WOODS HOLE GROUP

US Army Corps of Engineers
New England District

LONG ISLAND SOUND DREDGED MATERIAL MANAGEMENT PLAN (DMMP)

ENVIRONMENTAL DATA UPDATE VOLUME I: REPORT

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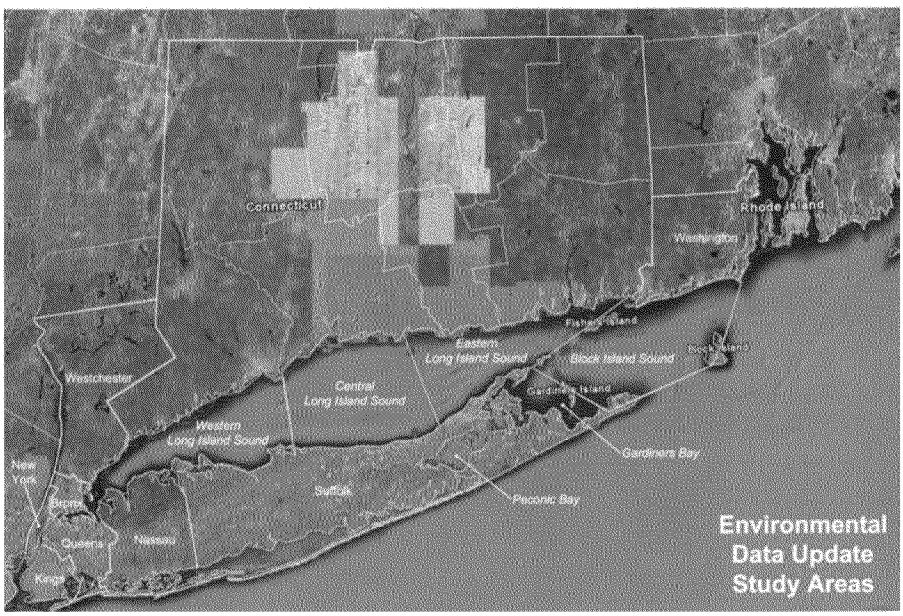

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1.0 INTRODUCTION

The US Army Corps of Engineers (USACE) is conducting baseline efforts to formulate alternatives for the management of dredged material in Long Island Sound. As part of that effort, Woods Hole Group, Inc. was contracted to develop an environmental data update for Long Island Sound. This report describes the environmental update project. An accompanying database of environmental data sources was developed to further summarize the data and provide references and contact information for all data described herein.

1.1 PURPOSE OF STUDY

Prior to this study, a comprehensive database of information relevant to the management of dredged material in Long Island Sound (LIS) was compiled by the USACE (1999) in support of a 2004 Environmental Impact Statement (EIS) on the designation of two dredged material disposal sites in Long Island Sound (USEPA, 2004). The previous database (USACE, 1999) described environmental data (and other information relevant to management of dredged material) for 1998 through December 2001. Woods Hole Group subsequently performed a Phase I Literature Review Update (Woods Hole Group, 2009) which identified more recently published (2002-2008) data and information for the study region. The intent of the current project, the Environmental Data Update, was to update environmental information in the comprehensive database from the 2004 EIS effort (USACE, 1999) using information obtained from the Phase I Literature Review Update task, and from other sources including Federal and State agencies and research institutions.

This Environmental Data Update task identified and summarized environmental data developed between 2002 and November 2009. Some documents of interest from the Phase I were determined to have been published before 2002 during the Environmental Data Update Task; these documents were retained in the database because they were of interest to USACE. This report and the accompanying database will provide USACE with an overview of current environmental data for Long Island Sound, and will offer information on data gaps and potential research needs. Ultimately this project will aid the USACE in developing alternatives for management of dredged material in the Long Island Sound area.

1.2 OVERVIEW OF WORK PRODUCT

The main work product of the LIS Dredged Material Management Plan (DMMP) Environmental Data Update is a Microsoft Excel workbook documenting the data sources encountered and reviewed for the project. The database was developed following the format of the 1999 Long Island Sound Dredged Material Disposal Database (USACE, 1999).

Two other work products were produced to summarize the environmental data obtained, and to facilitate review of the database. A summary report (this volume, Volume 1)

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presents the approach used in updating the environmental data source database, and summarizes the results of this work. Volume II includes a discussion of the format of the database and presents an abridged version of the database formatted for printing to facilitate in-report review. The full version of the database is provided electronically, as a Microsoft Excel workbook, on an accompanying DVD+R.

2.0 METHODS

Environmental data sources were identified by contacting researchers and Agency leads involved in data collection in the Long Island Sound area[1] and by doing standard data/information searches using online search engines. Because of their involvement with Long Island Sound environmental issues, the following institutions were targeted as potential sponsors of relevant data sources:

- US Environmental Protection Agency (USEPA)
- US Fish and Wildlife Service (USFWS)
- National Oceanic and Atmospheric Administration (NOAA) and National Marine Fisheries Service (NMFS)
- United States Geological Survey (USGS)
- US Army Corps of Engineers, New York District (USACE–NYD) and New England District (USACE-NAE)
- US Navy
- US Coast Guard
- Connecticut Department of Environmental Protection (CTDEP)
- New York State Department of Environmental Conservation (NYSDEC)
- New York Department of State (NYDOS)
- Rhode Island Coastal Resources Management Council (RICRMC)
- University of Connecticut (UCONN)
- University of Rhode Island (URI)
- State University of New York (SUNY)
- Woods Hole Oceanographic Institution (WHOI)

At the start of the project a number of Points of Contact (POCs), many of them working at the above institutions, were provided to Woods Hole Group by USACE. These individuals were contacted by phone and by e-mail for relevant information (see Attachment A for details on query structure).

Other important sources of information included the previously mentioned 2004 EIS for designation of two disposal sites in LIS (USEPA, 2004) and the Phase I Literature Review Update prepared for the USACE (Woods Hole Group, 2009).

1 The study area for this analysis includes coastal and navigable waters of Long Island Sound and its tributaries, as well as upland areas in Connecticut; Washington County in Rhode Island; and Suffolk, Nassau, Bronx, Queens, and Westchester Counties, Manhattan Borough (New York County) and Brooklyn Borough (Kings County) in New York.

