONTRACT C-296 SHEET 3
40 SHEETS IN SET



PROFILE

SCALES: Hor. 1" = 200'
Vert. 1" = 5'

Notes:
Elevations, Boston City Base.
For General Notes, see Sheet 2.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION — CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
GENERAL PLAN AND PROFILE — SHEET 2
SCALES AS SHOWN
JUNE 15, 1964

③

DRAWN K.W.H.
TRACED K.W.H.
CHECKED J.C.

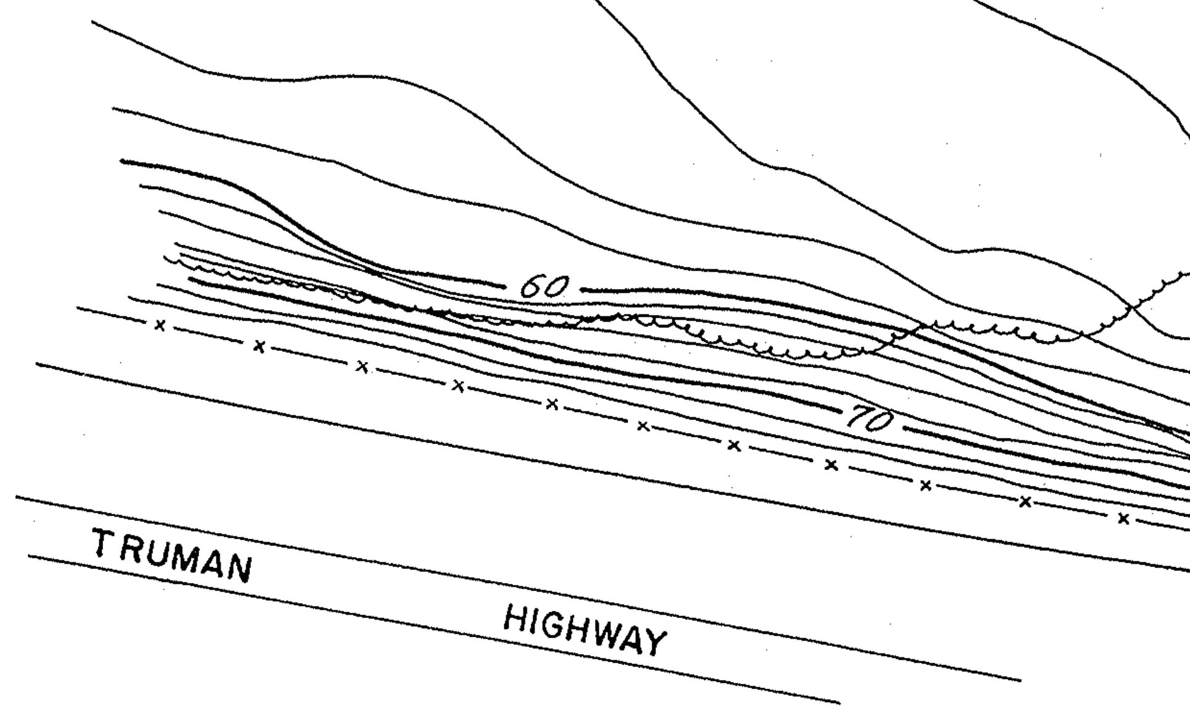
Martin F. Cosgrove
Deputy Chief Engineer

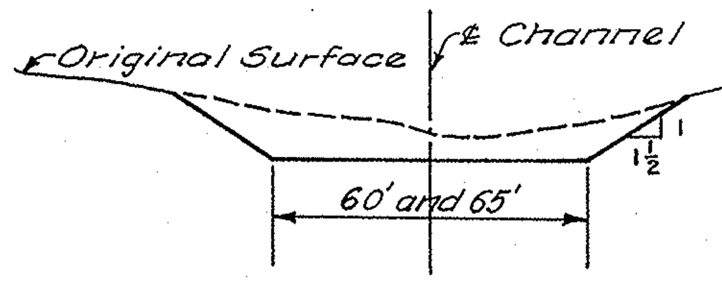
Chief Engineer

FILE CONT. C – 296 10.8U

ACC. 59203

CONTRACT C-296 SHEET 4
40 SHEETS IN SET





TYPICAL CHANNEL SECTION
STA. 147+70 TO STA. 237+00

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For Boring Data and Channel Cross Sections, see Sheet 14.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
PLAN - STA. 147+00 TO STA. 152+60

40 20 0 40 80 FT.

JUNE 15, 1964

④

DRAWN H.W.H.
TRACED H.W.H.
CHECKED J.C.

Martin A. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59204

CONTRACT C-296 SHEET 5
40 SHEETS IN SET

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheets 14, 15 & 16.
For typical channel section, see Sheet 4.
For details of work to be done at Bridge No. 7.54, see Sheet 33.
For details of 12" M.D.C. water relocation, see Sheets 30 & 31.
For typical drain headwall details, see Sheet 10.
For typical riprap detail, see Sheet 20.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
PLAN–STA. 152+60 TO STA. 164+75

40 20 0 40 80 FT.

JUNE 15, 1964

⑤

DRAWN J.L.
TRACED R.W.H.
CHECKED J.C.

Martin F. Cazz…ve
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59205

CONTRACT C-296 SHEET 6
40 SHEETS IN SET

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheets 16 & 17.
For typical channel section, see Sheet 4.
For details of sewer relocation at Sta. 168+90±, see Sheet 28.
For typical drain headwall details, see Sheet 10.
For typical riprap detail, see Sheet 20.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
PLAN – STA. 164+75 TO STA. 176+10

40 20 0 40 60 FT.

JUNE 15, 1964

⑥

DRAWN J.L.
TRACED W.O.B.
CHECKED J.C.

Martin R. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59206

CONTRACT C-296 SHEET 7
40 SHEETS IN SET

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheets 17 & 18.
For typical channel section, see Sheet 4.
For typical drain headwall details, see Sheet 10.
For typical riprap detail, see Sheet 20.
For details of work to be done at the Fairmount Ave. bridge, see Sheet 34.
For details of work to be done at Bridge No. 7.96, see Sheet 35.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION — CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY

PLAN — STA. 176+10 TO STA. 188+00

40 20 0 40 60 FT.

JUNE 15, 1964

⑦

DRAWN J.L.
TRACED H.W.H.
CHECKED V.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59207

CONTRACT C-296 SHEET 8
40 SHEETS IN SET

Note:
Existing structures encroaching M.D.C. property will be removed by others.

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross-sections, see Sheets 19 & 20.
For typical channel section, see Sheet 4.
For details of sewer relocation at Sta. 191+45±, see Sheet 29.
For typical drain headwall details, see Sheet 10.
For typical riprap detail, see Sheet 20.
For details of work to be done at the Dana Ave. bridge, see Sheet 36.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM TO NEPONSET VALLEY PARKWAY
PLAN–STA. 188+00 TO STA. 199+75

40 20 0 40 80 FT.

JUNE 15, 1964

⑧

DRAWN A.L.
TRACED K.W.H.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59208

CONTRACT C-296 SHEET 9
40 SHEETS IN SET

ALTERATIONS TO EXISTING ENGINEER'S OFFICE

10 5 0 10 20 FT.

Furnish And Install The Following Items:

① Two (2) plywood partitions to 9' ceilings with screened ventilating openings at top and insulating board on office side only, except at Ⓐ where plywood to be used on both sides. Paint new plywood with one coat to match existing walls.
② Two (2) new doors, 2'-6" wide with locks.
③ Thirteen (13) aluminum alloy screens, approx. 2'-3" wide by 2'-0" high.
④ Three (3) pull chains on existing ceiling fixtures.
⑤ One (1) ceiling duplex receptacle for fluorescent lights at ceiling fixture.
⑥ Two (2) four foot double tube fluorescent ceiling lamps with pull chains.
⑦ Replace broken asphalt floor tiles with new tiles of like appearance as required.
⑧ New insulating board on existing plywood partition office side near hall.

Notes:

Elevations, Boston City Base.

For General Plan and Profile, see Sheets 2 and 3.

For boring data and channel cross sections, see Sheets 20, 21 and 22.

For typical channel section, see Sheet 4.

For typical drain headwall details, see Sheet 10.

For details of work to be done at the "B" St. footbridge, see Sheet 37.

For typical riprap detail, see Sheet 20.

For details of work to be done at the Glenwood Ave. footbridge, see Sheet 38.

For details of City of Boston water line relocation, see Sheet 40.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM TO NEPONSET VALLEY PARKWAY

PLAN – STA. 199+75 TO STA. 210+75

40 20 0 40 80 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

9

DRAWN J.L.
TRACED R.W.W.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59209

CONTRACT C-296 SHEET 10
40 SHEETS IN SET

Notes:
Where existing drains are to be altered, the drain lines shall be extended or cut back to face of slope as directed.
For drains 18"ϕ and over, headwalls with 12" Paving, grouted, are required.
For drains under 18"ϕ, inverts and side slopes shall be paved with 9" Paving, grouted, and no headwalls required.

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheets 22 & 23.
For typical channel section, see Sheet 4.
For details of Hot-Top Pavements Inc. intake, see Sheet 26.
Concrete minimum compressive strength at 28 days to be 3000 #/□".
For typical riprap detail, see Sheet 20.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM TO NEPONSET VALLEY PARKWAY
PLAN – STA. 210 + 75 TO STA. 221 + 00

40 20 0 40 80 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

⑩

DRAWN J.R.
TRACED K.W.N.
CHECKED J.C.

Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59210

CONTRACT C-296 SHEET 11
40 SHEETS IN SET

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheets 23 & 24.
For typical drain headwall details, see Sheet 10.
For typical channel section, see Sheet 4.
For typical riprap detail, see Sheet 20.
For details of work to be done at Bridge No. 857, see Sheet 39.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
PLAN – STA. 221+00 TO STA. 233+50

40 20 0 40 80 FT.

JUNE 15, 1964

⑪

DRAWN J.R.
TRACED K.O.H.
CHECKED J.C.

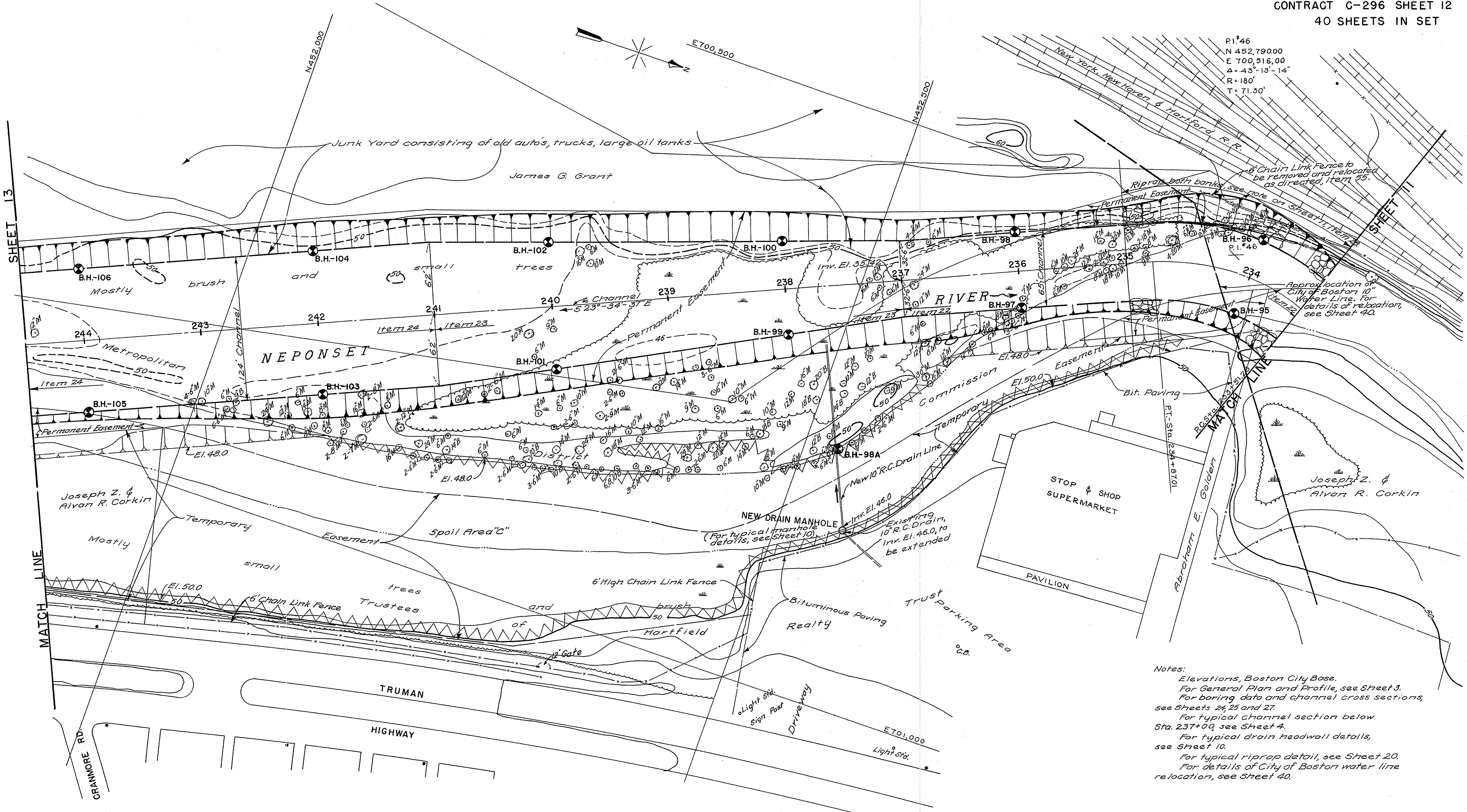
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

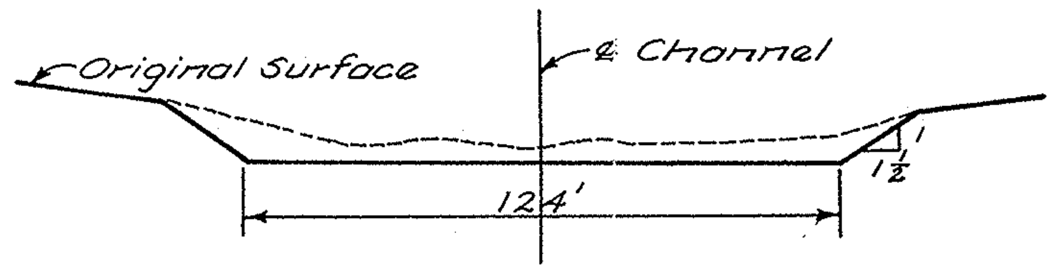
FILE CONT. C-296 10.8U

ACC. 59211

CONTRACT C-296 SHEET 12
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheets 24, 25 and 27.
For typical channel section below Sta. 237+00, see Sheet 4.
For typical drain headwall details, see Sheet 10.
For typical riprap detail, see Sheet 20.
For details of City of Boston water line relocation, see Sheet 40.



TYPICAL CHANNEL SECTION
STA. 241+00 TO STA. 248+00

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
PLAN – STA. 233+50 TO STA. 244+50

40 20 0 40 80FT.

JUNE 15, 1964

⑫

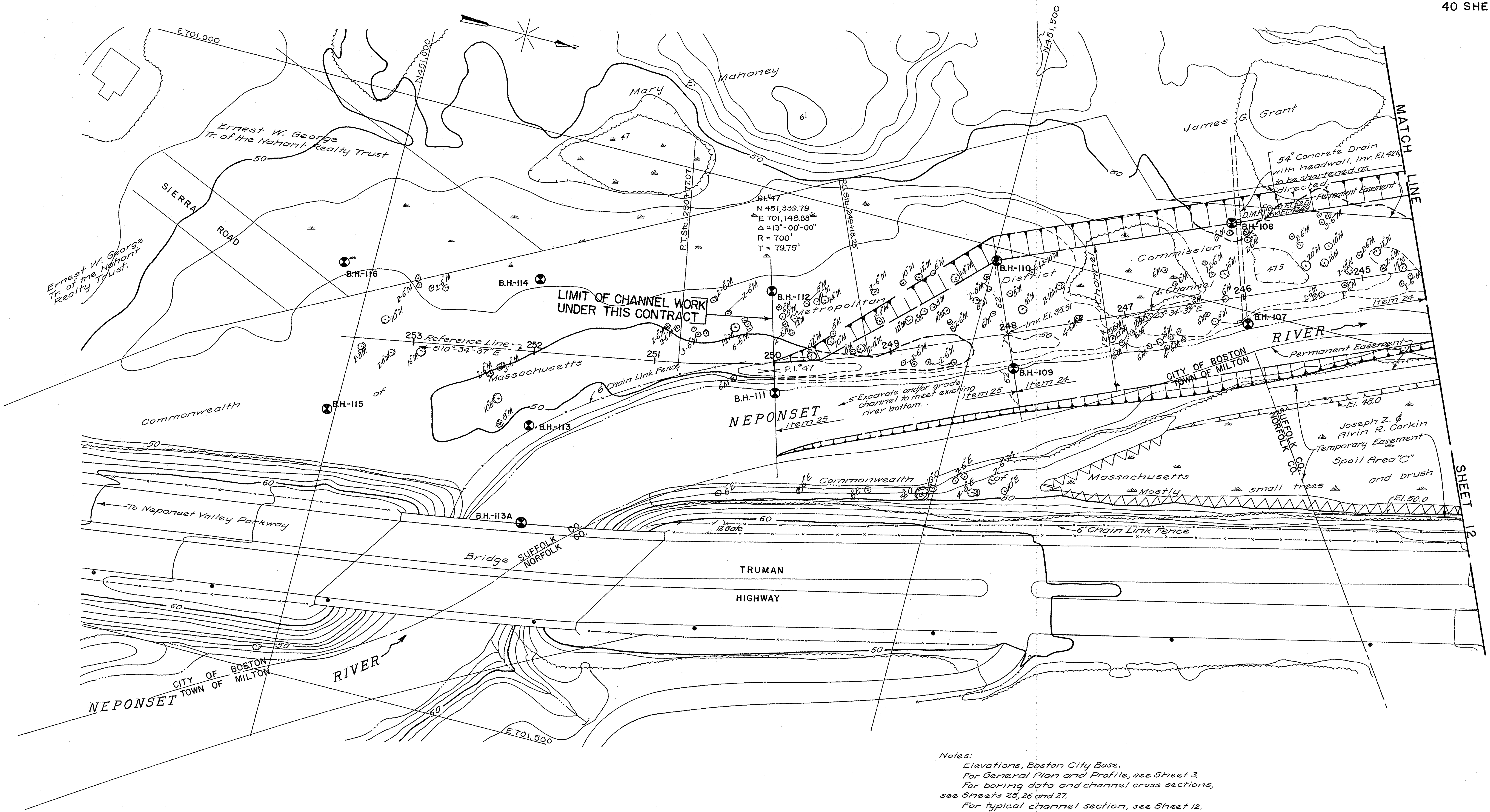
DRAWN J.L.
TRACED K.L.H.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59212

CONTRACT C-296 SHEET 13
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheets 25, 26 and 27.
For typical channel section, see Sheet 12.
For typical drain headwall details, see Sheet 10.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY

PLAN – STA. 244 + 50 TO STA. 253 + 00

40 20 0 40 80 FT.

JUNE 15, 1964

⑬

DRAWN J.L.
TRACED K.W.H.
CHECKED J.C.

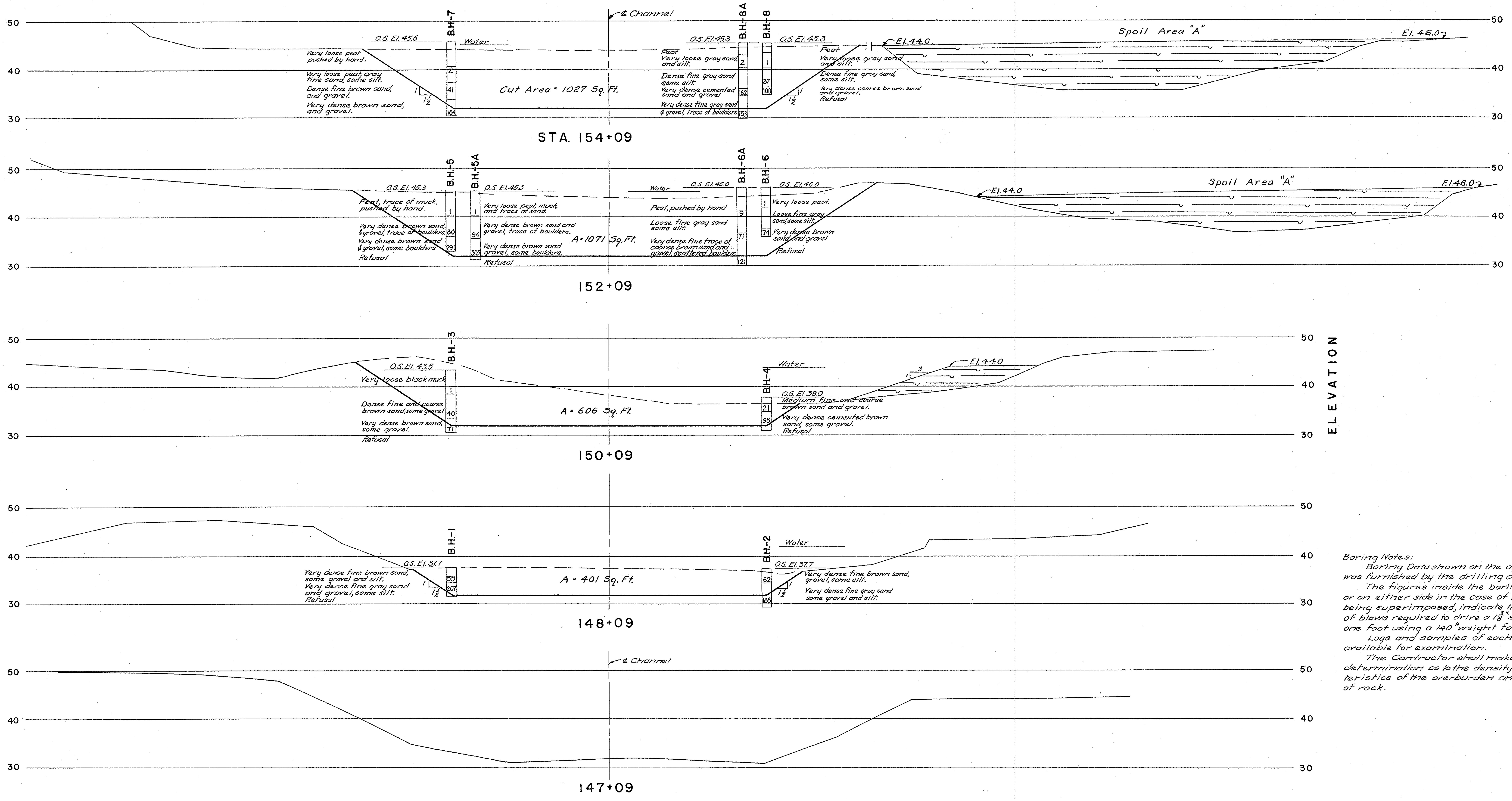
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59213

CONTRACT C-296 SHEET 14
40 SHEETS IN SET



Boring Notes:

Boring Data shown on the drawings was furnished by the drilling contractor.

The figures inside the boring diagram, or on either side in the case of two borings being superimposed, indicate the number of blows required to drive a $1\frac{3}{8}$" split sampler one foot using a 140# weight falling 30 inches.

Logs and samples of each boring are available for examination.

The Contractor shall make his own determination as to the density and characteristics of the overburden and the type of rock.

General Notes:

Elevations, Boston City Base.

For Typical Riprap Detail, see Sheet 20.

Payment limit for channel rock excavation shall be 6" beyond the indicated payment limit for channel excavation.

For Typical Channel Sections, see Sheets 4 and 12.

For location of borings, see Sheets 4 and 5.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20FT.

JUNE 15, 1964

⑭

DRAWN E.J.G.
TRACED H.W.H.
CHECKED D.R.

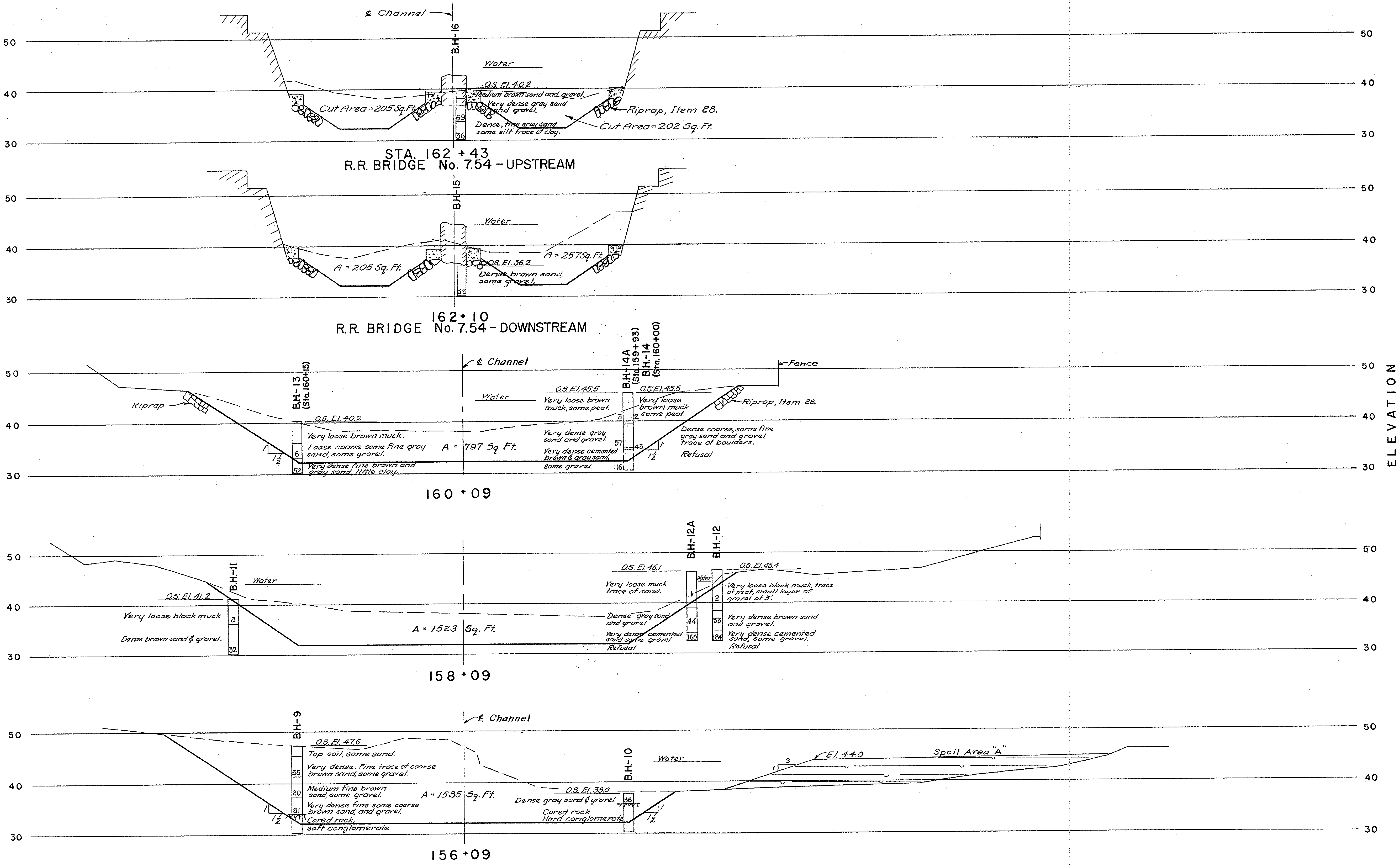
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59214

CONTRACT C-296 SHEET 15
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheet 5.
For details of work to be done at R.R. Bridge No. 7.54, see Sheet 33.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to Elev. 47, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION-CONSTRUCTION DIVISION
NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS
10 5 0 10 20 FT.
JUNE 15, 1964

15

DRAWN C.J.G.
TRACED K.W.H.
CHECKED

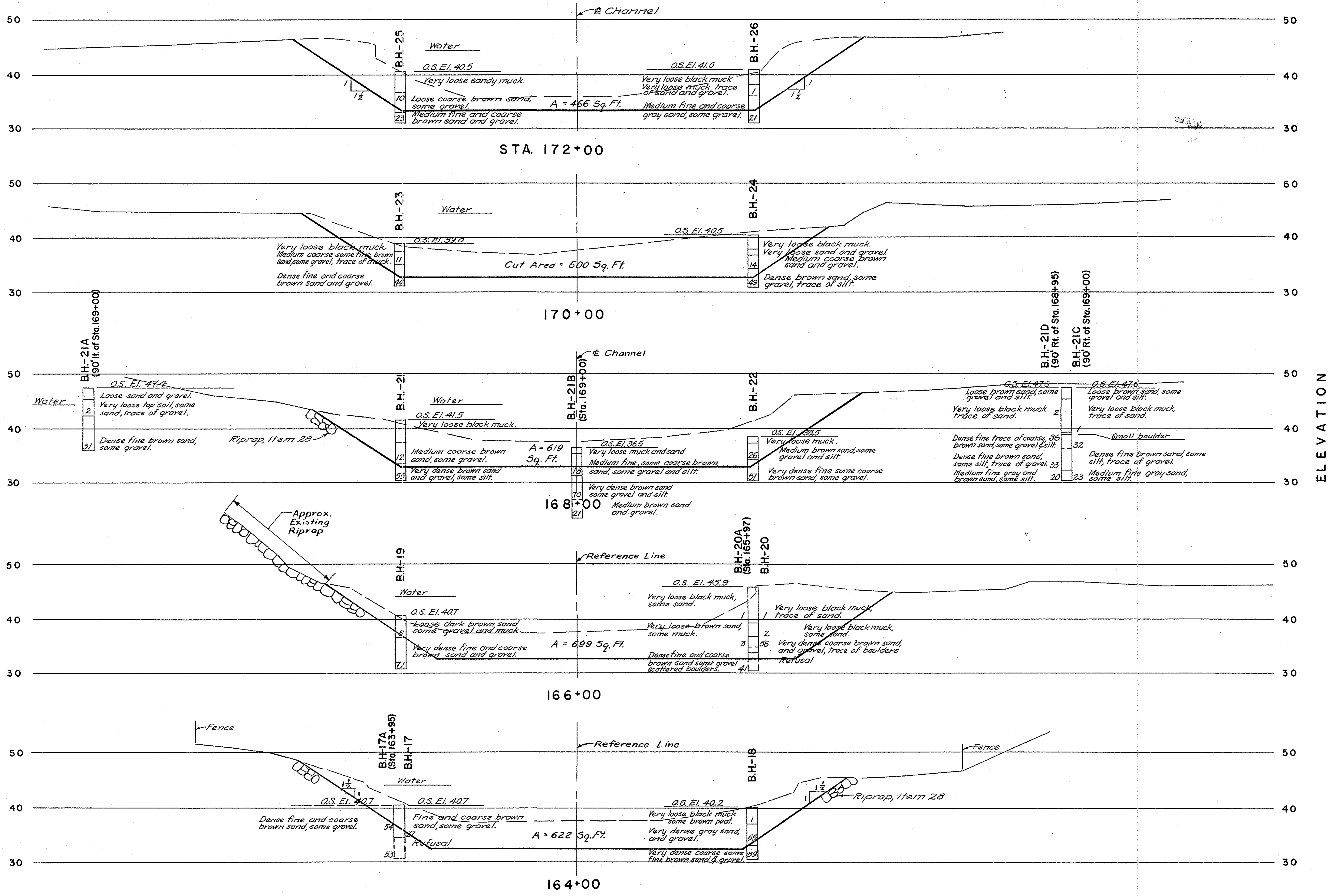
Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59215

CONTRACT C-296 SHEET 16
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 5 & 6.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to Elev. 48, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

16

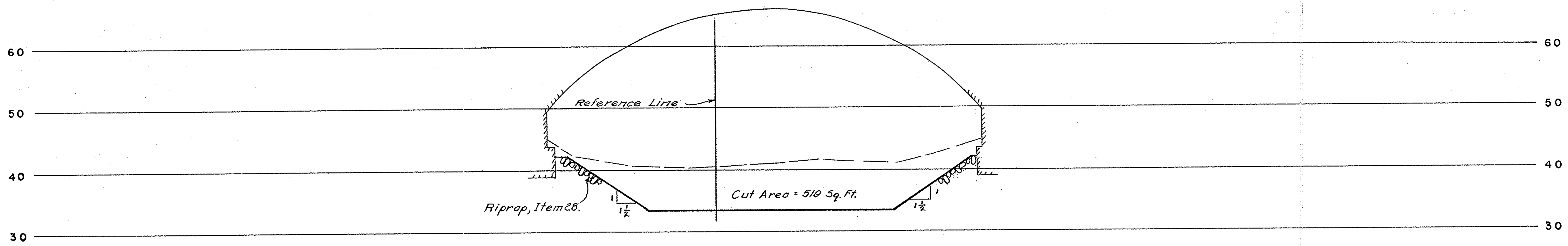
DRAWN E.J.G.
TRACED R.W.H.
CHECKED ORR

Martin J. Cosgrove
Deputy Chief Engineer

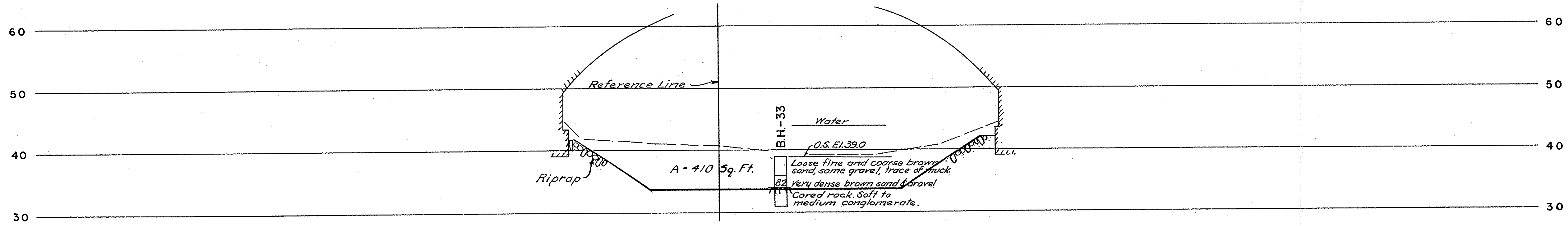
Chief Engineer

FILE CONT. C-296 10.8U
ACC.59216

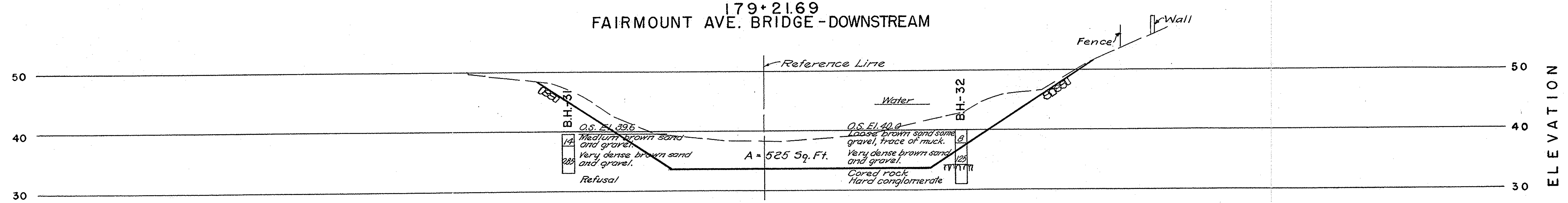
CONTRACT C-296 SHEET 17
40 SHEETS IN SET



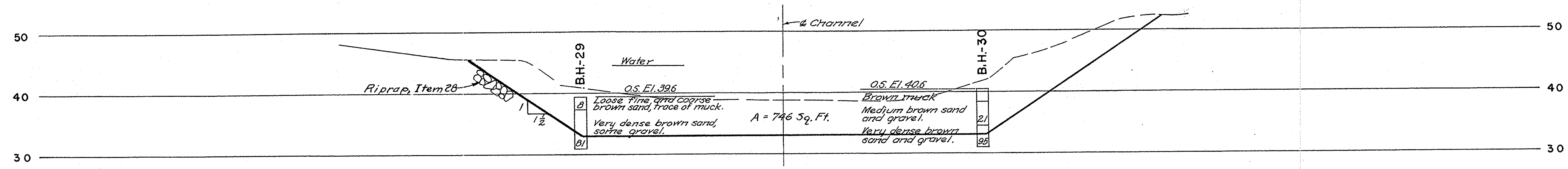
STA. 179+70.19
FAIRMOUNT AVE. BRIDGE – UPSTREAM



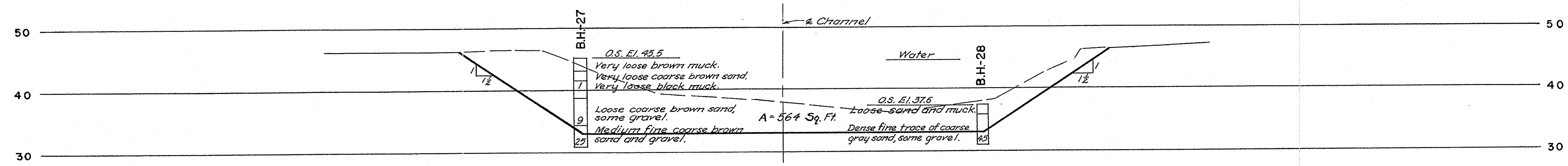
179+21.69
FAIRMOUNT AVE. BRIDGE – DOWNSTREAM



178+00



176+00



174+00

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to Elev. 48, unless otherwise directed.

