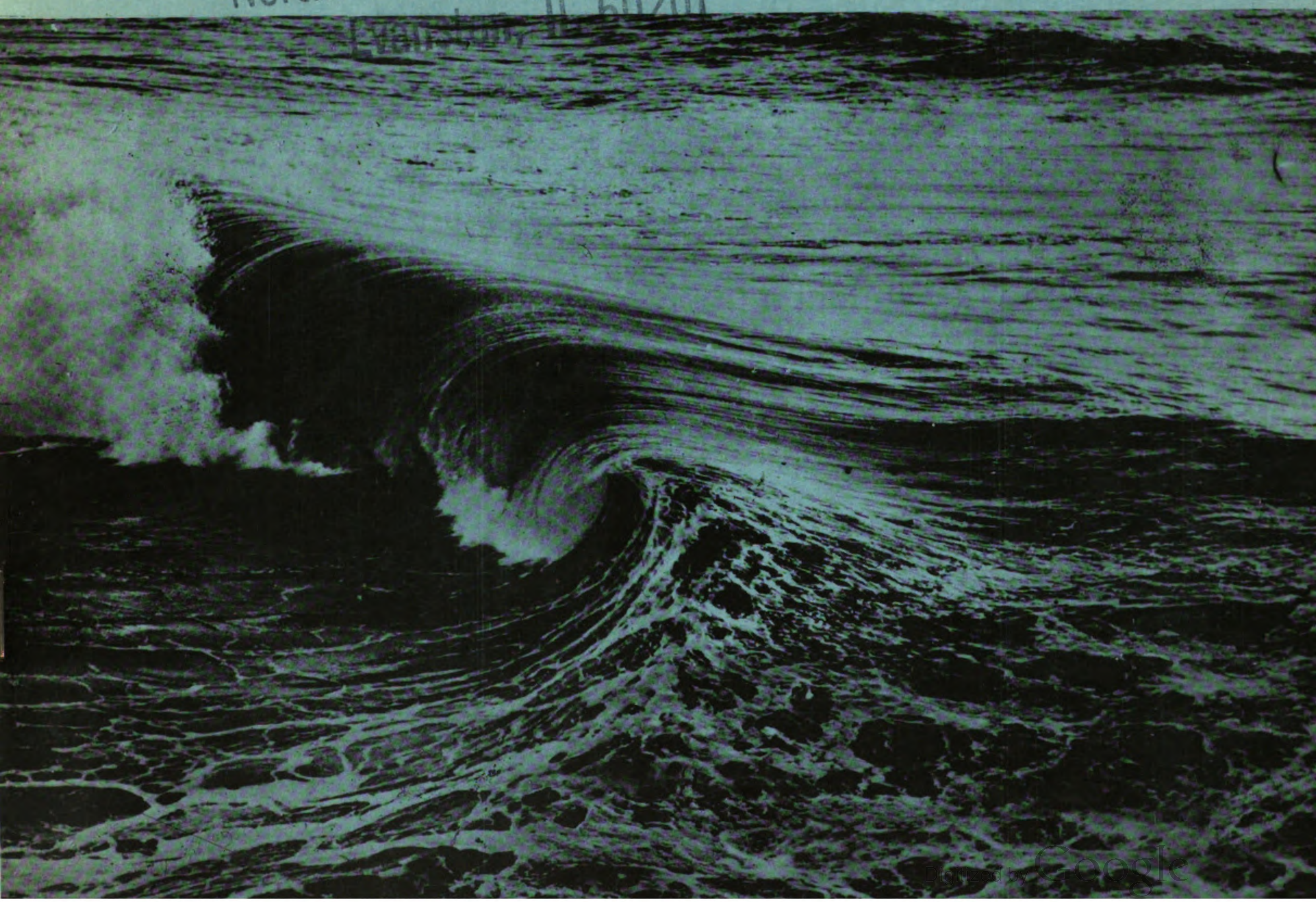
United States
Environmental Protection
Agency

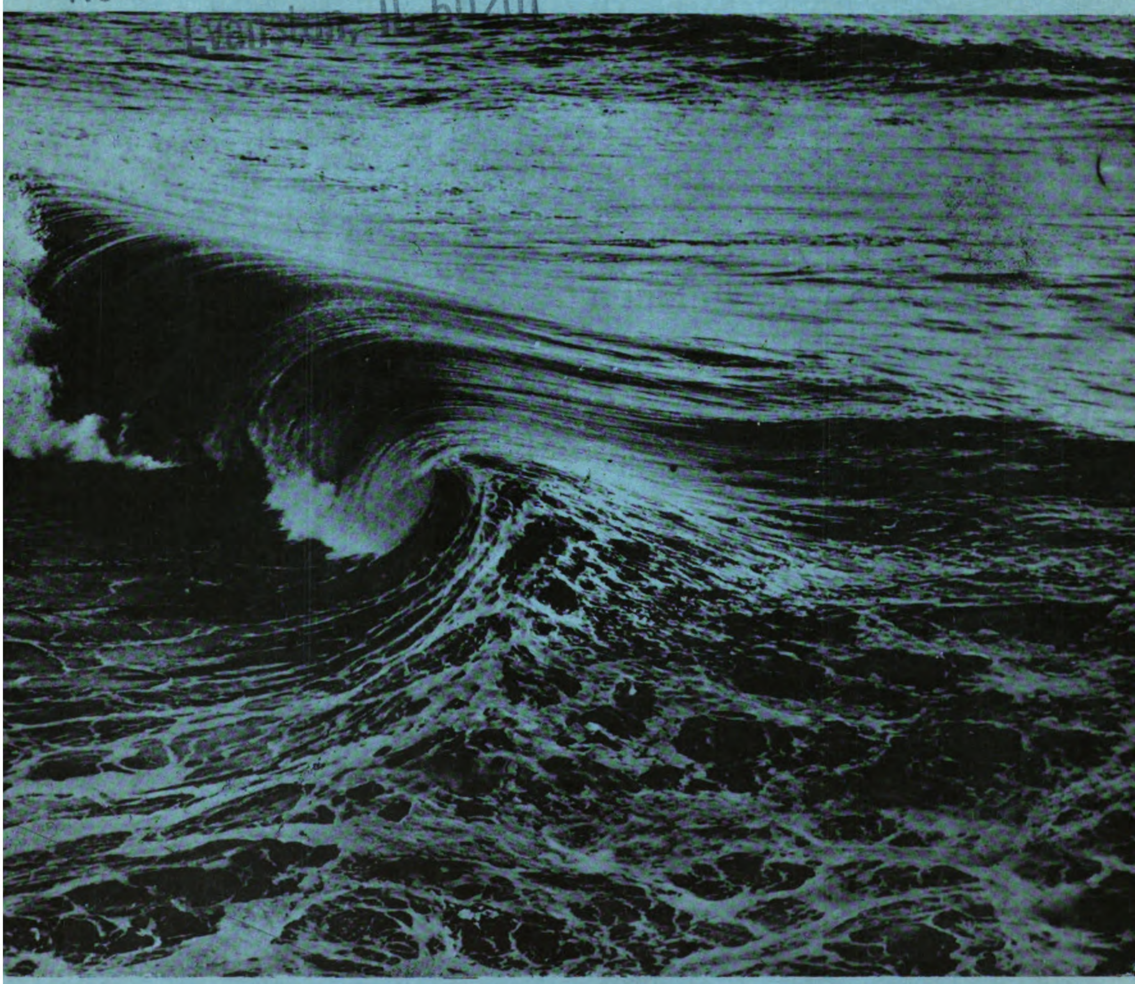
Office of Water
Criteria and Standards
Washington, D.C.

Draft
October, 1983

Environmental Impact Statement (EIS) for the New Jersey / Long Island Inlets Dredged Material Disposal Site Designation



Impact Statement (EIS) for the
New Jersey / Long Island Inlets
Dredged Material
Disposal Site Designation



ENVIRONMENTAL PROTECTION AGENCY

DRAFT

ENVIRONMENTAL IMPACT STATEMENT (EIS)

FOR

LONG ISLAND AND NEW JERSEY INLET

DREDGED MATERIAL DISPOSAL

SITE DESIGNATION

OCTOBER 1983

Summary Sheet

Environmental Impact Statement
for
Long Island/New Jersey Inlet Dredged
Material Disposal Site Designation

(x) Draft
( ) Final
( ) Supplemented to Draft

Environmental Protection Agency
Criteria and Standards Division

1. Type of Action

    (x) Administrative/Regulatory action
    ( ) Legislative action

2. Description of Proposed Action

    The proposed action is the final designation of the interim-designated Long Island, New York and New Jersey Inlet Dredged Material Disposal Sites (IDMDSs), to be managed by the U.S. Environmental Protection Agency (EPA), Region II. The IDMDS are under the jurisdication of two Corps of Engineers (CE) Districts: New York (Rockaway Inlet, East Rockaway Inlet, Jones Inlet, Fire Island Inlet and Shark River Inlet) and Philadelphia (Manasquan Inlet, Absecon Inlet and Cold Spring Inlet).

3. Summary of major beneficial and/or adverse environmental effects associated with the proposed action.

The major benefit of the proposed action is the provision of environmentally acceptable locations for the disposal of inlet dredged materials.

Adverse effects associated with the proposed action include mounding, smothering of some benthic organisms, and possible changes in sediment texture.

4. Alternatives to the proposed action.

The alternatives to the proposed action are: (1) No Action, which would allow the interim designation of the Long Island and New Jersey IDMDSs to expire in January 1985, after which use of the sites would be discontinued; and (2) use of an ocean disposal site other than the interim designated sites.

5. Comments have been requested from the following:

Federal Agencies and Offices

Council on Environmental Quality
Department of Commerce
  National Oceanic and Atmospheric Administration
Department of Defense
  Army Corps of Engineers
  Department of the Navy
Department of Health and Human Services
Department of the Interior
  Bureau of Land Management
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  Geological Survey
Department of State
Department of Transportation

United States Coast Guard
National Science Foundation

State and Municipalities

State of New Jersey
State of New York
City New York
Atlantic County
Cape May County
Monmouth County
Nassau County
Ocean County
Suffolk County

Private Organizations

American Littoral Society
Environmental Defense Fund, Inc.
National Academy of Sciences
National Wildlife Federation
New Jersey Marine Sciences Consortium
New York Testing Laboratories, Inc.
Port of New York and New Jersey
Resources for the Future
Sierra Club
Water Pollution Control Federation

Academic/Research Institutions

Rutgers University
State University of New York
University of Rhode Island

6. The Draft statement has been officially filed with the Office of Federal Activities, EPA.

7. Comments on the Draft are due 45 days from the date of EPA's publication of Notice of Availability in the Federal Register which is expected to be NOV 18 1983.

8. Comments should be addressed to:

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Criteria and Standards Divsion (WH-585)
Environmental Protection Agency
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Washington, D.C. 20460

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Philadelphia, PA 19106

SUMMARY

PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed action is to provide the most feasible and environmentally acceptable ocean locations for the disposal of dredged material from the Long Island and New Jersey Inlet areas. This Environmental Impact Statement provides the information needed to evaluate the proposed action.

The Long Island and New Jersey Inlet areas are used mainly by pleasure craft, commercial and sport fishing vessels. The CE has the responsibility of supervision of the inlet's construction, maintenance, and operation. The inlets are dredged periodically on an as need basis. The volume of dredged material varies upon shoaling rates. Without dredging, operating depths throughout the inlets would decrease, thus, limiting marine vessel traffic.

The Environmental Protection Agency (EPA), the agency responsible for designating ocean disposal sites, approved the existing Long Island and New Jersey IDMDSs for interim use in 1977 (40 CFR 228). The use of any site under interim designation will continue only if EPA grants the site permanent designation. EPA must either terminate the interim sites or permanently designate them for continued use by January 1985, when the Long Island and New Jersey IDMDS interim designations expire.

Alternatives Including the Proposed Action

The alternatives considered in this EIS are: (1) the proposed action of permanently designating the interim sites (Existing Sites), (2) No Action, and (3) use of an alternative ocean site (e.g., Mud Dump Site). Taking No Action towards permanent designation of the site for continued use would mean to refrain from designating an EPA-approved ocean site for dredged material disposal. After expiration of the interim designation in January 1985, the net result would be that the CE would not have an EPA-approved, permanently designated ocean sites for the disposal of dredged material from the Long Island and New Jersey Inlet areas. Therefore, the No Action alternative is not an acceptable alternative.

Land disposal alternatives are considered by the CE when evaluating the need for ocean disposal. If the material dredged is composed of clean sand, it could be then used as beach fill or as up-land fill. This alternative would eliminate the problems associated with disposal in ocean waters.

Three general ocean environments off Long Island and New Jersey are considered as possible locations for disposal sites: (1) Near-Shore (includes the Existing Sites), (2) Mid-Shelf, and (3) Deepwater.

The sites off Long Island and New Jersey considered as potentially suitable locations for disposal sites are:

- o The Existing Sites (interim designated) - Rockaway, East Rockaway, Jones, Fire Island, Shark River, Manasquan, Cold Spring and Absecon IDMDSs.

The Existing Sites used for dredged material disposal receive small amounts (maximum 200,000 yds^3/yr) of material from the nearby inlets. Most of the material is suitable for beach nourishment, and not all sites are used each year. Previous disposal of dredged material at the Existing Sites has not caused significant adverse impacts on human health, economics, safety, or aesthetics.

AFFECTED ENVIRONMENT

Natural sediments on the nearshore Shelf are medium to fine sands. Natural accumulations of muds occur in the Christiaensen Basin and Hudson Shelf Valley. Some seabed areas have been extensively modified by man, with visible deposits of dredged material, subway and bridge excavation rock, and demolition debris. Sediments may have been contaminated with constituents found in sewage sludge (especially in the Christiaensen Basin), but accumulations of sludge are not present.

Biological productivity in the Apex in high. Commercial and recreational fishing activities occur throughout the area. Tropical and boreal migrants seasonally extend their ranges into the Bight, resulting in high abundance and diversity of finfish. Spawning, nursery, and feeding areas occur over the entire Bight.

Inshore benthic fauna are dominated by organisms characteristics of a high-energy, coastal marine environment. Benthic populations are not static and undergo substantial natural variations in distribution and abundance. The Mud Dump has a low density of organisms, probably due to repeated disturbance (burial).

Environmental Consequences

Previous disposal of dredged material at the Existing Sites has had no significant adverse impacts on human health, economics, safety, or aesthetics. Mounding has not resulted in sufficient shoaling to create a navigational hazard. Minor, short-term adverse effects may occur as a result of dumping at the Existing Sites, including a temporary reduction in abundances of bottom-dwelling animals resulting from burial.

Disposal of dredged material would also be expected to have a minimal effect at the Mud Dump. Bottom topography at the Mud Dump has been extensively modified by dumping since 1914. The northwest corner of the site has a large mound of material resulting from previous disposal. Based on current disposal rates, it has been estimated that the Mud Dump will reach its disposal capacity within approximately ten to twelve years.

Disposal operations do not interfere with any long-term use of resources. The resources lost by ocean disposal are sand for landfill and/or beach nourishment projects, and money and energy expended for the dredging and transport operations. These losses are easily offset by the benefit to commerce from dredging the inlet systems.

CONCLUSION

The Existing Sites are environmentally acceptable and the most economical sites to receive material dredged from the Long Island and New Jersey Inlets. The Existing Sites are, therefore, the preferred alternative.

Long Island Sites

- The final designation of the interim designated Rockaway, East Rockaway Inlets, Jones Inlet, and Fire Island IDMDSs.

New Jersey

- The final designation of the interim designated Shark River Inlet, Manasquan Inlet, Absecon, and Cold Springs IDMDS.

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Chapter 1

Purpose and Need for Action

The proposed action in this Environmental Impact Statement (EIS) is the final designation for continuing use of the Long Island, New York (Rockaway Inlet, East Rockaway Inlet, Jones Inlet and Fire Island Inlet), and New Jersey (Shark River Inlet, Manasquan Inlet, Absecon Inlet, and Cold Spring Inlet) Inlet Dredged Material Disposal Sites (IDMDS). The purpose of the proposed action is to provide the most feasible and environmentally acceptable ocean locations for the disposal of inlet dredged materials. The EIS presents the information utilized in the evaluation of the suitability of ocean disposal areas for permanent designation for continuing use. The environmental studies and final designation processes are being conducted in accordance with the requirements of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) (86 Stat. 1052), as amended (33 U.S.C.A. §1401, et. seq.); the Environmental Protection Agency's (EPA) Ocean Dumping Regulations and Criteria (40 CFR §220-229); and other applicable Federal environmental legislation.

Based on an evaluation of all reasonable alternatives, the proposed action in this EIS is to give final designation to the existing, interim designated Long Island and New Jersey IDMDSs. The sites may be used for the disposal of dredged material only after evaluation of each Federal project or permit application has established that the disposal is within site capacity and in compliance with the criteria and requirements of EPA and the U.S. Army Corps of Engineers (CE) regulations.

The IDMDSs are under the jurisdiction of two CE districts: New York (Rockaway Inlet, East Rockaway Inlet, Jones Inlet, Fire Island Inlet and Shark River Inlet), and Philadelphia (Manasquan Inlet, Absecon Inlet and Cold Spring Inlet). The inlets are located along the south shore of Long Island, New York and the coast of New Jersey (Figure 1).

Rockaway IDMDS is located approximately 2 nmi southeast of the inlet (Figure 2). The entrance channel to Rockaway Inlet provides passage into Jamaica Bay, an important port of Long Island. In 1974, Jamaica Bay handled 3,857,423 short tons of vessel traffic. Principal commodities included: petroleum products, sand, rock, waste and scrap (CE, 1976b). Dredging to maintain channel depth has required the removal of approximately 200,000 yd^3 on an average of once every fifty years. The interim IDMDS was last used in 1979; dredged material was first dumped in the vicinity of the interim IDMDS in 1929.

East Rockaway IDMDS is located approximately 1.3 nmi southwest of the inlet (Figure 3). Waterborne commerce in 1972 included gasoline (1,166,508 tons), fuel oil (1,100,637 tons), waste and scrap (414,974 tons), and of lesser importance fishing (475 tons). Vessel tonnage was 3,260,943 in 1971 (CE, 1973). The interim IDMDS was last used in 1979; dredged material was first dumped in the vicinity of the IDMDS in 1938. Because of shoaling, yearly maintenance dredging of the inlet has been required for the last 20 years.

Jones IDMDS is located approximately 1.5 nmi southwest of the inlet (Figure 4). The inlet provides passage for small vessels; the major commodities being finfish and shellfish. In 1972 a total of 17,276 passenger and dry cargo vessels passed through the inlet (CE, 1974b). The interim IDMDS has been used since at least 1959, and was last used in 1978.

Fire Island IDMDS is located approximately 1.7 nmi southwest of the inlet (Figure 5). The interim IDMDS was used for dredged material disposal in the mid-1940's. The inlet requires annual maintenance (approximately 250,000 yd^3) dredging because of rapid shoaling; however, disposal of dredged sediments in the past has been on adjacent beaches. The CE plans to coordinate future inlet dredging with their beach erosion control program and to dump inlet sediments onto the beach. Fire Island Inlet is the primary waterway between the Atlantic Ocean and Great South Bay. The inlet is used extensively by both commercial and pleasure craft; fishing is the major activity of the commercial vessels.

New Jersey Sites

Shark River IDMDS is located approximately 0.4 nmi northeast of the inlet (Figure 6). The CE's dredging records show that inlet sediments were dumped in the vicinity of the IDMDS (exact location of site established 1977 by EPA) from 1955 to 1958. Because of littoral drift approximately 42,000 yd^3 needs to be removed from the project area every 5 years. Disposal of dredged sediments has been primarily on adjacent beaches, and is the CE preferred disposal alternative in the future because of beach erosion concerns. Ocean disposal is a secondary consideration when beach disposal is not feasible or economical. Vessels using Shark River Inlet are primarily recreational; no commerce was transported through the inlet between 1970 and 1974. However, during the same time period the number of passengers transported through the inlet increased from 333,970 (1970) to 534,430 (1974) (CE, 1967c).

Manasquan IDMDS is located approximately 0.3 nmi northeast of the inlet (Figure 7). The CE's dredging records show that the interim IDMDS has been used since at least 1964 and was last used in 1978. Manasquan Inlet is used primarily by recreational craft (CE, 1975b). The EPA recommends that the dredged material be used as beach nourishment whenever feasible.

Absecon IDMDS is located approximately 0.5 nmi southeast of the inlet (Figure 8). The CE's dredging records show that the interim IDMDS has been used since at least 1964 and was last used in 1978. Absecon City, on the south side of the inlet, is a base for a large fleet of fishing vessels (CE, 1975b).

Cold Spring IDMDS is located approximately 1 nmi southwest of the inlet (Figure 9). The CE's dredging records show that the interim IDMDS has been used since at least 1964, and was last used in 1979. Cold Spring Inlet (=Cape May Inlet) is used by fishing fleets, pleasure craft, and the Coast Guard (CE, 1975b).

Corps of Engineers Local Need

The CE has requested that the EPA permanently designate ocean dumping sites acceptable for the disposal of dredged material from the Long Island and New Jersey Inlets. Continued use of these waterways depends on routine dredging of Federal and non-Federal navigational channels and berthing areas. In the event ocean disposal sites are not designated the sedimentation process would selectively seal off portions of the shallow bayside waters of coastal Long Island and New Jersey. Isolation of some of the coastal waters from tidal influences would reduce the total acreage of estuaries. The channel may become inefficient and in extreme cases the inlet would close. This would have profound effect on the circulation patterns, salinity differences and sedimentation rates within the bayside waters.

Economically, there would be an impact on the area adjacent to the waterway in that there would be a reduction in the number of shore area vistors and therefore a corresponding reduction in patronage of service and recreational services. Additionally, land values would tend to decrease, especially in areas of lagoon home construction.

Natural shoaling processes would preclude passage of modern deep-draft vessels in the absence of dredging. The closure of these inlets would mean increased expenditures in time and money for recreational and commercial vessels.

Disposal of dredged sediments has been primarily on adjacent beaches and is the CE preferred disposal alternative. Ocean disposal is a secondary consideration when beach disposal is not feasible or economical.

EPA's Purpose and Need

As previously stated, the CE has indicated a need for locating and designating environmentally acceptable ocean dredged material disposal sites to carry out its responsibilities under the MPRSA and other Federal statutes. Therefore, in response to the CE's stated need, EPA in cooperation with the CE, initiated the necessary studies pursuant to the requirements of 40 CFR 228.4(e) to select, evaluate, and possibly designate the most suitable sites for the ocean disposal of dredged material. This document has been prepared to provide the public and decisionmakers with relevant information to assess the impacts associated with the final designation of the sites proposed, the Long Island and New Jersey Inlet Dredged Material Disposal Sites. It is not anticipated that the CE will conduct any further environmental studies with respect to the selection of these sites.

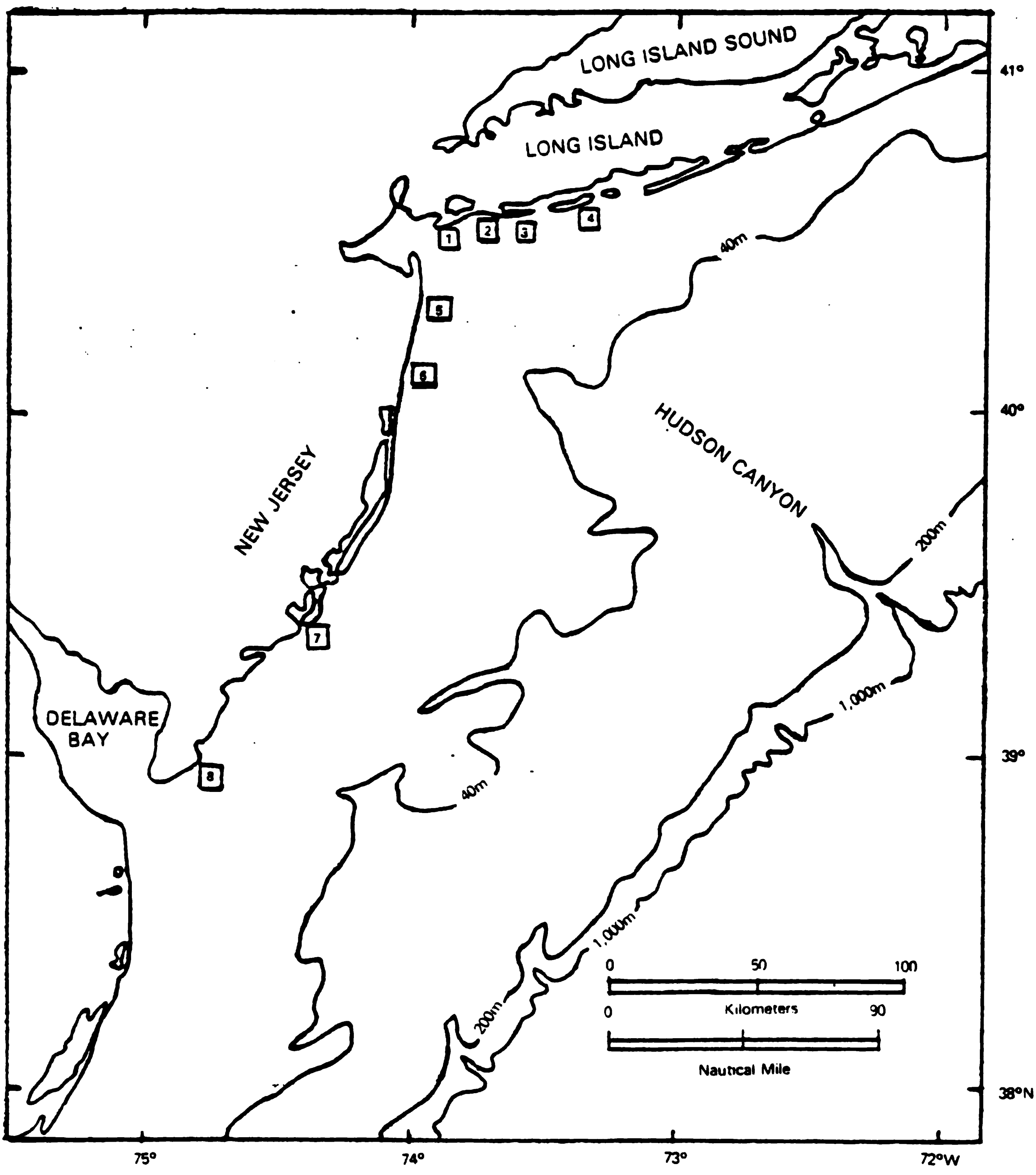
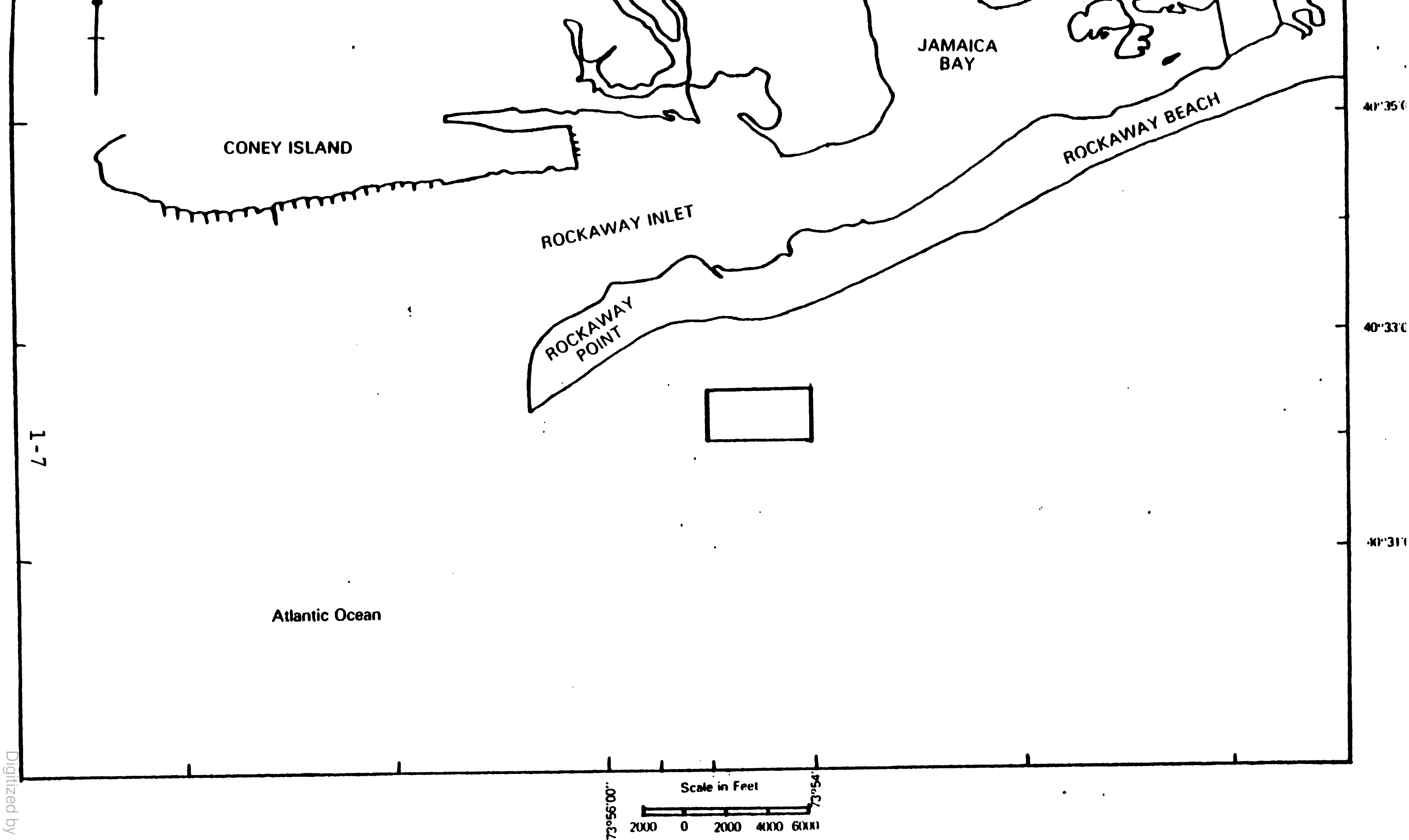