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Data sources identified by POCs or by other means were obtained by downloading or by mail, reviewed for appropriate content, and summarized in an Environmental Data Spreadsheet (an Excel spreadsheet). The spreadsheet format was based on the existing Long Island Sound dredged material disposal database (USACE, 1999). All fields included in the prior database are included in this one. A key to the fields in the spreadsheet is included in Volume II of this report. The spreadsheet itself is provided on a separate DVD+R, and an abridged, printable version is included in Volume II.

During the review of documents, environmental data sources were categorized by topic and study location in the database. All topics included in the 1999 Database (USACE, 1999) are included in this list. Therefore there are several topics (economic data, archaeological resources) for which no new environmental data or reports were identified. These were retained for continuity with the prior database. Study location categories were revised from the 1999 Database (USACE, 1999), in consultation with USACE-NAE, to address the specific needs of the Environmental Data Update. Definitions of the topic categories (verbatim from USACE, 1999) and location categories are provided below.

Topics

Benthic (macro-invertebrate) resource - Information on the presence of benthic resources in Long Island Sound, at and outside of the existing and historic disposal sites. Information on recolonization and species assemblages as an indicator of toxicity. Information on biodiversity.

Coastal Management - Information on coastal management approaches, policies. Erosion control. Shoreline uses.

Ecology, Habitats and Species - Information on specific habitats/species

Economic data and Analysis - Information on economic data and reports or studies on navigation traffic, usage and economic benefits of waterborne commerce in the Sound and its value as a commercial waterway by canvassing and interviewing marine trades associations, port authorities, harbor associations, fishermen's group and regional recreational boating groups and interests.

Environmental evaluation and economics of disposal options - Information and studies on dredged material disposal costs for alternative disposal methods and sites, costs of dredged material testing and evaluation. Information on environmental evaluation of management options available for such alternative sites and methodologies.

Fisheries/shellfisheries - Information on the presence of fish and shellfish including spawning, nursery (larvae) and migration, particularly information based on trawl and similar sampling efforts. Presence and extent of fishing and shellfishing grounds and areas and aquaculture within the Long Island Sound Region, whether natural or managed, commercial or recreational. Information on the economic value of fisheries and shellfisheries, including catch/effort and locations for lobster. Location and evaluation of

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essential fisheries habitat areas and presence, extent and value of submerged aquatic vegetation.

Fishing Activities and Human Health Risks - Contamination of fish catch, biomagnification of contaminants and consumption, particularly from disposal site vicinity. Human health effects of LIS caught seafood consumption. Information on the incidence and location of past blooms of nuisance and toxic phytoplankton species. Information on State Health advisories in the Sound including locations, incidences, contaminants, and species.

General Interest – Articles published in large circulation newspapers (or in newsletters and websites) that do not align with any other topic category described herein.

Geology and Geomorphology - Information on geological structure of Long Island Sound and coastlines. History of the geological features. Geochemistry.

Historic disposal activities and dump sites - Information on past dredged material disposal activities. Information on effects of disposal and capping at disposal sites. (Note: appropriate nomenclature for this category is "Historic disposal activities and disposal sites," however historic nomenclature is preserved in the database to facilitate merging with prior databases and future querying.)

Historic, cultural and archaeological resources - Location of known and potentially significant cultural, historic and archaeological resources in the LIS region.

Marine Wildlife and Endangered Species - Information on presence and geographical extent of marine wildlife, Federal and State listed species and critical habitats.

Physical Impact of Fishing Activities - Locations of fishing grounds, particularly for draggers. Effect of dragging activity on disposal mound integrity and benthic recolonization.

Physical oceanographic - Hydrography (detailed bathymetry), waves and wind fetch, currents and water circulation information, and storm frequency and their effect on disposal sites. Erosion/deposition data and sediment transport information for disposal sites and the Sound as a whole.

Public parklands, beaches and sanctuaries - Location of public parks and beaches and other public waterfront uses potentially affected adversely by dredging and the disposal of dredged material. Location/identification of sanctuaries potentially adversely affected by dredging and the disposal of dredged material. Also includes information on valuable habitats such as tidal marshes.

Sediment - Sediment information and mapping, including side scan data, particularly in formats useful in developing maps of the Sound. Also sediment chemistry data and analysis.

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State Dredged Material Disposal Guidance - Information and guidance developed by the states of Connecticut and New York, and where appropriate, Rhode Island, to regulate dredged material disposal and disposal site identification, screening, use, monitoring and management.

Water quality - Water column chemistry data and investigations. Measurement and variability of water quality data throughout the Sound. Nutrient (enrichment).

Meteorology - Information on meteorological and climatic conditions.

Locations

Entire LIS – Long Island Sound. Bounded on the west by the line between Throgs Neck (NY) and Willets Point (NY), and on the east by the line between Sandy Point (RI) and Orient Point (NY) through the chain of islands including Fishers, Plum and the Gulls.

Western LIS – Western Basin of Long Island Sound. Bounded on the west by the line between Throgs Neck (NY) and Willets Point (NY), and on the east by the line between Stratford Point (CT) and Port Jefferson (NY) along Stratford Shoal.

Central LIS - Central Basin of Long Island Sound. Bounded on the west by the line between Stratford Point (CT) and Port Jefferson (NY) along Stratford Shoal, and on the east by the line between Mulberry Point (CT) and Mattituck Point (NY) along the Mattituck Sill.

Eastern LIS - Eastern Basin of Long Island Sound. Bounded on the west by the line between Mulberry Point (CT) and Mattituck Point (NY) along the Mattituck Sill, and on the east by the line between Sandy Point (RI) and Orient Point (NY) through the chain of islands including Fishers, Plum and the Gulls.

Block Island Sound – Waters east of Long Island Sound and south of Washington County, Rhode Island. Bounded on the west by a line between Sandy Point (RI) and Orient Point (NY) (through the chain of islands including Fishers, Plum and the Gulls) and continuing to the midpoint of Montauk Point (NY) (through Gardiners Island). Bounded on the east by a line from Montauk Point (NY) through Block Island (RI) to Point Judith (RI). This area is referred to as Rhode Island Sound in the 1999 Long Island Sound Dredged Material Disposal Database (USACE, 1999).

Gardiners & Peconic Bays – A complex of bays between the forks of Long Island that is bounded on the seaward side by a line from midway out Montauk Point (NY), through Gardiners Island, to Orient Point (NY).

