

4.0 ENVIRONMENTAL EFFECTS

4.1 Introduction

This section of the EIS establishes the scientific and analytical basis for the summary of effects to environments in the affected area. The environmental consequences of the proposed action (i.e., designation of two ODMDs, Palm Beach Harbor and Port Everglades Harbor) are discussed in the following sections. The socioeconomic consequences of the proposed action are exclusively

beneficial and directly related to the socioeconomic benefits of functional ports in these areas, such as employment, commercial traffic and trade, commodity transport, and leisure cruising.

4.2 No-Action Alternative

Under the no-action alternative, a new ODMDS pursuant to Section 102 of MPRSA would not be designated at either location. The no-action alternative would result in no additional or future impacts to the biological and physical components of the marine environment. However, ocean disposal of dredged material could occur on a limited basis under Section 103 of MPRSA (see Section 2.1). The impacts to the biological and physical components of the marine environment associated with a Section 103 site selection and its limited use would be evaluated by the USACE at the time of selection.

4.3 Ocean Disposal Alternatives

4.3.1 Ocean Alternative Sites Not Considered

Although designation of ocean disposal site within 3 nmi of shore was considered, the possibility of unpredictable eddy currents from the Florida Current transporting disposed dredged material to nearshore reefs necessitated the designation of sites located further from the shore. Therefore, the interim sites at both Palm Beach Harbor and Port Everglades Harbor were not considered. In addition, the 3-mile candidate site was dropped from further consideration in favor of the 4.5-mile site as it was determined that a four square mile site was not necessary.

4.3.2 Evaluation Using General and Specific Criteria

The effects of the proposed action were evaluated using the criteria promulgated in 40 CFR Parts 228.5 and 228.6, which gives guidance for the selection of ocean disposal locations and require effective management to prevent unreasonable degradation of the marine environment. Criteria in 40 CFR Part 228.5 are titled “General criteria for the selection of sites,” and those in Part 228.6 are titled “Specific criteria for site selection.” Evaluation of the proposed Palm Beach Harbor and Port Everglades Harbor ODMDSs utilized the literature base and baseline data collected at the sites to assess compliance with both the general and the specific criteria of the regulation. Each of the general and specific criteria is addressed in this section as it relates to the suitability of the selected candidate sites as disposal sites. As presented in Section 2.5, the preferred site near Palm Beach Harbor has an area of approximately one square nmi and is located east-northeast of the Lake Worth Inlet approximately 4.5 nmi offshore. The Palm Beach 9-mile candidate site has an area of approximately four square nmi and is located approximately 9 nmi offshore east-northeast of the Lake Worth Inlet. The preferred site near Port Everglades Harbor has an area of approximately one square nmi and is located east-northeast of Port Everglades and approximately 4 nmi offshore. The Port Everglades site 7-mile candidate site has an area of approximately 4 square nmi and is located east-northeast of Port Everglades approximately 7 nmi offshore.

4.3.3 General Criteria (40 CFR 228.5)

- 1. 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 [40 CFR 228.5(a)].

The proposed ODMDSs for the Palm Beach Harbor and the Port Everglades Harbor do not support an exclusive commercial or recreational fishery. Fishery and shellfishery resources are not concentrated in, restricted to, or dependent upon the vicinity of the proposed ODMDSs.

The proposed ODMDSs would not be expected to adversely affect recreational boating. Dredging and dredged material disposal are common actions in these areas. The proposed ODMDSs are at a sufficient distance offshore that small recreational boats are not frequently present.

There are also no specially designated shipping lanes near the proposed disposal sites. The candidate ODMDSs are located seaward and slightly north of the entrance channels of Palm Beach Harbor and Port Everglades Harbor, and are areas of heavy commercial shipping traffic. However, it is not anticipated that future, intermittent use of the site would result in a level of activity that would significantly disrupt shipping.

2. **Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site 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 [40 CFR 228.5(b)].**

Based on dispersion modeling conducted for ODMDS designation for Palm Beach and Port Everglades, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (Section 4.3.5). Prevailing currents at these sites are to the north and parallel the coast. The preferred ODMDSs lie 4.0 nmi (7.4 km) to 4.5 nmi (8.3 km) east of the nearest landfall. The candidate ODMDSs lie 9 nmi (16.7 km) and 7 nmi (13.7 km) east of the nearest landfall in Palm Beach and Broward counties, respectively. The Palm Beach Harbor preferred ODMDS lies 1.7 nmi (3.2 km) east of the nearest reef (*Oculina varicosa*); the Palm Beach candidate ODMDS lies 6.2 nmi (11.5 km) east of this reef. At these locations, the likelihood of impacts to nearshore amenities is small. The proposed disposal sites do not lie near geographically limited fishery or shellfishery resources.

