

Lower Passaic River Restoration Project



DRAFT FINAL RESTORATION OPPORTUNITIES REPORT

In partnership with

July 2006



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***** NOTICE TO READERS*****

This report is being provided by the cooperating agencies so as not to delay the public availability of the document text, tables and figures. This document is however being released without Appendix A and Figure 3-3. Appendix A and Figure 3-3 are currently undergoing revision and will be incorporated into this document in the near future.

RESTORATION OPPORTUNITIES REPORT

LOWER PASSAIC RIVER RESTORATION PROJECT

Prepared by:

Earth Tech, Inc. in conjunction
with Malcolm Pirnie, Inc.

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1.0 EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), and New Jersey Department of Transportation – Office of Maritime Resources (NJDOT-OMR) have partnered together and joined state and federal Trustees to conduct a comprehensive restoration study of the Lower Passaic River and its tributaries. The Lower Passaic River Restoration Project 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 restoration goals for the Lower Passaic River are to create, enhance, and restore habitat; enhance plant and animal communities; improve water quality and sediment quality; and support human use.

The *Restoration Opportunities Report* (this document) presents potential restoration opportunities that have been identified to date. It was developed to facilitate the coordination of restoration-related actions among the involved regional stakeholders and the public. The restoration goals and activities discussed in this report will ultimately be incorporated into the Lower Passaic River Comprehensive Restoration Plan (P-CRP).

Potential restoration sites were initially identified through an open nomination process and a computer-based screening process. Sites were then grouped into eight restoration areas based on their geographical location and habitat similarities. These restoration areas include: the Freshwater River Section, Transitional River Section, and Brackish River Section of the Lower Passaic River as well as Second River, Third River, Saddle River, Kearny Point, and Oak Island Yards. Additional areas can be nominated by the public and other stakeholders during the National Environmental Policy Act (NEPA) scoping meetings and throughout the study. The natural resource trustees will be seeking other restoration opportunities within or outside the Lower Passaic River watershed to restore services to areas that were lost as a result of site-related contamination.

2.0 INTRODUCTION

2.1 STUDY BACKGROUND

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 a 17-mile tidally influenced river located in northern New Jersey. The Study Area (118 square miles) is defined as the Lower Passaic River and its basin, which comprises the tidally influenced portion of the river from the Dundee Dam [River Mile (RM) 17.4] to Newark Bay, and the associated watershed of this stretch of river, including the Saddle River, Second River, and Third River (Figure 2-1). The Study Area does not include the watershed upriver of the dam or the relatively small portion of the watershed that is located in New York.

The partner agencies, which include USEPA, USACE, and NJDOT-OMR, are bringing together the authorities of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Water Resources Development Act (WRDA) to produce a comprehensive watershed plan to improve water quality, address contaminated sediments, and restore and create habitat along the river. The partner agencies are also working with the federal and state Trustee agencies, including the National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Services (USFWS), and New Jersey Department of Environmental Protection (NJDEP), so that natural resource damages are addressed in this comprehensive plan.

The scope of the Study is to gather data needed to make decisions on:

- The development of a comprehensive, watershed-based plan to restore the functional and structural integrity of the Lower Passaic River ecosystem and to support broader, watershed-wide restoration efforts under WRDA.
- The characterization of contaminant sources and evaluation nature and extent of contamination.

- The evaluation of hydrodynamics, sediment transport and stability, and biotic processes to assess the fate and transport of contaminants in sediments, water, and biota.
- The evaluation of exposure pathways and receptors for the human health risk assessment and the ecological risk assessment.
- The characterization of the existing conditions of the ecosystem and ecological communities to evaluate restoration sites based on the ecological functional assessment metrics and assess injury to natural resources.
- The sharing of pertinent data collected in support of restoration actions that may be conducted by the Natural Resource Damage Assessment (NRDA) authorities.

2.2 PURPOSE OF THE RESTORATION OPPORTUNITIES REPORT

The purpose of the *Restoration Opportunities Report* is to outline restoration goals for the Study, including: creating, enhancing, and restoring habitat; enhancing plant and animal communities; improving water quality and sediment quality; and supporting human use. The report also presents the initial restoration areas that have been identified to date. (The *Restoration Opportunities Report* does not list specific restoration activities planned for these areas nor does it contain restoration designs.) The *Restoration Opportunities Report* was developed to facilitate the coordination of restoration-related actions among the involved regional stakeholders and the public. The restoration goals and actions discussed in this report will ultimately be incorporated into the P-CRP, which will integrate existing conditions, restoration opportunities, and the ecological functional assessment metrics (refer to Malcolm Pirnie, Inc., 2006a for discussion and table of metrics). The P-CRP will also develop restoration alternatives and provide an implementation plan for future restoration.

Potential restoration areas were initially identified through an open nomination process and a computer-based screening process (refer to Section 3.3 “Restoration Site Identification”). These restoration areas include: the Freshwater River Section, Transitional River Section, and Brackish River Section of the Lower Passaic River as

well as Second River, Third River, Saddle River, Kearny Point, and Oak Island Yards (refer to Section 4.0 “Potential Restoration Areas” for site-specific information on these areas). These restoration areas do not represent all the potential restoration opportunities within the Study Area; additional areas can be nominated by the public and other stakeholders following NEPA scoping meetings and throughout the Study.

2.3 AUTHORIZATION

While the overall Study is being conducted under both CERCLA and WRDA authorities, the *Restoration Opportunities Report* was authorized under the WRDA component of the Study. It is being carried out under the USACE General Investigations Program and was authorized in April 1999 by the U.S. House of Representatives, Committee on Transportation and Infrastructure as part of the Hudson-Raritan Study under WRDA Section 312 “Environmental Dredging” (USACE *et al.*, 2003). NJDOT-OMR is the non-federal sponsor for the WRDA component of the Study.

The Lower Passaic River is one of eight urban waterways that have been designated as pilot projects to demonstrate the planning and implementation of urban river cleanups and restoration as part of the Urban River Restoration Initiative (URRI). This URRI program is a national initiative to foster cooperation between USEPA and the USACE and is memorialized in a Memorandum of Understanding between these two agencies, which was signed in 2002 and renewed in 2005.

2.4 ORGANIZATION OF THE DOCUMENT

This document is divided into the following sections to articulate the discussion of restoration goals and identification of restoration opportunities.

Section 1.0, EXECUTIVE SUMMARY: summarizes the document.

Section 2.0, INTRODUCTION: outlines the purpose and scope of the document.

Section 3.0, PLANNING AND CONCEPTS: provides a discussion on restoration goals, restoration concepts, and the identification of restoration opportunities.

Section 4.0, POTENTIAL RESTORATION AREAS: provides an overview of the potential restoration areas, including in-river sites, large contiguous properties, tributary sites, and other sites within the watershed.

Section 5.0, ACRONYMS: lists acronyms used in this document and corresponding definitions.

Section 6.0, REFERENCES: lists references used in this document.

3.0 PLANNING AND CONCEPTS

3.1 DEVELOPMENT OF RESTORATION GOALS AND OPPORTUNITIES

3.1.1 RESTORATION GOALS

During previously held project workgroup meetings, participants established six restoration goals. These goals are presented in Table 3-1 and include:

- Create, enhance, and restore habitat.
- Enhance plant communities.
- Enhance animal communities.
- Improve water quality.
- Improve sediment quality.
- Support human use.

These restoration goals capture the overarching goals of the Study that will ultimately guide future restoration plans and will be incorporated in the P-CRP. A broad overview of these restoration goals are provided below.

Create, Enhance, and Restore Habitat. For the purposes of the Study, habitats will be delineated into the following categories: “subtidal” defined as habitats located below mean low water; “intertidal” defined as habitats located between mean low water and mean high water (including wetland and mudflat areas); “riparian” defined as habitats located above mean high water to the top of the river bank; and “upland” defined as the adjacent terrestrial habitats located on and above the river bank (Figure 3-1). This figure presents a generalized description of the sub-classification and typical habitat found within the Study Area. Together, the enhancement of plant and animal communities will assist in restoring subtidal habitat (including benthic and fish habitats), intertidal habitats (including wetland and mudflat habitats), riparian habitats, and upland habitat.

Enhance Plant Communities. The vegetative habitat surrounding the shorelines of the Lower Passaic River is impacted by chemical contamination as well as non-chemical

factors, including bulkhead and riprap armor installation. Much of the plant species that line the river banks and adjacent habitats are characterized as “opportunistic urban vegetation.” Many of these species [e.g., Japanese knotweed (*Polygonum cuspidatum*), mugwort (*Artemisia vulgaris*), and Phragmites] are invasive and provide little ecological value. Through creation, restoration, and enhancement activities, native habitats and species (e.g., oak-hickory-beech forest, native grasslands, and *Spartina* marsh) can be returned to the Lower Passaic River watershed. Moreover, the creation of native habitats within the river basin would benefit the regional ecosystem by providing a nursery ground for fauna, thus increasing the diversity and ecological value of the area.

Enhance Animal Communities. Animal communities in the Study Area are often limited by the degradation of their habitat and an absence of their preferred habitat. Through the enhancement and restoration of native habitats, species diversity and abundance would be improved. Restoration activities are expected to enhance the macrobenthic communities [e.g., blue crab (*Callinectes sapidus*)], fish community [e.g., blueback herring (*Alosa aestivalis*), American eel (*Anguilla rostrata*), and alewife (*Alosa pseudoharengus*)], herpetofauna community [e.g., diamondback terrapin (*Malaclemys terrapin*)], avian community (e.g., wading birds, waterbirds, shorebirds, and passerines), and mammal community including muskrat. Other restoration activities include establishing a fish passage and a fish ladder near Dundee Dam.

Improve Water Quality. Water quality in the Lower Passaic River is impacted by several point and non-point sources, including: leachate from contaminated sediments, stormwater runoff and storm sewer overflow, discharge from combined sewer overflow sites, permitted municipal and industrial discharge, non-point source runoff, and debris. Many of these sources are untreated and drain through mostly urban areas. The water quality throughout the Lower Passaic River could be improved by treating runoff, constructing wetlands, installing stormwater catch basins, increasing skimming activities to remove debris, controlling contaminated land sources, remediating groundwater contamination, and remediating contaminated sediment.

Improve Sediment Quality. Due to past industrial uses and impacted water quality, the sediments of the Lower Passaic River are severely degraded and impacted by contamination. This contamination has the potential of passing through the food chain and rendering many species unfit for consumption by anglers (*e.g.*, fish and crabs) and wildlife. Remediation of contaminated sediments, along with the improvement of water quality, could eventually allow for the safe consumption of these species and could minimize potential adverse health effects to individual organisms, communities, and populations.

Support Human Use. Currently, due to high levels of contamination, the river is not safe for swimming or wading. Access to the river is also limited; thus, restricting recreational opportunities for the local communities, especially those communities that are located in the densely populated, urban area known as the Ironbound.¹ Restoration efforts to support human use will work towards creating educational opportunities along the river and increasing both passive recreation (*e.g.*, walking trails and bird sighting activities) and active recreation (*e.g.*, athletic fields and boating). Overall, the clean up of the river, the restoration of native habitats, and improvements to river access would be a benefit to the human population within the Study Area.

3.1.2 RESTORATION OPPORTUNITIES

To accomplish these six restoration goals, restoration opportunities were discussed and developed at workgroup meetings. Opportunities were organized into a decision tree starting with the Restoration Goals and then breaking these goals into smaller “Specific Goals” that had measurable endpoints. The feasibility of accomplishing these Specific Goals was restricted by “Limiting Factors,” which were identified by the workgroup participants. (Limiting Factors identified during the workgroup meetings and listed in

¹ The Ironbound is a former industrial neighborhood in the City of Newark. In 2002, the Ironbound area contained 0.5 acres of parkland per 1,000 residents, which is less than the National Recreation and Park Association standard of 6.5 to 10 acres of parkland per 1,000 residents (Wallace, Roberts, and Todd, 2002). The number of recreational facilities, including tennis courts, athletic fields, and pools, were also less than national standards in the Ironbound area (Wallace, Roberts, and Todd, 2002).

Table 3-1 are not inclusive, and other restrictions may be identified during future restoration planning in the P-CRP.) Finally, restoration “Objectives” were developed to satisfy the Specific Goals while considering the previously identified Limiting Factors (Table 3-1). Together, this process establishes a framework for restoring the potential restoration areas (presented in Section 4.0 “Potential Restoration Areas”). Specific goals, Limiting Factors, and Objective are discussed below with details presented in Table 3-1.

Specific Goals help to define the Restoration Goals and provide specific, unique purposes to direct the Study. For example, the Restoration Goal of improving water quality is further defined by two Specific Goals (Table 3-1), which are contribute to achieving state and federal water quality certification for fishable/swimmable use and to protect water quality (refer to Table 3-1 for a complete listing of Specific Goals).