Figure 1. Location of IDMDS

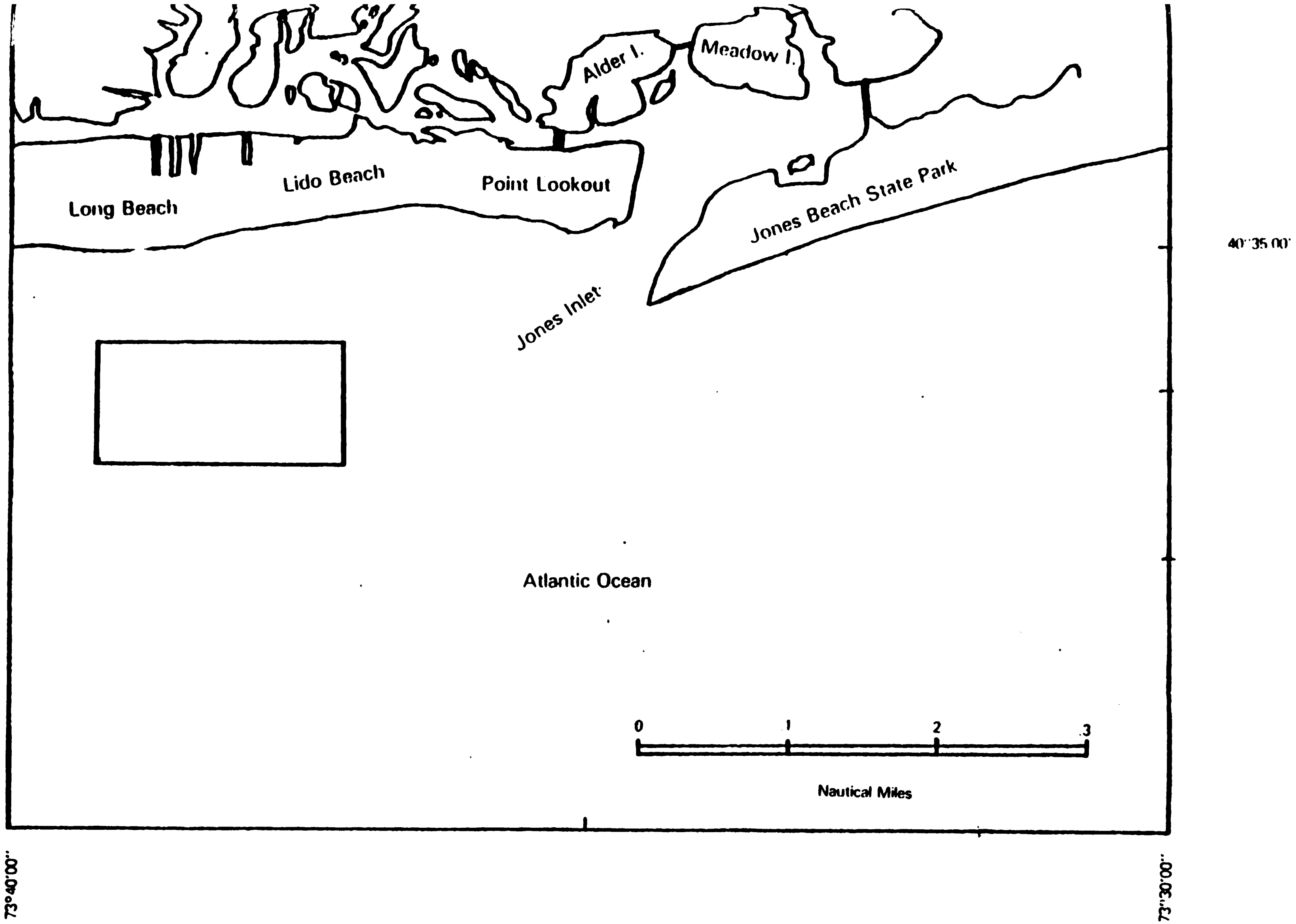
1. Rockaway Inlet
2. East Rockaway Inlet
3. Jones Inlet
4. Fire Island Inlet
5. Shark River Inlet
6. Manasquan Inlet
7. Absecon Inlet
8. Cold Spring Inlet



Boundary Coordinates	40°32'30"N, 73°55'00"W
	40°32'30"N, 73°54'00"W
	40°32'00"N, 73°54'00"W
	40°32'00"N, 73°55'00"W
Center Coordinates	40°32'15"N, 73°54'30"W

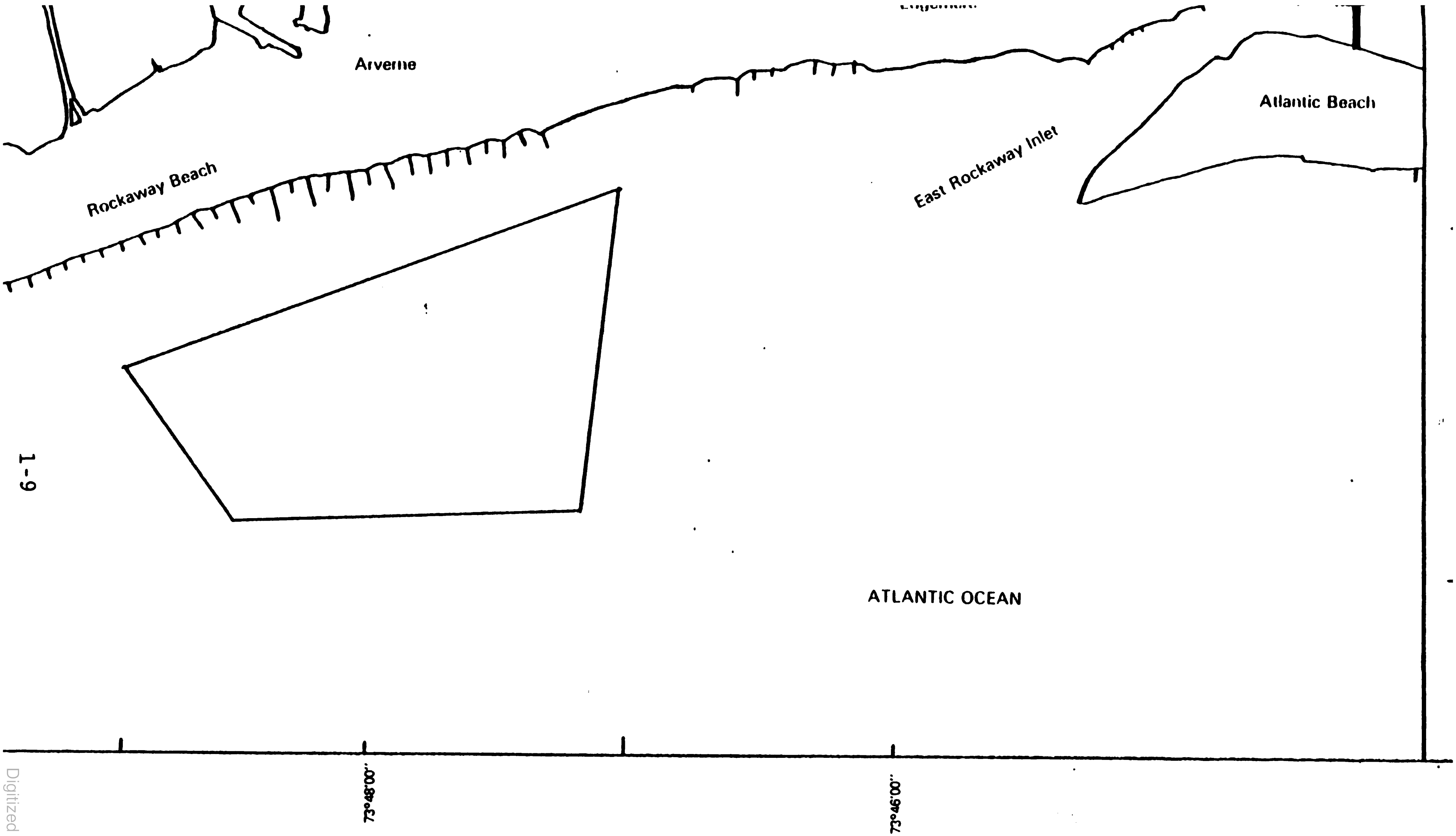
Area	0.38 Square Nautical Miles
Water Depth	8-11 Meters
Distance Offshore	0.4 Nautical Miles
Material Type	Dredged Material

Figure 2. Rockaway Inlet DMDS



Boundary Coordinates	40°34'32"N, 73°39'14"W	Area	1.19 Square Nautical Miles
	40°34'32"N, 73°37'06"W	Water Depth	7-10 Meters
	40°33'38"N, 73°37'06"W	Distance Offshore	0.5 Nautical Miles
	40°33'48"N, 73°39'14"W	Material Type	Dredged Material
Center Coordinate	40°34'10"N, 73°38'10"W		

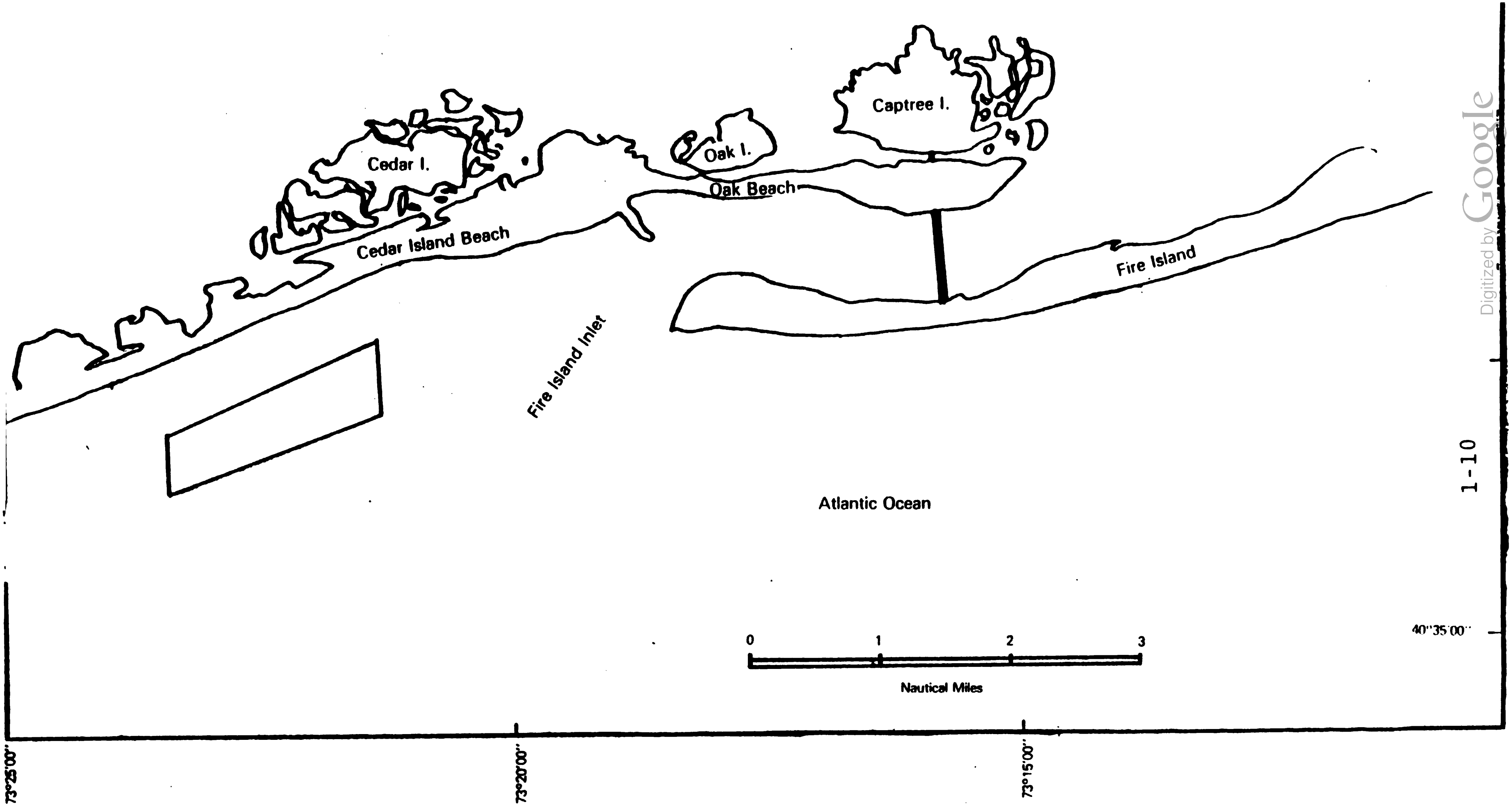
Figure 4. Jones Inlet DMDS



ndary Coordinates	40°34'36"N, 73°49'00"W
	40°35'06"N, 73°47'06"W
	40°34'10"N, 73°48'36"W
	40°34'12"N, 73°47'17"W
ter Coordinates	40°34'38"N, 73°48'00"W

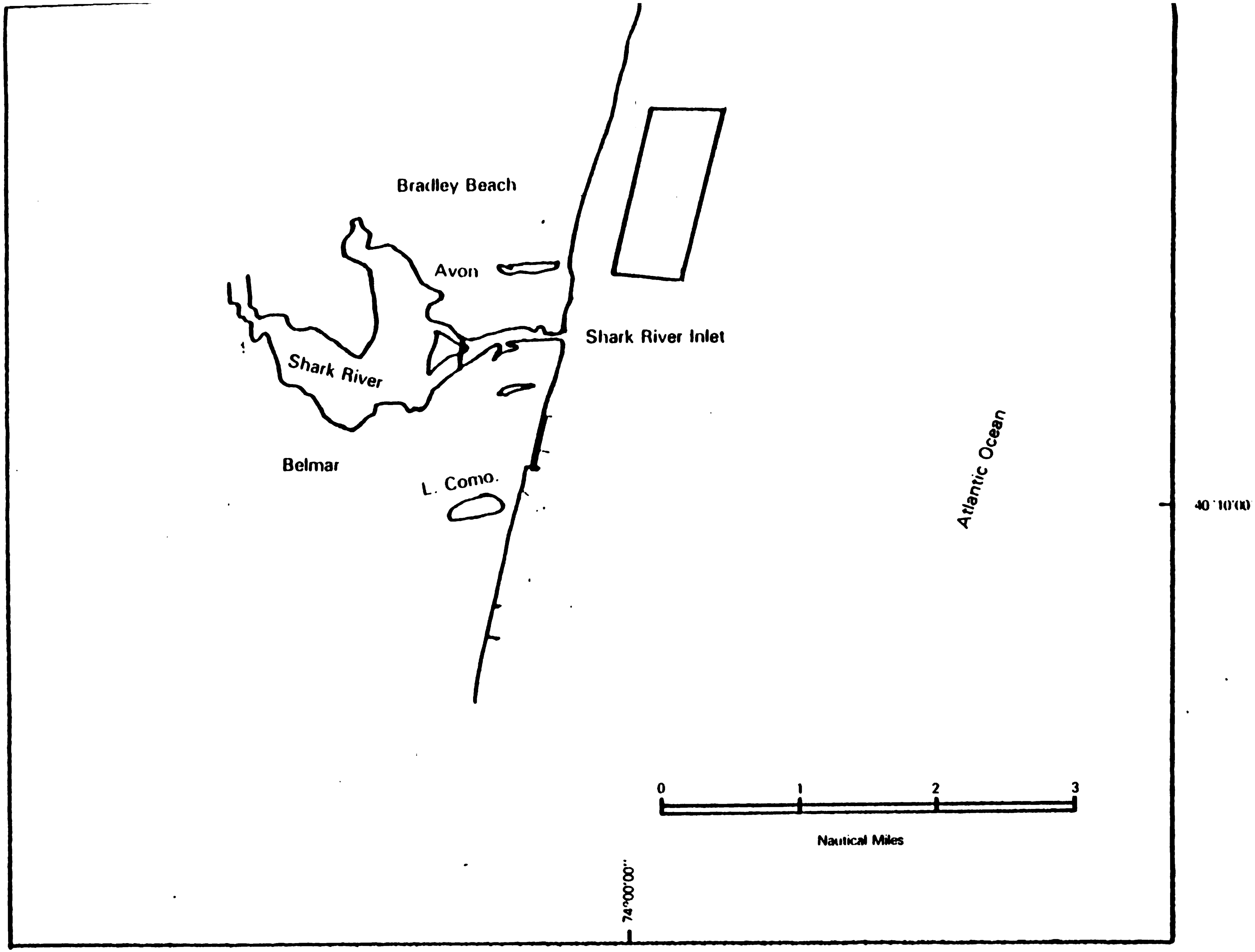
Area	0.38 Square Nautical Miles
Water Depth	6.9 Meters
Distance Offshore	0.4 Nautical Miles
Material Type	Dredged Material

Figure 3. East Rockaway Inlet DMDS

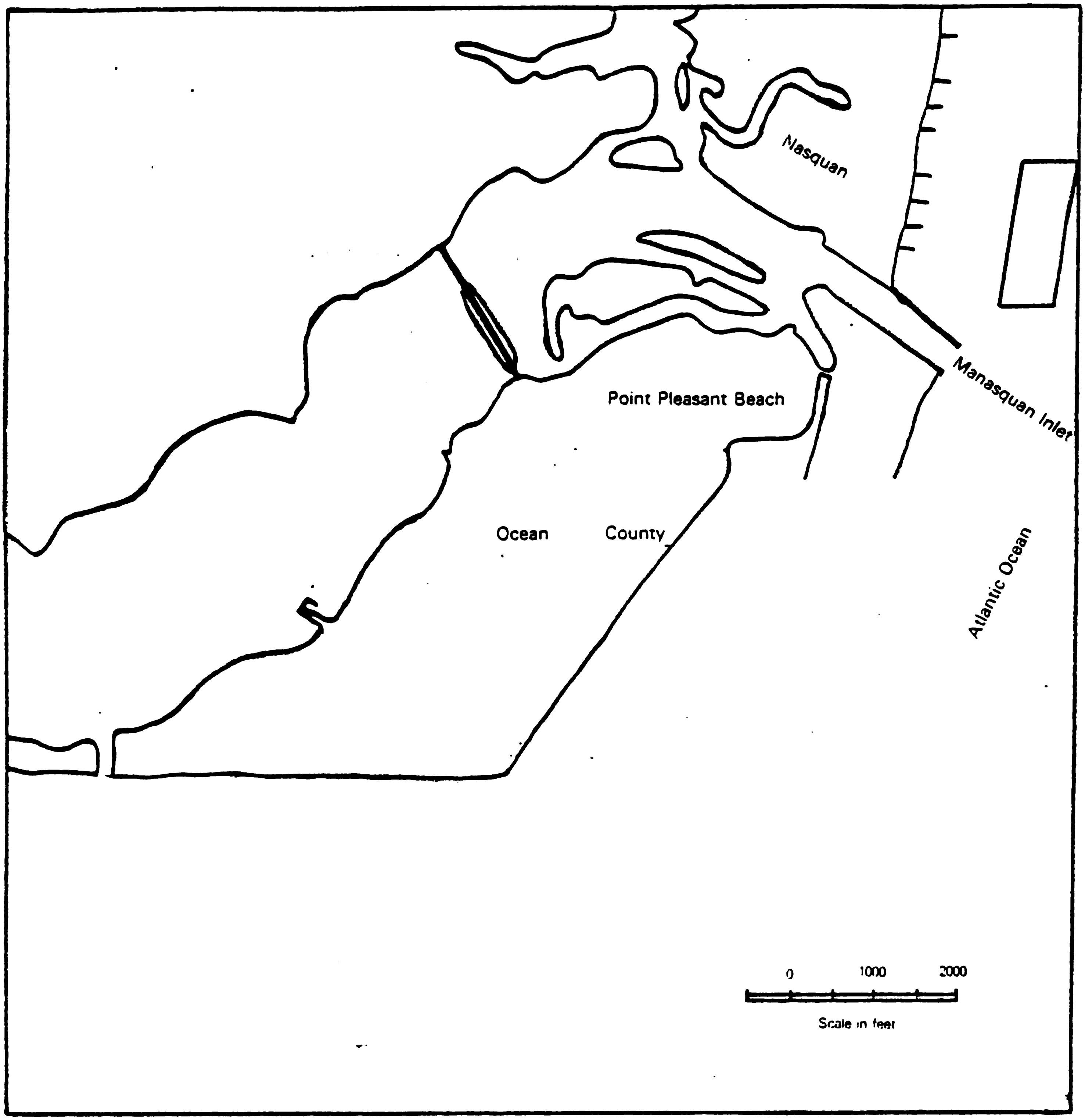


Boundary Coordinates	40°36'49"N, 73°23'50"W		Area	1.09 Square Nautical Miles
	40°37'12"N, 73°21'30"W		Water Depth	7-10 Meters
	40°36'41"N, 73°21'20"W		Distance Offshore	0.5 Nautical Miles
	40°36'10"N, 73°23'40"W		Material Type	Dredged Material
Center Coordinate	40°36'41"N, 73°22'35"W			

Figure 5. Fire Island Inlet DMDS

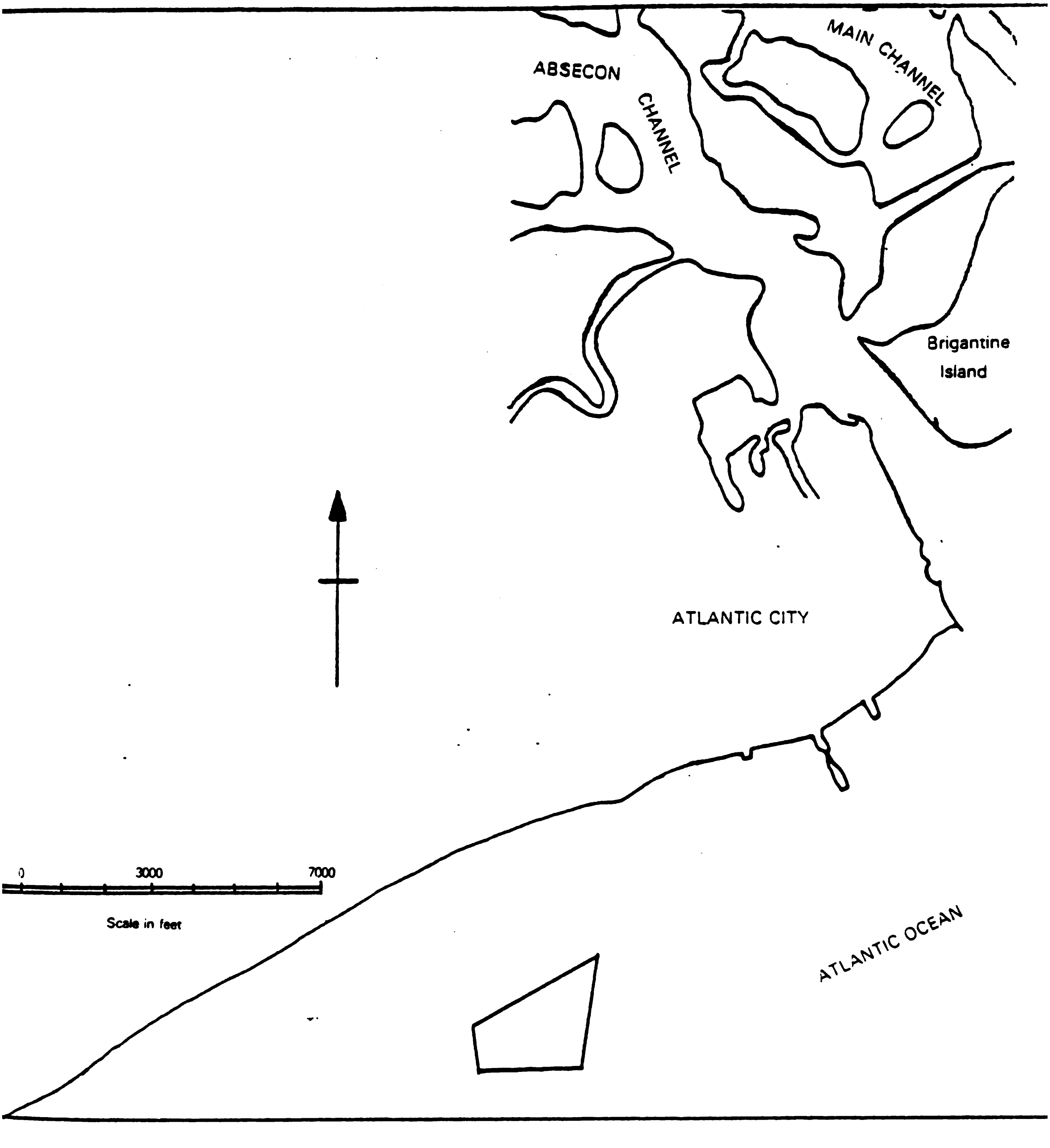


Boundary Coordinates	40°12'48"N, 73°59'45"W		Area	0.6 Square Nautical Miles
	40°12'45"N, 73°59'06"W		Water Depth	12 Meters
	40°11'36"N, 73°59'28"W		Distance Offshore	0.25 Nautical Miles
	40°11'42"N, 74°00'12"W		Material Type	Dredged Material
Center Coordinates	40°12'12"N, 73°59'39"W			



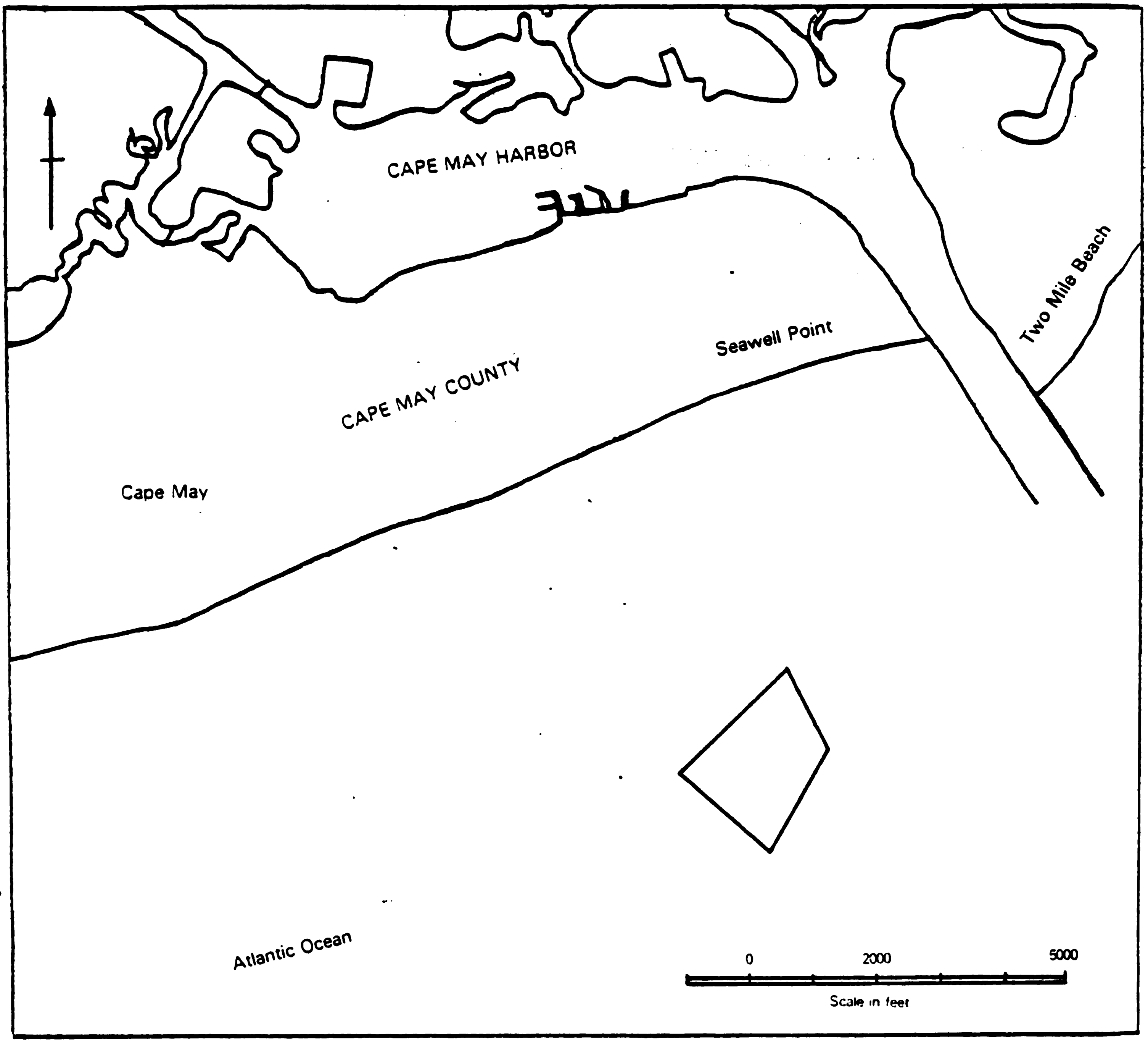
Boundary Coordinates	40°06'06"N, 74°01'57"W	Area	0.3 Linear Nautical Mile
	40°06'32"N, 74°01'65"W	Water Depth	7 Meters
	40°06'03"N, 74°01'89"W	Distance Offshore	0.25 Nautical Miles
	40°06'68"N, 74°01'85"W	Material Type	Dredged Material
Center Coordinates	40°06'30"N, 74°01'33"W		

Figure 7. Manasquan Inlet DMDS



ıdary Coordinates	39°19′07″N, 74°26′51″W	Area	0.3 Linear Nautical Mile
	39°19′64″N, 74°26′35″W	Water Depth	8 Meters
	39°19′04″N, 74°26′88″W	Distance Offshore	0.7 Nautical Miles
	39°19′06″N, 74°27′08″W	Material Type	Dredged Material
ter Coordinates	39°21′13″N, 74°23′47″W		

Figure 8. Absecon Inlet DMDS



Boundary Coordinates	38°55'86"N, 74°53'07"W	Area	0.3 Linear Nautical Mile
	38°55'61"N, 74°52'91"W	Water Depth	9 Meters
	38°55'38"N, 74°53'45"W	Distance Offshore	0.7 Nautical Miles
	38°55'06"N, 74°53'06"W	Material Type	Dredged Material
Center Coordinates	38°55'37"N, 74°53'14"W		

Figure 9. Cold Spring Inlet DMDS

Chapter 2

Alternatives Including the Proposed Action

EPA proposes that the existing, interim designated Long Island (East Rockaway, Rockaway, Jones, and Fire Island) IDMDS's and New Jersey (Shark River, Manasquan, Absecon, and Cold Spring) IDMDS's receive final designation for the disposal of inlet dredged material (Figure 2-1). Final site designation infers only EPA's determinations that the proposed sites are suitable for the disposal of dredged material. Approval for use of the sites will be determined only after review of each project to ensure that the proposed ocean disposal of dredged material is in compliance with the criteria and requirements of EPA and CE regulations. The alternatives considered were:

- <u>No Action</u> - the Long Island and New Jersey IDMDS's would retain their interim designations until their expiration in January 1985, after which no nearshore EPA-approved ocean disposal sites would be available fot dredge material disposal.

- <u>Proposed Action</u> - designation of the existing Long Island and New Jersey IDMDS's (here in after, Existing Sites).

- <u>Alternative Action</u> - designation of ocean sites other than the existing Long Island and New Jersey IDMDSs.

The environmental implication and effects of each alternative listed above have been analyzed from available data and are presented in this chapter.

NO-ACTION ALTERNATIVE

The No Action alternative to the proposed action would be to refrain from designating EPA-approved ocean sites for the disposal of dredged material from the Long Island and New Jersey Inlets. The Existing Sites are currently designated on an interim basis. The interim designations are scheduled to expire in January 1985 unless formal rulemaking is completed earlier that designates the interim sites for continuing use.