3. **If at anytime during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in CFR 228.5 through 228.6, the use of such sites will be terminated as soon as alternate disposal sites can be designated [40 CFR 228.5(c)].**

The MPRSA site selection process is designed to identify a preferred alternative that minimizes or avoids unacceptable impacts to the physical, biological, and socioeconomic environment. The use of the previously designated interim disposal sites was discontinued as a result of the implementation of the Water Resources Development Act of 1992.

4. **The sizes of ocean disposal sites 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-term impacts. The size, configuration, and location of any disposal site will be determined as part of the disposal site evaluation or designation study [40 CFR 228.5 (d)].**

A limited area of about one square nmi (3.4 km²) has been proposed for the preferred ODMDSs at Palm Beach Harbor and Port Everglades Harbor. Larger areas (4 square nautical miles) are required for the offshore candidate sites at both locations. The dispersion modeling studies for the preferred sites conducted by WES revealed no short-term or long-term adverse impacts (Section 5.07). The results indicated that the sediment was generally moving toward the north, not toward the reef. Under the most severe conditions, silt-clay concentrations diminish to approximately one mg/l or less above background at a distance of 1,500 m from the disposal location. For the preferred Port Everglades Harbor and Palm Beach Harbor ODMDSs, the dredged material would be disposed 6,100 m and 5,500 m from reef locations respectively. Due to the greater depths at the offshore candidate sites at both locations, larger disposal sites are required to contain most of the disposed dredged material within the site boundaries. Additionally even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the modeling of the mounds at both sites did not show significant erosion.

The location, size, and configuration of preferred sites allow and facilitate long-term capacity, site management, and site monitoring. Bottom contours in the area can be monitored through bathymetric survey methods. Monitoring of the proposed sites is discussed in the SMMPs (Appendix J).

5. **EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically [40 CFR 228.5 (e)].**

The Palm Beach and Port Everglades ODMDSs are located 4.5 nmi and 4 nmi from the coastline, respectively. The continental shelf in the vicinity of the proposed sites has a width of approximately 0.73 miles (0.63 nmi). The sites therefore lay approximately 3.87 nmi (Palm Beach) and 3.37 nmi beyond the edge of the continental shelf, and are located on the upper Florida-Hatteras slope. The offshore candidate sites also lay beyond the edge of the continental shelf. Historically used sites are also located on the upper continental slope, but their proximity to environmental amenities makes their use questionable.

4.3.4 Specific Criteria (40 CFR 228.6)

1. **Geographical position, depth of water, bottom topography, and distance from coast [40 CFR 228.6 (a)1].**

See Table 17. Bottom topography images are provided in figures 1 and 2.

2. **Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases [40 CFR 228.6 (a) 2].**

The most active breeding and nursery areas are located in inshore waters, along adjacent beaches, or in nearshore reef areas. While breeding, spawning, and feeding activities may

take place near the considered alternative ODMDSs, these activities are not believed to be confined to, or concentrated in, these areas. It is unlikely that localized and intermittent dredged material disposal operations would affect migration, feeding, or nesting of marine mammals and sea turtles. While many marine species may pass through the considered alternative ODMDSs, passage is not geographically restricted to these areas. The probability of significant impact from dredged material disposal is likely inversely related to the motility of these organisms.

Table 17. Geographic Position, Water Depth, Bottom Topography and Distance from Coast of ODMDSs

Site	Geographic Coordinates		Max/Min Depth	Bottom Topography	Min Distance to Shore (western edge)
Palm Beach 4.5-mile (preferred) site	26°47'30"N 26°47'30"N 26°46'30"N 26°46'30"N	79°57'09"W 79°56'02"W 79°57'09"W 79°56'02"W	509 ft/ 607 ft	Uniform Soft Bottom	4.3 nmi
Palm Beach 9-mile candidate site	26°45'00"N 26°45'00"N 26°47'00"N 26°47'00"N	79°53'00"W 79°51'00"W 79°53'00"W 79°51'00"W	855 ft/ 985 ft	Uniform Soft Bottom	8 nmi
Port Everglades 4-mile (preferred) site	26°07'30"N 26°07'30"N 26°06'30"N 26°06'30"N	80°02'00"W 80°01'00"W 80°02'00"W 80°01'00"W	577 ft/ 712 ft	Soft Bottom; E-W Oriented Low Relief Ridges in Center & NE Corner of Site	3.8 nmi
Port Everglades 7-mile candidate site	26°06'30" N 26°06'30" N 26°08'30" N 26°08'30" N	79°57'30"W 79°59'30"W 79°59'30"W 79°57'30"W	785 ft/ 920 ft	Soft Bottom in N giving way to Hard Bottom in S	6 nmi

Source: EPA 1999, 2000.