Limiting Factors are the constraints that could significantly preclude the attainment of the Specific Goals under current conditions (note that the Limiting Factors in Table 3-1 are not inclusive and other restrictions may be identified during future restoration planning in the P-CRP). In our previous example, the Specific Goal of protecting water quality is restricted by the absence or limited extent of wetland and vegetative buffers and the uncontrolled point and non-point sources of contamination (Table 3-1). Limiting Factors are often duplicative across Specific Goals (*i.e.*, a single Limiting Factor can prevent the attainment of multiple Specific Goals). Limiting Factors are used to frame the formulation of a single corresponding restoration “Objectives.”

Objectives are observable and quantifiable actions to achieve the Specific Goal. The Objectives define the basis for measuring progress toward attaining Specific Goals and for selecting ecological functional assessment metrics. To complete our example used above, the Specific Goal of protecting water quality is limited by two factors; however, measurable actions to achieve the Specific Goal include: (1) increase riparian forests, maritime forests, freshwater wetlands, and salt marshes, (2) implement best management practices to control point and non-point sources, and (3) remediate contaminated sediments under the CERCLA component of the Study and remediate process waste

water (Table 3-1). Like Limiting Factors, Objectives are often duplicative across Specific Goals, such that the completion of a single action can contribute to the attainment of multiple Specific Goals. The Objectives lay down the framework for establishing the habitat assessment technique outlined in the *Draft Final Technical Memo Ecological Functional Assessment* (Earth Tech, Inc., 2004). They are also consistent with the ecological functional assessment metrics that underwent partner agency review and were incorporated into the *Draft Field Sampling Plan, Volume 2* (Malcolm Pirnie, Inc., 2006a). These metrics are designed to:

- Establish existing ecological conditions of the Study Area.
- Assist in the formulation of habitat restoration alternatives.
- Determine success criteria.
- Quantify ecological improvements.

3.2 GENERAL RESTORATION CONCEPTS

Restoration opportunities in the Study Area will impact a variety of habitats including subtidal and intertidal habitats, riparian habitat, and adjacent upland habitat. In an attempt to restore these habitats, several generalized restoration actions were identified based on the field reconnaissance (refer to Section 3.3.3 “Field Reconnaissance”).

Figures 3-2 represents a generalized restoration schemes along the Lower Passaic River. Restoration actions presented in Figure 3-2 include but are not limited to the removal of invasive plants and replacement with native species; creation of new wetland and open water areas; creation of new tidal channels; and re-establishment of tidal connections or improvement of existing hydrology.

Other potential restoration actions, which include both near-term actions and long-term actions, are outlined in Table 3-2. (Certain actions listed in Table 3-2 may only be applicable at specific restoration areas.) Near-term actions pertain to feasible restoration actions that can be implemented before the CERCLA remedy is completed. The implementation of these near-term restoration actions will not affect the CERCLA remedy. Conversely, long-term actions pertain to restoration actions that would be implemented after the CERCLA remedy is completed. These restoration actions are

similar to the objectives established for the Hudson-Raritan Estuary restoration program (Bain *et al.*, 2006). The P-CRP is anticipated to integrate the restoration goals presented in Table 3-1 and the restoration action presented in Table 3-2 to develop site-specific restoration plans.

Contaminated soil and groundwater could be an issue at some of the upland restoration sites. Consideration for the remediation of soil and groundwater will be addressed in early phases of restoration under the CERCLA component of the Study.

3.3 RESTORATION SITE IDENTIFICATION

The P-CRP will address restoration opportunities throughout the Study Area. However, the *Restoration Opportunities Report* (this document) presents and discusses restoration opportunities that will occur within the riverine boundaries of the Lower Passaic River and in areas located adjacent to the river and in upland habitat. Potential restoration areas identified in the *Restoration Opportunities Report* will be ultimately incorporated in the P-CRP.

Two processes were utilized to identify potential restoration sites: an open nomination process sponsored by the partner agencies and stakeholders, and a computer-based [Geographic Information System (GIS)] screening of the Study Area. Potential restoration sites located within the river, adjacent to the river, and in upland habitats were then grouped into potential restoration area (refer to Section 4.0 “Potential Restoration Areas”). These restoration areas will be evaluated in the P-CRP using the goals and objectives presented in Table 3-1 to determine those areas with the highest potential of restoration. Site evaluation presented in the P-CRP will also consider land availability, land use, and size of property at each potential restoration area.

3.3.1 OPEN NOMINATION PROCESS

The open nomination process for identifying potential restoration sites involved a field reconnaissance program and a public solicitation program. As part of the initial reconnaissance program (December 2004 boat reconnaissance), the partner agencies identified initial restoration opportunities along the river. Kearny Point and Oak Island

Yards, which are listed in the *Project Management Plan* (USACE *et al.*, 2003) as restoration sites, were nominated under NRDA. The Public Service Electric & Gas (PSE&G) property in Harrison, New Jersey was nominated by NOAA.

The partner agencies then solicited input from stakeholders and public-interest groups (including the Passaic River Coalition, the New York and New Jersey Baykeeper, the Ironbound Community Coalition, and township master plans) to identify additional potential restoration sites in the Study Area. These additional restoration opportunities include the proposed sites previously identified in the *Expanding Recreation Opportunities: The Ironbound Community Recreation and Open Space Plan* (Wallace, Roberts, and Todd, 2002), sites identified in the *Restoration Options Report* (USACE and the City of Newark, 2000), and sites identified in the *Harrison Waterfront Redevelopment Plan* (Heyer, Gruel & Associates, 2003). The Newark proposed sites include, but are not limited to, the development of a waterfront park, creation of pedestrian corridors, creation of new parks and recreational areas, re-construction of existing city parks, and restoration of wetland areas. The Harrison proposed sites include, but are not limited to, the restoration and remediation of the historical PSE&G property and the development of a waterfront park. A field reconnaissance was conducted on the nominated-sites, where access was available, to collect site-specific data (refer to Section 3.3.3 “Field Reconnaissance”).

The open nomination process considered and accepted all nominated and solicited sites as potential restoration sites because of the limited areas available along the Lower Passaic River for restoration. The public and other stakeholders may continue to nominate other areas as potential restoration sites following NEPA scoping meetings. NEPA requires federal agencies to conduct scoping meetings to facilitate and encourage public participation with regard to decisions that affect the quality of the human environment. As part of the scoping process (which may include public meetings or formal public hearings), agencies solicit input and information from the public. In addition, the natural resource trustees will be seeking other restoration opportunities within or outside the Lower Passaic River watershed (including areas identified as part of the Hudson Raritan

Estuary Program) under NRDA to restore services to areas that were lost as a result of site-related contamination.

3.3.2 COMPUTER-BASED SCREENING PROCESS

Since the majority of the nominated restoration sites were located within close proximity to the Lower Passaic River, a computer-based screening process was conducted to consider upland areas located throughout the Study Area. Restoration of these upland areas can have a positive effect on the function and health of the ecosystem.

Areas that were selected through this computer-based screening process were identified using a rank-based evaluation of land features that were available from a NJDEP database. These land features included: historic properties, golf courses, streams, wetlands, grasslands, forests, floodplains, open water, Superfund Sites, National Priority Sites, Resource Conservation and Recovery Act (RCRA) sites, and Known Contaminated Sites. The results of this computer-based screening process are presented in Figure 3-3. Details on the screening process are provided in Appendix A; in brief, land features extracted from the NJDEP database were ranked based on their potential to be restored. The Study Area was then converted into a grid, and grid cells were ranked using GIS as being located “on,” “adjacent to,” or “neither on nor adjacent to” a particular land feature. The ranks were combined to generate a relative weighting. For reference, the highest weight was given to areas located adjacent to streams, wetlands, grasslands, forests, floodplains, and open waters. These areas are likely candidates for restoration and are presented in Figure 3-3.

While the computer-based screening process is capable of identifying impacted areas in the watershed, this evaluation has some shortcomings. For example, the analysis was limited to existing GIS data layers (*e.g.*, parks and cemeteries were not considered as land features); it did not incorporate land use or land availability; and it did not consider similar habitats. Consequently, a more in-depth investigation (including a field reconnaissance and data collection) is necessary before these identified areas can be classified as potential restoration sites. An emphasis will exist on restoring sites that are

located close to the Lower Passaic River and restoring habitats that have been injured by site-related contamination. A field reconnaissance of these areas is planned by USACE but has not been conducted at the time that this report was written.

3.3.3 FIELD RECONNAISSANCE

Field reconnaissance was conducted during October and December 2004 (Malcolm Pirnie, Inc., 2005) and January and February 2005 (Earth Tech, Inc., 2005) to collect site-specific data and to understand the restoration opportunities at the sites that were identified through the open nomination process. (Reconnaissance was limited to sites that were accessible.) The data collected during the reconnaissance provide the basic information necessary to evaluate and screen sites as potential restoration sites. Data collected during the reconnaissance are included on the Field Data Sheets, which were attached to the field reconnaissance reports (Malcolm Pirnie, Inc., 2005; Earth Tech, Inc., 2005). The data provided on these Field Data Sheets are based on the observations made by the field team. In some cases, data were added to the Field Data Sheets from other sources (*e.g.*, the Study's GIS database). All field surveys were conducted via automobile, boat, or foot. The information gathered during the reconnaissance was evaluated at workgroup meetings.

Areas identified during the computer-based GIS process were not involved in this field reconnaissance. However, partner agencies will visit these areas to determine whether or not a future reconnaissance effort is warranted for site screening and data collection. An additional reconnaissance by the USACE-NY District is planned for the areas located in northern Bergen County. The results of the field reconnaissance will be incorporated into the P-CRP.

4.0 POTENTIAL RESTORATION AREAS

4.1 DESCRIPTION OF POTENTIAL RESTORATION AREAS

More than 50 potential restoration sites, including Kearny Point and Oak Island Yards, were identified during the open nomination process. These sites are located along the Lower Passaic River from RM 0 to 17.4. For ease of discussion and presentation, these potential restoration sites, which are located in the river, adjacent to the river, and in upland areas, were grouped into eight restoration areas based on geographical location and habitat similarities. [The areas identified during the computer-based screening process (Section 3.3.2 Computer-Based Screening Process) are not discussed in this section since these areas have not yet been formally defined as potential restoration sites.]

The eight restoration areas are:

- Freshwater River Section of the Lower Passaic River
- Transitional River Section of the Lower Passaic River
- Brackish River Section of the Lower Passaic River
- Saddle River
- Third River
- Second River
- Kearny Point
- Oak Island Yards

Restoration areas will continue to be evaluated using the goals and objectives presented in Table 3-1 to determine which areas have the highest potential of restoration. Implementation plans for future restoration and evaluation of potential restoration areas will be addressed in the P-CRP.

The following discussion and accompanying figures (Figure 4-1 through Figure 4-8) provide an overview of these eight restoration areas. Each figure contains site-specific information on the area (refer to Section 4.2 “Site Specific Information”), representative

photographs for each area, and an aerial map containing the potential restoration area. (Note that Section 4.0 “Potential Restoration Areas” does not list specific restoration activities planned for an area nor does it contain restoration designs.) Table 4-1 provides a summary of the eight potential restoration areas that were nominated for restoration.

Freshwater River Section (Figure 4-1) encompasses approximately RM 9.0 to 17.4 where the water conditions are defined as “almost always” freshwater (*e.g.*, salinity values are less than 1 part per thousand). At high tide, the saltwater front rarely penetrates this section; however, the water elevations in this section may be tidally influenced. Sediments tend to be characterized by coarse-grained material; low sedimentation rates in this river section tend to yield relatively thin sediment beds. The Freshwater Section likely reflects a freshwater ecosystem and likely provides suitable habitat for freshwater aquatic plants (vascular and algae), macroinvertebrates, fish (bass and minnows), and wildlife species that forage on these prey types (Malcolm Pirnie, Inc., 2006a; Malcolm Pirnie, Inc., 2006b). The Freshwater River Section encompasses 8.4 miles of the Lower Passaic River, or approximately 280 acres of in-river restoration opportunities, and 30 potential restoration sites (approximately 160 acres) located adjacent to the river or in upland habitat.

