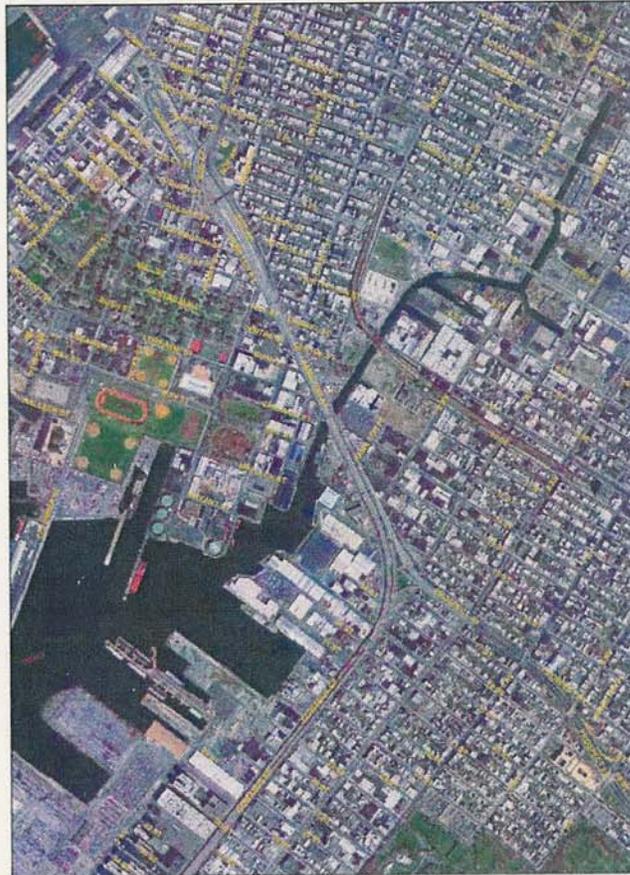




**GOWANUS BAY AND GOWANUS CANAL
KING'S COUNTY, NEW YORK**

**GOWANUS STUDY AREA
DATA ASSESSMENT REPORT**



OCTOBER 2003

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LIST OF ABBREVIATIONS & ACRONYMS

BOD	Biological oxygen demand
CARP	Contamination Assessment Reduction Project
CSO	Combined sewer overflow
DO	Dissolved oxygen
EIS	Environmental impact statement
EPA	Environmental Protection Agency
FEIS	Final environmental impact statement
FSAP	Field sampling and analysis plan
GCCDC	Gowanus Canal Community Development Corporation
GIS	Geographical information systems
MGP	Manufactured gas plant
NOAA	National Oceanic and Atmospheric Administration
NJ	New Jersey
NS&T	National Status and Trends (NOAA Program)
NTU	Nephelometric turbidity unit
NY	New York
NYCDEP	New York City Department of Environmental Protection
NYD	New York District
NYCDOS	New York City Department of Sanitation
NYSDOT	New York State Department of Transportation
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyl
PMP	Project management plan
RCRA	Resource Conservation and Recovery Act
REMAP	Regional Environmental Monitoring and Assessment Program (of U.S. EPA)
RI	Remedial investigation
SPI	Sediment profile imagery
SOP	Standard operating procedures
SVOC	Semivolatile organic compounds



LIST OF ABBREVIATIONS & ACRONYMS (continued)

TOC	Total organic carbon
TPH	Total petroleum hydrocarbon
TSS	Total suspended solids
USA	Use and Standards Attainment
USACE	United States Army Corps of Engineers
VOC	Volatile organic compounds



1.0 INTRODUCTION

1.1 Gowanus Restoration Study Background

In response to a resolution of the U.S. House of Representatives Committee on Transportation and Infrastructure, the U.S. Army Corps of Engineers (USACE), New York District conducted a reconnaissance study to characterize and inventory water resources and sediment quality issues in the Hudson-Raritan Estuary. This evaluation identified the Gowanus Bay and Canal as a priority for restoration (USACE, 2001a) and a Restoration Study (i.e., the Gowanus Restoration Program) was initiated.

As defined by the Project Management Plan (PMP) prepared by the Corps (USACE, 2001a), the area of interest for the Gowanus Restoration Program includes: (1) the two mile length of the Gowanus Canal from Gowanus Bay to its inland terminus at Butler Street in Brooklyn; (2) the canal's six square mile watershed area; and, (3) Gowanus Bay, which extends eastward from Bay Ridge Channel to the beginning of the Gowanus Canal. Extensive habitat loss within this area has been identified as a significant environmental concern, as well as elevated levels of chemical contaminants in surface waters and sediments. Restoration measures that will be considered under the Restoration Program include sediment removal and decontamination as well as relocation of sewage treatment outfalls.

For a comprehensive baseline, good spatial representation of the study area will be required, to ensure that "hot spots" are identified, as well as other areas of concern. It is important that all habitat areas are characterized, as conditions can vary substantially within urbanized and developed areas.

1.2 Project Objectives

To support the USACE-New York District's Gowanus Restoration Program, Battelle was contracted by Northern Ecological Associates, Inc. (NEA) under NEA's USACE contract # DACW51-01-D-0017, Delivery Order 0009, to perform the Gowanus Canal Data Assessment. The purpose of this assessment was to identify and review existing data for the Gowanus Bay and Canal and determine their potential utility in developing an ecological baseline for evaluation in the Gowanus Restoration Program. This data assessment project originally consisted of three tasks:

Task 1: Review of Existing Data (USACE, 2002)

Task 2: Summary of Data Gaps (USACE, 2003b)

Task 3: Preliminary Sampling Strategy.

Under Task 1, existing technical reports and data sets were identified and reviewed. Under Task 2, the reports and data identified in Task 1 were summarized to provide a basis for determining potential data gaps in information relevant to the Gowanus Canal. Once Task 2 had been completed, the development of a preliminary sampling strategy



was accomplished through a series of meetings between USACE-New York District and Battelle. Battelle assisted the USACE-New York District in determining the types of chemical, biological, and physical analyses and locating sample collection sites that would provide a baseline characterization of conditions in the Gowanus study area, and begin to fill some of the data gaps identified. The USACE-New York District then partnered with the Baltimore District to conduct a site investigation of the Gowanus Bay, Canal, and watershed study areas in the spring of 2003. With the completion of the site investigation, it was no longer necessary for Battelle to develop a preliminary sampling strategy as a project deliverable for Task 3. Task 3 was modified, and became the preparation of a final Gowanus Study Area Data Assessment Report that includes the results of the USACE's 2003 site investigation.

1.3 The Gowanus Study Area Data Assessment Report

This report consists of four sections. Section 1 describes the project background, basis, and objectives. Section 2 presents the data sources identified in Tasks 1 and 2 of this project by data types. Section 3 provides descriptions of each of the data sources and comments on the data relevance and utility. Section 4 is a brief discussion of the overall findings of this data assessment project.

2.0 RELEVANT INFORMATION BY DATA TYPE

One of the first steps of the Restoration Program will be the development of an Environmental Resource Inventory Report, which will describe the current biological, ecological, and natural resources within the study area and provide a baseline for measurement of ecosystem benefits (USACE, 2001a). For the purpose of this inventory, the following types of data have been identified:

1. Sediment quality (e.g., total organic carbon [TOC], grain size, chemistry)
2. Ecological community information (e.g., benthic invertebrates, fish, upper trophic level species)
3. Water quality (e.g., dissolved oxygen [DO], salinity, chemistry)
4. Bathymetry
5. Land use

Data and information contained in the reports, documents, and databases identified in Task 2 (Summary of Data Gaps) each fall into at least one of these five type categories. For each category, Tables lists the data sources and reference them to the narrative summaries provided in Section 3.