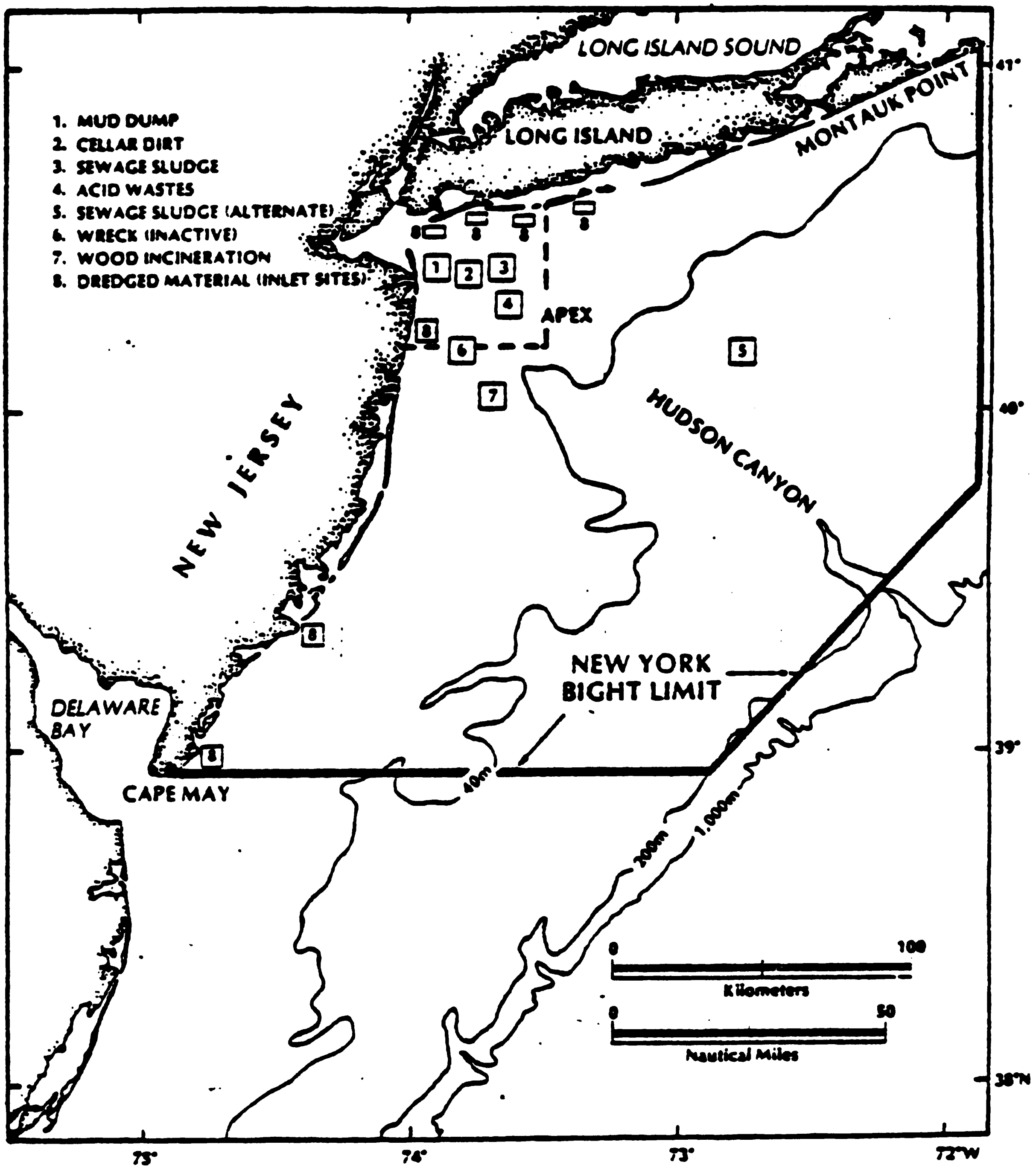


Figure 2-1. Ocean disposal sites in the New York Bight

By taking no action, the present ocean sites would not receive final designation, nor would an alternative ocean disposal site(s) be designated. Consequently, the CE would not have nearshore EPA-recommended ocean disposal sites available in the area. The CE would be required to either: (1) justify an acceptable alternative disposal method (e.g., land based), (2) develop information sufficient to select acceptable alternate ocean sites, or (3) modify or cancel proposed dredging projects that depend upon disposal in the ocean as the only feasible method for the disposal of dredged material. Based on these factors, the No Action Alternative is not considered to be an acceptable alternative to the proposed action.

NON-OCEAN DISPOSAL ALTERNATIVES

The non-ocean disposal alternatives are not evaluated or presented in this EIS since the designation of an environmentally acceptable ocean disposal site is independent of individual project disposal requirements. Non-ocean disposal alternatives must be considered during each permit cycle for non-Federal projects and each project EIS for Federal projects.

- As part of the permit application process, land-based disposal alternatives must be evaluated by both the EPA Regional Office and the CE District, as specified in the Ocean Dumping Regulations (40 CFR Part 227).

- The CE, in conjunction with the EPA Regional Office must evaluate the environmental effects associated with alternative disposal methods (e.g., ocean or land-based) for every project.

SELECTION OF ALTERNATIVE SITES

The general criteria (Ocean Dumping Regulations at 40 CFR 228.5) used in selection of an ocean disposal site are:

- **The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.**

- **Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality...can be...reduced to normal ambient seawater levals or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.**

- **The sizes of ocean disposal sites will be limited in order to localize any immadiate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long range impacts.**

- **...Wherever feasible, designate ocean dumping sites beyond the edge of the Continental Shelf and other such sites that have been historically used.**

Using the general criteria above, three ocean environments off Long Island and New Jersey are considered as possible locations for ocean disposal sites (1) nearshore (depths less than 12m, up to approximately 1 nmi offshore), (2) mid-shelf (depths between 15m and 200m, approximately 10 nmi to 100 nmi offshore), and (3) deepwater slope (depths greater than 200m, approximimtely 100 nmi offshore).

a. Nearshore (less than 1 nmi from shore) - The nearshore Existing Sites are the most feasible and environmental acceptable ocean locations of the disposal of dredged material from the Long Island and New Jersey Inlet areas. The inlet sites are 0.2 to 0.7 nmi offshore, and have been historically used for disposal of dredged material. The dredged materials are nearly identical to the natural sediments in the vicinities of the inlet sites. Only small volumes of material (less than 200,000 yd^3/yr) are dumped at any of the sites.

The proposed IDMDS, which have been previously used for dredged material disposal, are closer to the inlets than any other available ocean sites, making the sites more economically feasible. Dumping in other areas would increase the travel time at sea and also reduce actual dredging time.

There are no clear advantages to designating disposal sites at an alternative nearshore location other than at the Existing Sites. Previous disposal of dredged material at the Existing Sites has not caused significant adverse impacts on human health, economics, safety, or aesthetics. In addition, disposal operations have not interferred with any long-term use of resources. After evaluating the alternatives, it is proposed that the Existing Sites be designated.

b. Mid-Shelf - (<200m in depth) - In selecting a site(s) within the Bight for dredged material disposal, other activities in the area must be evaluated for possible use conflicts (mineral resources, oil and gas lease tracts, fisheries, etc.)

Adequate background environmental information on the area presently exists to provide firm bases for projecting possible disposal impacts. Several shelf locations in the New York Bight have been used for the disposal of wastes (e.g., dredged material, cellar dirt, sewage sludge, and industrial wastes and acids), which could be considered as potential locations for the disposal of inlet dredged material. These other locations were eliminated because of potential conflicts with site use, environmental acceptability, and high transportation costs.

The New York Mud Dump is the most reasonable alternative location other than the historically used interim IDMDS. Many Federal projects, and virtually all private projects use the Mud Dump. Dumping has occurred at the Mud Dump since 1914. A large mound resulting from previous disposal is in the northwest quadrant of the site. The natural sediments at the site have been covered by the accumulation of dredged material. The Mud Dump can possibly provide an alternative site for Long Island and New Jersey dredged materials.

c. Deepwater Slope - (200 - 2000m in depth) - The 106-Mile Site is the closest point to New York Harbor, beyond the Continental Shelf. The Hudson Canyon is due north of the site and is a major geological feature and possible migrating route for fish entering the New York Bight (EPA, 1982). The Hudson Canyon has not been rigorously evaluated, but if various species use the area they could be adversely affected by disposal.

Little background environmental information exists for the Continental Slope beyond the 106-Mile Site. Designation of a site for dredged material disposal in that area would require extensive pre-disposal and monitoring surveys.

This general area is eliminated from further consideration primarily because there is no environmental advantage to barging the dredged material at least 80 nmi from shore. This distance would add considerably to the transportation time and expenses and could require additional barges or vessels. Key information regarding the effects of disposal in the deep ocean is limiting. Finally, surveillance of disposal activities at such distances would be difficult and costly. Therefore, economics represents a major constraint to this alternative.

DETAILED BASIS FOR THE SELECTION OF THE ALTERNATIVE SITES

Part 228 of the Ocean Dumping Regulations describes general and specific criteria for selection of sites to be used for ocean dumping. In brief, the general criteria state that site locations will be chosen "...to minimize the interference of disposal activities with other activities in the marine environment..." and so chosen that "...temporary perturbations in water quality of other environmental conditions during initial mixing...can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery." In addition, ocean disposal site sizes "...will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts." Finally, whenever feasible, EPA will "...designate ocean dumping sites beyond the edge of the Continental Shelf and other such sites that have been historically used." Final designation of the Existing Sites satisfy all of these criteria.

DETAILED CONSIDERATION OF THE ALTERNATIVE SITES

The proposed action is the final designation of the existing, interim designated Long Island and New Jersey Inlet Dredged Material Disposal Sites. This proposed action is based on site evaluations using the 11 specific criteria listed at 228.6(a) of the Ocean Dumping Regulations. EPA established these 11 criteria to constitute "...an environmental assessment of the impact of the site for disposal." The criteria are used to make critical comparisons between the alternative sites, and, using information found in Chapters 3 and 4 of this EIS, were the basis for final site selection.

The Existing Sites (interim designated Long Island and New Jersey IDMDS) and a mid-Shelf Site (Mud Dump) were considered within the context of the 11 site selection criteria.

DETAILED CONSIDERATION OF THE ALTERNATIVE SITES

1. <u>Geographical position, depth of water, bottom topography and distance from coast [40 CFR §228.6(a)(1)]</u>

Table 2-1 summarizes the geographic and physical characteristics for the alternative Existing Sites and the Mud Dump. Bottom topography at the Existing Sites is dominated by sand ridges and swales. Accumulations of dredged material at the Mud Dump has altered the natural bottom topography.

TABLE 2-1

LONG ISLAND INLET DREDGED MATERIAL DISPOSAL SITES

	Boundary Coordinates; Area	Water Depth (m)	Distance Offshore (nmi)	Bottom Topography
Rockaway	40°32'30"N, 73°55'00"W 40°32'30"N, 73°54'00"W 40°32'00"N, 73°54'00"W 40°32'00"N, 73°55'00"W; 0.38 nmi^2	8-11	0.4	Ridge & Swale
East Rockaway	40°34'36"N, 73°49'00"W 40°35'06"N, 73°47'06"W 40°34'10"N, 73°48'36"W 40°34'12"N, 73°47'17"W; 0.81 nmi^2	6-9	0.4	"
Jones	40°34'32"N, 73°39'14"W 40°34'32"N, 73°37'06"W 40°33'48"N, 73°37'06"W 40°33'48"N, 73°39'14"W 1.19 nmi^2	7-10	0.5	"
Fire Island	40°36'49"N, 73°23'50"W 40°37'12"N, 73°21'30"W 40°36'41"N, 73°21'20"W 40°36'10"N, 73°23'40"W 1.09nmi^2	7-10	0.5	"

TABLE 2-1

NEW JERSEY INLET DREDGED MATERIAL DISPOSAL SITES

	Boundary Coordinates; Area	Water Depth (m)	Distance Offshore (nmi)	Bottom Topography
Shark River	40°12'48"N, 73°59'45"W 40°12'44"N, 73°59'06"W 40°11'36"N, 73°59'28"W 40°11'42"N, 74°00'12"W .6 nmi^2	12	0.25	"
Manasquan	40°06'06"N, 74°01'57"W 40°06'32"N, 74°01'65"W 40°06'03"N, 74°01'89"W 40°06'68"N, 74°01'85"W 0.3 linear nmi	7	0.25	"
Absecon	39°19'07"N, 74°26'51"W 39°19'64"N, 74°26'35"W 39°19'04"N, 74°26'88"W 39°19'06"N, 74°27'08"W 0.3 linear nmi	8	0.7	Ridge & Swale
Cold Spring	38°55'86"N, 74°53'07"W 38°55'61"N, 74°52'91"W 38°55'38"N, 74'53'45"W 38°55'06"N, 74°53'06"W 0.3 linear nmi	9	0.7	"
	MID-SHELF ALTERNATIVE			
Mud Dump	40°23'48"N, 73°51'28"W 40°21'48"N, 73°50'00"W 40°21'48"N, 73°51'28"W 40°23'48"N, 73°50'00"W 2.2 nmi^2	16 - 29	5.3 (NJ) 9.6 (LI)	Accumulated Dredged Material

2. Location in Relation to Breeding, Spawning, Nursery, Feeding or Passage Areas of Living Resources in Adult or Juvenile Phases

All the above activities occur throughout the coastal areas of the Bight. The Existing Sites are not known to be uniquely important for any species. The Existing Sites are located near inlets (<2 nmi) that serve as passageways for finfish which use the estuaries and bays for spawning and nursery grounds. The inland waters also provide resting and feeding areas for migratory birds. Shellfish are distributed along both the Long Island and New Jersey coastlines. However, Rockaway, East Rockaway, Shark River Manasquan and Cold Spring IDMDS are all located within Federal and/or State shellfish closure areas (Figure 2-2).

The Mud Dump is not known to be uniquely important for any species in the adult or juvenile life stages. The Hudson Shelf Valley may be an important passage area for lobster and finfish entering the Apex from offshore. The Mud Dump is located on the western edge of the Valley. The probability of adverse effects for dredged material disposal would probably be low if the Mud Dump were designated. The Mud Dump also is within the present shellfish closure zone.

3. Location in Relation to Beaches and Other Amenity Areas

All Existing Sites are located close to shore (<1 nmi). However, the release of material at the sites is not expected to adversely affect the shorelines public health or aesthetics. The inlets and nearby beaches do provide important recreational areas and many tourists utilize these areas during the summer months.

The New York and Philadelphia CE Districts have in the past scheduled their dredging projects during periods of low recreational activity (September to January) so as not to interfere with recreation activities.

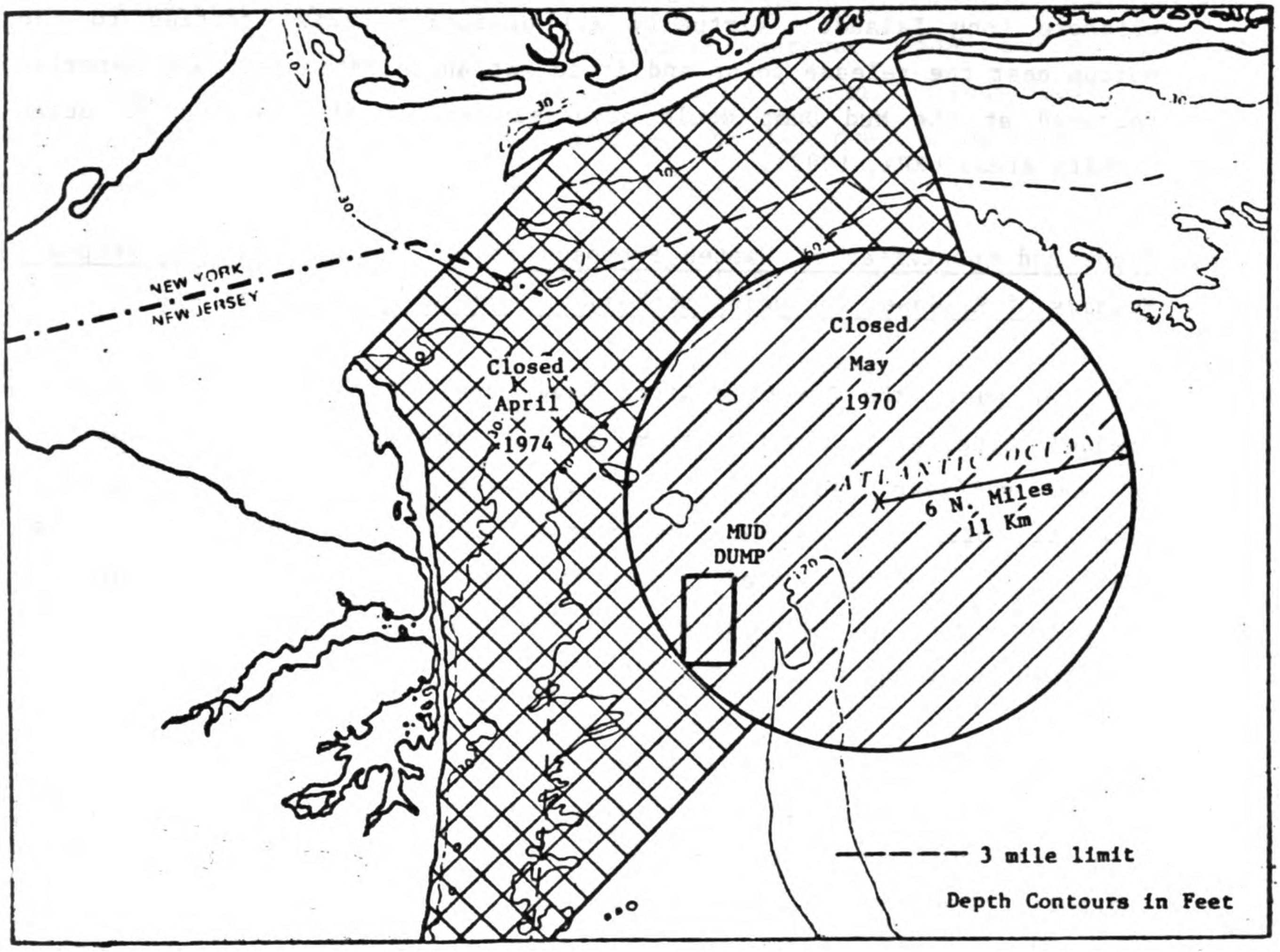


Figure 2-2. Commercial Shellfish Closure Zone

Source: Mitre, 1979

The Mud Dump Site is located 5.3 nmi offshore New Jersey and 9.6 nmi offshore Long Island. Virtually all dredged material settles to the bottom near the release point and it is not anticipated that any material released at the Mud Dump would adversely effect the beaches or other amenity areas (EPA, 1982).

4. Types and Quantities of Wastes Proposed to be Disposed of, and Proposed Methods of Release, Including Methods of Packing the Waste if any

In the past, the Existing Sites have received variable quantities of dredged materials, ranging from 200,000 yd^3/50 years (Rockaway) to 200,000 yd^3/year (Absecon). It is estimated that future dredged material total volumes will be approximately 1 million yd^3 per year (Table 2-2). Sediments dredged from the inlets are predominantly sand and there have been no indications of significant adverse effects resulting from dumping at any of the Existing Sites.

Dredging and disposal methods vary for the different inlets. Rockaway and East Rockaway Inlets typically use a hopper dredge for inlet maintenance projects. Shark River and Fire Island Inlets typically use a hydraulic pipeline to dispose of sediments on the beach; however, if an ocean disposal site is used in the future, dredging and disposal would probably be conducted by a hopper dredge. Disposal methods for Jones, Manasquan, Absecon and Cold Spring Inlets vary because equipment used to dredge the inlets is determined by private contractor.

At the Mud Dump all dredged material would be transported by dump scow or hopper dredge. Each load would be bottom dumped over a period of a few minutes and none of the material would be containerized or packaged in any way.

In the cases of beach nourishment, the dredged material must be relatively clean and coarse textured. It is recommended that dredged material be used for beach nourishment wherever needed and economically feasible. Based on the findings of a Rutgers' Study (1981), beach nourishment should be the preferred use for dredged material from both Absecon, Cold Spring, and Manasquan Inlets.

5. Feasibility for Surveillance and Monitoring

Surveillance is feasible at each of the alternative sites because of their limited distance from shore. The Mud Dump is located offshore from New Jersey and Long Island, 5.3 and 9.6 nmi respectively. The Existing Sites all are located less than 1 nmi from the shorelines.

The USCG presently conducts routine surveillance at the Mud Dump. Dumpers holding permits (i.e., non-Federal projects) must notify the USCG prior to depature. If a dumper violates a permit condition, the USCG refers the matter to the EPA for resolution.

Monitoring would be feasible at either the Existing Sites or the Mud Dumps. NOAA has developed and implemented a monitoring program (Northeast Monitoring Program) for the New York Bight. The NYD-CE and Waterway Experiment Station (WES) are presently developing a monitoring plan. However, the plan has not been completed nor has the CE decided when it will be implemented.

Table 2-2

Site	Description of Dredged Material	Approximate Dredged Volumes (yd^3)	Frequency of Dredging	Method of Release *
Long Island Inlets				
Rockaway	96% sand	200,000	every 50 years	from hopper dredge
East Rockaway	98% sand	100,000	annual	"
Jones	99% sand	175,000	"	variable**
Fire Island	99% sand	1.5 million	"	pumped onto beach from hydraulic pipeline
New Jersey Inlets				
Shark River	88-96% sand	42,000	every 5 years	pumped onto beach from hydraulic pipeline
Manasquan	at least 80% sand	80,000	bi-annual	variable**
Absecon	at least 80% sand	200,000	annual	"
Cold Spring	sand, percentage unknown	50,000	bi-annual	"

*Usual method reported by CE; dredged material is not packed

**Equipment used for dredging is determined by contractor, therefore method of release may vary

6. Dispersal, Horizontal Transport and Vertical Mixing Characteristics of the Area, Including Prevailing Currents, Direction and Velocity, if any

Circulation patterns in the Bight are variable, a result of wind, geology, and the New York and New Jersey coastlines (CE, 1983). Generally, nearshore current flows are towards the southwest and onshore. McClennen and Kramer (1976) reported that normal bottom, tidal currents average 10 cm/s. Wind driven currents in the Bight indicate a net surface flow to the southwest at speeds averaging about 4 or 5 cm/s, but subject to reversals, especially during summer (Hansen, 1977).

At each of the alternative sites, long-term sediment transport would be epiodic and dominated by storms. Butman et al., (1979) reported that currents associated with storm conditions (primarily in winter) resuspended and transport bottom sediments in a southwest direction on the mid-Atlantic Shelf. The NYD-CE has stated that disposal of dredged material at the Existing Sites, should aid in the control of beach erosion. The majority of the sediment should be transported inshore towards the beaches (CE, 1973 and 1974b). In general, transport of suspended solids from dredged material disposal will depend primaily upon the speed and direction of the wind and upon the direction of tidal currents.

7. Existence and Effects of Current and Previous Discharges and Dumping in the Area (Including Cumulative Effects)

The environmental effects of dredged material disposal are dependent upon the characteristics of the dredged material and the environmental conditions at the disposal sites.

Short-term impacts have included temporary increases in turbidity, burial of benthic organisms and the possible alteration of existing habitats (CE, 1983). At disposal sites studied in the Dredged Material Research Program (DMRP) between 1973 and 1978, it was demonstrated that the effects on physical, chemical, and biological variables in the water column were negligible.

Other impacts may include depletion of dissolved oxygen, elevated ammonia concentrations, increases or decreases in phytoplankton productivity, and direct physical effects on fish (NJDEP, 1981). However, Wright (1978) stresses that the effects are site specific and that no evidence has been found to demonstrate significant impacts beyond the disposal areas, except in cases of movement of the dredged material by bottom currents.

Dredged material disposal has produced no significant adverse effects on the water quality at the Existing Sites. EPA/IEC survey data did not indicate any trends attributable to previous or current disposal of dredged material. No major differences in finfish and shellfish species or numbers were found in recent EPA/IEC surveys within and adjacent to the Existing Sites.

Past use of the Existing Sites has created localized, but temporary mounding and temporary disturbances of benthic infauna and demersal fish assemblages (Chapter 3, EPA/IEC Survey). High variability in diversity and density of benthic communities within the nearshore region normally exists. This natural variability may obscure the identification of impacts due to past use of the Existing Sites. However, no adverse, cumulative effects are evident from previous disposal operations.

The vicinity of the Mud Dump has been affected by disposal operations since dumping began in 1914. Until late 1978, the southern portion did not receive direct dumps, but was rather influenced from dumping occurring near the northwest corner. Since then, disposal vessels have been directed to dump in the southern half of the Mud Dump. Up to 1.2m (4 ft) of dredged material has accumulated in the southern half of the site, and there are indications that some changes to the south and east (towards the Hudson Shelf Valley) may result from disposal (EPA, 1982). Other changes may occur west of the site (e.g., geochemical parameters and grain-size characteristics), but would be limited to less than a mile from the western boundary. The site itself is nearly devoid of benthic infauna, probably due to repeated dumping. Outside the site boundaries, the distribution of numerically dominant organisms is apparently unaffected by disposal activities. Seasonal data shows no trends associated with dumping, and sedimentary characteristics appear to be the dominant factor controlling the benthos.

8. <u>Interference with Shipping, Fishing, Recreation, Mineral Extraction, Desalination, Fish and Shellfish Culture, Areas of Special Scientific Importance and Other Legitimate Uses of the Ocean</u>

The inlets handle light shipping traffic and because of the proximity of the Existing Sites to the inlets some traffic undoubtedly would pass through the sites. However, all Existing Sites are located inshore of the major shipping lanes, with the exception of Rockaway IDMDS and the Mud Dump which are located within a precautionary zone. Use of Mud Dump would have the highest probability of disposal operations interference. However, barges have been traveling to the site for nearly 70 years without any reported navigational problems (EPA, 1982).

A number of important commercial or recreational fisheries exist in Long Island and New Jersey inshore waters. However, none of the disposal sites represent unique fishery areas. A total of about 125 species of finfish have been reported from the estuarine marine waters of the vicinity. Many species are primarily offshore species as adults but utilize the inshore waters when they are young. A number of species are important food sources.

Many of the areas adjacent to the inlet are condemned for the taking of oysters, clams, and mussels because of bacterial contamination. Shellfishing is presently restricted at the following disposal sites: Rockaway Inlet, East Rockaway Inlet, Shark River Inlet, Manasquan Inlet, Cold Spring Inlet, in addition to the Mud Dump.

The creation of temporary turbidity within the disposal areas may have a short-term impact on the local marine life. Benthic organisms would be destroyed as their original habitat conditions are disturbed.

Recreational use of the Bight waters near the Existing Sites consists primarily of boating and sport fishing. The sport fisherman may discover a temporary loss of fish at the disposal area during disposal operations, but this would not be a permanent impact.

The public beaches also should not have to suffer any disruptions in their use due to the proximity of the disposal sites. No significant impacts on aesthetics shall occur. The disposal operations might possibly add noise to the surrounding areas. However, the proximity of residential communities and the time of operation are such that this disturbance would be minimal.

No resource developments occur in the immediate vicinity of the Existing Sites or the Mud Dump, and no mineral extraction or desalination projects are expected in the vicinity of the sites. The Existing Sites and the Mud Dump are not of unique scientific importance; aquaculture activities presently do not occur in the vicinity of the alternative sites.

9. <u>The Existing Water Quality and Ecology of the Site as Determined by Available Data or by Trend Assessment or Baseline Surveys</u>

Environmental surveys conducted by EPA/IEC have indicated that the disposal of dredged materials at the Existing Sites has not caused significant adverse effects on water quality (e.g., dissolved nutrients, trace metals, dissolved oxygen, or pH).

Effects on plankton in the area are difficult to assess because of the high natural variability in their populations. Since no significant release of nutrients or trace metals accompany the disposal of dredged material, no detectable effects upon phytoplankton are expected. Similarly no adverse effects upon anadramous or pelagic finfish are expected. Water quality is similiar to conditions reported in the literature for the New York Bight (EPA, 1982).

Some temporary changes in the water quality would occur as a result of disposal operations at the sites. Resuspension of sediment subsequent to disturbance of bottom deposits would be inevitable; however, the resulting increase in turbidity and concomitant water discoloration would not persist and would depend upon the nature of the suspended material.

The release of organic matter and volatile solids from the dredged material might cause a temporary decrease in the dissolved oxygen (DO) concentrations at the disposal sites. If oil and grease are present (i.e., Shark River Inlet) in significant concentrations this might lead to the formation of a surface film thus inhibiting the replenishment of the DO supply via diffusion and aggrevate the situation. However, wave action should prove capable of both diluting the suspended organics and dispersing the surface of films (CE, 1976).

EPA/IEC Data indicates that the organisms present in the disposal areas are not unique to the disposal sites, but rather are found throughout the area. Thus, while macrobenthic losses are expected to occur within the sites, it is anticipated that a similar benthic community will re-establish itself. Also, benthic organisms will be effected by turbidity and sedimentation during disposal operations. As the sediments settle, benthic habitats can be blanketed, resulting in the temporary smoothering of sessile, benthic organisms. Highly motile invertebrates will move to avoid these disturbances and return after the operations have ceased. An increase in turbidity results in a decrease in the zone of light penetration, thereby reducing the primary productivity in the area. This reduction affects the entire food web because less food is produced at the primary level.

The Mud Dump has been extensively modified by previous disposal activities. Benthic density is low, probably resulting from repeated burial. Levels of some contaminants (e.g., metals) are higher than in surrounding areas.

Differences of opinion exist regarding the sources of contaminants, extent of contaminant levels, and possible overloading of the plume area. Although areas of the bottom are stressed, the fauna shows high spatial and temporal variability, primarily controlled by natural process (Pearce et al., 1976). For example, the 1976 oxygen depletion event did not result from ocean dumping but from natural physical and biological processes (Folkowski et al., 1980). However, others maintain that the levels of cadmium, PCBs, and aromatic hydrocarbons are approaching or exceeding safe levels (EPA, 1982).

10. <u>Potential for the Development or Recruitment of Nuisance Species in the Disposal Site</u>

There are no known components in the dredged material or consequences of its disposal which would attract or result in the recruitment of nuisance species to any the alternative disposal sites. EPA/IEC surveys at the sites did not detect the development or recruitment of any nuisance species.

11. <u>Existence at or in Close Proximity to the Site of any Significant Natural or Cultural Features of Historical Importance</u>

No such features are known to exist at or near any of the alternative sites.

No ship wrecks off New Jersey or Long Island within the areas of interest, are listed on the National Register of Historic Places.

Conclusions

A summary of the 11 site-selection criteria for the alternative sites is presented in Table 2-3.