Transitional River Section (Figure 4-2) represents the portion of the Lower Passaic River between the Freshwater River Section and Brackish River Section, where the salt front typically advances under high-tide conditions (approximately RM 6.0 to 9.0). Hence, this river section is continuously influenced by saltwater intrusion and mixing, resulting in changing water chemistry as well as flocculating and settling of dissolved organic matter and particulates. Sediment characteristics in the Transitional River Section are similar to the Freshwater River Section, which are dominated by coarse-grained material and relatively thin, fine-grained sediment beds. The habitat in the Transitional River Section reflects a mixture of freshwater and salt-tolerant ecosystems, resulting in a high diversity of plant and animal (Malcolm Pirnie, Inc., 2006a; Malcolm Pirnie, Inc., 2006b). The Transitional River Section encompasses 3.0 miles of the Lower Passaic River, or

approximately 130 acres of in-river restoration opportunities, and 6 potential restoration sites (approximately 13 acres) located adjacent to the river or in upland habitat.

Brackish River Section (Figure 4-3) encompasses approximately RM 0 to 6.0 where the water conditions are defined as “almost always” moderately saline. At high tide, the salt front usually advances past the Brackish Section and rarely stops within this section. Hence, the water elevations are heavily influenced by tides. Historical dredging of the Lower Passaic River has created deep channels in this river section; however, the lack of maintenance dredging has resulted in thick sediment beds forming in these channels, which are dominated by fine-grained material. The Brackish Section reflects a salt-tolerant ecosystem and likely provides suitable habitat for estuarine aquatic plants (vascular and algae), macroinvertebrates (polychaetes, blue mussel, blue crab), fish (white perch), and wildlife species that forage on these prey types (Malcolm Pirnie, Inc., 2006a; Malcolm Pirnie, Inc., 2006b). The Brackish River Section encompasses 6.0 miles of the Lower Passaic River, or approximately 530 acres of in-river restoration opportunities, and 52 potential restoration sites (approximately 250 acres) located adjacent to the river or in upland habitat. These riparian/upland restoration sites include the PSE&G property in Harrison, New Jersey and the sites previously proposed in the Newark and Harrison redevelopment plans (USACE and the City of Newark, 2000; Wallace, Roberts, and Todd, 2002; Heyer, Gruel & Associates, 2003).

Saddle River (Figure 4-4) is a major tributary (5.8 miles) of the Lower Passaic River with its confluence located at RM 15.6. The Saddle River originates in New York and then flows south through the New Jersey municipalities of Lodi, Garfield, and Wallington. The drainage area of this river is 54.6 square miles, and the mean stream flow is approximately 100 cubic feet per second (cfs; gauged at Lodi, New Jersey). Restoration opportunities will encompass the lower 0.78 miles of Saddle River (approximately 9.6 acres including a 50-foot buffer) and include 2 potential restoration sites (approximately 19 acres) that are located adjacent to Saddle River or in upland habitat.

Third River (Figure 4-5) is another major tributary of the Lower Passaic River with its confluence located at RM 11.3. The Third River stretches approximately 10 miles through the New Jersey municipalities of Nutley and Clifton. The drainage area of this river is 11.8 square miles, and the mean stream flow is approximately 21 cfs (gauged at Passaic, New Jersey). Near the confluence, the Third River is shallow with a moderate to swift flow of water. Rocks and coarse materials comprise the river beds with limited rooted aquatic or emergent vegetation. Restoration opportunities will encompass the lower 4.9 miles (approximately 59 acres, which includes a 50-foot buffer) of Third River and include 4 potential restoration sites (approximately 86 acres) that are located adjacent to Third River or in upland habitat.

Second River (Figure 4-6) is a major tributary (3.1 miles) of the Lower Passaic River with its confluence located at RM 8.1. The Second River is a residential river that flows through the New Jersey municipalities of Newark, Bloomfield, and Belleville. The drainage area of this river is 11.6 square miles, and the mean stream flow is approximately 18 cfs (gauged at Belleville, New Jersey). Near the confluence, Second River is approximately 40 feet wide containing alluvial deposited rocks and other coarse material. While the river banks are abutted by numerous local parks, the shoreline consists mainly of concrete vertical walls and bulkheads of differing heights. Numerous stormwater outfalls are present within the culverts, walls, and bulkheads along the Second River. Restoration opportunities will encompass the lower 2.0 miles of Second River (approximately 49 acres, which includes a 100-foot buffer) and include 4 potential restoration sites (approximately 4.1 acres) that are located adjacent to Second River or in upland habitat.

Kearny Point (Figure 4-7) is located between the confluences of the Lower Passaic River, Hackensack River, and Newark Bay. This large contiguous property, which borders the Study Area, is listed in the *Project Management Plan* (USACE *et al.*, 2003) as a restoration area and was nominated as a potential restoration site under NRDA. It is anticipated that restoration opportunities at Kearny Point will encompass approximate 73 acres. A preliminary restoration plan for Kearny Point was developed by BASF

Corporation (Jacques Witford, 2000 and Jacques Witford, 2002) and will be considered in the P-CRP for future restoration plans. The “Kearny Point” restoration site does not include Kearny Marsh since this marsh area is a candidate restoration site under the Hackensack Meadowland study (USACE, 2004d).

Oak Island Yards (Figure 4-8), a former industrial site, is a large contiguous property of approximately 39 acres (USACE and the City of Newark, 2000) located just south of the mouth of the Lower Passaic River. Oak Island Yards, which borders the Study Area, is listed in the *Project Management Plan* (USACE *et al.*, 2003) as a restoration area and was nominated as a potential restoration site under NRDA. Restoration opportunities at Oak Island Yards will include property adjacent to an existing tidal creek (approximately 90 acres) and 2 nearby wetland areas (approximately 1.6 acres) previously identified in the *Restoration Options Report* (USACE and the City of Newark, 2000).

4.2 SITE-SPECIFIC INFORMATION

Figures 4-1 through 4-8 contain site-specific information and historical data for each potential restoration area. As discussed in Section 4.1 “Description of Potential Restoration Areas,” each potential restoration area is comprised of potential restoration sites located in the river, adjacent to the river, and in upland habitats. Data are organized into categories that cover the many different topics that are applicable to a comprehensive ecosystem restoration approach. (Note that data collection for the Study and specific restoration sites will remain an on-going process.) For each restoration area, relevant documents were cited, abstracted, and then listed where appropriate under one or more of the following categories:

Survey, Maps, and GIS includes topographical data, aerial photographs, historical maps, and GIS datasets.

Real Estate Property Owners includes information on past and present owners as well as acquisition information when available. A Real Estate Plan (REP) will be included in the P-CRP. The REP will identify the real estate requirements for each restoration plan

formulated and determine a dollar value of the land required for each restoration plan. Real estate costs are considered a project cost and could be a determining factor in deciding which restoration plan is recommended.

Based upon ecosystem priorities and available funding by the partner agencies, lands will be identified for implementation of specific ecological restoration projects. The non-federal sponsors for these individual projects would be responsible for providing the required lands. Typically, the non-federal sponsor is a local governmental body. State, city, or county governments are the usual local sponsors. In addition, the Cooperating Parties² may contribute property for restoration as a result of negotiations with the partner agencies through the NRDA process. The non-federal sponsors will be required to acquire the necessary real estate in accordance with Section 301, Title III, Public Law 91-646, as amended. This law was enacted by the U.S. Congress to encourage and expedite the acquisition of real property by agreements with owners, to avoid litigation and relieve congestion in the courts, and to promote public confidence in federal or federally funded land acquisition practices. Negotiations will be conducted with the owner or owners of each tract in an effort to arrive at a satisfactory settlement. In certain cases, condemnation may be required either to settle price disagreements or to clear the title to the land. It is expected that condemnation will only be used where no other alternative exists that enables the goals of the project to be met.

Site History and Land Use includes current and past site history and land use description and information.

Biological Studies – Animal/Plant includes studies, assessments, and surveys for plants, birds, benthic organisms, fish, and other wildlife as well as any threatened and endangered species information.

² The USEPA initiated work on the Study using funds from the federal Superfund program. USEPA has signed an agreement with over 40 private companies (Cooperating Parties) for them to fund the Superfund portion of the Study.

Biological Studies – General includes wetland delineations and assessments, vegetation studies and surveys, and other general environmental information.

Geotechnical /Geophysical includes soils and geology data.

Hydraulic/Hydrology includes surface water (storm water and surface runoff), groundwater, flood control, hydrologic structures, and general river, stream, or creek data.

Water and Sediment includes water quality, sediment chemistry data (*e.g.*, total organic carbon content), and contaminant concentrations in sediment and water.

Historical/Cultural Resources includes historical and cultural resources assessments and other information.

Existing Restoration/Remediation Design Plans includes information on existing conceptual, preliminary, and final restoration and remediation design plans as well as plans for relevant structures or other site construction activities.

5.0 ACRONYMS

AMNET	Ambient Biomonitoring Network (refer to acronyms in figures)
ASI	Aqua Survey, Inc. (refer to acronyms in figures)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
DSCC	Diamond Shamrock Chemical Company (refer to acronyms in figures)
GIS	Geographic Information System
NEPA	National Environmental Policy Act
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NJDOT-OMR	New Jersey Department of Transportation – Office of Maritime Resources
NJTPA	New Jersey Turnpike Authority (refer to acronyms in figures)
P-CRP	Lower Passaic River Comprehensive Restoration Plan
PSE&G	Public Service Electric & Gas
RCRA	Resource Conservation and Recovery Act
REP	Real Estate Plan
RM	River Mile
SPMD	Semi-permeable Membrane Device (refer to acronyms in figures)
TSI	Tierra Solutions, Inc. (refer to acronyms in figures)
URRI	Urban River Restoration Initiative
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey (refer to acronyms in figures)
WRDA	Water Resources and Development Act

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TABLES

Table 3-1 Restoration Goals and Objectives

Restoration Goals	Specific Goals	Limiting Factor	Objective
Habitat Goals			
Create, Enhance, and Restore Habitat	Habitat restoration includes subtidal, intertidal (including wetlands and mudflats), riparian, and upland habitats. Specific goals, limiting factors, and objectives are addressed below under enhance plant communities, enhance animal communities, improve water quality, improve sediment quality, and support human use. Attainment of each habitat goal will be quantified as the length or area of habitat restored; (e.g. , 24 acres of benthic habitat restored or 1.2 miles of riparian habitat restored).		
Water Quality Goals			
Improve Water Quality	Contribute to achieving state and federal water quality certification for fishable/swimable uses	Concentrations in water of contaminants that exceed the state standards for fishable/swimable waters	Reduce concentrations in water of contaminants that exceed the state standards for fishable/swimable waters
		Concentrations in sediment of contaminants that exceed the state standards for fishable/swimable waters	Remediate contaminated sediments and replace with clean substrate
		Inputs from point and non-point sources of contaminants that exceed the state standards for fishable/swimable waters	Reduce inputs from point and non-point sources of contaminants that exceed the state standards for fishable/swimable waters
	Protect water quality	Absence or limited extent of wetland and vegetative buffers	Add riparian forests, maritime forests, freshwater wetlands, and salt marshes
		Uncontrolled point and non-point sources of contamination	Implement best management practices to control point and non-point sources
			Properly dispose of contaminated sediments and prevent recontamination by remediate contaminated sediments and remediation/restoration process waste water
Sediment Goals			
Improve Sediment Quality	Protect sediment quality; specific limiting factors and objectives are addressed under Improve Water Quality, Enhance Plant Communities, and Enhance Animal Communities Restoration Goals	Absence or limited extent of wetland and vegetative buffers	Add riparian forests, maritime forests, freshwater wetlands, and salt marshes
		Uncontrolled point and non-point sources of contamination	Implement best management practices to control point and non-point sources
Flora Goals			
Enhance Plant Communities	Increase native plants while decreasing non-native plants	Presence of and continuing invasion by non-native plants	Increase proportion of total plants comprising native species
		Low plant diversity	Increase diversity of plant communities
	Increase diversity of plant communities	Presence of and continuing invasion by non-native plants	Increase proportion of total plant comprising native species
		Water quality degradation	Improve water quality, as required to support target floral species
		Sediment quality degradation	Remediate contaminated sediments and replace with clean substrate
		Restricted flows	Remove obstacles to water flow by structures and debris in constrained channels
		Sedimentation	Reduce sedimentation
		Presence of and continuing invasion by non-native flora	Increase proportion of total plant comprising native species
	Increase abundance of plant species of special concern <consult with USFWS to select target species>	Water quality degradation	Improve water quality, as required to support target plant species
		Sediment quality degradation	Remediate contaminated sediments and replace with clean substrate
		Restricted flows	Remove obstacles to water flow by structures and debris in constrained channels
		Sedimentation	Reduce sedimentation