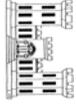
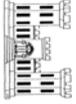
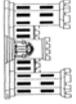


Table 1. Data Source Information

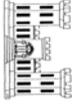
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
SEDIMENT QUALITY DATA SOURCES						
1	Gowanus Expressway Tunnel Study/ NYSDOT (2000)	1	1999	Evaluating area for alternatives to Expressway Tunnel	Grain Size, Atterberg Limit Determinations, % Moisture, Chemistry (VOCs, SVOCs, petroleum, metals, PCBs, asbestos)	Contributes to background characterization of chemical contaminants in soil adjacent to the study area.
2	Samples collected near the Flushing Tunnel Hazen & Sawyer (1999)	6	1999	Characterization of Flushing Tunnel sediment conditions at time of tunnel reactivation	Chemistry (metals, pesticides/herbicides), VOCs, SVOCs, TPH, PCBs), Corrosivity, ignitability, reactivity	Characterizes Flushing Tunnel sediment conditions at time of tunnel reactivation. Utility of data is limited; unknown if data was obtained before or after tunnel reactivation
3	Inner Harbor CSO Facility Planning Project /NYCDEP (1993)	7	1992	Evaluating sediment chemistry in the vicinity of existing CSOs	Chemistry of priority pollutant analytes including metals, PCBs, PAHs and VOCs)	Contributes to background characterization of chemical contaminants in Gowanus Canal and Bay.
5	Harbor Sediment Trackdown Sampling Project/ CARP Database (2002a)	1	2000	Compilation of sediment data collected from NY Harbor	Chemistry (PAHs, pesticides/PCBs, dioxins)	Contributes to background characterization of chemical contaminants. Sample was taken from Gowanus Bay, post-Flushing Tunnel reactivation.



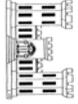
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
8	Red Hook Flats Dredged Material Evaluation/ USACE (1997/2001b)	1	1997 and 2001	Data collected in support of dredged material disposal application	TOC, grain size, moisture, Chemistry (metals, PCBs/pesticides, PAHs, dioxins/furans)	Representative of sediment conditions in the harbor beyond Gowanus Bay and Channel.
9	REMAP/ EPA (1998)	1	1998	Data collected as part of NY/NJ Harbor Monitoring program	Chemistry (priority pollutants)	Contributes to background characterization of chemical contamination.
12d	Tributary Benthos Characterization Field Sampling and Analysis Program Year 2002/ NYCDEP (2002b)	7	2002	Evaluation of benthic substrate characteristics in NY Harbor tributaries.	TOC, grain size, percent solids	Characterizes recent sediment physical properties within Gowanus Canal.
15	Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, New York (Draft)/ USACE (2003a and 2003b)	30; 25 stations analyzed	2003	Establishing baseline sediment data for the Gowanus Canal and Bay.	Specific gravity, consistency limits and plasticity, soil gradation (grain size), total Coliform, chemical contaminants (VOCs and SVOCs, pesticides, PCBs, RCRA metals, mercury, TPH)	Characterizes sediment physical properties and chemical constituents representative of the study area.



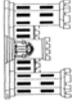
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
ECOLOGICAL COMMUNITY DATA SOURCES						
4	Reactivation of the Gowanus Canal Flushing Tunnel/ NYCDEP (2001a)	4	May 1997; monthly, March 1999 - February 2000	Evaluating potential impacts of Flushing Tunnel Reactivation on benthic and aquatic communities	Abundance and species diversity of benthic and nekton/plankton communities	Provides nekton/plankton community data for the Gowanus Canal over time, pre-, during, and post-Flushing Tunnel reactivation.
9	REMAP/ EPA (1998)	1	1998	Data collected as part of NY/NJ Harbor Monitoring program	Toxicity bioassays, benthic community analyses	Characterizes benthic community structure in Gowanus Bay, 1998.
10	Baseline Biological Monitoring Program/ USACE (1999)	Multiple trawls and 4 sampling locations	Monthly from October 1998 to September 1999	Data collected as part of a baseline monitoring program	Presence/absence data for benthic macroinvertebrates and fish	Characterizes benthic community structure in Gowanus Bay, 1998-1999.
11	Benthic Habitats Report/ NOAA (1996)	4 sediment grab stations; 20 sediment profile locations	1995	Data collected as part of a benthic habitat mapping effort for NY/NJ Harbor	Benthic community analyses and sediment profile imaging	Characterizes benthic community structure in Gowanus Bay, 1995.
12a	Harbor-Wide Ichthyoplankton Field Sampling and Analysis Program Year 2001/ NYCDEP (2001d)	1	2001	Data collected to identify and characterize ichthyoplankton communities for NY Harbor	Presence/absence data of ichthyoplankton	Provides biological profile over 1-year period; samples were collected in four events.



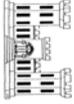
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
12b	Land Use Analyses and Characterizations of Shoreline Areas/ NYCDEP (2002c)	¼-mile radius surrounding Gowanus Canal evaluated	2002	Characterize land uses to understand the impacts the watershed has on the adjacent waterbodies.	Biological classifications of the land adjacent to the waterbodies identified in the USA project	Characterizes current biological conditions of the Gowanus Canal shoreline.
12c	Harbor-Wide Epibenthic Recruitment and Survival Field Sampling and Analysis Program Years 2001-2002/ NYCDEP (2001c)	1	2001	Epibenthic communities are used as indicators for water quality.	Presence/absence data of macroinvertebrates	Characterizes epibenthic community structure in Gowanus Canal, 2001.
15	Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, New York (Draft)/ USACE (2003a)	29	2003	Provide a baseline biological characterization of the sediment in Gowanus Canal.	Presence/absence of benthic macroinvertebrates	Provides benthic enumeration and identification (corresponding to water quality stations) in study area



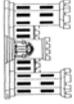
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
WATER QUALITY DATA SOURCES						
3	Inner Harbor CSO Facility Planning Project/ NYCDEP (1993)	5	1992	Evaluating general water quality of the area for CSO planning	DO, temperature, salinity, fecal coliform, TSS, sulfate, bacteria, ammonia, BOD	Characterizes water quality conditions in Gowanus Canal and Bay, 1992
4	Reactivation of the Gowanus Canal Flushing Tunnel/ NYCDEP (2001a)	5	Monthly from November 1998 to March 2000	Evaluating water quality conditions before and after the Reactivation of the Flushing Tunnel	DO, temperature, salinity, velocity	Characterizes water quality conditions in the Gowanus Canal over time: pre-, during- and post-Flushing Tunnel reactivation
6	Harbor Loading and Trackdown/ CARP Database (2002b)	1	2 events in 1999 and 1 in 2000	Compilation of water quality data from NY Harbor	Chemistry (PAHs, pesticides/PCBs, dioxins)	Characterizes water quality conditions in Gowanus Canal, 1999-2000
7	Harbor Survey/ NYCDEP (2001b)	2	Periodic sampling from 1997 to 2000	Extensive survey of water quality throughout NY Harbor	Temperature, salinity, pH, DO, chlorophyll a, Secchi depth measurements	Characterizes water quality conditions in Gowanus Bay for 1997-2000
8	Red Hook Flats Data Evaluation/ USACE (1997/2001b)	1	1997 and 2001	One site water and one sediment elutriate sample. Data collected in support of dredged material disposal application	Chemistry (metals, PCBs/pesticides)	Data are representative of water quality conditions in the harbor beyond Gowanus Bay and Canal
9	REMAP/ EPA (1998)	1	1998	Data collected as part of NY/NJ Harbor Monitoring program	DO, temperature, salinity, Secchi depth measurement	Characterizes water quality conditions in Gowanus Bay 1998



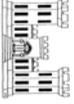
Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
12a	Harbor-Wide Ichthyoplankton Field Sampling and Analysis Program Year 2001/ NYCDEP (2001d)	1	2001	Biological data was collect to understand water quality within NY Harbor, this data is used to support their findings.	Secchi depth, DO, temperature, salinity	Characterizes water quality conditions in Gowanus Bay 1998
12c	Harbor-Wide Epibenthic recruitment and Survival Field Sampling and Analysis Program Years 2001-2002/ NYCDEP (2001c)	1	2001	Biological data was collect to understand water quality within NY Harbor, this data is used to support their findings.	DO, temperature, salinity, Secchi depth measurement	Characterizes water quality conditions in Gowanus Bay 1998
15	Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, New York (Draft)/ USACE (2003a; 2003b)	29	2003	Establishing baseline water quality data for the Gowanus Canal.	DO, pH, salinity, depth, and turbidity in NTU	Characterizes current water quality conditions in Gowanus Canal and Bay



Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
BATHYMETRIC DATA SOURCES						
3	Inner Harbor CSO Facility Planning Project/ NYCDEP (1993)	Gowanus Canal	1992	Data collected to aid in the development of a water quality model	Hydrographic data of the Gowanus Canal	Contributes to background characterizaion of hydrographic conditions in Gowanus Canal and Bay
LAND USE DATA SOURCES						
1	Gowanus Expressway Tunnel Study/ NYDOT (2000)	Land surrounding proposed tunnel location	1999	Evaluating area for alternatives to Expressway Tunnel	Provided a detailed parcel map of the land surrounding the Gowanus Canal	Characterizes ownership of the land surrounding the sample sites
3	Inner Harbor CSO Facility Planning Project/ NYCDEP (1993)	Land surrounding Gowanus Canal and Bay	1993	Classification of land use related to CSO locations	Identified parks and open space, public and private institutions, low density residential, high density residential, and commercial and industrial in the Red Hook Area	Classification focuses on the Red Hook area, only land in the northeastern part of the Gowanus Canal is classified
12b	Land Use Analyses and Characterizations of Shoreline Areas/ NYCDEP (2002c)	¼-mile radius surrounding canal	2003	Characterize land uses to understand the impacts the watershed has on the adjacent waterbodies.	Performed in-depth land use classification sof the land surrounding the waterbodies identified in the USA Project	Report provides a detailed land use map for the area surrounding the Gowanus Canal



Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
13	Gowanus Canal Bulkhead Inventory Study/ GCCDC (2000)	Bulkheads along Gowanus Canal	2000	Bulkhead survey performed to identify poorly maintained and deteriorated bulkeads in the Gowanus Canal.	Performed in-depth land use classifications on the land surrounding the waterbodies identified in the USA Project	Identifies the owners of the land adjacent to the Gowanus Canal in 2000 and the bulkheads in need of repair
14	Remedial Investigation Work Plan-Citizens Gas Works, Former Manufactured Gas Plant Site/ GEI Consultants (2003)	Land surrounding the former gas plant site	2002	Understanding land use patterns surrounding the former gas plant site.	Parcel ownership maps were included in the report	Identifies current land owners in the land surrounding the gas plant
16	Toxic Targeting Property Map Gowanus Canal/ Toxic Targeting (2003)	Land surrounding Gowanus Canal and Bay	2002	Examination of the potential contaminates located near the Gowanus Canal	Identifies inactive hazardous waste disposal sites; hazardous waste treater, storer, disposer locations; hazardous substance waste disposal sites; major oil storage; solid waste; chemical storage and civil enforcement docket facilities; wastewater discharge; toxic and air release sites; and historic utility sites	Provides information regarding the potential sources of contaminants



Data Source Number	Report Title/Author or Agency	Number of Stations in Study Area	Dates of Sample Collection	Rationale for Sampling	Analyses	Data Utility
17	Final Environmental Impact Statement for the Comprehensive Solid Waste Management Plan Draft Modification/ NYDOC (2000)	Area ½ mile from the Hamilton Avenue Modified MTS	2000	Determine what types of infrastructure would be impacted if the Hamilton Avenue Modified MTS was to become the solid waste transfer station.	Land use, zoning, neighborhood character, open spaces, parklands, and natural resources	Provided a strong summary of the land characteristics surrounding the Hamilton Avenue MTS

3.0 SUMMARIES OF EXISTING INFORMATION

This section presents a summary of the data and information contained in the reports, documents, and databases identified in the Summary of Data Gaps (Tasks 1 and 2). Data Source ID numbers assigned correspond to the numbers indicated in Tables 1 through 5 in Section 2. Each data source summary consists of a brief description of the project as well as a map depicting sampling locations. The maps show actual sample site coordinates whenever possible (i.e., if data sets included sample site latitudes and longitudes). If coordinates were not available, sample collection locations were approximated using the information provided.

1. Geotechnical Investigation Report, Gowanus Expressway Tunnel Study (NYSDOT, 2000)

The purpose of this 1999 data collection was to provide geotechnical information in the vicinity of the Gowanus Canal to classify soil as part of an evaluation of tunnel alternatives. Of the 14 boring and split-spoon samples collected, only one, (BH-12B) was collected from within the area of interest for the Gowanus project (Figure 1). Physical parameters measured. Sediment included grain size, Atterberg limits, moisture content, and sediment chemistry analyses (volatile organic carbon [VOC], semivolatile organic carbon [SVOC], petroleum, metals, PCBs, and asbestos).

During collection of the boring sample at BH-12B, fill material exhibiting a petroleum-like odor was encountered. However, SVOC analysis of this sample did not indicate elevated levels of petroleum-based SVOCs, nor were other analytes detected. The soil was silty sand with gravel and concrete.

2. Data tables describing samples collected near the Flushing Tunnel (Hazen and Sawyer, 1999)

According to Hazen and Sawyer (personal communication, R. Daniels, 12/16/02), the data tables and description of sampling methodology provided represent the complete report prepared for this sampling effort. Six sediment core samples were collected in 1999 from in and around the Gowanus Canal Flushing Tunnel (Figure 2). Toxicity characteristic leachate procedure (TCLP) analysis for metals, pesticides, herbicides, volatiles, acid extractables, base neutrals, TPJ PCBs were conducted. Corrosivity, ignitability, and reactivity were also analyzed. Six whole samples were analyzed for priority pollutant metals and volatiles. Results of TCLP analyses were near or below diction limits.

In the Gowanus Flushing Tunnel whole sediment mean concentrations of seven of the thirteen priority pollutant metals (Cd, Cr, Cu, Pb, Hg, Ni, Zn; no data were available for Se, Ag, and Tl) were greater than the “high” concentrations for these metals, developed



by Daskalakis and O'Connor (1995), based on data from the NOAA National Status and Trends (NS&T) Program. A “high” concentration in sediments was defined as the geometric mean concentration plus one standard deviation of the NOAA NS& T Site means. Concentrations of volatile organics in the Flushing Tunnel whole sediments were nearly all undetected, with the exception of toluene, chlorobenzene, ethylbenzene, and xylenes.

These data provide useful information regarding sediment chemistry conditions at the time of the Flushing Tunnel reactivation in 1999. It is possible that changes in water quality (e.g., flow rates, DO) associated with the operation of the tunnel may have impacted the sediment chemistry, particularly with regard to chemical bioavailability.

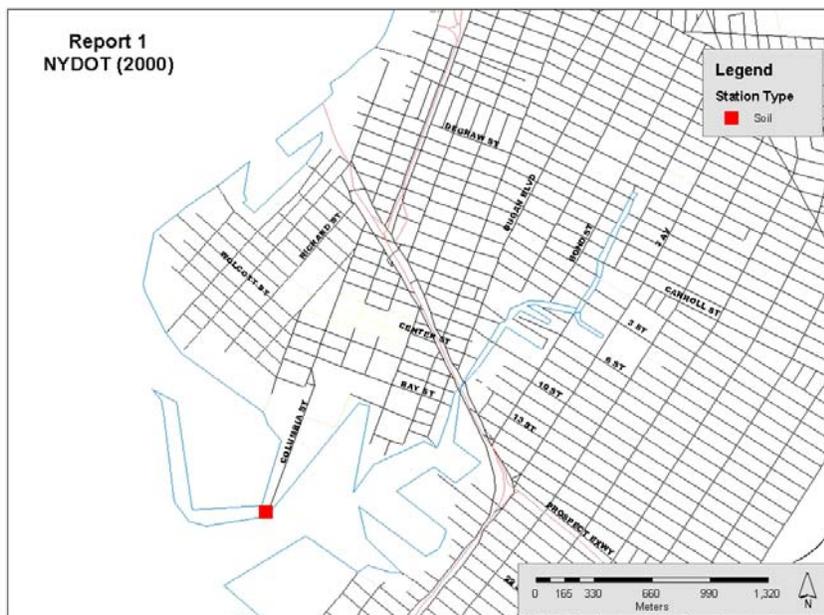


Figure 1. Soil Sampling Locations Evaluated for the Gowanus Expressway Tunnel Study (NYSDOT, 2000)