3. Location in relation to beaches and other amenity areas [40 CFR 228.6 (a)3].

The preferred disposal sites for Palm Beach Harbor and Port Everglades are located approximately 4.5 nmi and 4.0 nmi offshore, respectively, as measured to the center of the sites. The offshore candidate disposal sites for Palm Beach Harbor and Port Everglades are located approximately 9.0 nmi and 7.0 nmi offshore, respectively. The nearest beaches are located on the shorelines west of the sites. Distances from the western edge of the sites are provided in Table 17 above. Because of the distance of the proposed sites from the shoreline and the expected localized effects at the disposal sites, it is unlikely that dredged material disposal at any of the considered alternative sites would adversely affect coastal beaches.

The locations in relation to amenity areas such as natural and artificial reefs were discussed in sections 3.4, 3.13.1 and in tables 15 and 16. The locations relative to the considered alternative sites are summarized below:

Site	Distance to Nearest Artificial Reef	Distance to Outer Reef
Palm Beach 4.5-mile (preferred) site	2.3 nmi 4.3 km	2.6 nmi 4.8 km
Palm Beach 9-mile candidate site	5.8 nmi 10.7 km	7.2 nmi 13.3 km
Port Everglades 4-mile (preferred) site	2.3 nmi 4.3 km	3.0 nmi 5.5 km
Port Everglades 7-mile candidate site	5.0 nmi 9.3 km	6.2 nmi 11.5 km

WES (1998) conducted modeling studies under a variety of current velocities and directions to estimate the dynamics of the sediment cloud following its release from the disposal vessel. In all Port Everglades applications, results indicate silt-clay concentrations diminish to approximately 1 mg/l or less above background at a distance of 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less above background at a distance of 2,440 m of the disposal location. In all Palm Beach applications, silt-clay concentrations diminish rapidly to 1 mg/l or less above background within 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less above background within 2,400 m of the disposal location.

4. Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packing the dredged materials, if any [40 CFR 228.6(a)4].

The only material to be placed at the proposed ODMDSs will be dredged material that meets the EPA Ocean Dumping Criteria in 40 CFR 220-229. No beach quality material is proposed to be transported to the proposed ODMDSs. The proposed sites are expected to be used for routine maintenance of the respective Harbor Projects. Disposal volumes of up to 50,000 cy (38,230 m³) of material annually may be placed at each site. It has been demonstrated that the most cost effective method of dredging is clamshell/barge dredging for Palm Beach Harbor (Appendix B) and hopper dredging for Port Everglades Harbor (Appendix C). The disposal of dredge material to the proposed sites will be conducted using a near instantaneous dumping type barge or scow.

Dredged material must meet the EPA Ocean Dumping Criteria in 40 CFR 220-229 and will be tested following procedures outlined in the 1991 EPA/COE Dredged Material Testing Manual (Green Book) and the 1993 EPA Region 4 / COE South Atlantic Division Regional Implementation Manual (RIM) prior to ocean disposal. Dredged material from the Palm Beach and Port Everglades Harbors have been characterized in the following reports: Final Report for Port Everglades and Palm Beach Harbor Florida, 1998 Evaluation of Dredged Material for Ocean Disposal (PPB Inc.); Geotechnical Testing Services of Intracoastal Waterway for Channel Widening Project, Port Everglades (Ardaman and Assoc., 1997); Soil

Borings and Grab Sample Study on Atlantic Intracoastal Waterway, Port Everglades (Geoverse Inc., 1998); Sediment and Water Quality of Candidate Ocean Dredged Material Disposal Sites for Port Everglades and Palm Beach Florida (EPA, 1999); and Dispersion Characteristics for Palm Beach and Port Everglades Ocean Dredged Material Disposal Sites (WES, 1998).

5. Feasibility of surveillance and monitoring [40 CFR 228.6(a)5].

Monitoring of the preferred sites is discussed in the Site Management and Monitoring Plans (SMMPs) provided in Appendix J. Surveillance and monitoring of the preferred and candidate sites are feasible. However, due to the greater depths and greater distance offshore of the offshore candidate sites, monitoring would be more expensive for these sites. The depths at the offshore candidate sites are beyond EPA's current in-house sidescan sonar capability. Additionally, collecting grab samples from the bottom and water samples at these depths and high currents is more difficult than at the preferred sites.

6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any [40 CFR 228.6 (a) 6].