Table 3-1 Restoration Goals and Objectives

Restoration Goals	Specific Goals	Limiting Factor	Objective
Fauna Goals			
Enhance Animal Communities	Increase diversity of benthic macroanimal communities	Water quality degradation	Improve water quality, as required to support target animal species
		Sediment quality degradation	Remediate contaminated sediments and replace with clean substrate
		Low substrate/benthic habitat diversity	Increase diversity of benthic habitats features
	Increase abundance of fish communities and improve health of fishery resources; (e.g., shad, blueback herring, alewife, American eel, striped bass, mummichog, and blue crab)	Presence of and continuing invasion by non-native plants and animals	Reduce presence of and invasion by non-native plants and animals
		Absence of key native species that historically occurred in system	Introduce key native species
		Water quality degradation	Improve water quality, as required to support target animal species
		Sediment quality degradation	Remediate contaminated sediments and replace with clean substrate
		Restricted flows	Remove obstacles to water flow by structures and debris in constrained channels
		Absence or limited availability of critical habitat features; (e.g., cobble substrate, deep pools, or riffle-pool sequence)	Increase availability of critical habitat features
		Restricted access to critical fish habitats; (e.g., breeding, spawning, or foraging habitat)	Remove access restrictions to critical fish habitats features
		Absence of critical habitats; (e.g., breeding, spawning, or foraging habitat)	Increase availability of critical habitats features
		Increase abundance of herpetoanimal species; (e.g., diamondback terrapin)	Presence of and continuing invasion by non-native plants and animals
	Water quality degradation		Improve water quality, as required to support target animal species
	Sediment quality degradation		Remediate contaminated sediments and replace with clean substrate
	Restricted flows		Remove obstacles to water flow by structures and debris in constrained channels
	Absence or limited availability of critical habitat features		Increase availability of critical habitat features
	Increase abundance of avian species of special concern, wading birds, waterbirds, shorebirds, and passerines, including spotted sandpiper, belted kingfisher, and egrets	Absence or limited availability of critical habitats; (i.e., breeding, nesting, roosting, and foraging habitat)	Increase availability of critical habitats features
		Absence or limited availability of critical habitat features; (e.g., dense, sturdy herbaceous vegetation, nest cavities, or mast-bearing trees)	Increase availability of critical habitat features
		Presence of and continuing invasion by non-native plants and animals	Reduce presence of and invasion by non-native plants and animals
	Increase abundance of mammalian species, including muskrat	Absence or limited availability of critical habitats	Increase availability of critical habitats features
Absence or limited availability of critical habitat features; (e.g., dense herbaceous vegetation or steep banks)		Increase availability of critical habitat features	
Presence of and continuing invasion by non-native plants and animals		Reduce presence of and invasion by non-native plants and animals	

Table 3-1 Restoration Goals and Objectives

Restoration Goals	Specific Goals	Limiting Factor	Objective
Public Access Goals			
Support Human Use	Improve public access	Public access constrained by private ownership, risks to safety and health, bulkheading, hardened shoreline, or absence of egress	Provide public access to water front areas and wetlands for nature exposure
	Improve aesthetics	Presence of urban blight, abandoned and deteriorated facilities, and refuse	Remove abandoned and deteriorated facilities, and refuse
		Presence of degraded ecological communities	Restore ecological communities
	Improve opportunities for public education	Public access constrained by private ownership, risks to safety and health, or absence of egress	Provide public access to water front areas and wetlands for nature exposure
	Improve understanding of the requirements for successful restoration of the Lower Passaic River System	Absence of prior effort	Systematically monitor pre-restoration and post-restoration conditions
	Improve navigation	Sedimentation	Reduce sedimentation
	Improve opportunities for passive recreation	Public access constrained by private ownership, risks to safety and health, or absence of egress	Provide public access to water front areas and wetlands for nature exposure
	Improve opportunities for recreational fishing	Public access constrained by private ownership, risks to safety and health, or absence of egress	Provide public access to water front areas and wetlands for nature exposure
		Absence of facilities for recreational fishing	Construct fishing piers, docks, and wharfs
	Improve flood and attenuation	Absence or limited extent of wetlands	Add riparian forests, maritime forests, freshwater wetlands, and salt marshes
Restricted flows		Remove obstacles to water flow by structures and debris in constrained channels	

Table 3-2 Restoration Actions

Restoration Goals	Specific Goals	Objectives	Restoration Actions
Habitat Goals			
Create, Enhance, and Restore Habitat	Habitat restoration includes subtidal, intertidal (including wetlands and mudflats), riparian, and upland habitats. Specific goals, limiting factors, and objectives are addressed below under enhance plant communities, enhance animal communities, improve water quality, improve sediment quality, and support human use. Attainment of each habitat goal will be quantified as the length or area of habitat restored; (e.g., 24 acres of benthic habitat restored or 1.2 miles of riparian habitat restored).	<ul style="list-style-type: none"> - Secure upland property - Secure wetland - Improve habitat in areas not linked to the final Remedy (e.g., Oak Island Yards, Tribs, upland) - Restore habitat in areas linked to final remedy. - Establish fish passage/ladder/shad run 	
Water Quality Goals			
Improve Water Quality	Contribute to achieving state and federal water quality certification for fishable/swimable uses	Reduce concentrations in water of contaminants that exceed the state standards for fishable/swimable waters	<ul style="list-style-type: none"> - Implement Early Action Evaluation (EAE) - Implement Minish Park Mitigation Pilot - Green Roof, Rain Garden, and Downspot Connection - Reduce sources of untreated storm water and sewer system outflows - Implement final Remedy - Add riparian forests, maritime forests, freshwater wetlands, and salt marshes
		Remediate contaminated sediments and replace with clean substrate	
	Protect water quality	Reduce inputs from point and non-point sources of contaminants that exceed the state standards for fishable/swimable waters	
		<p>Add riparian forests, maritime forests, freshwater wetlands, and salt marshes</p> <p>Implement best management practices to control point and non-point sources</p> <p>Properly dispose of contaminated sediments and prevent recontamination by remediate contaminated sediments and remediation/restoration process waste water</p>	
Sediment Goals			
Improve Sediment Quality	Protect sediment quality; specific limiting factors and objectives are addressed under Improve Water Quality, Enhance Plant Communities, and Enhance Animal Communities Restoration Goals	Add riparian forests, maritime forests, freshwater wetlands, and salt marshes	<ul style="list-style-type: none"> - Implement Early Action Evaluation (EAE) - Implement final remedy
		Implement best management practices to control point and non-point sources	
Flora Goals			
Enhance Plant Communities	Increase native plants while decreasing non-native plants	Increase proportion of total plants comprising native species	<ul style="list-style-type: none"> - Implement Early Action Evaluation (EAE) - Improve habitat in areas not linked to the final Remedy - Implement final Remedy - Restore habitat in areas linked to final Remedy
	Increase diversity of plant communities	Increase diversity of plant communities	
		Increase proportion of total plant comprising native species	
		Improve water quality, as required to support target floral species	
		Remediate contaminated sediments and replace with clean substrate	
		Remove obstacles to water flow by structures and debris in constrained channels	
		Reduce sedimentation	
	Increase abundance of plant species of special concern <consult with USFWS to select target species>	Increase proportion of total plant comprising native species	
		Improve water quality, as required to support target plant species	
		Remediate contaminated sediments and replace with clean substrate	
Remove obstacles to water flow by structures and debris in constrained channels			
Reduce sedimentation			

Table 3-2 Restoration Actions

Restoration Goals	Specific Goals	Objectives	Restoration Actions
Fauna Goals			
Enhance Animal Communities	Increase diversity of macrobenthic communities	Improve water quality, as required to support target animal species	<ul style="list-style-type: none"> - Improve habitat in areas not linked to the final remedy. - Implement Early Action Evaluation (EAE). - Implement final remedy. - Establish fish passage/ladder. - Restore habitat in areas linked to final remedy.
		Remediate contaminated sediments and replace with clean substrate	
		Increase diversity of benthic habitats features	
	Increase abundance of fish communities and improve health of fishery resources; (e.g. , shad, blueback herring, alewife, American eel, striped bass, mummichog, and blue crab)	Reduce presence of and invasion by non-native plants and animals	
		Introduce key native species	
		Improve water quality, as required to support target animal species	
		Remediate contaminated sediments and replace with clean substrate	
		Remove obstacles to water flow by structures and debris in constrained channels	
		Increase availability of critical habitat features	
		Remove access restrictions to critical fish habitats features	
		Increase availability of critical habitats features	
	Increase abundance of herpetofauna species; (e.g. , diamondback terrapin)	Reduce presence of and invasion by non-native plant and animal	
		Improve water quality, as required to support target animal species	
		Remediate contaminated sediments and replace with clean substrate	
		Remove obstacles to water flow by structures and debris in constrained channels	
		Increase availability of critical habitat features	
	Increase abundance of avian species of special concern, wading birds, waterbirds, shorebirds, and passerines, including spotted sandpiper, belted kingfisher, and egrets	Increase availability of critical habitats features	
		Increase availability of critical habitat features	
		Reduce presence of and invasion by non-native plants and animals	
	Increase abundance of mammalian species, including muskrat	Increase availability of critical habitats features	
Increase availability of critical habitat features			
Reduce presence of and invasion by non-native plants and animals			

Table 3-2 Restoration Actions

Restoration Goals	Specific Goals	Objectives	Restoration Actions
Public Access Goals			
Support Human Use	Improve public access	Provide public access to water front areas and wetlands for nature exposure	<ul style="list-style-type: none"> - Reduce floatables. - Create bird watching access, Establish fish passage. - Implement Minish Park Mitigation Pilot. - Remove containers on river banks. - Create small craft and non-motorized boat access points, information Kiosks, and public waterfront areas. - Improve human use in areas linked and not linked to the final remedy. - Establish brownfield remediation. - Create Greenways, Fields and Parks. - Establish river boat ecotourism opportunity, Build/rehabilitate fishing pier and Build boat marina
	Improve aesthetics	Remove abandoned and deteriorated facilities, and refuse Restore ecological communities	
	Improve opportunities for public education	Provide public access to water front areas and wetlands for nature exposure	
	Improve understanding of the requirements for successful restoration of the Lower Passaic River System	Systematically monitor pre-restoration and post-restoration conditions	
	Improve navigation	Reduce sedimentation	
	Improve opportunities for passive recreation	Provide public access to water front areas and wetlands for nature exposure	
	Improve opportunities for recreational fishing	Provide public access to water front areas and wetlands for nature exposure	
		Construct fishing piers, docks, and wharfs	
	Improve flood and attenuation	Add riparian forests, maritime forests, freshwater wetlands, and salt marshes	
Remove obstacles to water flow by structures and debris in constrained channels			

Table 4-1: Summary of Potential Restoration Areas

Potential Restoration Area	In-River Length (miles) ^a	In-River Area (acres) ^a	Number of Riparian/Upland Sites	Area of Riparian/Upland Sites (acres)
Freshwater River Section	8.4	280	30	160
Transitional River Section	3.0	130	6	13
Brackish River Section	6.0	530	52	250
Saddle River	0.78	9.6 ^b	2	19
Third River	4.9	59 ^b	4	86
Second River	2.0	49 ^b	4	4.1
Kearny Point	NA	NA	1	73
Oak Island Yards	NA	NA	3	92

Notes:

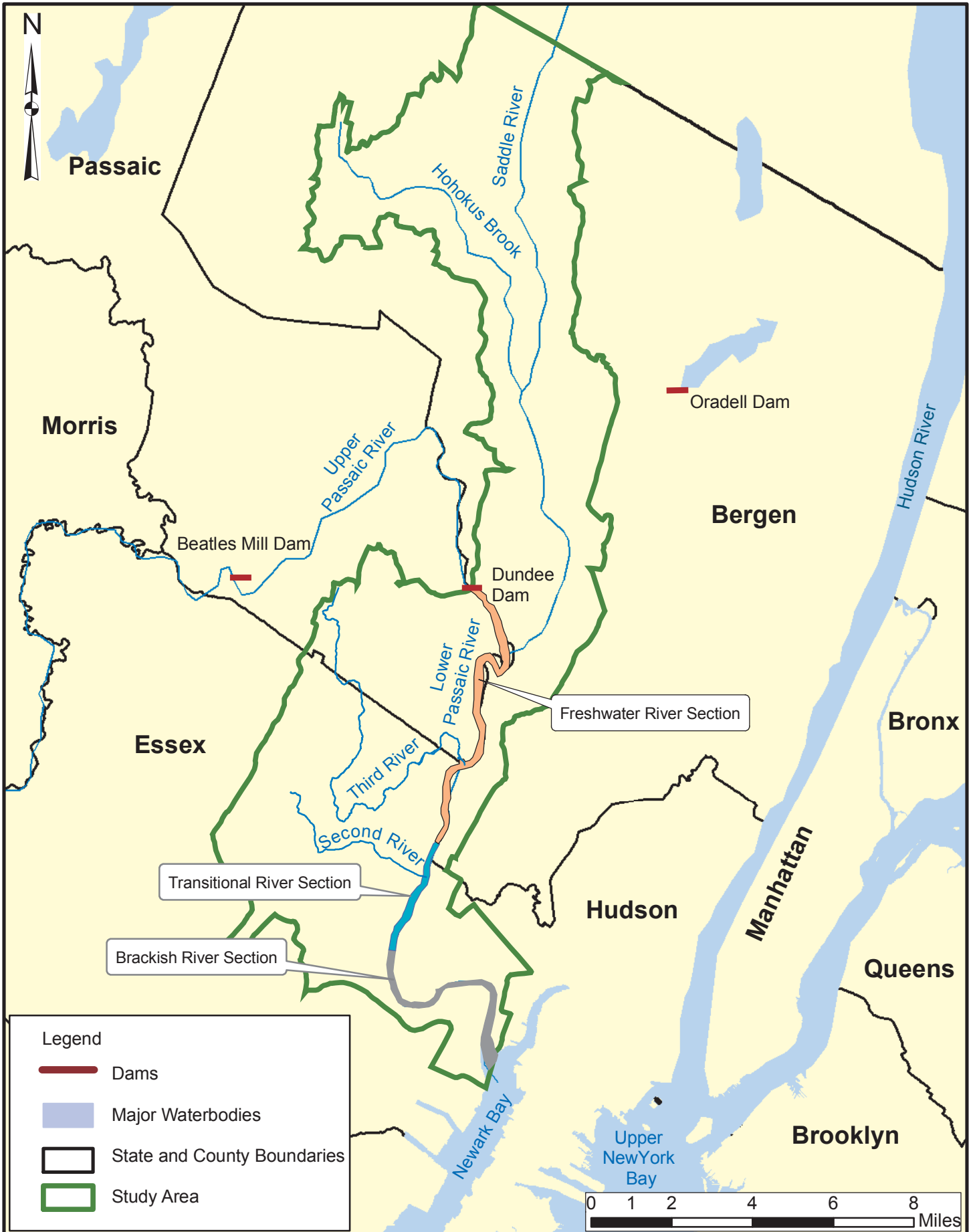
a: Referring the in-river habitat restoration in the Lower Passaic River.

b: In-river habitat restoration for the tributaries includes a 50-foot buffer on the Saddle River and Third River and a 100-foot buffer on Second River.

NA not applicable

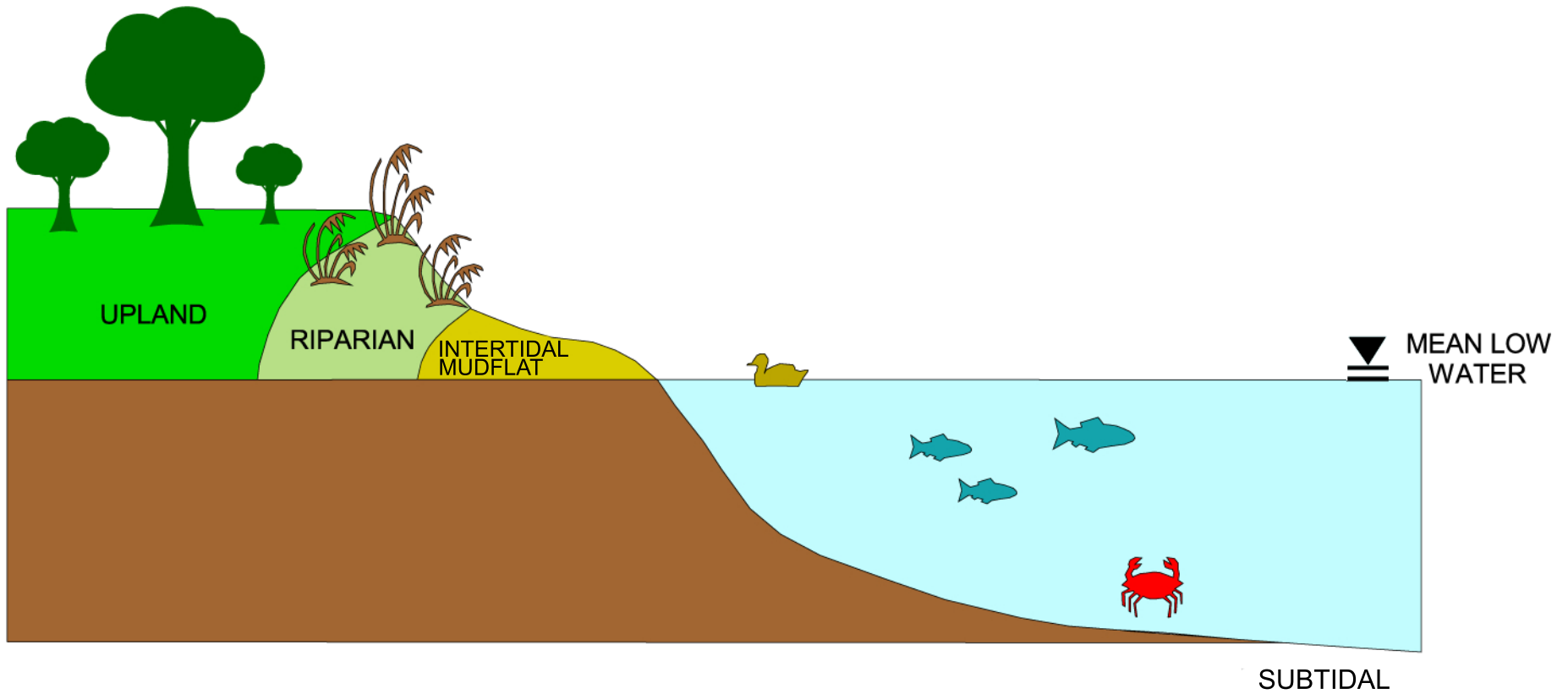
FIGURES

Map Document: (S:\Projects\PASSAIC\MapDocuments\4622001-1\WRDA\MXDFSP2_033106\MXD\Introduction\site\location.mxd) 5/10/2006 - 5:55:27 PM



Study Area Location Map
Lower Passaic River Restoration Project

FIGURE 2-1
July 2006



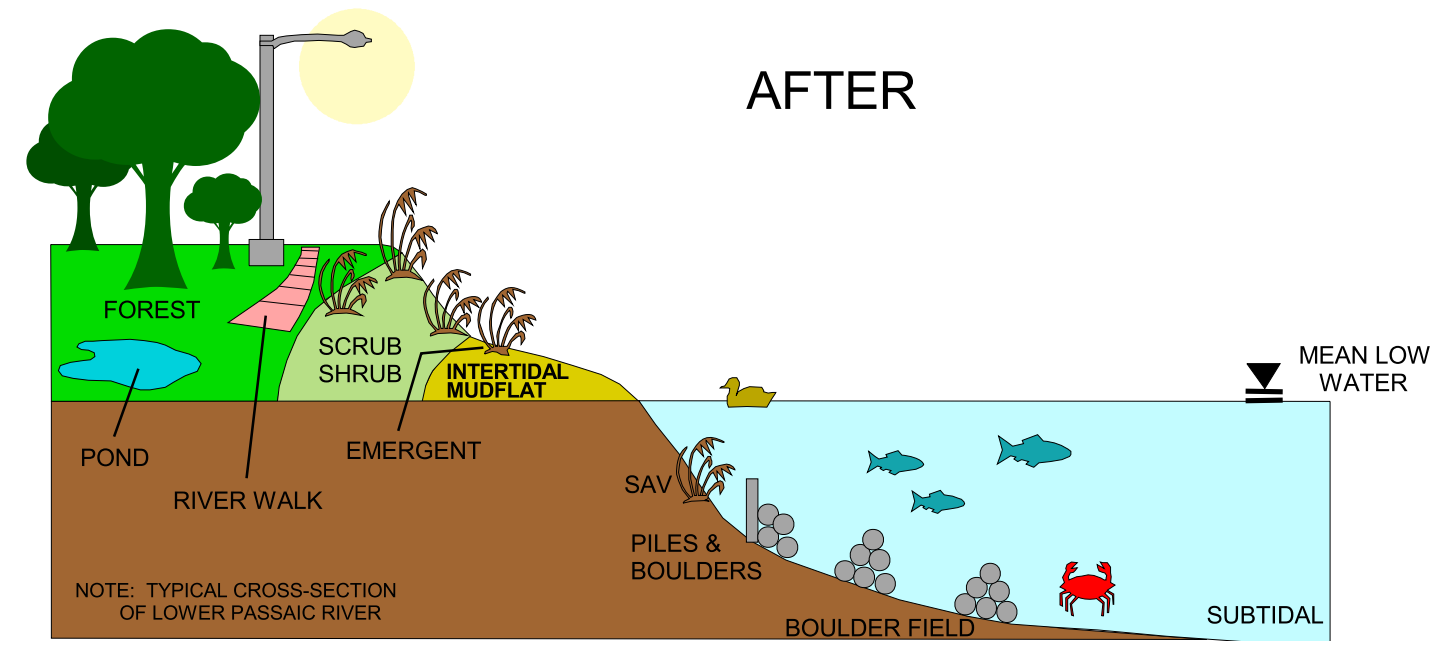
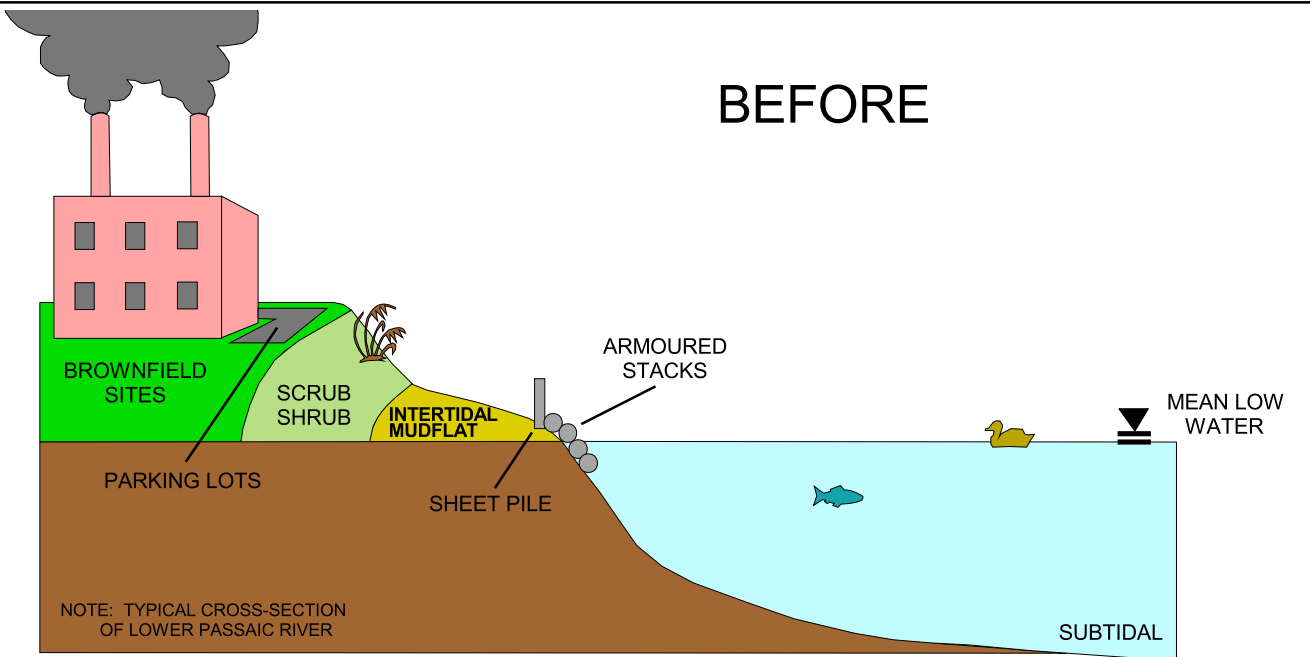
NOTE: TYPICAL CROSS-SECTION
OF LOWER PASSAIC RIVER



Generalized Habitat Types Along Lower Passaic River
Lower Passaic River Restoration Project

Figure 3-1

July 2006



Generalized Habitat Restoration Along Lower Passaic River
Lower Passaic River Restoration Project

Figure 3-2
 July 2006

Freshwater River Section

Location: The Area is the upper eight miles of the Lower Passaic River from river mile 9 to river mile 17.

Area Description: The northern reach includes a small inland channel and riverbank. Island vegetated with trees and shrubs at river mile 16.5. Land consists of a steep slope vegetated with trees and shrub species. Slope to river nearly vertical and covered with trees and shrubs. Low, flat island in Passaic River. Island vegetated with deciduous woody species. Large tract of land along eastern bank (south of dam) steep, wooded bank with trees. In the southern portion, banks developed, rip-rapped or concrete with heavy past industrialization.