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 6 & 7.
For details of work to be done at Fairmount Ave. Bridge, see Sheet 34.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

17

DRAWN E.J.G.
TRACED R.W.H.
CHECKED

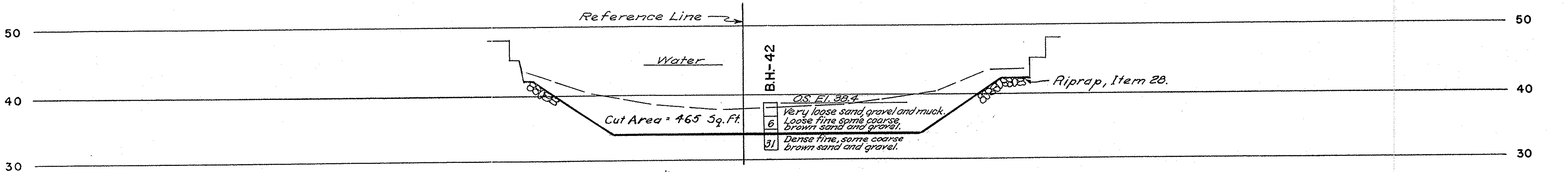
Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

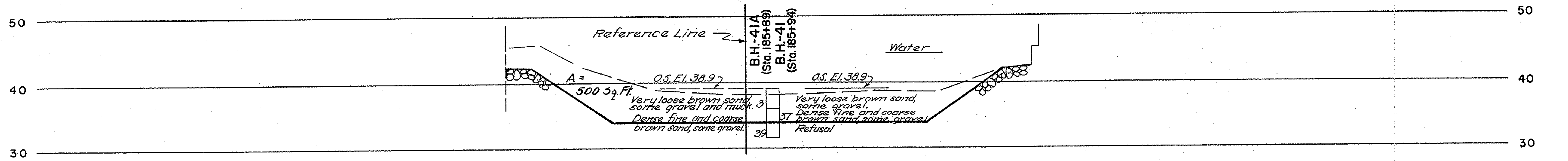
ACC. 59217

CONTRACT C-296 SHEET 18
40 SHEETS IN SET

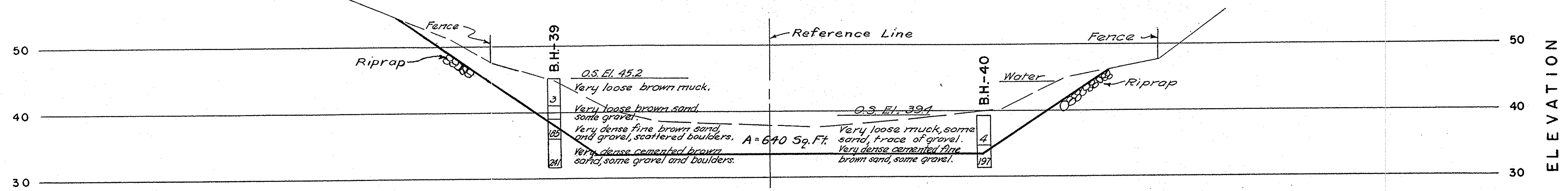


*STA. 186+18
R.R. BRIDGE No. 7.96 - UPSTREAM

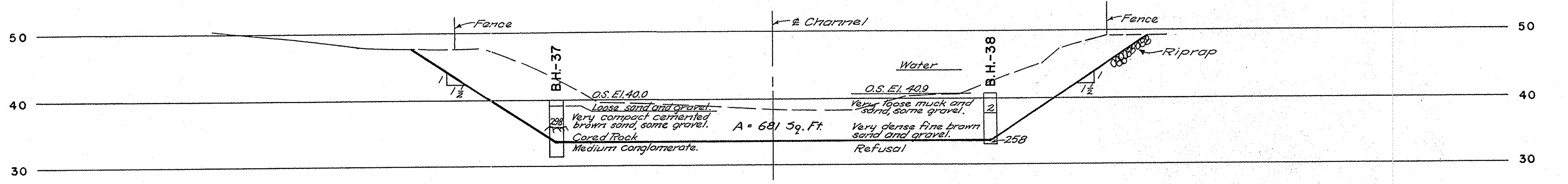
* Sections at these stations are parallel to faces of Bridge #7.96.



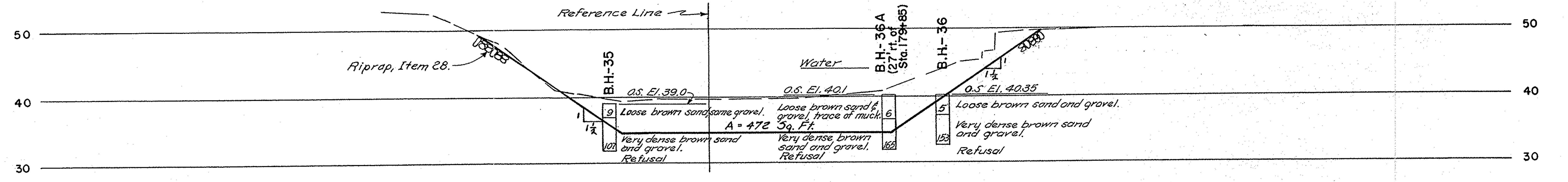
*185+94
R.R. BRIDGE No. 7.96 - DOWNSTREAM



184+00



182+00



180+00

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheet 7.
For details of work to be done at Bridge No. 7.96, see Sheet 35.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 49, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

18

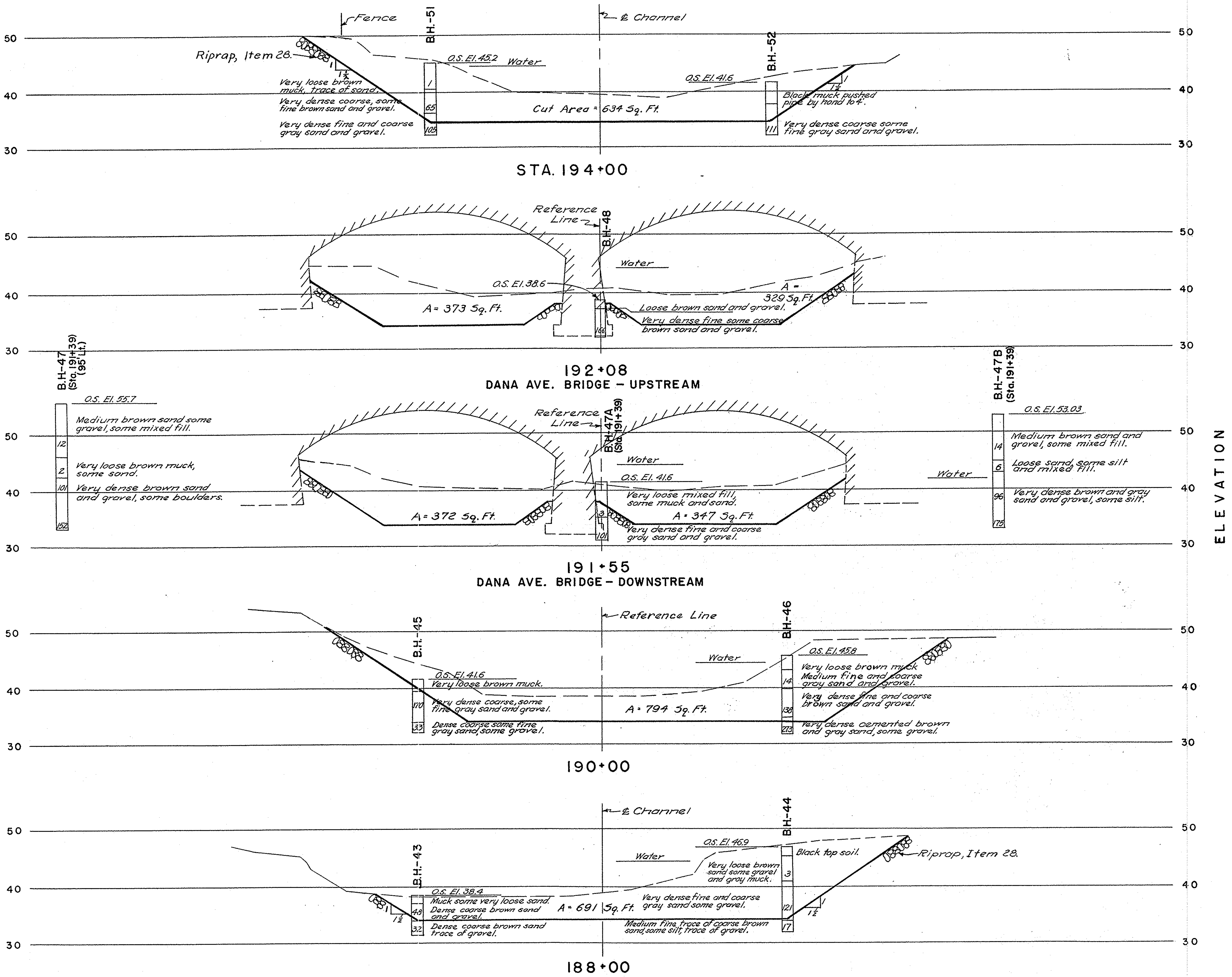
DRAWN E.J.G.
TRACED K.W.H.
CHECKED

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59218

CONTRACT C-296 SHEET 19
40 SHEETS IN SET



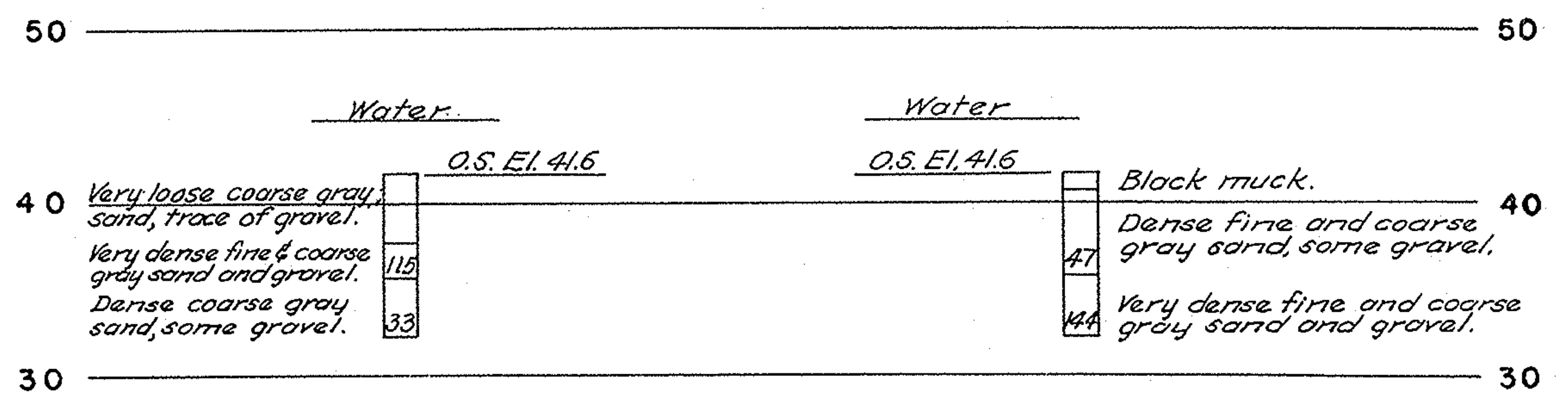
STA. 194+00

192+08
DANA AVE. BRIDGE – UPSTREAM

191+55
DANA AVE. BRIDGE – DOWNSTREAM

190+00

188+00



B.H. 49

STA. 193+30
(100' Rt. of ℄)

B.H. 50

STA. 192+90
(125' Rt. of ℄)

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 7 & 8.
For details of work to be done at Dana Ave. Bridge, see Sheet 36.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 49.0, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION–CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

⑲

DRAWN E.J.G.
TRACED K.L.S.H.
CHECKED R.A.M.

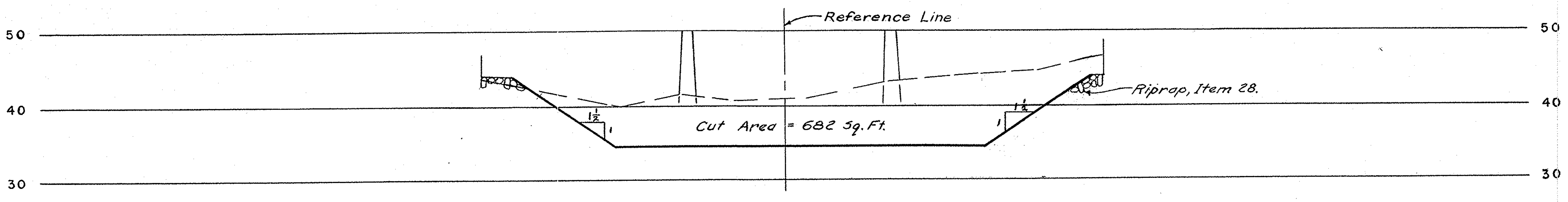
Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

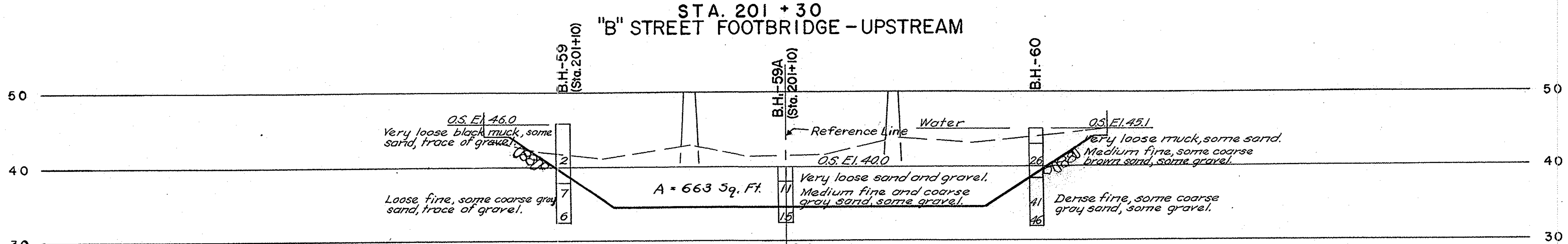
FILE CONT. C-296 10.8U

ACC. 59,219

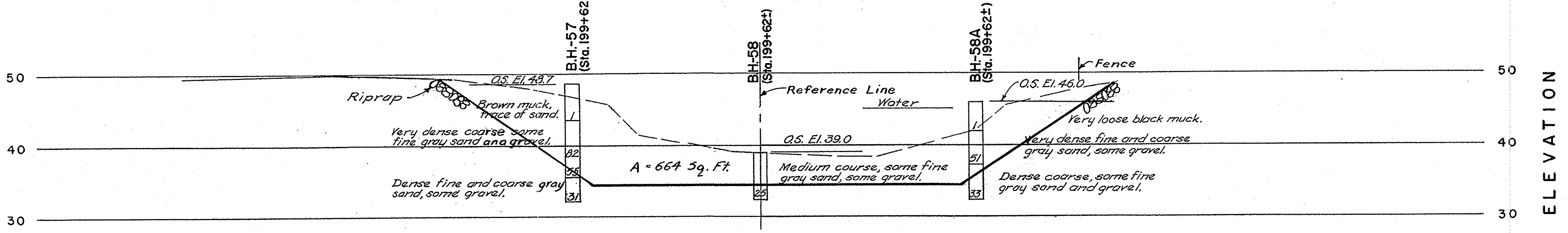
CONTRACT C-296 SHEET 20
40 SHEETS IN SET



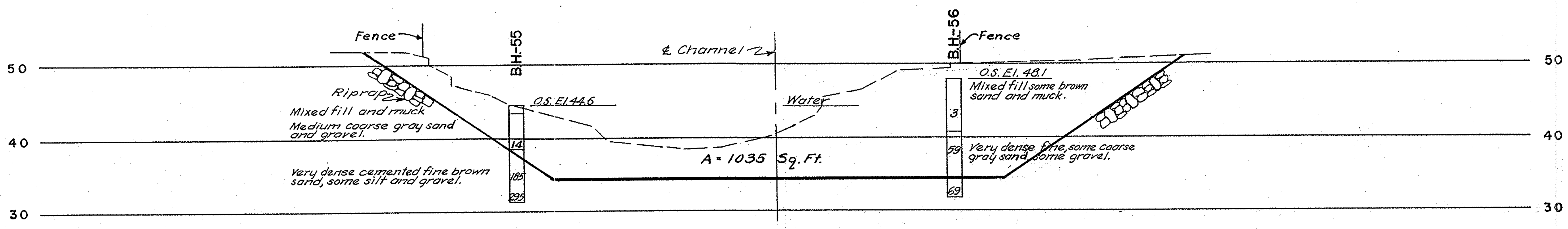
STA. 201 + 30
"B" STREET FOOTBRIDGE - UPSTREAM



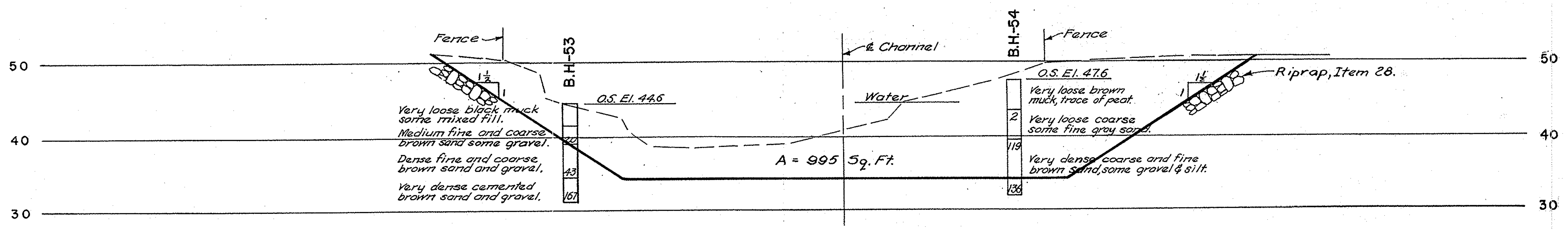
201+20
"B" STREET FOOTBRIDGE - DOWNSTREAM



200 + 00

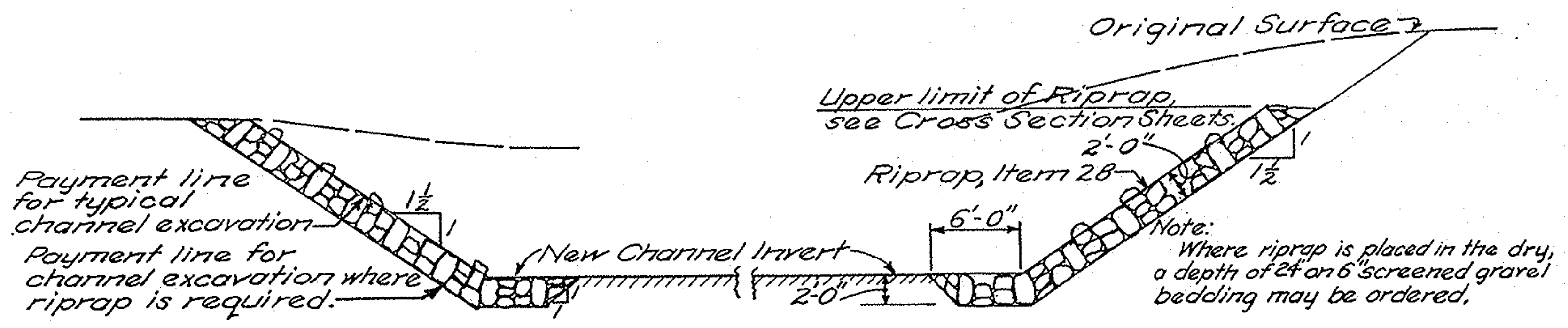


198 + 00



196 + 00

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to Elev. 50, unless otherwise directed.



TYPICAL RIPRAP DETAIL

Note:
Details of Riprap, Item 28, under and in vicinity of bridges, are shown on pertinent bridge detail sheets.

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 8 & 9.
For details of "B" St. footbridge repairs, see Sheet 37.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

(20)

DRAWN E.J.G.
TRACED K.W.H.
CHECKED

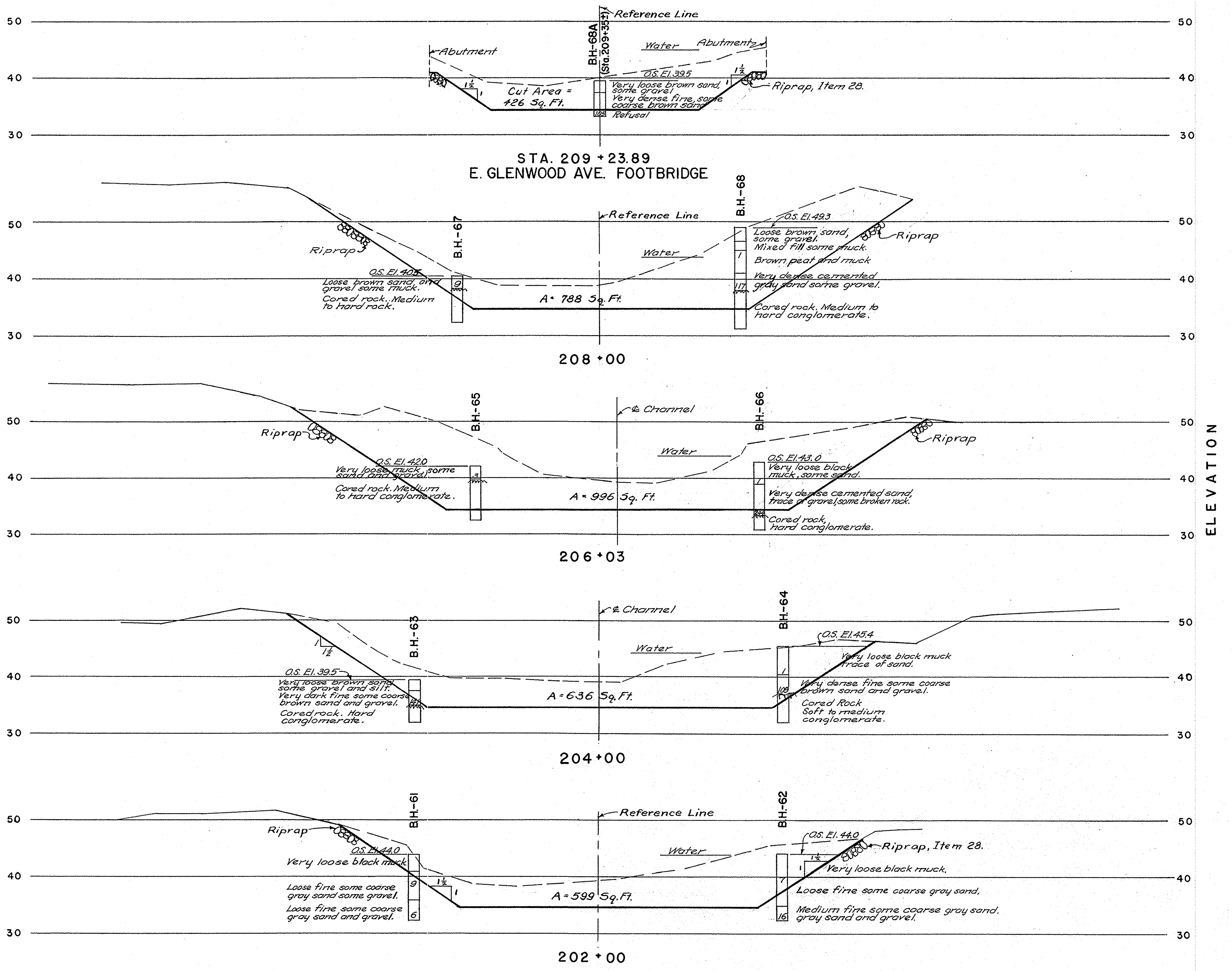
Martin R. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59220

CONTRACT C-296 SHEET 21
40 SHEETS IN SET



Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 50, unless otherwise directed.

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheet 9.
For details of work to be done at E. Glenwood Ave. footbridge, see Sheet 38.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

21

DRAWN E.J.G.
TRACED K.L.H.
CHECKED

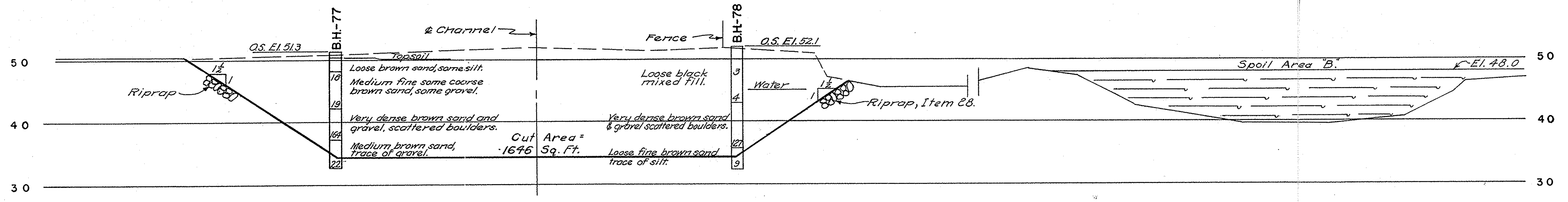
Martin V. Cosgrove
Deputy Chief Engineer

Chief Engineer

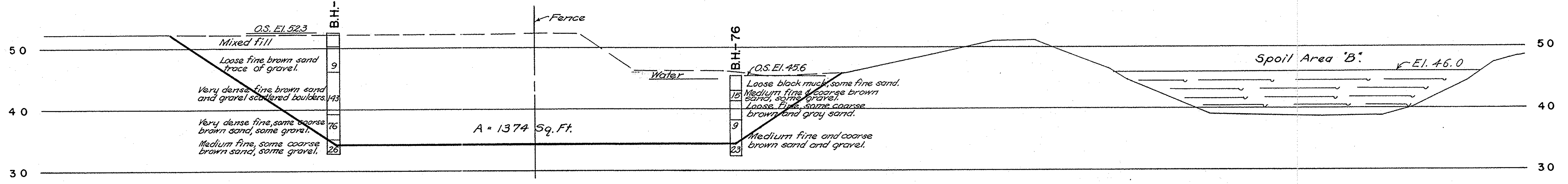
FILE CONT. C-296 10.8U

ACC. 59221

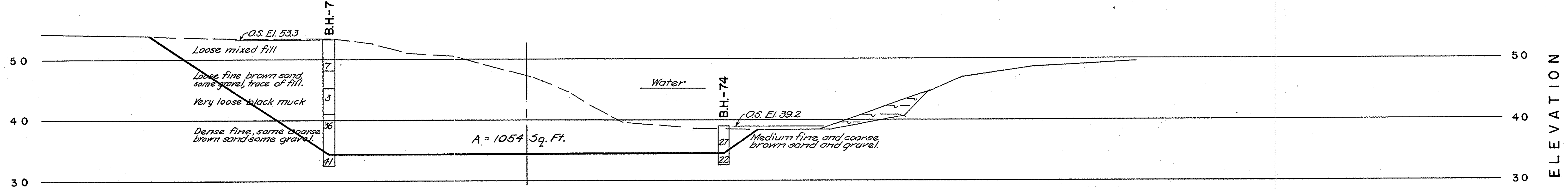
CONTRACT C-296 SHEET 22
40 SHEETS IN SET



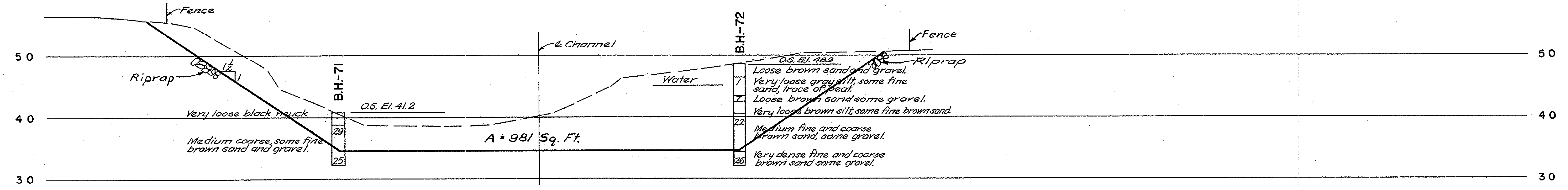
STA. 218 + 00



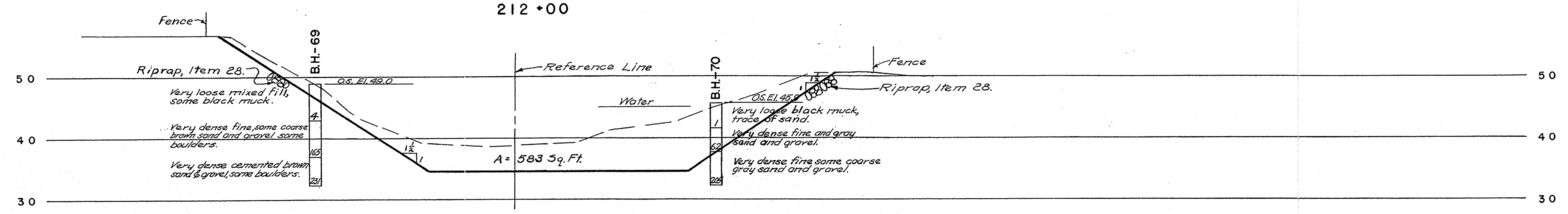
216 + 00



214 + 00



212 + 00



210 + 00

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 9 & 10.
For location of Spoil Area "B", see Sheet 10.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 50, unless otherwise directed.

DRAWN E.J.G.
TRACED R.W.H.
CHECKED

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

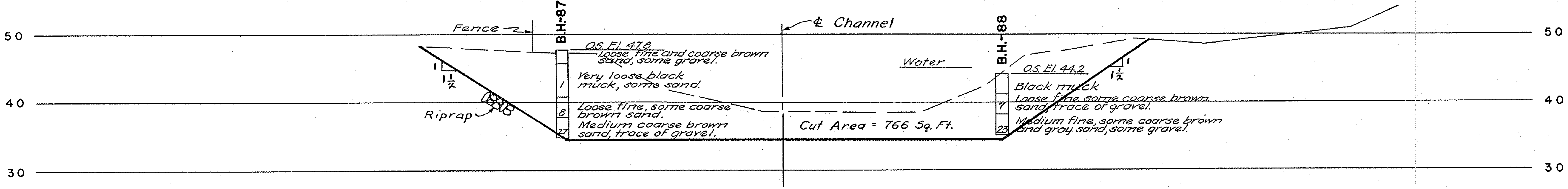
10 5 0 10 20FT.

JUNE 15, 1964

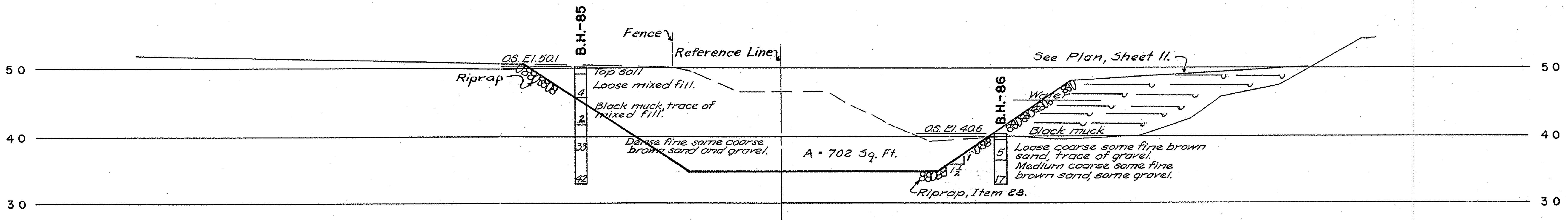
22

FILE CONT. C-296 10.8U
ACC. 59 222

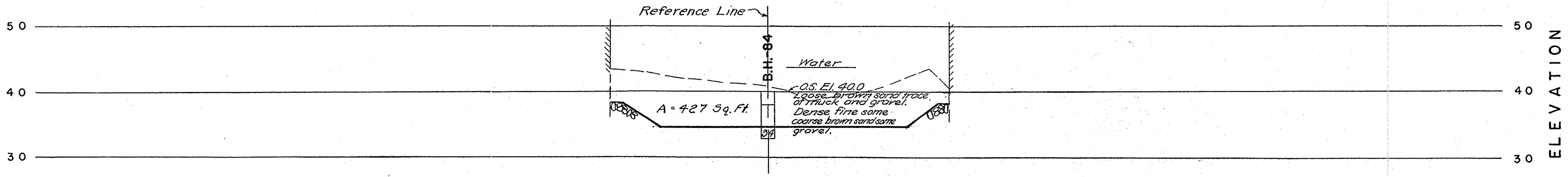
CONTRACT C-296 SHEET 23
40 SHEETS IN SET



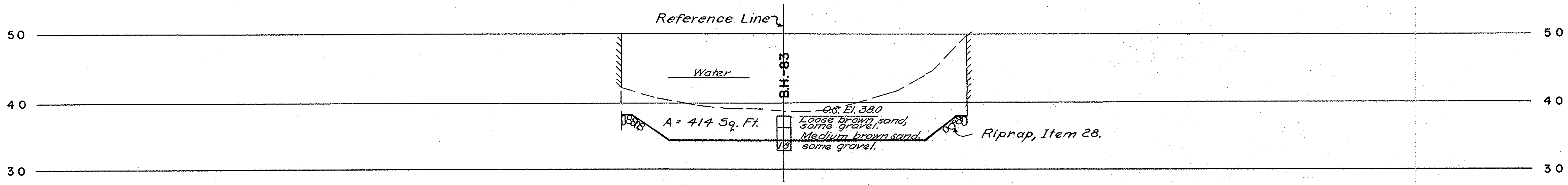
STA. 226+00



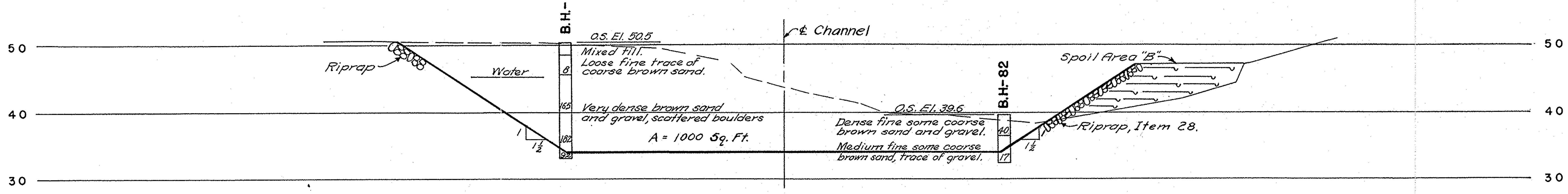
224+68.22



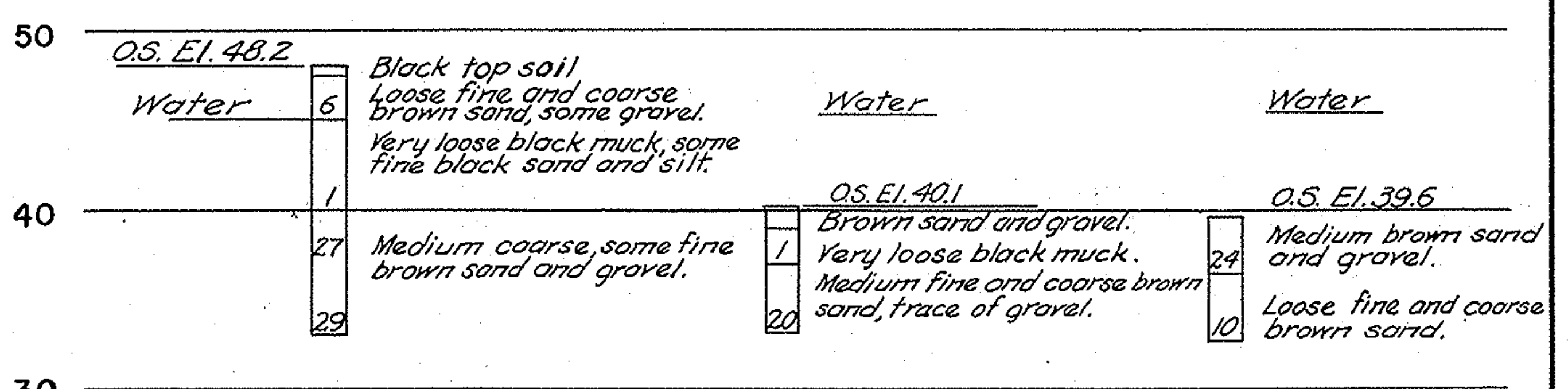
223+08.00
R.R. BRIDGE No. 8.57-UPSTREAM



222+74.81
R.R. BRIDGE No. 8.57- DOWNSTREAM



220+81.88



B.H. 79	B.H. 80 A	B.H. 80
STA. 219+50 ± (120' Rt. of ℄)	STA. 219+95 (208' Rt. of ℄)	STA. 219+50 ± (250' Rt. of ℄)

Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 10 & 11.
For details of work to be done at Bridge No. 8.57, see Sheet 39.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 50, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION
NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS
10 5 0 10 20 FT
JUNE 15, 1964

(23)

DRAWN E.J.G.
TRACED H.W.H.
CHECKED

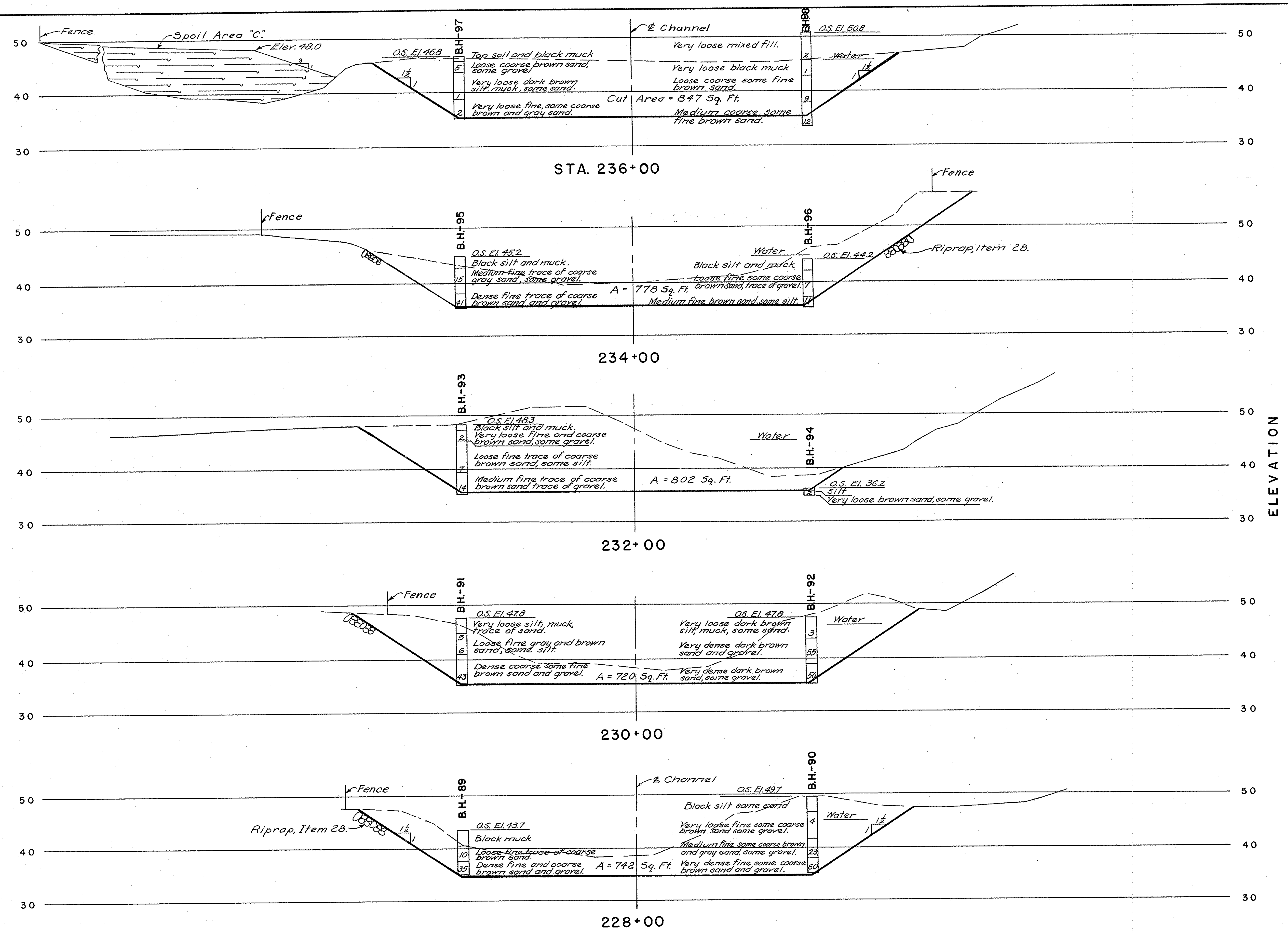
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C- 296 10.8U

ACC.59223

CONTRACT C-296 SHEET 24
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 11 & 12.