Previous Dredged Material Fate Studies in Close Proximity of the Project Alternative Sites. In response to a request by the Jacksonville District, WES performed technical studies of the Gulf Stream meanders, frontal eddies, and prevailing tides and currents off the east coast of Florida with respect to the potential for reef siltation by disposed dredged material originating from the Miami ODMDS. In these studies, both the short-term disposal and long-term erosion simulations of sediment transport as a function of local velocity fields indicated little possibility of affecting reefs as a direct result of use of the proposed sites (CERC, 1989; CERC, 1995).

In addition, the National Oceanic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratory in Miami, FL conducted a field study of the disposal plumes from the Miami Harbor project. The study concluded that the dredged material, except for a low concentration residual remaining within the water column, reached bottom within the designated site boundaries. For the discharges monitored, the resulting plumes were observed to be transported in a north to northeast direction (NOAA, 1991)

Dredged Material Fate Studies for Port Everglades/Palm Beach ODMDSs. An evaluation of the Port Everglades and Palm Beach ODMDSs was performed at the request of the USACE, Jacksonville District (Cialone and Lillycrop, 1998). The study utilized three years of velocity data from an ADCP located offshore Port Everglades, Florida. The directional distribution of velocities reflected in the data indicates that the most prevalent currents are headed to the north and these currents also have the greatest average velocity. Maximum surface currents did not exceed 530 cm/sec with average surface currents on the order of 70 to 100 cm/sec. Currents are discussed further in Section 3.7. Additional work was requested by the USACE, Jacksonville District, to clarify, justify and further examine the study results (WES, 2001). The following discussion and results are taken from the original and supplementary studies conducted WES/CERC. Copies of the studies are also attached in appendices K and I.

Short-Term Modeling Results. STFATE was used to estimate the dynamics of the sediment cloud following its release from the dredge. The model computes the time-history of a single disposal operation from the time the dredged material is released from the barge until it reaches equilibrium. STFATE was used to model worst case and typical current profiles.

Port Everglades. In all Port Everglades applications sediment was disposed 6,100 m from the grid origin (reef location). Two sediment compositions were simulated, with 60 percent and 70 percent solids by weight and 38 percent and 5 percent fines, respectively. Additionally, eight velocity profiles were simulated ranging from 50 percent to 99 percent exceedence velocities in both the north and west direction. Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less at a distance of 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less at a distance of 2,440 m of the disposal location. Under the most severe conditions (North 99 percentile velocity: 70 percent solids), the maximum total sediment concentration within 4,000 m from the reef location was approximately 3 mg/l at a depth of 137 m. A major portion of the dredged material is sand with a concentration of 2.7 mg/l, while the silt-clay concentration value was 0.5 mg/l.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that the sediment was moving toward the northeast and not toward the reef. Concentrations for the typical velocity profile were never observed west of the disposal location, which was 6100 m from the reef. The results show that sediment is moving toward the north and approximately parallel to the shore away from the reef for the typical velocity profile. After 100 minutes, the maximum total concentration in the water column for the 70 percent solids case was 2 mg/l. Consequently, it can be concluded that under typical conditions no potential exists for sediment movement from the ODMDS at Port Everglades onto the reef.

Palm Beach. In all Palm Beach applications sediment was disposed 5,500 m from the grid origin (reef location). Two sediment compositions were simulated, with 80 percent and 85 percent solids by weight and 6 percent fines. In addition, eight velocity profiles were simulated ranging from 50 percent to 99 percent exceedence velocities in both the north and west direction. Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less within 2,400 m of the disposal location. Under the most severe conditions (North 99 percentile velocity: 85 percent solids), the maximum total sediment concentration within 3,800 m from reef location was approximately 19 mg/l at a depth of 55 m. A major portion of the dredged material is sand with a concentration of 17.4 mg/l, while the silt-clay concentration value was 1.5 mg/l. The sand in the dredged material settles rapidly and it is expected that the concentration will decrease with closer distance to the reef.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that

the sediment was moving toward the north and approximately parallel to the shore away from the reef. After 105 minutes, the maximum total concentration in the water column for the 85 percent solids case was 2 mg/l.

It can therefore be concluded that under typical conditions no potential exists for sediment movement from the ODMDS at Palm Beach onto the reef.