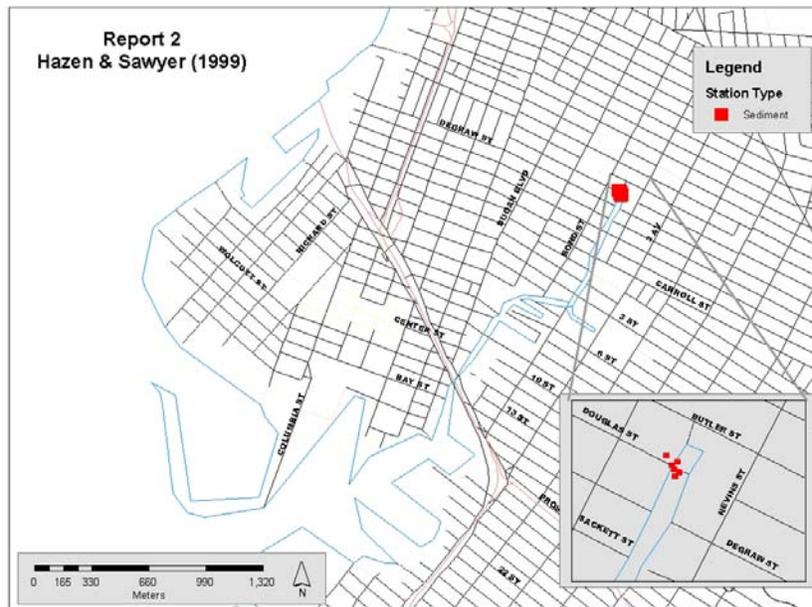


Figure 2. Sediment Sampling Stations Located Near the Mouth of the Flushing Tunnel (Hazen and Sawyer, 1999)

3. Draft Facilities Planning Report. The City of New York Department of Environmental Protection Inner Harbor CSO Facility Planning Project (NYCDEP, 1993)

The purpose of this study was to identify, measure and evaluate Combined Sewer Overflow (CSO) impacts in the Inner Harbor planning area. During the summer of 1989, CSO discharges were examined in the Lower East River, Hudson River, Upper New York Bay and the Gowanus Bay, Creek, and Canal.

Water samples were taken at five locations in the Gowanus Canal and Channel for determination of water quality conditions (Figure 3) in both wet weather and dry weather sampling events. Water quality parameters included DO, total and fecal coliform, enterococci, BOD, TSS, TKN, ammonia, nitrites and nitrates, chlorophyll-*a*, and oil and grease. Results of the water quality monitoring program were used to develop a water quality model, which was also presented in an additional document, Inner Harbor CSO Facility Planning Project, Task 4.3B, Gowanus Canal Monitoring (NYCDEP, 1993b).

Sediment core samples were collected at seven locations in the Gowanus Canal (Figure 3). Locations of two of the sediment sampling stations were not clearly indicated on the map provided and were estimated based on information in the report.



2000. These surveys included abundance and species diversity of benthic and nekton/plankton communities. Data collected after the reactivation of the tunnel indicated increased DO levels, and showed signs of initial benthic recovery.

These data provide relatively recent information regarding water and sediment quality following the reactivation of the flushing tunnel, as well as the potential impacts on the aquatic community structure. However, samples are primarily focused on the area closest to the tunnel.

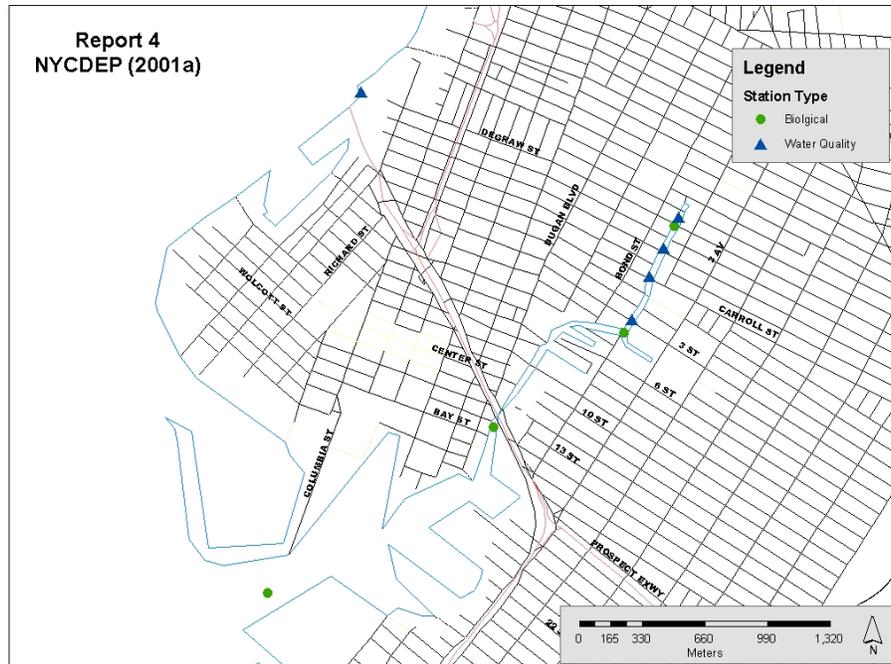


Figure 4. Water Quality and Biological Sampling Stations (NYCDEP 2001a)

5. Unpublished Data Stored in the Contaminant Assessment and Reduction Program (CARP) Database Related to the Harbor Sediment Trackdown Sampling Project (CARP, 2002a)

Sediment data collected from throughout NY Harbor are summarized in the CARP database. Of these data, only one sampling station was located within the study area (Figure 5). This station represents one sampling event in 2000.



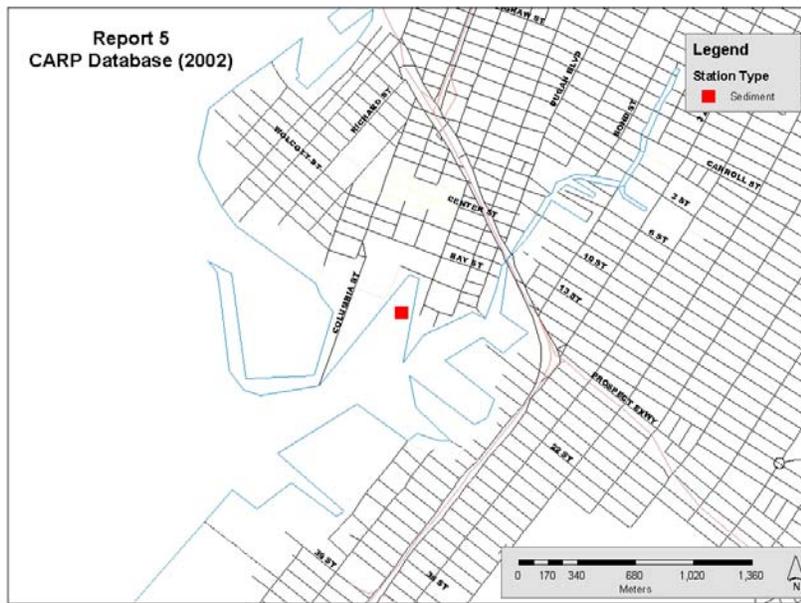


Figure 5. Sediment Sampling Locations from CARP (CARP, 2002a)

6. Unpublished Data Stored in CARP Database Related to the Harbor Loading and Trackdown Project (CARP, 2002b)

Water quality data collected from throughout NY Harbor are also summarized in the CARP database. Of these data, relevant samples were collected in 1999 (2 sampling events) and 2000 (1 sampling event) from one location within the Gowanus Canal and Bay area (Figure 6).