Note:
Upper limit of riprap for sections shown on this sheet shall be carried to El. 51, unless otherwise directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION–CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

24

DRAWN E.J.G.
TRACED R.W.H.
CHECKED

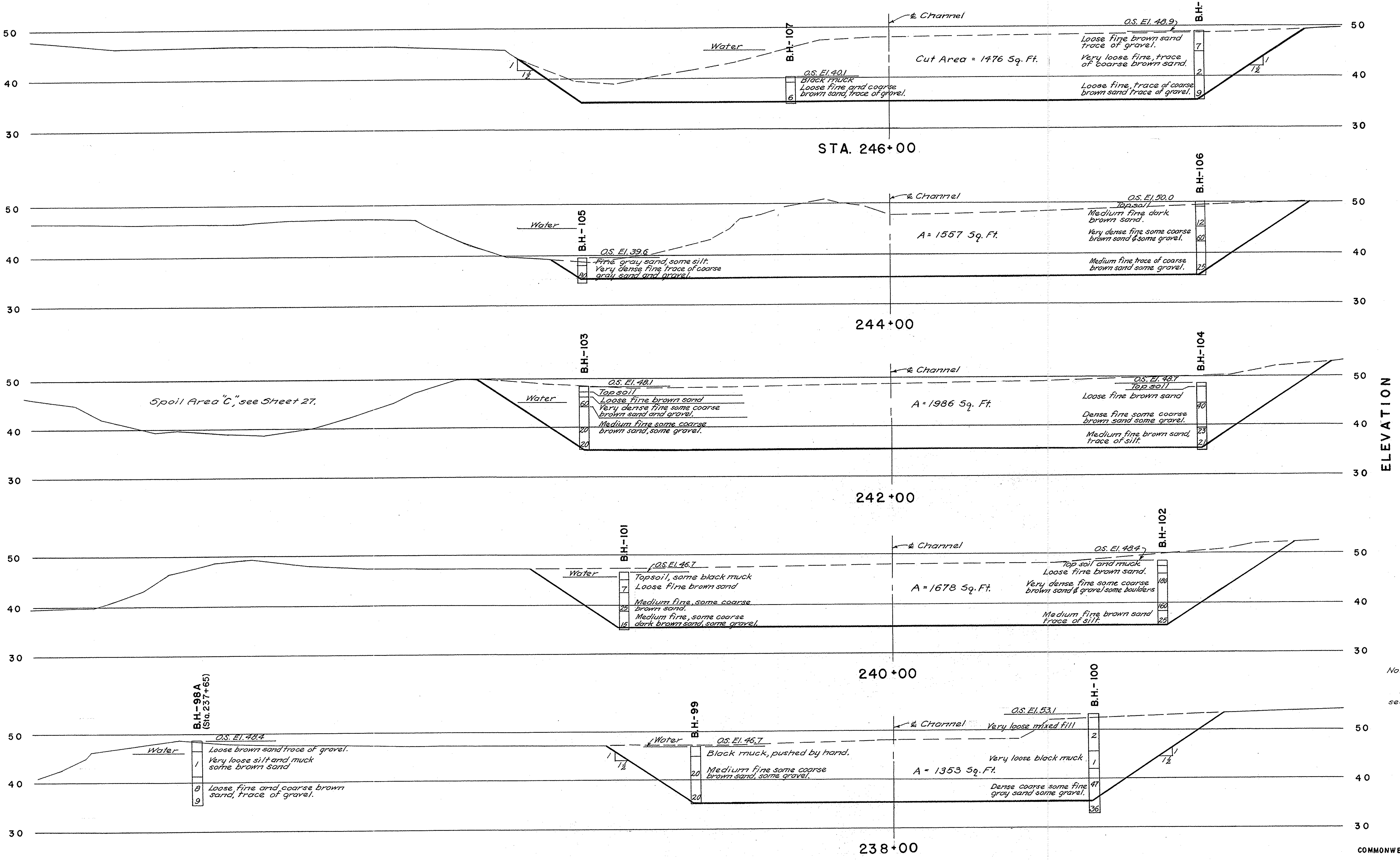
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC.59224

CONTRACT C-296 SHEET 25
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheets 12 & 13.

Note:
For sections of Spoil Area "C" at Station 238+00 to Station 246+00, see Sheet 27.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION–CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.

JUNE 15, 1964

25

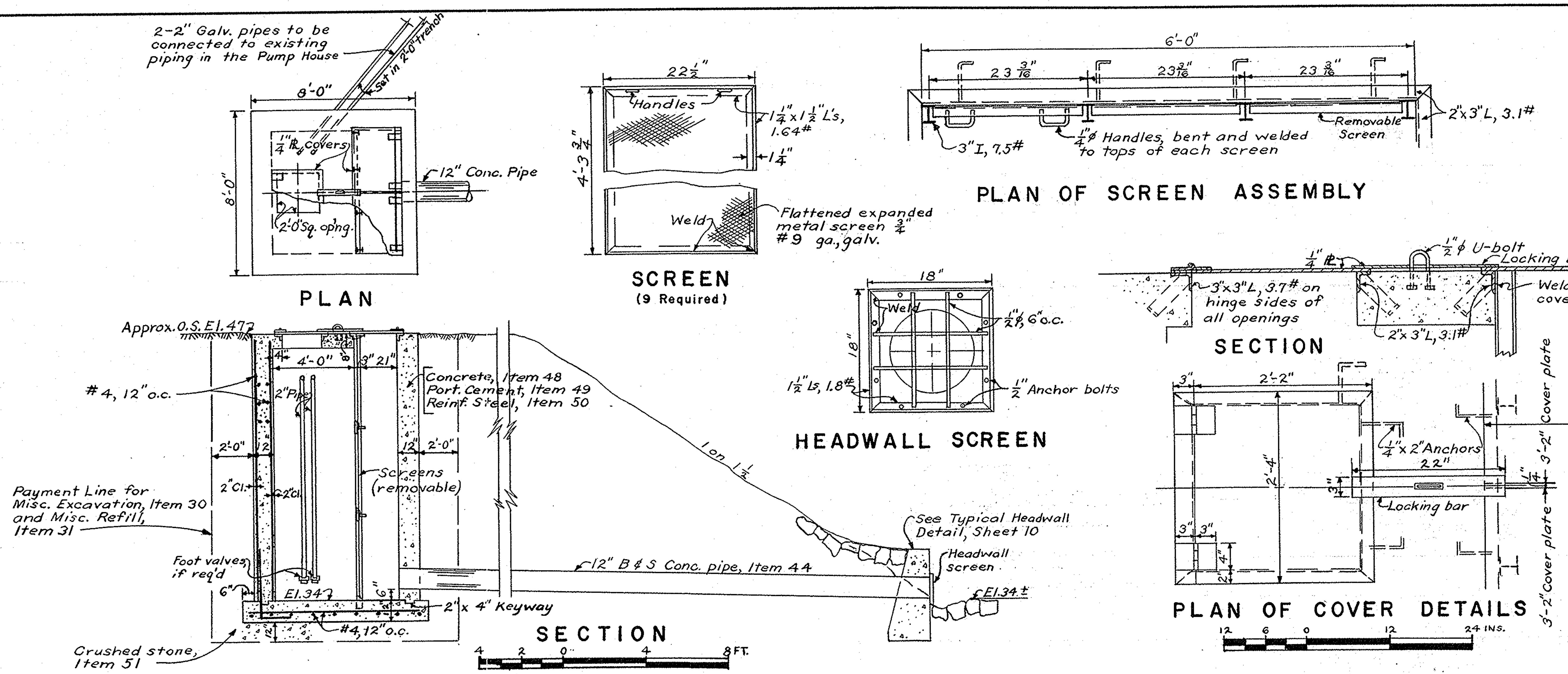
DRAWN E.T.G.
TRACED R.W.H.
CHECKED

Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

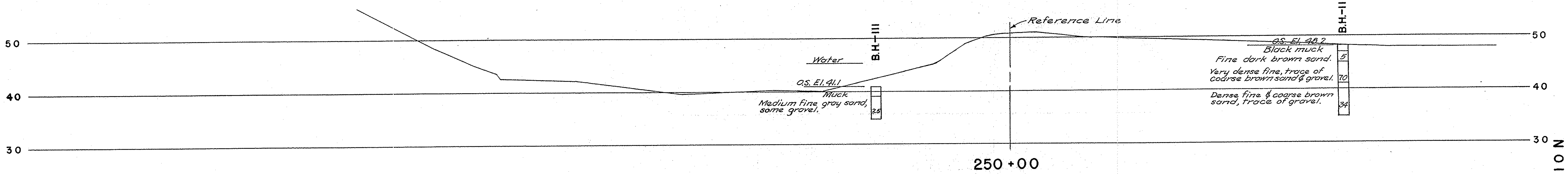
FILE CONT. C-296 10.8U

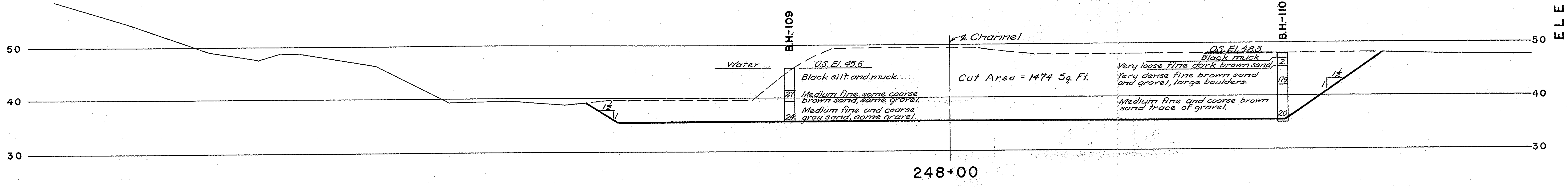
ACC.59225



Note:
Work and materials in addition to other regular items shown here or as directed by the Engineer to construct the complete water intake system shall be included under Item 44.
All steel not embedded in concrete to be galvanized or given 2 coats of zinc rich paint.

INTAKE FOR HOT-TOP PAVEMENTS, INC.





Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of borings, see Sheet 13.
For location of Intake for Hot-Top Pavements Inc., see Sheet 10.
Concrete minimum compressive strength at 28 days to be 3000#/☐"
Chamfer all exposed corners as directed.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION - CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS
10 5 0 10 20 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

26

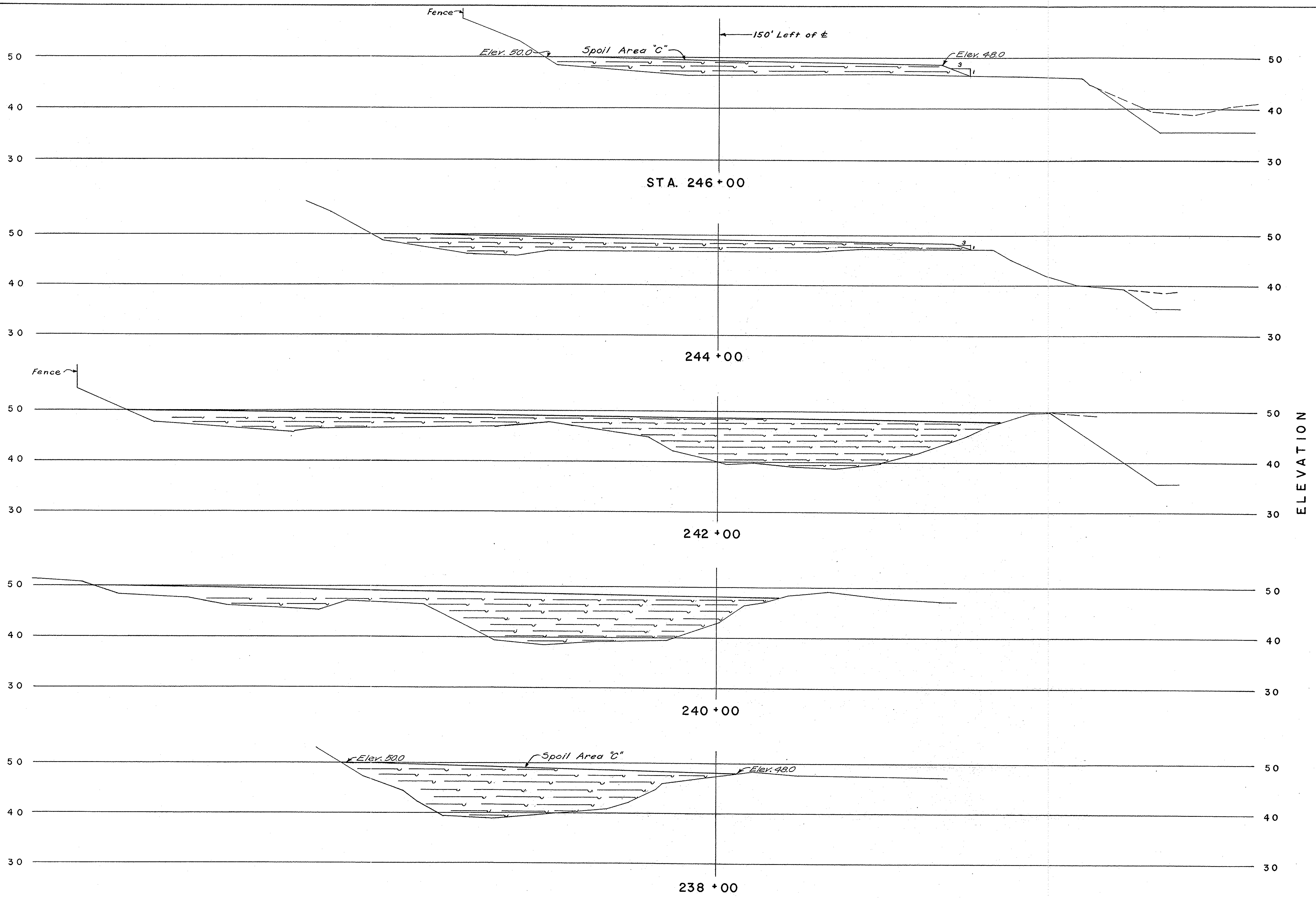
DRAWN E.J.G.-RHW
TRACED E.J.G.-RWH
CHECKED [illegible] J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59226

CONTRACT C-296 SHEET 27
40 SHEETS IN SET



Notes:
Elevations, Boston City Base.
For General Notes and Boring Notes, see Sheet 14.
For location of Spoil Area "C", see Sheets 12 and 13.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION - CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
CHANNEL CROSS SECTIONS

10 5 0 10 20 FT.
JUNE 15, 1964

(27)

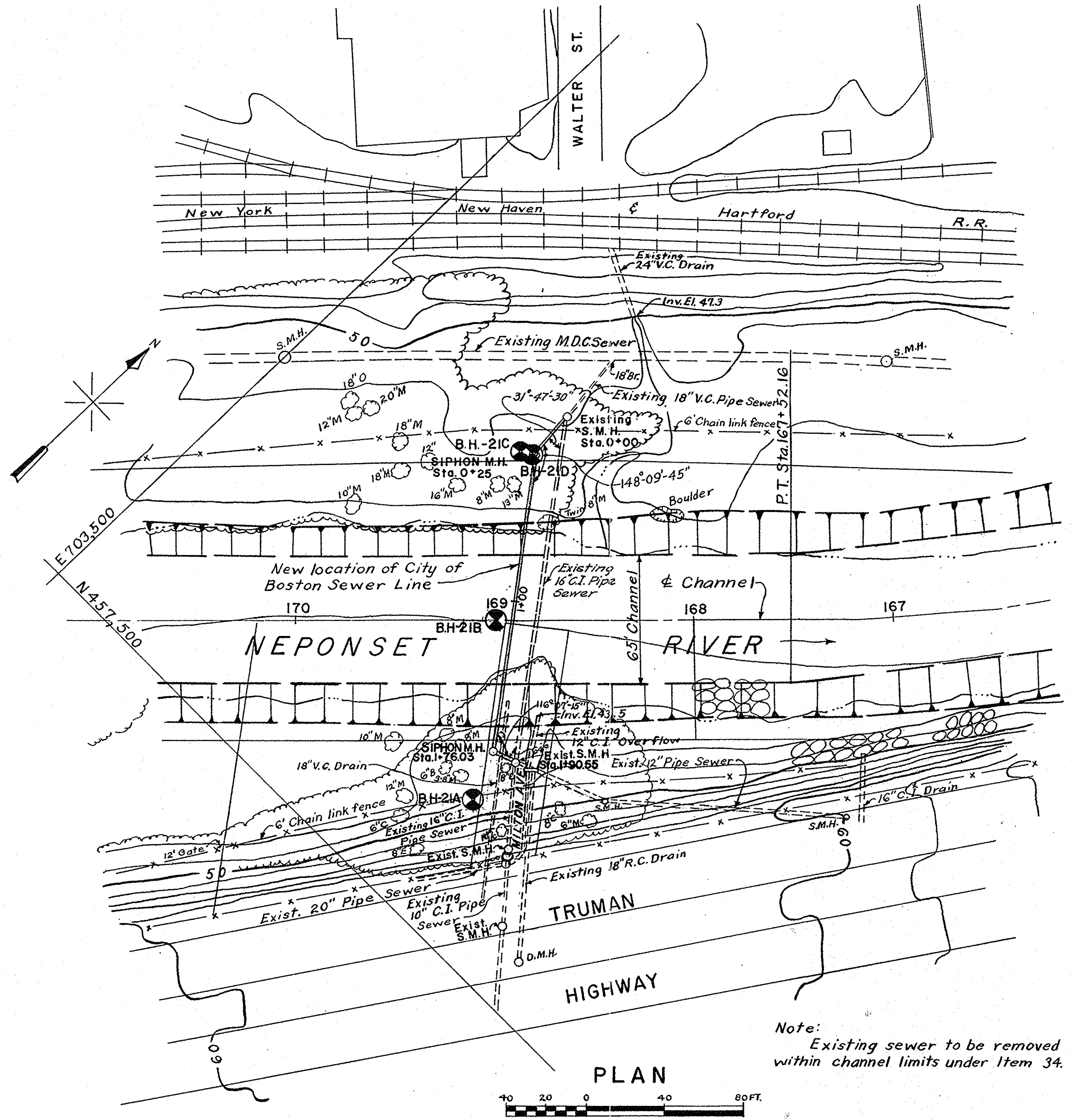
DRAWN *E.J.G.*
TRACED *E.J.G.*
CHECKED *[illegible]*

Martin J. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59227

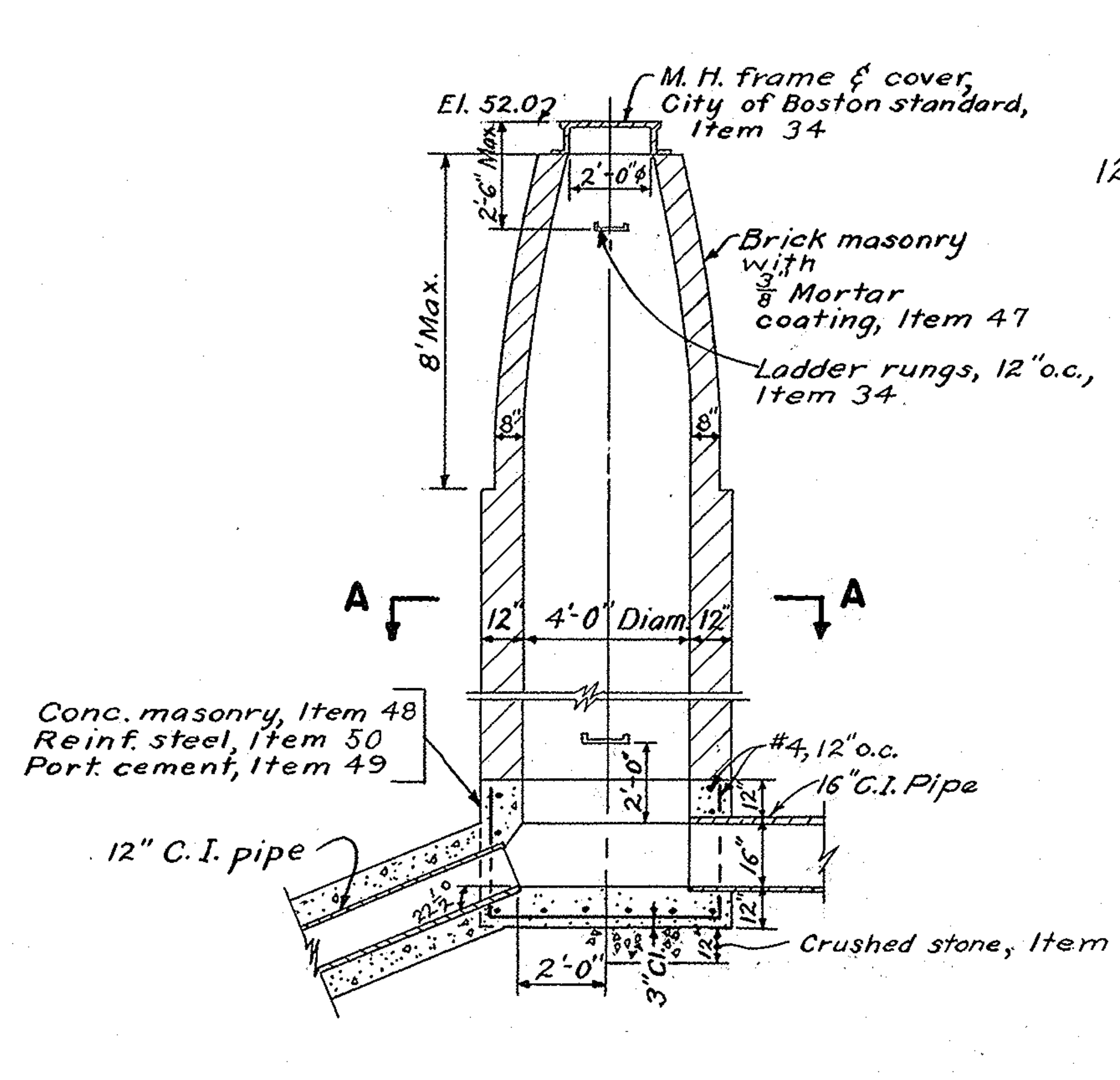
CONTRACT C-296 SHEET 28
40 SHEETS IN SET



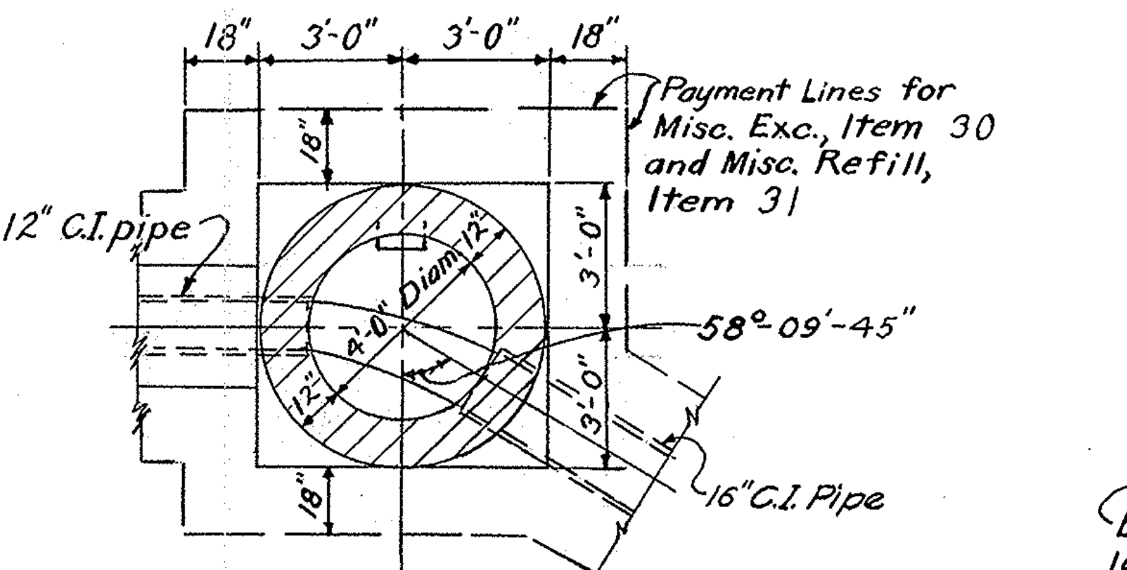
Note:
Existing sewer to be removed within channel limits under Item 34.

PLAN

40 20 0 40 80 FT.



SECTION THRU MANHOLE

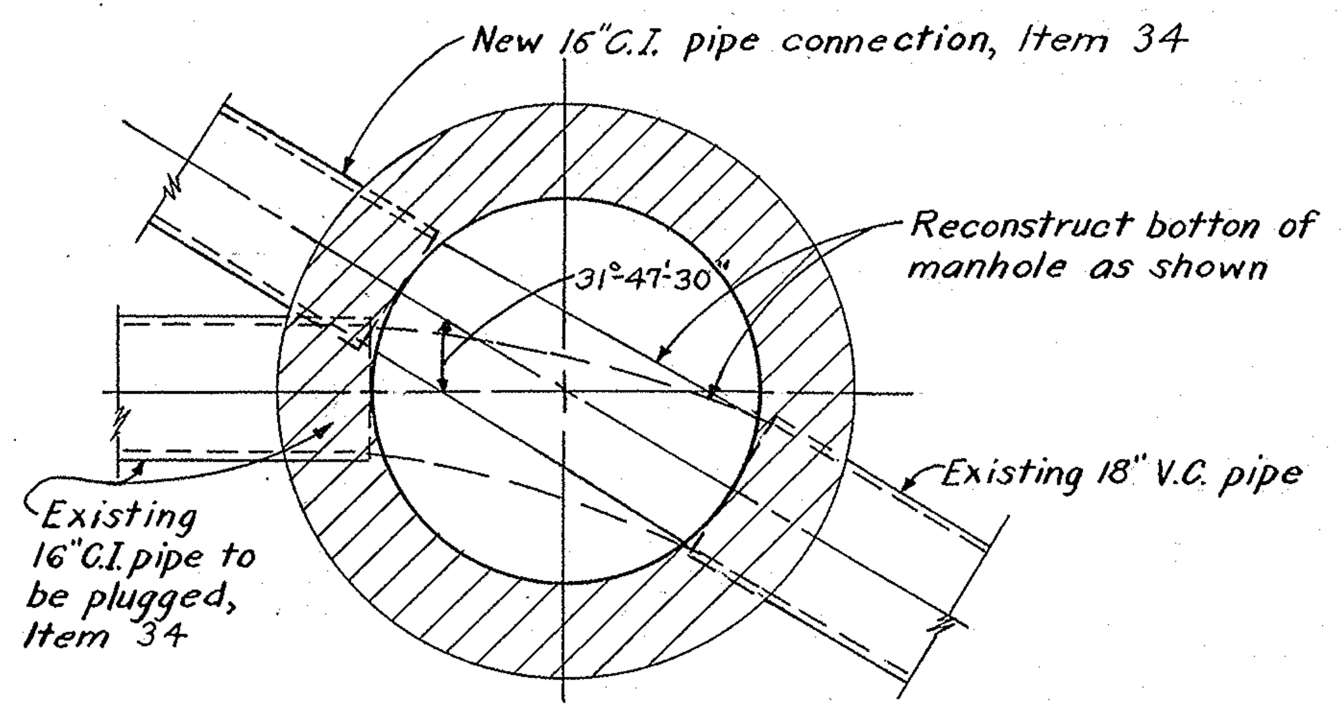


SECTION A-A

SIPHON MANHOLE DETAILS

M.H.-STA. 0+25 SHOWN
M.H.-STA. 1+76.03 SIMILAR

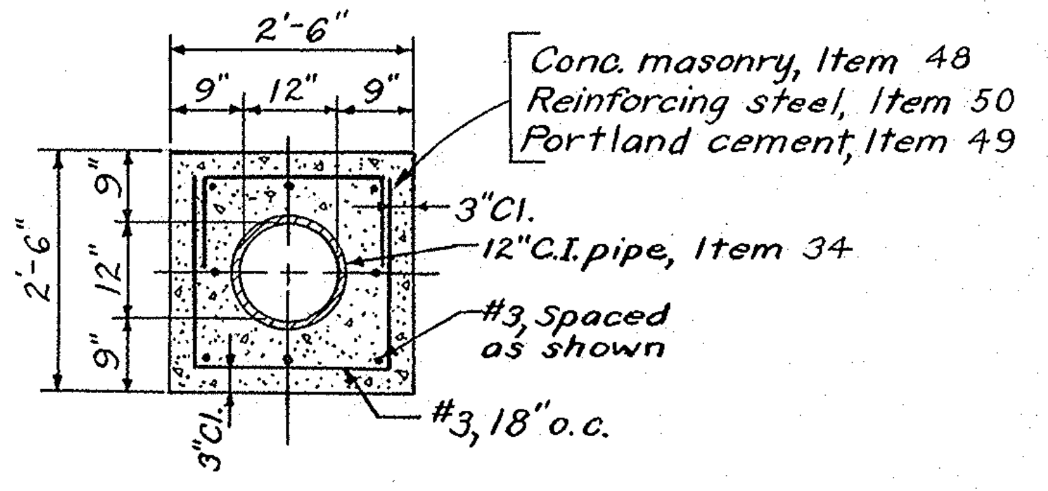
4 2 0 4 8 FT.



PLAN OF EXISTING MANHOLE

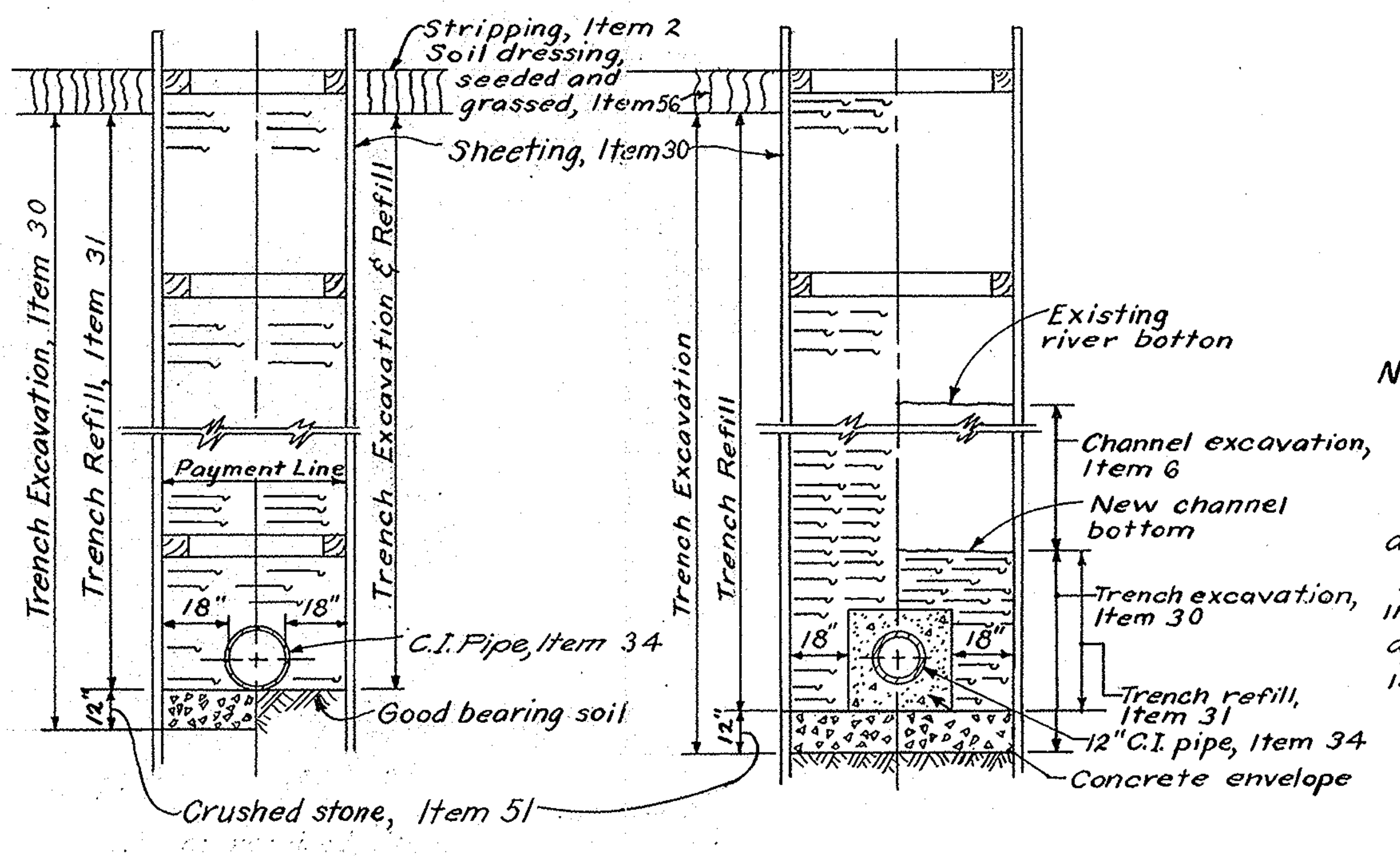
M.H.-STA. 0+00 SHOWN
M.H.-STA. 1+90.55 SIMILAR

2 1 0 2 4 FT.



CONCRETE ENVELOPE

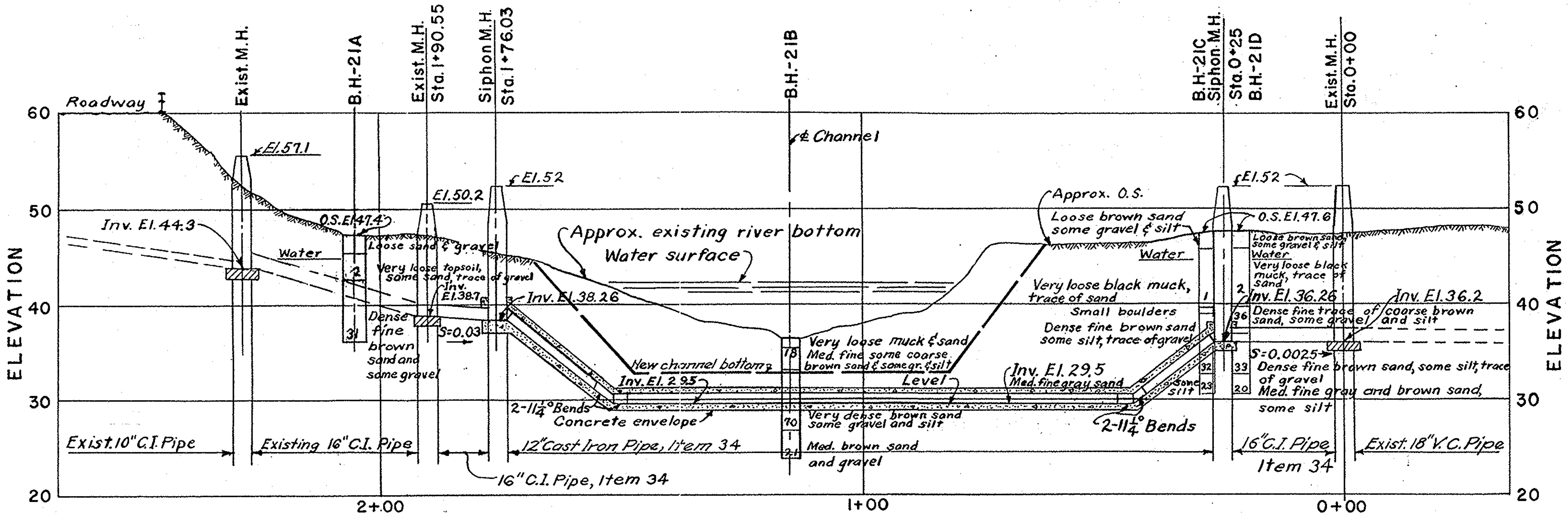
2 1 0 2 4 FT.