SUMMARY OF THE SITE SELECTION
CRITERIA AS APPLIED TO THE ALTERNATIVE SITES

Table 2-3

Criterion	Existing Sites	Shelf Site
1. Geographic position, depth of water, bottom topography, and distance from the coast	Sites located close to shore (<1 nmi); depths <12m; ridge and swale topography	Located >10 nmi water depths 16-29m; mounding resulting from previous disposal activities
2. Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases	Living resources breed and spawn in and near inlet areas; the nearshore regions are important fish and invertebrate passage areas	All activities occur throughout the Bight; located on western edge of Hudson Shelf Valley, which may be an important passage area
3. Location in relation to beaches and other amenity areas	All sites within 1 nmi from beaches; and recreational areas	No beaches in immediate vicinity; some recreational fishing near site
4. Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of packing the waste, if any	Sites receive 25,000 - 200,000 yd^3 annually; 80%-98% sand composition; disposal methods vary; beach nourishment recommended	Same as for the Existing Sites
5. Feasibility of surveillance and monitoring	Surveillance by shore-based observers on day-use boats possible; monitoring is feasible	Surveillance by shipriders or aircraft possible; monitoring is feasible
6. Disposal, horizontal transport and vertical mixing characteristics of the area including prevailing current direction and velocity, if any	Rapid settling; no persistent turbidity plume; potential for beach nourishment; transport dependent upon wind speed, direction and tidal currents	Short-term movement of material is minimal; long-term movement dominated by storms; net movement is NW to SW
7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects	Adverse effects including temporary mounding, smothering of some benthic organisms; no significant impacts	The site has received dredged material for over 30 years; adverse effects include reduction of bottom-dwelling organisms, and a mound in NW area of the site

ble 2-3 (cont'd)

Criterion	Existing Sites	Shelf Site
Interference with ipping, recreation, neral extraction, salination, fish and ellfish culture, areas special scientific portance and other gitimate uses of the ean	Mineral extraction, desalination, fish and shellfish culture does not occur; minimal interference with commercial/ recreational shipping; previous disposal operations have not interfered with other legitimate uses of the ocean	Minimal interference with shipping. Next to highly populated sport fishing area. No interference with other criteria
The existing water ality and ecology as termined by available ta by trend assessnt or by baseline studies	Water quality and ecology of the site have not been adversely affected by disposal; benthic organisms will be most directly affected	Disposal has only transient effects on water quality. Extreme mounding at NW corner. Low biotic density due to repeated disposal
. Potentiality for the velopment or recruitnt of nuisance species the disposal site	Dredged material has no components which would favor development or recruitment of nusiance species	Same as for the Existing Sites
. Existance at or in lose proximity to the te of any sigificant tural or cultural fracres of historical portance	No features of historical importance at or near the sites	Same as for the Existing Sites

All the Existing IDMDS are compatible with the criteria used for site evaluation, are at reasonable costs, and are prefered to the alternative Mud Dump site. The following criteria are considered extremely relevant in the selection of the Existing Sites as the favorable locations for the disposal of dredged material.

- o Historical disposal of dredged material at the Existing Sites has not shown significant adverse effects. Site-specific investigations have detected only minor, temporary changes in the physical, chemical, and biological characteristics at the sites.

- o Surveillance and monitoring of these sites are significantly easier because the Existing Sites are close to shore (<1 nmi) and within shallow-water depths (<12m).

- o Disposal at the Existing Sites may provide benefical beach nourishment.

- o Dredged material disposal at the Existing Sites is significantly more cost effective.

Disposal of inlet dredged materials is not preferred at the Mud Dump for the following reasons:

- o It has been estimated that based on current disposal rates, the life expectancy of this site is only an additional 10-12 years.

- o Only provides a possible alternative for some Long Island and northern New Jersey inlets due to increased distance from inlets.

- o Mud Dump's sedimentary characteristics differ from natural sediments of the inlet areas.

On the basis of historical use, the absence of significant adverse impacts, cost effectiveness, and the relative ease of which a monitoring program can be implemented, the EPA proposes, in accordance with the Regulations, that the interim designated Long Island and New Jersey IDMDS receive final designation.

Use of the Sites

All future uses of the Long Island and New Jersey IDMDS for Ocean Dumping must comply with the EPA Ocean Dumping Regulations and Criteria. Only dredged materials from the inlet areas meeting the requirements of 40 CFR §227.13 will be disposed of at the IDMDS. The sites may be used for such disposal only after evaluation of each Federal project or permit application has established that the disposal is in compliance with the criteria and requirements of EPA and CE regulations.

Permissible Material Loadings

Historically dredged material disposal volumes have ranged from 25,000 yd^3 - 200,000 yd^3 annually. These disposal operations have caused only localized mounding, slight changes in sediment texture, and minor effects to the benthic fauna (described in previous sections). Continuation of these rates of disposal are acceptable. Accelerated disposal rates may also be acceptable. If accelerated disposal rates occur and are observed in monitoring programs to produce appreciable adverse effects, disposal operations would be altered in accordance with the Ocean Dumping Regulations (40 CFR §228.11) in order to reduce effects.

Disposal Methods

Present disposal methods practiced by the CE at the Existing Sites are acceptable for future dumping. The materials are dredged, and either transported by hopper dredge, barge or scow combination, and discharged from under water ports while the vessel is underway and within the boundaries of the disposal sites.

Material dredged from Fire Island and Shark River Inlets in the past have been deposited onto the nearby beaches from hydraulic pipelines. The EPA recommends that the use of dredged material for beach nourishment should be implemented wherever possible. Pending further study it also may be the preferred use for other inlet dredged materials. Beach erosion is a major environmental problem in Long Island and New Jersey. Beach nourishment is an effective management program to help control erosion and offers significant beneficial effects.

Disposal Schedules

The EPA recommends that disposal operations be performed during the period from September to January. Disposal operations during this time period would cause minimal significant effects on the quality of the natural or human environment at the disposal sites or at any other location.

Monitoring the Disposal Sites

Section 228.9 of the Ocean Dumping Regulations established that the impacts of dumping on a disposal site and surrounding marine environment will be evaluated periodically. The information used in making the disposal impact evaluation may include data from monitoring surveys. Thus, "if deemed necessary" the CE District Engineer (DE) and the EPA Region II Administrator (RA) may establish a monitoring plan by determining the appropriate monitoring parameters, the frequency of sampling, and the areal extent of the survey. The factors considered in making determinations include the frequency and volumes of disposal, the physical and chemical nature of the dredged material, the dynamics of the site's physical processes, and the life histories of the species monitored.

The primary purpose of the monitoring program is to determine whether disposal at the site is significantly affecting areas outside the sites, and to detect long-term adverse effects. Consequently, the monitoring study must survey the sites and surrounding areas, including control sites and areas likely to be effected, as indicated by environmental factors (e.g., prevailing currents and sediment transport). The results of an adequate survey will provide early indication of potential adverse effects radiating from the sites. Knowledge of density and concentrations gradients facilitates predication of future impacts on areas surrounding the disposal sites, and provides direction for management of future disposal activities.

Guidelines for the Monitoring Plan

Historically, no significant adverse effects from previous disposal activities have been observed. Monitoring requirements for the sites are minimized by the nature of the dredged material (sand) and its similarity to sediments at the disposal sites and surrounding areas. Many physical parameters will not be significantly affected by disposal (e.g., temperature, and salinity). Physical parameters showing variation during disposal (e.g., turbidity) quickly return to ambient levels due to the high-energy environment in the sites and the nature of the dredged material. The DE and RA may choose to monitor selected parameters occasionally experiencing a wide natural variability (e.g., sediment characteristics during exceptionally high runoff) in order to separate natural environmental fluctuations from these caused by dredged material disposal.

Chapter 3

Affected Environment

The Existing Sites are all within the New York Bight. Physical processes of the Bight operate over broad areas, as well as locally, and cause variations in the chemical and biological characteristics of the water over the entire region. The sediments and associated biota in the Apex and near each of the sites are typical of sand-bottom communities occurring throughout the mid-Atlantic Bight.

CLIMATE

Climate parameters of interest at the Existing Sites are air temperature, rainfall, wind patterns, and the occurrences of storm and fog. Air temperature interacts with surface waters and may influence the vertical stability of the water during warm periods. Rainfall increases freshwater runoff, thereby decreasing surface salinity and intensifying the vertical stratification of the water. Coastal runoff contributes suspended sediment and various chemical contaminants. Winds and storms generate waves and currents which can resuspend and transport dredged material. A high incidence of fog during particular seasons might affect navigational safety and limit disposal operations.

AIR TEMPERATURE

Average normal temperatures are similar for the New York and New Jersey coasts, with New Jersey temperatures slightly higher. Mean temperatures range from the minimum of 2°C in February to a maximum of 22°C in August for New York. Annual average temperatures range from 11°-12°C along coastal New York and New Jersey.

During extreme winters the interior bay waters are completely closed to navigation by ice. In ordinary winters, some of the channels, especially near the Long Island and New Jersey inlets, remain open most of the time, though ice always forms on the flats. The inlets are rarely closed but passage is often difficult because of running ice. All the principal inlets and adjacent channels are used in winter by local fishing boats (NOAA, 1972).

PRECIPITATION/FOG

The Bight coastal region averages 18 to 24 thunderstorms a year; most occurring from June to August. Precipitation occurs throughout the year, and August generally has been the month of heaviest precipitation (11-12 cm).

Visibility at the Existing Sites is sometimes reduced by fog, smoke, and haze. Thick fog occurs, but not frequently enough to significantly restrict travel to and from the site. Visibility reduced by fog to less than 1 nmi occurs with greatest frequency in May and June (11 and 8 days/month, respectively). When necessary, disposal operations could be performed safely under conditions of reduced visibility.

WINDS

Surface winds are one of the most important driving forces to cause current flow variations over the Continental Shelf in the Bight (Beardsley et al., 1976). The distribution of surface wind speeds and directions has a pronounced seasonal variation but very little spatial variation (Lettau et al., 1976), suggesting that surface winds over the Bight are governed by broad circulation systems rather than small, local systems. Westerly and northwesterly surface winds generally predominate in winter, while southerly and southwesterly winds generally prevail in summer (Lettau et al., 1976).

Winds speeds over Bight coastal areas are usually moderate. During winter, winds are primarily offshore, with average velocities of 4.5 to 5.8 m/s (10 to 15 mph). Summer winds are predominantly onshore, with average speeds of 2.7 to 4.0

m/s (6 to 10 mph; Lettau et al., 1976). Highest recorded wind velocities for the Bight (50 m/s [113 mph]) were due to tropical storms (Hurricane Hazel, recorded at the Battery in 1954; Lettau et al., 1976).

STORMS

Seasonal storms are characteristic of the Bight. Extratropical (north easterly) storms are common from November until April (Pore et al., 1974); tropical storms (hurricanes) usually occur in late summer or early autumn, but are rare (Pore and Barrientos, 1976). Storms may restrict a particular disposal operation, but frequencies or severities are not sufficiently common to restrict disposal operations for extended periods.

PHYSICAL CONDITIONS

Clear seasonal patterns of temperature, salinity, density structure, isolation, and river runoff occur in the Bight. The physical conditions at all the Existing Sites are similar.

TEMPERATURE

Annual minimum water temperatures (often less than 2°C), associated with well-mixed, unstratified waters, occurs in January (Bowman and Wunderlich, 1976). Thermal stratification begins in May when surface temperatures reach 9°C to 11°C, whereas bottom (below 30m) temperatures remain near 4°C. The thermocline continues to intensify through the summer. Maximum surface temperatures (up to 26°C) occur in August.. Bottom waters retain their characteristics with little modification until storms and cooling trends break down the thermocline in late autumn. By the end of October, surface temperatures are 16°C to 18°C over most of the Apex. As winter progresses, vertical mixing continues and the temperatures decline towards the winter minimum.

SALINITY

Surface salinity distribution show winter maxima and summer minima (Bowman and Wunderlich, 1976). Salinity generally increases with increasing depth over the shelf, although in some areas the water is homogeneous with depth. Salinity steadily increases seaward from less than 32°/oo along the coast to between 32 and 34°/oo over the central shelf, reaching approximately 35°/oo at the Shelf Break (mean values)

WATER MASSES

Hollman (1971) has identified three water types in Bight Shelf Waters: (1) Hudson River Plume Water; (Bowman and Wunderlich, 1977), (2) Surface Shelf Water, and (3) Bottom Shelf Water.

Hudson River Plume Water

The combined discharges to the Hudson and Raritan Rivers flow from the Lower Bay into the northwest corner of the Apex as a low-salinity plume. Discharge volumes are maximal in April and minimal in August. Approximately one-half of the annual discharge occurs during March, April and May (Bowman and Wunderlich, 1976). The plume presists throughout the year; the extent and depth are highly dependent on local winds and flow rates from the Hudson and Raritan Rivers (McLaughlin et al., 1975). Generally, the plume flows southward between the New Jersey coastline and the axis of the Hudson Shelf Valley. During winter, however, the plume may flow eastward between the southern coast of Long Island and the axis of the Hudson Shelf Valley, or, in some instances, the plume may split and flow both eastward and southward.

Surface Shelf Water

With the onset of heavy river discharge in the spring, surface salinities in the Bight decrease and a moderate salinity-maintained stratification occurs, separating Surface Shelf Water from Bottom Shelf Water. Decreasing winds and increasing insolation cause a stronger thermocline to develop (Charnell and Hansen, 1974). The two-layer system reaches its maximum strength by August. Summer Surface Shelf Water is characterized by moderate salinity (25 to 27 parts per thousand) and high temperatures (26°C; Bowman and Wunderlich, 1976).

Bottom Shelf Water

During winter, water characteristics essentially are homogeneous over the Bight Shelf. With rapid formation of a thermocline and separation of Surface Shelf Water in spring, bottom waters become isolated until the next winter. Bigelow (1933) reported that this "cold pool" (temperatures of 6°C to 8°C), which extended from the south of Long Island to the opening of Chesapeake Bay, was surrounded on all sides by warmer water. The cool temperatures of the bottom water persists even after the surface layers have reached the summer maximum. The upper layer of the Bottom Shelf Water is usually between 30m to 100m depth during summer (Bowman and Wunderlich, 1977).

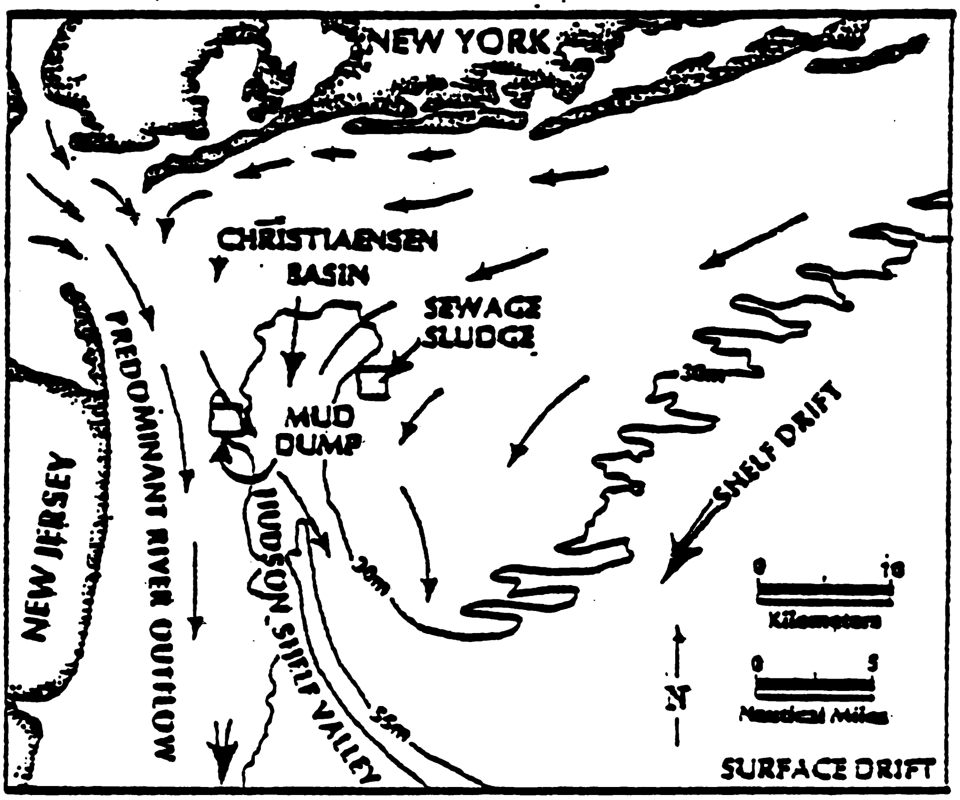
TIDAL CURRENTS

Tides along the Long Island and New Jersey coasts are semi-duirnal with two flood and two ebb tides during a 24.48 hour period. The mean tidal range within the Long Island and New Jersey inlets varies between four and five feet. In the inland waters the tides are affected by the winds. In general, westerly winds produce lower than normal waters and easterly winds produce higher than normal water. Strong winds of long duration may cause as much as three feet of variation in water level in portions of the waterways which normally experience a tidal range of only 0.05 feet. Near the IDMDS the wind has considerably less effect. Tidal lay in the waterway varies with latitude and position relative in the inlets.

WAVES

Waves normally come from the east with a slight shift to the northwest during the winter and to the southwest during the summer. The median wave height is approximately 4 feet during the winter and 2 feet during the summer (Bumpus et al., 1973; Swanson, 1976).

Waves have little influence on the initial dispersal of dredged material at the IDMDS because most of the material settles quickly to the bottom. Both storm-induced surface waves and tidal-influenced internal waves, however, can contribute to sediment resuspension, and must be considered in evaluating bottom sediment transport at the Existing Sites.



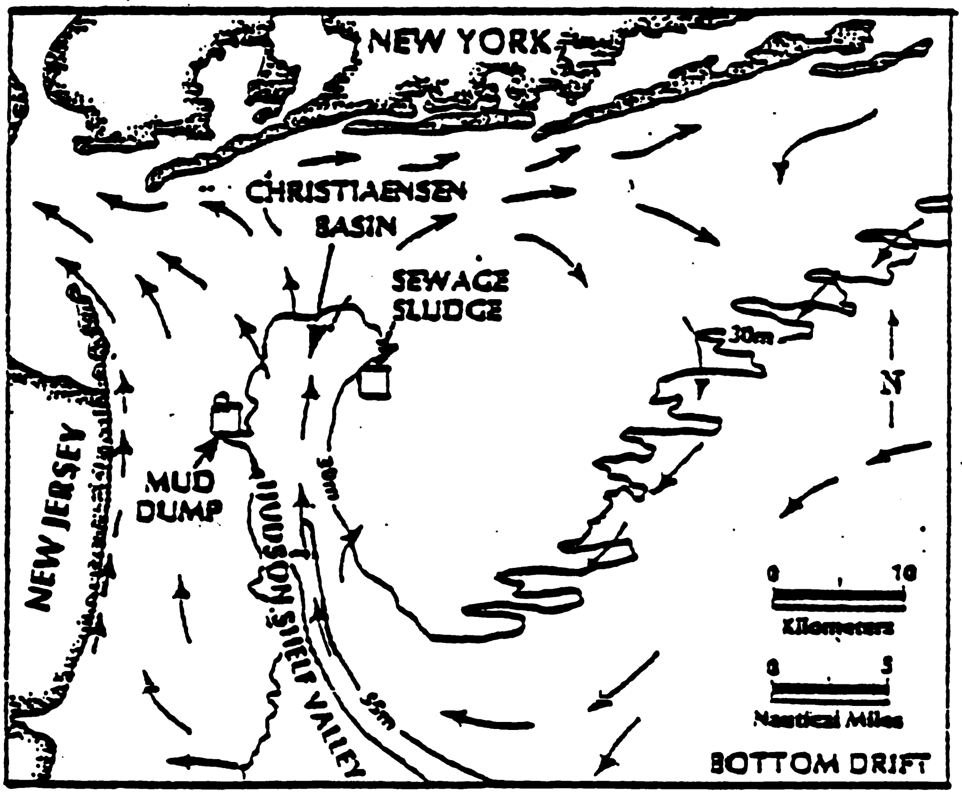


Figure 3-1. Surface and Bottom Circulation in the Apex (Late Autumn)
Source: McLaughlin et al., 1975

GEOLOGICAL CONDITIONS

The New York Bight Continental Shelf is a sloping plain resulting from glaciation and sea level changes over the past several million years (Freeland and Swift, 1978). The apex of the Bight is the result of a post glacial rise in sea levels which partially submerged the lower valleys of the Hudson and Raritan Rivers (O'Connor et al., 1977).

The landward boundary of the New York Bight is formed by barrier islands with numerous tidal inlets (O'Conner et al., 1977). These inlets are areas where coarse and medium grained sediments are deposited by littoral forces (Gross, 1976). These tidal forces also result in the entrainment and accumulation of sediment in the vicinity of the Long Island and New Jersey Inlets.

The inner shelf is dominated by ridge and swale topography (Figure 3-2). Ridge spacing is generally about 1 nmi, amplitude 2 to 10 m; alignment is mostly east to northeast at 20° to 30° angler to the shoreline.

SEDIMENT COMPOSITION

Shelf sediments are well sorted and predominantly sand with scattered patches of gravel, except in the Hudson Shelf Valley, the Christiaensen Basin and in the immediate vicinities of the tidal inlets (Swifts et al., 1979). The sediments are composed primarily of quartz and feldspar and range from coarse to medium sand. The inlet sediments generally consist of well-sorted medium to fine quartz sand with minor contributions of silt and clay. The fine grained silt and mud components are primarily the result of natural forces (Beardsley et al., 1976).

CIRCULATION

The major feature of Bight surface circulation is a flow towards the southwest, paralleling the coastline (Figure 3-1). Surface speeds average 3.7 cm/s (Connor et al., 1979). A anticyclonic (clockwise) bottom gyre is present. This gyre is one component of a northward-flowing bottom current which splits when it reaches shallower waters near the coast (McLaughlin et al., 1975).

Exchange circulation, characterized by seaward surface flow of estuarine waters and landward flow of denser bottom waters, occurs throughout the Sandy Hook/Rockaway Point Transect. These features can be displaced due to tidal oscillations and can be masked by stronger, but variable, wind-driven currents, and may be drastically altered for periods of several weeks. Alterations are more common during the summer, when sustained periods of strong, persistent, southerly winds can influence circulation patters (Hansen, 1977).

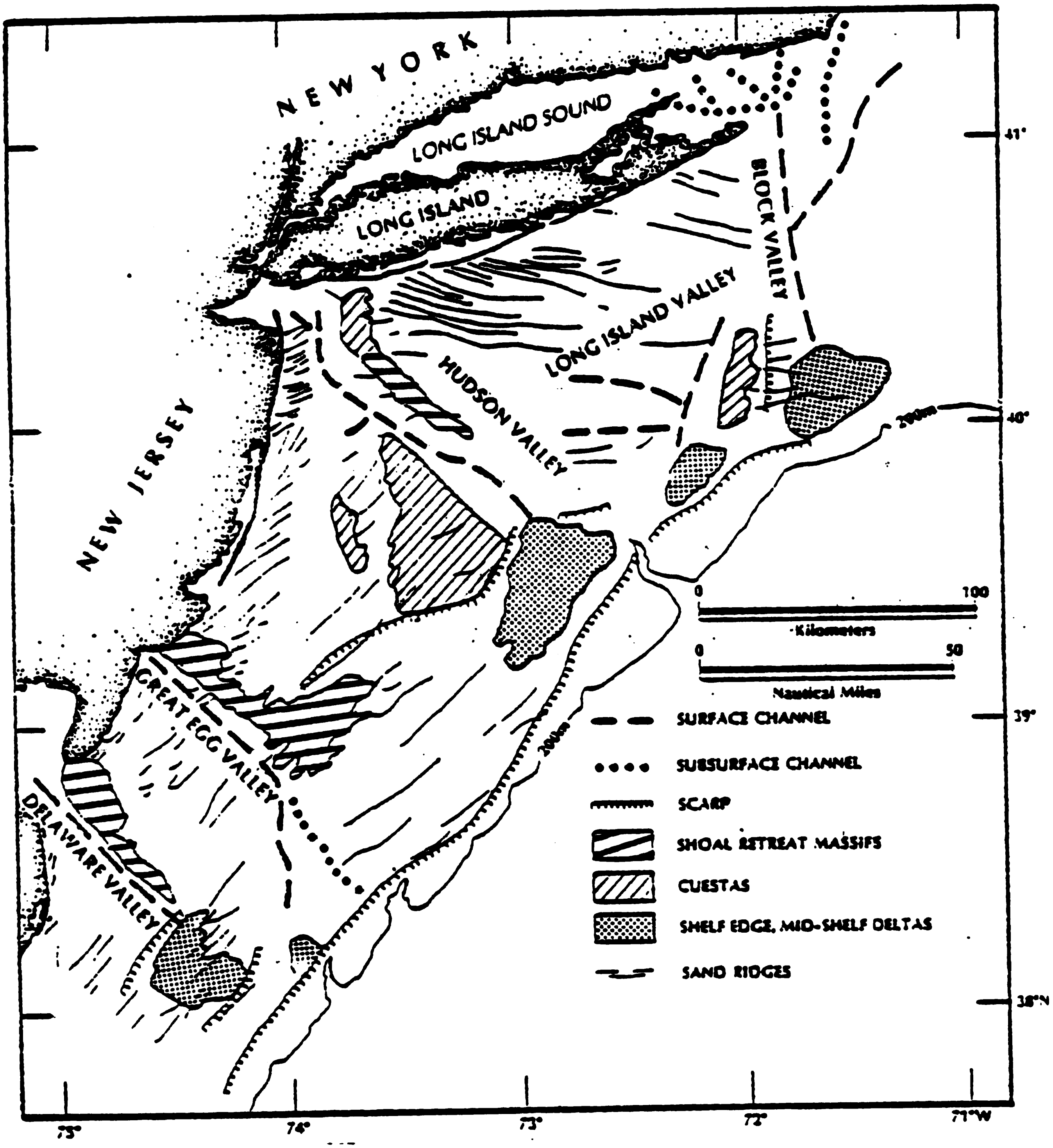


Figure 3-2. Topography of the New York and New Jersey Shelf
Source: Modified from Swift et al., 1972

Sedimentation in the inlet area is affected by waves, currents, and the depth of the channel. The general characteristics of the dredged material varies with hydrodynamic environment at the Long Island and New Jersey inlets.

CHEMICAL CONDITIONS

The New York metropolitan area is a major source of contaminants entering the Bight (Table 3-1). Atmospheric dust and washout by rainfall, freshwater runoff from land, urban and industrial effluents, and barged material (e.g., dredged material, acid wastes, and sewage sludge) dumped into the ocean cause high levels of trace metals in the water and bottom sediments of the Apex (Ecological Analysis and SEAMOcean, 1983). Dissolved-metal concentrations in the waters are of the Apex are higher than on the open Shelf.

Outflow from the Hudson and Raritan Rivers are a major source of dissolved nutrients to the New York Bight, extending as a plume of enriched water southward along the New Jersey coast (CE, 1983). Elevated levels of dissolved inorganic forms of nitrogen and phosphorus have been attributed to sewage inputs into the Hudson estuary. Transport to the Bight is largely controlled by river flow (Garside et al., 1976). Seasonal patterns of winter maxima and summer minima for concentrations of nitrate and phosphate are generally observed throughout the Bight (O'Connor et al., 1977).

DISSOLVED OXYGEN

Levels of dissolved oxygen at the Existing Sites are dependent upon several factors including temperature, salinity, rate of re-aeration, photosynthetic production and use by biological respiration processes and chemical oxidation (CE, 1983).

Dissolved oxygen concentrations in the water of the Apex are near saturation in January, and reach a minimum in August. In summer, a stable thermocline exists and dissolved oxygen concentrations in the lower layer may drop to 10% of saturation (Segar and Berberian, 1976). Concentrations may fall to 30% of saturation in the vicinity of the Mud Dump (O'Conner et al., 1977a).

Table 3-1. **Estimated Contaminant Input, in Percentage Contribution Except as Noted, to the New York Bight Apex (After Ecological Analysts and SEAMOcean, 1983)**

	Hudson Estuary	Dredged Material Dumping	Sewage Sludge Dumping	Other Dumping	Atmospheric Input	Coastal Discharges	Annual Load (tons/yr)
Total Solids	25.6	65.5	2.8	5.3	—	0.8	7.03×10^6
Oil and Grease	62.1	15.4	8.1	>0.1	—	14.4	206,300
Arsenic	54.7	43.1	2.1	—	0.1	—	133.5
Cadmium	55.0	31.4	8.4	0.3	0.3	4.7	105.5
Chromium	45.3	39.4	9.5	0.9	>0.1	5.0	1,636.5
Copper	41.3	45.6	11.1	0.2	—	1.8	3,002.2
Lead	48.0	40.0	9.2	0.1	1.2	1.5	2,125.9
Mercury	53.3	30.7	3.0	>0.1	—	13.0	52.5
Zinc	50.1	38.6	8.2	0.4	0.5	2.2	6,841.2

HEAVY METALS, TRACE ELEMENTS AND OTHER ANTHROPOGENIC INPUTS

Heavy metals both in the water column and within the sediment of the inner Apex of the New York Bight are elevated beyond levels found in outer shelf areas and other unpolluted marine systems. Identified sources of increased heavy metals include the ocean dumping of dredged materials, sewage sludge, acid waste and cellar dirt as well as terrestrial runoff, waste water and atmospheric inputs (Mueller et al., 1976). The degree of enrichment of numerous heavy metals, (lead, copper, silver, mercury, cadmium, iron and manganese) in dredged material deposits is several orders of magnitude greater than found for other coastal deposits (Dayal et al., 1981). Surface waters in the vicinity of the Existing Sites are not found to be affected by heavy metal contamination beyond that attributable to the Hudson River Plume (Segar and Cantillo, 1976); this is most likely a consequence of the rapid sequestering of these metals by particles and organic matter and relatively rapid removal from the water column by sedimentation.

The data indicates that dredged material is the single largest source of metals loading to the Bight. Dredged material in the New York Bight Apex is reported to contribute up to 80 percent of the heavy metal loadings. This does not include mercury, which comes primarily from municipal wastewater discharges (EPA, 1980).

Elevated levels of PCBs within the sediments of the Bight are largely a result of the dumping of sewage sludge (EPA, 1982). The highest concentrations of PCBs in the Bight are in the black muds of the Christiaensen Basin, although levels above background are also found in the Mud Dump (O'Connor et al., 1980; EPA, 1982). Areas of the Hudson River and Upper New York Harbor are the most highly polluted with PCBs (Table 3-2).

BIOLOGICAL CONDITIONS

The Existing Sites are part of a coastal ecosystem whose marine biota are reflective of a nearshore, marine environment. The major biotic units of interests are plankton, benthos and fisheries.

PLANKTON

The pattern of phytoplankton production and seasonal succession in the Bight is typical of coastal, temperate waters (Malone, 1976; Walsh et al.; and Yentsch, 1977). Major environmental factors affecting the plankton are temperature, light levels, vertical stability of the water column and nutrient supply. Seasonal variation in productivity is associated with summer and winter, with the highest levels occurring during the summer and lowest levels occurring during the winter.

Maximum production in the New York Bight is associated with the nutrient - rich plume of the Hudson estuary water (CE, 1983). The spring is dominated by blooms of diatom species. Later in the spring and summer a diverse range of phytoplankton populations are present such as diatoms, dinoflagellates, and chlorophytes.