Potential Restoration Opportunities: Enhance fish/benthic habitat; decrease non-native plant; re-vegetate with indigenous species; reduce combined sewer overflow discharges; enhance stormwater management; promote fish passage; remove debris; plant upland forest; remove manmade structures; bio-stabilize shoreline; re-grade shoreline; improve public access; install habitat enhancing structure; and create inter-tidal, subtidal, and riparian habitat.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

US Geological Survey (USGS) digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a). USACE Bathymetric Survey (2004b).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

Passaic River history (Iannuzzi et. al., 2002).

Biological Studies –Animal/Plant:

Limited benthic and fish data NJDEP Ambient Biomonitoring Network (AMNET) (NJDEP 1998) and USEPA Coastal Assessment programs (USEPA 2001). Quantitative data from USACE Flood Tunnel Project (USACE 1987). Confirmatory benthic community samples collected during Sediment Profile Imaging work (Germano & Associated 2005). Fisheries data (Clifton Health Department 1999). Kingfisher habitat survey (NJDOT/USACE 2006 data collection).

Biological Studies General:

Sediment Profile Imaging (Germano & Associated 2005). Qualitative discussion on habitat types, field reconnaissance (Malcolm Pirnie 2005, Earth Tech 2005).

Geotechnical:

Atterberg limits, bulk density, moisture content and percent solid data [Aqua Survey (ASI) 2005b]. Geophysical surveys: gradiometric survey; side-scan sonar; sub-bottom profiling; magnetometer (ASI 2005b). No data available for areas above high tide.

Hydraulics/Hydrology:

Hydrodynamics (USEPA 2005 data collection).

Water & Sediment:

High Resolution Cores (USEPA 2005 data collection); Semi-permeable Membrane Device (SPMD) (USEPA 2005 data collection); Water Column Sampling (USEPA 2005 data collection); Salinity data (Malcolm Pirnie 2005).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

Passaic River Coalition (2004), USACE Flood Tunnel Project (USACE 1987).



Dundee Dam, river mile 17.4



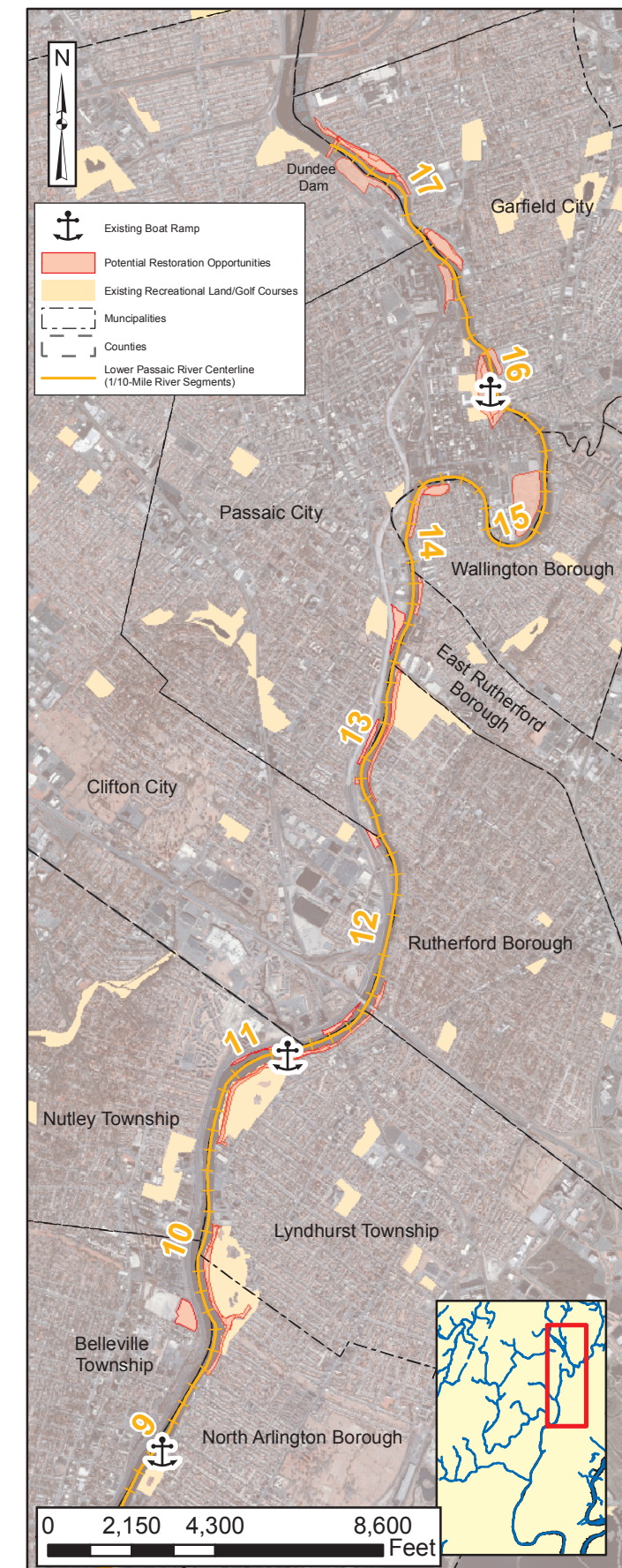
Right bank descending, river mile 15.9



Left bank descending, river mile 12.8



Left bank descending, river mile 9.6



Potential Restoration Area: Freshwater River Section

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-1
July 2006

Transitional River Section

Location: The Area is the three miles of the Lower Passaic River from river mile 6 to river mile 9.

Area Description: Limited industrialization of river banks with the following features: steep riparian edge, riparian fringe and mudflats adjacent to road and local parks, private homes, commercial buildings and lots; small riparian fringe and large armored areas.

Potential Restoration Opportunities: Remediate contaminated sediment; decrease non-native plants; re-vegetate with indigenous species; reduce combine sewer overflow discharge; enhance stormwater management; add fish aggregate devices; remove debris; remove manmade structures; bio-stabilize shoreline; re-grade shoreline; improve public access; install habitat enhancing structure; and improve inter-tidal, subtidal, and riparian habitats.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a). USACE Bathymetric Survey (2004b).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

Passaic River history (Iannuzzi et. al., 2002).

Biological Studies –Animal /Plant:

Quantitative data on benthic community, fish population, avian species [Tierra Solutions, Inc (TSI) 2002 and 2003, NJ Turnpike Authority (NJTPA) 1987, Chemrisk 1995, USACE 1987, NJDEP 1998, USEPA 2001, ASI 2005a]. Confirmatory benthic community samples collected during Sediment Profile Imaging (Germano & Associated 2005). Plankton data (Chemrisk 1995). Mammal and avian survey data (USACE 1987). Kingfisher habitat survey (NJDOT/USACE 2006 data collection).

Biological Studies General:

Qualitative data on habitat types (TSI 2003). Sediment profile imaging (Germano & Associated 2005). Qualitative discussion on habitat types, field reconnaissance (Malcolm Pirnie 2005).

Geotechnical/Geophysical:

Atterberg limits, bulk density, moisture content and percent solid data (ASI 2005b). Geophysical surveys: gradiometric survey; side-scan sonar; sub-bottom profiling; magnetometer (ASI 2005b). No data available for areas above high tide line.

Hydraulics/Hydrology:

Hydrodynamics (USEPA 2005 data collection).

Water & Sediment:

High Resolution Cores (USEPA 2005 data collection).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

Passaic River Coalition (2004), USACE Flood Tunnel Project (USACE 1987).



Left bank descending, river mile 8.2



Left bank descending, river mile 7.8



Left bank descending, river mile 7.6



Left bank descending, river mile 6.8



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Potential Restoration Area: Transitional River Section

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-2
July 2006

Brackish River Section

Location: The Area is the six miles of the Lower Passaic River from river mile 0 to river mile 6.

Area Description: Heavily industrialized urban river. Limited habitat along river banks and un-vegetated mudflats.

Potential Restoration Opportunities: Remediate contaminated sediment; decrease non-native plants; re-vegetate with indigenous species; reduce combined sewer overflow discharge; enhance stormwater management; remove debris; plant upland forest; remove manmade structures; bio-stabilize shoreline; re-grade shoreline; improve public access; install habitat enhancing structure; and improve inter-tidal, subtidal, and riparian habitats.

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a). USACE Bathymetric Survey (2004b).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

Data available are from the Passaic River Study Area; river mile 1 to river mile 7 (TSI 2003). Passaic River history (Iannuzzi et al., 2002).

Biological Studies –Animal /Plant:

Quantitative data on benthic community, fish population, avian species (TSI 2002 and 2003, Jacques Whitford 2002, New Jersey Turnpike Authority (NJTPA) 1987, Chemrisk 1995, USACE 1987, Aqua Survey Inc, (ASI) 2005a, NOAA 1997). Survey of mammals (USACE 1987). Confirmatory benthic community samples collected during sediment profile imaging (Germano & Associated 2005). Biological tissue residue analysis, toxicity testing and bioaccumulation studies (TSI 2003). Kingfisher habitat survey (NJDOT/USACE 2006 data collection). Emergent vegetation (TSI 2003)

Biological Studies General:

Qualitative data on habitat types (TSI 2002). Sediment profile imaging (Germano & Associated 2005). Qualitative discussion on habitat types, field reconnaissance (Malcolm Pirnie 2005).

Existing Site Specific Data Inventory

Geotechnical/Geophysical:

Sediment geotechnical testing (TSI 2003), USEPA 2006 data collection) for shear stress, erosion rate, density, consolidation tests, and pore pressure. Sediment grain size, total organic carbon, Atterberg limits, bulk density, moisture content and percent solid data (ASI 2005b). Geophysical surveys: gradiometric survey; side-scan sonar; sub-bottom profiling; magnetometer (ASI 2005b). No data available for areas above high tide line.

Hydraulics/Hydrology:

Hydrodynamics (USEPA 2005 data collection). River current data are available from July-August 1995, April 1996, and April-May 1996 (TSI 2003). Tide gauge data from April 1995 to May 1996 (TSI 2003). Additional hydrodynamic data were collected in 2004 by Rutgers University (<http://marine.rutgers.edu/cool/passaic/>), which included the results from two dye studies.

Water & Sediment:

Conventional surface water quality parameters have been monitored in the lower 6 miles of the Passaic River (TSI 2003, Diamond Shamrock Chemical Company (DSCC) 1985a, and NOAA 1999). Groundwater has been monitored at the 80 and 120 Lister Avenue site (DSCC 1985a and b). Sediment contamination data available from Passaic River Study Area (DSCC 1985a and TSI 2002) and recent dredging pilot work (USACE/NJDOT 2005 data collection). High Resolution Cores (USEPA 2005 data collection); SPMD (USEPA 2005 data collection); Water Column Sampling (USEPA 2005 data collection); Low Resolution Cores (USEPA 2006 data collection). Salinity data (Malcolm Pirnie 2006a).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

Minish Park (USACE 2004c); Harrison Waterfront Redevelopment Plan (Heyer, Gruel & Associates 2003); and the Ironbound - Expanding Recreation Opportunities: The Ironbound Community Recreation and Open Space Plan. Phase 1 Report: Analysis and Recommendations (Wallace, Roberts, and Todd 2002); USACE Flood Tunnel Project