TYPICAL TRENCH AND RIVER CROSSING SECTIONS

4 2 0 4 8 FT.

Notes:
Elevations, Boston City Base.
For general notes, see Sheet 2.
For general boring notes, see Sheet 14.
Concrete minimum compressive strength at 28 days to be 3000 #/□.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.



PROFILE

SCALES: Hor: 1" = 20'
Vert. 1" = 10'

DRAWN J.C.
TRACED E.T.J.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

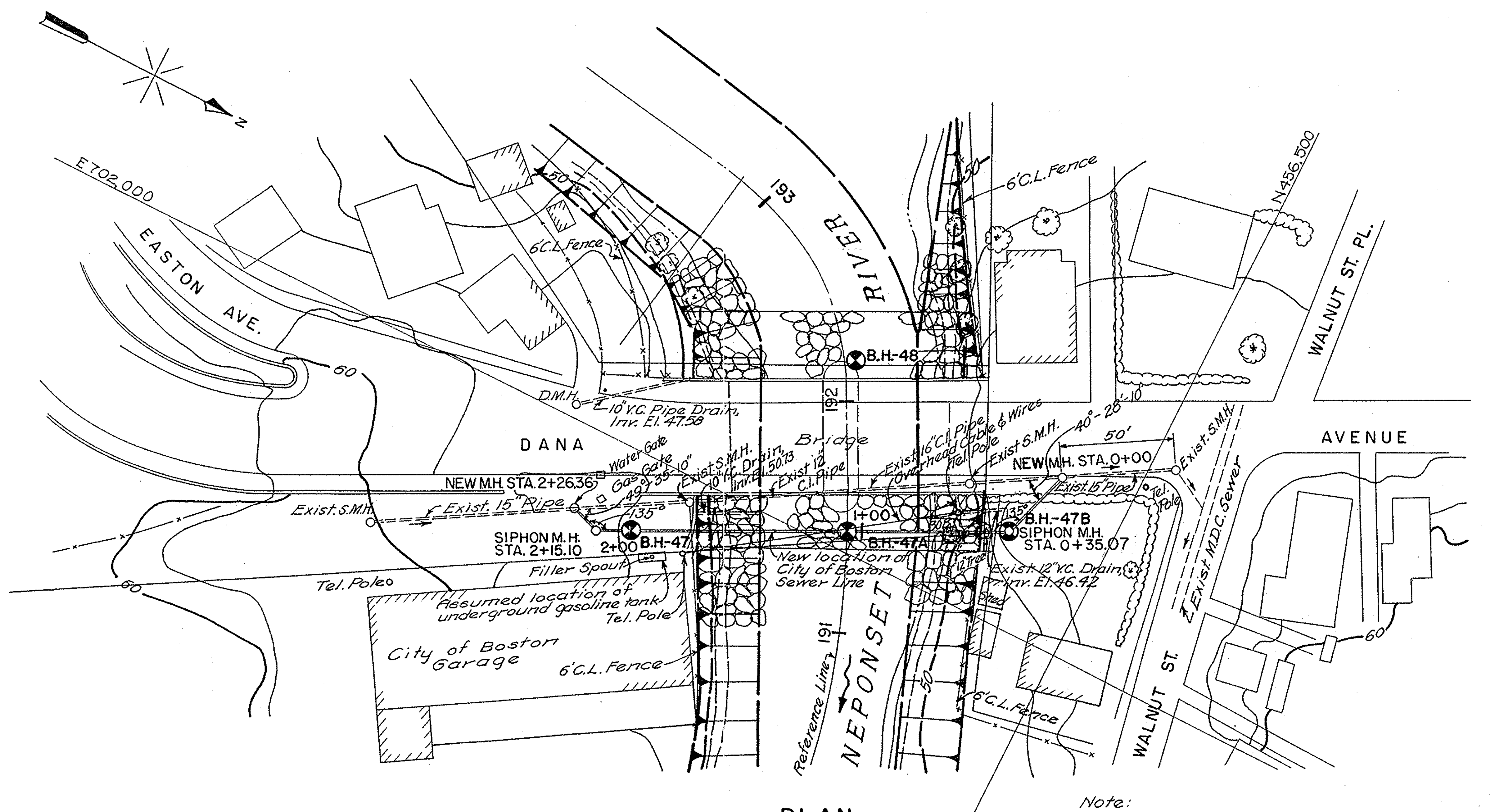
COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION–CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
RELOCATION OF SEWER LINE AT STA. 168+90±
SCALES AS SHOWN
JUNE 15, 1964

28

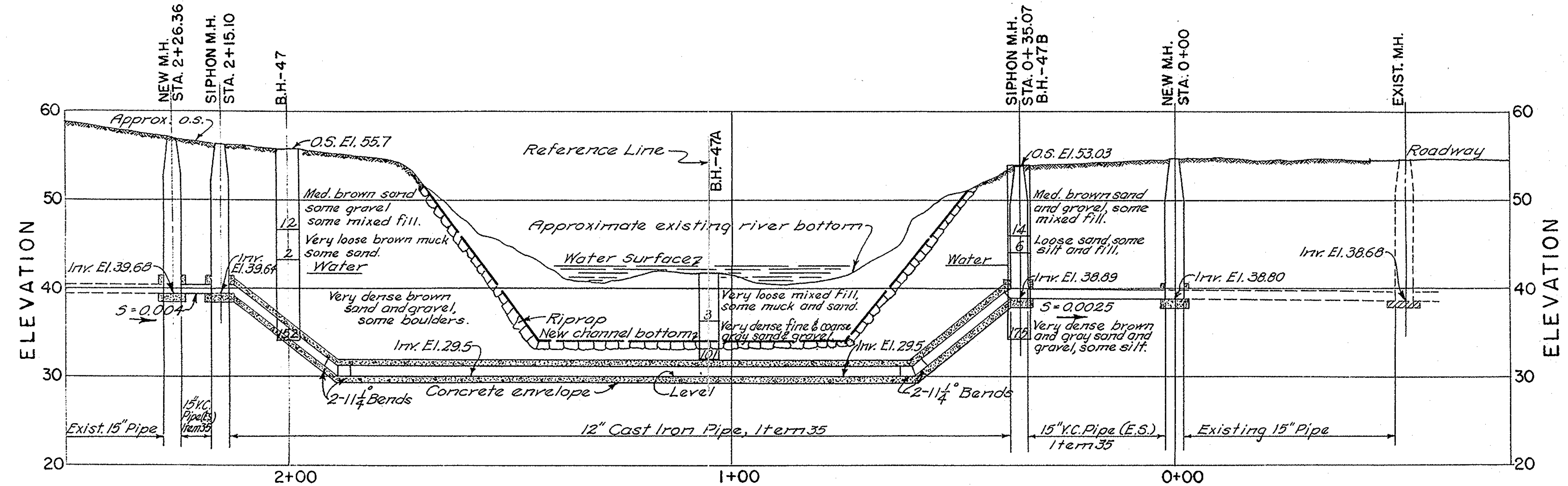
FILE CONT. C-296 10.8U
ACC. 59228



PLAN

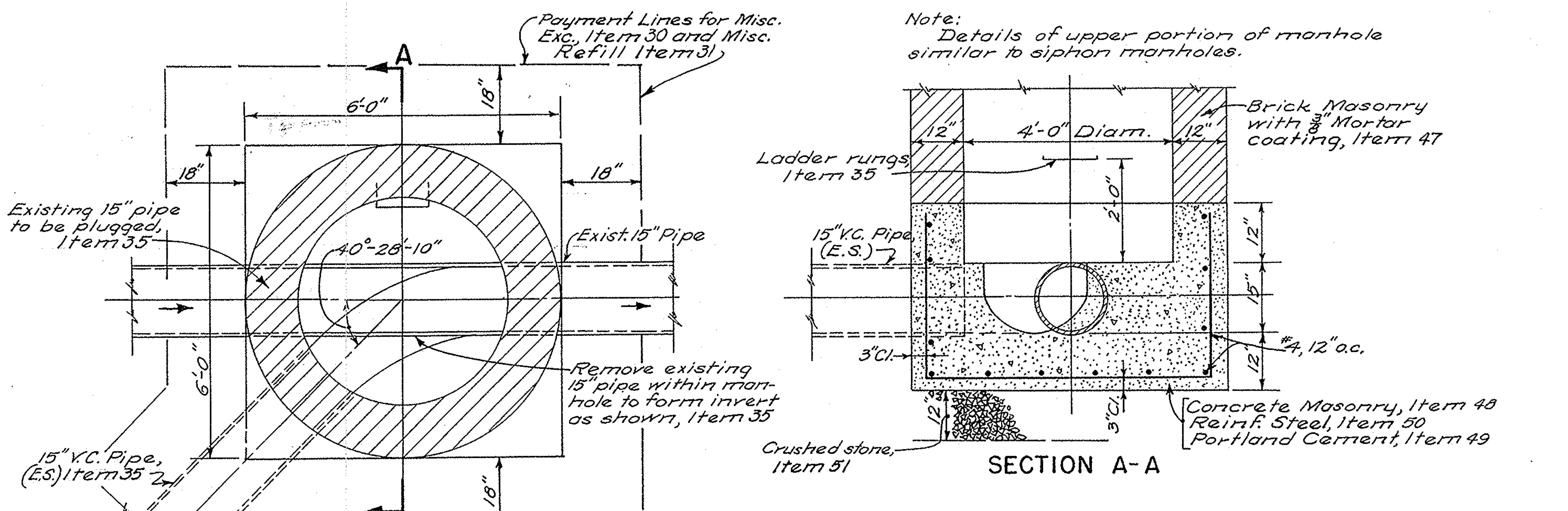
40 20 0 40 80 FT.

Note:
Existing sewer to be removed within channel limits under Item 35.



PROFILE

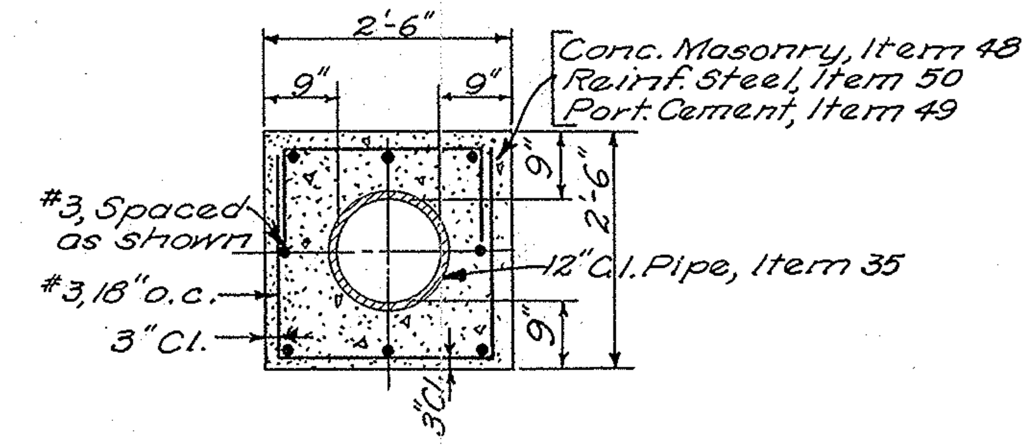
HOR. SCALE: 1" = 20'
VERT. SCALE: 1" = 10'



NEW MANHOLES ON EXISTING SEWER LINE

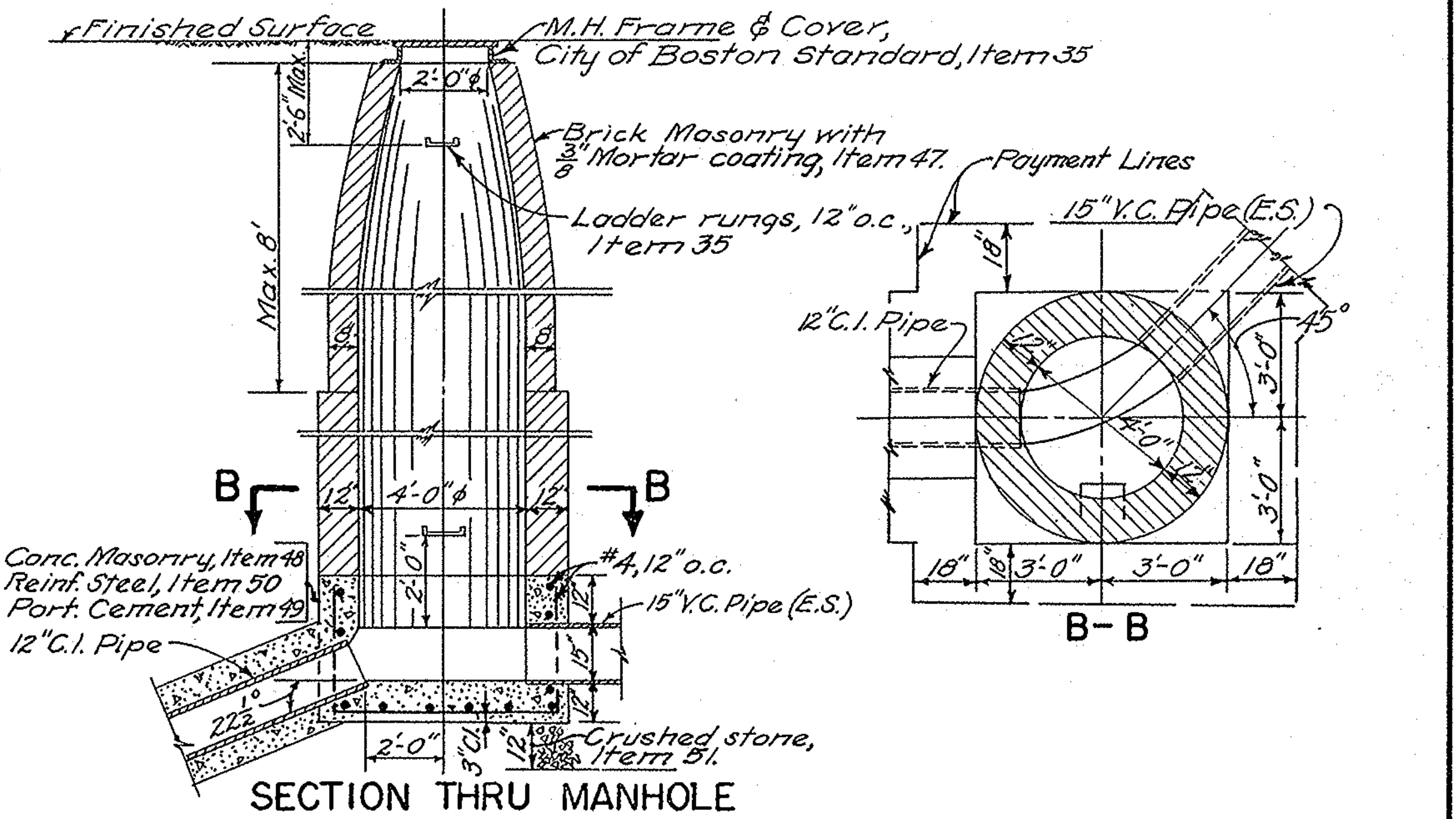
(M.H. - STA. 0+00 SHOWN)
(M.H. - STA. 2+26.36 SIMILAR)

2 1 0 2 4 FT.



CONCRETE ENVELOPE

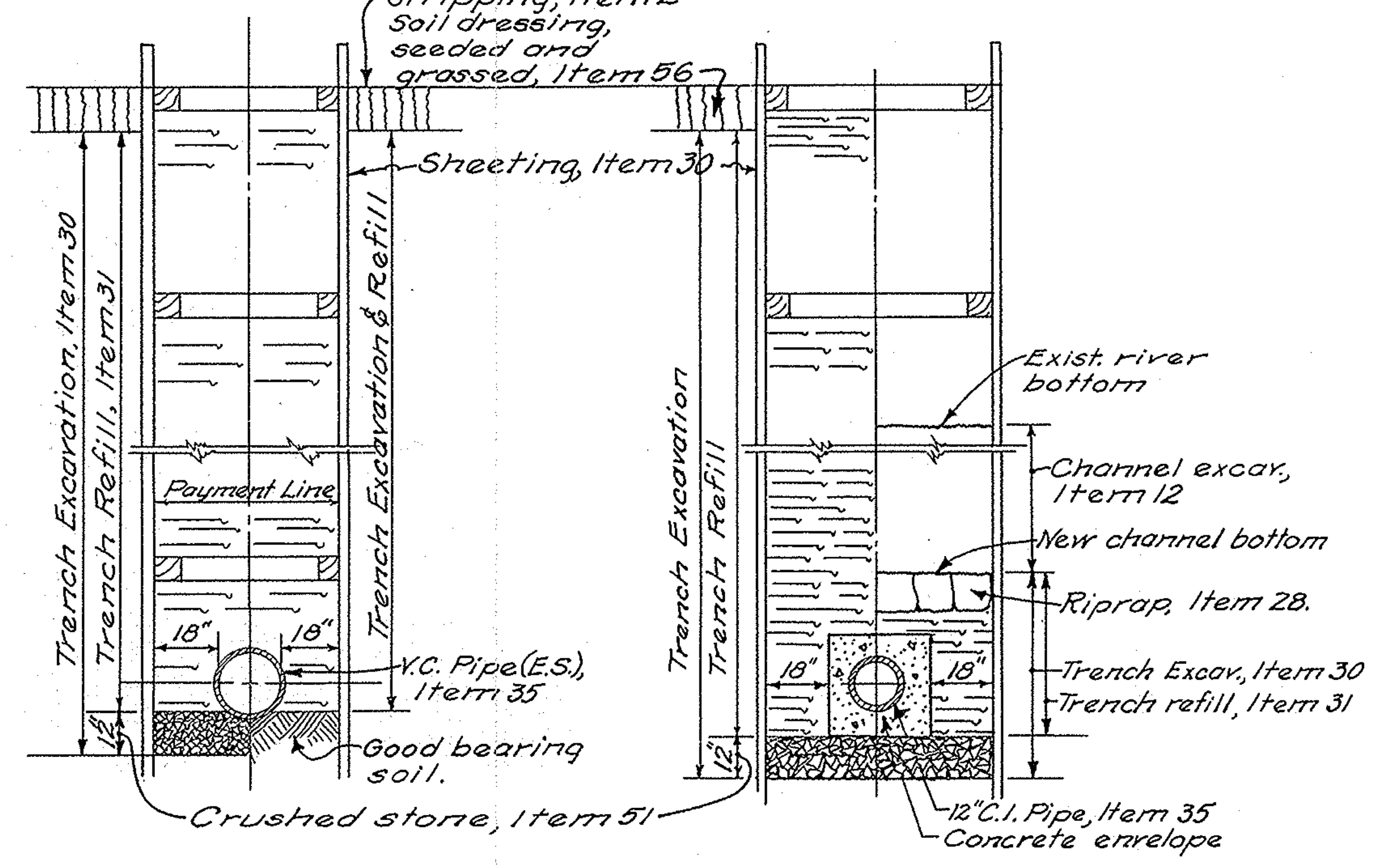
2 1 0 2 4 FT.



SIPHON MANHOLE DETAILS

(M.H. - STA. 0+35.07 SHOWN)
(M.H. - STA. 2+15.10 SIMILAR)

4 2 0 4 8 FT.



TYPICAL TRENCH AND RIVER CROSSING SECTIONS

4 2 0 4 8 FT.

Notes:
Elevations, Boston City Base.
For general notes, see Sheet 2.
Concrete minimum compressive strength at 28 days to be 3000#/□".
For general boring notes, see Sheet 14.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION–CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
RELOCATION OF SEWER LINE AT STA. 191+45±
SCALES AS SHOWN
JUNE 15, 1964

DRAWN J.C.
TRACED W.W.
CHECKED J.C.

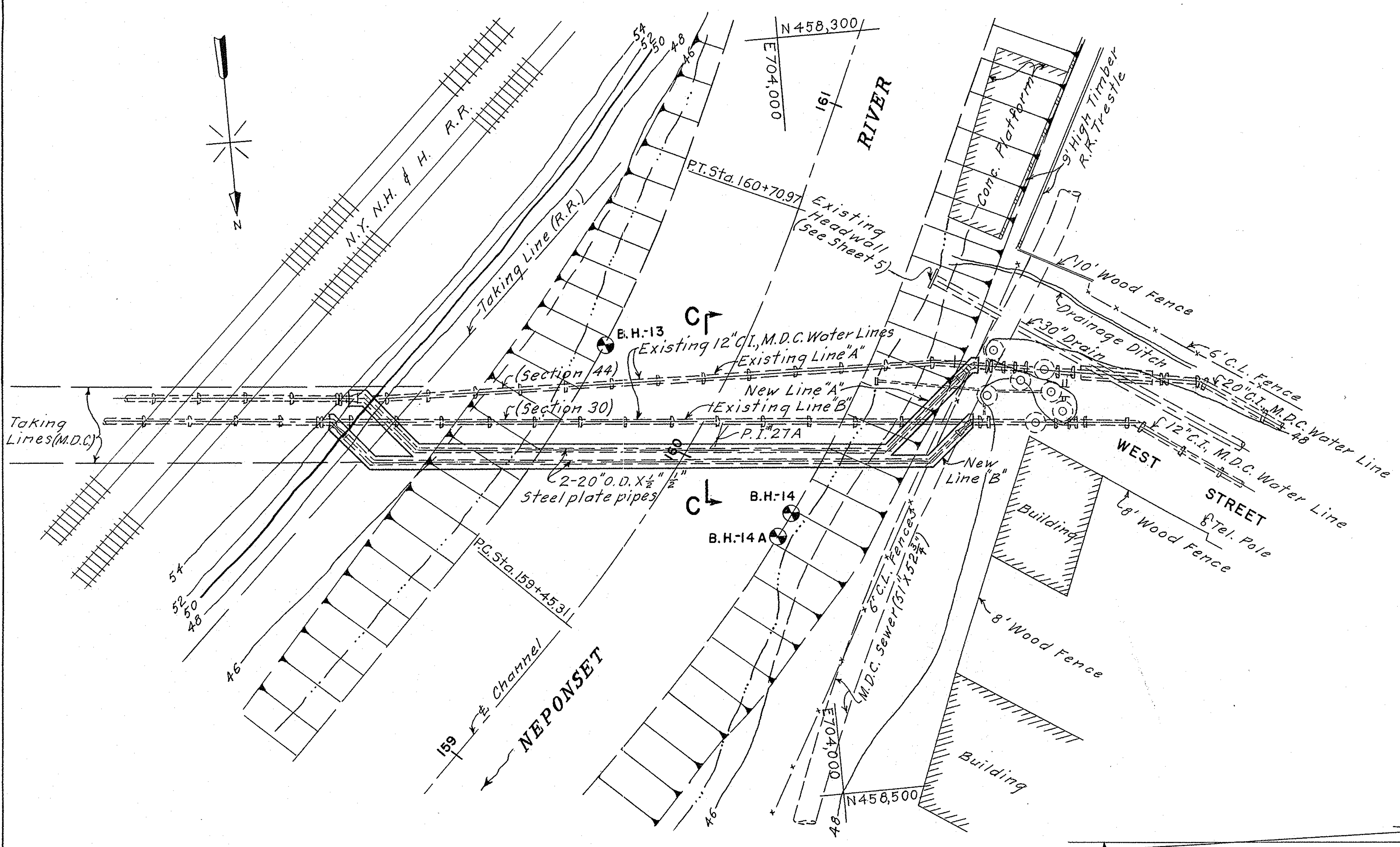
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

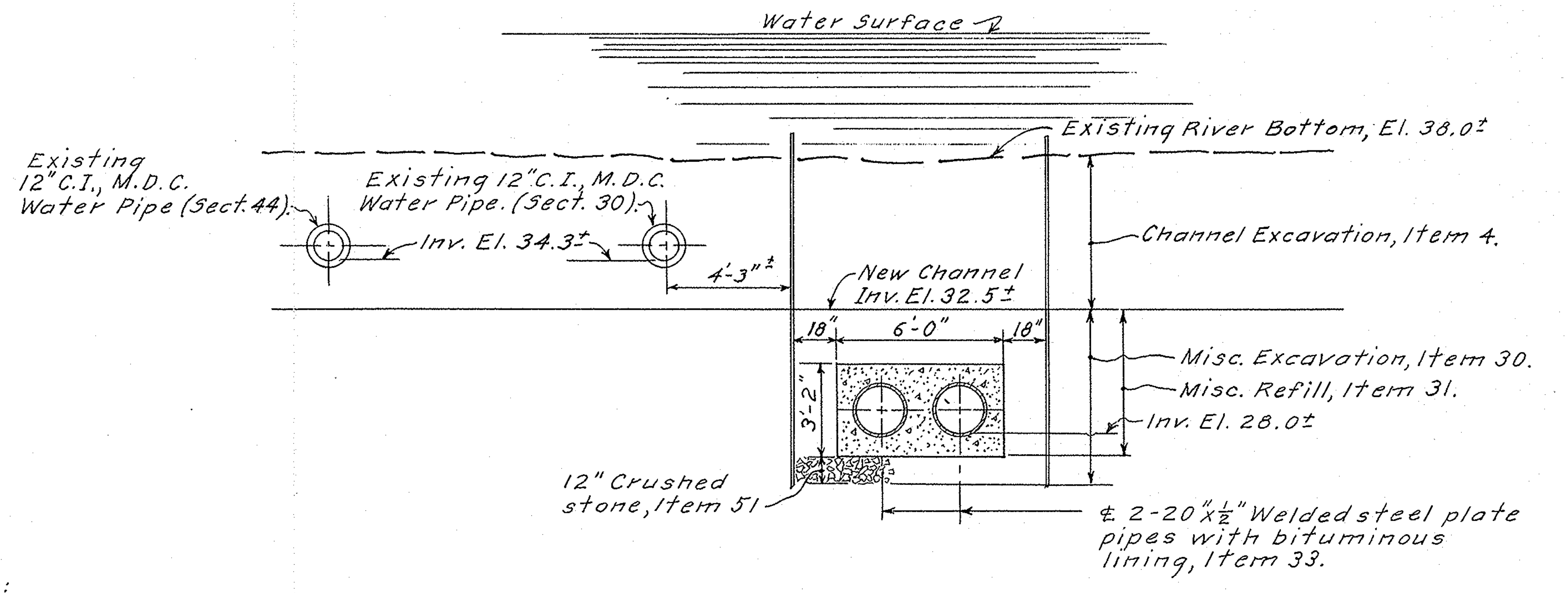
ACC. 59229

CONTRACT C-296 SHEET 30
40 SHEETS IN SET



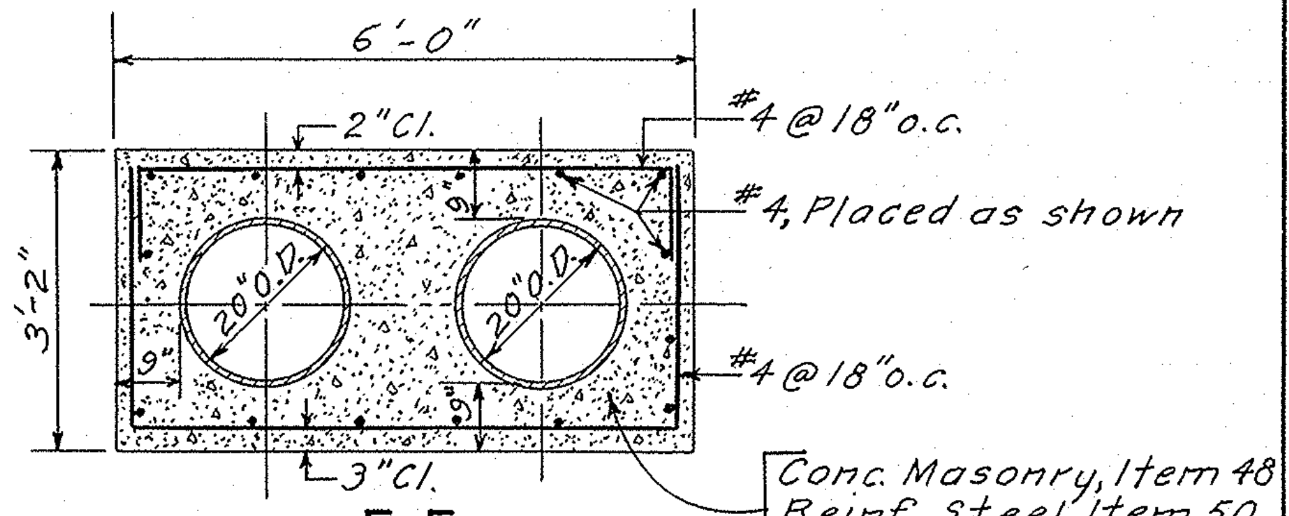
PLAN

20 10 0 20 40 FT.

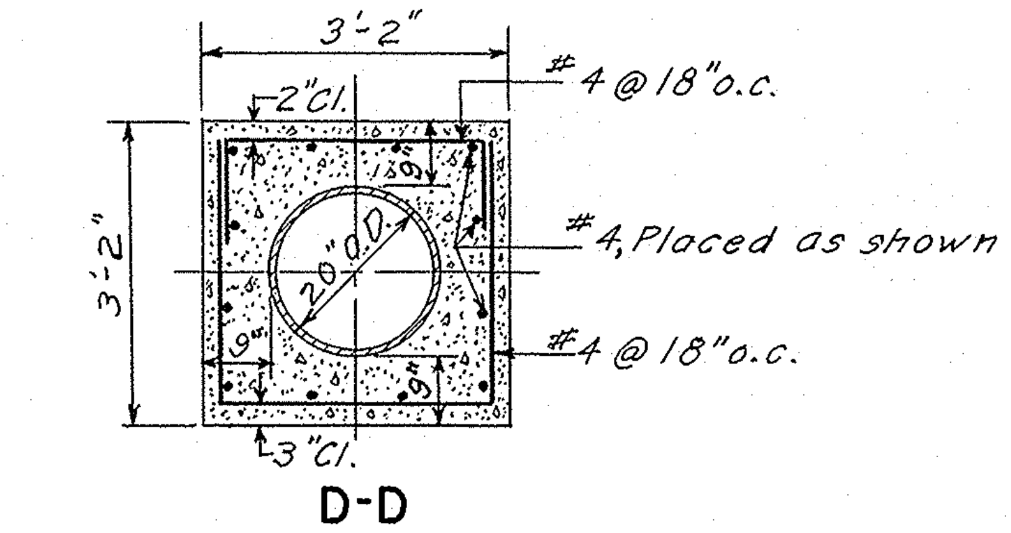


SECTION C-C

Note:
Provide bell clamps and butt straps as required.
Details shown on this Contract Drawing indicate the crossings wanted and are subject to revision by Working Drawings to be issued from time to time.

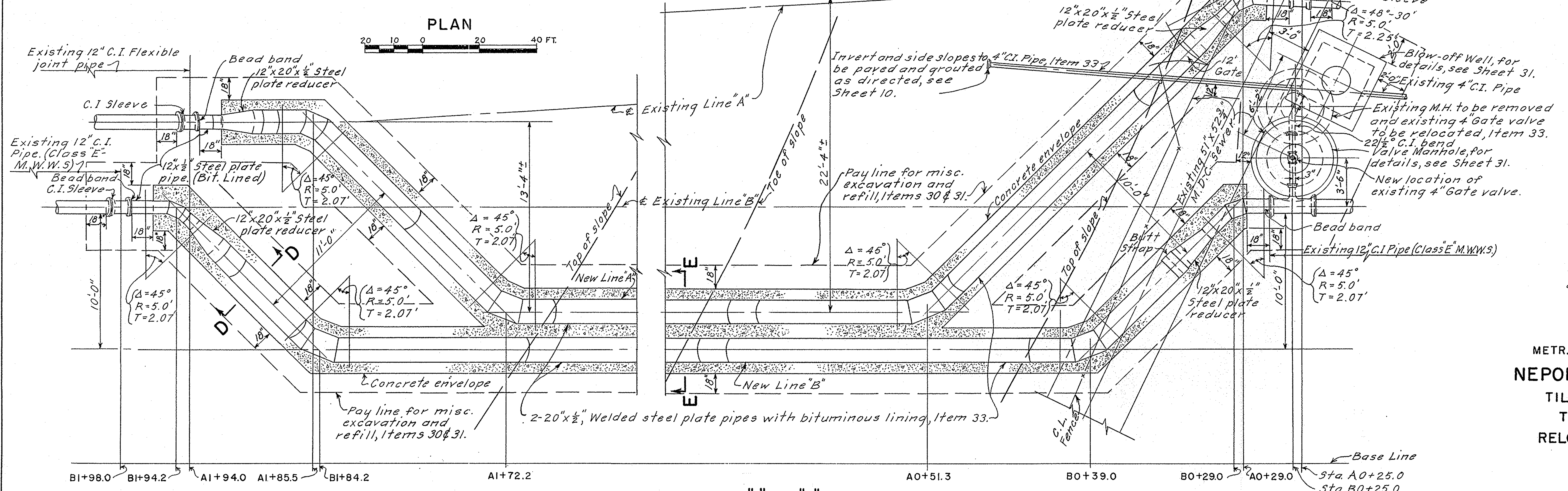


E-E



D-D

2 1 0 2 4 FT.



PLAN OF NEW LINES "A" AND "B"

Notes:
Elevations, Boston City Base.
For location of crossing, see Sheet 5.
For Profiles of New Lines "A" & "B", see Sheet 31.
For Boring Data, see Sheet 15.
Concrete minimum compressive strength at 28 days to be 3000 #/□".

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
RELOCATION OF M.D.C. WATER LINES AT
WEST STREET - SHEET 1

4 2 0 4 8 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

DRAWN A.M.
TRACED C.L.M.
CHECKED A.M.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

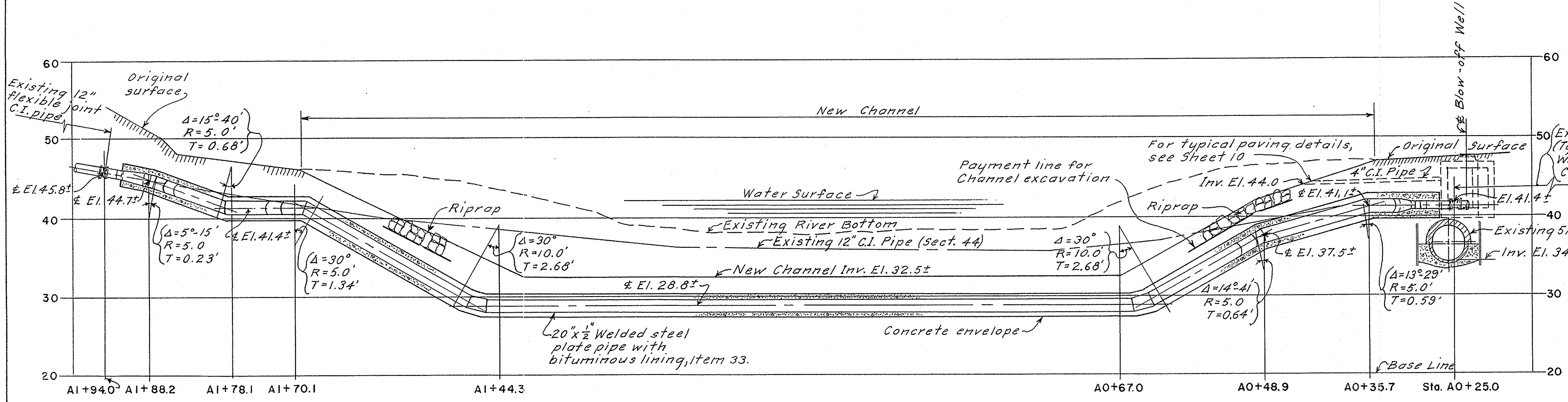
ACC. 59,230

(30)

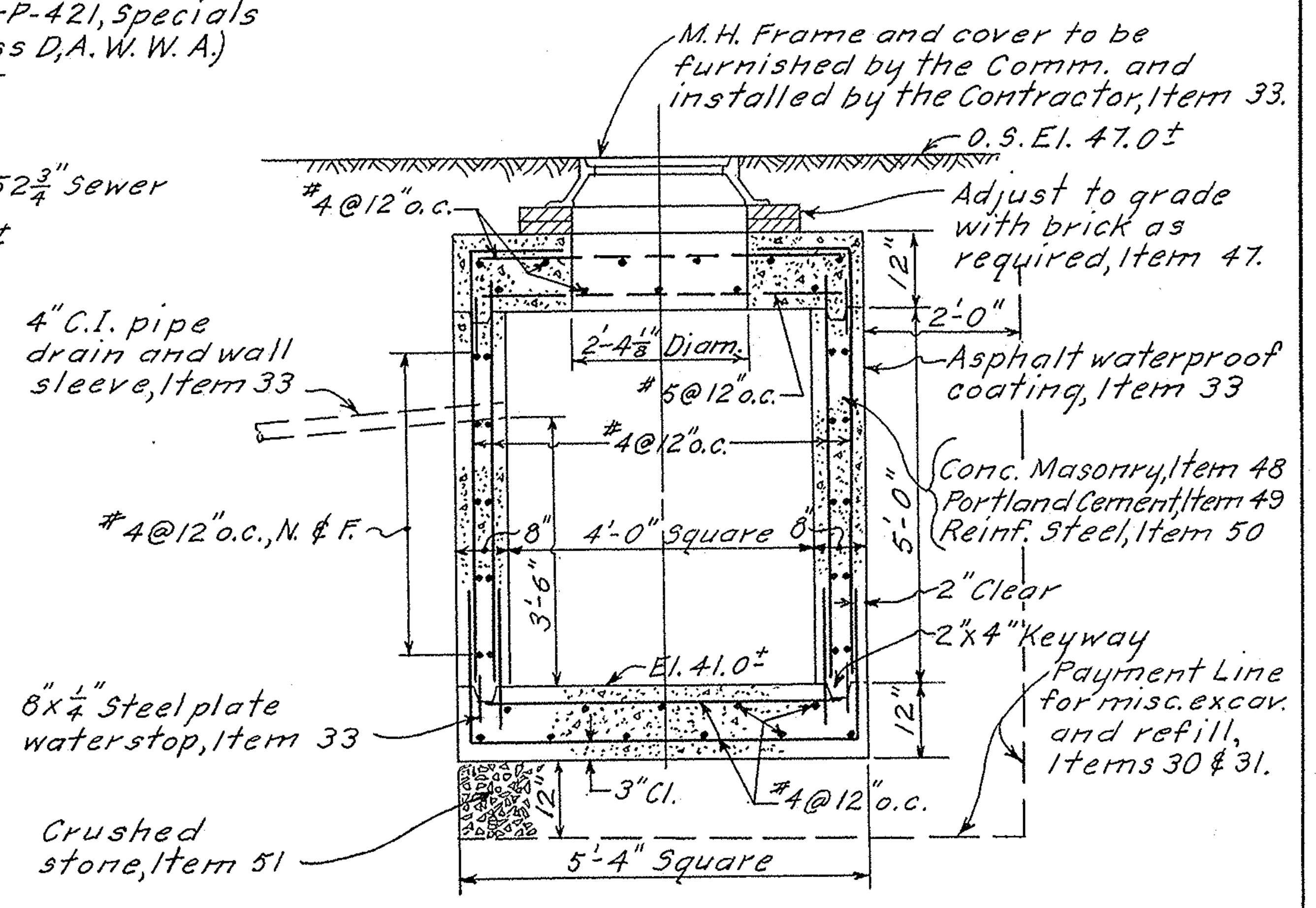
CONTRACT C-296 SHEET 31
40 SHEETS IN SET

WORK METHOD

1. Build river crossing, with no interference to Existing Lines "A" and "B".
2. Shut down Existing Line "B" and make connections.
   Service in Existing Line "A" to be maintained until New Line "B" connections are built, tested and placed into service.
3. Build New Line "A" connections.

