

FOCUSED FEASIBILITY STUDY FOR PASSAIC RIVER SEDIMENTS: IDENTIFYING OPPORTUNITIES FOR EARLY ACTION

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ABSTRACT

The Lower Passaic River Restoration Project is an interagency effort to remediate and restore the complex ecosystem of the Lower Passaic River, which includes the 17-mile (28 kilometer) tidally influenced portion of the river from the Dundee Dam to the river's confluence with the Hackensack River and Newark Bay. For the first time, on a project of this magnitude, a joint Water Resources Development Act (WRDA) – Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) approach is being taken to address the restoration (including remediation) of one of the most degraded waterways in the United States. In a partnership among the United States Environmental Protection Agency (USEPA), United States Army Corps of Engineers (USACE), New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), United States Fish and Wildlife Service (USFWS), and New Jersey Department of Environmental Protection (NJDEP), an integrated comprehensive restoration study (Study) is in progress to develop a comprehensive remediation/restoration plan for this highly degraded urban waterway and the surrounding 118 square mile (305 square kilometer) watershed.

The substances and contaminants found in the sediments of the Study Area include dioxins, pesticides such as dichlorodiphenyl trichloroethane (DDT), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals such as cadmium, copper, lead, mercury, nickel, and zinc. The Focused Feasibility Study (FFS) seeks to determine the feasibility of taking early action to address threats to human health and the environment while the overall Study proceeds.

Early action goals have been developed, which include: (1) mass remediation, (2) address sources (erosion), and (3) consistency with overall project goals. To achieve these goals, analyses are being conducted to identify target areas for remediation, and to characterize current risks associated with these target areas.

Technologies are being screened and alternatives assembled based on combinations of dredging and capping. These alternatives are being evaluated against criteria consistent with USEPA guidance, which may require many engineering feasibility analyses to be conducted, including but not limited to:

- Dredged material management analysis
- Development of approaches for management of dredging resuspension and residuals
- Hydrodynamic modeling to estimate potential for flooding impacts
- Cap erosion modeling to guide design of cap armor layer
- Risk characterization
- Cost estimation

The completion of these analyses at such an early stage in the project will result in many benefits to the overall Study process, including the differentiation of data gaps, highlighting of areas for coordination, and confirmation of

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project goals. The focus of this presentation will be to describe the FFS process and identify benefits to the overall project from this early evaluation of remedial alternatives.

Keywords: Remediation, restoration, dredging, dredged material management, capping, DDT, PCB, dioxin, mercury

INTRODUCTION

The Lower Passaic River Restoration Project (herein referred to as the Study) is an interagency effort to remediate and restore the complex ecosystem of the Lower Passaic River, which is the 17-mile (28 kilometer) tidally-influenced portion of the river located in northern New Jersey. The Study Area [118 square miles (305 square kilometers)] is defined as the Lower Passaic River and its basin, which comprises the tidally influenced portion of the river from the Dundee Dam to Newark Bay, and the watershed of this river portion, including the Saddle River, Second River, and Third River (Figure 1). The Study is being conducted as a pilot project under the Urban Rivers Restoration Initiative.