Zooplankton populations in the Bight are usually dominated by copepods. Zooplankton population densities generally reflect the seasonality of algal production and the food web appears to be well balanced with a large part of the production being consumed in the water column (Walsh et al., 1976; and Yentsch, 1977).

TABLE 3-2

Total PCB Concentrations in Sediments
From the New York Region
(ug/g [ppm] dry weight)

Location	Total PCB's
Hudson	60.0
Km 240	6.0
New York Harbor	2.0
Gowanus Canal	0.4
Newton Creck	0.2
Raritan Bay	0.0009
Sandy Hook Transient	0.7
Christiaensen Basin	0.4
Mud Dump	0.03
Sludge Site 1	0.2
Sludge Site 2	0.2
Arthur Kill	0.81

Source: CE, 1983

BENTHOS

The nearshore benthic fauna of the Bight is dominated by organisms characteristic of high energy coastal marine environments. The benthic communities at the Existing Sites are usually characterized by mollusks, crustaceans and worms living on and in the sediments.

Several benthic communities are present within the Apex. Pratt (1973) recognized three bottom faunal groups widespread on the mid-Atlantic Continental shelf associated with sand, silty-sand, and silt-clay substrates (Figure 3-3). Apex sediments range from sand gravel to mud (Freeland et al., 1976), and elements of all three biotic communities occur within the Bight. The sand faunal group is the dominant community in the Apex and is represented by suspension feeders. The more seaward silty-sand faunal areas contain higher organic content and are typified by amphipods and mollusks. Silty-clay habitats develop where the fine sediments accumulate and are found in the Bight in estuaries, bays and the head of the Hudson Canyon. These areas are characterized by echinoderms, polychaetes and bivalues.

FISHERIES

Many finfish of commercial and recreational importance occur in the area of the Existing Sites. The diversity and abundance are due to the geographical location of the Bight, which is the northern limit of temperate and subtropical migrants, and the southern limit of boreal migrants. Some species occur inshore, other offshore and some migrate from inshore to offshore. Significant numbers of adults, planktonic eggs and larvae can be found over the entire mid-Atlantic Shelf throughout the year.

Over 300 species are known to occur, but only about 80 are of commercial importance (McHugh and Ginter, 1978; Mitre, 1981). The most productive commercial fisheries include menhaden, whiting, scup, flounder, red hake, tilefish and butterfish (McHugh, 1977) and the greatest catches by weight by sport fisherman have been bluefish, Atlantic mackeral and striped bass (Mitre,

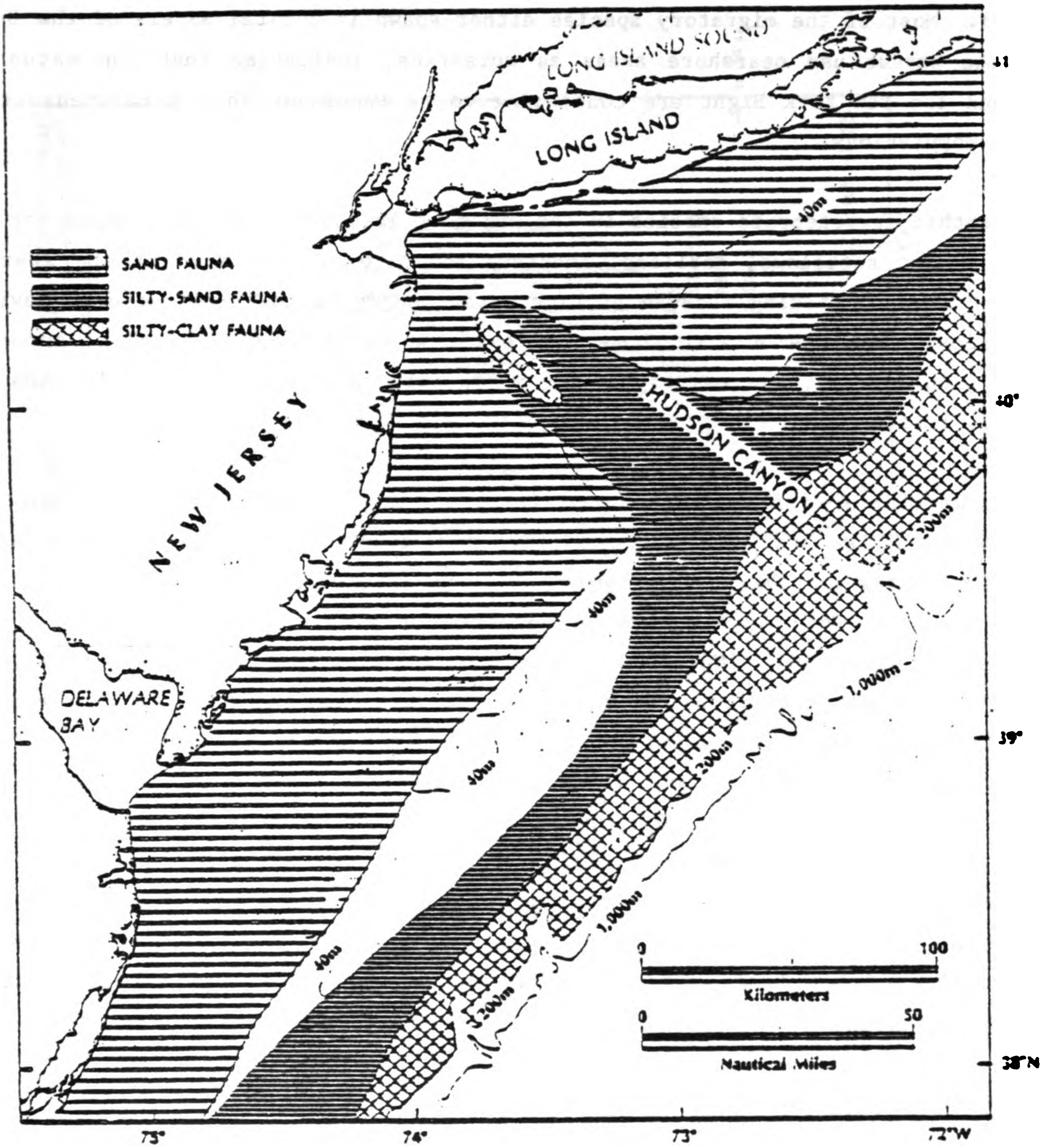


Figure 3-3. Benthic Faunal Types in the Mid-Atlantic Bight
Source: Adapted from Pratt, 1973

1979). Most of the migratory species either spawn in coastal waters of the Bight or the larvae use nearshore areas as nurseries, indicating that the estuaries around the New York Bight are continuing to be important in the maintenance of fish populations.

Benthic invertebrate species in the Bight of greatest commercial value include surf clams, softclams, scallops, lobsters and blue crabs. Much of the Apex is closed to shellfishing because of high total and fecal coliform bacteria levels. The closure applies only to those species in which the whole animal is consumed (e.g., surf clam), and not to species where only part of the animal is consumed (e.g., lobsters).

Commercial shellfish species are found at all the Existing Sites, but the following IDMDS are all located within the existing shellfish closure area, thereby making the shellfish unharvestable (Rockaway, East Rockaway, Shark River, Manasquan and Cold Spring; Figure 3-4). The yield of the shellfishery has increased since 1942 (McHugh and Ginter, 1978). The increase in shellfish landings is attributable to the growth of the surf clam industry. Surf clams are common throughout the sandy areas of the Bight, but the most productive areas are along the outer shores of Long Island and off Barnegat Bay and Little Egg Harbor in New Jersey (CE, 1983). To prevent dredged material disposal operations from interfering with the surf clam industry there is a prohibition of dumping the dredged material during the surf clam spawning period which occurs from May through July. In addition to the surf clam industry, significant commercial harvesting of hard and soft clams, bay and sea scallops, and lobsters exists throughout large areas of the Bight (Mitre, 1979).

THREATENDED AND ENDANGERED SPECIES

Five endangered species of whales may be found in waters of the mid-Atlantic Bight (Gusey, 1976): blue whale (*Balaenoptera musculus*), finback whale (*B. physalus*), sei whale (*B. borealis*), humpback whale (*Megaptera noveangliae*), and sperm whale (*Physeter catodon*). None are common in nearshore waters and their presence in the Apex would be unusual. No critical habitats for these species occur in or near the Existing Sites.

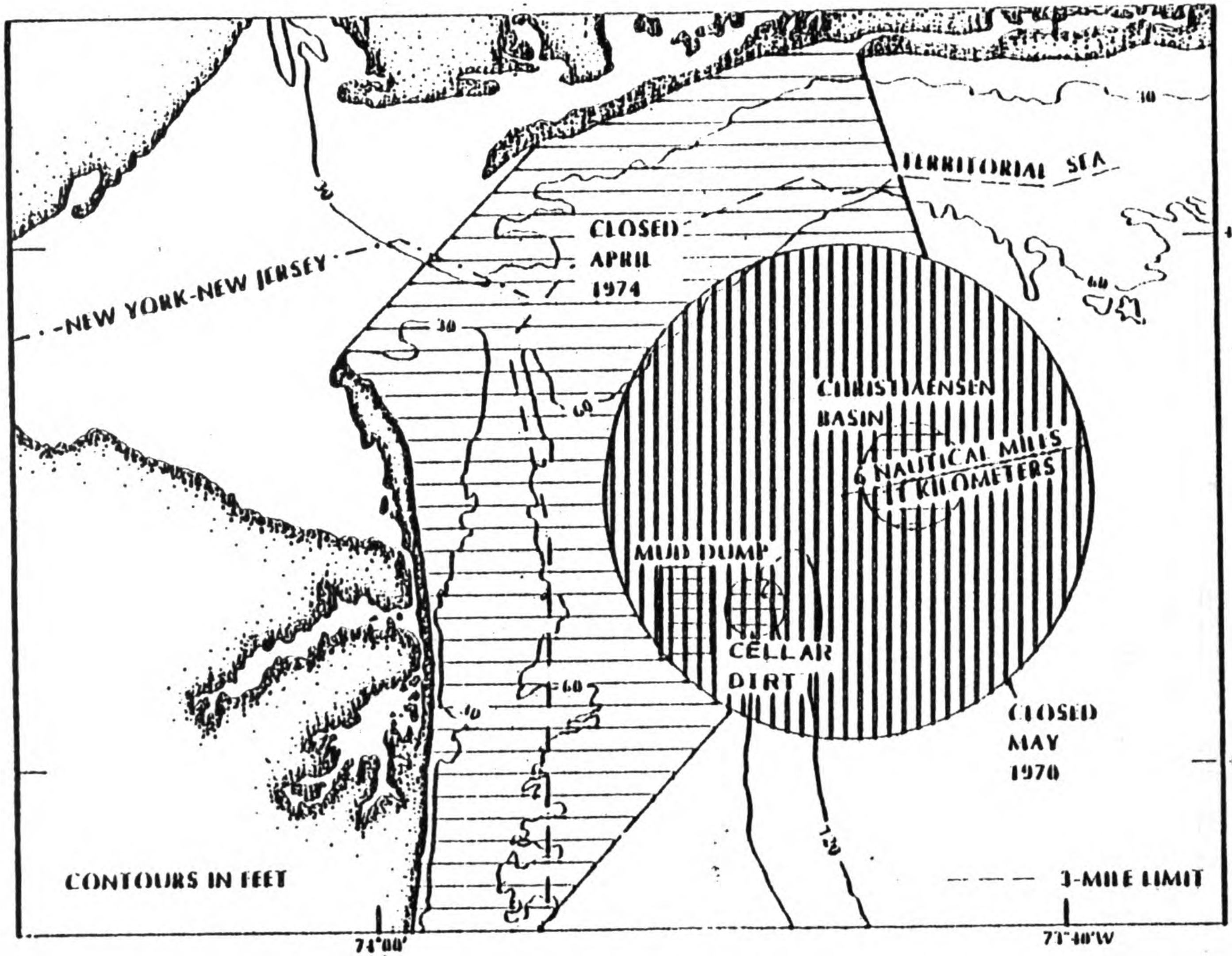


Figure 3-4. Commercial Shellfishig Closure Areas

Source: Verber, 1976

Three species of endangered birds are found within the marine and coastal regions of the Bight (Howe et al., 1978): bald eagle (Haliaeetus leucocephalus), brown pelican (Pelecanus occidentalis), and Eskimo curlew (Numenius borealis). These birds are not expected to be adversely affected by the disposal of dredged material at any of the alternative sites.

CURRENT ACTIVITIES IN THE SITE VICINITIES

Commercial Fisheries

New Jersey and New York together accounted for 4% of the total U.S. Commercial landings in 1975. The stocks of many important commercial species of both shellfish and finfish show indications of overfishing and landings have remained fairly stable due largely to the industries ability to shift emphasis to different species (McHugh, 1977; McHugh and Ginter, 1978). Commercially important species include finfish such as scup, whiting and tilefish. Shellfish such as the surf clam, lobster and quahog are important species. Tables 3-3 and 3-4 present the most recent data available.

In the Apex, commercial fishing areas change seasonally. The target species for the boats depend upon the abundance of the stock and the price. Menhaden boats work the coast of New Jersey and do not limit fishing activities to the Apex. The Fishery Conservation and Management Act (FCMA) of 1976 created an economic resource zone, also known as the "200-mile limit" contiguous to the territorial sea. The fishery conservation zone has been divided and authority given to Fishery Management Councils to regulate the resources within their regions by means of Fishery Management Plans.

RECREATIONAL FISHERIES

Most recreational fishing in the Bight is confined to the inner Shelf and the area is easily accessible to the public. Important species are striped bass, weakfish, bluefish and mackerel. Recreational species fished further offshore

TABLE 3-3

TOTAL LANDINGS OF FIVE MAJOR COMMERCIAL FISHERIES SPECIES IN NEW YORK 1981

Species	lb*	$*
Hard Clams	4,586	18,219
Scup	3,516	1,882
Whiting	3,422	1,082
Tilefish	2,596	2,269
Surf Clams	2,287	807

* lbs. and $ x 1000

Source: CE, 1983

Table 3-4

TOTAL LANDINGS OF FIVE MAJOR COMMERCIAL FISHERIES SPECIES IN NEW JERSEY 1981

Species	lb*	$*
Menhaden	103,280	4,056
Quahog	20,805	6,338
Surf Clam	20,349	9,559
Whiting	9,082	1,802
Scup	6,575	1,821

* lbs. and $ x 1000

Source: CE, 1983

are bluefin tuna, marlin and swordfish. The sport catch often equals or surpasses the commercial landings of certain species (e.g., striped bass) and significantly contributes to the economics of several coastal areas.

Figure 3-5 shows the major recreational fishing grounds in the Apex. Many of the areas support seasonal fisheries. For example, the Mud Hole is a popular whiting area in the winter and tuna area in the summer, Shrewsbury Rocks are little used in the winter but are a popular bluefish area in the summer. The more important fishing areas are 17-Fathom Bank, Mud Hole, Shrewsbury Rocks, the Farms and Klondike Bank (Christensen, personal communication*).

Shipping

The major trade routes serving the New York-New Jersey area coincide with the three traffic lanes into New York Harbor: the Nantucket, Hudson Canyon, and Barnegat Traffic Lanes (Figure 3-6). The trade routes which lie within the Navigational Lanes are usually the safest routes for shipping traffic. The U.S. Coast Guard (USCG) recommends they be used by all major shipping traffic.

Hopper dredges and barges spend little time in the site because each dump takes only 3 to 5 minutes. It is suggested that hazards to navigation occur primarily due to transit to and from the site, increasing somewhat as the distance offshore increases. Adherence to the International Regulations for Preventing Collisions at Sea, 1972 (USCG, 1977) will prevent accidents.

The inlets along New Jersey and Long Island serve as extrance ports for light commercial and recreational ship traffic. None of the alternative site locations pose unacceptable navigational hazards that preclude their use.

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*D. Christensen, NOAA-NMFS, Sandy Hook Laboratory, Highland, New Jersey

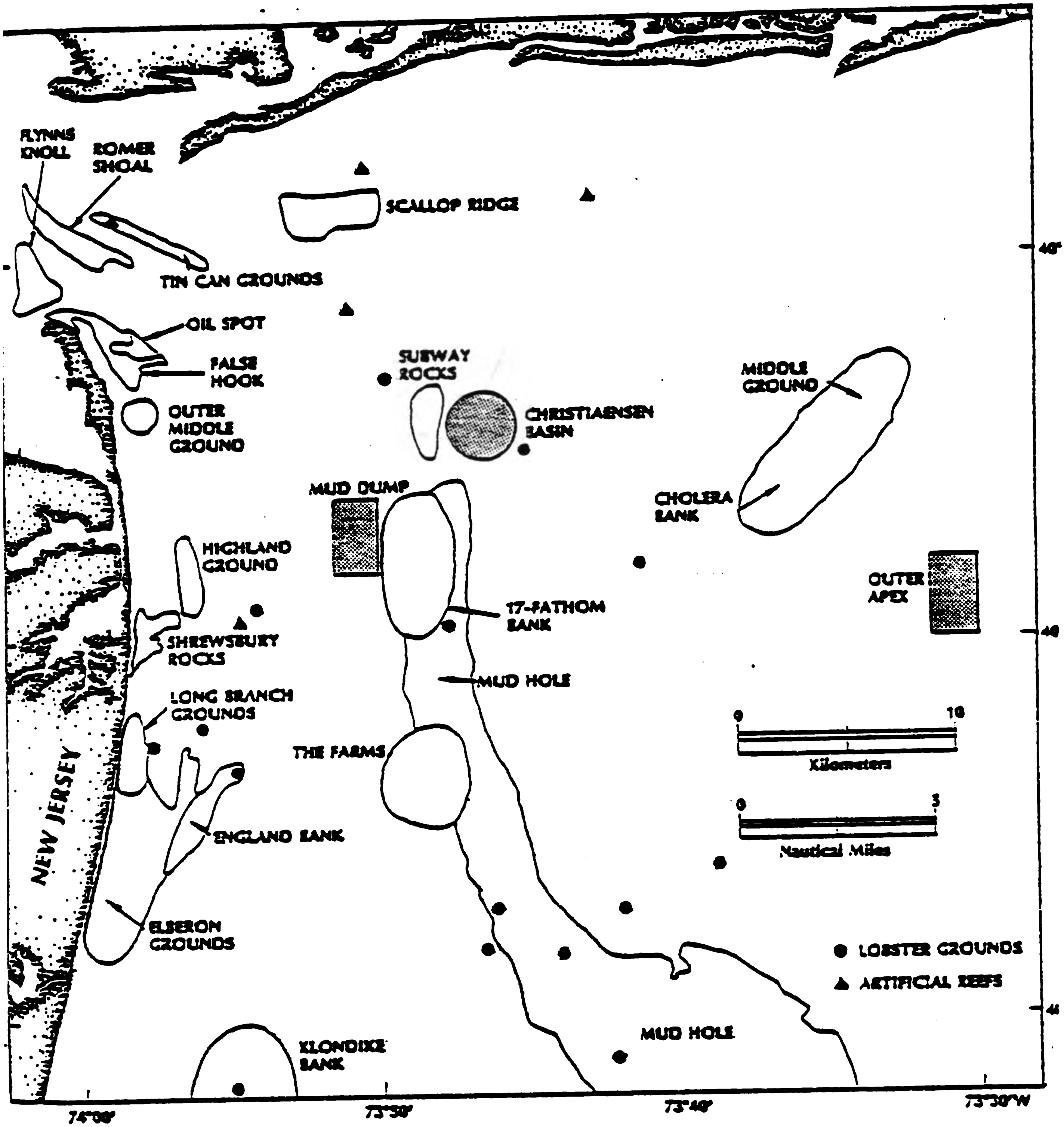

Figure 3-5. Important Recreational Fishing Grounds in the New York Bight Apex
Source: Schmidt, 1980, unpublished

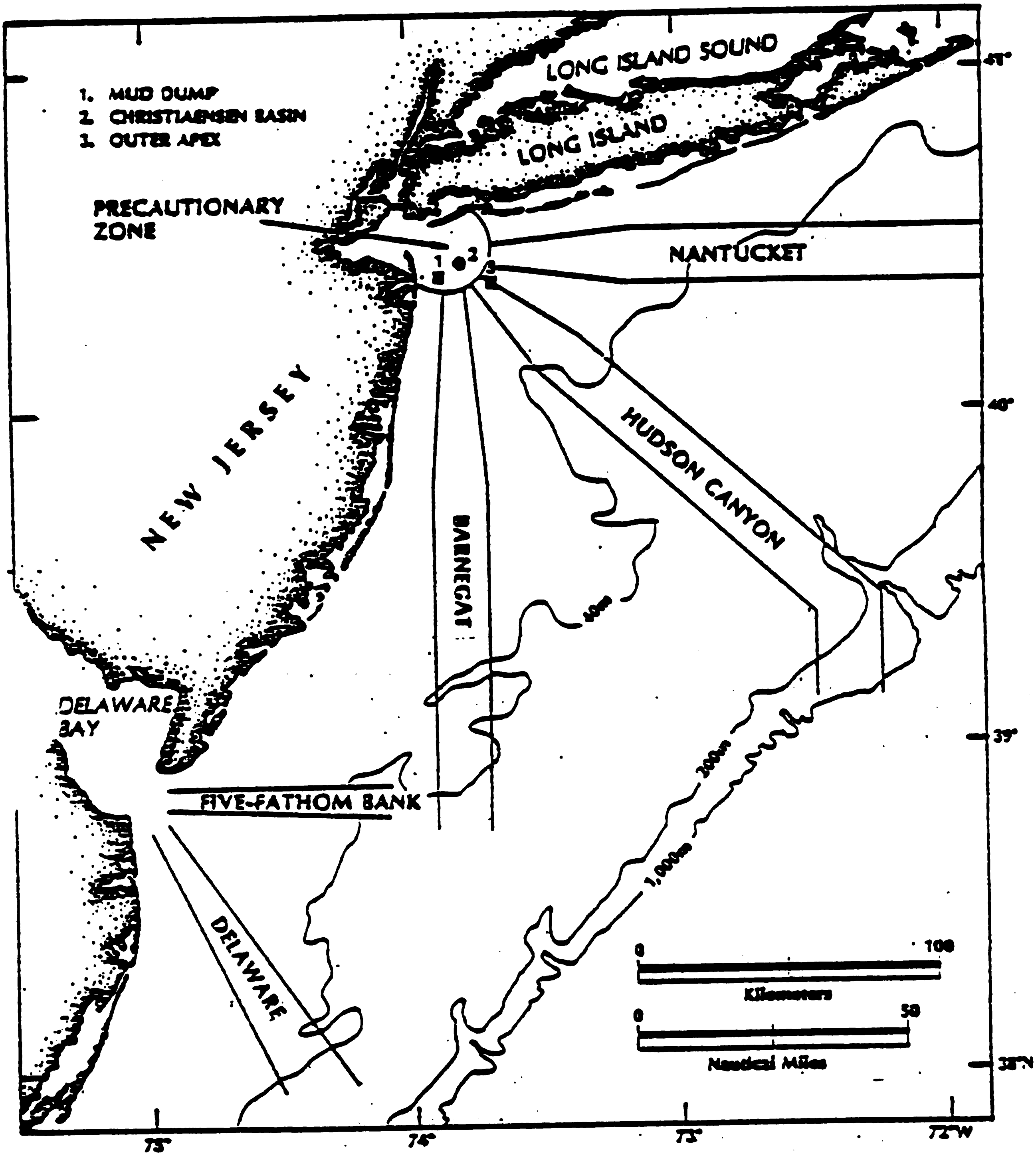

Figure 3-6. Traffic Lanes in the Mid-Atlantic Area

Recreational Activities

The New York Bight offers an indefinite number of recreational activities. Nearly one half of the shoreline of the Bight is currently devoted to public recreation (Carls, 1978). There are numerous state, county and national parks which serve the area's population. In addition to these public lands, there are substantial numbers of private facilities (e.g., marinas, beaches and campgrounds).

The most popular forms of recreational activity are swimming, boating, sunbathing and fishing (Carls, 1978). An upward trend in all recreational activities is expected to continue. This trend should result in an intensification of the demand for coastal and marine recreational resources (CE, 1983).

Oil and Gas Exploration

The U.S. Department of the Interior, Bureau of Land Management (BLM), completed the first sale of oil and gas leases in the mid-Atlantic (Baltimore Canyon Trough; Outer Continental Shelf [OCS] Sale No. 40) in August 1976.

Exploratory drilling at 6 of the 93 tracts leases in OCS Sale No. 40 began in spring and summer of 1978. May 1978, BLM published a draft EIS on OCS Sale NO. 49, held in February 1979. No existing or planned oil and gas lease tracts are located in any interim or designated ocean disposal sites in the Bight. Lease Sale No. 59 was held in December of 1981, with leases subsequently awarded on 50 tracts. Currently there are 148 active leases in the mid Atlantic Area. In July of 1982, a reoffering sale was held (RS-2) whereby 155 tracts offered in Sale No. 59 were offered again.

In addition to the previous uses, the New York Bight is utilized for a variety of other activities. Among those are:

- Scientific Research - represented by the National Oceanic and Atmospheric Administration's (NOAA) intensive Marine Eco-System's Analysis (MESA) program. This program is aimed at increasing knowledge about the Bight and man's impact upon it.

- Outer Continental Shelf (OCS) Energy Development Activities - the Bight is located at the junction of the BLM's North and Mid-Atlantic Lease areas and has been subject to lease sales and exploratory drilling.

- Sand and Gravel Mining - although experiencing a lull presently, sand and gravel mining in the Bight has been a commercially important activity. Since 1973, Lower N.Y. and Raritan Bays have been the only areas mined.

- Military Uses - the Bight is contained within the Narragansett Bay Operating Area and is subject to occassional military activity such as submarine operations, gunnery practice, sea trials, radar tracking and general operations.

OCEAN WASTE DISPOSAL

As of 1980, EPA and CE have permitted the disposal of municipal and industrial wastes at various locations in the Bight (Figure 3-7). This section briefly describes activities at the sites, excluding the Long Island and New Jersey IDMDS. Designation of the IDMDS for the disposal of dredged material will not interfere with the use of these other sites.

MUD DUMP

The Mud Dump (Figure 3-7, #1) has been moved frequently since dredged material was first dumped in 1888. The site has occupied its present location since 1915. Until 1972, fly ash residues from fossil-fueled power plants also were released at the site. The Mud Dump received an annual average of 10 million yd^3 of dredged material between 1970 and 1982. Future projected annual volumes are 8 to 10 million yd^3 (5 to 7 million yd^3 from Federal projected and 2 to 3 million yd^3 from non-Federal projects).

CELLAR DIRT SITE

The Cellar Dirt (Figure 3-7, #2) was permanently designated by the EPA on May 6, 1983, for the disposal of excavation dirt and rock. Currently, there is only one permittee dumping a maximum of 150,000 yd^3 of material at the site.

SEWAGE SLUDGE SITE

Sewage sludge consists of water residual municipal sewage solids from primary and secondary treatment plants. The present Sewage Sludge Site (Figure 3-7, #3) was established in 1924. Twelve permittees currently (1982) dispose of sludges at the site, with the City of New York discharging more than any other permittees. The total volume of sewage sludge discharge in 1982 was 7.6 million tons.

ACID WASTE SITE

The Acid Waste Site (Figure 3-7, #4) was established in 1948 for the disposal of aqueous wastes. One permittee Allied Corporation presently is using the site. In 1982, Allied Corporation disposed of 30,000 wet tons of hydrochloric acid.

WOOD INCINERATION SITE

The EPA has designated the Wood Incineration Site (Figure 3-7, #7) for the disposal of combustion products of scrap wood from harbor debris, pier pilings and waterfront construction sites. The site is used as needed and only the combustion products (e.g., particulates) reach the ocean; the remaining ash is recycled or dumped on land.

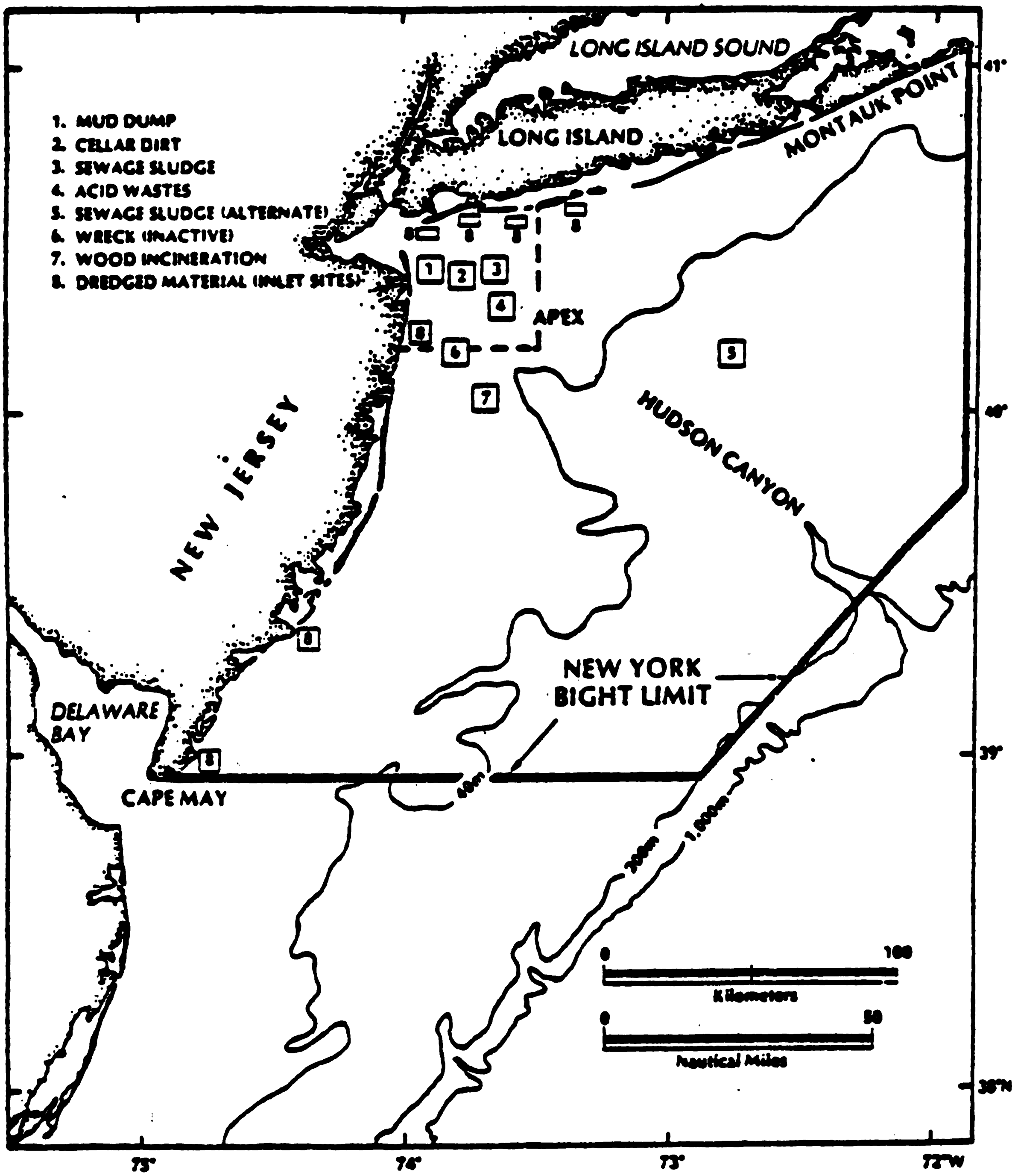

Figure 3-7. Ocean disposal sites in the New York Bight

Chapter 4

ENVIRONMENTAL CONSEQUENCES

This chapter examines available scientific and analytical data to determine the environmental consequences of dredged material disposal at the Existing Sites evaluated in Chapter 2. The environmental effects include:

- Environmental changes directly affecting public health (specifically, on commercial or recreational fisheries) and safety (navigational hazards);

- Effect of disposal operations on aesthetics;

- Environmental consequences of dredged material disposal on biota, water chemistry, and sediments of the sites;

- Unavoidable adverse environmental effects and mitigating measures;

- Relationships between short-term use and long-term productivity; and

- Irreversible to irretrievable committments of resources which would occur if the proposed action is implemented.