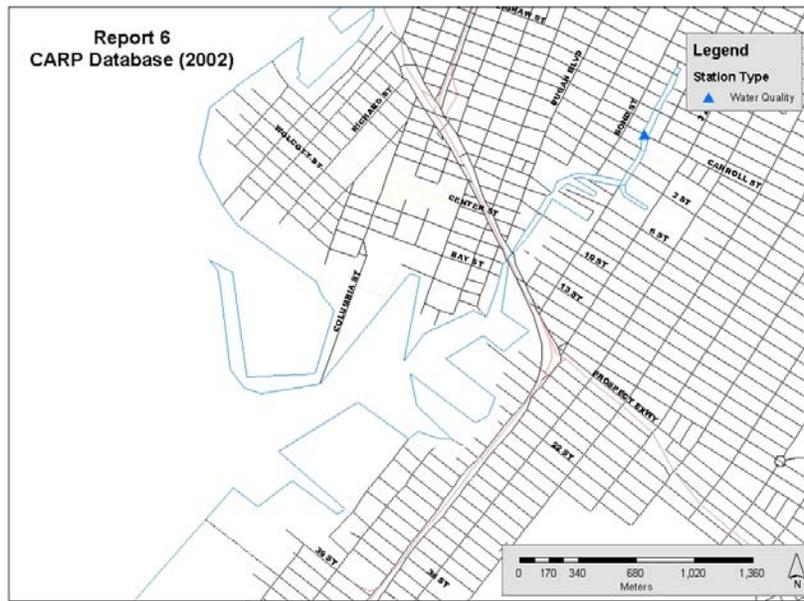


Figure 6. Water Quality Sampling Locations from CARP (CARP, 2002b)

7. Harbor Survey (NYCDEP, 2001b; 2003)

NYCDEP has conducted a water quality sampling survey annually from 1997 to 2001. A report is prepared each year and published online. The survey consists of 45 stations, 33 in the Harbor and 12 in the smaller waterways. Two of the stations evaluated were located within the Gowanus region (Figure 7). In addition to the water quality information, a fish survey was also conducted, reportedly finding that fish are relatively abundant within the Bay area.

Reports from the two most recent survey years were reviewed for this data assessment. This evaluation provides relatively recent information about the water quality of Gowanus Bay, however, without access to the full data report, the utility of the data is limited.



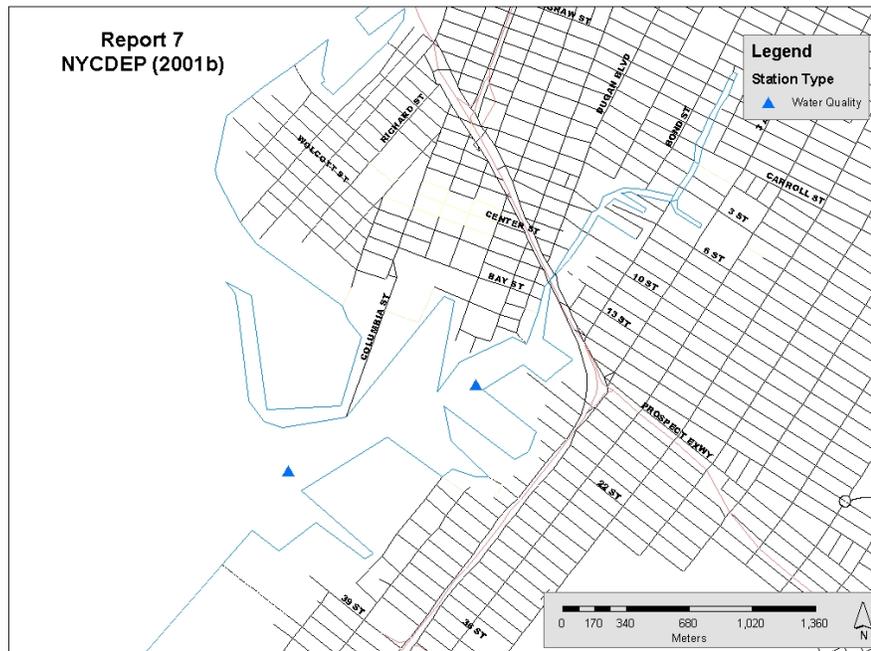


Figure 7. Water Quality Sampling Stations from the Harbor Survey (NYCDEP 2001b; 2003)

8. Red Hook Flats Dredged Material Evaluation Reports (USACE, 1997; 2001b)

These two data reports summarize the results of chemical analyses of water/elutriate, sediment, and tissue samples in support of an evaluation of dredged material from Red Hook Flats proposed for ocean disposal. For each dredged material evaluation (one conducted in 1997 and one in 2001), multiple sediment core samples were collected from the Red Hook Flats area and composited to form one representative sample for chemical analysis and measurement of physical parameters, as well as benthic acute toxicity tests, water column toxicity tests, and bioaccumulation studies with the clam, *Macoma nasuta* and worm, *Neries virens*. Site water samples were analyzed for chemical constituents, and were also combined with composite sediment to create elutriate for chemical analysis.

The sediment sample used for analyses and tests was a composite, intended to represent the entire Red Hook Flats area to be dredged, near the mouth of Gowanus Bay. Therefore, the sample location presented (obtained from the CARP (2002a, b) database for data collected in 1997, and assumed to be the same for data collected in 2001) is an estimation, representing the dredging site (Figure 8).



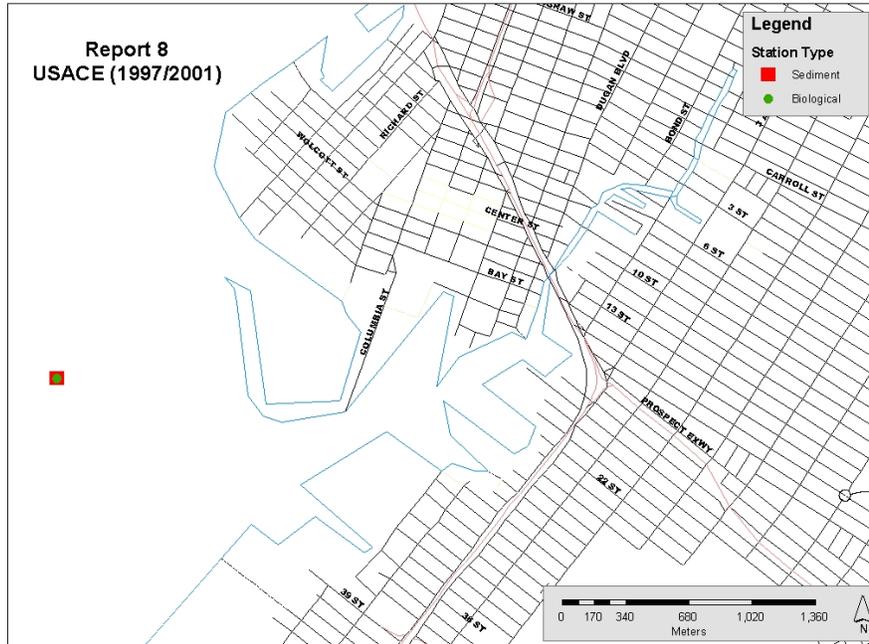


Figure 8. Biological and Sediment Chemistry Sampling Stations at Red Hook Flats (USACE 1997; 2001b)

9. Regional Environmental Monitoring and Assessment Program (REMAP) Trend Assessment in the NY/NJ Harbor System (EPA 1998)

This report provides sediment, water quality and biological data collected from throughout the NY/NJ Harbor system during one sample event in 1998. However, only one of the stations sampled was located in the vicinity of Gowanus Bay (Figure 9). These data are still being validated, therefore, a full report has not yet been prepared.



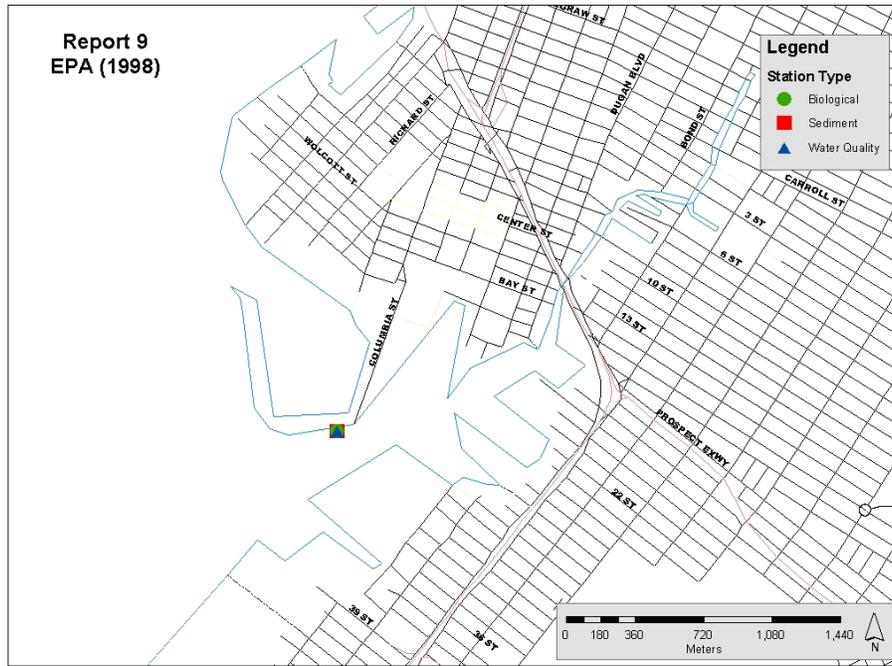


Figure 9. REMAP Sampling Stations (EPA, 1998)

10. Baseline Biological Monitoring Program Conducted in Support of the New York and New Jersey Navigation Study EIS (USACE, 1999).