Shoreline (CT) - Coastal lands adjacent to Long Island Sound located in Connecticut.

Shoreline (NY) - Coastal lands adjacent to Long Island Sound located in New York.

Shoreline (RI) - Coastal lands adjacent to Long Island Sound located in Rhode Island.

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Upland (CT) – Lands in Connecticut that are in the Long Island Sound watershed above the first major change in terrain features after the shoreline area.

Upland (NY) - Lands in New York that are in the Long Island Sound watershed above the first major change in terrain features after the shoreline area.

Upland (RI) - Lands in Rhode Island that are in the Long Island Sound watershed above the first major change in terrain features after the shoreline area.

After environmental data sources were downloaded, reviewed, and summarized, they were rated on their relevance to the development of a dredged material management plan. Documents were assigned a High/Medium/Low rating based on a number of criteria. Criteria for rating the relevance of environmental data included the extent and duration of data collection, the size of the area of investigation (entire LIS or a smaller sub-region), the status of the evaluated resources in the document as endangered, high-value, or regulated by a State or Federal Agency, the availability of geospatial data, and the extent to which the source provides primary, citable data.

3.0 RESULTS

Two hundred fifty environmental data sources were identified and summarized for this project. The main topics covered include Water Quality, Ecology/Habitats/Species, Fisheries and Shellfisheries, and Sediment. Combined, these topics account for 75% of the topics addressed in the documents. Figure 1 shows the distribution of topics covered. This includes all documents in the database. If a document is associated with more than one topic (there are two "Topic" fields in the database), both topics are included in the distribution calculation.

3.1 DATA SOURCES

The majority of the data sources were developed by state and federal agencies including CTDEP, USGS, NOAA, (including NMFS and NEFMC), USACE, and NYSDEC. Data sources were also developed by regional universities with significant research programs focused on Long Island Sound, such as URI, UCONN, and SUNY Stony Brook. Figure 2 illustrates the distribution of environmental data sources by sponsoring institution. Sponsoring organizations that each produced less than 1% of the data sources (two or fewer documents) are grouped in this chart as "Other Organizations."

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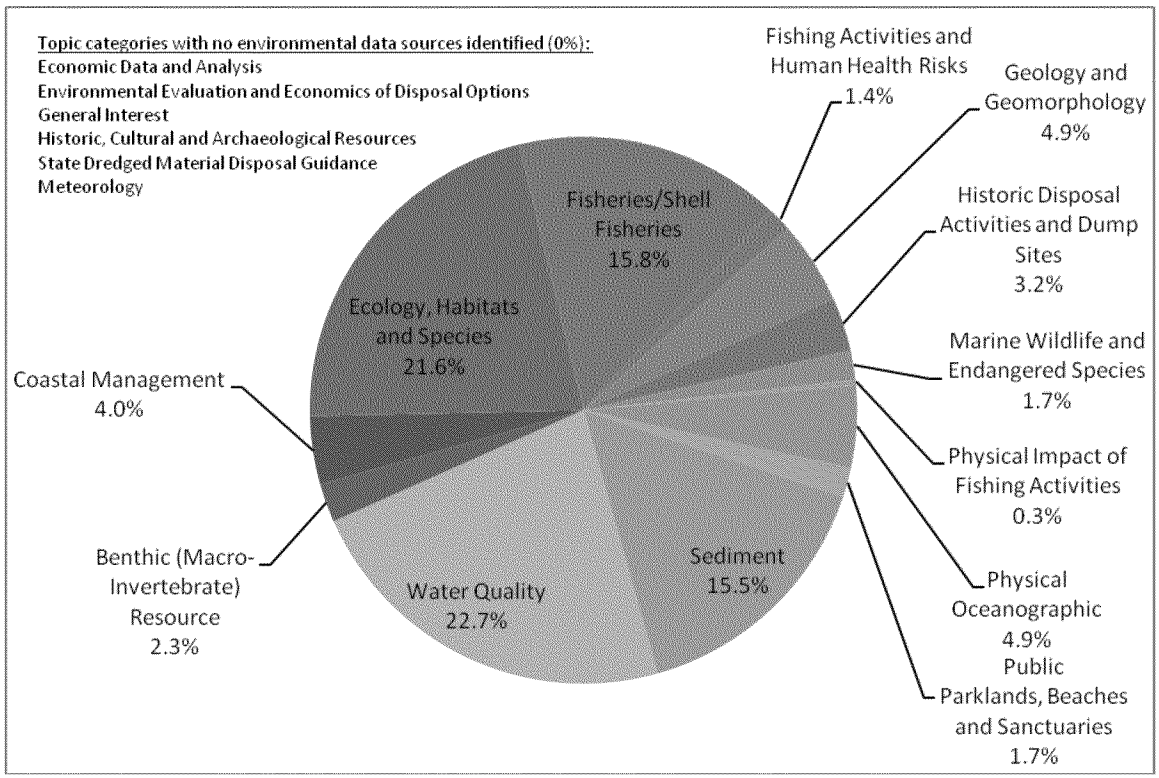

Figure 1. Topics Identified in LIS Environmental Data Sources.

Table 1 presents a matrix of topic counts by sponsoring organization. Only sponsoring organizations that produced greater than 1% of the documents in the database (more than two) were included in this matrix. Note that, in the generation of this matrix, if a document is associated more than one topic (there are two "Topic" fields in the database), those topics are counted separately. Therefore, the number of topics is not consistent with the number of documents.

Together, Table 1 and Figure 2 show that the major sponsors of environmental data for Long Island Sound are USEPA, CT DEP, USGS, USACE, UCONN, URI, and NOAA, and that the topics most often covered are water quality, ecology/habitats/species, fisheries/shellfisheries, and sediments. Physical oceanography, geology/geomorphology, and coastal management are frequently covered as well. The table and figure also show certain topics such as economic data and archaeological resources that were not covered by the data sources included in this environmental data update. These topics were included in the database for consistency with the prior database (USACE, 1999), but they are not directly relevant to the environmental data update, so no documents or data were obtained for this project. Those topics will be covered in the Phase II LIS Literature Review.