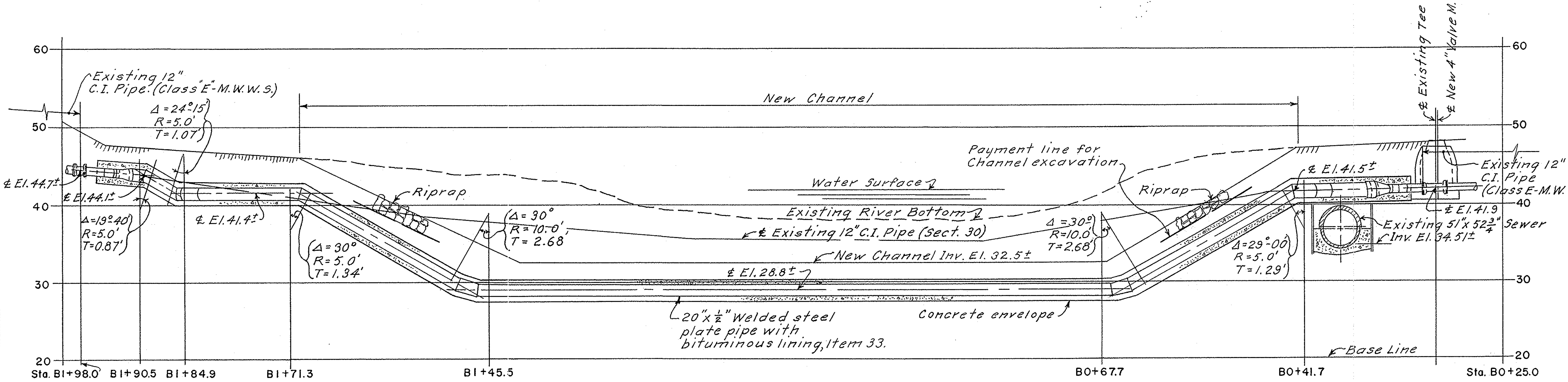


PROFILE OF NEW LINE "A"

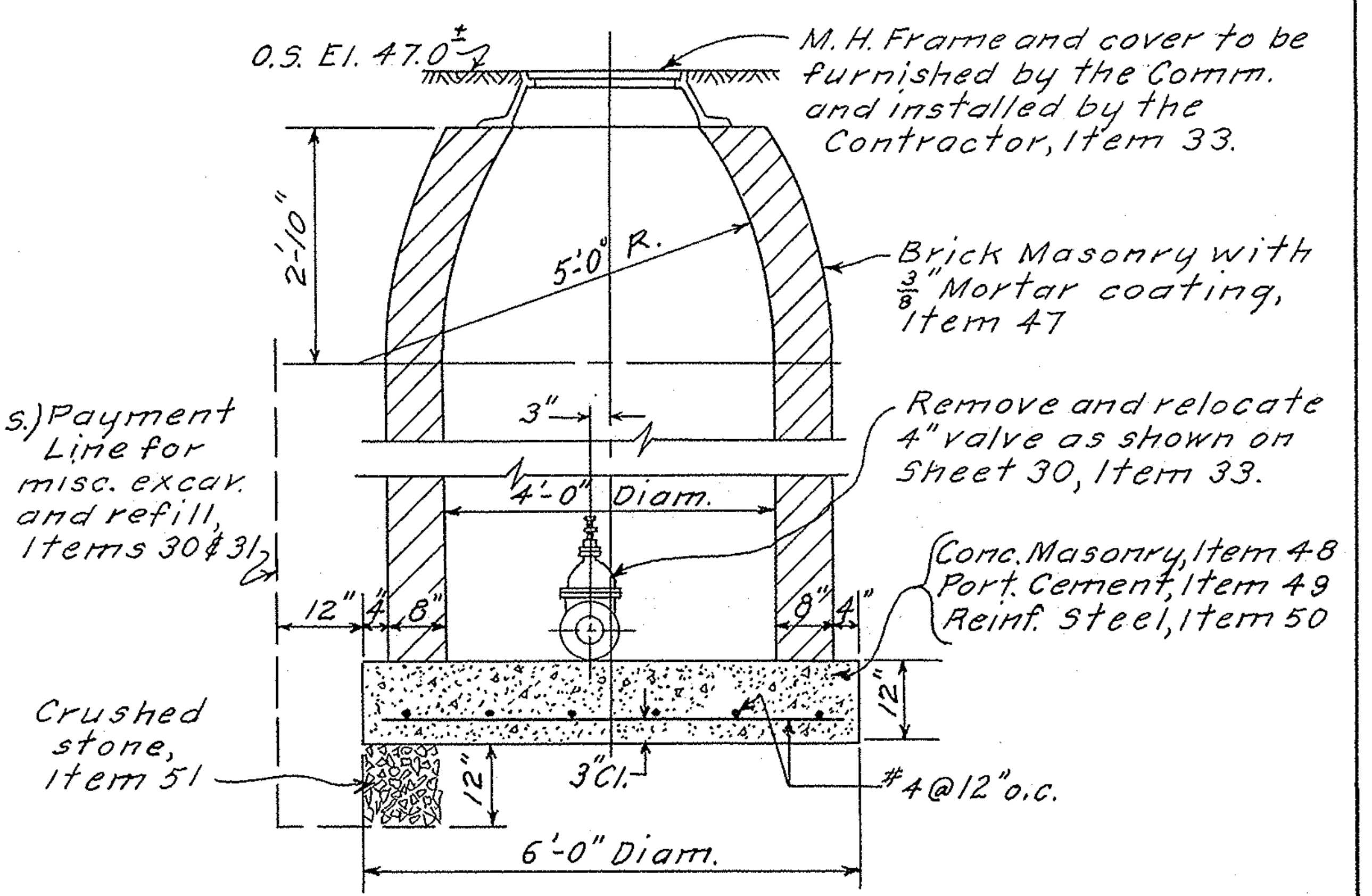


SECTION THRU BLOW-OFF WELL

2 1 0 2 4 FT.



PROFILE OF NEW LINE "B"



SECTION THRU 4" VALVE MANHOLE

2 1 0 2 4 FT.

Notes:
Elevations, Boston City Base.
For Plan of New Lines "A" & "B", see Sheet 30.
For additional details and notes, see Sheet 5.
Concrete minimum compressive strength at 28 days to be 3000 #/□".
Details shown on this Contract Drawing indicate the crossings wanted and are subject to revision by Working Drawings to be issued from to time.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
RELOCATION OF M.D.C. WATER LINES AT
WEST STREET – SHEET 2

8 4 0 8 16 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

31

DRAWN J.W.
TRACED R.E.M.
CHECKED J.W.

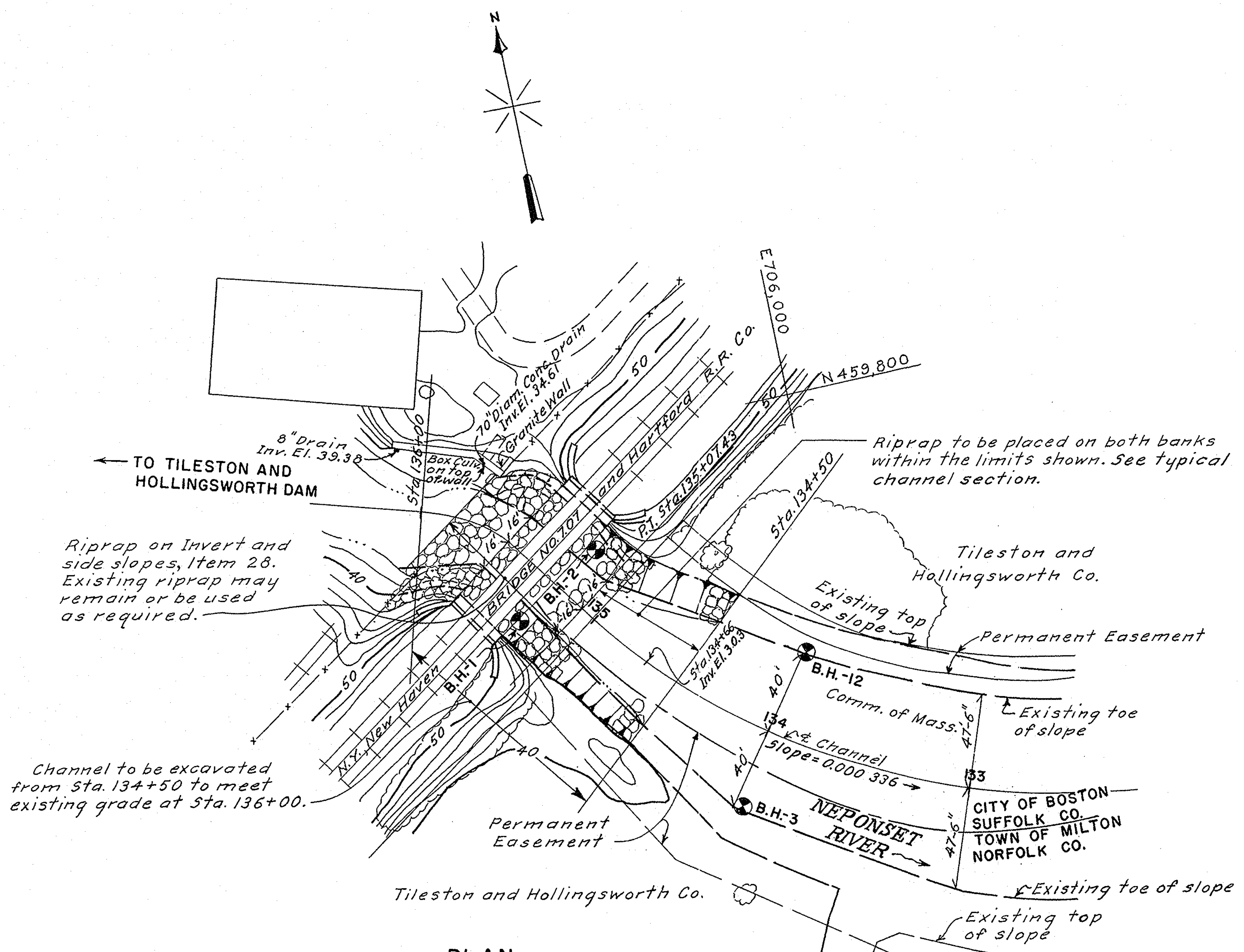
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8 U

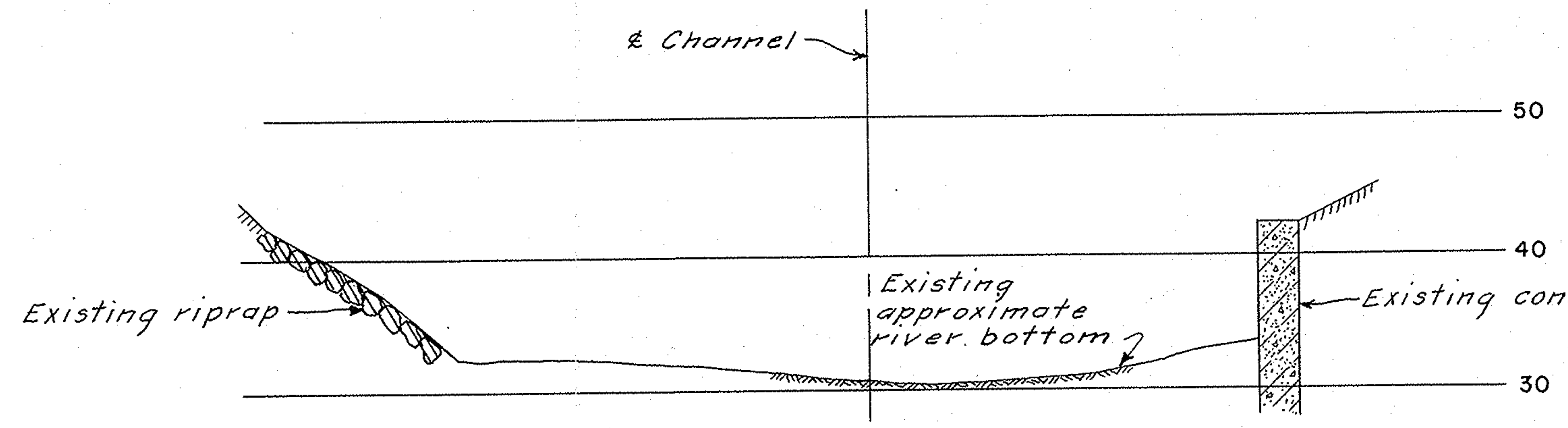
ACC. 59,231

CONTRACT C-296 SHEET 32
40 SHEETS IN SET

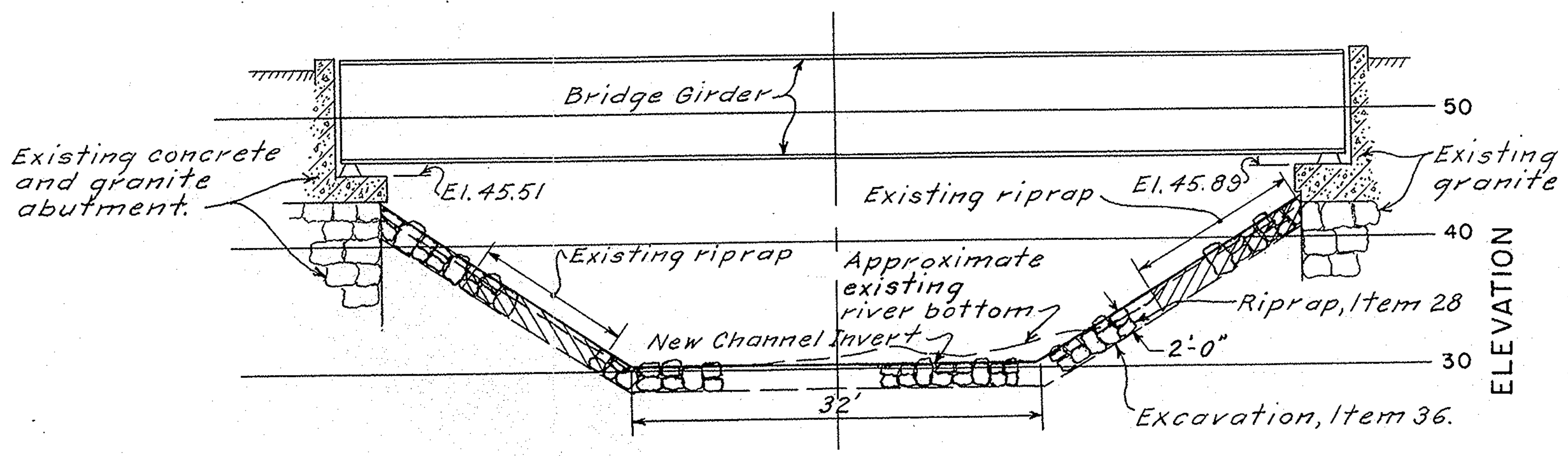


PLAN

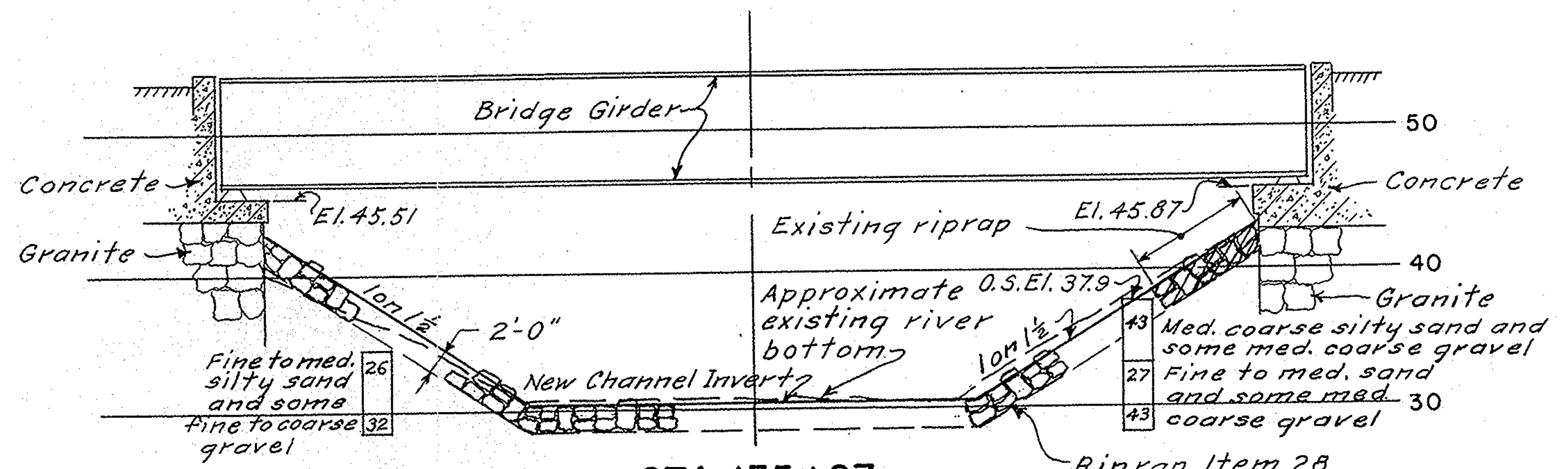
40 20 0 40 80 FT.



STA. 136+00



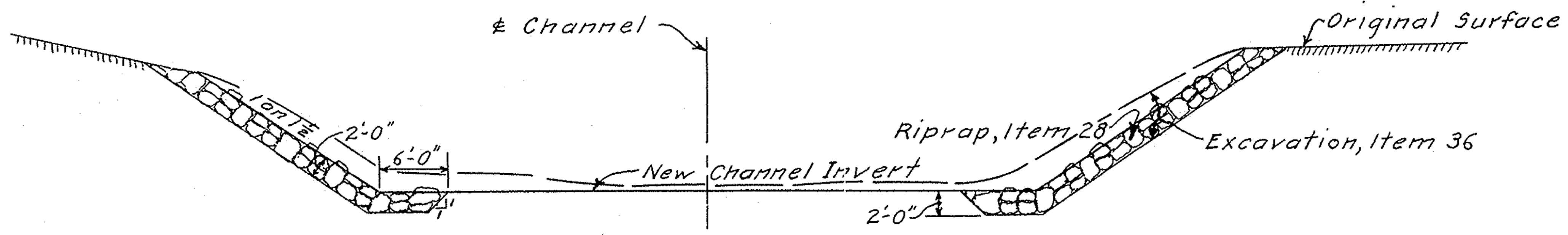
STA. 135+48



STA. 135+27

CROSS SECTIONS

Notes:
Elevations, Boston City Base.
Logs and samples at each boring are available for examination.



TYPICAL CHANNEL SECTION
BETWEEN STA. 134+50 AND STA. 135+07.43
NOT TO SCALE

Note:
Where riprap is placed in the dry, a depth of 2'-0" on 6" of screened gravel bedding may be ordered.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
R. R. BRIDGE NO. 7.07-DETAILS
10 5 0 10 20 FT.
EXCEPT AS SHOWN
JUNE 15, 1954

32

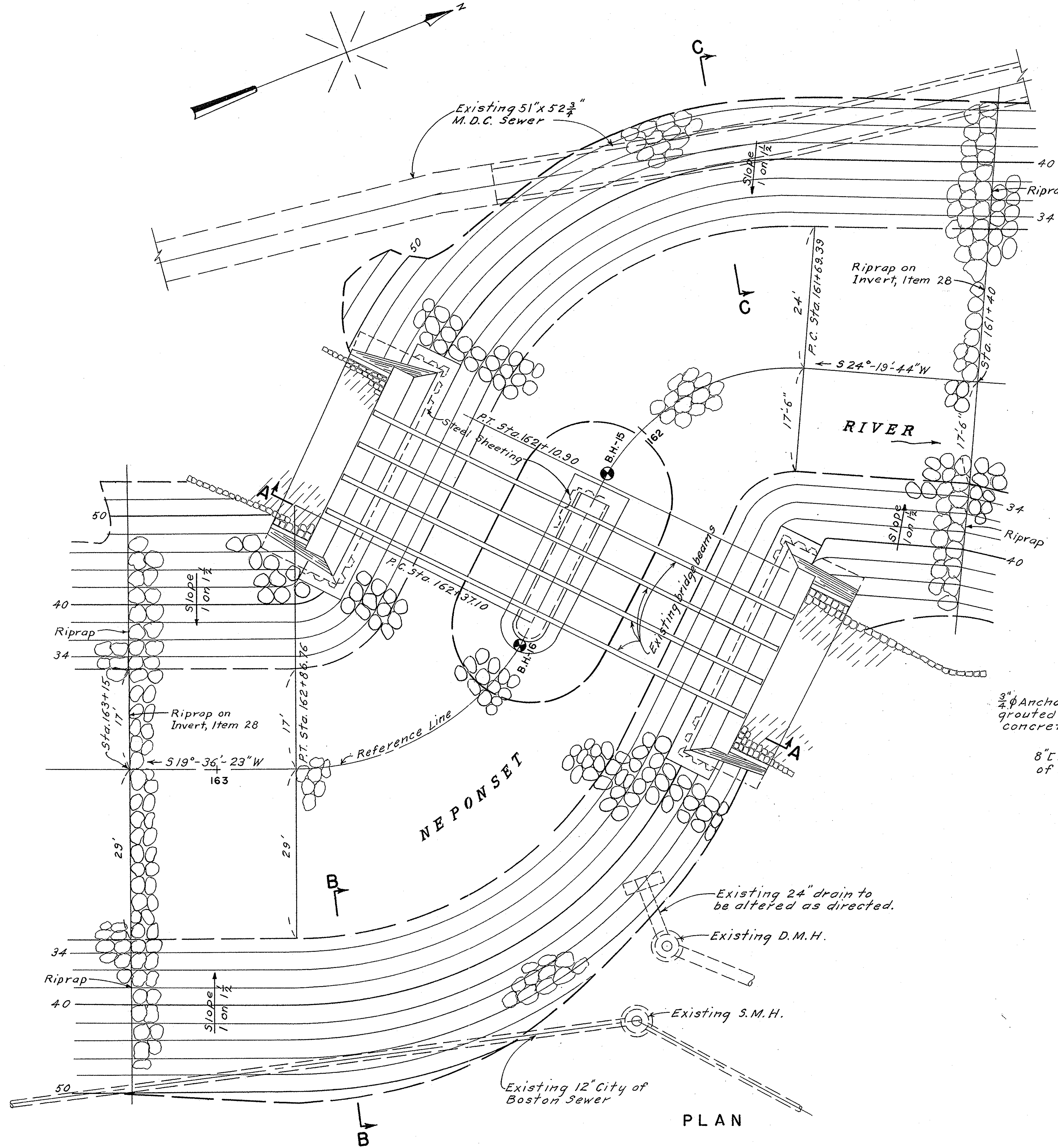
DRAWN *A.M.*
TRACED *E.C.M.*
CHECKED *A.M.*

Martin D. Cosgrove
Deputy Chief Engineer

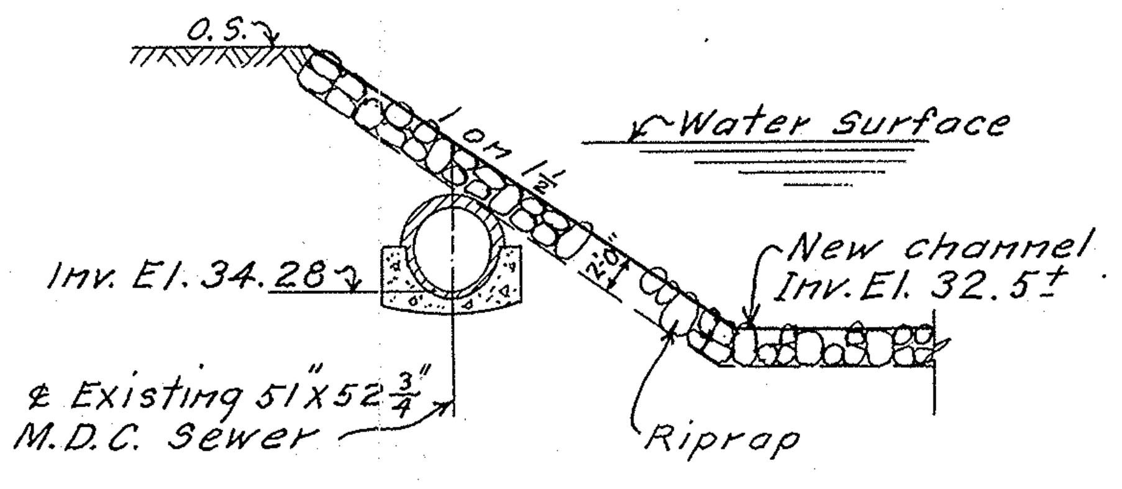
Chief Engineer

FILE CONT. C-296 10.8U

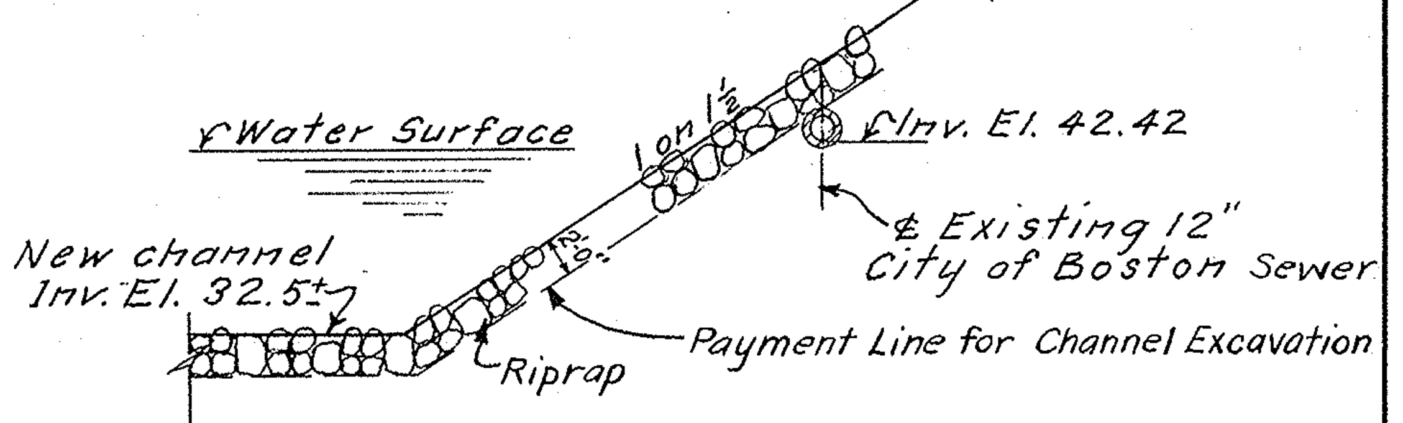
ACC. 59,232



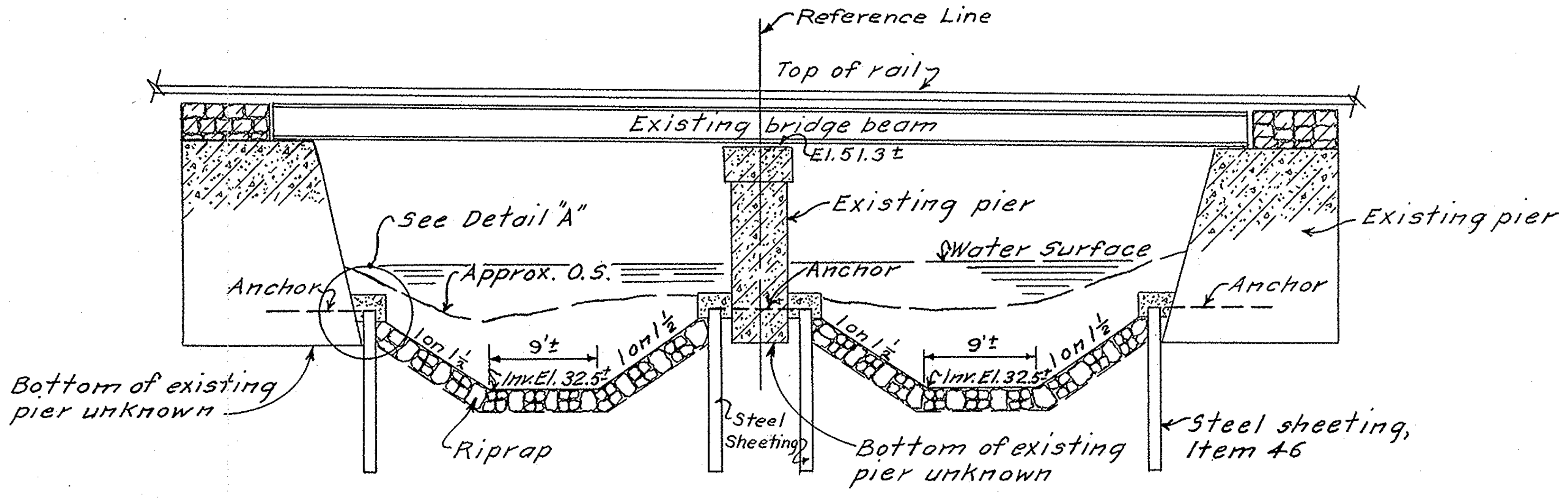
PLAN



C-C

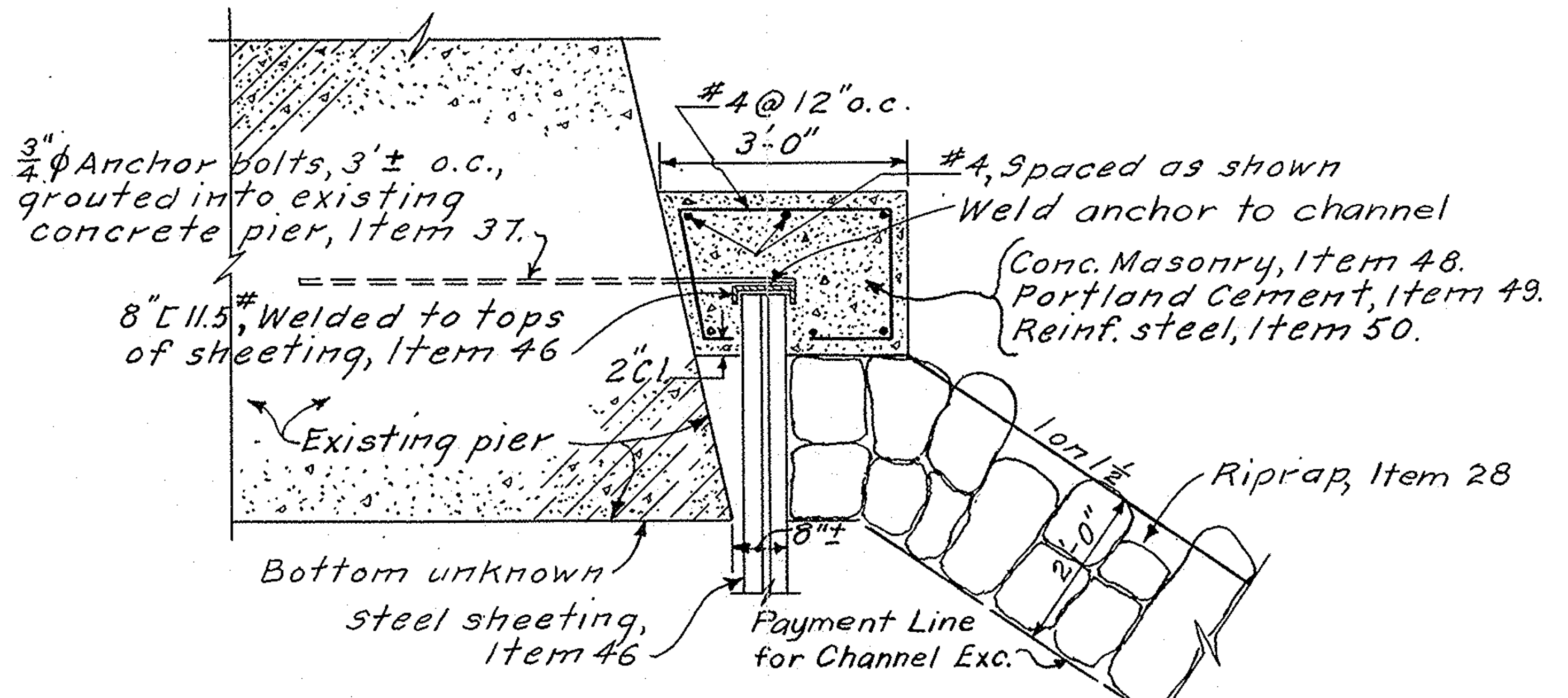


B-B



SECTION A-A

Note:
Location of bottom of foundation to be determined by means of test pits as required.



DETAIL "A"

2 1 0 2 4 FT.

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For additional details and notes, see Sheet 5.
For typical riprap detail, see Sheet 20.
For boring data and channel cross sections, see Sheet 15.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.
Concrete minimum compressive strength at 28 days to be 3000 #/□".

COMMONWEALTH OF MASSACHUSETTS

METR. DISTR. COMMISSION—CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
R. R. BRIDGE NO. 7.54-DETAILS

10 5 0 10 20 FT.

EXCEPT AS SHOWN
JUNE 15, 1964

33

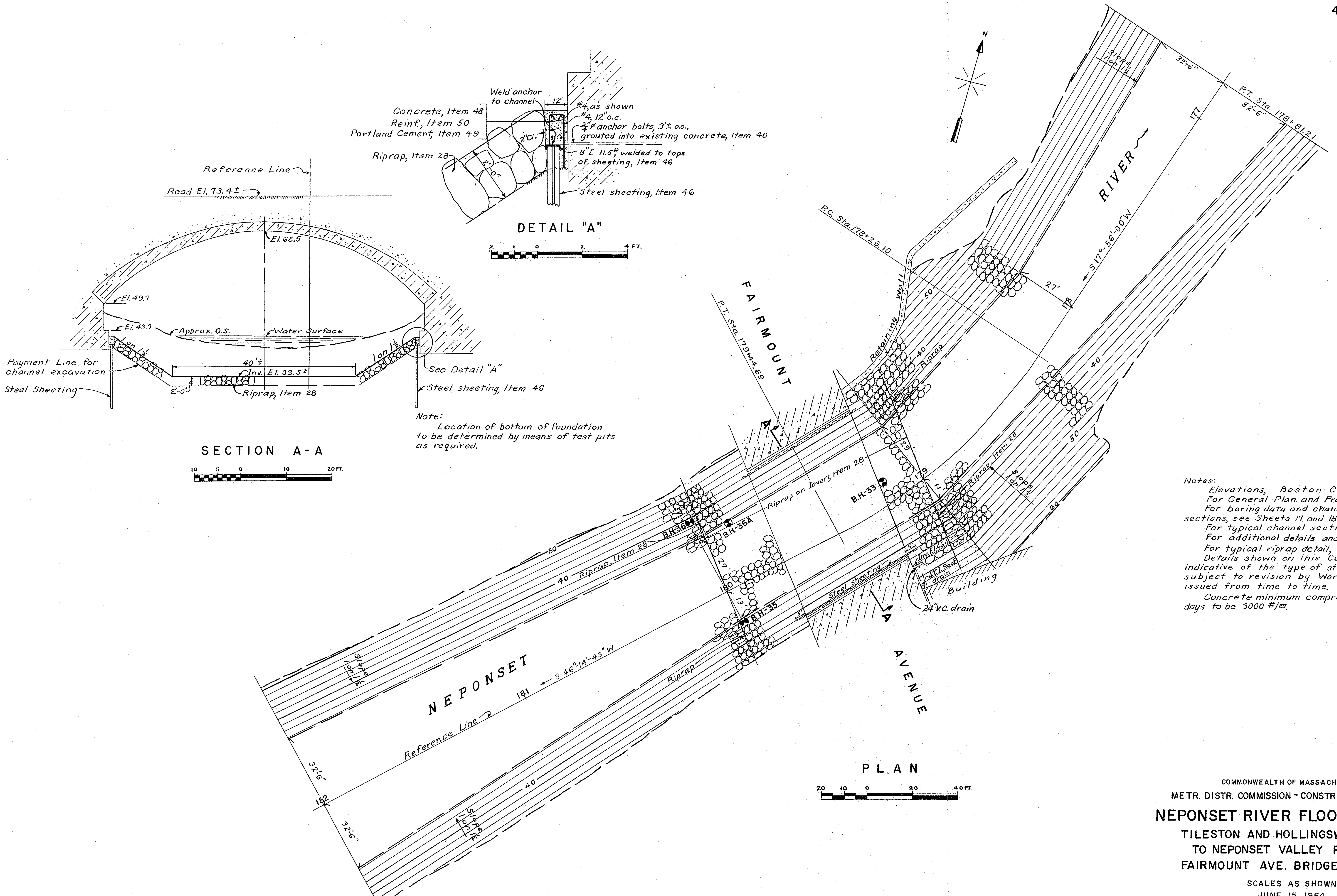
DRAWN S.M.
TRACED E.E.M.
CHECKED J.C.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59,233



DETAIL "A"

SECTION A-A

Note:
Location of bottom of foundation to be determined by means of test pits as required.