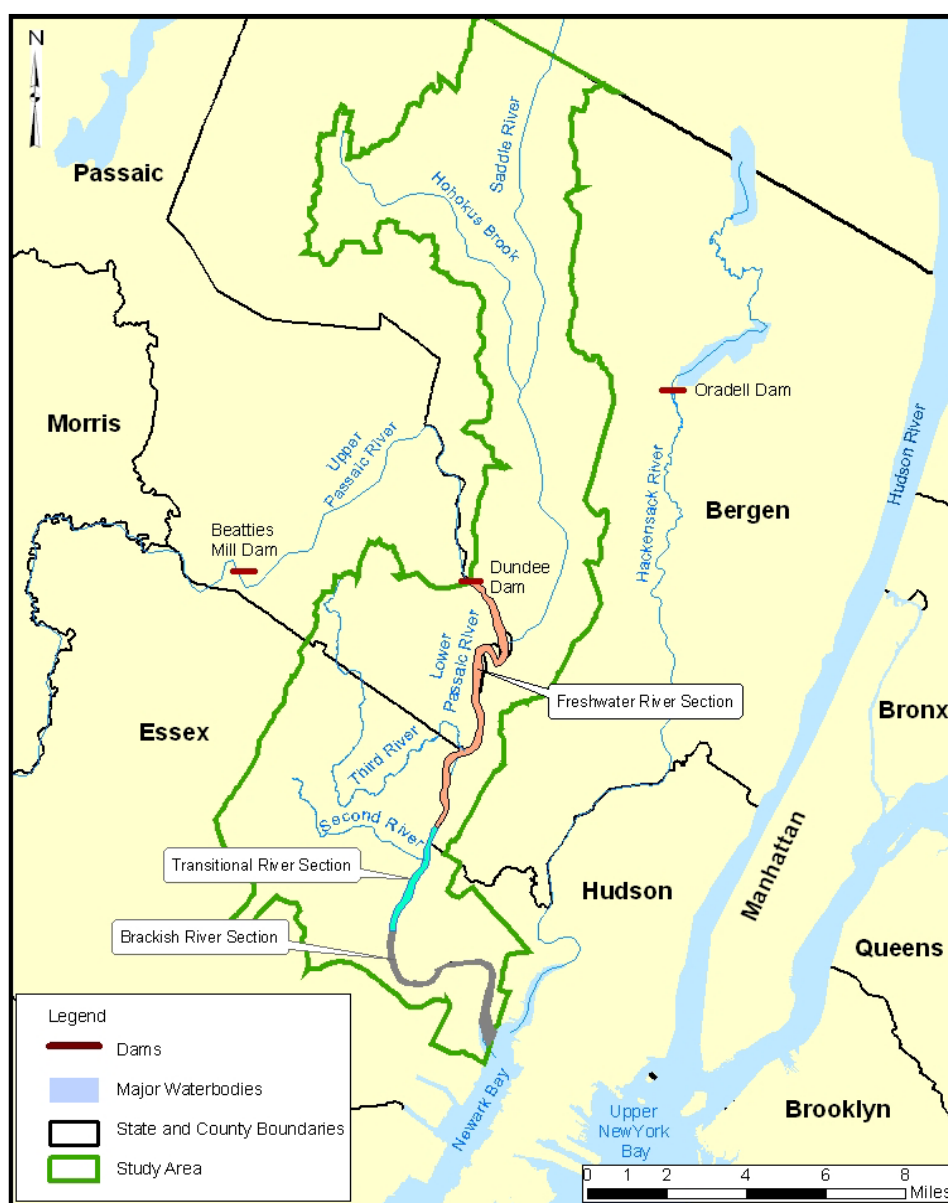


Figure 1. Study area of lower Passaic River restoration project.

The United States Environmental Protection Agency (USEPA), United States Army Corps of Engineers (USACE), and New Jersey Department of Transportation (NJDOT) have partnered with the National Oceanic and Atmospheric Administration (NOAA), United States Fish and Wildlife Service (USFWS), and New Jersey Department of Environmental Protection (NJDEP) to bring together the authorities of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Water Resources Development Act (WRDA) to produce a comprehensive restoration Study of the Lower Passaic River and its tributaries.

The Study is focused on comprehensive watershed ecosystem restoration of the tidally influenced section of the Lower Passaic River from the Dundee Dam to the river mouth in Newark Bay. The lower six miles (actually River Miles 1 – 7) of the river have been investigated previously as an operable unit of the Diamond Alkali Superfund site and contaminants found in the sediments in this stretch include dioxins, pesticides such as DDT, PCBs, PAHs, and metals such as cadmium, copper, lead, mercury, nickel, and zinc.