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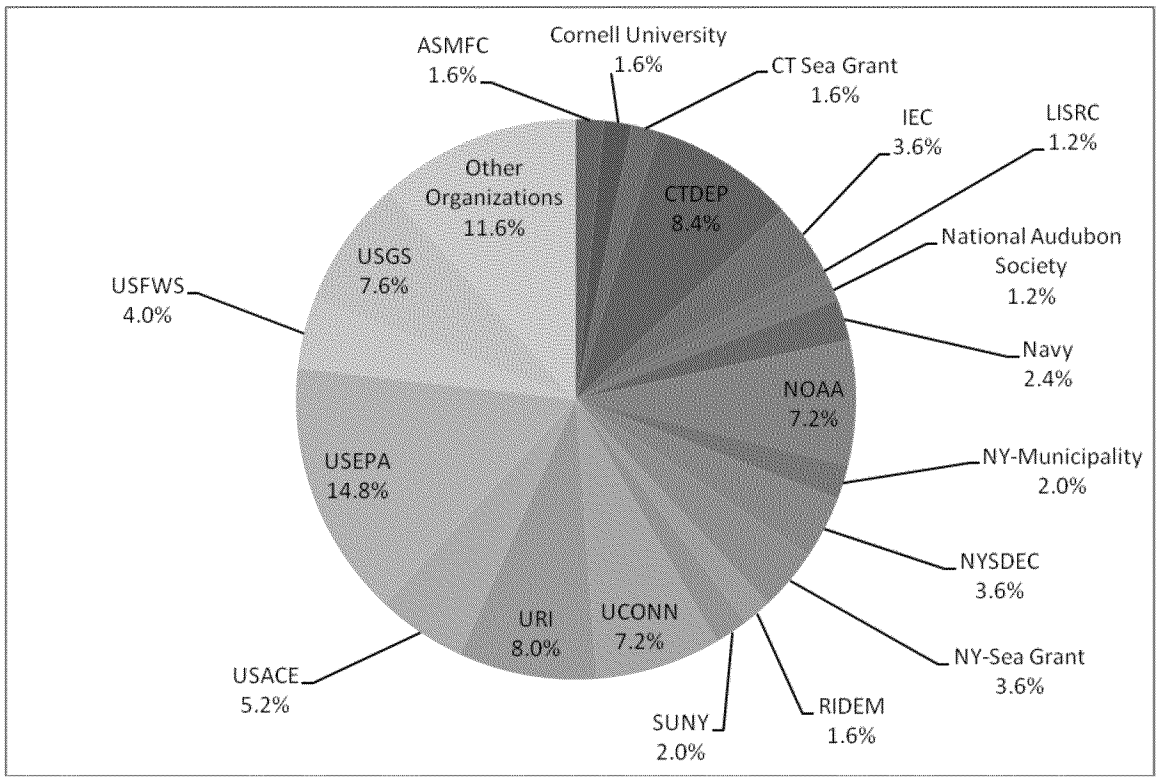

Figure 2. Agencies and Institutions Producing LIS Environmental Data[2]

[2] ASMFC (Atlantic States Marine Fisheries Commission), CTDEP (Connecticut Department of Environmental Protection), IEC (Interstate Environmental Commission), LISRC (Long Island Sound Resource Center), NOAA (National Oceanographic & Atmospheric Administration – includes New England Fisheries Management Council and National Marine Fisheries Service), NYSDEC (New York State Department of Environmental Conservation), RIDEM (Rhode Island Department of Environmental Management), SUNY (State University of New York – Stony Brook), UCONN (University of Connecticut), URI (University of Rhode Island), USACE (U.S. Army Corps of Engineers), USEPA (U.S. Environmental Protection Agency – includes Region 1, Region 2, and Long Island Sound Study), USFWS (U.S. Fish & Wildlife Service), USGS (U.S. Geological Survey), Other Organizations (entities that individually produced less than 1% of the data sources encountered).

Table 1. Environmental Data Source Topic Matrix by Organization

(Organizations Producing more than two Documents)

	Benthic (Macro-Invertebrate) Resource	Coastal Management	Ecology, Habitats and Species	Economic Data and Analysis	Environmental Evaluation and Economics of Disposal Options	Fisheries/Shell Fisheries	Fishing Activities and Human Health Risks	General Interest	Geology and Geomorphology	Historic Disposal Activities and Dump Sites	Historic, Cultural and Archaeological Resources	Marine Wildlife and Endangered Species	Physical Impact of Fishing Activities	Physical Oceanographic	Public Parklands, Beaches and Sanctuaries	Sediment	State Dredged Material Disposal Guidance	Water Quality	Meteorology
ASMFC						5													
Cornell University			4																
CT Sea Grant			1			3												1	
CTDEP			6			6			2				1			1		12	
IEC																		9	
LISRC									2						1	2			
National Audubon Society			3																
Navy			1			1								2		4			
NOAA		3	3			15													
NY-Municipality			2			2												3	
NYSDEC		1	8			1													
NY-Sea Grant						8										1		3	
RIDEM						3	1								1				
SUNY	1													1		1		4	
UCONN		3	7						2					1		1		10	
URI	1	1	4			3			3			1		8	1	2		2	
USACE	2		1			1				10						12			
USEPA	3	1	13			5	3									6		24	
USFWS		2	8									2			2				
USGS									5					4		19		1	
Total	**7**	**11**	**61**	**0**	**0**	**53**	**4**	**0**	**14**	**10**	**0**	**3**	**1**	**16**	**5**	**49**	**0**	**69**	**0**

3.2 DATA SUMMARIES

The following sections provide a summary of the major environmental data sources gathered for this task, organized by sponsoring institution.

3.2.1 US Environmental Protection Agency (USEPA)

The USEPA periodically updates its National Coastal Conditions report, which is heavily informed by the National Coastal Assessment's Environmental Monitoring & Assessment Program (EMAP) national coastal database. This USEPA-maintained online searchable database contains data on water quality, sediment quality, benthic habitat, coastal habitat, fish tissue contaminants, and fisheries throughout Long Island Sound.