PLAN

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheets 17 and 18.
For typical channel section, see Sheet 4.
For additional details and notes, see Sheet 7.
For typical riprap detail, see Sheet 20.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.
Concrete minimum compressive strength at 28 days to be 3000 #/□".

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION - CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
FAIRMOUNT AVE. BRIDGE-DETAILS

SCALES AS SHOWN
JUNE 15, 1964

③④

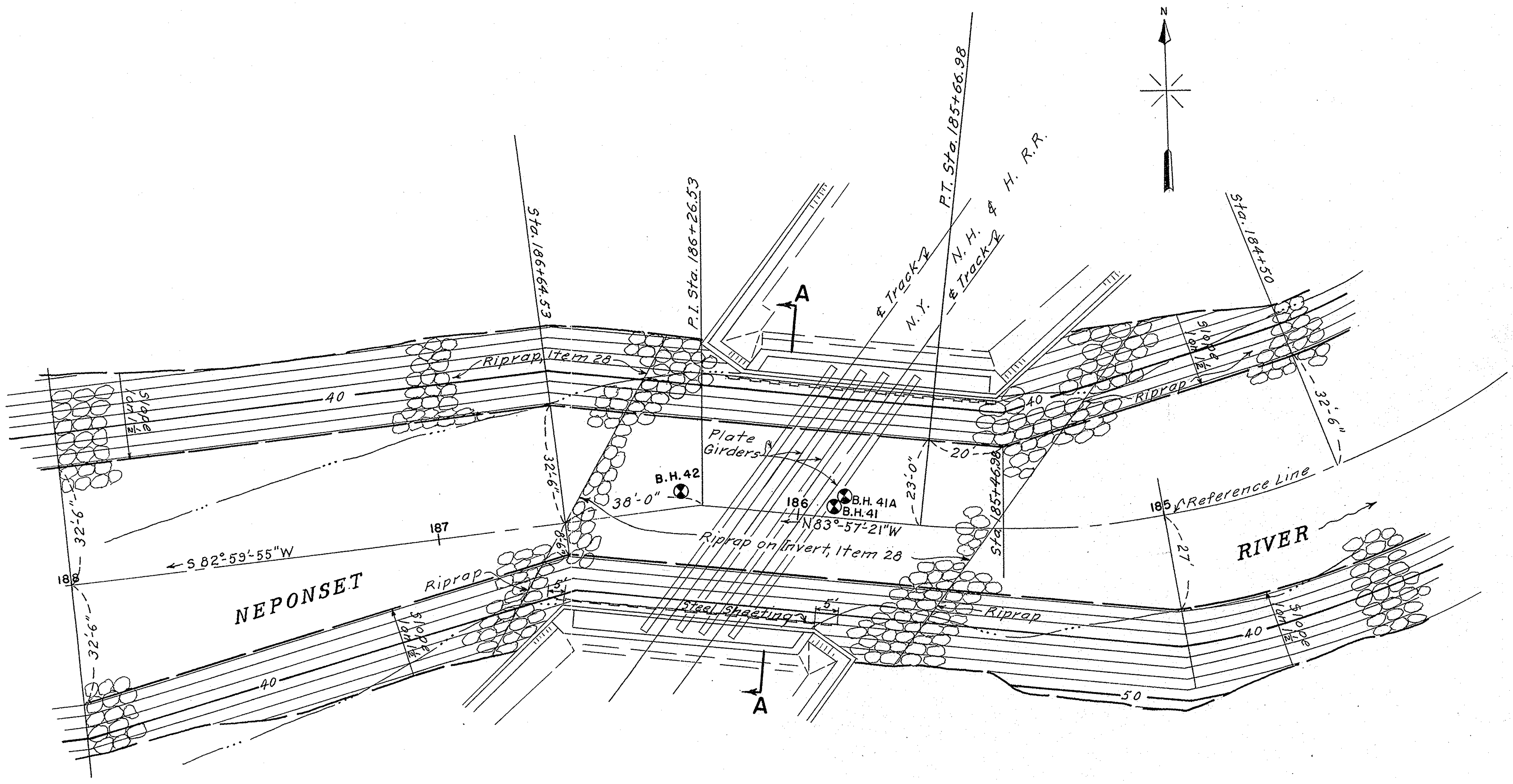
DRAWN R.W.W.
TRACED E.J.T.
CHECKED J.C.

Martin A. Cosgrove
Deputy Chief Engineer

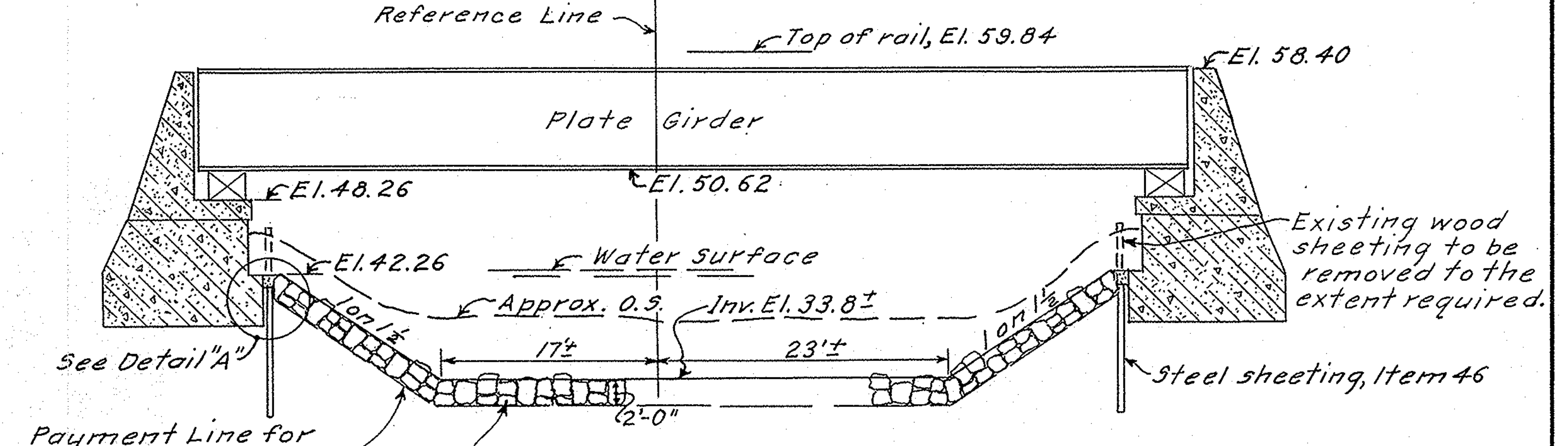
Chief Engineer

FILE CONT. C-296 10.8U
ACC. 59,234

CONTRACT C-296 SHEET 35
40 SHEETS IN SET



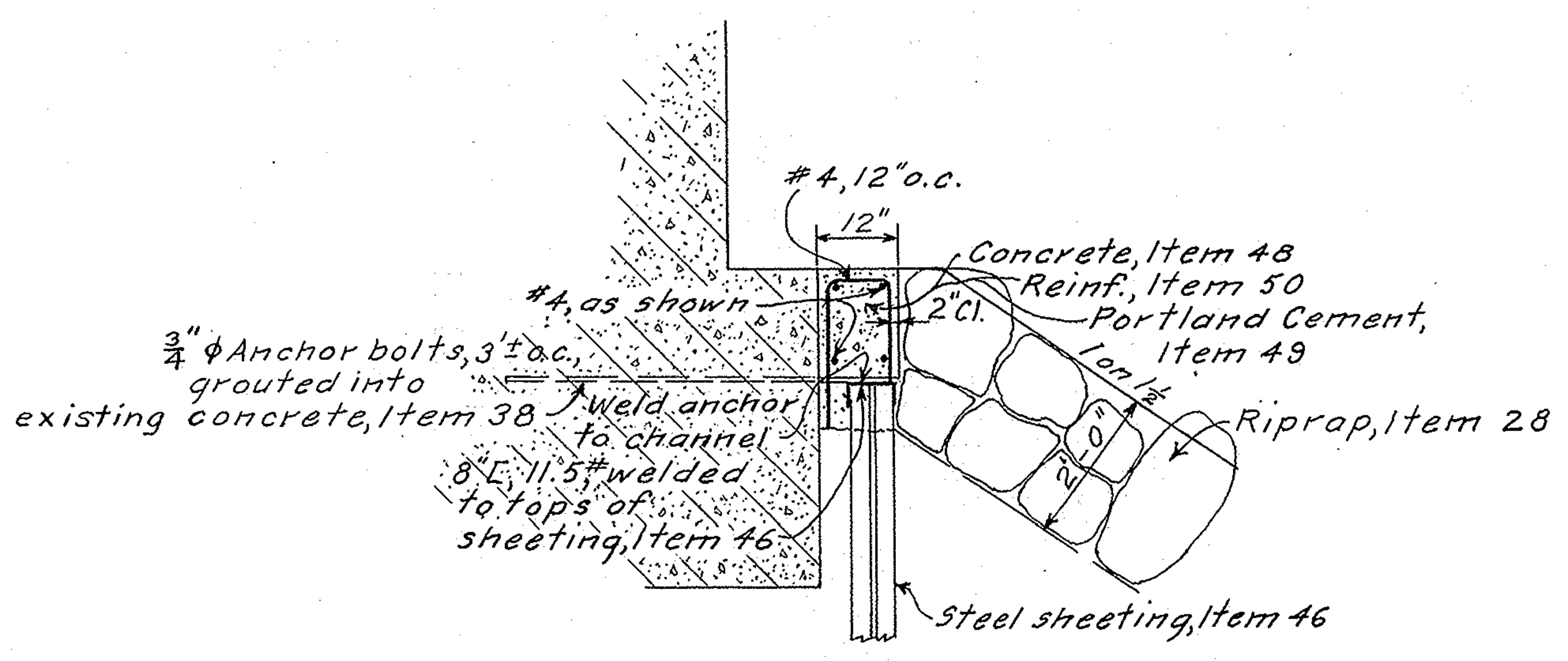
PLAN



Note:
Location of bottom of foundation to be determined by means of test pits as required.

SECTION A-A

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheets 18 and 19.
For typical channel section, see Sheet 4.
For typical riprap detail, see Sheet 20.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.
For additional details and notes, see Sheet 7.
Concrete minimum compressive strength at 28 days to be 3000#/▫.



DETAIL "A"

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION-CONSTRUCTION DIVISION
NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
R.R. BRIDGE NO. 7.96-DETAILS
SCALES AS SHOWN
JUNE 15, 1964

35

DRAWN RHW
TRACED E.E.M.
CHECKED J.C.

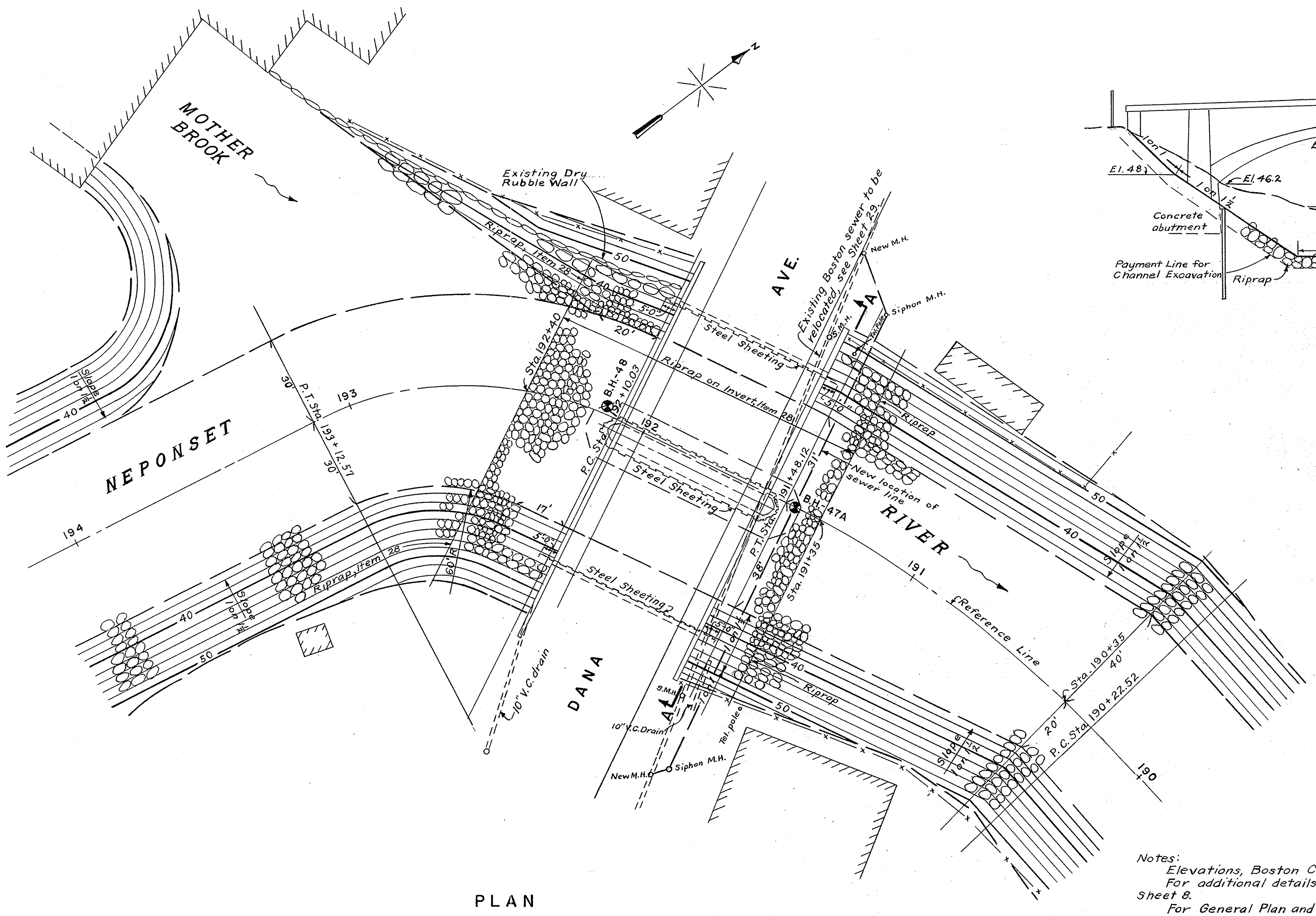
Martin N. Cosgrove
Deputy Chief Engineer

Chief Engineer

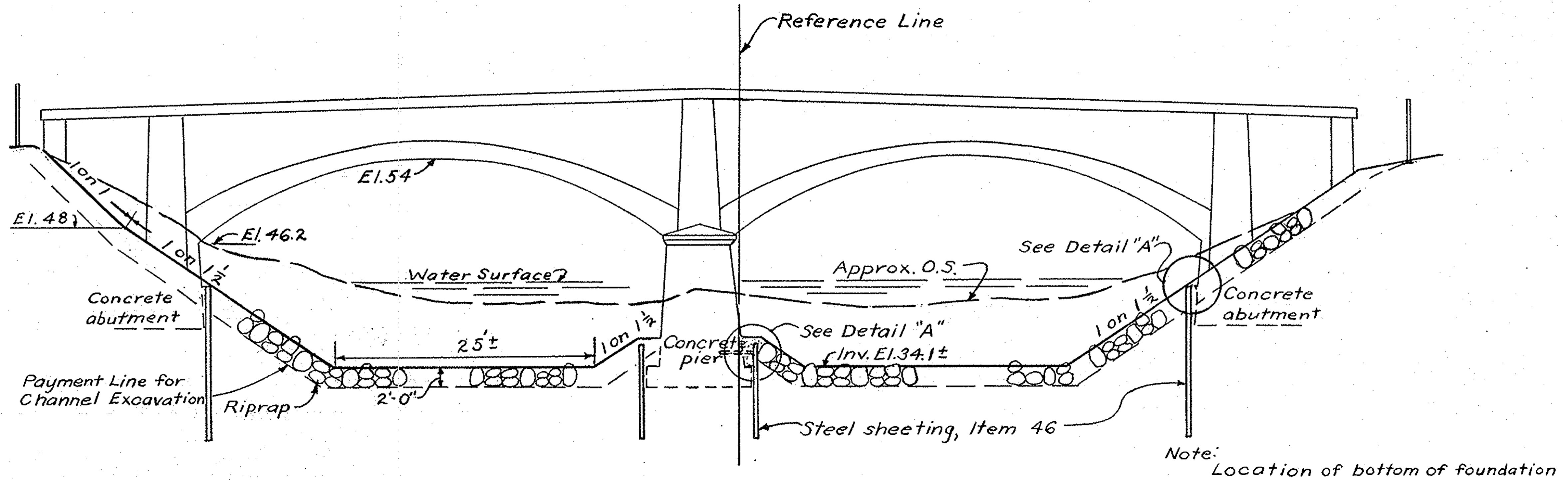
FILE CONT. C-296 10.8U

ACC. 59,235

CONTRACT C-296 SHEET 36
40 SHEETS IN SET



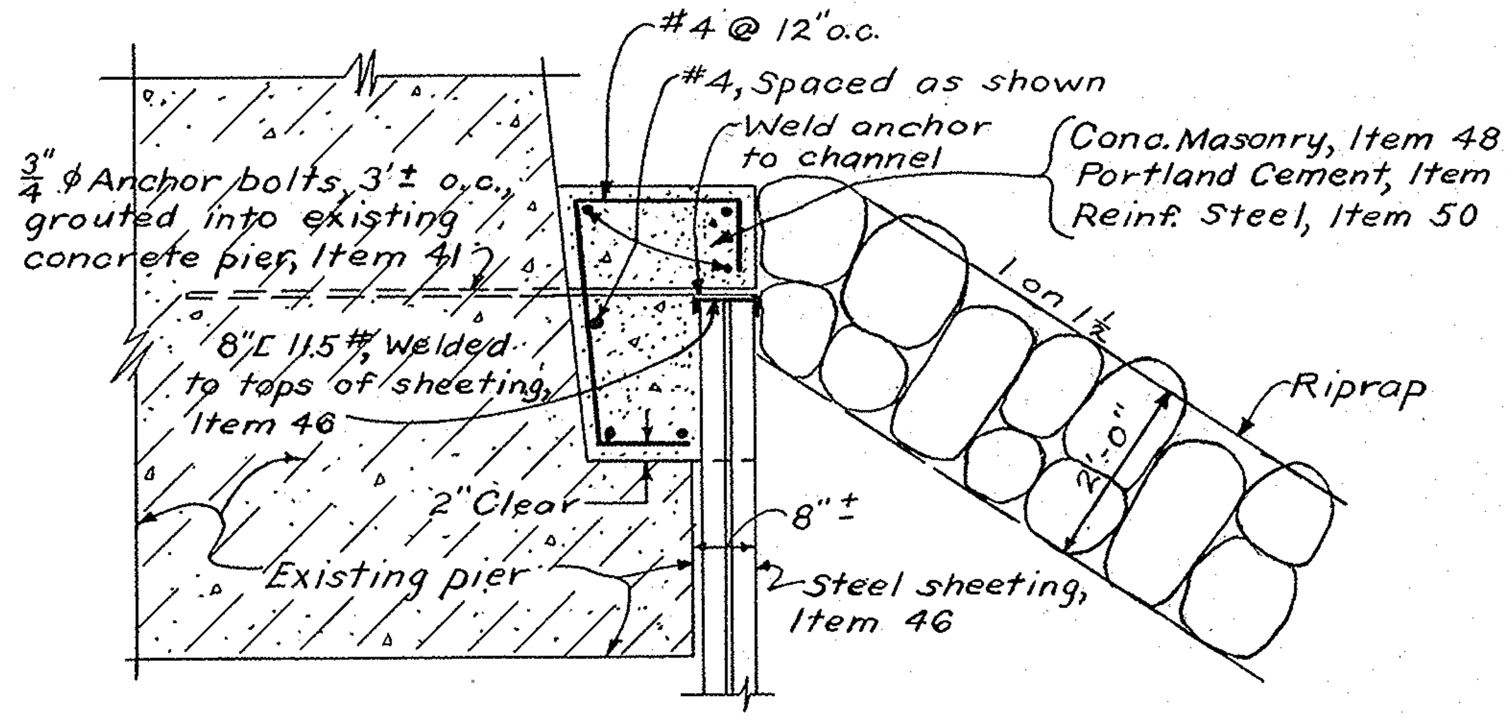
PLAN



Note:
Location of bottom of foundation to be determined by means of test pits as required.

SECTION A-A

10 5 0 10 20 FT.



DETAIL "A"

2 1 0 2 4 FT.

Notes:
Elevations, Boston City Base.
For additional details and notes, see Sheet 8.
For General Plan and Profile, see Sheet 2.
For boring data and channel cross sections, see Sheet 19.
For typical channel section, see Sheet 4.
For typical riprap detail, see Sheet 20.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by working drawings to be issued from time to time.
Concrete minimum compressive strength at 28 days to be 3000 #/□".

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
DANA AVE. BRIDGE – DETAILS

20 10 0 20 40 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

36

DRAWN E.B.H.
TRACED E.J.H.
CHECKED J.C.

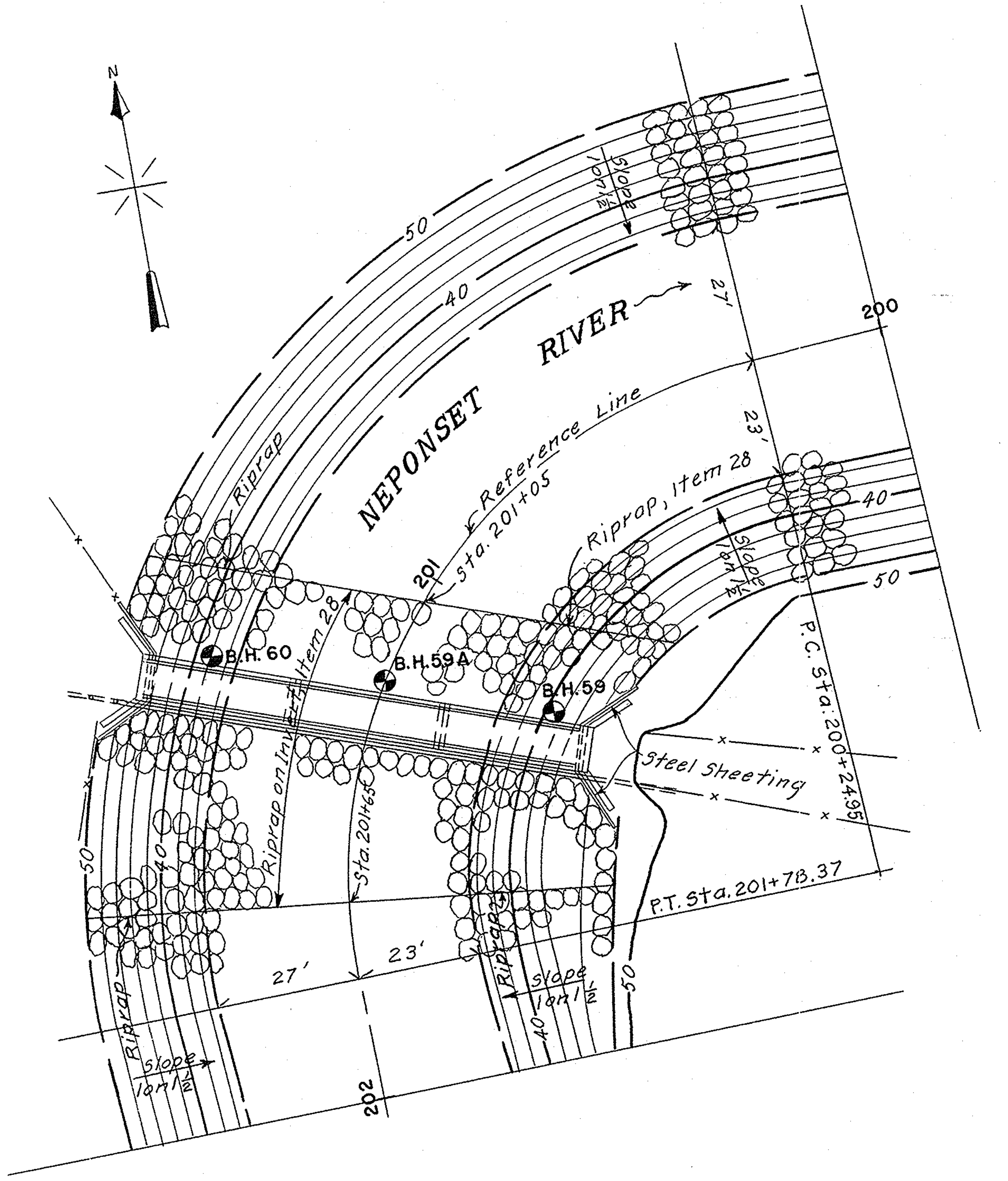
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

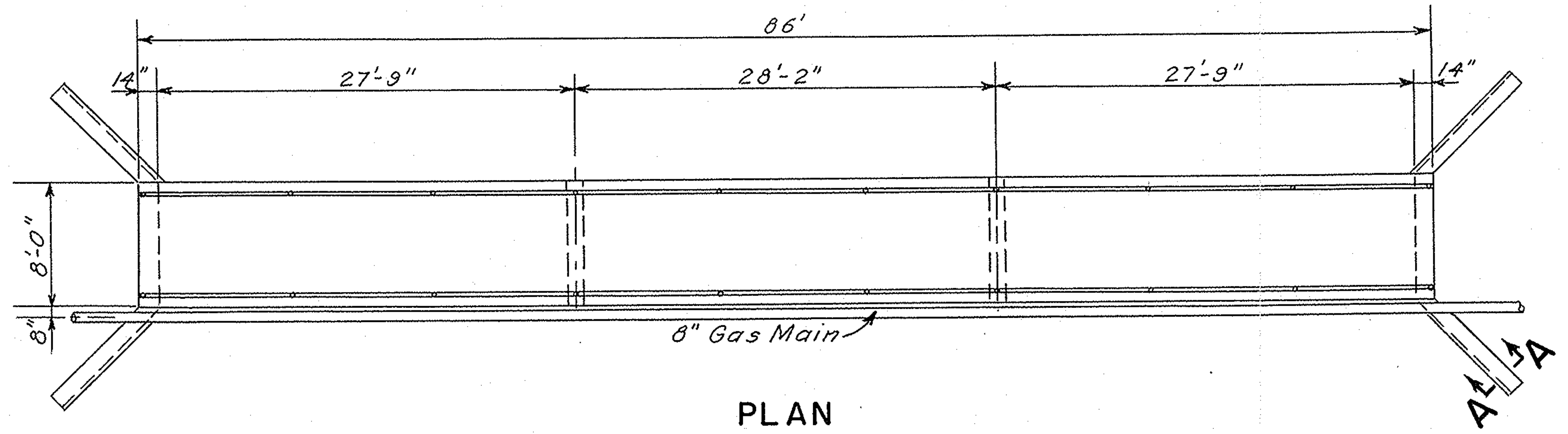
ACC. 59,236

CONTRACT C-296 SHEET 37
40 SHEETS IN SET

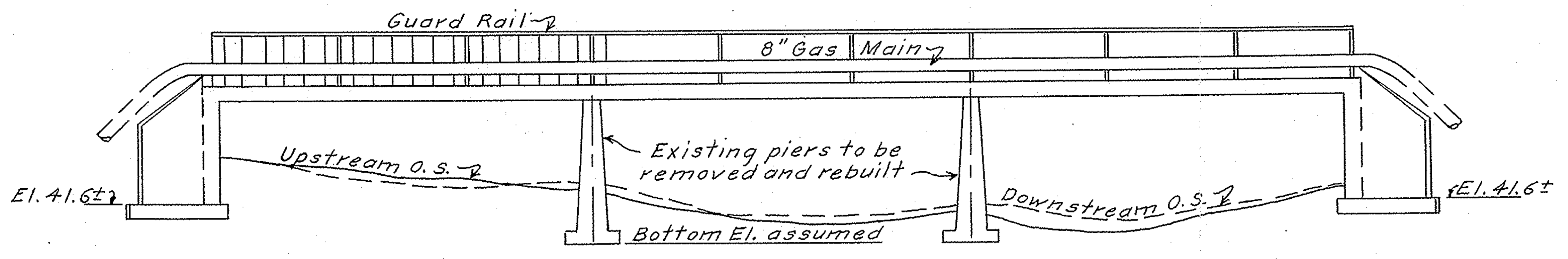


PLAN

20 10 0 20 40 FT.

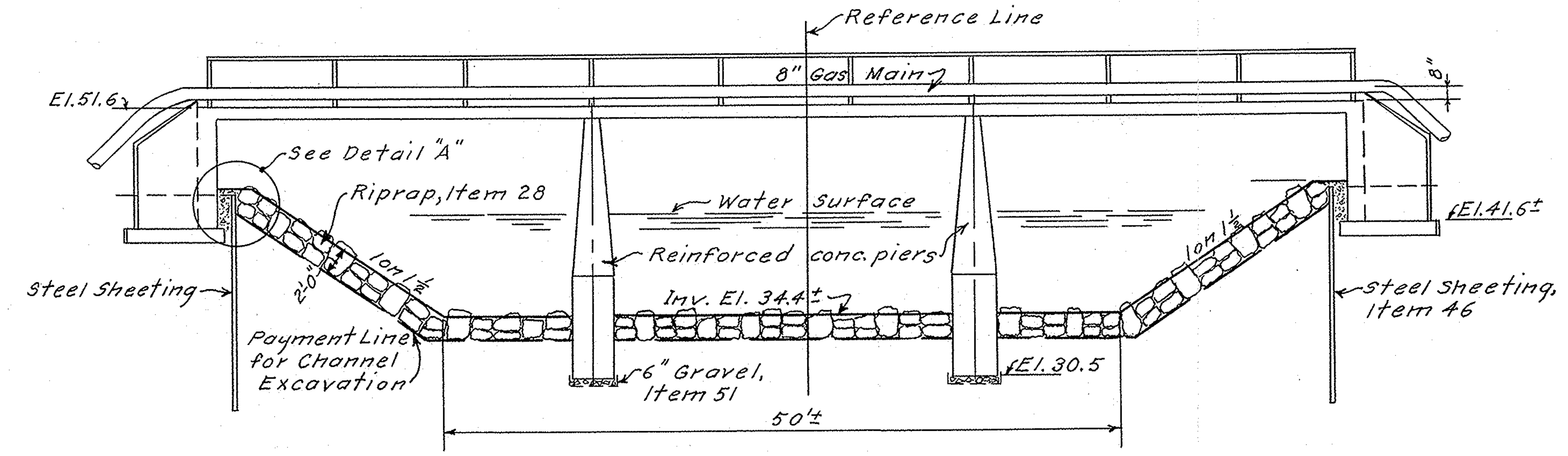


PLAN



ELEVATION

EXISTING BRIDGE

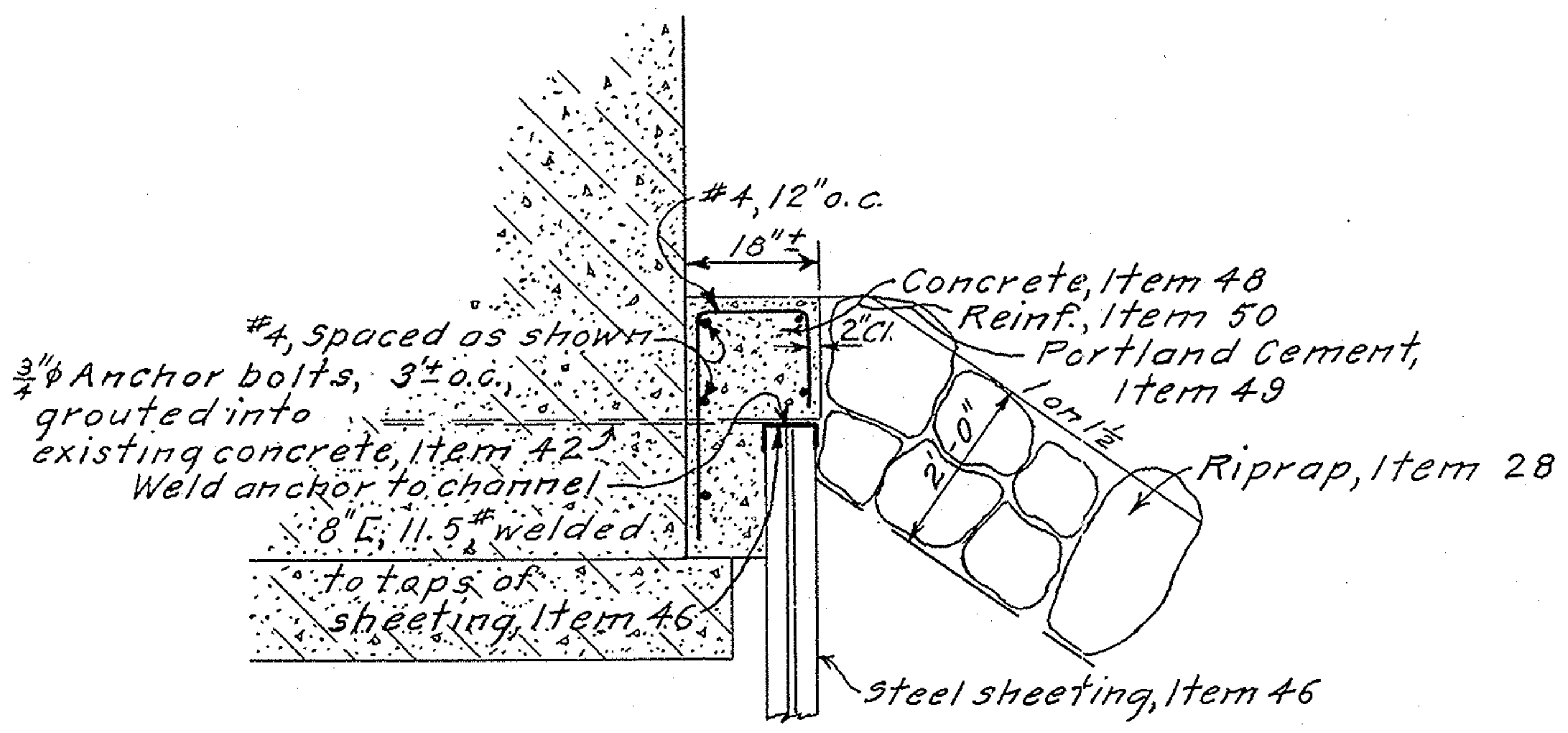


Note:
Location of bottom of foundation to be determined by means of test pits as required.

NEW CHANNEL AND PIERS

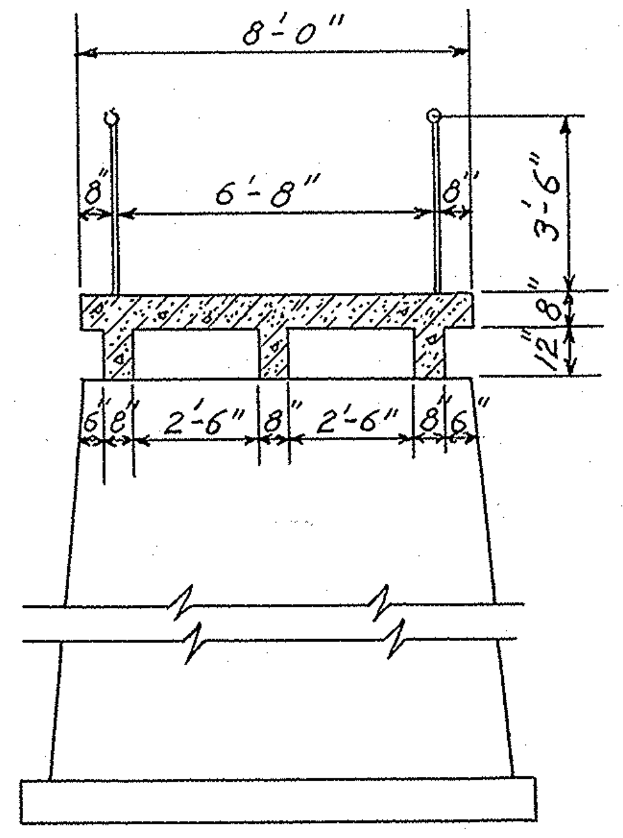
8 4 0 8 16 FT.

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For typical channel section, see Sheet 4.
For additional details and notes, see Sheet 9.
For boring data and channel cross sections, see Sheets 20 & 21.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.
Concrete minimum compressive strength at 28 days to be 3000#/□.
Chamfer all exposed corners as directed.

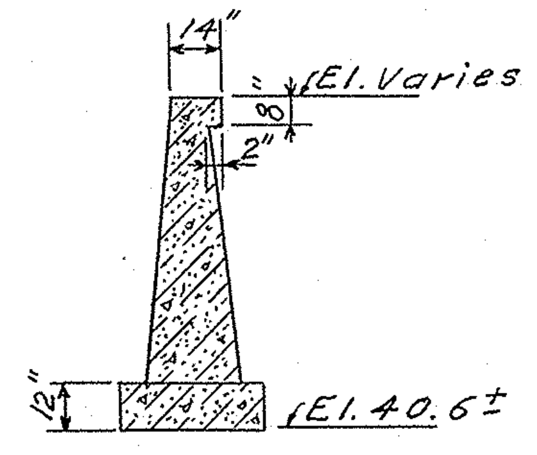


DETAIL "A"

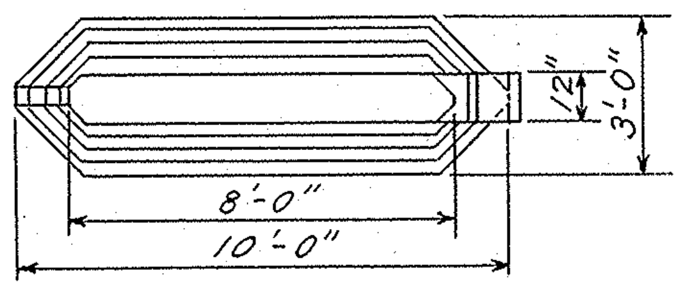
2 1 0 2 4 FT.