Right bank descending, river mile 2.2



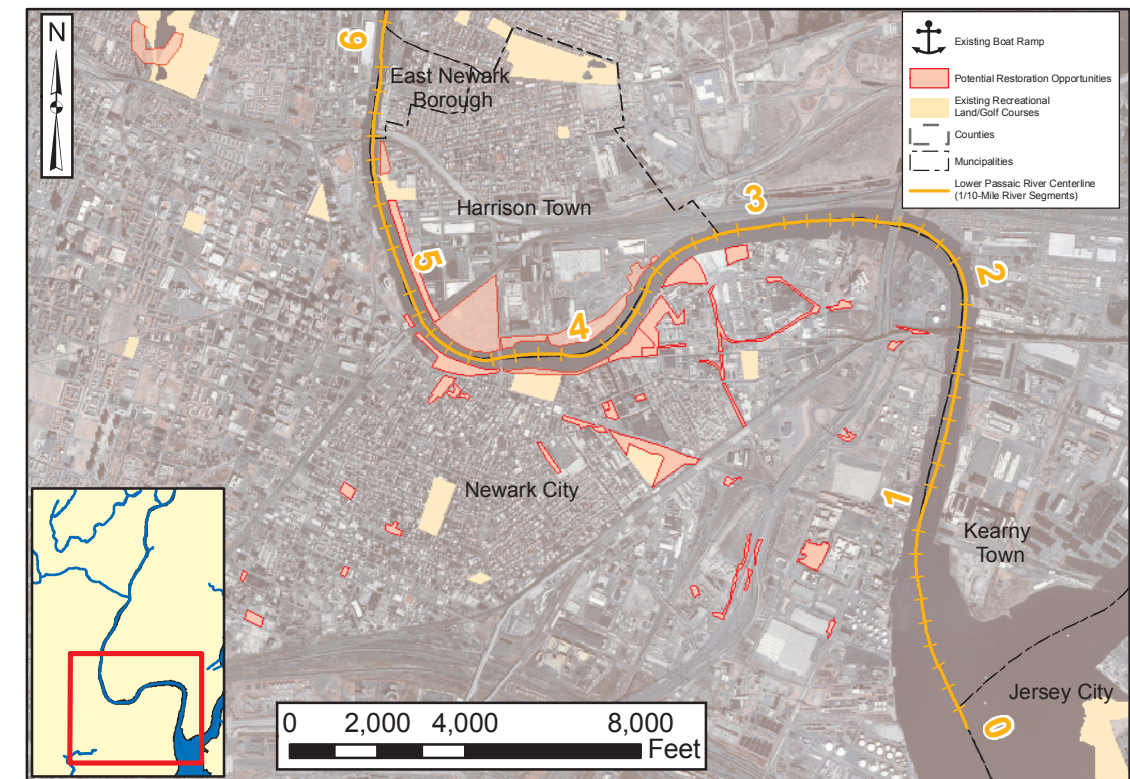
Left bank descending, river mile 3.7



Right bank descending, river mile 2.6



Right bank descending, river mile 4.8



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Potential Restoration Area: Brackish River Section

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-3
July 2006

Saddle River

Location: The Area is the lower 0.78 miles of the Saddle River, which is a tributary of the Lower Passaic River.

Area Description: Restricted to the lower 0.78 miles of the Saddle River. The lower portion is vegetated with deciduous trees and shrub species. Large fields on bluff next to cemetery. Parking lot (south of tributary) next to industrial area (lot with concrete blocks).

Potential Restoration Opportunities: Enhance fish/benthic habitat; decrease non-native flora; re-vegetate with indigenous species; remove debris; remove manmade structures; bio-stabilize shoreline; install habitat enhancing structure.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

No Data Obtained.

Biological Studies –Animal/Plant:

Kingfisher habitat survey (NJDOT/USACE 2006 data collection).

Biological Studies General:

Qualitative discussion on habitat types, field reconnaissance (Earth Tech 2005).

Geotechnical:

No Data Obtained.

Hydraulics/Hydrology:

USGS Gauging Station data at Lodi, NJ.

Water & Sediment:

Water Column (USEPA 2005 data collection)
SPMD (USEPA 2005 data collection).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

No Data Obtained.



Left bank descending on Saddle River



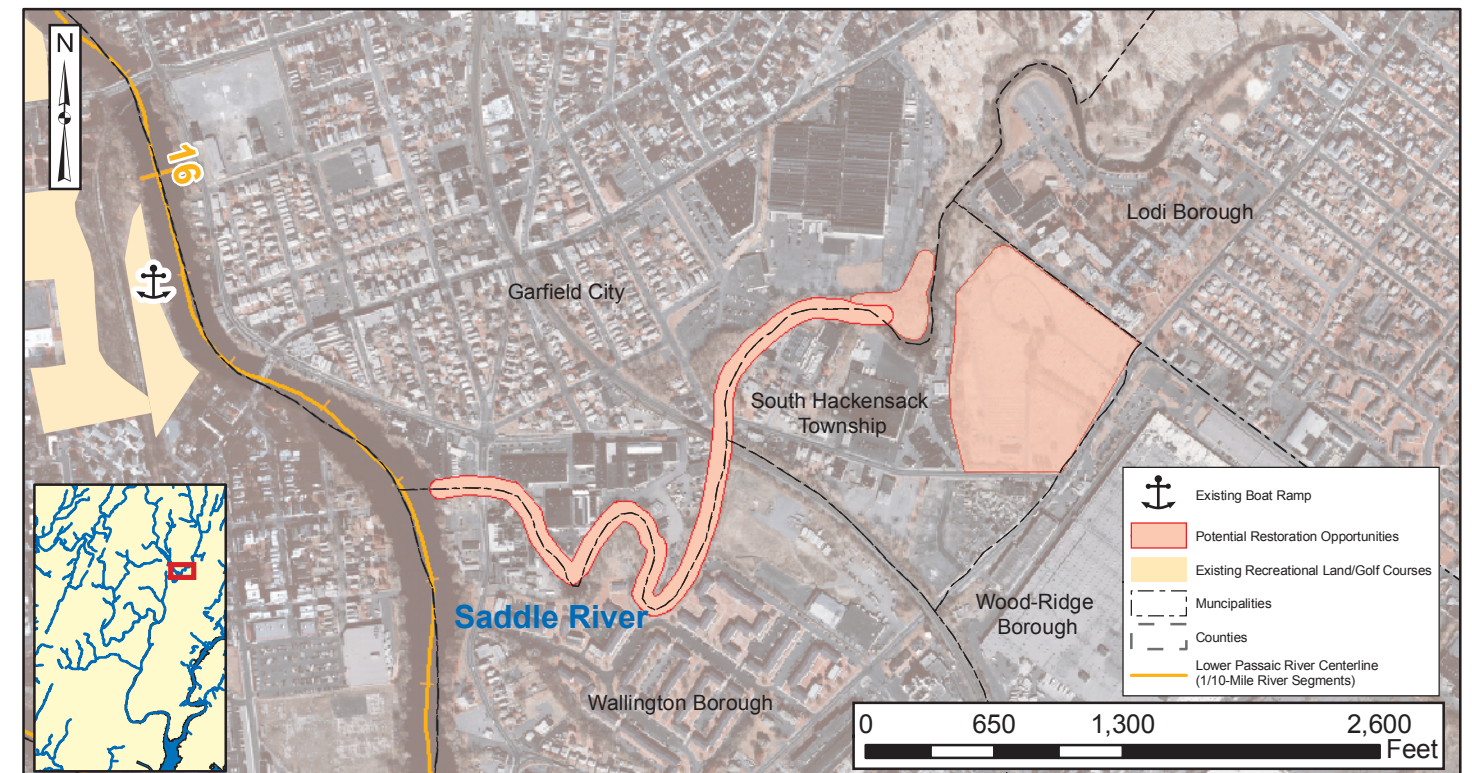
Right bank descending on Saddle River



Left bank descending on Saddle River



Right bank descending on Saddle River



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Potential Restoration Area: Saddle River

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-4
July 2006

Third River

Location: The Area is the lower 4.9 miles of the Third River, which is a tributary of the Lower Passaic River.

Area Description: The Third River is shallow, moderate to swift flowing with numerous riffles. Rocks and coarse materials comprise the bed. Minimal, if any rooted aquatic vegetation or emergent vegetation was observed within the river bed. The river also flows through small ponds, a rock lined swale, golf course, a steeply sided ravine, parks, and concrete-lined walls or gabions. One former industrial facility is located on the Third River in Bloomfield, Scientific Glass. The parcel where the former plant was appears to contain some rubble however there are no structures on the site. The smaller parcel consists of an isolated wooded area which currently serves as higher ecological valuable habitat for the region.

Potential Restoration Opportunities: Enhance fish/benthic habitat; decrease non-native flora; re-vegetate with indigenous species; enhance stormwater management; promote fish passage; remove debris; plant upland forest; remove manmade structures; bio-stabilize shoreline; re-grade; improve public access; install habitat enhancing structure; Clark's Pond – removal of excess sediment to improve water quality and fish habitat. Install minor dams and widening of the stream in select locations to permit facultative herbaceous and scrub/shrub species. Cleanup of ornamental ponds and Lake Kingsland (removal of nuisance water fowl, planting of rooted aquatic vegetation, and addition of fish).

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

No Data Obtained.

Biological Studies –Animal/Plant:

Two benthic sampling stations from NJDEP AMNET program upstream of confluence with Passaic River (NJDEP 1998). Fish collection by the Clifton Health Department (1999). Kingfisher habitat survey (NJDOT/USACE 2006 data collection).

Biological Studies General:

Qualitative discussion on habitat types, field reconnaissance (Earth Tech 2005).

Geotechnical:

No Data Obtained.

Hydraulics/Hydrology:

USGS Gauging Station data at Passaic, NJ.

Water & Sediment:

Water Column (USEPA 2005 data collection)
SPMD (USEPA 2005 data collection).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

No Data Obtained.



Right bank descending on Third River



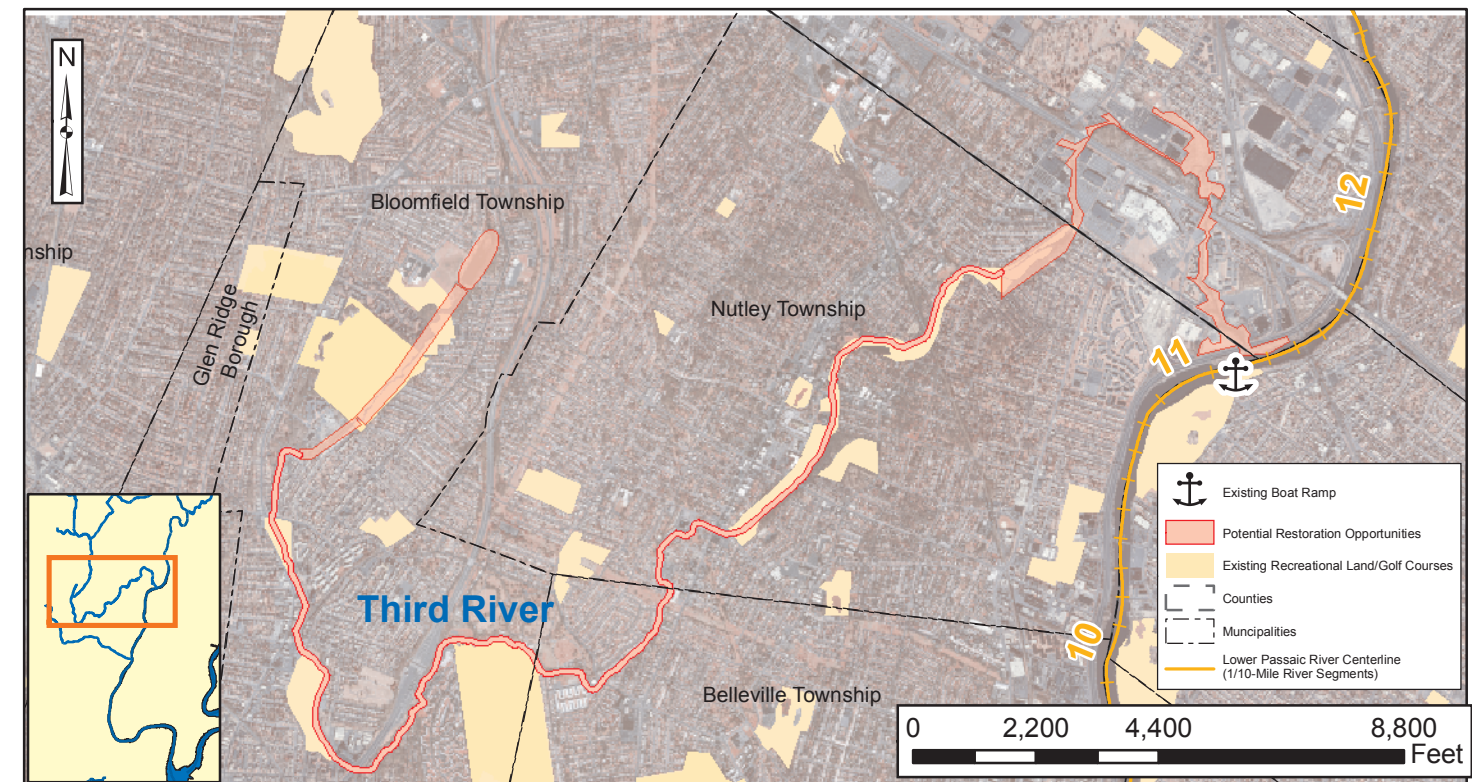
Wetlands on edge of Third River



Third River looking southeast



Third River looking southwest



Potential Restoration Area: Third River Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-5

July 2006



Second River

Location: The Area is the lower 2 miles of the Second River, which is a tributary of the Lower Passaic River.