EFFECTS ON PUBLIC HEALTH AND SAFETY

Evaluation of potential adverse effects on humans caused by the disposal of dredged material in the ocean is a fundamental aspect. The nature of the disposal operation and type of material to be dumped may have direct or subtle effects upon public health and safety. Many health hazards may not be obvious; the potential for bioaccumulation of toxic chemicals from dredged material by organisms that may be consumed by the public is of primary concern. Similarly, dredged material harboring pathogenic bacteria and viruses may limit recreational water-sport activities and human consumption of fish and shellfish taken from the disposal site vicinity. Navigational hazards may develop from excessive shoaling of dredged material at the sites and from movement of disposal vessels to and from the site.

INTRODUCTION OF POTENTIALLY HARMFUL TOXINS

Potential effects on human health, resulting from the consumption of marine organisms, can be evaluated from bioassay and bioaccumulation tests performed on marine organisms. Toxic levels of trace metals for most marine organisms have not been established, partially due to extreme variabilities in the sensitivities exhibited by organisms during their different life stages. The form of chemical contaminants is difficult to determine in the natural environment, but is important in determining toxicity. Trace metals present in dredged material may follow many pathways when introduced to the site environment; for instance, the trace metals can: (1) be released into the water while the dredged material is settling or after deposition on the sea floor, (2) remain adsorbed to site sediments, and/or (3) be ingested, primarily by benthic organisms.

Laboratory and field tests on dredged material indicate that, under certain conditions (e.g., oxidizing or reducing environments), some trace metals are released from dredged material into seawater in concentrations well above background levels (Lee et al., 1975). Manganese was released in the greatest quantities under both oxidizing and reducing conditions. Under reducing conditions, substantial amounts of iron and lead were released. Zinc was taken up from water under both oxidizing and reducing conditions, while copper, lead, and cadmium were neither released nor taken up under oxidizing conditions. Actual increases over background values which did occur were insignificant (parts per billion or less), so that considerable analytical difficulties are encountered in even detecting the contaminants. Furthermore, there is little evidence to indicate that such low levels would cause adverse effects on marine organisms during the extremely short time before the concentrations were diluted to the original background levels (Pequegnat et al., 1978b).

Some organisms have accumulated PCB's or DDT from some dredged material. However, field studies have not conclusively shown higher levels of PCB or DDT accumulation in organisms. Pequegnat et al., (1980b) reported that concentrations of organochlorine residues in organisms showed little correlation to the presence of the respective contaminants in the sediment. This problem is currently under investigation; West and Hatcher (1980) indicated that most PCB's in the Apex were derived from the dumping of sewage sludge.

INTERFERENCE WITH NAVIGATION

Navigational safety should not be adversely affected by disposal operations at the Existing Sites. Although there is some risk of collision wherever the hopper dredges are operating or in transit to the sites, the probability is negligible considering the short-term and intermittant schedule of disposal operations. No incidence of such problems have been reported during previous use of the sites.

EFFECTS ON AESTHETICS

Aesthetics of nearshore waters and beaches would most likely be unaffected by dredged material disposal activities. Nearshore waters are naturally turbid and the disposal of dredged material at the Existing Sites would not leave a permanently detectable surface plume. The CE has stated that dumping at these nearshore sites would aid in the control of beach erosion since the dredged material should be transported inshore towards the beaches.

EFFECTS ON THE ECOSYSTEM

Effects of dredged material disposal on the marine ecosystem are of considerable public concern. Whereas some effects are large-scale and immediately apparent, others are subtle; it is frequently difficult to differentiate between changes due to natural fluctuations and those resulting from human perturbations. The consequence of effects may be difficult to interpret in light of incomplete knowledge of biological pathways, ecology of organisms, and community dynamics. However, such effects may have far-reaching consequences (e.g., damage of fisheries), or may be minor or inconsequential. Long-term effects are the most difficult to assess because effects are often indirect and may be cumulative, with potentials for adverse environmental consequences.

Effects of dredged material on the ecosystem depends upon several factors: physical and chemical characteristics of the dredged sediment, degree of similarity between dredged sediments and those of the site, amount of material to be dumped, frequency of disposal, nutrients associated with dredged material, and turbidity associated with disposal operations. The physical and biological characteristics of the receiving environment are also equally important. Effects of dredged material disposal may be lessened by locating disposal sites in an area where mixing and dilution are maximized, where sediments occasionally are disturbed, and/or where biological sensitivity is low.

The following discussion is divided into sections pertaining to effects on: (1) water quality, (2) sediment quality, (3) biota, and (4) recreation and economics.

EFFECTS ON WATER QUALITY

TURBIDITY

Dredged material disposal causes an immediate increase in turbidity of the receiving waters. Duration of the turbidity plume formed depends on particle size, currents and turbulent mixing (Wright, 1978). Sediment suspensions are unavoidable but short-term.

Changes in turbidity may be both beneficial and adverse to the environment. Beneficial effects may include the release of nutrients and the adsorption of undesirable chemical contaminants by the turbidity plume (Stern and Stickle, 1978).

Adverse effects of turbidity include temporary and local decreases in light penetration (possibly reducing photosynthesis), mechanical abrasion of the filter-feeding and respiratory structures of animals, and adsorbtion of essential nutrients from the water (Cairns, 1968). However, numerous studies have concluded that the suspended loads are unlikely to cause any short- or long-term adverse effects. Most organisms are not seriously affected by suspended sediments in the water (Hirsch et al., 1978). The exceptions are those in systems sensitive to water clarity, such as coral reefs and kelp beds (Hirsch et al., 1978; Stern and Stickle, 1978). None of these systems occur within or in the immediate vicinity of the Existing Sites.

Disposal of dredged material at the Existing Sites is not expected to be a significant environmental problem. The inlet sediments are predominantly sand and should sink rapidly and therefore, resuspension should not pose a problem.

DISSOLVED OXYGEN

Dredged sediments may contain substances which are susceptible to oxidation by dissolved oxygen, thus, the sediments may exert a slight oxygen demand as they descend through the water column. The initial oxygen decrease depends partly on the type of material dumped: lowest demands occur for clean sand and gravel, highest demands for anoxic and organically rich sediments (Baram et al., 1978). These changes are unlikely to produce harmful effects on fishes or other organisms, unless dissolved oxygen levels are depressed prior to dumping. Because waters at the Existing Sites are well oxygenated, no adverse effects are anticipated.

NUTRIENTS

Deposition of dredged material may release nutrients in the water column. Nutrients release may stimulate phytoplankton growth; but in high concentrations, nutrients (e.g., ammonia) can become toxic to some organisms (Pequegnat et al., 1978). The potential occurrence of either effect is dependent upon the concentrations of constitutents released, environmental factors (including dissolved oxygen levels), and mixing and dilution rates.

Nutrients associated with diposal operations are of little direct concern to the benthic or planktonic community because no significant numbers of photosynthetic organisms are present on or near the bottom. Nutrients which do escape from the sediments after disposal and enter the water column would be diluted below toxic levels within 10m of the diposal point (Connor et al., 1979).

TRACE ELEMENTS AND CHLORINATED HYDROCARBONS

Disposal of dredged material in the ocean usually does not increase concentrations of trace metals in the water column. Manganese is generally the trace metal most likely to be released; however, manganese "is generally not toxic and is a required micronutrient" (Brannon, 1978).

Unlike trace metals and nutrients, chlorinated hydrocarbons (CHC's) do not naturally occur in dredged sediments, and the presence of these substances is due to anthropogenic (human) contamination (Brannon, 1978). Natural processes may concentrate them in bottom sediments (Burks and Engler, 1978); CHC's are relatively insoluble and thus are rapidly sorbed (adsorbed and absorbed) to sediments. Only limited quantities are released to interstitial water (Burks and Engler, 1978).

EFFECTS ON SEDIMENT QUALITY

Contaminants in dredged material generally are not released into the water following disposal, but remain associated with the solid fraction of the material (Brannon, 1978). Disposal at any sites is not expected to produce significant adverse environmental effects.

EFFECTS ON BIOLOGICAL CONDITIONS

PLANKTON

Dumping of dredged material will cause a short-term increase in turbidity, resulting in a temporary decrease in light penetration with a concomitant reduction of photosynthetic activity (Stern and Stickle, 1978). No long-term changes in dissolved nutrients, trace metal concentrations, or phytoplankton primary productivity have been attributed to the disposal of dredged material (Wright, 1978; Hirsch et al., 1978). No short- or long-term adverse effects on plankton are expected at the Existing Sites.

NEKTON

Transient turbidity plumes associated with the disposal of dredged material poses no significant threat to fishes. Suspended particles can cause gill damage, reducing fish respiratory surface area (Ritchie, 1970), but this type of gill damage has not been positively identified as harmful to fish in terms of overall survival. Turbidity plumes associated with dredged material disposal are so brief that these changes probably do not occur to any significant degree.

During periods of high turbidity, pelagic fish probably swim to more favorable areas. More sedentary fish (e.g., flatfishes) usually have a higher tolerance to suspended particles, thereby minimizing the effects of suspended solids on their respiration (O'Connor et al., 1977).

After dumping, fish may be attracted to disposal sites by the exposure of food items in the dredged material and by the mound formed by dumping (Oliver et al., 1977). Adverse effects are not expected because disposal has only short-term, transient effects on water-column parameters and foraging activity by fish is not restricted to the mound.

BENTHOS

Benthic communities are usually characterized by macroinvertebrates such as mollusks, crustaceans and worms living on and within the sediments, the characteristics of which determine the nature and species composition of the resident fauna.

The most significant adverse impacts of dredged material disposal have been observed in the benthos (Wright, 1978). The benthos are affected by burial and smothering, which temporarily reduce abundances of benthic species. The intensity of this effect varies with the type of dredged material, thickness of the overburden resulting from dumping, frequency of dumping, the benthic organisms involved, and the physical processes occurring in the receiving environment.

Recolonization by benthic organisms has been reported to occur fairly rapidly (within a few months) when dredged sediments are similar to the disposal site sediments. Presumably, the benthic communities have adapted to this type of perturbation.

One potential conflict with disposal at the nearshore Existing Sites is the occurrence of shellfish within the region. Although, several of the sites are located within areas closed to shellfishing, it is not known at this time to what extent site use presents a conflicts to fishery resources.

THREATENED AND ENDANGERED SPECIES

Threatened and endangered species in the areas off Long Island and New Jersey are highly mobile and therefore could avoid any area in which dumping was occurring. The feeding ranges of such species are sufficiently large so that the infrequent dumping activities should not significantly affect their feeding activities. In addition, the area of the disposal sites are small compared to the total feeding area available to such species. Thus, it is unlikely that threatened and endangered species would be adversely affected by the disposal of dredged material at the Existing Sites.

EFFECTS ON RECREATION AND ECONOMICS

FISHERIES

Fishery resources occur in and around all alternative sites. however, all sites are located away from rocky outcrops and other identified productive fishing grounds in the Bight. Past use of the nearshore Existing Sites for the disposal of dredged material has not resulted in any known adverse impacts on fishing or shellfishing.

COMMERCIAL SHIPPING

Use of the Existing Sites should not conflict with normal commercial shipping traffic, provided routine navigational precautions are observed. The presence of hopper dredges or bottom dump scow barges at the Existing Sites may represent an obstacle to vessels approaching the inlets entrance; however, this is considered a minor problem because no conflicts have been recorded by the CE from previous site use.

Navigational hazards resulting from movement of the barges to and from the site are minimal. Two factors suggest that barge transits will not cause unacceptable navigational hazards: (1) dumping is completed within a short period of time, (2) lengthy maneuvering within the site during release is not required.

MILITARY ACTIVITIES

No conflict to military activities should arise with the use of any of the Existing Sites.

RECREATION

Adverse effects on Long Island and New Jersey beaches are not expected because of prevailing currents and because no impacts have been reported during past disposal activities.

Recreational fishing and boating occurs around the Existing Sites and may be disturbed temporarily as a result of disposal operations. Any adverse impacts on sportfishing and diving activities are expected to be minimal and short-lived. However, the infrequent and transitory nature of disposal operations are not expected to produce significant adverse impacts.

MINING AND OIL AND GAS EXPLORATION

Sand resources occur almost continuously along the inner mid-Shelf. However, no mining or mineral extraction is known to occur at any of the Existing Sites.

Oil and gas exploration in the New York Bight indicates that the Continental Shelf may contain sufficient quantities oil and gas for exploitation. All of the nearshore Existing Sites are outside the oil and gas lease sale tract areas.

TRANSPORTATION OF DREDGED MATERIAL TO THE SITE

Minor disruptions of harbor and channel traffic will occur as a result of transportation and disposal of dredged material. Most of these disturbances are associated with the dredging operations and subsequent transport of the dredged material out of the inlets, where shipping and recreational boat traffic may cause congestion. Such inconveniences will occur regardless of the location of a disposal site.

Transportation costs for hauling dredged material from the dredging area to an ocean disposal site may represent a large part of the cost of a dredging operation. Expenses for fuel, labor and equipment rental are directly related to the distance between the dredging site and the disposal area and to the total time necessary to dump the material.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS AND MITIGATING MEASURES

Potential unavoidable adverse effects that may occur within the Existing Sites include:

- o Accumulation of dredged material on the ocean floor;
- o Generation of a turbidity plume which will temporarily lower water quality;
- o Smothering of less motile benthic biota by burial under dredged material; and
- o Further alteration of sediment composition that would affect organisms abundance, diversity, and possibly community structure at a site.

Some of the unavoidable adverse effects, are of short duration and of limited impact due to the rapid dilution of the material after release. Other impacts pose little environmental consequence because of the limited size of the site. However, changes within a site are acceptable as long as areas outside the site are not affected.

A monitoring program would detect any unacceptable adverse effects that might occur outside the general boundaries of the site. The monitoring plan will concentrate on the benthic environment to determine possible long-term adverse effects on the benthic community and to determine dredged material distribution of the bottom.

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Disposal operations should not interfere with the long-term use of any resources at the Existing Sites. Commercial fishing and sportfishing at and near the Existing Sites should not be significantly affected because the site constitutes only a small portion of the New York Bight inhabited by commercially important species. It is not anticipated that short-term impacts at the Existing Sites would significantly affect the long-term productivity of the area. Any short-term losses will be offset by the benefit to commerce from the dredging of the Long Island and New Jersey Inlet areas.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Several resources will be irreversibly or irretrievably committed by the proposed action:

- o Loss of some potentially recyclable material (i.e., sand for landfill);
- o Loss of energy in the form of fuel required to power the disposal vessels to and from the disposal sites;
- o Loss of economic resources due to costs associated with disposal in the ocean, and
- o Loss of some benthic organisms at the sites which are buried during disposal operations.

Chapter 5

COORDINATION

PREPARERS OF THE DRAFT EIS

The Draft EIS was issued by the Environmental Protection Agency's Ocean Dumping EIS Task Force. This document was based on a Preliminary Draft prepared by the Environmental Protection Agency. Reviews and revisions were prepared by Frank G. Csulak. Additional reviews and support were provided by the members of the EIS Task Force:

William C. Shilling, Project Officer
Edith R. Young

BIBLIOGRAPHY

Adams, W.N. 1977. Comments and interpretations of coliform analysis performed aboard the Coast Guard cutter ALERT, Operation Wakefall (September 1975), Operation Mogul (February 1977). NETSU, FDA-PHS Davisville, RI. Unpublished.

Alexander, J.E., and E.C. Alexander. 1977. Chemical properties. MESA New York Bight Atlas Monograph 2. New York Sea Grant Institute. Albany, New York.

Alexander, J.E., R. Hollman, and T. White. 1974. Heavy metal concentrations at the Apex of the New York Bight. Final Report 4-35212. New York Ocean Science Lab. Montauk, New York.

Ali, S.A., M.G. Gross, and J.R.L. Kishpaugh. 1975. Cluster analysis of marine sediments and waste deposits in the New York Bight. Environ. Geol. 1:143-148.

Altschuler, S.J., and G.A. Riley. 1967. Microbiological studies in Long Island Sound. Bull. Bing. Ocean. Coll. 19:81-88.

American Public Health Association. 1976. Standard methods for the examination of water and wastewater. Fourteenth edition, 1975. American Public Health Association, Washington, DC. 1193 pp.

Apel, J.R., H.M. Bryne, J.R. Proni, and R.L. Charnell. 1975. Observations of oceanic internal and surface waves from the Earth Resources Technology Satellite. J. Geophys. Res. 80(6):865-881.

Austin, H.M., and J. Dickinson. 1973. The distribution of zooplankton in the New York Bight, September and November 1971. Pages 109-145 in The Oceanography of the New York Bight: Physical, Chemical, Biological; Volume II. Tech. Report No. 0017, New York Ocean Science Laboratory, Montauk, NY.

Azarovitz, T., C.R. Bryne, M.J. Silverman, B.L Freeman, W.G. Smith, S.C. Turner, B.A. Halgreen, and P.J. Festa. 1979. Effects on finfish and lobster. Pages 295-314 in: R.L. Swanson and C.J. Sinderman, (eds.) Oxygen depletion and associated benthic mortalities in NY Bight, 1976. NOAA Prof. Paper II. Washington, DC.

Azarovitz, T., M. Silverman, V. Anderson, A. Thoms, and C. Aussicker. 1976a. Demersal finfish catches in the New York Bight by stations and species, R/V ATLANTIC TWIN, October 31-December 5, 1972. NOAA DR ERL MESA-11. 143 pp.

____ 1976b. Demersal finfish catches in the New York Bight by station and species, R/V ATLANTIC TWIN, May 8-June 4, 1973. NOAA DR ERL MESA-12. 143 pp.

____ 1976c. Demersal finfish catches in the New York Bight by station and species, R/V ATLANTIC TWIN, October 1-November 7, 1973. NOAA DR ERL MESA-13. 102 pp.

_____ 1976d. Demersal finfish catches in the New York Bight by station and species, R/V DELAWARE II and ATLANTIC TWIN, April 1-May 2, 1974. NOAA DR ERL MESA-14. 101 pp.

_____ 1976e. Demersal finfish catches in the New York Bight by station and species, R/V ALBATROSS II and DELAWARE II, September 23-October 4, 1974. NOAA DR ERL MESA-15. 110 pp.

_____ 1976f. Demersal finfish catches in the New York Bight by station and species, R/V ALBATROSS II and ATLANTIC TWIN, March 4-14, 1975. NOAA DR ERL MESA-16. 137 pp.

Beardsley, R.C., W.C. Boicourt, and D.V. Hansen, eds. 1976. Physical oceanography of the Middle Atlantic Continental Shelf and New York Bight. Special Symp. Vol. 2. Am. Soc. Lim. and Oceanogr. Lawrence, KS.

Beves, P. 1976a. Meteorology, Chapter 3. In: A summary of environmental information on the Continental Slope Canadian/United States border to Cape Hatteras, NC. Prepared for BLM by Research Institute of the Gulf of Maine, Portland. (NTIS No. PB 284-001).

Bigelow, H.B. 1933. Studies of the waters on the Continental Shelf. Cape Cod to Chesapeake Bay, I. The cycle of temperature. Pap. Phys. Oceanogr. Meteorol. 2(4):135.

Bigelow, H.B., and M. Sears. 1939. Studies of the waters of the Continental Shelf, Cape Cod to Chesapeake Bay. III. A volumetric study of the zooplankton. Mem. Mus. Comp. Zool., Harvard. 54(4):183-378.

Biscaye, P.E., and C.R. Olsen. 1976. Suspended particulate concentrations and compositions in the New York Bight. Pages 124-137 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Special Symposia. Vol. #2. Lawrence, KS.

Boicourt, W.C., and P.W. Hacker. 1976. Circulation on the Atlantic Continental Shelf of the United States, Cape May to Cape Hatteras. Mem. Soc. R. Sci. Liege Ser 6. 10:187-200.

Bokuniewicz, H.J., J. Gebert, R.B. Gordon, J.L. Higgins, P. Kaminsky, C.C. Pilbeam, M. Reed, and C. Tuttle. 1978. Field study of the mechanics of the placement of dredged material at open-water disposal sites. Volume I: main text and appendices A-I. DMRP Tech. Rep. D-78-7. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 318 pp.

Bokuniewicz, H.J., J. Gebert, R.B. Gordon, P. Kaminsky, C.C. Pilbeam, M. Reed, and C. Tuttle. 1977. Field study of the effects of storms on the stability and fate of dredged material in subaqueous disposal areas. DMRP Tech. Rep. D-77-22. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 87 pp.

Bowman, M.J. 1972. Hydrographic study of the Shelf and Slope Waters of New York Bight. State University of New York/Marine Science Research Center. Tech. Rep. #16. SUNY, Stony Brook, Long Island, NY. 48 pp.

_____1977. Hydrographic properties. MESA New York Bight Atlas Monograph 1. New York Sea Grant Institute, Albany, NY. 78 pp.

Bowman, M.J., and L.D. Wunderlich. 1977. Hydrographic Properties. NOAA-MESA New York Bight Atlas Monograph I. New York Sea Grant Institute. Albany, New York.

_____1976. Distribution of hydrographic properties in the New York Bight Apex. Pages 58-68 in M.G. Gross, ed. Middle Atlantic Continental Shelf and New York Bight. Special Symp. Vol. 2. Am. Soc. Lim. and Oceanogr. Lawrence, KS.

Brackett, D.S. 1976a. Ocean transport and hazards, Chapter II. In: Summary of environmental information on the Continental Slope Canadian/United States border to Cape Hatteras, NC. Prepared for BLM by Research Institute of the Gulf of Maine Portland (NTS No. PB-284-003).

_____1976b. Archeological sites, Chapter 12. In; ibid.

Brannon, J.M. 1978. Evaluation of dredged material pollution potential. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. Tech Rept. DS-78-6. 39 pp.

Brezenski, F.T. 1977. Viral and bacterial studies conducted in the New York Bight, 1976 and 1977. Water quality data, New York Bight Apex, Summer of 1977. Appendix F. EPA, Region II. New York, NY. 25 pp.

Brown, B.E., E.M. Henderson, S.A. Murawski, and F.M. Serchuk. 1977. Review of status of surf clam populations in the Middle Atlantic. NMFS, Northeast Fish. Ctr. LR-77-08. 16 pp.

Bryson, R.A., and J.F. Lahey. 1958. The march of the seasons. Technical Report AFCRC-TR-58-223. University of Wisconsin, Madison, WI.

Buelow, R., B.H. Pringle and J. Verber. 1968. Preliminary investigation of waste disposal in the New York Bight. USPHS Bur. Dis. Prev. and Environ. Contr. 33 pp. (Reprint #10759).

Bumpus, D.F., R.E. Lynde, and D.M. Shaw. 1973. Physical oceanography. In: S.B. Saila, coordinator. Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Series 2. Marine Experiment Station, Grad. Sch. Oceano. U.R.I., Kingston, RI. pp. 1-1 to 1-72.

Bumpus, D.F. 1973. A description of the circulation on the Continental Shelf of the East Coast of the United States. Progress in Oceanography. 6:111-153.

_____1969. Reversals in the surface drift in the Middle Atlantic Bight area. Deep-Sea Res Suppl. 16:17-23.

Bureau of Land Management (BLM). See U.S. Department of Interior.

Burks, A. and R.M. Engler. 1978. Water quality impacts of aquatic dredged material disposal (laboratory investigations). Tech. Rep. DS-78-4. U.S. Army Engineer Waterways Experiment Staion, Vicksburg, MS.

Butman, B., M. Noble, and D.W. Folger. 1979. Long-term observations of bottom current and bottom sediment movement on the mid-Atlantic Continental Shelf. J. Geophys. Res. 84(c3):1187-1205. .

Buzas, M.A., J.H. Carpenter, B.H. Ketchum, J.L. McHugh, V.J. Norton, P.J. O'Connor, J.L. Simon, and D.K. Young. 1972. Smithsonian Advisory Committee report on studies of the effects of waste disposal in the New York Bight. Submitted to Coastal Eng. Res. Cen., U.S. Army Corps of Engineers. Washington, D.C. 65 pp.

Callaway, R.J., A.M. Teeter, D.W. Browne, and G.R. Ditsworth. 1976. Preliminary analysis of the dispersion of sewage sludge discharged from vessels to New York Bight Waters. Pages 199-211 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Special Symp. Vol. 2. Am. Soc. Lim. and Oceanogr. Lawrence, KS.

Carls, E.G. 1978. Recreation. MESA New York Bight Atlas monograph 19. New York Sea Grant Institute. Albany, NY. 32 pp.

Carmody, D.J., J.B. Pearce, and W.E. Yasso. 1973. Trace metals in sediments of New York Bight. Mar. Poll. Bull. 4(9):132-135.

Cassin, J.M. 1977. Phytoplankton population dynamics of Great South Bay and contiguous waters. Res. Found. St. U. of New York #AU-375. (reviewed for Biol. Bull.) 32 pp.

Charnell, R.L., (ed.) 1975. Assessment of offshore dumping in the New York Bight, Technical Background: Physical oceanography, geological oceanography, chemical oceanography. NOAA TR ERL 332 MESA-3. Boulder, CO. 83 pp.

Charnell, R.L., M.E. Darnell, G.A. Berberian, B.L. Kolitz, and J.B. Hazelworth. 1976. New York Bight project water column characterization cruises 1 and 2 of the NOAA ship RESEARCHER, 4-15 March, 5-14 May 1974. NOAA DR ERL MESA-18. Boulder, CO. 220 pp.

Charnell, R.L., and D.V. Hansen. 1974. Summary and analysis of physical oceanographic data collected in the New York Bight Apex during 1969 and 1970. MESA Report 74-3. NOAA-ERL. 44 pp.

Chave, K.E., and J.N. Miller. 1978. Baseline studies and evaluation of the physical, chemical, and biological characteristics of nearshore dredge spoil disposal, Pearl Harbor, Hawaii. Part C: Long-term effects of dumping. Final Report. Prepared for Pacific Division Naval Facilities Engineering Command, Honolulu, HI. Environmental Center, University of Hawaii. 120 pp.

Chen, K.Y., S.K. Gupta, A.Z. Sycip, J.C.S. Lu, M. Knezevic and W. Choi. 1976. Research study of the effect of dispersion, settling and resedimentation on migration of chemical constituents during openwater disposal of dredged materials. Contract Rep. D-76-1. Environmental Effects Lab., U.S. Army Engineer Waterways Exp. Station, Vicksburg, MS. 243 pp.

Chenoweth, S. 1976a. Phytoplankton. Section 7.1 in TRIGOM. Summary of environmental information on the Continental Slope Canadian/United States Border to Cape Hatteras, NC. The Research Institute of the Gulf of Maine, Portland. (Also NTIS. PB-284 002).

_____1976b. Zooplankton. Section 7.2 in TRIGOM. In: ibid.

_____1976c. Commercial and sport fisheries, chapter 10. In: Ibid (NTS No. PB-284-003).

Chenoweth, S., S.K. Katona, and D.S. Brackett. 1976. Nekton. Chapter 7.4 in: Summary of environmental information on the Continental Slope Canadian/United States Border to Cape Hatteras, NC. The Research Institute of the Gulf of Maine, Portland. (NTIS No. PB-284-002). 14 pp.

Conner, W.G., D. Aurand, M. Leslie, J. Slaughter, A. Amr, and F.I. Ravenscroft. 1979. Disposal of dredged material within the New York district: Volume I, present practices and candidate alternatives. MITRE Tech. Rep. MTR-7808 Vol. 1. The MITRE Corp., McLean, VA. 398 pp.

Corwin, N. 1970. Reduced data reports for ATLANTIS II 52 and GOSWOLD 140, appendix 1. Woods Hole Oceanogr. Inst. Tech. Rep. 70/15. Woods Hole, MA.

Cusumano, R.D., T.F. Maher, and B. Mackay. 1977. Ocean sludge monitoring report and preliminary results. Nassau County Dept. Health, Nassau, Long Island, NY. 6 pp. plus tables and figures.

Davey, F.W., and D.K. Phelps. 1977. Trace metals in the oceans: problem or no? In: Estuarine pollution control and assessment. EPA 440/1-77-007. U.S. Environmental Protection Agency, Washington, DC.

Dayal, R., M.G. Heaton, M. Fuhrmann, and I.W. Duedall. 1980. A geochemical and sedimentological study of the dredge material deposit in the New York Bight. Draft report submitted to Marine Ecosystems Analysis Program, NOAA, Stony Brook, NY. In press.

Deevey, G.B. 1956. Oceanography of Long Island Sound. V. Zooplankton. Bulletin Bingham Oceanography Coll. 15:113-155.

DOI. See U.S. Department of Interior.

Dowling, J.J. 1976. Nassau County water quality assessment report, appendix III-distribution of benthic invertebrates in the nearshore ocean sediments of Nassau County, including areas impacted by ocean disposal of sewage sludge, 1976 report year. (Draft) Nassau County Dept. of Health. 56 pp.

Drake, D.E. 1974. Suspended particulate matter in the New York Bight Apex. September to November 1973. NOAA Tech. Rept. ERL 318-MESA 1. Boulder, CO. 53 pp.

Duce, R.A., G.T. Wallace, and B.J. Ray. 1976. Atmospheric trace metals over the New York Bight. NOAA Tech. Rept. ERL 361-MESA 4. 17 pp.

Ducsik, D.W. 1973. Coastal zone utilization. In: S.B. Saila, coordinator. Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Series 2. Marine Experiment Station, Grad. Sch. Oceano., URI, Kingston, RI. pp. 12-1 to 12-141.

Edwards, R.L. 1976. Middle Atlantic Fisheries: recent changes in populations and outlook. In: M.g. Gross, (ed.) Middle Atlantic Continental Shelf and the New York Bight Proc. Symp. Special Symposia. Vol. 2. Amer. Soc. Limn. and Oceanogr. Lawrence, KS.