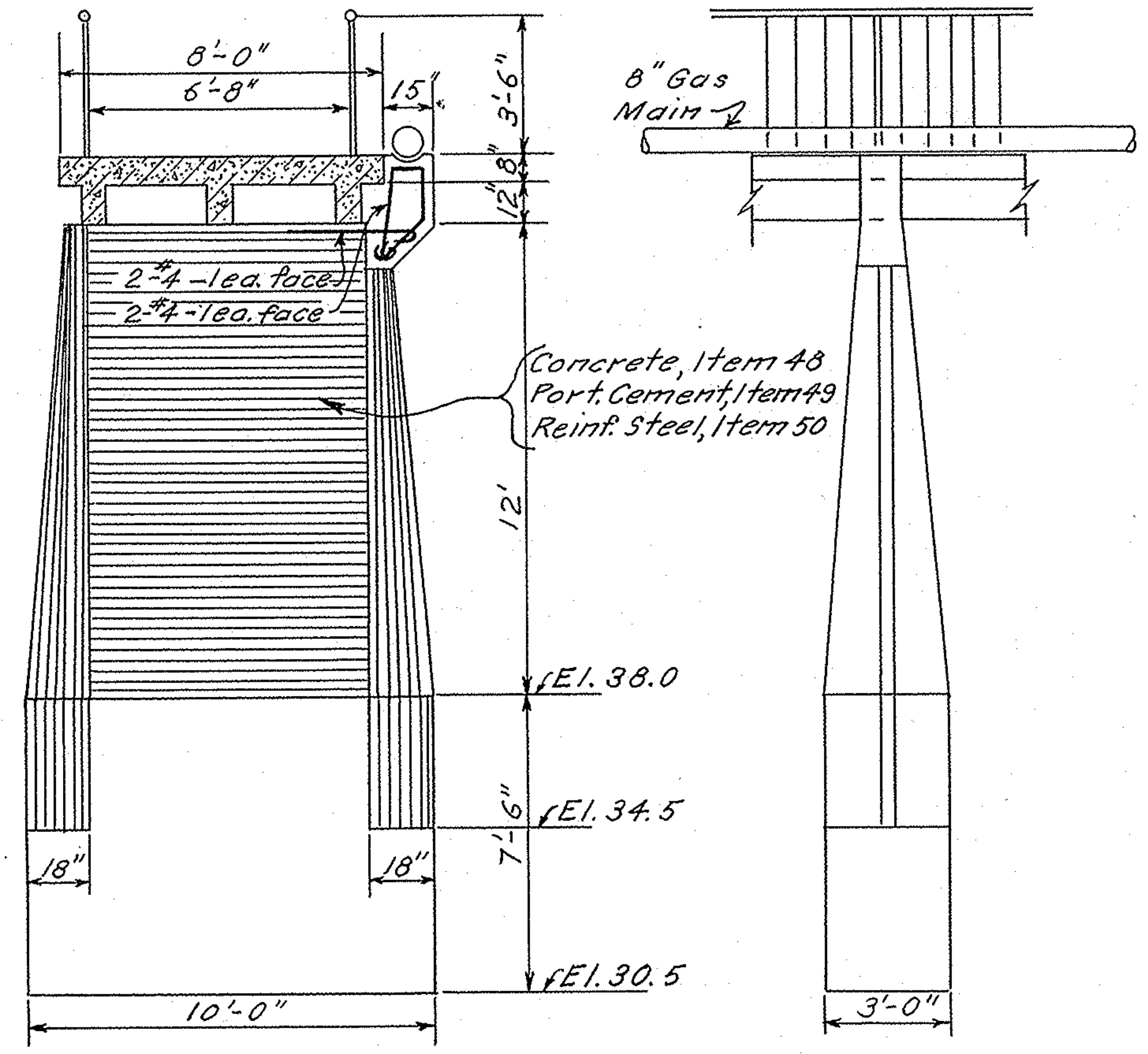
EXISTING PIER



SECTION A-A



PLAN



ELEVATION SECTION

NEW PIERS

4 2 0 4 8 FT.

Note:
The center piers shall be reinforced with #4 bars, 12" o.c., both ways on all faces.

COMMONWEALTH OF MASSACHUSETTS

METR. DISTR. COMMISSION — CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
"B" STREET FOOTBRIDGE - DETAILS

SCALES AS SHOWN
JUNE 15, 1964

㊲

DRAWN J.F.C.
TRACED E.E.M.
CHECKED J.C.

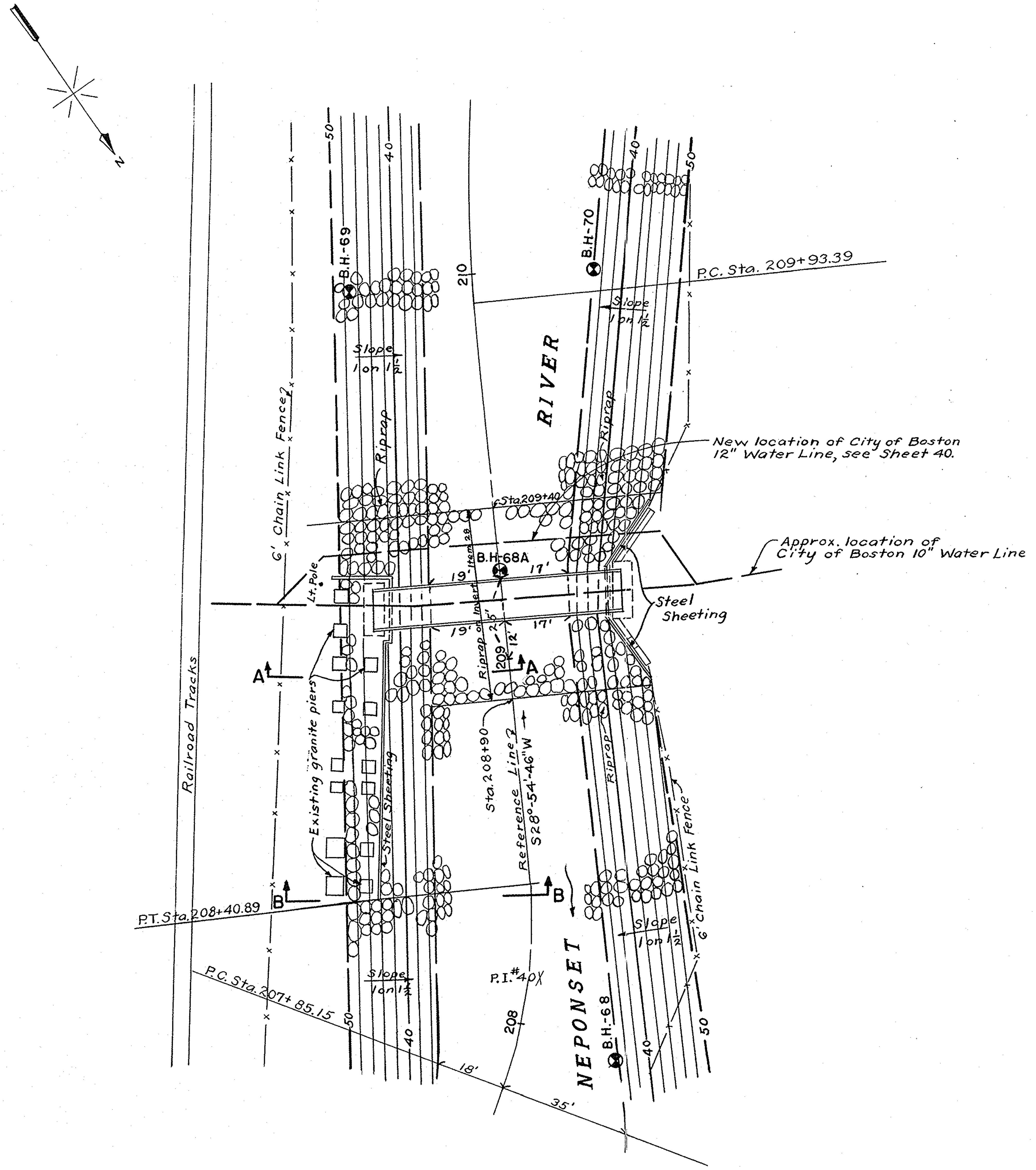
Martin A. Cosgrove
Deputy Chief Engineer

Chief Engineer

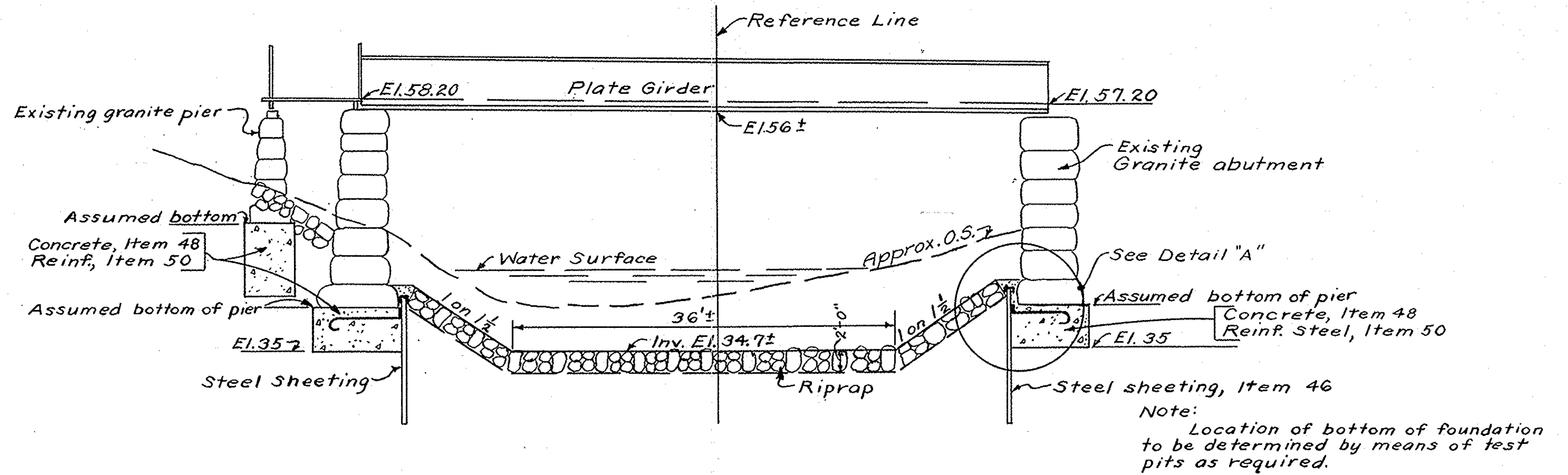
FILE CONT. C-296 10.8U

ACC. 59237

CONTRACT C-296 SHEET 38
40 SHEETS IN SET

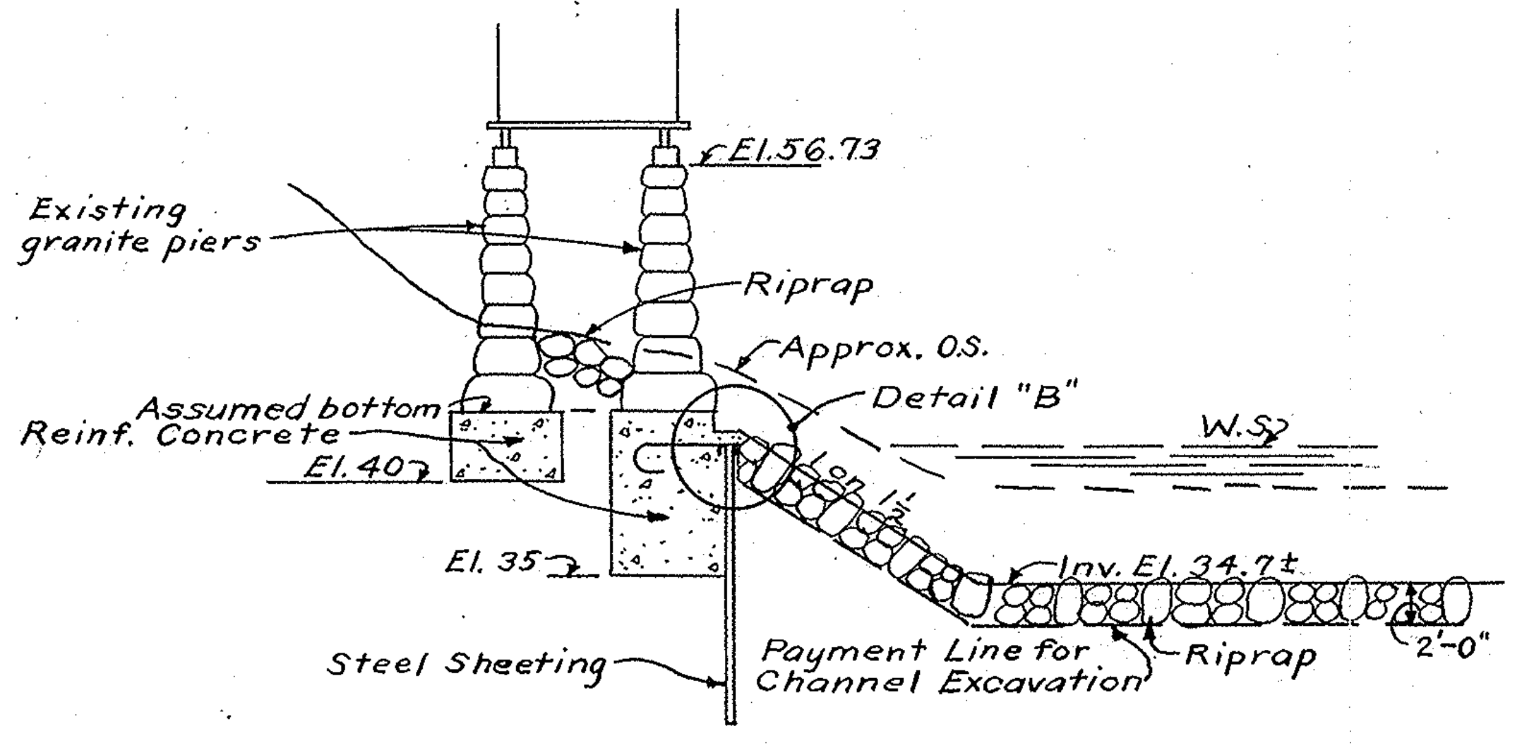


PLAN

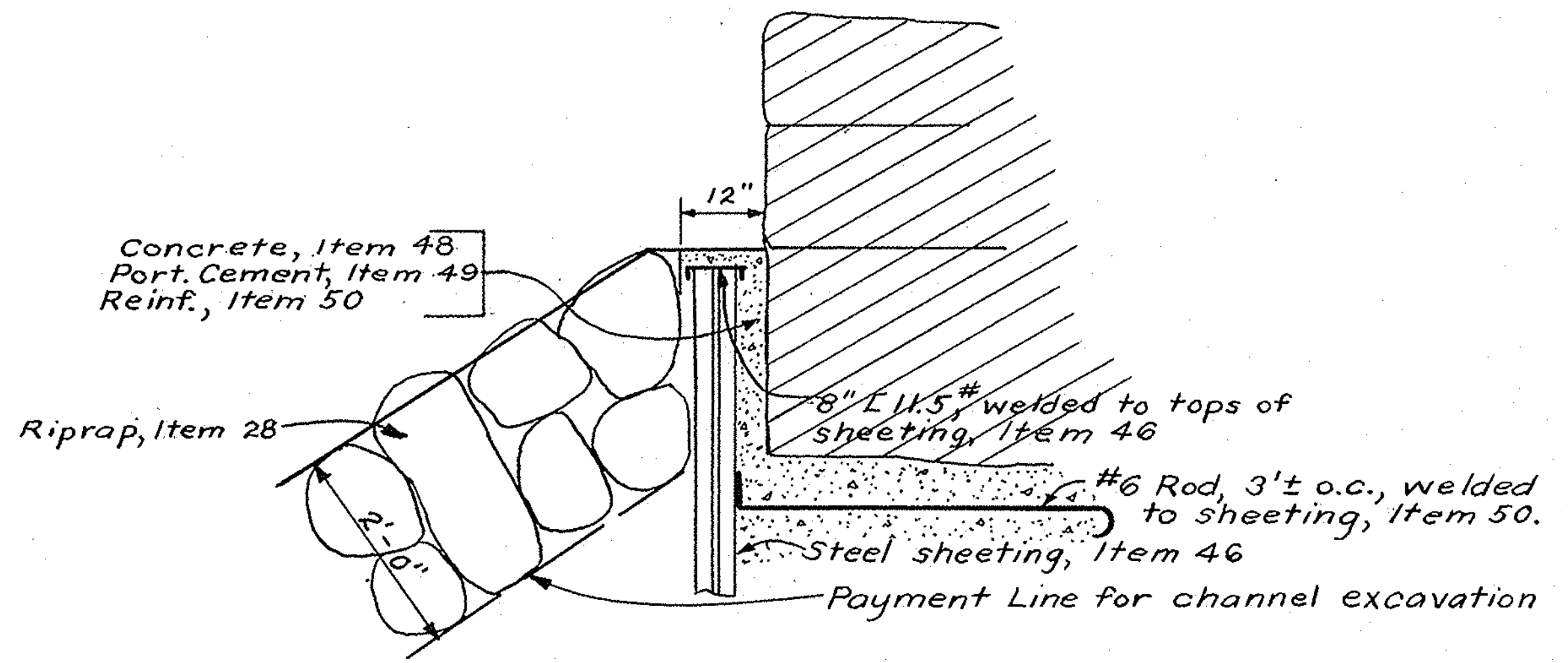


Note:
Location of bottom of foundation to be determined by means of test pits as required.

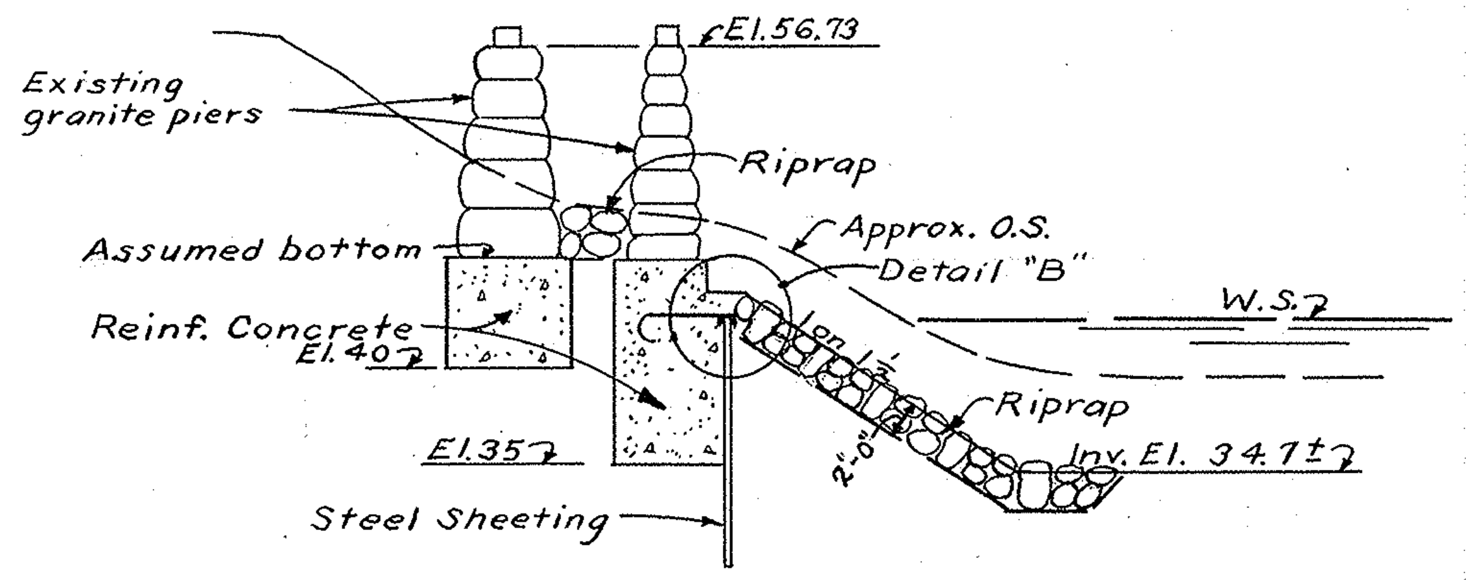
SECTION THRU FOOTBRIDGE



SECTION A-A



DETAIL "A"
DETAIL "B" SIMILAR



B-B

Notes:
Elevations, Boston City Base.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheets 23 and 24.
For typical channel section, see Sheet 4.
For typical riprap detail, see Sheet 20.
For additional details and notes, see Sheet 9.
Concrete minimum compressive strength at 28 days to be 3000#/▭.
Details shown on this Contract Drawing are indicative of the type of structures wanted and are subject to revision by Working Drawings to be issued from time to time.

THIS DESIGN SUBSTITUTED.
FOR NEW DESIGN SEE PLAN
BY COLEMAN BROS. CORP., OUR ACC. 59243.
J.C. 5/6/65

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION - CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
GLENWOOD AVE. FOOTBRIDGE-DETAILS
10 5 0 10 20 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

38

DRAWN J.F.C.
TRACED C.J.G.
CHECKED J.C.

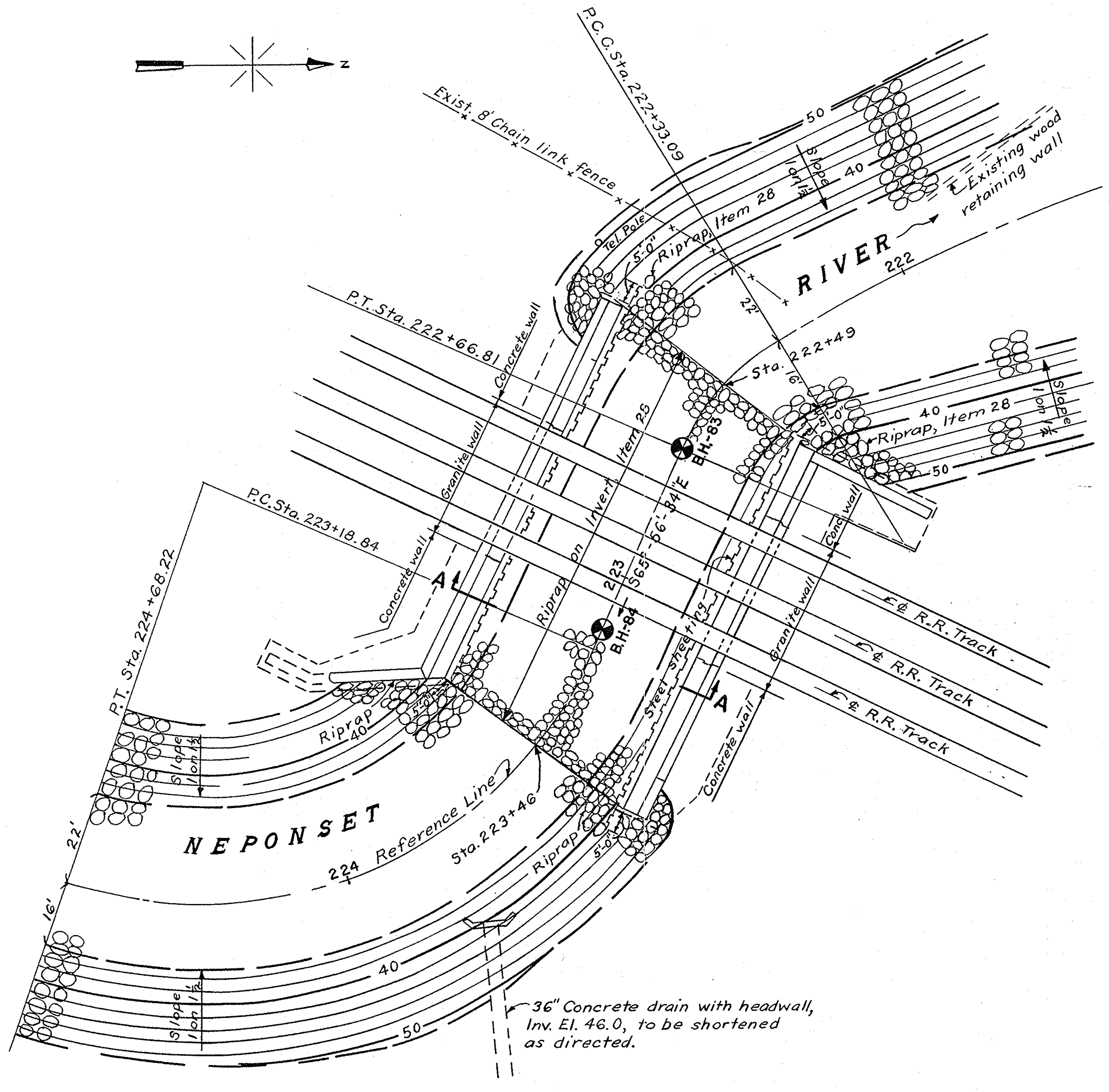
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

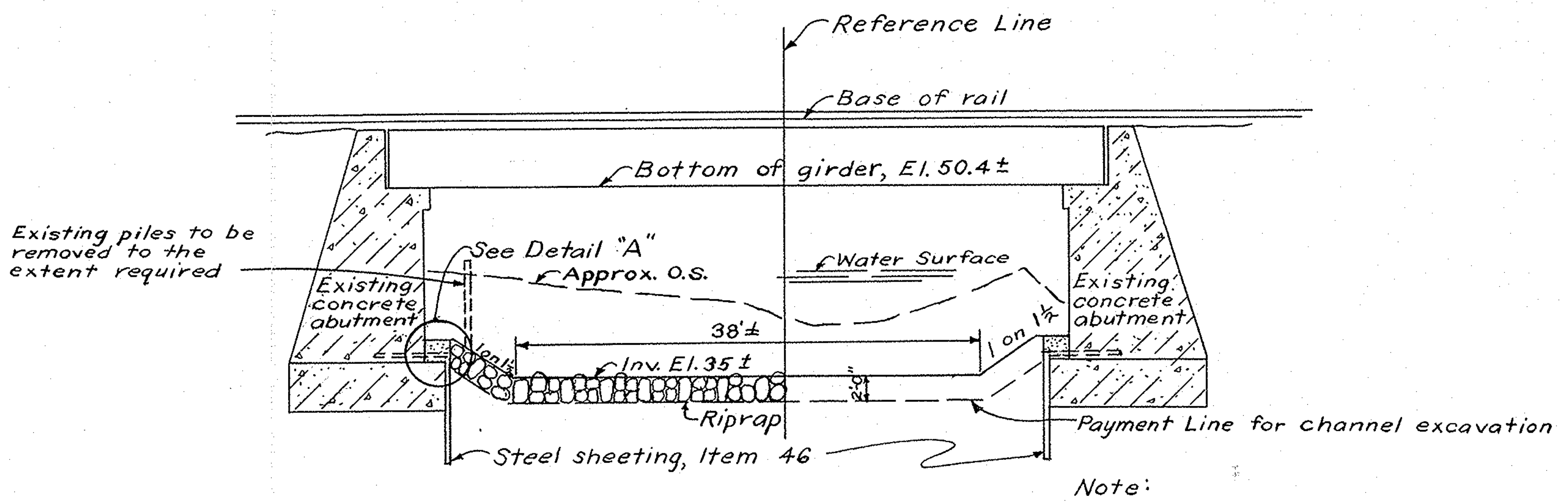
FILE CONT. C-296 10.8U

ACC. 59,238

CONTRACT C-296 SHEET 39
40 SHEETS IN SET



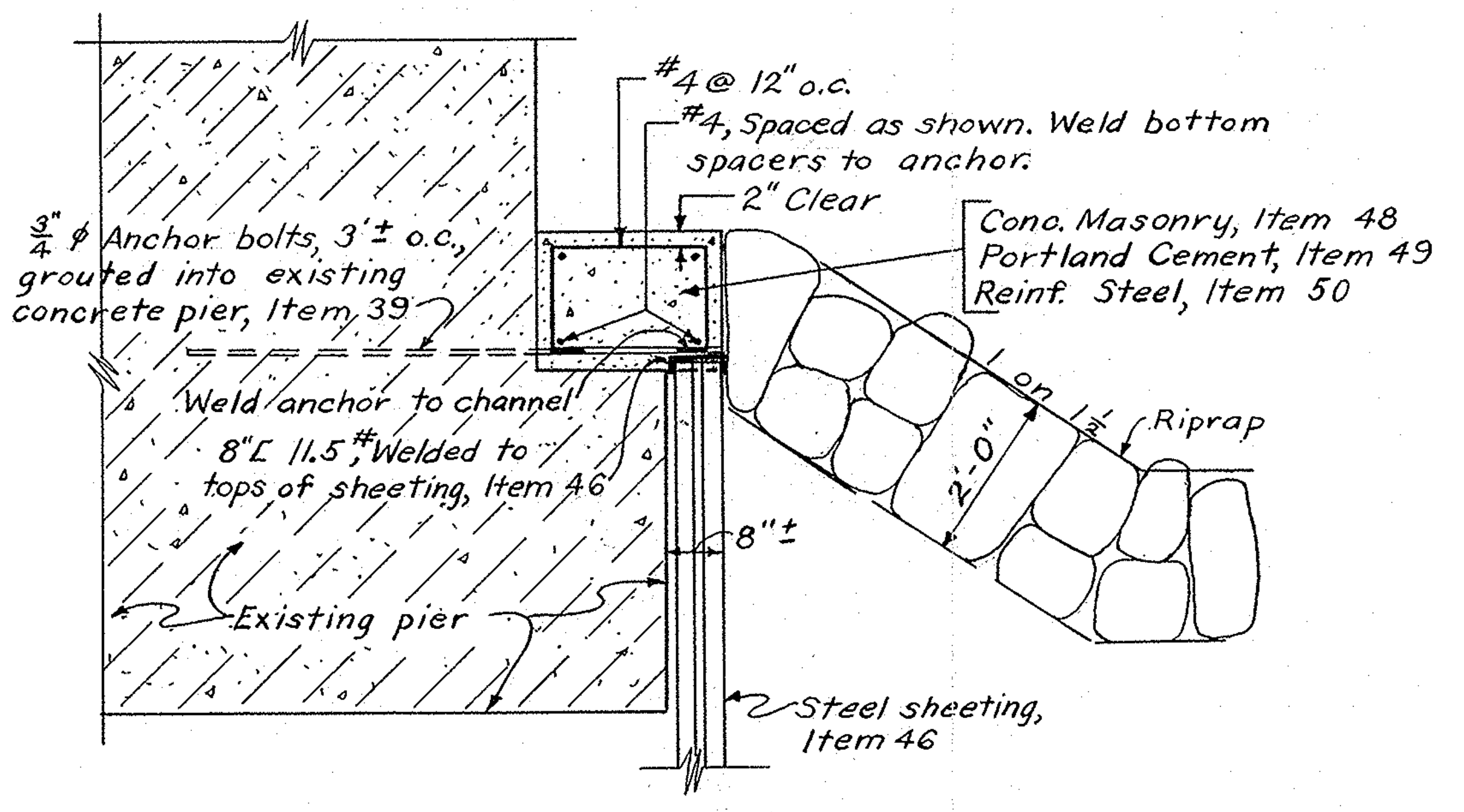
PLAN



Note:
Location of bottom of foundation to be determined by means of test pits as required.

SECTION A-A

10 5 0 10 20 FT.



DETAIL "A"

2 1 0 2 4 FT.

Notes:
Elevations, Boston City Base.
For additional details and notes, see Sheet 11.
For General Plan and Profile, see Sheet 3.
For boring data and channel cross sections, see Sheet 23.
For typical drain headwall details, see Sheet 10.
For typical channel section, see Sheet 4.
For typical riprap detail, see Sheet 20.
Details shown on this Contract Drawing are indicative of the type of structures wanted, and are subject to revision by working drawings to be issued from time to time.
Concrete minimum compressive strength at 28 days to be 3000 #/□.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION – CONSTRUCTION DIVISION

NEPONSET RIVER FLOOD CONTROL

TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
R. R. BRIDGE NO. 8.57-DETAILS

20 10 0 20 40 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

39

DRAWN CEH
TRACED E.J.G.
CHECKED J.C.

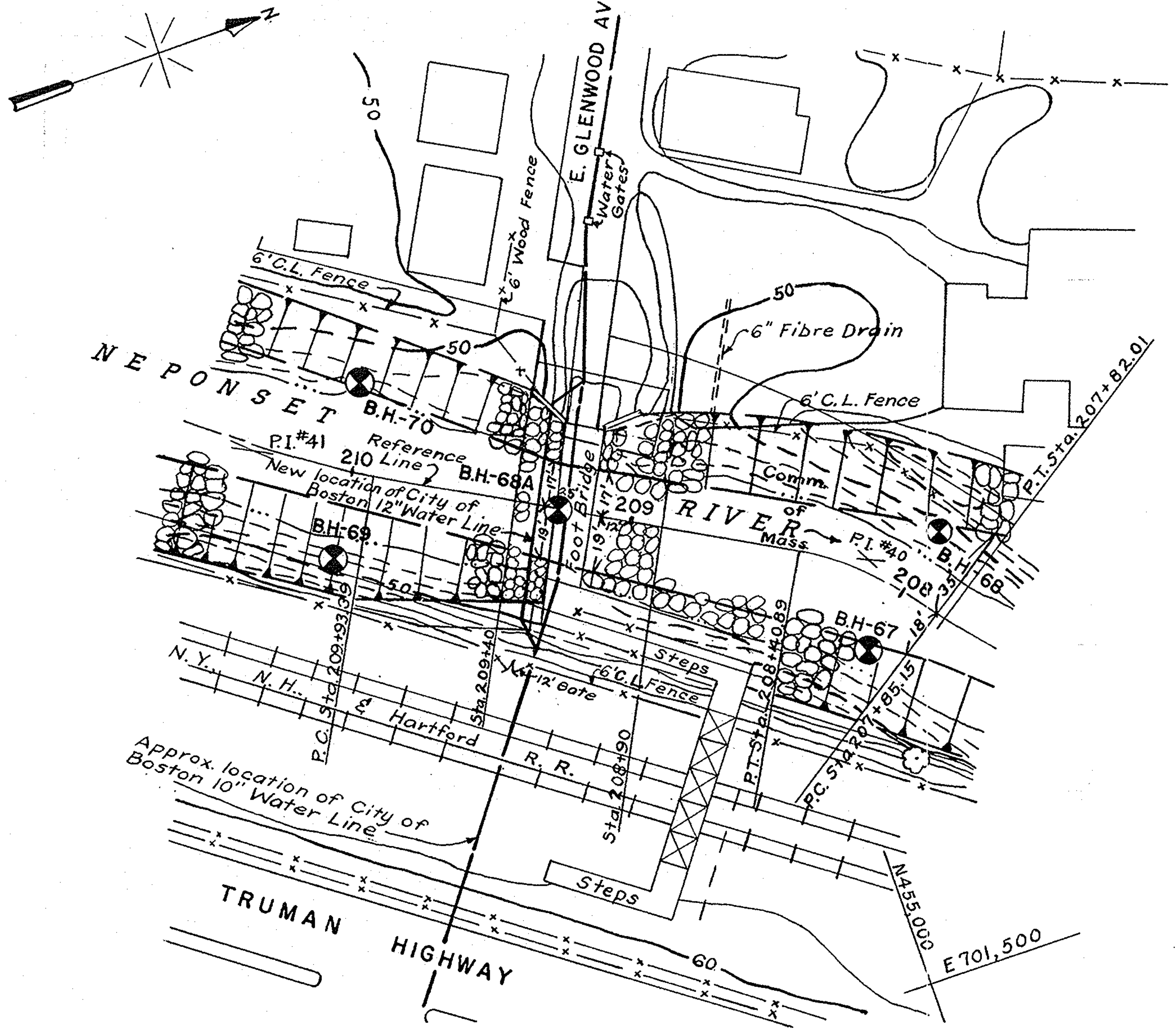
Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59,239