USEPA also administers the National Estuary Program. The Long Island Sound Study (LISS) is one of 28 federally recognized estuary programs in the country. Begun in 1985, the LISS is a multi-agency partnership aimed at restoring and protecting the Sound. In addition to its restoration and environmental management activities, LISS supports research, monitoring, and assessment of environmental quality and natural resources in Long Island Sound. In coordination with the USEPA Long Island Sound Office, CT Sea Grant, and NY Sea Grant, the LISS has distributed research grants since 1999. Studies under this program have produced data on eelgrass distribution, fish tissue contaminants, tidal marsh elevation and porewater quality, hypoxia, phytoplankton, toxic contamination of water/sediment/biota, benthic habitat, water quality, sediment quality, shellfish harvest, endangered species, and nutrient loading for Long Island Sound. (LISS, 2009)

The 2004 Final EIS for the Designation of Dredged Material Disposal Sites in Central and Western Long Island Sound was developed by USEPA. This document (USEPA, 2004) presents various types of data for certain areas within Long Island Sound, including bathymetry, geomorphology, currents and sediment transport, salinity, sediment chemistry/toxicity and grain size analysis, benthic community, water quality, fisheries data such as habitat, distribution and landings, species lists (both protected and unprotected), and locations of protected areas.

Thirty seven environmental data sources were obtained from USEPA: 32 from the LISS and five from USEPA offices. Twenty-three studies focus on the entire Sound, four on the western basin, one on the central basin, five on the New York shoreline, one on the Connecticut shoreline, and three on Connecticut upland areas. Three documents address benthic resources, one addresses coastal management, 13 address ecological resources, five address fisheries, three address human health risks from fishing, six address sediment, and 24 address water quality.

3.2.2 Connecticut Department of Environmental Protection (CTDEP)

The CTDEP collects and maintains data on resources and environmental conditions, much of it stored as downloadable Geographic Information System (GIS) files. The state GIS Center holds an extensive database of GIS data including inland and marine

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bathymetry, groundwater and surface water classifications, coastal area boundaries, drainage basins, land use, habitats of concern (wetlands, eelgrass), species of concern (migratory waterfowl) and other data.

The CT Department of Long Island Sound Programs maintains online data and a mapping tool with bathymetry, surficial sediment distribution, sediment chemistry, and benthic communities. This agency office also maintains data on public access to LIS as well as fishing, boating, and recreation area maps.

The CTDEP also performs an extensive year-round water quality monitoring program that includes monthly samples of temperature, salinity, and dissolved oxygen at over 40 shallow stations and 200+ offshore stations throughout the Sound. During the summer additional hypoxia surveys are done bi-monthly to evaluate the extent and duration of low oxygen events.

Fisheries data are collected by CTDEP annually via trawl survey at 200 stations. Fisheries data and reports include information on the number and size of fish obtained in trawl surveys, as well as specialized subjects including marine recreational fisheries.

The CTDEP Comprehensive Wildlife Conservation Strategy maintains maps of the distribution and abundance of wildlife (mammals, birds, amphibians, reptiles, and fish) throughout the state.

In total, 21 environmental data sources were obtained from CTDEP. Ten studies focus on the entire Sound, one on the eastern basin, one on the Connecticut shoreline, and nine on Connecticut upland areas. Six documents address ecological resources, six address fisheries, two address geology and geomorphology, one addresses the physical impacts of fishing, one addresses sediment, and 12 address water quality.

3.2.3 US Geological Survey (USGS)

USGS has completed numerous studies of the seafloor in basins and areas of interest throughout Long Island Sound, including the Bridgeport, Milford, and Central LIS disposal sites. Interpolated bathymetry surveys have been conducted in coordination with NOAA in the following areas: H11043 (Branford vicinity), H11044 (Milford vicinity), H11045 (Milford vicinity), H11250 (The Race), H11252 (Six Mile Reef), H11255 (Roanoke Point vicinity), and H11361 (Six Mile Reef). Sidescan sonar imagery surveys have been conducted in coordination with NOAA at H11043, H11044, and H11045, and in coordination with CTDEP for Norwalk, Milford, New Haven Harbor, Central Long Island Sound Dumping Grounds, Roanoke Point, Falkner Island, Hammonasset, Niantic Bay, New London, and Fishers Island Sound. The resulting reports use sidescan sonar imagery, seismic reflection, and bathymetry data to describe surficial geology and delineate sedimentary environments throughout the Sound. These data are available (in raw format and as interpreted GIS shapefiles) on the USGS website (http://coastalmap.marine.usgs.gov/regional/contusa/eastcoast/midatl/lis/pubsrefs.html) and on DVD-R media produced and distributed by USGS.

USGS also produced a report on non-point source nitrogen loading to Long Island Sound. (Mullaney et al., 2002) Estimates of nitrogen loading were determined using nitrogen monitoring data and streamflow data.

A total of 19 environmental data sources were obtained from USGS. Five studies focus on the entire Sound, one on the western basin, nine on the central basin, three on the eastern basin, and one on the Connecticut shoreline. Five documents address geology and geomorphology, four address physical oceanography, all 19 address sediment, and one addresses water quality.

3.2.4 National Oceanic and Atmospheric Administration (NOAA)

NOAA has developed Environmental Sensitivity Index (ESI) Maps that depict sensitive environmental resources along the nation's coast. The Long Island Sound coastline is covered by these maps (NOAA, 2002). While chiefly developed for planning oil and chemical spill response, these maps provide useful information for identifying vulnerable coastal resources.

The ESI maps are developed through a cooperative effort among the primary state response agency (CTDEP Emergency Response and Spill Prevention Division, NYSDEC Spill Response Program, RIDEM Office of Emergency Response), other state and federal agencies, and industry. In 1995, ESI project members began using GIS to produce, update, and distribute ESI maps that are of higher quality than previous versions.

ESI documents include maps of shoreline habitat types, locations of critical habitat, management areas and wildlife refuges, distribution of birds, fish, marine mammals, terrestrial mammals, reptiles, invertebrates, plants, and threatened/endangered species by area, season and life stage. These maps also include shoreline rankings (sensitivity to oil spills), sensitive biological resources and habitats, and human-use resources such as beaches, parks and marinas.

NOAA also maintains the fishery landings statistics for Connecticut, New York, and Rhode Island. These data do not indicate the contribution from Long Island Sound fishery, but do show the state-wide landings information.

NOAA produces Essential Fish Habitat (EFH) documents, which delineate coastal waters that are important to the success of fish populations at various life stages. These documents also provide life history information for the EFH species that occur in LIS.