The purpose of this investigation was to compile presence/absence data for benthic macroinvertebrates and fish from areas throughout the NY Harbor to establish a community baseline for evaluation in an Environmental Impact Statement (EIS). As part of this investigation, four benthic sampling stations and multiple fish trawls were included within the Gowanus Bay area (Figure 10). Sampling was conducted monthly from October 1998 to September 1999. An on-line summary of the data collected is provided.



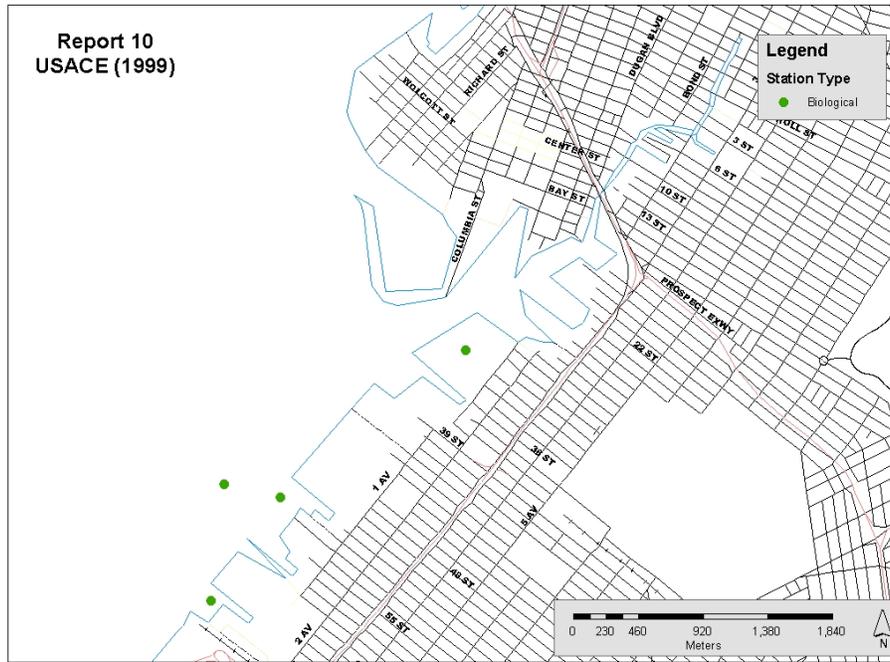


Figure 10. Baseline Biological Monitoring Stations (USACE 1999)

11. Benthic Habitats of New York/New Jersey Harbor (NOAA, 1996)

The objective of this National Oceanic and Atmospheric Administration (NOAA) study was to map benthic habitats within the NY/NJ Harbor. Data were collected in 1995 using both sediment grabs and sediment profile imagery (SPI). The study design included four sediment grabs and approximately 20 SPI locations within Gowanus Bay, however no samples were collected within the Canal (Figure 11).



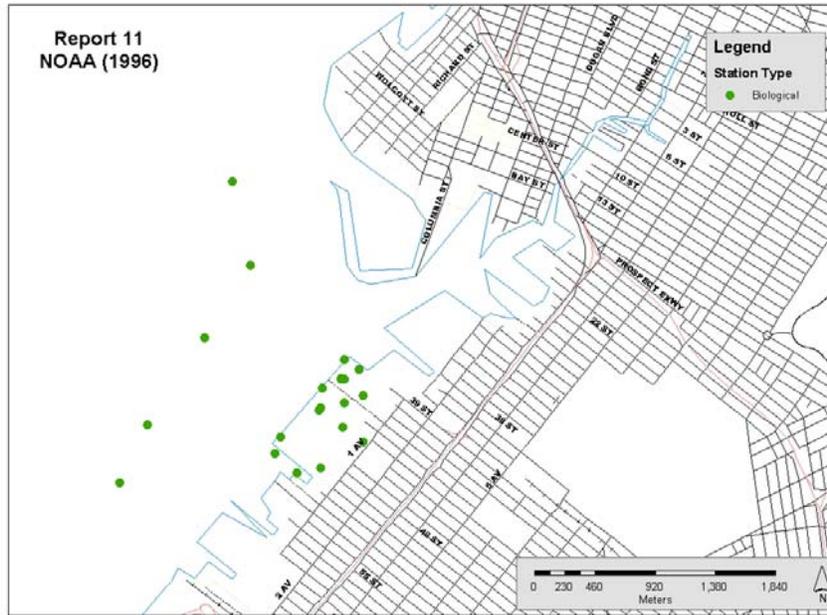


Figure 11. Benthic Habitat Sampling Locations (NOAA, 1996)

12. Use and Standards Attainment (USA) Project (NYCDEP, 2002a)

The following documents and Field Sampling and Analysis Plans (FSAP) were prepared by NYCDEP in support of the USA project. The primary goals of the USA project are to define beneficial use goals for the waterbodies evaluated and to provide the technical, scientific, and economic basis to support the regulatory process needed to define water quality standards. The FSAPs identified describe proposed sampling efforts for obtaining the data necessary to achieve these goals. Much of the data proposed for collection is outside of the study area for the Gowanus Restoration Program, however, these documents will be useful in developing the sampling strategy in Task 3.

The following components of the USA Program contain data relevant to the Gowanus Study Area:

12a. Harbor-wide Ichthyoplankton Field Sampling and Analysis Program, Year 2001 (NYCDEP, 2001) The NYCDEP collected water samples within the NY Harbor and analyzed them for presence/absence of ichthyoplankton. They also performed basic water quality tests (Secchi depth, temperature, salinity, and DO) on the samples. The purpose of this study was to determine which fish were expected to spawn within the NY Harbor. There was only one station located within the Gowanus Study Area.



12b. Work Plans for Land Use Analyses and Characterizations of Shoreline Areas (November, 2002) The NYCDEP desired to characterize the land uses within the watersheds of each USA Project waterbody. They were interested in examining the impact that present and potential land use has on the adjoining watersheds. The land uses were characteristics are commercial, industrial, open space and outdoor recreation, public facilities and institutions, residential, transportation and utility, vacant land, mixed use, and other and waterfront recreational. They also evaluated the biological and physical condition of the shoreline. The classifications were performed on all land within a ¼ mile radius of the waterbody.

12c. Harbor-wide Epibenthic Recruitment and Survival Field Sampling and Analysis Program (Years 2001-2002) The NYCDEP performed epibenthic recruitment studies in the 23 USA Project waterbodies. They also examined secchi depth, temperature, salinity and DO at the same station locations. The purpose of this study was to determine if the epibenthic community is limited by poor water quality. The study was performed in 2001-2002 and there was one station located within the Gowanus Study Area.

12d. Tributary Benthos Characterization Field Sampling and Analysis Program Year 2002 (June, 2002) The NYCDEP examined TOC, percent solids and grain size throughout NYC waterbodies in the summer of 2002. Their goal was to use the data to provide the basis for calibrating the sediment TOC of their water quality model. Seven of the stations were within the Gowanus Study Area.