CONTRACT C-296 SHEET 40
40 SHEETS IN SET



PLAN

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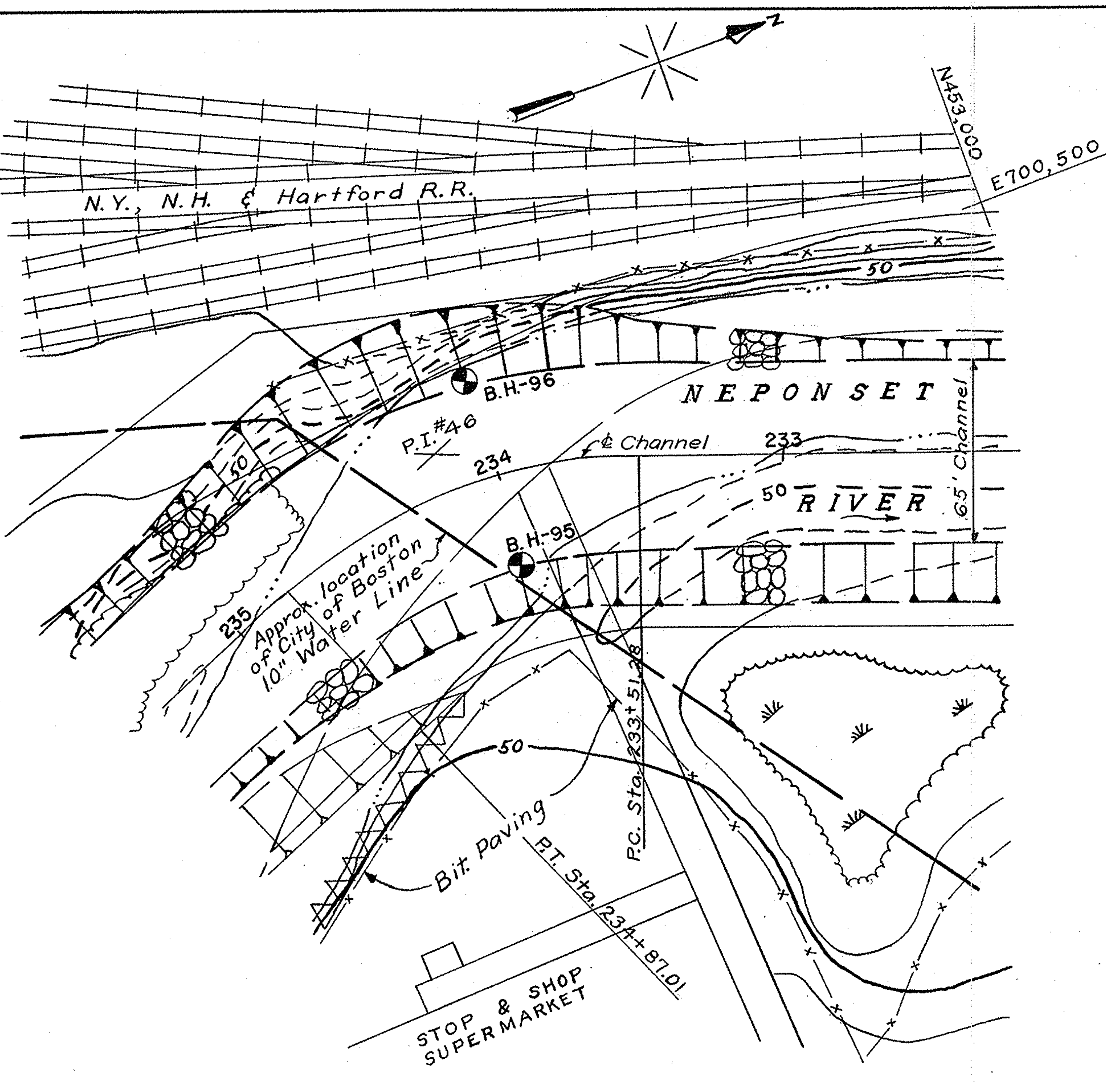
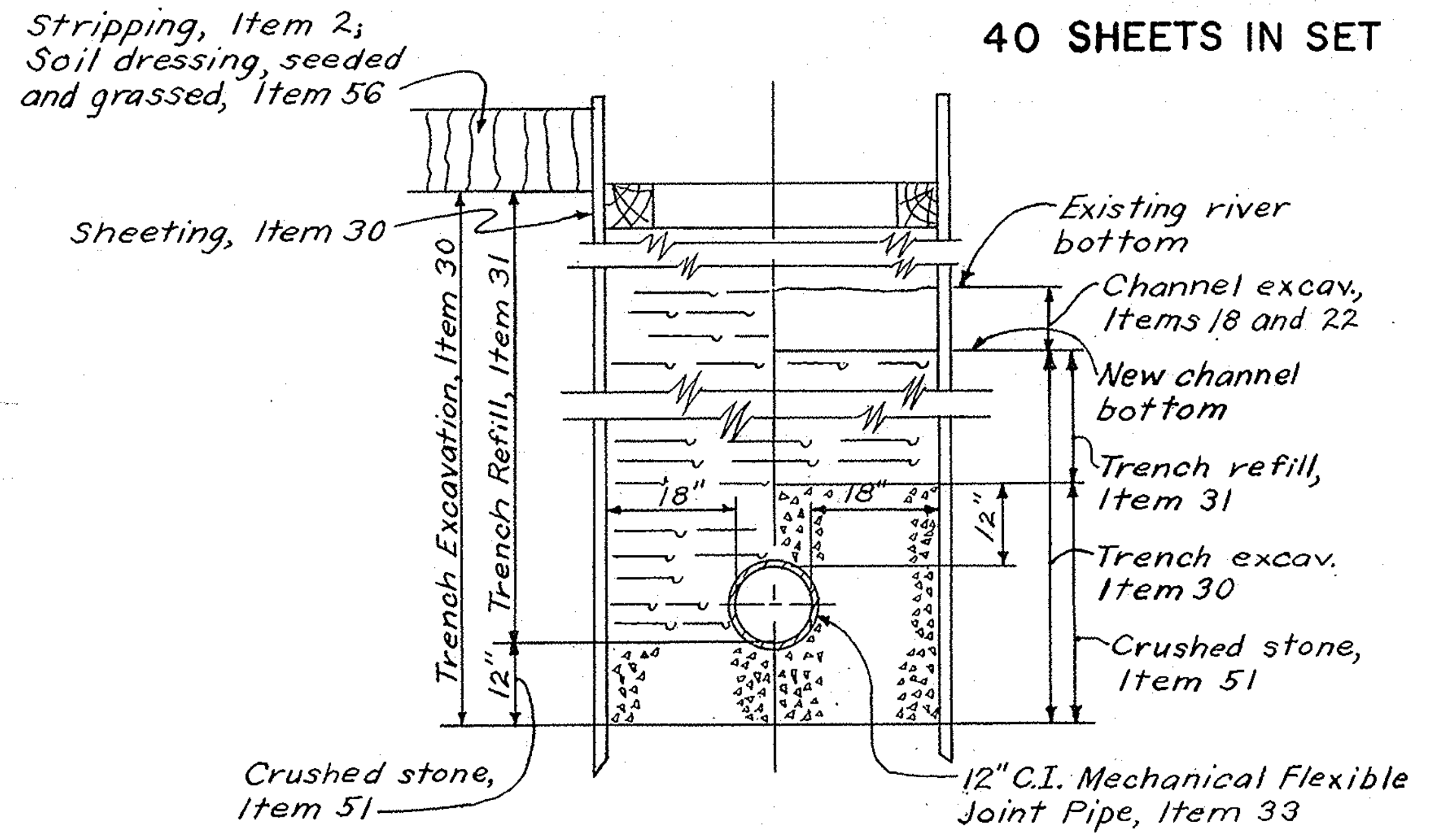


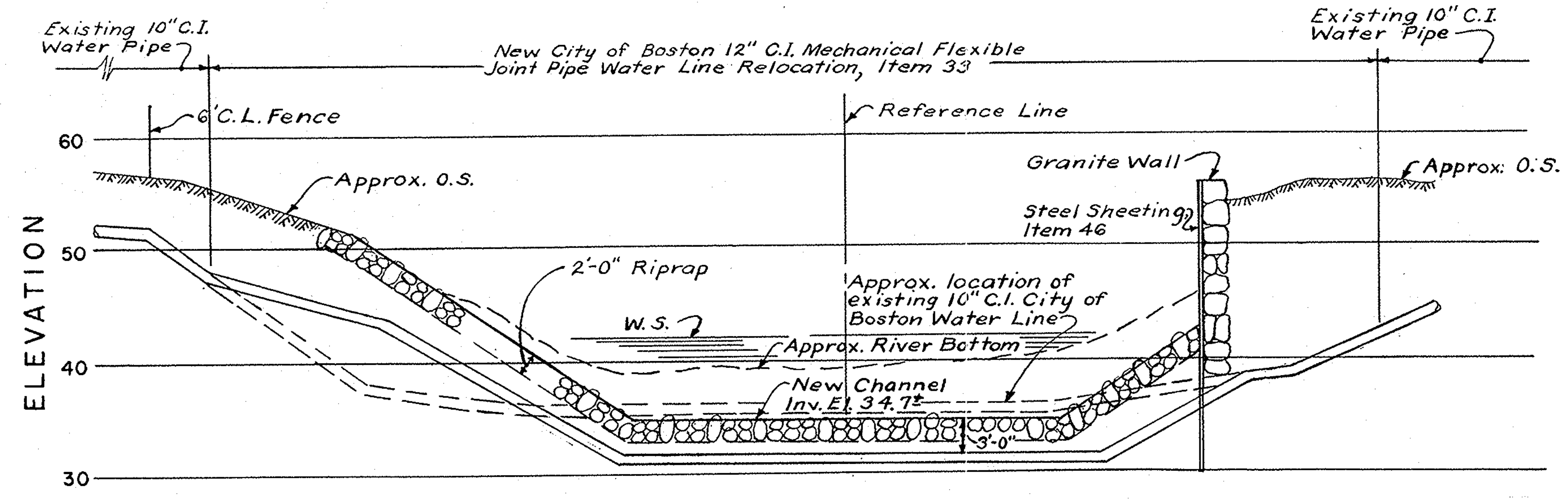
PLAN

40 20 0 40 80 FT.

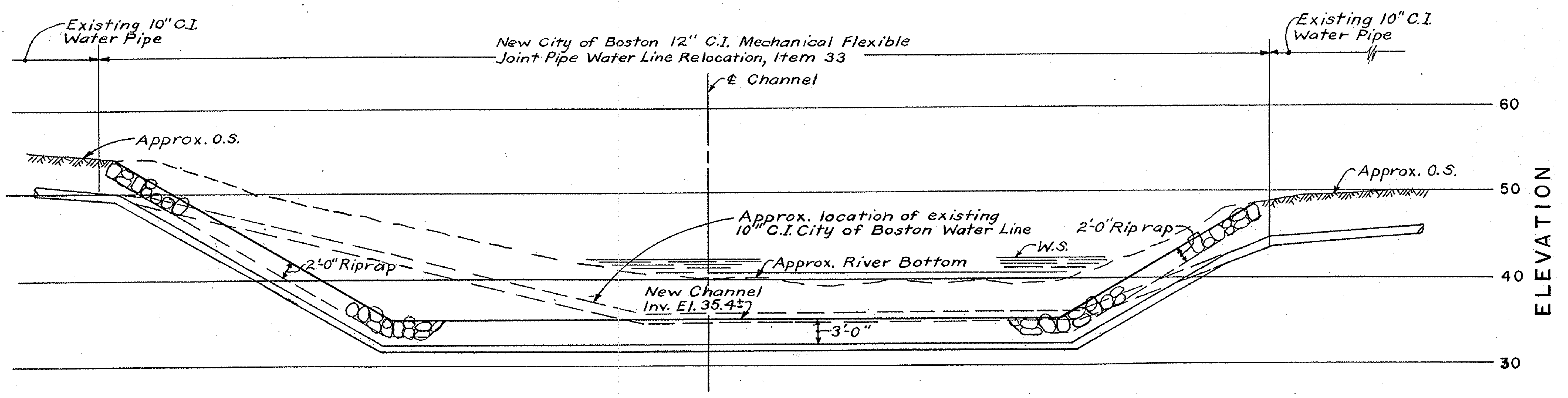


TYPICAL TRENCH & RIVER CROSSING SECTIONS

2 1 0 2 4 FT.



PROFILE
(Looking Upstream)



PROFILE
(Looking Downstream)

Note:
New 12" C.I. Pipe Line to be constructed to new grade in same location.

Notes:
Test pits will be required to determine the exact location, depth and type of joints at these crossings.
Details shown on this Contract Drawing indicate the crossings wanted and are subject to revision by Working Drawings to be issued from time to time.
Existing pipes within the channel limits to be removed under Item 33.

Notes:
Elevations, Boston City Base.
For additional details and notes, see Sheets 9 and 12.
For boring data and channel cross sections, see Sheets 21, 22 and 24.
For details of work to be done at the Glenwood Ave. footbridge, see Sheet 38.
For General Plan & Profile, see Sheet 2.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. COMMISSION - CONSTRUCTION DIVISION
NEPONSET RIVER FLOOD CONTROL
TILESTON AND HOLLINGSWORTH DAM
TO NEPONSET VALLEY PARKWAY
RELOCATION OF CITY OF BOSTON WATER LINES
10 5 0 10 20 FT.
EXCEPT AS SHOWN
JUNE 15, 1964

DRAWN A.U.
TRACED E.J.T.
CHECKED A.U.

Martin F. Cosgrove
Deputy Chief Engineer

Chief Engineer

FILE CONT. C-296 10.8U

ACC. 59,240

40

APPENDIX G

CONCEPTUAL POST-DREDGING CAP DESIGN AND MODELING RESULTS

AECOM
430 National Business Pkwy
STE 190
Annapolis Junction, MD 20701

Project name:
Phase 1 Reach – Lower Neponset River
Superfund Site

Project ref:
60703400

To:
Frederick R. Symmes, Weston Solutions, Inc.

From:
Mandar Bokare, Ph.D., AECOM

Date:
March 3, 2025

CC:
Kristine Carbonneau, AECOM
Mike Gardner, AECOM

Memo

Subject: Preliminary Post-Dredging Cap Design and Modeling Results for Lower Neponset River Site

Introduction and Design Objectives

AECOM performed contaminant 'breakthrough' modeling to evaluate the preliminary post-dredging cap design for the Lower Neponset River Superfund Site (Site). The purpose of this evaluation is to inform the Removal Action Alternatives outlined in the Engineering Evaluation/Cost Analysis (EE/CA) for the upper one-mile stretch (Phase 1 Reach) of the Site. The EE/CA will support a potential non-time critical removal action (NTCRA) of sediment contaminated with polychlorinated biphenyls (PCBs) within the Phase 1 Reach.

This memo provides a summary of the contaminant 'breakthrough' modeling conducted for the evaluation of cap design consisting of sand and activated carbon (AC) as the primary contaminant isolation and treatment cap layer for PCBs in underlying sediment. The design objective for this modeling evaluation was the RAA-4 cleanup level of 1 milligram per kilogram (mg/kg) total PCBs in sediments.

This memo presents a summary of the modeling method; the parameters used to establish acceptable performance; the input parameters to the model; the results of the modeling output; and discussion of implications on efficacy based on available data.

Model Description/Application Approach

The contaminant breakthrough modeling was conducted using CapSim 4.2 (Shen et al., 2023), which is a software for simulating one-dimensional transport (vertical) of contaminants through a sediment cap. The cap design evaluated in these simulations consisted of four layers, starting from nearest to the surface of the river as shown below. Additional details on the geotechnical and physico-chemical properties of the materials in these layers are provided in **Table 1** through **Table 4**.

- **A top layer of coarse sand**
  - A 9-inch-thick layer of coarse sand
  - Intended to be a habitat layer for colonization by benthic invertebrates
  - Assumed median stone size (D_{50}) of 0.75 millimeters (mm) and 3% organic carbon
- **A stone armor layer**
  - 1-foot (ft)-thickness

  - Designed for protection of the isolation layer against erosion
  - Consists of 4-inch D_{50} armor stone[1] (see **Attachment 1** for sizing calculation)
  - Assumed to have 0.01% organic carbon
- **A filtration layer**
  - 3-inch-thick layer of sand
  - Designed to reduce vertical dispersion of fine-medium sand and AC from chemical isolation layer
  - Assumed D_{50} of 0.6 mm and 0.1% organic carbon
- **A chemical isolation layer**
  - A 3-inch-thick layer of fine-grained sand
  - Designed to sequester PCBs and prevent recontamination of the top layer of sand.
  - Assumed D_{50} of 0.2 mm and 0.1% organic carbon for sand
  - Two separate scenarios modeled: one with 1% (by weight [wt]) and another with 2% (by wt)
  - Assumed D_{50} of 0.5 mm for AC

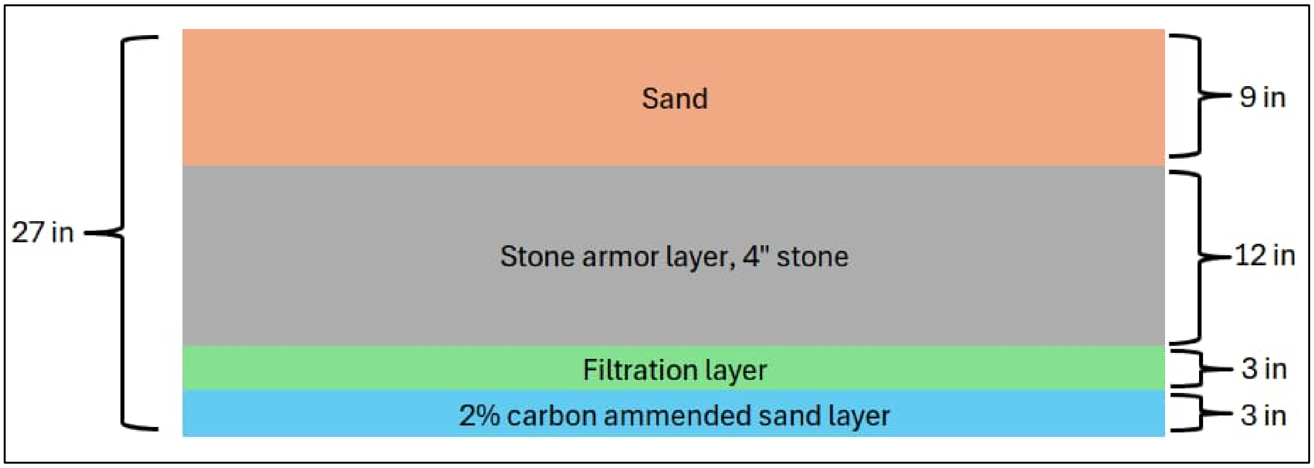


Figure 1: Conceptual Design for Contaminant Isolation Capping Evaluated for Lower Neponset River

Contaminant Modeled

For the purposes of this modeling evaluation, the PCB-52 congener was used as a surrogate for total PCBs. The octanol-water partitioning coefficient (log K_{OW}) for PCB congeners ranges from 4.46 for PCB-1 to 8.18 for PCB-209 (Hawker and Connell, 1988), with lower log K_{OW} values indicating higher solubility and mobility in water. PCB-52 has low log K_{OW} 5.84, indicating moderate solubility and mobility in the environment, and thus presents a conservative approach for contaminant breakthrough modeling.

---

[1] 4-inch D50 was calculated using the Isbash Formula and HEC-RAS modeled 500-year peak velocities (approximately 7 feet per second [fps]). Note that velocities > 7 fps (approximately 8 fps) were predicted in isolated area (e.g., beneath bridge abutments); these areas may require larger stone (> 4") for armoring. The details will be developed during the design phase.

Calculation of Site-Specific Organic Carbon to Water Partitioning Coefficient for PCBs

Co-located data for total PCBs in bulk sediments and in porewater, along with a corresponding organic carbon concentration, were used to derive Site-specific organic carbon to water partitioning coefficient (K_{OC}) for total PCBs, as per Equation (1).

$$K_{OC}\left(\frac{L}{kg}\right) = \frac{\text{PCB Concentration in Bulk Sediment}\left(\frac{\mu g}{kg}\right)}{\text{Dissolved PCB Concentration in Porewater}\left(\frac{\mu g}{kg}\right)\times\text{Fraction of Organic Carbon in Bulk Sediment}}$$

– Equation (1)

µg/kg – micrograms per kilogram
L/kg – liters per kilogram

Calculation of K_{OC} requires measurement of the truly dissolved concentration of PCBs in sediment porewater. However, the porewater PCB data currently available for the Site were measured as the sum of PCBs associated with suspended solids and colloids and PCBs in the truly dissolved phase, rather than just PCBs in the truly dissolved phase. As a result, the truly dissolved phase concentration of PCBs for this modeling effort was assumed to be 20% of the total PCB concentration measured in Site porewater. This assumption is based on the fact that PCBs have very low solubility in water and are primarily associated with suspended solids and colloids. An average log K_{OC} of 6.21 for the Site was derived based on the assumption of 20% of PCBs being in the truly dissolved phase. Additional details are provided in **Table 5**.

Increasing the % of PCBs in the truly dissolved phase results in a lower K_{OC} and imparts additional conservativeness to the model as it assumes a reduced strength of sorption of PCBs to organic carbon relative to what would be expected based on the low solubility of PCBs in water. Conversely, reducing the percent of PCBs in the truly dissolved phase increases the log K_{OC}, which reduces the conservativeness of the model by assuming a greater strength of sorption of PCBs to organic carbon than what would be expected. Thus, 20% was regarded to be a reasonable assumption that reflects the low solubility of PCBs and also imparts additional conservativeness to the model.

PCB Concentration in Underlying Sediments and Porewater

The maximum PCB concentration in sediments below the isolation layer was determined based on the assumption that the top 3 feet of the sediments would be dredged prior to cap placement. The maximum concentration at depths greater than 3 feet is 2,049,520 µg/kg and occurred at the 23A-0064-PLC1-CS (A46X7) sampling location **(Table 6)**. Based on the log K_{OC} of 6.21 derived in the previous section and an average organic carbon fraction of 0.0092 in sediments at greater than 3-ft depth, the porewater concentration in the bottom sediment layer was calculated to be 140 µg/L as per Equation (2) **(Table 6)**. This maximum concentration and the corresponding porewater concentration were used as the bottom boundary condition for the cap.

$$\text{Dissolved PCBs in porewater}\left(\frac{\mu g}{L}\right) = \frac{\text{PCB Concentration in Bulk Sediment}\left(\frac{\mu g}{kg}\right)}{K_{OC}\left(\frac{L}{kg}\right)\times\text{Fraction of Organic Carbon in Bulk Sediment}}$$

– Equation (2)

Physico-Chemical Properties for PCBs

The physico-chemical properties for PCBs, such as log K_{OC}, and the Freundlich adsorption parameters quantifying the adsorption of PCB-52 on AC are provided in **Table 7**.

Sediment Properties

Sediment processes parameters required as inputs for CapSim include: groundwater upwelling Darcy velocity, bioturbation depth, particle and porewater biodiffusion coefficients, and consolidation depth and time. Of these parameters, groundwater upwelling Darcy velocity is the parameter that governs contaminant breakthrough with respect to sediment properties. No direct or indirect measurements of the Darcy velocity for the Site have been performed to date. As a result, for all scenarios, a moderate Darcy velocity of 500 centimeters per year (cm/year) was used as the model input. The bioturbation depth of 7.2 cm based on Site-specific measurements was used (AECOM, 2023). Additional details on the sediment properties and processes can be found in **Table 8**.

Model Set Up

Simulations were performed for up to 100 years using all available Site-specific data. Two scenarios were evaluated wherein only the percent of AC in the chemical isolation was varied (1% and 2%), while all other model parameters and inputs were unchanged.

For each scenario modeled, the predicted concentration of PCBs in the top 7 cm of the habitat layer (representing the depth of the biologically active zone) at the end of 100 years was compared to the PRG of 1 mg/kg for total PCBs to evaluate effectiveness of the cap.

An additional evaluation was performed using a Darcy velocity of 1,000 cm/year for 1% AC concentration in the isolation for up to 500 years to predict potential time for breakthrough under very conservative conditions.

Summary of Model Results

For both scenarios involving 1% and 2% AC by weight of the isolation layer, the model predicted concentration of total PCBs in the habitat layer (averaged over a 7 cm depth corresponding to depth of the biologically active zone) at the end of 100 years was 0.3 mg/kg, which is lower than the 1 mg/kg PRG.

The additional evaluation performed using a Darcy velocity of 1,000 cm/year for 1% AC concentration in the chemical isolation layer for up to 500 years predicted that total PCB concentration in the habitat layer will not exceed the 1 mg/kg PRG for approximately 185 years.

References

- AECOM (2023). Site Reconnaissance Summary: Lower Neponset River Superfund Site. December 2023.
- Hawker, D.W. and Connell, D.W. (1988). Octanol-water partition coefficients of polychlorinated biphenyl congeners. Environ. Sci. Technol. 1988, 22, 4, 382–387.
- Shen, X., Lampert, D., Zhang, X., and Reible, D. (2023). Welcome to CapSim: Software for Simulating Contaminant Transport through a Sediment Capping Environment (CapSim 4.2). Available online at: https://www.depts.ttu.edu/ceweb/research/reiblesgroup/CapSim4.2.6_setup_64bit.exe

Table 1: Geotechnical and Physico-Chemical Properties of Habitat Layer for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Habitat Layer			
Material	N/A	N/A	Coarse Sand
Hydrodynamic Dispersivity	Variable	cm	10% of layer thickness (CapSim recommendation in absence of measured data)
Porosity	0.5	N/A	Assumed
Bulk density	1.5	g/cc	Assumed
Particle size	0.75	mm	Representative D50 for fine sands as per Valentine (2019).
Organic carbon fraction	0.03	N/A	Moderate amount of organic carbon assumed in habitat layer for supporting benthic invertebrates
Permeability Model	Kozeny & Carman	N/A	Built-in model in CapSim
Permeability	1.60E-05	cm^2	Calculated value by CapSim using Kozeny and Carman permeability model
Sorption Isotherm	Linear K_{OC}-f_{OC}	N/A	Linear K_{OC}-based partitioning for PCBs
Sorption Kinetics	Equilibrium	N/A	

References:

Valentine, P.C. (2019). Sediment Classification and the Characterization, Identification, and Mapping of Geologic Substrates for the Glaciated Gulf of Maine Seabed and Other Terrains, Providing a Physical Framework for Ecological Research and Seabed Management. U.S. Geological Survey Scientific Investigations Report 2019–5073, 37 p., https://doi.org/10.3133/sir20195073.

Table 2: Geotechnical and Physico-Chemical Properties of Armor / Erosion Protection Layer for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Armor / Erosion Protection Layer			
Material	N/A	N/A	Armor Stone
Hydrodynamic Dispersivity	Variable	cm	10% of layer thickness (CapSim recommendation in absence of measured data)
Porosity	0.8	N/A	Assumed
Bulk density	2.5	g/cc	Assumed
Particle size	102	mm	4" D50 was calculated using Isbash Formula and HEC-RAS modeled 500-year peak velocities (approximately 7 feet per second [fps]). Note that velocities > 7 fps (approximately 8 fps) were predicted in isolated area (e.g., beneath bridge abutments); these areas may require larger stone (> 4") for armoring. The details will be developed during the design phase.
Organic carbon fraction	1.00E-04	N/A	Negligible organic carbon in armor layer; Conservative Assumption
Permeability Model	Kozeny & Carman	N/A	Built-in model in CapSim
Permeability	7.40	cm^2	Calculated value by CapSim using Kozeny and Carman permeability model
Sorption Isotherm	Linear K_{OC}-f_{OC}	N/A	Linear K_{OC}-based partitioning for PCBs
Sorption Kinetics	Equilibrium	N/A	

Table 3: Geotechnical and Physico-Chemical Properties of Filtration Layer for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Filtration Layer			
Material	N/A	N/A	Sand
Hydrodynamic Dispersivity	Variable	cm	10% of layer thickness (CapSim recommendation in absence of measured data)
Porosity	0.5	N/A	Assumed
Bulk density	1.25	g/cc	Assumed, CapSim default value for sand
Particle size	0.6	mm	Assumed to be 3 times the D50 for sand in isolation layer
Organic carbon fraction	0.001	N/A	Conservative Assumption
Permeability Model	Kozeny & Carman	N/A	Built-in model in CapSim
Permeability	1.00E-05	cm^2	Calculated value by CapSim using Kozeny and Carman permeability model
Sorption Isotherm	Linear K_{OC}-f_{OC}	N/A	Linear K_{OC}-based partitioning for PCBs
Sorption Kinetics	Equilibrium	N/A	

Table 4: Geotechnical and Physico-Chemical Properties of AC-Amended Sand Cap for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Isolation Layer			
Material	N/A	N/A	98 - 99% fine grained sand and 1 - 2 % AC by weight
Hydrodynamic Dispersivity	Variable	cm	10% of layer thickness (CapSim recommendation in absence of measured data)
Sand for Isolation Layer			
Porosity	0.4	N/A	Assumed
Bulk density	1.25	g/cc	Assumed, CapSim default value for sand
Particle size	0.2	mm	Representative D50 for fine sands as per Valentine (2019).
Organic carbon fraction	0.001	N/A	Sand assumed to have low levels of organic carbon
Permeability Model	Kozeny & Carman	N/A	Built-in model in CapSim
Permeability	3.70E-07	cm^2	Calculated value by CapSim using Kozeny and Carman permeability model
Sorption Isotherm	Linear K_{OC}-f_{OC}	N/A	Linear K_{OC}-based partitioning for PCBs
Sorption Kinetics	Equilibrium	N/A	
AC			
Porosity	0.6	N/A	CapSim default values
Bulk Density	0.57	g/cc	Bulk density for coconut shell based AC from Gomez-Eyles et al. (2013)
Particle Size	0.5	mm	CapSim default values
Permeability	1.90E-07	cm^2	CapSim Calculated Value
Organic carbon	1	N/A	CapSim default values
Sorption Isotherm	Freundlich	N/A	Representative isotherm type for sorption of PCBs on to AC
Sorption Kinetics	Equilibrium	N/A	

References:

Gomez-Eyles, J.L., Yupanqui, C., Beckingham, B., et al. (2013). Evaluation of Biochars and Activated Carbons for In Situ Remediation of Sediments Impacted with Organics, Mercury, and Methylmercury. Environ. Sci. Technol. 2013, 47, 13721−13729. DOI: 10.1021/es403712q

Valentine, P.C. (2019). Sediment Classification and the Characterization, Identification, and Mapping of Geologic Substrates for the Glaciated Gulf of Maine Seabed and Other Terrains, Providing a Physical Framework for Ecological Research and Seabed Management. U.S. Geological Survey Scientific Investigations Report 2019–5073, 37 p., https://doi.org/10.3133/sir20195073.

Table 5: Derivation of Site-Specific K_{OC}

Starting Depth (ft.)	Ending Depth (ft.)	Total PCBs in Sediment (ng/g)	TOC in Sediment (mg/kg)	Total PCBs in Porewater (not-Filtered, pg/L)	% of Porewater PCBs in dissolved form (Assumed)	Total PCBs in porewater (ng/L, dissolved)	TOC (kg/kg)	Total PCBs in Bulk Sediments (ng/kg)	Sediment-Water Partitioning Coefficient, K_D (L/kg)	K_{OC} (L/kg)	log K_{OC} (L/kg)
0	0.5	2514	1.40E+04	9.67E+04	20%	19.34	0.014	2.51E+06	1.30E+05	9.29E+06	6.97
0	0.5	2.75E+05	4.50E+04	2.27E+06		4.54E+02	0.045	2.75E+08	6.05E+05	1.34E+07	7.13
0.5	3.2	2.19E+05	5.80E+04	1.90E+07		3.80E+03	0.058	2.19E+08	5.76E+04	9.93E+05	6.00
0	0.5	4.47E+04	9.60E+04	1.05E+06		2.10E+02	0.096	4.47E+07	2.13E+05	2.22E+06	6.35
0	0.5	4788	1.70E+05	3.58E+06		716	0.17	4.79E+06	6.69E+03	3.93E+04	4.59
Average log K_{OC} (L/kg)											**6.21**

Table 6: PCB Concentrations in Bulk Sediments and Porewater after Dredging of Sediments in the 0 - 3 ft. Interval

Sample Code	Sample Name	Sample Date	Start Depth (ft.)	End Depth (ft.)	Total PCBs (ng/g or µg/kg)	f_{OC}	log K_{OC} (L/kg)	Calculated Porewater Concentration (µg/L)
23A-0002-PLC2-CS	A4720	6/29/2023	3.1	6	<0.164	0.0092	6.21	N/A
23A-0002-PLC2-CT	A46Y4	6/29/2023	3.1	6	<0.154			N/A
23A-0008-PLC1-CS	A46Q5	6/27/2023	3	6.2	169			0.011
23A-0009-PLC1-CS	A46Q2/MA46Q2	6/27/2023	3	5.7	1439			0.097
23A-0018-PLC1-CS	A46G2	6/23/2023	4.4	5.5	1.23E+04			0.83
23A-0019-B2C2-CS	A46F4	6/23/2023	3.1	4.3	1341			0.091
23A-0029-PLC1-CS	A46Q8	6/27/2023	3.3	5.8	437			0.030
23A-0048-PLC1-CS	A46R1	6/27/2023	3.2	5	191			0.013
23A-0053-B1C1-CS	A46L6	6/25/2023	3.2	5.7	47			0.0032
23A-0062-PLC1-CS	A46W3	6/28/2023	3	4.7	9.34E+05			63
23A-0063-PLC1-CS	A46Y3	6/29/2023	3.7	4.9	1.18E+04			0.80
23A-0064-PLC1-CS	A46X7	6/29/2023	3.7	5.7	2.05E+06			140
23A-0064-PLC1-CT	A46X8	6/29/2023	3.7	5.7	1.45E+06			100
23A-0069-PLC1-CS	A4641	6/22/2023	3.4	6	12			0.00083

Table 7: Physico-Chemical Properties of PCBs Used for LNR CapSim Modeling Evaluation

Parameter	Value	Unit	Reference/Justification
Total PCBs (T_PCBs)			
Molecular Weight	292	g/mol	Molecular weight for PCB-52
Diffusivity in Water	5.37E-06	cm^2/s	CapSim 4.2 Database
Organic Carbon to Water Partition Coefficient (log K_{OC})	5.91	log (L/kg)	Calculated (Table 5)
DOC to Water Partition Coefficient (log K_{DOC})	5.54	log (L/kg)	CapSim 4.2 Database
Freundlich Isotherm Coefficient (log K_F) for Sorption of PCBs on Activated Carbon	7.410	$\mu g/kg/(\mu g/L)^N$	log K_F for PCB (52+43) for coconut shell based activated carbon from Gomez-Eyles et al. (2013).
Freundlich Isotherm Coefficient (log K_F) for Sorption of PCBs on Activated Carbon after Accounting for Co-Sorption of DOM and NOM.	6.206	$\mu g/kg/(\mu g/L)^N$	K_F in CapSim reduced by a factor of 16 to account for co-sorption of DOM and NOM as per Werner et al (2006).
Freundlich Isotherm Coefficient (1/n) for Sorption of PCBs on Activated Carbon	0.61	Unitless	(1/n) for PCB (52+43) for coconut shell based activated carbon from Gomez-Eyles et al. (2013).

References:

Gomez-Eyles, J.L., Yupanqui, C., Beckingham, B., et al. (2013). Evaluation of Biochars and Activated Carbons for In Situ Remediation of Sediments Impacted with Organics, Mercury, and Methylmercury. Environ. Sci. Technol. 2013, 47, 13721−13729. DOI: 10.1021/es403712q

Werner, D.; Ghosh, U.; Luthy, R. G. Modeling Polychlorinated Biphenyl Mass Transfer after Amendment of Contaminated Sediment with Activated Carbon. Environ. Sci. Technol. 2006, 40 (13), 4211−4218.

Table 8: Sediment Properties and Processes for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Sediment Processes			
• Upwelling flow type: Steady Flow			
• Modeling Hyporheic Exchange: None			
• Modeling Erosion: None			
• Modeling Bioturbation: Uniform			
• Particle Size Impact: No			
• Modeling Ionic Activity: No			
Darcy Velocity	500	cm/year	Assumed. In the absence of measured data, a mid-range Darcy velocity assumed for the site.
Bioturbation Depth	7.2	cm	Average bioturbation depth of 7.2 cm based on AECOM (2023)
Particle biodiffusion coefficient	1	cm^2/year	CapSim recommended value
Pore water biodiffusion coefficient	100	cm^2/year	CapSim recommended value
Modeling Consolidation	Yes	N/A	Conservative assumption
Maximum Consolidation Depth	19	cm	50% consolidation based on total thickness of habitat, filtration, and chemical isolation layers
Time to 90% consolidation	1	year	Assumed, based on professional judgement
Benthic Boundary Conditions			
• Benthic Boundary Type: Mass Transfer			
• Benthic Mass Transfer Model: Lake Model			
Initial Water Depth	2	m	Based on maximum depth of 6 ft. as per Phase 1 data (AECOM, 2023)
Horizontal Water Velocity	1.70	m/s	95% CI of surface water velocity (upstream of dam, based on 1D HEC RAS channel velocity statistics)
Density of air	1.0	g/L	CapSim default value
Wind Speed	5.0	m/s	CapSim default value
Lake fetch	61	m	Maximum width of the river, estimated from bathymetric figures in AECOM (2023)
Dissolved Organic Matter	5.0	mg/L	Assumed to be equal to average DOC concentration measured in porewater.
Surface Water Concentration			
Total PCBs	8.43E-03	µg/L	Average total PCB concentration measured in surface water.
Bottom Boundary Conditions			
• Bottom boundary type: Fixed concentration			
Bottom Concentration	140	µg/L	Maximum calculated porewater concentration in sediments > 3 ft. depths. See Table 6 for calculations.
Initial Conditions			
Initial Concentration Profile in Cap	Uniform	N/A	CapSim default

Table 8: Sediment Properties and Processes for LNR CapSim Modeling Evaluation

Property	Value/Type	Unit	Reference/Justification
Input Option	Equilibrium	N/A	Initial condition at time T = 0 when cap is placed.
Initial Porewater Concentration in Cap	0	µg/L	Initial concentration in porewater at time T = 0 assumed to be equal to zero as cap material has no COCs.
Initial Concentration in Bulk Phase (sand, soil, AC, or sediment)	0	µg/kg	Clean capping/treatment materials assumed to have no PCBs at time T = 0.
Initial concentration profile in native sediment layer	Uniform	N/A	CapSim default
Input option	Equilibrium	N/A	CapSim default
Input Phase	Porewater	N/A	CapSim default
Initial Porewater Concentration	Variable	ng/L	Calculated porewater concentration in 0 - 0.33 ft. depth interval based on maximum bulk sediment concentration data available

References:

AECOM (2023). Site Reconnaissance Summary: Lower Neponset River Superfund Site. December 2023.

Attachment 1

Isbash Formula for nonmovement Conditions

Isbash Formula

T&H Dam Removed, 500-year peak flow velocities*

Velocity (fps)	Velocity Ranking	D50 (ft)	D50 (in)
8.27	Max	0.44	5.33
5.60	95% CI	0.20	2.44
5.27	Mean	0.18	2.16
3.75	Min	0.09	1.10

T&H Dam in Place, 500-year peak flow velocities*

Velocity (fps)	Velocity Ranking	D50 (ft)	D50 (in)
8.16	Max	0.43	5.18
5.55	95% CI	0.20	2.40
5.23	Mean	0.18	2.13
3.74	Min	0.09	1.09

Cap Erosion Protection Layer Design**

Velocity (fps)	Velocity Ranking	D50 (ft)	D50 (in)
7.00	Design Velocity	0.30	4.00

$$D_{50} = \frac{CV^2}{2g\frac{\Upsilon_s - \Upsilon_w}{\Upsilon_w}}$$

Where:

D_{50} = median stone diameter (ft)

V = surface water velocity (ft/s)

g = acceleration due to gravity (ft/s^2)

C = Isbash constant

Υ_w = unit weight of water (62.4 lb/ft^3)

Υ_s = unit weight of solids (165 lb/ft^3)

Notes:

*Lower Neponset River HEC-RAS model steady state channel velocities (See Hydraulics and Sediment Stability Analysis Memorandum).

**Erosion protection layer designed to withstand 500-year peak flow velocities.