Eighteen environmental data sources were obtained from NOAA: 12 from the New England Fisheries Management Council, three from the National Marine Fisheries Service, and three from NOAA. Fourteen studies focus on the entire Sound, two on the Connecticut shoreline, one on the New York shoreline, and one on the Rhode Island shoreline. Three documents address coastal management, three address ecological resources, and 15 address fisheries.

3.2.5 University of Rhode Island (URI)

The University of Rhode Island has produced a number of documents with environmental data through its Graduate School of Oceanography. Theses, journal articles, databases, maps, and reports from URI have generated data on a wide variety of environmental resources. Research has addressed coastal lagoon habitats, fisheries areas, marine and coastal bird ecology, primary productivity, benthic habitats, water quality, physical oceanography, and fish habitat. URI is involved in a prominent monitoring program for Long Island Sound called FOSTER, which is a ferry-based water quality and oceanographic monitoring system on the New London – Orient Point ferry.

URI's Geospatial Extension Program, a part of the Environmental Data Center in the Department of Natural Resources Science, operates the Rhode Island Geographic Information System (RIGIS) in coordination with the State of Rhode Island Statewide Planning Program. The RIGIS website serves geospatial data for the state, including data on biological resources, wetlands and coastal resources, conservation areas, geological features, and inland water resources.

Twenty environmental data sources were obtained from URI. Twelve studies focus on Block Island Sound, three on the eastern basin of Long Island Sound, two on the Rhode Island shoreline, and three on Rhode Island upland areas. One document addresses benthic resources, one addresses coastal management, four address ecological resources, three address fisheries, three address geology and geomorphology, one addresses marine wildlife, eight address physical oceanography, one addresses public lands, two address sediment, and two address water quality.

3.2.6 University of Connecticut (UCONN)

University of Connecticut research has focused on primary productivity, water quality, coastal marshes, and biogeochemistry. The Long Island Sound Integrated Coastal Observing System (LISICOS) and Monitoring Your Sound (MYSound) programs at UCONN are prominent water quality and wave monitoring systems at seven stations distributed throughout Connecticut's waters in Long Island Sound, providing real-time data through an online interface.

Additionally, UCONN houses the state's primary GIS data repository, the Map and Geographic Information Center (MAGIC), as well as the Center for Land Use Education and Research (CLEAR). MAGIC and CLEAR have produced spatial data on bedrock geology, surficial materials, soils, open space, municipal solid waste sites, hydrography, rivers, drainage basins, aquifer protection areas, coastal boundaries, boat launches, land cover, coastal riparian buffers, and forest fragmentation.

Eighteen environmental data sources were obtained from UCONN. Six studies focus on the entire Sound, two on the central basin, five on the Connecticut shoreline, and five on Connecticut upland areas. Three documents address coastal management, seven address ecological resources, two address geology and geomorphology, one addresses physical oceanography, one addresses sediment, and ten address water quality.

3.2.7 US Army Corps of Engineers (USACE)

The US Army Corps of Engineers is also a significant source of environmental data, much of it developed in conjunction with dredging studies. For this reason, environmental data from USACE tends to be in-depth but local in nature, as is the case with the Disposal Area Monitoring System (DAMOS) studies of disposal areas. Environmental data in these studies focus on sediment physical and chemical characteristics, bathymetric and sediment-profile imaging around disposal mounds, and benthic community analysis of recolonized areas. Long-term data sets have been collected on reference areas associated with the disposal sites in the Sound.

In collaboration with USEPA, USACE also produced an Environmental Impact Statement for the Rhode Island Region Long-Term Dredged Material Disposal Site Evaluation Project (USACE and USEPA, 2004). This document inventories bathymetry, sedimentary environments, physical oceanography, sediment characteristics and transport, water quality, benthic community, fish habitat, fisheries data, marine and coastal birds, marine mammals and reptiles, threatened and endangered species, and coastal special management areas in Block Island Sound and Rhode Island Sound.

Thirteen environmental data sources were obtained from USACE. One study focuses on the western basin of Long Island Sound, eight on the central basin, three on the eastern basin, and one on Block Island Sound. Two documents address benthic resources, one addresses ecological resources, one addresses fisheries, ten address historic disposal activities, and 12 address sediment.

3.3 SPATIAL DISTRIBUTION OF DATA

Spatially, the data are distributed throughout Long Island Sound, the coast, and the upland areas. Eighty-eight data sources (35%) contain data on the whole Sound. Studies on specific sub-basins of Long Island Sound are less abundant and account for 58 data sources (23%); there were 16 of Eastern LIS, 21 of Central LIS, and 21 of Western LIS. Studies of basins adjacent to Long Island Sound account for 10% of the data sources; there were only 15 studies of Block Island Sound and ten of Gardiners and Peconic Bays. In total, studies of the Sound and adjacent water bodies in the study area represent 68% of all environmental data sources encountered in this task.

Shoreline studies account for 18% of the data; there were 15 studies on the New York shoreline, 20 studies of the Connecticut coast, and only nine studies of the Rhode Island coast. Upland studies account for 14% of the data; there were 20 data sources on Connecticut upland areas, 12 data sources for New York upland areas, and three data sources for Rhode Island upland areas. Figure 3 illustrates the distribution of the geographic origin of environmental data reviewed in this study.

Table 2 presents the spatial distribution of environmental data sources by topic. It can be used to identify spatial gaps in the data obtained in the LIS DMMP Environmental Data Update. Potentially significant data gaps exist for geological studies of the shoreline, studies of the physical impacts of fishing activities, documentation of public lands of the

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New York shoreline and Connecticut upland areas, and studies of water quality in Block Island sound and along the New York and Rhode Island shorelines.