The purpose of the Study is to recommend a comprehensive watershed-based plan for the restoration and remediation of the Lower Passaic River. This will include the identification of restoration opportunities in the Study Area, such as habitat, water quality, and sediment quality improvements, which support broader estuary-wide restoration efforts. Remediation efforts and ecosystem restoration measures will be analyzed together to ensure that the overall solution(s) to the complex problems posed by the contamination in the area are compatible and effectuate the best mix of cost-effectiveness, permanence, and protectiveness. Remediation efforts may include sediment removal, placement of caps, sediment decontamination in-situ or ex-situ, and shoreline stabilization. Complimentary restoration goals may include benthic habitat restoration, tidal wetland restoration, vegetative buffer creation, shoreline stabilization, and aquatic habitat improvement. The Study is an integrated, joint effort among the partner agencies to examine the ecosystem problems within the watershed and to identify remediation and restoration options to address these problems.

The Focused Feasibility Study (FFS) is being conducted concurrently and as a task under the overall Study. The FFS seeks to determine whether action(s) can be taken in the near term to effectively address contaminated sediment in the Lower Passaic River and reduce risks to human health and the environment.

FOCUSED FEASIBILITY STUDY: APPROACH AND SCOPE

Evaluation of potential interim/early actions is recommended in USEPA guidance (USEPA 2005). The FFS is being developed utilizing the principles of adaptive management and is incorporating stakeholder input at frequent intervals to generate consensus and optimize agency resources through a collaborative process. Workgroup meetings are being held with the public and the agencies, and include interim presentations of FFS activities and discussions of review comments on preliminary documents. The Workgroups are providing an important forum for the exchange of technical and administrative ideas, education of the stakeholder group, and consensus building. This collaborative approach will lead to a strengthened technical product and a reduced project schedule. The engineering evaluations being conducted as part of the FFS are helping to improve the understanding of the River, prioritize certain data gaps, and highlight areas of necessary interagency coordination.

The FFS is utilizing and evaluating the substantial data set that was collected from River Miles 1 – 7 during the earlier Superfund studies. The FFS is also incorporating the recent data collected under the overall Study, including high and low resolution coring data, water column data, and geophysical surveys. Based on the conceptual site model, the most extensive deposits of fine-grained contaminated sediments exist in the lower 7 to 8 miles of the river and the early action evaluations are being focused in this area. Furthermore, evaluations are focused on actions that may be designed and implemented in the near term.

Early action goals have been developed, which include: (1) to remediate contaminant mass, (2) to prioritize areas of concern that may be unstable, eroding, or acting as source areas, and (3) to ensure consistency with any final remedy selected for remediation of the entire Lower Passaic River. Inherent in these goals is a preference for a response that will reduce risks to human and ecological receptors in and around the Lower Passaic River watershed.

FOCUSED FEASIBILITY STUDY: MAJOR ELEMENTS

Conceptual Site Model and Risk Evaluation

The Conceptual Site Model (CSM) summarizes what has been learned to this point about environmental processes and the nature and extent of contamination in the Study Area, as well as the fate and transport of suspended solids and contaminants in the Lower Passaic River and Newark Bay. An important conclusion of the CSM is that historical contaminated sediment deposits, which were created when the channel was deeper, are no longer stable and are now undergoing erosion. A particular area of concern is the area near RM 3.5 where the river turns sharply and erosional areas are observed on the outsides of the bends. The reworking of the historical sediments is an ongoing source of contamination to other areas of the Lower Passaic.

Preliminary human health and ecological risk evaluations will be performed to evaluate whether current conditions within the Lower Passaic River pose significant risks to human and ecological receptors. The cancer risks derived in the human health risk evaluation will be compared to a risk range of 10^{-4} (one in ten thousand) to 10^{-6} (one in a million) and non-cancer threshold of 1. For the ecological risk evaluation, chemical-specific and receptor-specific toxicity reference values (TRVs) will be compared to the ingestion dose estimates, which will result in hazard quotient (HQ) estimates. In general, an HQ above 1 indicates the potential for risk; an HQ below 1 indicates a low potential for risk.