Area Description: Second River is a tributary of the Passaic River (mouth located in Newark, Essex County). Second River approximately 40 feet wide with alluvial, deposited rocks/coarse material. (Just below bridge, there is a 1-foot waterfall and then river confluence), much of the bottom cobble stoned. Part of the Second River: has concrete walls with steep slopes and urban vegetation.

Potential Restoration Opportunities: Enhance fish/benthic habitat; decrease non-native flora; re-vegetate with indigenous species; enhance stormwater management; promote fish passage; remove debris; remove manmade structures; bio-stabilize shoreline; install habitat enhancing structure. Along the ravine in Glen Ridge there are numerous rock out crops of tertiary red sandstone and siltstone, a geological interpretive walk can be placed in this area.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a).

Real Estate Property Owners:

No Data Obtained.

Site History and Land Use:

No Data Obtained.

Biological Studies –Animal/Plant:

One benthic sampling station from NJDEP AMNET program at confluence with Passaic River (NJDEP 1998). Kingfisher habitat survey (NJDOT/USACE 2006 data collection).

Biological Studies General:

Qualitative discussion on habitat types, field reconnaissance (Earth Tech 2005).

Geotechnical:

No Data Obtained.

Hydraulics/Hydrology:

USGS Gauging Station data at Belleville, NJ.

Water & Sediment:

Water Column (USEPA 2005 data collection)
SPMD (USEPA 2005 data collection).

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

Newark restoration options (USACE 2000).



Second River: Looking east in Bloomfield



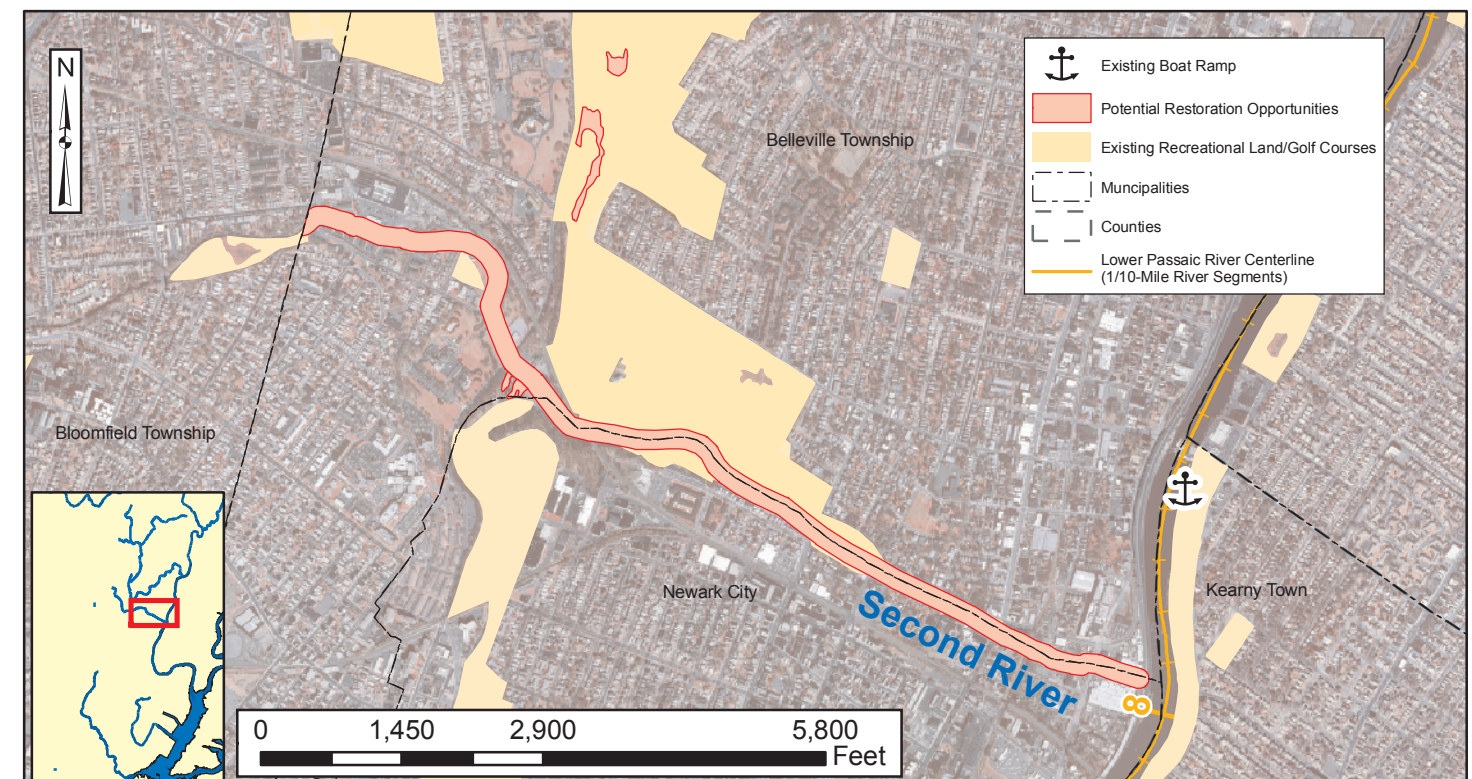
Second River: Looking upstream at the Main Street Bridge



Second River: Looking east in Bellville Park along Mill Street



Outfall located on Second River



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Potential Restoration Area: Second River

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-6
July 2006

Kearny Point

Location: The Area is Kearny Point in Kearny, New Jersey.

Area Description: Former industrial site. Dimensions of Site: 3000 feet × 1600 feet (triangular) in water location with attached upland areas (73 Acres).

Potential Restoration Opportunities: Add clean fill in some intertidal area to create mudflats; low and high marsh; dunes community; maritime forest; intertidal pools; tidal channels; Osprey nesting areas; wildlife habitat snags; and nature center with walkway and observation platforms.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a).

Real Estate Property Owners:

BSAF Corporation.

Site History and Land Use:

Former chemical manufacturing facility.

Biological Studies –Animal/Plant:

Winter and summer fish sampling, one time benthic community sampling (Jacques Whitford 2002).

Biological Studies General:

Qualitative discussion on habitat types, field reconnaissance (Malcolm Pirnie 2005).

Geotechnical:

No Data Obtained.

Hydraulics/Hydrology:

No Data Obtained.

Water & Sediment:

No Data Obtained.

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

Preliminary restoration/enhancement plans provided (Jacques Whitford 2000).



Kearny Point Shoreline: Looking south



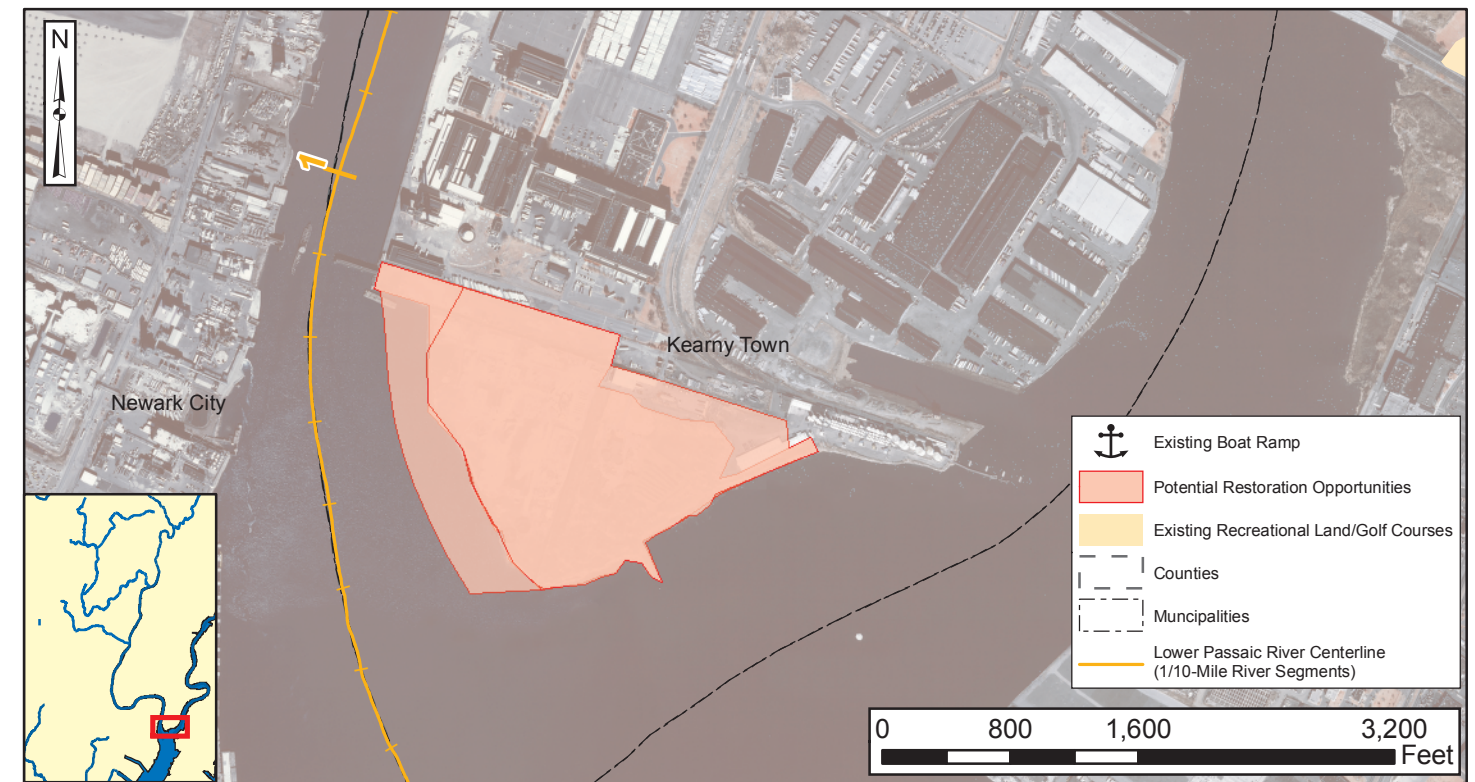
Kearny Point Shoreline: Interior of Site



Kearny Point Shoreline: Looking south/southwest



Kearny Point Shoreline: Looking north (colors are due to the presence of industrial dyes)



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Potential Restoration Area: Kearny Point

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-7
July 2006

Oak Island Yards

Location: The Area is Oak Island Yards.

Area Description: Former industrial site, vacant lot. Physical Dimensions of Site: 8400 feet. × 2700 feet.

Potential Restoration Opportunities: Remove fill; create high and low marsh; tidal channels; upland forest; dune community; add public access and create Osprey nesting areas.

Existing Site Specific Data Inventory

Survey, Maps, GIS:

USGS digital raster graphics maps and NJDEP Regional Data and other data inclusive of this site as provided in Lower Passaic River Restoration Project GIS Mapping Overview and Design Report (USACE 2004a).

Real Estate Property Owners:

City of Newark and others.

Site History and Land Use:

No Data Obtained.

Biological Studies –Animal/Plant:

No Data Obtained.

Biological Studies General:

Qualitative discussion on habitat types, field reconnaissance (Malcolm Pirnie 2005).

Geotechnical:

No Data Obtained.

Hydraulics/Hydrology:

No Data Obtained.

Water & Sediment:

No Data Obtained.

Historical/Cultural Resources:

No Data Obtained.

Existing Restoration/Remediation Design Plans:

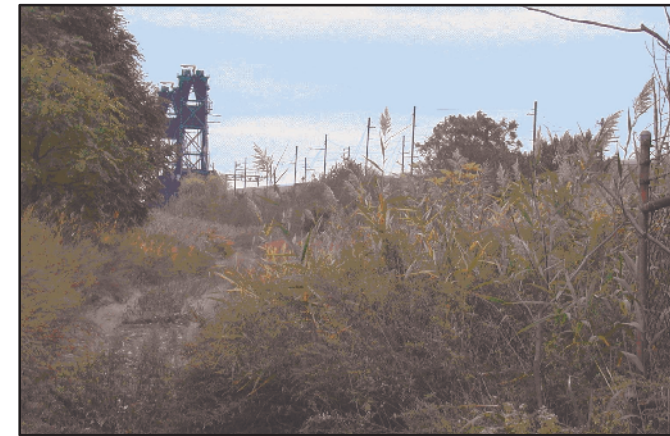
Newark restoration options (USACE 2000).



Oak Islands Yards Shoreline



Weequaqua Creek on Oak Tree Island



Interior of Oak Island Yards: Western side looking south



Oak Tree Island marsh edge



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Potential Restoration Area: Oak Island Yards

Lower Passaic River Restoration Project

Aerial photography shown is Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet.

Figure 4-8

July 2006

APPENDIX A
(Currently Under Revision)