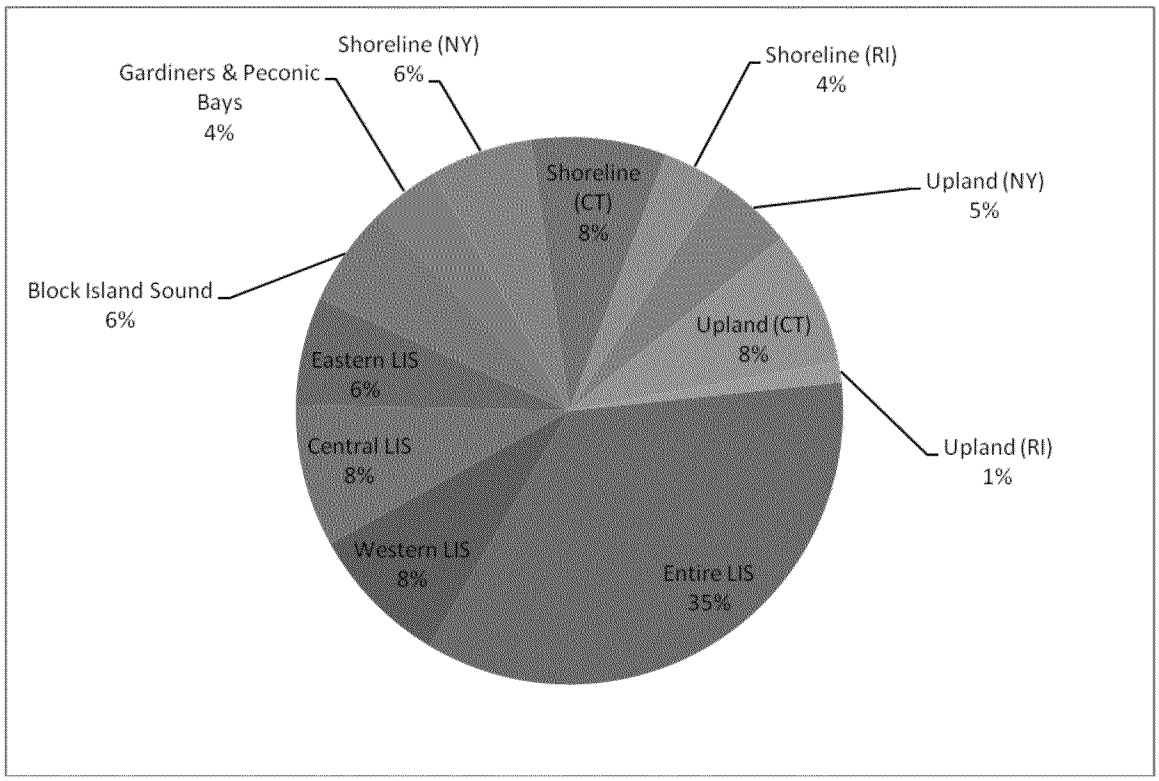

Figure 3. Spatial Distribution of LIS Environmental Data

3.4 DMMP RELEVANCE RANKING

Data sources were rated based on their relevance to the development of a DMMP. Criteria considered in the relevance rating included the association of environmental data with a field sampling or monitoring program (as opposed to a literature review or paper study), the breadth of spatial coverage of the data, the availability of geographic information systems (GIS) data, the number of topics covered, and whether the data source addressed endangered, regulated, or high-value resources.

Of the 250 environmental data sources identified, 94 were given a "High" rating for relevance to the development of a DMMP, 90 were given a "Medium" rating, and 66 were given a "Low" rating. All documents with a "High" relevance rating are expected to be useful in developing the dredged material management plan for Long Island Sound. Those rated "Medium" are also potentially useful. Documents rated "Low" are unlikely to yield primary, citable data that could be used in developing the DMMP.

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Table 2. Environmental Data Source Topic Matrix by Study Location

	Benthic (Macro-Invertebrate) Resource	Coastal Management	Ecology, Habitats and Species	Economic Data and Analysis	Environmental Evaluation and Economics of Disposal Options	Fisheries/Shell Fisheries	Fishing Activities and Human Health Risks	General Interest	Geology and Geomorphology	Historic Disposal Activities and Dump Sites	Historic, Cultural and Archaeological Resources	Marine Wildlife and Endangered Species	Physical Impact of Fishing Activities	Physical Oceanographic	Public Parklands, Beaches and Sanctuaries	Sediment	State Dredged Material Disposal Guidance	Water Quality	Meteorology
Entire LIS		2	12			38	4		8			2		1		18		42	
Western LIS	2		2			1			1	1						4		17	
Central LIS	1								1	7				4		18		3	
Eastern LIS	2		4						1	3			1	6		5		2	
Block Island Sound	1		2			5	1		2			1		4	1	2			
Gardiners & Peconic Bays			7			2												3	
Shoreline (NY)	2	3	13			2						1				1			
Shoreline (CT)		2	11			4								1	1	5		3	
Shoreline (RI)		2	3			2								1	3	1			
Upland (NY)		2	9									1			1			1	
Upland (CT)		3	10			1			3			1						7	
Upland (RI)			2						1									1	

Note : Gray shading indicates not relevant to environmental data update database. Red shading indicates potential data gap.

To evaluate whether topic, work type, or physical setting was related to relevance rank, tabular summaries of relevance rating against these three variables were prepared. Table 3 presents the number of topics addressed by high- medium- and low-relevance documents. Since documents can address more than one topic, topic numbers do not match exactly the total number of documents. High-relevance documents primarily addressed water quality, fisheries, and ecology, habitats and species. Medium-relevance documents primarily addressed water quality, sediment, and ecology, habitats and species. Low-relevance documents primarily addressed water quality, physical oceanography, fisheries, and ecology, habitats and species. Interestingly, certain topics such as ecology, habitats and species were common in all three relevance categories. Because the relevance rating was based on a combination of factors including study duration, spatial coverage, and availability of primary data, the topics covered don't necessarily determine relevance rating.

Table 3. Environmental Data Source Topics by Relevance

	DMMP Relevance Rating		
	High	**Medium**	**Low**
Benthic (Macro-Invertebrate) Resource	2	3	3
Coastal Management	8	2	4
Ecology, Habitats and Species	35	24	16
Economic Data and Analysis	0	0	0
Environmental Evaluation and Economics of Disposal Options	0	0	0
Fisheries/Shell Fisheries	33	12	10
Fishing Activities and Human Health Risks	3	1	1
General Interest	0	0	0
Geology and Geomorphology	8	5	4
Historic Disposal Activities and Dump Sites	0	10	1
Historic, Cultural and Archaeological Resources	0	0	0
Marine Wildlife and Endangered Species	2	3	1
Physical Impact of Fishing Activities	0	0	1
Physical Oceanographic	3	3	11
Public Parklands, Beaches and Sanctuaries	1	2	3
Sediment	14	32	8
State Dredged Material Disposal Guidance	0	0	0
Water Quality	26	34	19
Meteorology	0	0	0

Table 4 presents the type of data sources (such as monitoring, field study, or review article) included in the high- medium- and low-relevance categories. Monitoring, field sampling, and environmental analyses were the most prevalent document types. Monitoring programs tend to be rated higher because they typically cover a larger spatial area, whereas field sampling tends to be more localized. Environmental analyses received high ratings because they tend to address multiple DMMP-relevant topics and include information on endangered, regulated, or high-value resources. Review articles received lower rankings because they rarely provided primary data.