Long Term Modeling Results. A screening level erosion model was used to estimate the long-term response of the dredged material mounds at the Port Everglades and Palm Beach ODMDSs to local environmental forcing functions. The screening level erosion modeling was completed using the three largest historical storms selected from the National Hurricane Center's HURDAT database. An additional case of a severe extratropical storm was also simulated for the Port Everglades site. The model was used to estimate the peak sediment flux and total sediment loss caused by the three severe tropical storms. A 305 m × 305 m × 0.41 m square mound configuration was assumed for a 50,000 cy mound. This volume represents the annual amount that each disposal site is expected to accommodate. The total sediment losses for each storm, in which the peak flux was assumed to occur for four hours across one side of the 305 m × 305 m disposal site, are 3.5 m³ at Port Everglades (0.09 percent of 50,000 cy mound) and 3 m³ at Palm Beach (0.08 percent of 50,000 cy mound).

The USACE also suggested applying the screening level erosion model for a larger mound of 500,000 cy (10 times the volume) to simulate the long-term fate of the disposal mound for both sites. The assumed dimension of the proposed mound was 965 m × 965 m × 0.41 m. The input data to the screening level model (wave height, wave period, water depth, sediment size, and velocity) were those used in the previous application. The total sediment loss for each storm was estimated when the peak flux was assumed to occur for four hours across one side of the 965 m × 965 m disposal site. The maximum computed total sediment loss is 11 m³ at Port Everglades and 10 m³ at Palm Beach; both are less than 0.003 percent of the disposed mound volume of 500,000 cy. The results of the study indicate that even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the mounds at Port Everglades and Palm Beach will not be significantly eroded.

7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects) [40 CFR 228.6(a)7].

There are two formerly designated interim-designated ODMDSs near Palm Beach Harbor. Use of these sites was discontinued by the implementation of the Water Resources Development Act of 1992. The disposal of dredged material from Palm Beach Harbor was conducted annually between 1950-1953, 1955-59, 1961-63, 1968, 1979-81, and 1983. During this time, 5,230,828 cy (3,999,491 m³) of material have been disposed. The characteristics of the dredged material are poorly graded sand with traces of shell fragments (Barry Vittor and Associates, Inc., 1985).

The existing EPA interim-designated ODMDS at Port Everglades Harbor is located approximately 2.5 nmi (4.6 km) west-southwest of the preferred site. It was first used for dredged material disposal in 1952. Required maintenance dredging of Port Everglades Harbor has been relatively infrequent and occurred in 1952, 1960, 1978, and twice in 1982.

During this time, 219,810 cy (168,067 m³) of material were disposed at the interim site. The characteristics of the dredged material are organic silt with some clay (Barry Vittor and Associates, Inc., 1985). No records of ocean disposal prior to 1952 are available for this area. A 1984 survey conducted by the EPA indicated that some damage to nearby inshore, hard bottom areas may have occurred because of the movement of fine material associated with the disposal of dredged material at the site. In light of the survey findings, disposal at the Port Everglades interim site was discontinued.

8. Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean [40 CFR 228.6 (a) 8].

Commercial Shipping/Recreational Boating . The preferred Palm Beach Harbor ODMDS is located just north and approximately 4.5 nmi (8.3 km) east of the entrance channel to the Port of Palm Beach and the Lake Worth inlet, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

The preferred Port Everglades Harbor ODMDS is located just north and approximately 4.0 nmi (7.4 km) east of the entrance channel to the Port Everglades Harbor, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

Fishing. Commercial and recreational fishing activity is concentrated in inshore and nearshore waters or at offshore natural and artificial reefs. Proximity of the considered alternative sites to the offshore natural and artificial reefs was discussed under Specific Criteria #3. All considered alternative sites are located at least 2.3 nmi (4.3 km) from the natural or artificial reefs. Therefore, disposal activities are not expected to interfere with fishing activities.

Recreation. Coastal waters of Broward and Palm Beach Counties are used for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving, but few of these activities occur in, and none is restricted to, the preferred ODMDSs.

Mineral Extraction. No mineral extraction occurs in the immediate project area. According to the MMS, no data are available regarding sand resources in the project areas. The MMS has not identified any sources of beach quality material in the vicinity of the proposed sites.

Other Activities. No desalination or mariculture activities occur in the immediate area. Data for communication cables is not determinable within the project areas according to the Office of Public Affairs (OPA). The Florida Department of Environmental Protection (FDEP) further stated that undisclosed cables might potentially exist from the Navy. Placement of a natural gas pipeline is proposed between Port Everglades and Freeport, Grand Bahama Island. EPA is coordinating with other federal agencies in order to minimize any potential interferences with the proposed pipeline.