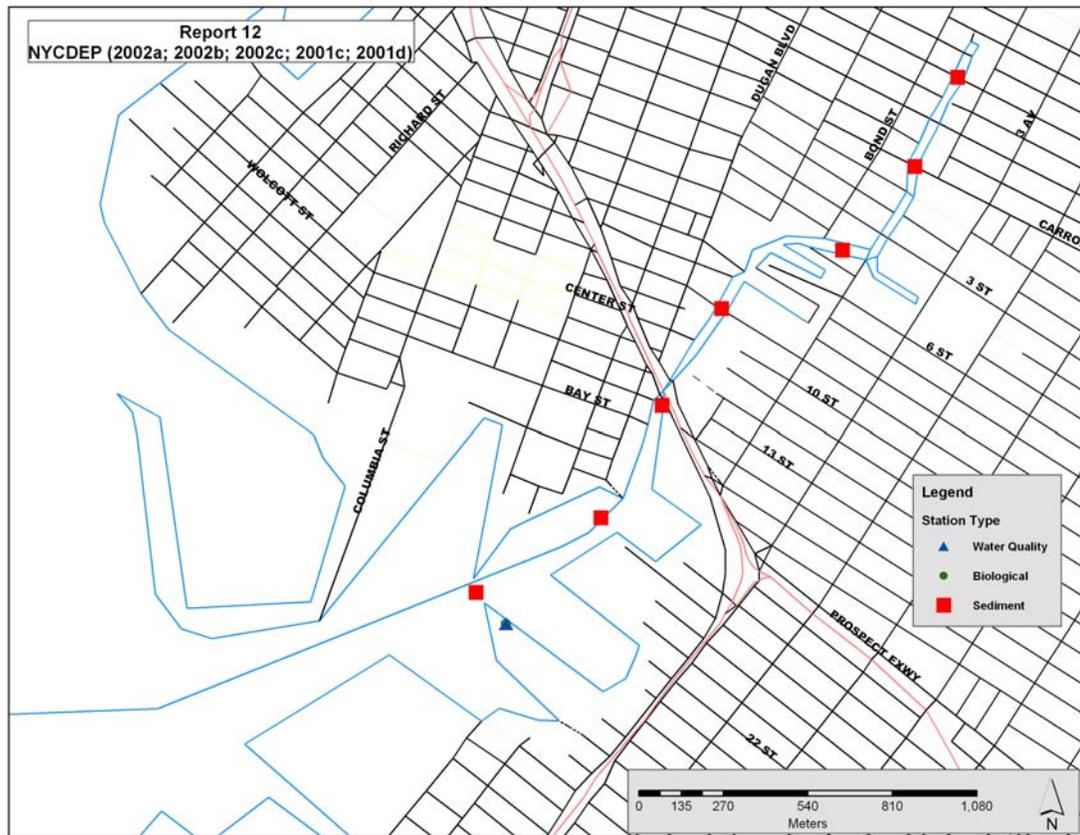


Figure 12. Use and Standards Attainment (USA) Project

13. Gowanus Canal Bulkhead Inventory Study (GCCDC, 2000)

The Gowanus Canal Community Development Corporation (GCCDC) conducted an inventory survey of the fill retaining structures within the Gowanus Canal. Each structure was visually examined and summarized regarding its condition, the type of construction, the length of the bulkhead, depth of water from mean low water and the length of the deck above mean low water. The report provided photographs of the bulkheads, descriptions of the type of construction, and georeferenced site plans.



**14. Remedial Investigation Work Plan-Citizens Gas Works,
Former Manufactured Gas Plant Site
(GEI Consultants, 2003)**

GEI Consultants, Inc. prepared a Remedial Investigation Work Plan for the Citizens Gas Works former Manufactured Gas Plant (MGP) site. This site, located in the Carroll Gardens neighborhood of Brooklyn, NY, consists of four parcels of land that border the Gowanus Canal. The workplan describes proposed sampling that will be conducted in support of the Remedial Investigation. This sampling was designed to identify potential source areas, determine the nature and extent of contamination, pathways of contaminant migration and possible receptors, and an evaluation of the need for corrective measures, if any. In addition, a qualitative human health risk assessment was scheduled to begin in 2003.

Previous investigations at the site indicated the presence of elevated concentrations of volatile and semivolatile organic compounds (VOC/SVOC), polyaromatic hydrocarbons (PAH), and metals in the soil. Historical data collected at the site are summarized, however, specific sampling locations are not provided.

**15. Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, New York
(Draft)
(USACE, 2003a)**

In spring 2003, the USACE-New York District, in partnership with the USACE Baltimore District, partnered to plan and conduct a comprehensive site investigation of the Gowanus study area. Subsurface drilling and sampling was conducted to characterize the geotechnical, chemical, and bacteriological conditions of the sediment within the Gowanus Bay and Canal. Thirty separate borings were taken, drilled in a systematic pattern in the Bay and Canal. Sediment samples were analyzed for physical parameters including grain size, plasticity, density, and moisture content. Selected sediment samples were analyzed for bacteriological analysis (total Coliform) and chemical contaminants, including volatile and semivolatile organic compounds, pesticides and PCBs, RCRA metals, mercury, and total petroleum hydrocarbons.

A benthic community assessment was conducted as a component of the spring 2003 Site Investigation (USACE, 2003b). Benthic taxa were identified and taxon abundance were determined in samples from 29 sites. Water quality parameters, including DO, pH, salinity, depth, and turbidity in nephelometric turbidity unit (NTU) were also measured at each of the benthic sampling stations.



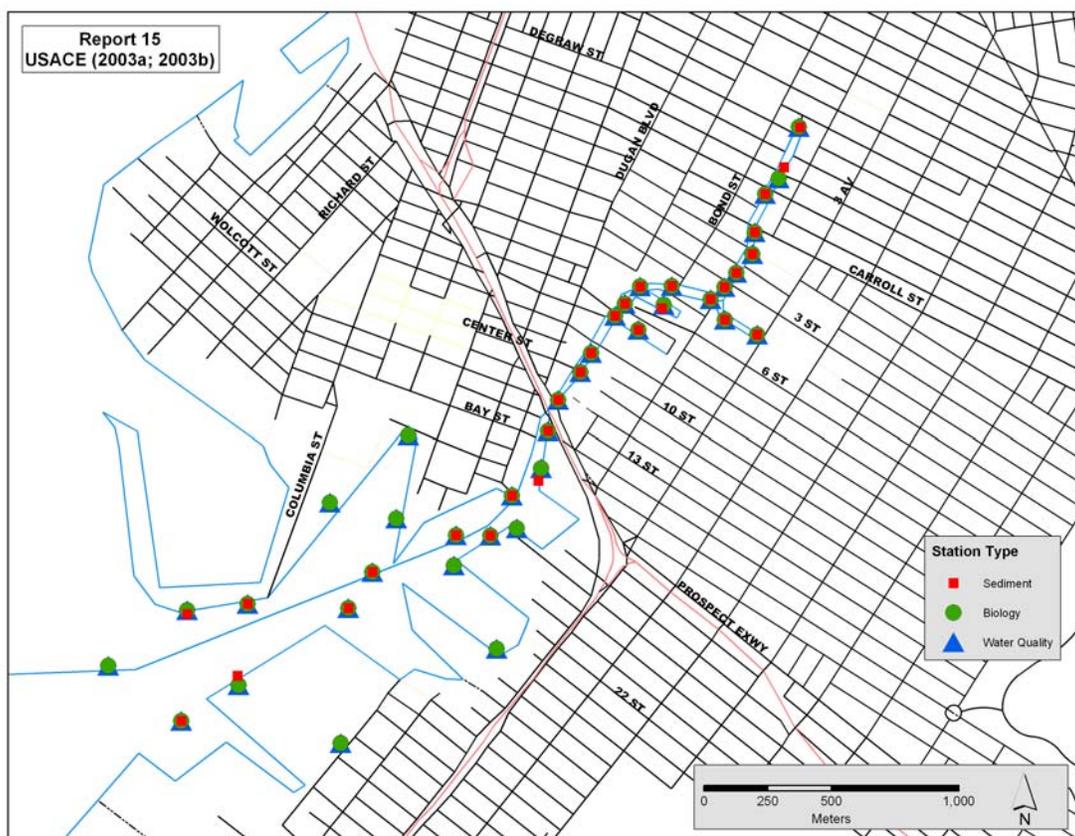


Figure 13. Site Investigation, Gowanus Bay and Gowanus Canal, Kings County, New York (Draft)

16. Toxic Targeting Property Map, Gowanus Canal (Toxic Targeting, 2003)

The company, Toxic Targeting, identified the potential toxic locations within the Gowanus Canal. They provided information regarding inactive hazardous waste disposal sites; hazardous waste treater, storer, disposer locations; hazardous substance waste disposal sites; major oil storage facilities; chemical storage facilities; wastewater discharge; civil enforcement docket facilities, solid waste facilities; toxic and air release sites; and historic utility sites. A map of the area surrounding the Gowanus Canal is located at the following website: <http://www.toxicstargeting.com/gowanus.htm>



17. Final Environmental Impact Statement for the Comprehensive Solid Waste Management Plan (Draft) (NYC Department of Sanitation, 2000)

The NYC Department of Sanitation provided an environmental analysis of sites and facilities accessible to barge or rail transporters of solid waste. A final environmental impact statement (FEIS) was prepared for 15 sites within the New York City area. One of the sites was Hamilton Avenue Modified Transfer Station, whose property edge borders the Gowanus Canal. The FEIS summarizes information regarding land use, zoning, neighborhood character, open spaces, parklands, and natural resources.