EG&G. 1977a. Currents observed in New Jersey coastal waters near 39°28'N Lat. and 74°15'W Long., during September, October, and November. 1975. Prepared for Public Service Electric and Gas Co., Newark, NJ. 55 pp.

_____ 1977b. Marine chemistry measurements in New Jersey coastal waters near 39°28'N Lat. and 74°15'W Long. on 13 January 1976. Prepared for Public Service Electric and Gas Co., Newark, NJ. 23 pp.

_____ 1977c. Water temperature and salinity observations in New Jersey coastal waters near 39°28'N Lat. and 74°15'W Long. during December 1975, January and February 1976. Prepared for Public Service Electric and Gas Company. Newark, NJ. 52 pp.

Emery, K.O., and E. Uchupi. 1972. Western North Atlantic Ocean: topography, rocks, structure, water, life, and sediments. Am. Assoc. Petroleum Geol., Memoir 17. 332 pp.

EPA. See U.S. Environmental Protection Agency.

Esaias, W.E. 1976. Phytoplankton distributions in the New York Bight March-June 1976. Pages 47-52 in: J.H. Sharp, ed. Anoxia on the Middle Atlantic Shelf During the Summer of 1976. Office International Decade Ocean Explor., National Science Foundation.

Falk, L.L., T.D. Myers, and R.V. Thomann. 1974. Waste dispersion characteristics and effects in an oceanic environment. E.I. DuPont de Nemours, University of Deleware, Hydroscience Inc., prepared for EPA (12020 EAW).

Falkowski, P.G., and S.O. Howe. 1976. Preliminary report to IDOE on the possible effects of the Ceratium tripos bloom in the New York Bight, March-July 1976. Brookhaven National Laboratory, BNL-21944. 7 pp.

FDA-PHS. Unpublished data - New York Bight coliform data, collected December 13-17, 1971. 4 pp.

Festa, P.J. 1974. A study of the distribution of young and larval summer flounder in New Jersey estuarine waters, October 1962 to March 1972. New Jersey Dept. Envir. Protection DIU. Fish, Game and Shellfish. Mis. Rep. No. 11M. 30 pp.

Franz, D.R. 1976. Distribution and abundance of inshore populations of the surf clam Spisula solidissima. In: M.G. Gross, (ed.) Middle Atlantic Continental Shelf and the New York Bight. Proc. Symp. Lawrence, Kansas.

Freeland, G.L., and G.F. Merrill. 1976a. Deposition and erosion in the dredge soil and other New York Bight dumping areas. Pages 936-946 in: P.A. Krenkel, J. Harrison and J.C. Burdick, (eds.). Dredging and its environmental effects. Amer. Soc. Civil. Eng., NY. 1037 pp.

_____1977b. The 1973 bathymetric survey in the New York Bight Apex: Maps and geological implications. NOAA TM ERL MESA-19. Boulder, CO. 22 pp.

Freeland, G.L., and D.J.P. Swift. 1978. Surficial sediments. MESA New York Bight Atlas Monograph 10. New York Sea Grant Institute, Albany, NY. 93 pp.

Freeland, G.L., D.J.P. Swift, W.L. Stubblefield, and A.E. Cook. 1976. Surficial sediments of the NOAA-MESA study areas in the New York Bight. Pages 90-101 in: M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Special Symposia Vol. 2. Amer. Soc. Limnol. and Oceanog., Lawrence, KS.

Freeland, G.L., D.J.P. Swift, and R.A. Young. 1979. Mud deposits near the New York Bight dumpsites: origin and behavior. Pages 73-95 in: H.D. Palmer and M.G. Grass, eds. Ocean dumping and Marine Pollution.

Freudenthal, H.D., and J.J. Lee. 1963. Glenodinium halli n. sp. and Gyrodinium instriatum n. sp., dinoflagellates from New York waters. J. Protozool. 10(2):182-189.

Frey, J.R. 1974. Polychaetes of the New York Bight: A key and a discussion of the ecology of the dominant species. Western State Commission on Higher Education, Boulder, CO. (NTIS PB 241 173). 40 pp.

_____1973. Species composition and diversity of polychaetes in the New York Bight. Western State Commission on Higher Education, Boulder, CO. (NTIS PB 241 191). 17 pp.

Gaines, J.L. Evaluation of the present shellfish harvesting closure lines in the New York Bight, May 5 to 9, 1980. NETSU, FDA-PHS, Davisville, RI. Unpublished.

Gibson, C.I. 1973. The effects of waste disposal on the zooplankton of the New York Bight. Ph.D. dissertation. Lehigh University. 187 pp.

Goeggel, G.B. 1978. Phase III environmental surveys of deep ocean dredged spoil disposal sites in Hawaii. Prepared for U.S. Army Corps of Engineers, Honolulu, HA. Hawaii Planning Design and Research, Honolulu, HA. 141 pp.

Goldberg, E.D. 1963. The oceans as a chemical system. Pages 3-35 in: M.N. Hill, (ed.). The Sea. Vol. 2. Chap 1. Interscience Publishers, NY.

Gopalan, U.K. and J.S. Young. 1975. Incidence of shell disease in shrimp in the New York Bight. Mar. Poll. Bull., 6(10):149-153.

Gordon, A.L. and F. Aikman III. 1981. Salinity maximum in the pycnocline of the Middle Atlantic Bight. Limnology and Oceanography 26:123-130.

Gordon, A.L., A.F. Amos, and R.D. Gerard. 1976. New York Bight water stratification - October 1974. Pages 45-57 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanog., Inc., Lawrence, KS.

Greig, R.A., A. Adams, and D.R. Wenzloff. 1977. Trace metal content of plankton and zooplankton collected from the New York Bight and Long Island Sound. Bull. Env. Contam. Toxicol. 18(1):3-8.

Greig, R.A., D.R. Wenzloff, and J.B. Pearce. 1976. Distribution and abundance of heavy metals in finfish, invertebrates, and sediments collected at a deepwater disposal site. Mar. Poll. Bull. 7(10):185-187.

Grice, G.D., and A.D. Hart. 1962. The abundance, seasonal occurrence and distribution of the epizooplankton between New York and Bermuda. Ecol. Monogr. 32(4):287-309.

Gross, M.G. 1970a. Analysis of dredged wastes, fly ash, and waste chemicals - New York Metropolitan Region, Mar. Sci. Res. Cent., State Univ. New York, Stony Brook, N.Y. Technical Report No 7. 33 pp.

_____1970b. New York metropolitan region - a major sediment source. Water Resource Research 6:927-31.

_____1972. Geologic aspects of waste solids and marine waste deposits, New York metropolitan region. Geol. Soc. Am. Bull. 83:3163-3176.

_____Gross, M.G. Ed., 1976a. Waste Disposal. MESA New York Bight Atlas Monograph 26. New York Sea Grant Institute, Albany, NY. 31 pp.

_____1976b. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Special Symposia. Volume 2. 441 pp.

Grosslein, M.D. 1976. Some results of fish surveys in the mid-Atlantic important for assessing environmental impacts. Pages 312-323 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Special Symposia. Vol. 2.

Grumman Ecosystems Corp. 1973. Marine environmental considerations pertinent to offshore siting of nuclear power facilities - Vol. II - Literature Review.

Gusey, W.F. 1976. The fish and wildlife resources of the Middle Atlantic Bight. Shell Oil Company. 582 pp.

Hamer, P.E. 1971. Migratory patterns of some New Jersey striped bass, Morone saxatilis. New Jersey Dept. Envir. Protection, Div. Fish, Game and Shellfish. Misc. Rep. No. 6M. 25 pp.

Hammon, A. 1976. Port facilities and commerce. MESA New York Bight Atlas Monograph 20. New York Sea Grant Institute, Albany, NY. 41 pp.

Han, G.C., D.V. Hansen, and J.A. Gult. 1980. Steady-state diagnostic model of the New York Bight. J. Phys. Oceanogr. 10(12):1998-2020.

Han, G.C. and D.A. Mayer. 1981. Current structure on the Long Island inner shelf. J. Geophys. Res. 86(C5):4205-4214.

Hansen, D.V. 1977. Circulation. MESA New York Bight Atlas Monograph 3. New York Sea Grant Institute, Albany, NY. 23 pp.

Hardy, C.C., E.R. Baylor and P. Moskowitz. 1976. Sea surface circulation in the northwest Apex of the New York Bight - with appendix: bottom drift over the Continental Shelf. Vol. I and Vol. II - Part 1: Diagrams and data for interface drift cards, Part 2: Diagrams and data for seabed drifters. NOAA Tech. Mem. ERL MESA-13. 334 pp.

Harris, W.H. 1976. Spatial and temporal variation in sedimentary grain-size facies and sediment heavy metal ratios in the New York Bight Apex. Pages 102-123 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Special Symposia. Vol. 2.

Harvey, G.R., W.G. Steinhauer, and J.M. Teal. 1973. Polychlorobiphenyls in North Atlantic ocean water. Science. 180:643-644.

Harvey, G.R. and W.G. Steinhauer. 1976. Biogeochemistry of PCB and DDT in the North Atlantic. Pages 203-221 in: J.O. Nrriagu, (ed.) environmental biogeochemistry. Vol. 1: Carbon, nitrogen, phosphorus, sulfur and selenium cycles. Ann Arbor Sciences.

Haskin, H.H. and M.L. Tarnowski. 1979. Surf clam inventory-New Jersey waters. N.J. Oyster Research Lab, Rutgers University. 5 pp.

Hatcher, P.G., and L.E. Keister. 1976a. Carbohydrates and organic carbon in New York Bight sediments as possible indicators of sewage contamination. Pages 240-248 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Special Symposia. Vol. 2.

_____ 1976b. Sediments of the New York Bight; their bulk organic chemical properties. NOAA DR ERL MESA-21. Boulder, CO. 20 pp.

Hathaway, J.C. (ed.) 1971. Data file, Continental margin program, Atlantic Coast of the United States. Vol. 2. Sample collection and analytical data. Woods Hole Oceanographic Institution Tech Rept. 71-15. 496 pp.

Havens, J.M., D.M. Shaw, and E.R. Levine. 1973. Offshore weather and climate. Pages 11-1 to 11-43 in: S.B. Saila, coordinator. Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Series 2. Marine Experiment Station. Grad. Sch. Oceano., URI, Kingston, RI.

Hazelworth, J.B. 1974. New York Bight Project. Water sampling cruises 1-5 of the NOAA Ship FERREL, August-November 1973. NOAA MESA Report 74-2. Boulder, CO. 191 pp.

Hazelworth, J.B., S.R. Cummings, S.M. Minton, and G.A. Berberian. 1977a. MESA New York Bight Project, expanded water column characterization cruise (XWCC 11), NOAA Ship RESEARCHER, September 1976. NOAA DR ERL MESA-29. Boulder, CO. 191 pp.

Hazelworth, J.B., S.R. Cummings, and G.A. Berberian. 1977b. MESA New York Bight Project, expanded water column characterization cruise (XWCC 8) NOAA GEORGE B. KELEZ, April 1976. NOAA DR ERL MESA-27. Boulder CO. 112 pp.

Hazelworth, J.B., and M.A. Darnell. 1976. MESA New York Bight Project expanded water column characterization cruises (XWCC 2,3) NOAA Ship RESEARCHER, 22 February - 5 March; 9-12 April 1975. NOAA DR ERL MESA 23. Boulder, CO. 237 pp.

Hazelworth, J.B., B.L. Kolitz, R.B. Starr, R.L. Charnell, G.A. Berberian and M.A. Weiselberg. 1975a. New York Bight Project, water column sampling cruises No. 6-8 of the NOAA Ship FERREL, April-June 1974. NOAA DR MESA-1, Boulder, CO. 177 pp.

_____ 1975b. New York Bight Project, Water column sampling cruises No. 9-12 of the NOAA Ship FERREL, July-November, 1974. NOAA DR ERL MESA-3. Boulder, CO. 231 pp.

Hirsch, N.D., L.H. DiSalvo, and R. Peddicord. 1978. Effects of dredging and disposal on aquatic organisms. DMRP Tech. Rep. DS-78-5. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 41 pp.

Hoff, J.C., and R.C. Becker. 1969. The accumulation and elimination of crude and clarified poliovirus suspensions by shellfish. Am. J. Epidemiol. 99:53-58.

Hollman, R. 1971. Nearshore physical oceanography. New York Ocean Science Laboratory Tech. Rpt. No 0008. New York Ocean Science Laboratory, Montauk, New York. 11 pp.

Horne, R.A., A.J. Jahler, and R.C. Rossello. 1971. The marine disposal of sewage sludge and dredge spoil in the waters of the New York Bight. Report to USA COE, Coastal Engineering Res. Ctr., Contract DACW 72/70C/0030. 235 pp.

Howe, M.A., R.B. Clapp, and J.S. Weske. 1978. Marine and coastal birds. MESA New York Bight Atlas Monograph 31. New York Sea Grant Institute, Albany, NY. 87 pp.

Hulburt, E.M. 1963. The diversity of phytoplanktonic populations in oceanic, coastal and estuarine regions. J. Marine Res. 21:81-93.

_____1966. The distribution of phytoplankton and its relationship to hydrography, between southern New England and Venezuela. J. Marine Res. 24:67-81.

Hulburt, E.M., and J. Rodman. 1963. Distribution of phytoplankton species with respect to salinity between the coast of southern New England and Bermuda. Limnol. and Oceanogr. 8:263-69.

Ichthyological Associates, Inc. 1975. Ecological studies in the bays and other waterways near Little Egg Inlet and in the ocean in the vicinity of the proposed site for the Atlantic generating station, New Jersey, Progress report for the period January - December 1974, Vols. 1 and 2. For Public Service Electric and Gas Company.

_____1976. Ecological studies in the bays and other waterways near Little Egg Inlet and in the ocean in the vicinity of the proposed site for the Atlantic generating station, New Jersey, Progress report for the period January - December 1975, Vols. 1 and 2. For Public Service Electric and Gas Company.

Ichthyological Associates, Inc. 1972. Ecological considerations for ocean sites off New Jersey for proposed nuclear generating stations. pp. 1-140.

IMCO. 1976, 1977. Report on ocean dumping.

Interstate Electronics Corporation. 1973. Ocean waste disposal in the New York Bight. Report 4461C1557: IEC, Oceanics Division, Anaheim, CA. n.p.

_____1978. Cellar Dirt Site in the New York Bight. Phase I Interim Report. Prepared for EPA by IEC, Washington, DC. 37 pp.

Interstate Electronics Corporation. In preparation. EIS for Cellar Dirt Site designation. IEC, Anaheim. CA.

Jannasch, H.W., and C.O. Wirsen. 1977. Microbial life in the deep sea. Sci. Amer. 236:42-65.

Jeffries, H.P., and W.C. Johnson. 1973. Zooplankton. Pages 4-1 to 4-93 in S.B. Saila, ed. Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Ser. No. 2. Univ. of Rhode Island. 682 pp.

Jensen, A.C. 1975. Artificial fishing reefs. MESA New York Bight Atlas Monograph 18. New York Sea Grant Institute, Albany, NY. 23 pp.

Jolly, R., and G. Grant. 1976. Trace metals. 7 pp. in: Environmental data acquisition and analysis, MID-Atlantic OCS. VIMS and BLM.

Jones, R.A., and G.F. Lee. 1978. Evaluation of the elutriate test as a method of predicting contaminant release during open-water disposal of dredged sediments and environmental impact of open-water dredged material disposal. Volume I: Discussion. DMRP Tech. Rep. D-78-45. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 283 pp.

Kester, D.R., and R. Courant. 1973. A summary of chemical oceanographic conditions: Cape Hatteras to Nantucket Shoals. Pages 2-1 to 2-36 in S.B. Saila, ed. Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Series No. 2. Univ. Rhode Island. 682 pp.

Ketchum, B.H., A.C. Redfield, and J.C. Ayers. 1951. The oceanography of the New York Bight. Papers in Physical Oceanography and Meteorology. 12(1). MIT and WHOI. Cambridge, MA. 46 pp.

Kinnaman, J.H. 1970. South shore water quality survey results, 1970. Nassau County Dept. Health, Bureau of Water Pollution Control.

Koditschek, L. 1976. Antimicrobial resistant bacteria in the New York Bight. Pages 383-393 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. of Limnol.and Oceanog., Inc., Lawrence, KS.

Kolitz, B.L., J.B. Hazelworth, R.B. Starr, and S.R. Cummings. 1976a. MESA New York Bight Project, expanded water column characterization cruises (XWCC 4-5), NOAA Ship GEORGE KELEZ, May-June 1975. NOAA DR ERL MESA-24. Boulder, CO. 231 pp.

Kolitz, B.L., J.B. Hazelworth, R.B. Starr, G.A. Berberian, and S.R. Cummings. 1976b. MESA New York Bight Project, expanded water column characterization cruise (XWCC-7), NOAA Ship GEORGE B. KELEZ, December 1975. NOAA DR ERL MESA-26. Boulder, CO. 122 pp.

Kraft, J.C. and C.J. John. 1976. The geological structure of the shorelines of Delaware. Del. Seagrant Tech. Rpt. 14-76. 107 pp.

Larsen, P.F., and S. Chenoweth. 1976. Benthos. Section 7.3 in BLM. Summary of environmental information on the Continental Slope - Canadian/United States Border to Cape Hatteras, NC. The Research Institute of the Gulf of Maine, Portland, ME. (Also NTIS. PB-284-002).

Lavelle, J.W., G.H. Keller and T.L. Clarke. 1975. Possible bottom current response to surface winds in the Hudson Shelf Channel. J. Geophys. Res. 80:1953-56.

Lavelle, J.W., R.A. Young, D.J.P. Swift, and T.L. Clarke. 1978. Near-bottom sediment composition and fluid velocity measurements on the inner Continental Shelf, New York. J. Geophys. Res. 83(c12):6052-6062.

Lear, D.W., M.L. O'Malley, and S.K. Smith. 1981. Effects of ocean dumping on a temporate mid-shelf environment. Pages 485-502 in: B.H. Ketchum, D.A. Kester, and P.K. Park (eds), Ocean Dumping of Industrial wastes. Plenum Press, New York.

Lee, G.F., and R. Jones. 1977. Assessment of the environmental significance of chemical contaminants present in dredged sediments dumped in the New York Bight. Submitted to U.S. Army Corps of Engineers New York District, September 1977. (Unpublished.) 62 pp.

Lee, G.F., R.A. Jones, F.Y. Saleh, G.M. Mariani, D.H. Homer, J.S. Butler, and P. Bandyopadhyay. 1978. Evaluation of the elutriate test as a method of predicting contaminant release during open-water disposal of dredged sediments and environmental impact of open-water dredged material disposal. Volume II: Data Report. DMRP Tech. Rep. D-78-45. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 1186 pp.

Lee, G.F., M.D. Piwoni, J.M. Lopez, G.M. Mariani, J.S. Richardson, D.H. Homer, and F. Saleh. 1975. Research study for the development of dredged material disposal criteria. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 381 pp.

Leslie, M., D. Aurand, D. Schultz, and R. Holman. 1980. Disposal of dredged material within the New York district: Volume II: Preliminary evaluation of upland disposal. MITRE Tech. Rep. MTR-7808 Vol. 2. The MITRE Corp., McLean, VA. 243 pp.

Lettau, B., W.A. Brower Jr., and R.G. Quayle. 1976. Marine Climatology. MESA New York Bight Atlas Monograph 7. New York Sea Grant Institute, Albany, NY. 239 pp.

Litchfield, C.D., M.A. Devanas, J. Zindulis, M. Meskill, J. Freedman, and C. McClean. 1980. Influence of cadmium on the microbial populations and processess in sediments from the New York Bight Apex. In press.

Liu, O.C., H.R. Seraichekas, and B.L. Murphy. 1966. Virul pollution of shellfish. I. Some basic facts of uptake. Soc. Exper. Biol. Med. Proc. 123:481-487.

Longwell, A.C. 1976. Chromosome mutagenesis in developing mackerel eggs sampled from the New York Bight. NOAA TM ERL MESA-7. Boulder, Colorado. 61 pp.

Lynch, M.P. and B.L. Laird. 1977. Middle Atlantic Outer Continental Shelf environmental studies. Vol. II-B. Chemical and biological benchmark studies. Virginia Institute for Marine Sciences (08550-CT-5-42) for Bureau of Land Management, U.S. Dept. of Interior. 644 pp.

Malone, T.C. 1976. Phytoplankton productivity in the Apex of the New York Bight: environmental regulation of productivity/chlorophyll a. Pages 260-272 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanog., Inc., Lawrence, KS.

_____1977. Plankton systematics and distribution. MESA New York Bight Atlas Monograph 13. New York Sea Grant Institute. Albany, New York. 45 pp.

Mandelli, E.F., et al. 1970. A study of primary productivity in coastal waters of southern Long Island, NY. Mar. Biol. 7:153-160.

Martin, G.W. 1929a. Dinoflagellates from marine and brackish waters of New Jersey. Iowa Univ. Stud. Nat. Hist. 12(9):1-32.

_____1929b. Three dinoflagellates from New Jersey. Bot. Gaz. 87: 556-558.

Maurer, D., P. Kinner, W. Leathem, and L. Watling. 1976a. Benthic fauna assemblages off the Delmarva Peninsula. Estuarine and Coastal Marine Science. 4:163-177.

_____1979. Seasonal changes in feeding types of estuarine benthic invetebrates from Delaware Bay. J. Exp. Mar. Biol. Ecol. 36:125-155.

Maurer, D., P. Kinner, J.Tinsman, and W. Leathem. 1976b. Baseline study of Sussex County, Delaware Ocean outfalls. CMS-C-1-76, Univ. of Delaware. 287 pp.

Mayer, D.A., D.V. Hansen, and D.O. Ortman. 1979. Long-term current and temperature observations on the Middle Atlantic Bight. J. Geophys. Res. 84(c4):1776-1792.

McCarthy, J.J. 1970. A urease method for urea in seawater. Limnol. and Oceanogr. 15:309-13.

McClennen, C.E.. 1973. New Jersey Continental Shelf near bottom current meter records and recent sediment activity. J. Sed. Petrology 43:371-380.

McClennen, C.E. and W.P. Kramer. 1976. Estimates of sediment transport using computer processing of current meter data. Unpub. MS. 15 pp.

McCullough, D. 1972. The great bridge. Simon and Schuster, NY. 636 pp.

McDermott, V. 1971. Study of the ichthyoplankton associated with two of New Jersey's coastal inlets - April 1968 to March 1970. New Jersey Dept. Envir. Protection Div. Fish. Game and Shellfish. Misc. Rep. No. 7M. 34 pp.

McGraw, D.J. 1969. Continuation of the investigation of waste disposal in the New York Bight. U.S. Dept. HEW-PHS. Northeast Tech. Service Unit, Davisville, RI. 11 pp.

McHugh, J.L. 1977. Fisheries and fishery resources of New York Bight. NOAA Tech. Rep. NMFS Cir. 401. 50 pp.

McHugh, J.L., and J.J.C. Ginter. 1978. Fisheries. MESA New York Bight Atlas Monograph 16. New York Sea Grant Institute, Albany, NY. 129 pp.

McLaughlin, D., J.A. Elder, G.T. Orlob, D.F. Kibler, and D.E. Evenson. 1975. A conceptual representation of the New York Bight ecosystem. NOAA Technical Memorandum ERL MESA-4. Environmental Research Lab., U.S. Dept. Commerce, Boulder, CO. 359 pp.

McLeod, G., and T.R. Gilbert. 1976. Chemical oceanography. Pages 6-1 to 6-39 in: TRIGOM. Summary of environmental informmation on the Continental Slope Canadian/U.S. border to Cape Hatteras, NC. Prepared for BLM by Research Institute of Maine, Portland, ME. (NTIS No. PB 284 001-004).

Meade, R.H. 1972. Sources and sinks of suspended matter on Continental Shelves. Pages 249-262 in: D.J. Swift, (ed.) Shelf sediment transport: processes and patterns. Dwayne and Pilkey, Dowden, Hutchinson, and Ross, Inc. Stroudsburg, PA.

Meade, R.H., P.L. Sachs, F. Manheim, J.C. Hathaway, and D.W. Spencer. 1975. Sources of suspended matter in waters of the Middle Atlantic Bight. J. Sed. Petrol. 45:171-188.

Mears, H.C. and R. Eisler. 1977. Trace metals in liver from bluefish, tautog, and tilefish in relation to body length. Ches. Sci. 18:315-318.

Milliman, J.D. 1973. Marine geology. Pages 10-1 to 1-91 in: S.B. Saila, ed. Coastal and offshore environmental inventory - Cape Hatteras to Nantucket Shoals. Complement volume. Marine Pub. Ser. No. 2, Univ. Rhode Island, Kingston, RI. 02881.

Mohnen, V.A. 1977. Air quality. MESA New York Bight Atlas Monograph 28. New York Sea Grant Institute, Albany, NY. 43 pp.

Mooers, C.N.K., J. Fernandez-Partagas and J.F. Price. 1976. Meteorological forcing fields of the New York Bight (1st year). RSMAS, Tech. Rpt. TR 76-8. 151 pp.

Morgan, C.W., J.M. Bishop, and F.F. Mulher. 1976. Oceanography of the New York Bight-Agugust 1974. United States Coast Guard. Oceanographic Report. CG-373-71, Oceanographic Unitt, Washington, DC. 89 pp.

Mueller, J.A., J.S. Jeris, A.R. Anderson, and C.F. Hughes. 1976. Contaminant inputs to the New York Bight. Marine Ecosystems Analysis Program Office NOAA Technical Memo ERL-MESA 6. Boulder, Colorado. 347 pp.

Murawski, S.A., and F.M. Serchuk. 1979a. An assessment of offshore surf clam, Spisula solidissima, populations off the Middle Atlantic coast of the United States. Northeast Fisheries Center, National Oceanic and Atmospheric Administration, Woods Hole, MA. Unpublished.

_____ 1979b. Distribution, size composition, and relative abundance of ocean quahog, Arctica islandica, populations off the Middle Atlantic coast of the United States. Northeast Fisheries Center, National Oceanic and Atmospheric Administration, Woods Hole, MA. Unpublished.

Murchelano, R.A., and C. Brown. 1970. Heterotrophic bacteria in Long Island Sound. Mar. Biol. 7(1):1-6.

Murchelano, R.A., and J. Ziskowski. 1976. Fin rot disease studies in the New York Bight. Pages 329-336 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanog., Inc., Lawrence, KS.

National Oceanic and Atmospheric Administration. 1980a. Report to the Congress on ocean dumping monitoring and research, January through December, 1978. U.S. Department of Commerce, Washington, DC. 42 pp.

_____1980b. Northeast monitoring program (NEMP): A pilot marine monitoring program. Unpublished. 67 pp.

Nelsen, T.A. 1979. Suspended particulate matter in the New York Bight Apex: observations from April 1974 through January 1975. NOAA Tech. Mem. ERL MESA 42.

Nickels, J., E. Geer and A. Penna. 1979. New York Bight diver observation program, results of 1978 survey. Amer. Lit. Soc., Tech. Rpt. No. 1. 27 pp.

NJDEP (New Jersey Department of Environmental Protection). 1980a. Approved area charts - shellfish growing water classification. Division of Water Resources, NJDEP. 6 pp.

_____1980b. Proposed New Jersey Coastal Management program. Draft environmental impact statement. NOAA-NJDEP. 427 pp.

_____1980c. New Jersey Coastal Management program bay and ocean shore segment. Final environmental impact statement. NOAA-NJDEP. 466 pp.

NOAA-MESA. 1975. Annual summary of research results for fiscal year 1974, MESA New York Bight project. NOAA TM ERL MESA-2. Boulder, CO. 193 pp.

_____1976. Evaluation of proposed sewage sludge dumpsite areas in the New York Bight. NOAA TM ERL MESA-11. Boulder, CO. 212 pp.

_____1977. New York Bight Project Annual Report for FY 1976-1976T. NOAA Tech. Memo. ERL MESA-25. Boulder, CO. 91 pp.

NOAA-NMFS. 1980. Fisheries of the U.S. 1979. Current Fisheries Statistics. No. 8000, U.S. Dept. of Commerce, Washington, DC. 131 pp.

_____1978a. DELAWARE II clam survey 778-01, information report (covering the Mid-Atlantic Shelf Long-Island to Cape Hatteras), 4 January - 11 February, 1978. Northeast Fisheries Center, Woods Hole, MA. 20 pp.

1978b. Fishery statistics of the United States - 1975. Statistical Digest No. 69. U.S. Department of Commerce, Washington,, D.C. 418 pp.

______1977a. New York landings. Annual summary, 1976. Current Fisheries Statistics No. 7212.

______1977b. New Jersey landings. Annual summary, 1976. Current Fisheries Statistics No. 7213.

______1975. Sea scallop survey. Cruise report - NOAA ship ALBATROSS IV. August 7-16, 1975 and September 27-October 3, 1975: Mid Atlantic Coast. Fish. Cen., Sandy Hook Lab., Highlands N.J.

______1972. The effects of waste disposal in the New York Bight - Summary Final Report. U.S. Dept. Commerce. NOAA. NMFS, Northeast Region. Sandy Hook Lab., Highlands, NJ. 70 pp.

NYOSL. (New York Ocean Science Laboratory). 1974. An interdisciplinary study on the estuaries and coastal oceanography of Block Island and adjacent New York coastal waters: Ground truth. Final Report. Tech. Rpt. #0027.

______1973. The oceanography of the New York Bight: physical, chemical, and biological. NYSOL, Montauk, NY. 205 pp.

______1971. The state of knowledge of chemical processes affecting Long Island coastal and estuarine waters. New York Ocean Science Lab., Tech. Rep. No. 0009. Montauk, NY. 148 pp.

NYSDEC (New York State Department of Environmental Conservation). 1981. Notice of condition of all shellfish grounds located within or adjacent to the town on Oyster Bay, Nassau County, State of New York. Bureau of Shellfisheries, NYSDEC, Stony Brook, New York, 24 pp.

O'Brien and Gere Engineers. 1979. Bioaccumulation study on <u>Homarus americanus</u>. Prepared for U.S. Army Corps of Engineers, New York District. 52 pp.

O'Connor, D.J., R.V. Thomann, and H.J. Salas. 1977a. Water Quality. MESA New York Bight Atlas Monograph 27. New York Sea Grant Institute, Albany, NY. 104 pp.

O'Connor, J.M. 1980. Testimony to the Merchant Marine and Fisheries Committee, U.S. House of Representatives, 21 May 1980. Unpublished.

O'Connor, J.M., J.B. Klotz, and T.J. Kneip. 1980. Sources, sinks, and distribution of organic contaminants in the New York Bight ecosystem. In: G. Meyer, (ed.) Ecological effects of environmental stress in the New York Bight. MESA/ERL Sea Grant Symposium - In press.

O'Connor, J.M., D.A. Neumann, and J.A. Sherk, Jr. 1977b. Sublethal effects of suspended sediments on estuarine fish. Tech. Paper 77-3. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA. 90 pp.

O'Connor, J. 1975. Contaminant effects on biota of the New York Bight. Pages 50-63 in Proc. Gulf Caribbean Fisheries Inst., 28th Annual Session. U. Miami, Miami, FL.