Scientific Resources. Located on the south side of the Port Everglades inlet in Dania, Florida, the South Florida Ocean Measurement Center (SFOMC, formerly the South Florida Testing Facility) has housed an active, continuously operating Navy range for over forty years. The SFOMC was placed under the administration of the Naval Surface Warfare Center, Carderock Division in 1994. The SFOMC allows the monitoring of surface ship, submarine, and remote vehicle signatures in the nearshore environment. Multiple fixed in-water electromagnetic and acoustic measurement sites at 10, 20, and 200 m are controlled from a secure range house. The range encompasses the Navy's only shallow and deep magnetic research and development ranges, including submerged operations. The Port Everglades Harbor 4-mile (Preferred) ODMDS is located approximately 1.5 miles from the northern boundary of the SFOMC.

9. The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys [40 CFR 228.6 (a) 9]

Baseline surveys conducted for the Palm Beach Harbor and the Port Everglades Harbor ODMDSs show the water quality and other environmental characteristics of the preferred and candidate ODMDSs to be typical of the Atlantic Ocean (Appendix G). Salinity, dissolved oxygen, and transmissivity data indicated water masses over the sites were similar to open ocean waters and deviated little between sites. Macroinfaunal samples were dominated in numbers by annelids and arthropods. All areas surveyed were similar in that they had a similar number of taxa dominated by the same major taxonomic groups. The southern portion of the Port Everglades Harbor 7-mile candidate site was dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.

10. Potential for the development or recruitment of nuisance species in the disposal site [40 CFR 228.6 (a) 10].

The disposal of dredged material should not attract or promote the development of nuisance species. No pre-disposal nuisance organisms were identified in surveys conducted in the vicinities of the proposed ODMDSs or in previously utilized disposal sites in the surrounding area.

Based on information on the community structure of the preferred sites, no adverse changes in benthic species composition are expected. The communities currently present in the sites are characteristic of sand bottom substrates. The material proposed for the disposal includes fine-grained sand. The similarity of dredged materials to the sediments of the disposal sites and surrounding areas should make the development or recruitment of undesirable species unlikely.

11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance [40 CFR 228.6 (a) 11].

No natural or cultural features of historical importance are known to occur at, or in proximity to, the preferred or candidate sites with the exception of the low relief limestone hard bottom identified in the southern portion of the Port Everglades Harbor 7-mile candidate site. No other significant features were noted in video or sidescan surveys of the alternative sites.

4.3.5 Summary of Specific Criteria Applications

Tables 18 and 19 summarize the application of the specific criteria to the sites.

4.3.6 Unavoidable Adverse Environmental Effects and Mitigation Measures

Unavoidable adverse impacts from dredged material disposal at any of the alternative sites include the following:

- Formation of temporary, localized water column changes associated with suspended sediment plumes;
- Burial and smothering of non-motile infauna and/or epifauna;
- Possible alterations in sediment texture, grain size and/or chemical composition; and
- Changes in bathymetry (mounding of material).

Plumes of suspended sediment associated with sinking dredged materials would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are limited to disposal operations, are localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles as discussed in Section 4.3.4. Use of the sites is expected to be infrequent.

Deposition of dredged materials will bury and smother localized populations of benthic organisms, reducing abundance and diversity of the benthic communities in the immediate area of dumping. The magnitude of this impact will depend on the extent of the affected area, volume of dredged material disposed, and specific tolerances of affected species to periodic burial. The recovery of impacted areas will reflect the ability of buried organisms to burrow through the sediment layer and the ability of adjacent populations to recolonize the area. Differences in grain size characteristics between the dredged materials and the existing site sediments could exacerbate impacts to the benthic fauna. Alterations in the bottom sediment texture could affect the survival of existing species or recruitment of new species. Benthic assemblages requiring hard substrate or structure will be less tolerant of burial and less able to recolonize than those assemblages associated with sand or sand-silt substrates.

With regard to water column effects and benthic impacts, mitigating measures include required periodic evaluations of dredged materials proposed for ocean disposal using applicable guidance. The periodic bioassay and bioaccumulation testing of dredged materials will ensure that dredged materials remain non-toxic to marine organisms. Mitigation includes selection of preferred disposal sites that avoid hard substrate or structure. In addition, disposal operations will be managed (see SMMPs in Appendix J) to limit the areal extent of burial. Site management and monitoring activities including routine bathymetry and site use documentation are mitigation measures for physical effects such as mounding, area covered, and frequency of impact for a specific area.