Determination of Potential Remedial Targets

Analyses being utilized to identify areas of the river for potential remediation include:

- **Surface Concentration Analysis:** Considers contaminant concentrations in the surficial sediment that are in contact with the overlying water column, fish, and benthic invertebrates. Therefore, surface concentrations represent the near-term exposure conditions to the biota, as well as the properties of the sediments in continuous contact with the water column.
- **Erosional Analysis:** Identifies areas that are primarily depositional and those that are primarily erosional based on a comparison of historical bathymetric surveys. Areas that are primarily erosional have a higher probability for sediment transport and mixing with other surface sediments within the range of the salt front, both up- and down-river, and a higher probability to resuspend contaminated sediment and transport it downstream.
- **Inventory Analysis:** Provides an approximate measure of the mass of various contaminants, which can be used to assess the potential for long-term release and contamination of the immediate area as well as mixing with other surface sediments both up- and down-river. The contaminant inventories are not evenly distributed and vary along the length of the Lower Passaic River, with maximum values occurring near the areas encompassing RM1 to RM2, RM3 to RM4, and RM6 to RM7. However, the coring data that form the basis for these inventories indicate a high degree of local spatial heterogeneity, suggesting that localized areas of relatively higher concentrations typically described as “hot spots” do not exist. Instead, “hot” regions of the river typically exist on the scale of a mile or more, nearly bank to bank in lateral extent. Despite the observations of local spatial heterogeneity, the inventories of four contaminants (mercury, 2,3,7,8-TCDD, Total PCB, and Total DDT) examined in detail were shown to correlate, indicating that their inventories coincide in space and are consistent with the anticipated geochemical behavior of the compounds

Remedial Technologies Screening

The study will include a review of technologies and process options that may be utilized for identified general response actions. The technology selection and screening processes are being conducted in accordance with the USEPA RI/FS Guidance for CERCLA sites (USEPA, 1988). Various databases, technical reports, and publications are being consulted to identify applicable technologies. Next, technology classes that encompass the means for achieving general response actions are being selected. The selected technology classes are being expanded into lists of potentially applicable process options. Technologies utilized for the general response actions of removal, containment, in situ treatment, monitored natural recovery, and ex situ treatment are being evaluated on the basis of implementability, effectiveness, and cost. The evaluations may use data collected during site-specific pilot studies.

Remedial Action Alternatives Analysis

Based on the effectiveness, implementability, and cost screening of remedial technologies, several remedial options are being retained for further evaluation. Combinations of these process options are being assembled into conceptual alternatives for remediation of the area of focus. These alternatives involve capping and dredging and various combinations of the two; a No Action alternative is being evaluated as well. Future use of the river is being considered in the development and evaluation of alternatives, including navigational needs, as well as requirements for potential ecological restoration options.

A description and conceptual layout of each alternative is being prepared and analyses are being conducted for features unique to each alternative that will support an evaluation against the NCP criteria during the Proposed Plan phase. Also being included is a comparative analysis of the remedial alternatives. Components of the detailed analysis include the following:

- Calculation of removal volumes for each of the alternatives;
- Analysis of potential dredged material management streams utilizing a comparison of analytical data to thresholds;
- Modeling of cap erosion using a hydrodynamic model and cap armor layout;
- Estimation of flooding impacts based on water surface elevation results from the hydrodynamic model; and
- Development of cost estimates incorporating contractor input and the effect of economies of scale.

CONCLUSION

The Focused Feasibility Study, which is being conducted concurrently with, and as part of, a comprehensive restoration Study, seeks to determine whether action(s) can be taken in the near term to effectively address contaminated sediment in the Lower Passaic River and reduce risks to human health and the environment. The FFS, which is being developed utilizing the principles of adaptive management, is incorporating stakeholder input at frequent intervals to generate consensus and optimize agency resources through a collaborative process. Workgroup meetings are creating opportunities for stakeholder education and improving technical and administrative products. The engineering evaluations conducted as part of the Focused Feasibility Study have helped improve the understanding of the River, prioritize certain data gaps, and highlight areas of necessary interagency coordination. All of these outcomes benefit the overall Study.

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