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Table 4. Environmental Data Source Work Types by Relevance

	DMMP Relevance Rating		
	High	**Medium**	**Low**
Data comparison	0	1	3
Directory	11	11	11
Environmental Analyses	29	25	13
Field Sampling	15	13	23
Forum for current research	0	0	5
Lab Analysis/Tests	0	0	0
Model	0	0	2
Monitoring	35	34	2
Regulations/Manuals	4	3	4
Review	0	3	3

Table 5 presents the spatial distribution of study locations for documents of high- medium- and low-relevance. In general, studies that covered the entire Sound were rated higher than regional or site-specific studies. However, certain low-rated documents also covered the entire LIS area. These documents had shorter study durations, covered topics less applicable to dredged material management, or did not provide primary data.

Table 5. Study Location by Relevance

	DMMP Relevance Rating		
	High	**Medium**	**Low**
Entire LIS	52	20	16
Western LIS	0	16	5
Central LIS	0	17	4
Eastern LIS	0	10	6
Block Island Sound	6	4	5
Gardiners & Peconic Bays	6	0	4
Shoreline (NY)	9	2	4
Shoreline (CT)	8	7	5
Shoreline (RI)	3	0	6
Upland (NY)	4	7	1
Upland (CT)	4	6	10
Upland (RI)	2	1	0

4.0 SUMMARY

This report (Volume I) describes the design and results of an annotated database updating environmental data sources available for Long Island Sound. Volume II includes the annotated database in both hard-copy and electronic formats. The hard-copy of the database, presented as an in-text table of Volume II, is an abridged version of the full database that facilitates review of environmental data sources and allows users to quickly identify documents of interest that can then be investigated further in the full electronic database. The full electronic database is provided as a Microsoft Excel workbook on an

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accompanying CD-R. Further details of database design are provided in the Volume II narrative.

Two hundred fifty Long Island Sound environmental data sources were identified, reviewed, and summarized. There were four data comparisons, 33 directories, 67 environmental analyses, 51 field sampling efforts, five forums for current research, two models, 71 monitoring programs, 11 regulations and manuals, and six reviews. Sixty-two data sources contain or present geospatial data.

The most prevalent topics covered were water quality, ecology/habitat/species, sediment, and fisheries. The most prevalent study area was the entire Long Island Sound, with limited investigation of the various basins. Coastal areas in Connecticut and New York were well studied, but not many data sources were found on coastal Rhode Island. This may be related to the small area within Rhode Island (one coastal county) in the LIS study area. Upland areas were better studied in Connecticut than in New York or Rhode Island. Potential data gaps were identified for geological studies, studies of the physical impacts of fishing activities, documentation of public lands, and studies of water quality. These data gaps may be addressed through further coordination with appropriate agencies and institutions or through targeted research.

Data sources summarized herein will be important sources of information for the development of a DMMP for Long Island Sound. Of the 250 documents included in this study, 184 were ranked as high- or medium- relevance to dredged material management. This suggests the database includes a large body of information on which the USACE can draw when developing the dredged material management plan for Long Island Sound.

5.0 REFERENCES

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ATTACHMENT A QUERY SCRIPT MEMO FOR GATHERING INFORMATION FROM POINTS OF CONTACT

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September 18, 2009

Susan Holtham
U.S. Army Corps of Engineers
696 Virginia Rd.
Concord, MA 01742

RE: Script for Long Island Sound Environmental Data Queries

Dear Susan:

We plan to use the following script when contacting researchers and Agency representatives for information on Long Island Sound environmental data sources.

Please let us know if you'd like to make any changes to this basic outline of our queries.

Hello,
This is Joe Famely with the Woods Hole Group in Massachusetts. We are contractors working on a project for the Army Corps of Engineers' New England District to support them in the development of a Dredged Material Management Plan for Long Island Sound. One of our preliminary tasks with the Corps is to identify recent environmental studies and data that may be available for the Long Island Sound region.

Are you conducting or do you know of research that is generating environmental data in the Long Island Sound region that would be useful in preparing a Dredged Material Management Plan? We are particularly interested in any studies made or data collected since 2002. Any information on work being done in the Sound itself, in harbors navigable waterways or tributaries associated with the Sound, in the State of Connecticut, in New York (including waters between the forks of Long Island) or in Washington County Rhode Island would be relevant and useful to us.

If asked to clarify "region", re-state above, and provide east/west boundaries from SOW.

If asked to clarify "Environmental Data":
Overall, we're looking for any information that would be useful in describing existing natural resources in the area, particularly those that could be affected by either dredging or dredged materials placement (either offshore or upland). This will help us to refine the availability of existing environmental data that could be used in the DMMP analysis.

More specifically:

- *Threatened and endangered species (and habitat)*
- *Finfish and shellfish data (commercial & recreational)*
- *Benthic invertebrates*
- *Marine mammals, birds, reptiles*
- *Aquifers and water supplies*
- *Bathymetry, bottom sediments and physical oceanographic data*

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- *Sediment and water quality data*
- *Critical watersheds*
- *Wetlands*
- *Upland landforms and other resources sensitive to dredged material disposal*

If data are available, ask contact:

- *Where is the data from*
- *Timeframe of the data – when it was collected, analyzed, etc.*
- *The researchers take on the data's applicability to dredged material management*
- *Is it available electronically?*
- *POC info for follow-up if needed*

U.S. Army Corps of Engineers – New England District project contacts:

- *Susan Holtham, Technical Lead*
  Susan.e.holtham@usace.army.mil
  (978) 318-8536

- *Mike Keegan, Project Manager*
  Michael.f.keegan@usace.army.mil
  (978) 318-8087

- *Mark Habel, Study Manager*
  Mark.l.habel@usace.army.mil
  (978) 318-8871

Thank you,

Heidi Clark and Joe Famely

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