4.4 Socioeconomic Impacts

No significant socioeconomic impacts are anticipated because of actions associated with the proposed projects. Cost estimates for Port Everglades Harbor dredging (Appendix C) indicate that the 7-mile candidate site would increase project costs by 4 to 18 percent (depending on dredging method) over the 4-mile (preferred) site. For Palm Beach Harbor, cost estimates for dredging

Table 18. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 1. Approximately 9 nmi offshore Lake Worth Inlet on the upper continental slope. Depths: 855 to 985 feet (260 to 300 meters). Declivity of 65 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.	See Figure 1. Approximately 4.5 nm offshore Lake Worth Inlet on the upper continental slope. Depths: 509 to 607 feet (155 to 185 meters). Declivity of at least 98 ft (30 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (7.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (4.8 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 8 nmi (14.8 km) from coastal beaches. The natural reef zones lay at least 7.2 nmi (13.3 km) inshore of the proposed sites. Artificial reef sites are located at least 5.8 nmi (10.7 km) west of the proposed sites. Isolated patches of <i>Oculina</i> lay approximately 7.4 nmi (13.7 km) west of the site.	The site is located 4.3 nmi (8.0 km) from coastal beaches. The natural reef zones lay at least 2.6 nmi (4.8 km) inshore of the proposed sites. Artificial reef sites are located at least 2.6 nmi (4.8 km) west of the proposed sites. Isolated patches of <i>Oculina</i> lay approximately 1.7 nmi (3.2 km) west of the site.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with the EPA Ocean Dumping Regulations (40 CFR 220-229). No beach quality dredged material is planned for disposal at the proposed sites.	The only material to be disposed in the ODMDS will be dredged material that complies with the EPA Ocean Dumping Regulations (40 CFR 220-229). No beach quality dredged material is planned for disposal at the proposed sites.
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of monitoring.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix J.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom

Table 18. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
		waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach and Port Everglades ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach and Port Everglades ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located ≥ 2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	No known features.	No known features.

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4 Mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 2. Approximately 7 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 785 to 920 feet (240 to 280 meters). Declivity of at least 68 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Northern half of site dominated by uniform sandy bottom. Low relief hard bottom in southern half of site.	See Figure 2. Approximately 4 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 640 to 705 feet (195 to 215 meters) Declivity of at least 135 ft (40 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (6.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (3 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 6 nmi (11.1 km) from coastal beaches. The natural reef zones lay at least 6.2 nmi (11.4 km) inshore of the proposed sites. Artificial reef sites are located at least 5 nmi (9.3 km) west of the proposed sites.	The site is located 3.8 nmi (7.1 km) from coastal beaches. The natural reef zones lay at least 3 nmi (5.6 km) inshore of the proposed sites. Artificial reef sites are located at least 2.3 nmi (4.3 km) west of the proposed sites.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with the EPA Ocean Dumping Regulations (40 CFR 220-229). No beach quality dredged material is planned for disposal at the proposed sites.	The only material to be disposed in the ODMDS will be dredged material that complies with the EPA Ocean Dumping Regulations (40 CFR 220-229). No beach quality dredged material is planned for disposal at the proposed sites.
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of disposal.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix J.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4 Mile Site)
		maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach and Port Everglades ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach and Port Everglades ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located ≥ 2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat. The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	No known features.

(Appendix B) indicate that the 9-mile candidate site would increase project costs by 6 to 18 percent (depending on dredging method) over the 4.5-mile (preferred) site.

4.5 Cumulative Impacts

Cumulative impacts are defined in 40 CFR 1508.7 as “impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions.” NEPA guidance requires that such connected, similar impacts be examined.

4.5.1 Past Projects

EPA Interim-Designated ODMDSs. Dredged material disposal has occurred at the EPA interim-designated ODMDSs discussed in Section 2.4. Use of the two interim sites for Palm Beach was discontinued as a result of the implementation of the WRDA of 1992. The interim site for Port Everglades was discontinued after a 1984 EPA survey indicated that some damage to nearby inshore, hard bottom areas may have occurred due to the movement of fine material associated with disposed dredged material.

4.5.2 Current Projects

Maintenance of Palm Beach Harbor and Port Everglades Harbors Federal Navigation Projects. These projects will continue to require periodic dredging to maintain adequate depths for access and safe navigation. Ocean dredged material disposal will likely be required for these projects. The need for ocean disposal is based primarily on the lack of economically, logistically, and environmentally feasible alternatives for the disposal of the projected quantities of dredged material deemed unsuitable for beach nourishment or other beneficial uses.

Intracoastal Waterway Federal Navigation Project. The Intracoastal Waterway (ICWW) provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward Counties and is located a substantial distance from the continental shelf-slope break.

Beach Re-Nourishment Projects. Federal beach re-nourishment projects exist for both Palm Beach and Broward Counties. Both projects allow for the restoration of beaches to a general width of 100 feet with a berm elevation of 10 feet above mean low water, and periodic nourishment thereafter. Dredged material from Palm Beach and Port Everglades Harbors that is beach quality may be used for these projects.