4.0 OVERALL FINDINGS OF DATA ASSESSMENT

Seventeen data sources, consisting of reports and other documents, data sets, and web sites that are relevant to the Gowanus study area, have been identified and reviewed for this analysis. A number of these data sources, including the NYCDEP Harbor Survey, NYC Use and Standards Attainment Project, and EPA REMAP represent ongoing studies or programs carried out over a period of multiple years. These sources of information are useful for monitoring the temporal conditions in the study area and should be consulted for updates that may become available. A summary of the reports evaluated, organized by data type, is provided below.

4.1 Sediment Quality Data

Eight data sources were identified that contain information relevant to sediment quality in the Gowanus Study Area. Most of these reports included analysis of priority pollutant metals, volatile and semivolatile organic compounds, and specific pesticides, herbicides, PCBs, and PAHs. In addition, some of the studies included physical properties (e.g., grain size, TOC, and total solids) or engineering parameters, such as density, plasticity, and Atterberg limits. However, for the purpose of establishing baseline conditions in the Study Area, the utility of most of these data is limited, due to the number or location of samples or the date of sampling. For example, many of these data were collected prior to the reactivation of the flushing tunnel and, therefore, may not reflect current conditions. In addition, many of the individual studies evaluated sediments from only a small number of locations; therefore, it is difficult to get an accurate spatial representation of sediment characteristics. The most comprehensive sediment quality evaluation conducted to date was the recent USACE Site Investigation (Data Source #15; USACE, 2003). This investigation involved the collection of physical and chemical data from 25 locations spanning the entire length of the canal. At each location, a variety of analytes (e.g., TOC, grain size, priority pollutant metals, SVOCs, pesticides) were collected from multiple depths. The primary limitation associated with these data is that individual parameters do not appear to have been consistently evaluated across the various depths at



each location, creating data gaps. Despite that limitation, these data do provide the best available information on the current horizontal and vertical profile of sediment type and contaminant levels within the Gowanus Canal.

Overall, the existing sediment quality data provide a general background on the current and historical distribution of contaminants and sediment type throughout the Canal. Based on this information, assumptions can be made about the primary chemicals and areas of concern. Additional surface sediment chemistry information may be required to fully characterize the potential exposures to aquatic receptors for the purpose of the baseline evaluation.

4.2 Biological Data

Eight studies evaluating the aquatic community within the Gowanus Study Area were identified and reviewed. The majority of these evaluations focused on the abundance and species diversity of benthic invertebrates, although a few also considered plankton (Data Sources #4 and #12a) or fish (Data Source #10). In addition, one study (Data Source #12b) provides a biological classification of the adjacent land. The majority of these evaluations, however, are focused on areas within the Gowanus Bay, providing little information about the aquatic community within the Canal itself. The recent USACE Site Investigation, (Data Source #15; USACE, 2003a) provides the most comprehensive evaluation of the benthic community within the Canal itself, providing a measure of species abundance and diversity at 29 surface sediment locations spread along its entire length. These data, combined with the information collected by NYCDEP (Data Source #4; NYCDEP, 2001a) are likely to provide a good indication of the existing benthic community. However, information about other aquatic species (e.g., fish, plankton) within the Canal is still lacking.

4.3 Water Quality Data

Nine studies that included various measures of water quality within the Gowanus study area were identified. Most of these evaluations focused on standard parameters such as dissolved oxygen (DO), temperature, and salinity, however, a few also include Secchi depth measurements, suspended solids, or chemistry (e.g., metals, PAHs, PCBs) results. As indicated for the other data types, much of this information is limited either by the location of the sampling (primarily focused on Gowanus Bay), the small sample sizes (many studies have only one sampling point), or the date of sampling (most of the studies were conducted prior to the reactivation of the flushing tunnel). However, two studies, the Reactivation of the Gowanus Canal Flushing Tunnel, (Data Source #4, NYCDEP, 2001a) and the USACE Site Investigation, (Data Source #15; USACE 2003a; b) do provide relatively recent data from within the Canal. The NYCDEP (2001a) study was designed to evaluate the impacts of the Flushing Tunnel on water quality in the Canal and, therefore, includes DO, temperature, salinity and velocity data from both before and after it was reactivated, providing a temporal comparison. The USACE Site Investigation



(USACE, 2003) provides recent DO, pH, salinity, depth, and turbidity information from 29 locations spanning the length of the Canal. Together, these evaluations provide an adequate profile of some of the basic water quality parameters necessary to evaluate aquatic habitat. However, for the purpose of establishing a baseline, information on dissolved chemical concentrations in the water column is generally lacking.

4.4 Bathymetry Data

Only one study summarizing bathymetric data for the Canal was identified, the Inner Harbor CSO Draft Facilities Planning Report, (Data Source #3; NYCDEP, 1993). This data was collected as part of the inner harbor combined sewer outfall (CSO) facility planning project, to aid in the development of a water quality model. However, the data was collected in 1992, and therefore does not reflect current conditions.

4.5 Land Use

Seven studies were identified that provide information regarding the use or classification of the land adjacent to the Gowanus Canal. Two of the studies, the Gowanus Expressway Tunnel Study, (Data Source #1; NYSDOT, 2000) and the Inner Harbor CSO Draft Facilities Planning Report, (Data Source #3; NYCDEP, 1993) may be of limited utility either due to their focus on a small area or the date of data collection. However, the remaining studies appear to provide a fairly comprehensive picture of the surrounding land use, property ownership, and available natural resources.

4.6 Overall Summary

Although multiple studies have been conducted in and around the Gowanus Bay and Canal study area, none were specifically designed to address all data gaps for the baseline characterization of the water and sediment quality of the area, or the surrounding habitat. As a result, most of the studies identified have a limited number of samples and are focused on very specific data types. For example, the majority of the sampling locations were located either in the Bay or at the mouth of the Flushing Tunnel, with few samples collected from the length of the Canal or along the shoreline. In general, mainly surface conditions have been evaluated, and only a few of the studies collected more than one data type (e.g., sediment quality, biological data, water quality) at each station or conducted more than one sampling event. In addition, many of the studies were conducted prior to the reactivation of the flushing tunnel and, therefore, may not reflect current conditions. The recent USACE Site Investigation (USACE, 2003a,b) evaluation provides the most comprehensive evaluation of benthic community as well as current sediment and water quality parameters conducted to date, however, there are some limitations associated with those data as well, as noted above.

Sufficient data likely exist to initiate the development of a preliminary baseline. However, data gaps do still exist. The most critical is the absence of spatially or



temporally co-located sediment and biological data (e.g., benthic community, toxicity, tissue burden data), which makes it difficult to draw definitive causal relationships between elevated sediment concentrations and observed degradation in the aquatic community. These types of data are required to identify and quantify current exposures as well as to focus restoration efforts. Future data collection should focus on providing representative sediment samples from key areas within the Canal and Bay, including the shoreline, both at surface and at depth. All relevant data types (i.e., sediment quality, water quality, biological data) should be collected from each sampling location to ensure that potential links between observed benthic and fish community structure and sediment and water quality can be identified. In addition, information regarding sedimentation rates and chemical contamination at depth will be required to evaluate potential restoration options.



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