O'Connor, J. 1973. Dredging and spoiling on Long Island. Marine Sciences Research Center, Stony Brook. Tech. Rep. No. 19. 34 pp.

O'Connor, J., and H. Stanford (eds.). 1979. Chemical pollutants of the New York Bight; Priorities for research. NOAA-MESA, New York Bight Project. Boulder, CO. 217 pp.

Ogren, L. and J. Chess. 1969. A marine kill on New Jersey wrecks. Underwater Naturalist 6:4-12.

Oliver, J.S., P.N. Slattery, L.W. Hulberg, and J.W. Nybakken. 1977. Patterns of succession in benthic infaunal communities following dredging and dredged material disposal in Monterey Bay. DMRP Tech. Rep. D-77-27. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 186 pp.

Pararas-Carayannis, G. 1973. Ocean dumping in the New York Bight - An assessment of environmental studies. Tech. Memo. No. 39, U.S. Army Corps of Engineers, Springfield, VA. 159 pp.

_____ 1975. An investigation of anthropogenic sediments in the New York Bight. Ph.D. Dissertation. University Microfilms, Ann Arbor, MI. 266 pp.

Pearce, J.B. 1970. The effects of solid waste disposal on benthic communities in the New York Bight. FAO technology conference on marine pollution and its effects on living resources and fishing. Food and Agricultural Organization of the United Nations, Rome, Italy. 19 pp.

_____ 1972. The effects of solid waste disposal on benthic communities in the New York Bight. Pages 404-411 in M. Ruivo, ed. Marine Pollution and Sea Life. FAO Rome, Italy.

_____ 1980. Marine sand and gravel production in areas off the northeast coast of the United States. Mar. Poll. Bull. 10(1):14-18.

Pearce, J., C. MacKenzie, J. Caracciolo, and L. Rogers. 1978. Reconnaissance survey of the distribution and abundance of benthic organisms in the New York Bight Apex, 5-14 June 1973. NOAA Data Report ERL MESA-41. Marine Ecosystems Analysis Program, Boulder, CO. 9 pp.

Pearce, J.B., J. Thomas, J. Caracciolo, M. Halsey, and L. Rodgers. 1977. Distribution and abundance of benthic organisms in the New York Bight Apex, five seasonal cruises, August 1973 - September 1974. NOAA DR ERL MESA-32. 803 pp.

_____ 1976a. Distribution and abundance of benthic organisms in the New York Bight Apex, 26 August-6 September 1974. NOAA DR ERL MESA-9. Boulder, Colorado. 88 pp.

_____1976b. Distribution and abundance of benthic organisms in the New York Bight Apex, 2-6 August 1973. NOAA DR ERL MESA-8. Boulder, Colorado. 131 pp.

Pearce, J.B., J.V. Caracciolo, A. Frame, L.H. Rodgers, M.B. Halsey, J. Thomas. 1976c. Distribution and abundance of benthic organisms in the New York Bight, August 1968-December 1971. NOAA DR ERL MESA-7. 114 pp.

Pearce, J.B. J.V. Caracciolo, M.B. Halsey, and L.H. Rodgers. 1976d. Temporal and spatial distributions of benthic macroinvertebrates in the New York Bight. Pages 394-403 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Amer. Soc. Limnol. and Oceanog., Lawrence, KS. Special Symposia. Vol. 2.

Pequegnat, W.E., B.M. James, E.A. Kennedy, A.D. Fredericks, and R.R. Ray. 1978a. Development and application of the biotal ocean monitor system to studies of the impacts of ocean dumping. TerEco Tech. Rep. to U.S. Environmental Protection Agency, Office of Water Program Operations, T.A. Wastler, Project Officer. 143 pp.

Pequegnat, W.E., D.D. Smith, R.M. Darnell, B.J. Presley, and R.O. Reid. 1978b. An assessment of the potential impact of dredged material disposal in the open ocean. Dredged Material Research Program (DMRP) Technical Report D-78-2. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MI. 645 pp.

Pequegnat, W.E., B.M. James, E.A. Kennedy, A.D. Fredericks, R.R. Ray, and F. Hubbard. 1980. Application of the biotal ocean monitor system to a study of the impacts of ocean dumping of dredged material in the New York Bight. TerEco Tech. Rep. to U.S. Army Engineers, New York District, D.J. Suszkowski, Project Officer. 61 pp.

Phillips, G.R., and R.C. Russo. 1978. Metal bioacumulation in fishes and aquatic invertebrates: a literature review. EPA-600/3-78-103. Duluth, MN. 116 pp.

Pierce, R. 1980. Task force study (PCB's) on the Mud Dump. North Atlantic Div-U.S. Army Corps of Engineers. Unpublished Manuscript.

Pilson, M.E.Q., and E. Goldstein. 1973. Marine mammals. pages 7-1 to 7-48 in: S.B. Saila, (coordinator). Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Mar. Publ. Series 2. Marine Experiment Station. Grad. Sch. Ocean., URI, Kingston, RI.

Pore, N.A., and C.S. Barrientos. 1976. Storm surge. MESA New York Bight Atlas Monograph 6. New York Sea Grant Institute, Albany, NY. 44 pp.

Pore, N.A., W.S. Richardson and H.P. Perrotti. 1974. Forecasting extra-tropical storm surges for the northeast coast of the United States. NOAA TM NWS TDL-50.

Pratt, S.D. 1973. Benthic fauna. Pages 5-1 to 5-70 in S.B. Saila, (ed.). Coastal and offshore environmental inventory - Cape Hatteras to Nantucket Shoals. Marine Publication Series No. 2. Occasional Publication No. 5, University of Rhode Island, Kingston, RI. 693 pp.

Riley, G.A. 1952. Phytoplankton of Block Island Sound. Bull. Bing. Oceanogr. Coll. 8(3):40-64.

Riley, J.P., and G. Skirrow. 1965. Chemical Oceanography. Academic Press, New York, NY. 1220 pp.

Ritchie, D.W. 1970. Gross physical and biological effects of overboard spoil disposal in upper Chesapeake Bay. Project F: Fish. Special Report 3. Natural Resources Institute, University of Maryland, College Park, MD.

Rooney, S. 1976. Offshore birds, Chapter 7.5. In: Summary of environmental information of the Continental Slope Canadian/United States border to Cape Hatteras, NC. Prepared for BLM by Research Institute of the Gulf of Maine, Portland. (NTS No. PB-284-002).

Ropes, J.W. 1980. Biological and fisheries data on the Atlantic surf clam Spisula solidissima (Dillwyn). U.S. Department of Commerce, NOAA-NMFS, Northeast Fisheries Center Tech. Ser. Rept. 24. 88 pp.

Ropes, J.W. and A.S. Merrill. 1976. Historical cruise data on surf clams and ocean quahogs. NOAA DR ERL MESA-17. 106 pp.

Rowe, G.T. 1971. The effects of pollution on the dynamics of the benthos of New York Bight. Thal. Jugoslau. 7(1):353-359.

Ryther, J.H. 1954. The ecology of phytoplankton blooms in Moriches Bay and Great South Bay, Long Island, NY. Biol. Bull. 106:198-209.

Saila, S.B. 1973. Coastal and offshore environmental inventory - Cape Hatteras to Nantucket Shoals. Marine Experimental Sta., Grad. Sch. Oceanog. URI, Kingston, RI. 684 pp.

_____ 1973. Coastal and offshore environmental inventory - Cape Hatteras to Nantucket Shoals, complement volume. Marine Experimental Sta., Grad. Sch. Oceanog., URI. 382 pp.

Saila, S.B. and S.D. Pratt. 1973. Mid-Atlantic Bight Fisheries. Pages 6-21 to 6-125 in: S.B. Saila, (coordinator). Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shaols, complement volume. Marine Experimental Sta., Grad. Sch. Oceanog., URI, Kingston, RI.

Sandy Hook Laboratory. 1972. The effects of waste disposal in the New York Bight. Final Report. Vol. 1-9. NOAA/NMFS/MACFC/Sandy Hook Laboratory, Highlands, NJ. n.p.

Schlee, J.S. 1973. Atlantic Continental Shelf and Slope of the U.S. sediment texture of the northeastern part. U.S.G.S. Prof. Paper 529-L. 64 pp.

Schlee, J. and P. Sanko. 1975. Sand and gravel. MESA New York Bight Atlas Monograph 21. New York Sea Grant Institute, Albany, NY. July 1975. 26 pp.

Schmidt, L. Letter to T.A. Wastler, Chief, Marine Protection Branch, U.S. EPA, dated June 12, 1980. State of New Jersey, Division Fish, Game and Wildlife, Trenton, NJ. Unpublished.

Schubel, J.R., H.H. Carter, R.E. Wilson, W.M. Wise, M.G. Heaton, and M.G. Gross. 1978. Field investigations of the nature, degree and extent of turbidity generated by open-water pipeline disposal operations. Environmental Effects Lab., U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 297 pp.

Scott, J.T. and G.T. Csanady. 1976. Nearshore currents off Long Island. Woods Hole Oceanographic Contribution. BNL-22083. 25 pp.

SCS Engineers. 1977. Feasibility of inland disposal of dewatered dredged material: a literature review. Tech. Rep. D-77-33. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 153 pp.

Segar, D.A. and G.A. Berberian. 1976. Oxygen depletion in the New York Bight Apex: causes and consequences. Pages 220-239 in: M.G. Gross, Ed. Middle Atlantic Continental Shelf and the New York Bight. Proc. of the Symp. - Special Symposia, Vol. 2. Amer. Soc. Limno. and Oceano., Lawrence, KS.

Segar, D.A. and A.Y. Cantillo. 1976. Trace metals in the New York Bight. Pages 171-198 in: M.G. Gross, Ed. Middle Atlantic Continental Shelf and the New York Bight. Proc. of the Symp. - Special Symposia, Vol. 2. Amer. Soc. Limno. and Oceano., Lawrence, KS.

Sharp, J.H. (ed.). 1976. Anoxia on the Middle Atlantic Shelf during the summer of 1976. Report on a workshop held in Washington, D.C., October 15 and 16, 1976. Inter. Decade of Ocean Exploration, National Science Foundation, Washington, DC. 122 pp.

Shaw, D.M. 1973. Waves. Chapter 1. Physical oceanography. Pages 1-61 to 1-72 in: S.B. Saila, (coordinator), Coastal and offshore environmental inventory, Cape Hatteras to Nantucket Shoals. Marine Pub. Series 2. Marine Experiment Station, URI, Kingston, RI.

Shenton, E.H. 1976. Geological oceanography. Pages 5-1 to 5-64 in: TRIGOM. Summary of environmental information on the Continental Slope Canadian/U.S. Border to Cape Hatteras, NC. Prepared for BLM by Research Institute of the Gulf of Maine, Portland, ME. (NTIS No. PB 284-001-004).

Silberman, J. 1980. Third U.S. Coast Guard District, New York, NY. Letter to Marshall Holstrom, Interstate Electronics Corp., Anaheim. Ser. No. 16475. 2/15-80 dated 24 September 1980.

Simms, R.R., Jr. and B.J. Presley. 1976. Heavy metal concentrations in organisms from actively dredged Texas Bay. Bull. Environ. Contam. Toxicol. 16:520-527.

Simpson, H.J. 1979. Dredge spoils and sewage sludge in the trace metal budget of estuarine and coastal waters. Environmental Research Lab. EPA-600/3-79-029. Narragansett, RI. 206 pp.

Sindermann, C.J. 1976. Effects of coastal pollution on fish and fisheries - with particular reference to the Middle Atlantic Bight. Pages 281-301 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanog., Inc., Lawrence, KS.

Smayda, T.J. 1973. A survey of phytoplankton dynamics in the coastal waters from Cape Hatteras to Nantucket. Pages 3-1 to 3-100 in S.B. Saila, ed. Coastal and Offshore Environmental Inventory, Cape Hatteras to Nantucket Shoals. Marine Publications Service No. 2. University Rhode Island, Kingston, RI.

Starr, R.B., G.A. Berberian, and M.A. Weiselbert. 1976a. MESA New York Bight Project, expanded water column characterization cruise (XWCC-1) of the R/V ADVANCE II. NOAA DR ERL MESA-22. Boulder, CO. 43 pp.

Starr, R.B., J.B. Hazelworth, and G.A. Berberian. 1976b. MESA New York Bight Project, expanded water column characterization cruise (XWCC-6), NOAA Ship GEORGE B. KELEZ, 29 September-4 October, 1975. NOAA DR ERL MESA-25. Boulder, CO. 132 pp.

Starr, R.B., J.B. Hazelworth, S.R. Cummings, and G.A. Berberian. 1977. MESA New York Bight Project, expanded water column characterization cruise (XWCC 104) NOAA Ship GEORGE B. KELEZ 28 June-July, 1976. NOAA DR ERL MESA-28. Boulder, CO. 94 pp.

Steimle, F.W. 1976a. Hydrographic data collected after the 1976 oxygen depletion in the Mid-Atlantic Bight. NMFS/Sandy Hook Laboratory, Highlands, NJ. Unpublished.

_____1976b. Hydrographic data collected during a series of cruises investigating the 1976 oxygen depletion phenomenon in New York Bight. NOAA/NMFS Sandy Hook Laboratory Rep. No. 4. Highlands, NJ. 314 pp.

_____1978. Dissolved-oxygen levels in New York Bight waters during 1977. Tech. Ser. Rep. No. 20. Northeast Fisheries Center, NOAA-NMFS, Highlands, NJ. 30 pp.

Sterne, E.M., and W.B. Stickle. 1978. Effects of turbidity and suspended material on aquatic environments; literature review. DMRP Tech. Rep. D-78-21. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 117 pp.

Stewart, K.R., and L. Koditschek. 1980. Drug-resistance transfer in Escherichia coli in New York Bight sediment. Mar. Poll. Bull. 11(5):130-133.

Sullivan, B.K., and D. Hancock. 1977. Zooplankton and dredging: research perspectives from a critical review. Water Res. Bull. 13(3):461-467.

Suszkowski, D.J. 1977. History of dredging and disposal operations within the port of New York. Pages 11-37 in U.S. Army Corps of Engineers, New York District. Proceedings of the New York Dredged Material Disposal Alternatives Workshop, October 11-13, 1977.

Swanson, R.L. 1976. Tides. MESA New York Bight Atlas Monograph 4. New York Sea Grant Institute. Albany, NY. 34 pp.

Swartz, R. Unpublished data on benthic indicator species. EPA Laboratory, Newport, OR. Unpublished.

Swift, D.J.P., G.L. Freeland, P.E. Gadd, G. Han, J.W. Lavelle, and W.L. Stubblefield. 1976. Morphologic evolution and coastal sand transport, New York-New Jersey Shelf. Pages 69-89 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanogr., Inc., Lawrence, KS.

Swift, D.J.P., J.W. Kofoed, F.P. Saulsbury, and P. Sears. 1972. Holocene evolution of the shelf surface, south and central Atlantic Shelf of North America. Pages 499-574 in D.J.P. Swift, D.B. Duane, and O.H. Pilkey, eds. Shelf sediment transport: process and pattern. Dowden, Hutchinson and Ross, Inc., Stroudsburg, PA. 656 pp.

Thomas, J.P., W. Phoel, and F. Steimle. 1976. New York Bight Apex data on total oxygen consumption by the seabed, March 1974-February 1975. NOAA DR ERL MESA-6. 92 pp.

Thurberg, F.P., and R.O. Goodlett. 1979. Impact on clams and scallops. Part 2: Low dissolved-oxygen concentrations and surf clams-a laboratory study. Pages 277-280 in R.L. Swanson and C.J. Sindermann, eds. Oxygen depletion and associated benthic mortalities in New York Bight, 1976. NOAA Professional Paper 11. Washington, DC.

TRIGOM. 1976. Summary of environmental information on the Continental Slope-Canadian/United States border to Cape Hatteras, N.C. Prepared for the Bureau of Land Management by the Research Institute of the Gulf of Maine, Portland, ME. (NTIS No. PB 284 001-004.)

Uchupi, E. 1968. Atlantic Continental Shelf and Slope of the United States-physiography. U.S. Geological Survey. Professional Paper 529-1. 44 pp.

Udell, H.F. et al. 1974. Ocean dumping of sewage sludge: its effects on the south shore of Long Island-a status report. Contr. No. 11, Feburary - June 1974. p. 1-20.

U.S. Army Corps of Engineers, New York District. 1980. Dredged material disposal management program for the Port of New York and New Jersey: incremental implementation plan. New York, NY. 46pp.

_____1979. Report to Congress on administration of ocean dumping activities, 1978. U.S. Government Printing Office, Washington, DC. 49 pp.

_____1978. Report to Congress on administration of ocean dumping activities, 1977. U.S. Government Printing Office, Washington, DC. 47 pp.

_____Unpublished data, 1977. New York, NY. Unpublished.

_____1977a. Fire Island Inlet to Montauk Point, New York beach erosion control and hurricane protection project. Vol. I: FEIS. Dept. of Army New York Dist. Corps of Engineers, NY, NY. 309 pp.

_____1977b. Fire Island Inlet to Montauk Point, New York beach erosion control and hurricane protection project, Vol. II: Appendices. Department of Army New York Corps of Engineers. New York, NY.

_____1977d. Report to Congress on administration of ocean dumping activities, 1976. U.S. Government Printing Office, Washington, DC. 69 pp.

_____1977e. The proceedings of the New York dredged material disposal alternative workshop, October 11-13, 1977. The MITRE Corp./METREK Div., McLean, VA. 102 pp.

_____1977f. New York, NY. Unpublished.

_____1976a. Dredged material research program; fourth annual report. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 165 pp.

_____1976b. Envvironmntal assessment maintenance dredging of entrance channel of Jamaica Bay. Department of Army Corps of Engineers. New York N.Y.

_____1976c. Environmental assessment maintenance ddredging of Shark River. Department of Army New York Dist. Corps of Engineers. New York, NY. 160 pp.

_____1976d. New Jersey coastal inlets and beaches-Barnegat Inlet to Longport. U.S. Government Printing Office, Washington, DC. 637 pp.

_____1976e. Rockaway Inlet to Norton Point, New York (Coney Island Area) beach erosion control projects-FEIS. Office of the Chief of Engineers, Dept. Army, New York District, Washington, DC. 52 pp.

_____1976-1977. Ocean disposal of dredged material conducted by the Philadelphia ACOE in CY 1976 and 1977.

_____1975a. Operation and maintenance of the New Jersey intercoastal waterway and Manasquan, Absecon and Cold Spring Inlets, New Jersey, Final Environmental Impact Statement. Depart of Army Philadelphia District Corps of Engineers. Philadelphia, PA.

_____1975b. Public notice NAPOP-N, maintenance dredging-Manasquan River, Absecon Inlet, Cold Springs Inlet. Department of Army Philadelphia District Corps of Engineers. Philadelphia, PA.

_____1975c. Public notice 8052. Department of Army New York Dist. Corps of Engineers, New York, NY.

_____1975d. Public notice 8089. Department of Army New York Dist. Corps of Engineers, New York, NY.

_____1974a. Study of the New Jersey coastal inlets and beaches, Barnegat Inlet to Longport, NJ. House Doc. #7 4631.

_____1974b. Jones Inlet, Nassau County, New York (maintenance dredging). Final environmental impact statement. Department of Army New York Dist. Corps of Engineers. New York, NY.

_____1973. Maintenance of the East Rockaway Inlet. Final Environmental Impact Statement. Department of Army New York District Corps of Engineers. New York, NY.

_____1971. National Shoreline Study, Regional Inventory Report, North Atl. Region, Vol. I. U.S. Army Engineering Division, North Atlantic. 120 pp.

USCG. See U.S. Coast Guard.

U.S. Coast Guard. 1977c. Navigation rules: international-inland. CG-169. Washington, DC. 170 pp.

U.S. Department of Commerce. 1980. Ffishery Statistics of the U.S. 1976. NOAA, NMFS. Statistical Digest No. 70.

_____1975. Catch of ALBATROSS IV on groundfish survey 75-3, Part I: March 14-18, 1975; Part II: March 20-29, 1975. NOAA-NMFS, Sandy Hook Laboratory, Highlands, NJ. 14 pp.

_____1974a. Bibliography of the New York Bight, Part I-List of contacts. Part II.

_____1974b. Cruise report; NOAA ship ALBATROSS IV, January 22-February 5, 1974. NOAA-NMFS, Sandy Hook Laboratory, Highlands, NJ. 19 pp.

_____1974c. Cruise report 74: R/V ATLANTIC TWIN & R/V DELAWARE II. April 1-May 2, 1974. NOAA-NMFS, Sandy Hook Laboratory, Highlands, NJ. 24 pp.

_____1972a. New York Climate.

1972b. The effects of waste disposal in the New York Bight. Final report. The Coastal Engineering Research Center, U.S. Army Corps of Engineers, Washington, DC.

U.S. Department of Interior. 1980. Atlantic Outer Continental Shelf orders governing oil and gas lease operations. USGS.

_____1980. Lease sale status for sale no 59. New York OCS Office, NY.

_____1976. Final environmental statement, proposed 1976 outer Continental Shelf oil and gas lease sale offshore the mid-Atlantic states, OCS sale no. 40. Bureau of Land Management. 621 pp.

_____1972. Library research project mid-Atlantic OCS (reconnaissance). Bureau of Land Management. 123 pp.

_____1967. Proceedings conference pollution of the navigable waters of eastern New Jersey - Shark River to Cape May, Atlantic City, NJ., November 1, 1967. Federal Water Pollution Control Administration, Washington, DC. 345 pp.

U.S. Environmental Protection Agency. _(in preparation). Preliminary draft environmental impact statement for New York Bight Ocean Disposal Site designation. Oil and Special Materials Control Division, Marine Protection Branch, Washington, DC. 6 chap., 4 appendices.

_____1979a. Draft environmental impact statement for 106-Mile Ocean Waste Disposal Site designation. Oil and Special Materials Control Division, Marine Protection Branch, Washington, DC. 7 chap., 4 appendices.

_____1979b. DEIS on the New York Bight acid waste disposal site designation. Oil and Special Materials Control Div., Mar. Port. Br., Washington, DC. 6 Chap., 7 appendices.

_____1979c. New York Bight water quality, summer of 1978. Surveillance and Analysis Division, U.S. Environmental Protection Agency, Region II, New York, NY. 5 appendices.

_____1978a. Final environmental impact statement on the ocean dumping of sewage sludge in the New York Bight. U.S. Environmental Protection Agency, Region II, New York, NY. 226 pp., 11 appendices.

_____1978b. Bioassay procedures for the ocean disposal permit program EPA-600/9-78-010. EPA, ERL, Gulf Breeze, FL. 121 pp.

_____1978c. New York Bight water quality, summer of 1977. U.S. Environmental Protection Agency, Region II, New York, NY. 96 pp., 6 appendices.

_____1977. Ocean dumping: final revision of regulations and criteria. Federal Register, 42(70):2461-2490.

_____1976. Quality criteria for water. U.S. Government Printing Office, Washington, DC. 256 pp.

_____1975. Ocean disposal in the New York Bight. EPA Tech. Rep. 2. Surveillance and Analysis Division, U.S. Environmental Protection Agency, Region II, New York, NY. 86 pp.

_____1974. Ocean disposal in the New York Bight. EPA Tech. Rep. 1. Surveillance and Analysis Division, U.S. Environmental Protection Agency, Region II, New York, NY. 54 pp.

U.S. Naval Weather Service Command. 1970. Summary of synoptic meteorological observations, North American coastal marine areas. Vol. 2: Area 4-Boston, Area 5-Quonset Point, Area 6-New York, Area 7-Atlantic City. AD 707 699. National Technical Information Service, U.S. Department of Commerce, Springfield VA. 633 pp.

U.S. Nuclear Regulatory Commission. 1976a. Revised DEIS-Atlantic generating station, Units 1 and 2.

______1976b. Final EIS related to manufacture of floating nuclear power plants offshore power systems. Part II.

Vaughn, J.M., E.F. Landry, M.Z. Thomas, T.J. Vicale, and W.F. Penello. 1979. Survey of human enterovirus occurrence in fresh and marine surface waters on Long Island. App. Envir. Micro. 38(2):290-296.

Veatch, A.C., and P.A. Smith. 1939. Atlantic submarine valleys of the United States and the Congo submarine valley. Special Paper 7. Geological Society of America. 101 pp.

Verber, J.L. 1976. Safe shellfish from the sea. Pages 433-441 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanogr., Inc., Lawrence, KS.

______Data reports obtained during cruises in Region II. NETSU, FDA-PHS, Davisville, RI. Unpublished.

Vaughn, J.M., E.F. Landry, M.Z. Thomas, T.J. Vicale, and W.F. Penello. 1979. Survey of human enterovirus occurrence in fresh and marine surface waters on Long Island. App. Envir. Micro. 38(2):290-296.

Veatch, A.C. and P.A. Smith. 1939. Atlantic submarine valleys of the United States and the Congo Submarine Valley. Special paper 7. G.S.A. 101 pp.

Verber, J. Data reports obtained during cruises in Region II. NETSU, Davisville, RI. (Unpublished).

VIMS. 1977a. Middle Atlantic Outer Continental Shelf Environmental Studies. Vol. II-B. Chemical and Biological Benchmark Studies. M.P. Lynch-Program Manager. 644 pp.

______1977b. Middle Atlantic Outer Continental Shelf Environmental Studies. Vol. III. Geologic Studies. D.W. Folger Program Manager. 239 pp.

______1979a. Middle Atlantic Outer Continental Shelf Environmental Studies. Vol. II B. Chemical and Biological Benchmark studies. E.M. Burreson program manager. 544 pp.

______1979b. Middle Atlantic Outer Continental Shelf Environmental Studies. Vol. III Geolgic Studies. H.J. Knebel program manager. 183 pp.

Walker, H.A., S.B. Saila, and E.L. Anderson. 1979. Exploring data structure of New York Bight benthic data using post-collection stratification samples, and linear discriminant analysis for species composition comparisons. Est. Coast. Mar. Sci. 9:101-210.

Wallace, D.H. 1975. Letter to T.C. Hunter, Jr., Colonel, Corps of Engineers, Department of the Army dated March 13, 1975. MR5. United States Department of Commerce, Rockville, Maryland. Unpublished.

Walsh, J.J., T.E. Whitledge, F.W. Barvenik, C.D. Wirick, S.O. Howe, W.E. Esaias, and J.T. Scott. 1978. Wind events and food chain dynamics within the New York Bight. Limnol. Oceanogr. 23:659-683.

Walsh, J.J., T.E. Whitledge, S.O. Howe, C.D. Wirich, L.J. Castiglione, and L.A. Codispoti. 1976. Pages 273-274 in M.G. Gross, ed. Middle Atlantic Continental Shelf and the New York Bight. Proceedings of the Symposium. Special Symposia, Volume 2. Amer. Soc. Limnol. and Oceanog., Inc., Lawrence, KS.

Watling, L. and D. Mauer, eds. 1976. Ecological studies on benthic and planktonic assemblages in lower Delaware Bay. Univ. of Delaware CMS-RANN-3-76. 634 pp.

Wechsler, B.A. and D.R. Cogley. 1977. A laboratory study of the turbidity generation potential of sediments to be dredged. Tech. Rep. D-7714. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Wenzloff, D.R., R.A. Greig, A.S. Merrill, annd J.W. Ropes. 1979. A survey of heavy metals in the surf clam, Spisula solidissima and the ocean quahog, Artica islandica, off the Mid-Atlantic coast of the U.S. Fish: Bull. 77(1):280-285.

West, R.H., and P.G. Hatcher. 1980. Polychlorinated biphenyls in sewage sludge and sediments of the New York Bight. Mar. Poll. Bull. 11(5):126-129.

West, R.H., P.G. Hatcher, and D.K. Atwood. 1976. Polychlorinated biphenyls and DDTs in sediments and sewage sludge of the New York Bight. ERL, NOAA, U.S. Dept. Commerce, Washington, DC. 42 pp.

Westman, J.R. 1958. A study of the newly created "acid grounds" and certain other fishery areas of the New York Bight. Unpublished manuscript. 50 pp.

Wigley, R.L., R.B. Theroux, and H.E. Murray. 1975. Deep sea red crabs, Geryon quinquedens, survey off Northeastern United States. Mar. Fish. Rev. 37:1-21.

Wilk, S.J., W.W. Morse, D.E. Ralph, and T.R. Azarovitz. 1977. Fishes and associated environmental data collected in New York Bight, June 1974-June 1975. NOAA Tech. Rep. NMFS SSRF-716. 53 pp.

Williams, R.G., and F.A. Godshall. 1977. Summarization and interpretation of historical physical oceanographic and meteorological information for the mid-Atlantic Region. From NOAA. 295 pp.

Williams, S.F., and D.B. Duane. 1974. Geomorphology and sediments of the Inner New York Bight Continental Shelf. U.S. Army Corps of Engineers Tech. Memo. 45. Springfield, VA. 81 pp.

Wright, T.D. 1978. Aquatic dredged material disposal impacts. DMRP Tech. Rep. DS-78-1. Environmental Effects Lab., U.S. Army Engineer Waterways Experiment Stations, Vicksburg, MS. 57 pp.

Wright, W.R. 1976a. Physical oceanography. Chapter 4 in TRIGOM. A summary of environmental information on the Continental Slope - Canadian/U.S. Border to Cape Hatteras, N.C. The Research Institute of The Gulf of Maine.

Yasso, W.E. and E.M. Hartman, Jr. 1975. Beach forms and coastal processes. MESA New York Bight Atlas Monograph II. New York Sea Grant Institute, Albany, NY. 51 pp.

Yentsch, C.S. 1977. Plankton production. MESA New York Bight Atlas Monograph 12. New York Sea Grant Institute. Albany, New York. 25 pp.

Young, D.L.K., and R.T. Barber. 1973. Effects of waste dumping in New York Bight on the growth of natural populations of phytoplankton. Environ. Poll. 5:237-252.

Young, J. 1973. A marine kill in New Jersey coastal waters. Mar. Poll. Bull. 4:70.

Young, J.S., and J.B. Pearce. 1975. Shell disease in crabs and lobsters from New York Bight. Mar. Poll. Bull. 6(7):101-105.

Zich, H.E. 1977. The collection of existing information and field investigation of anadromous clupeid spawning in New Jersey. Bureau of Fisheries State of New Jersey Dept. of Envir. Protection Division of Fish,Game and Shellfisheries. Misc. Rept. 41. 35 pp.

BIBLIOGRAPHY

ADDENDUM

New York City Department of Environmental Protection, 1983. "Technical Information is Support the designation of the 106-Mile Site for the Ocean Disposal of Municipal Sewage Sludge," Submitted to EPA Region II, Prepared by Ecological Analysts, Inc., Sparks, MD, and SEAMOcean, Inc., Wheaton, MD.

Renwick W. 1981. Dredge spoil disposal siting study - Final Report, for NJDEP. Center for Coastal and Environmental Studies, Rutgers University, New Brunswick.

U.S. Corps of Engineers, New York District. 1983. Disposal of dredged material from the Port of New York and New Jersey, Final Environmental Impact Statement New York, NY.