Wastewater Outfalls. Current projects that may serve as potential sources of pollution in the area include wastewater outfalls. Offshore sewage outfalls have been used to discharge untreated or partially treated domestic wastewater in southeastern Florida for over 60 years. Under current regulations, untreated effluent is no longer discharged, and the discharged effluent has undergone secondary treatment and chlorination. Two wastewater ocean outfalls discharge into ocean waters near Palm Beach Harbor and two wastewater ocean outfalls discharge into ocean waters near Port Everglades Harbor. Amplifying information on these facilities is provided in tables 20 and 21.

Table 20. Wastewater Ocean Outfalls in the Vicinity of Palm Beach Harbor

Facility Description	Address (City)	Distance to 4.5-Mile (Preferred) Site (mi)
Delray Beach WTP	Unknown (Delray Beach)	26.8
Boca Raton WTP	1501 W Glades Rd (Boca Raton)	31.3

Source: EPA, 1998.

Table 21. Wastewater Ocean Outfalls in the Vicinity of Port Everglades Harbor

Facility Description	Address (City)	Distance to 4-Mile (Preferred) Site (mi)
Broward County North District WTP	2401 N Powerline Rd (Pompano Beach)	12.4
Hollywood WTP	3441 Hollywood Blvd (Hollywood)	11.1

Source: EPA, 1998.

Recent studies on the impact of sewage outfalls on marine habitat indicate that nutrient loading would most likely be caused by nutrient loading. However, significant adverse impacts to marine environments have not been documented in association with offshore wastewater outfalls, owing to dilution and mixing under the influence of prevailing currents. Additionally, any impacts would be ongoing, and would likely have been incorporated into existing water quality parameters.

4.5.3 Reasonably Foreseeable Future Projects

Potential reasonably foreseeable future projects in the vicinity of the project areas may include subsea placement of fiber optic cables, USACE harbor maintenance dredging projects, new or proposed USACE harbor deepening projects, and USACE beach re-nourishment projects. Future projects in the vicinity of the project area could involve channel modifications that are currently unknown.

Subsea Cable Placement. No projects for future subsea placement of fiber optic cables are known to exist at this time for offshore Palm Beach or Broward Counties. Mr. Robert Wargo of AT&T has been contacted for information regarding present and future plans for telecommunication cables offshore of Palm Beach and Broward Counties. At the time of submittal, information from Mr. Wargo remains outstanding.

Ocean Express Pipeline Project. In February 2002, AES Ocean Express LLC submitted an application to lay a 92.8 mile, 24-inch pipeline from Ocean Cay in the Bahamas to Broward County, Florida. 46.1 miles of this pipeline will be laid in the Federal OCS off Florida's east coast.

Calypso Pipeline Project. Tractebel Calypso LLC has also proposed construction of a pipeline to transport natural gas from the Bahamas to South Florida. An application for the pipeline was originally filed by Enron to lay the *Calypso* pipeline, and was assumed by Tractebel. This 24-inch pipeline would begin at a proposed regasification plant near Freeport, Bahamas and be laid 89.9 miles to Broward County Florida. 31.6 miles of this pipeline would be in the Federal OCS off Florida.

Port Everglades Harbor Deepening Project. A feasibility study is currently underway for improving the Federal navigation project at Port Everglades Harbor. The project, if approved, would consist of widening and deepening all the port's major channels and basins to accommodate future development. The proposed entrance channel would extend approximately 2,200 feet seaward from its current position. Ocean dredged material disposal would likely be required for this project.

4.5.4 Conclusion

Significant adverse cumulative impacts are not anticipated from the designation of ODMDS locations for Palm Beach and Port Everglades Harbors, in conjunction with past, present, or reasonably foreseeable future actions in the nearshore waters off Palm Beach and Broward Counties. Future projects in the area would be subject to the requirements of and would be evaluated in accordance with NEPA.

4.6 Relationship Between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Use of the proposed ODMDSs in the manner described should have no effect on long-term productivity. Based on modeling for the Miami ODMDS, the disposal of dredged materials at the proposed ODMDSs would not result in significant long-term water quality degradation. Water quality impacts of concern with regard to dredged material disposal include those associated with increased turbidity, decreased DO levels, and the release of sediment-bound contaminants such as heavy metals, nutrients, and hydrocarbons, including pesticides and PCBs. Generally, contaminants bound in sediments are not released under conditions normally occurring at open water disposal sites (Burks and Engler, 1978; Saucier *et al.*, 1978). Most potential contaminants remain sorbed on sediments, or are readily scavenged from the water column by particulate matter and metal oxides, and precipitated. In addition, only material meeting ocean disposal criteria will be disposed at the site.

Increased turbidity resulting from dredged material disposal is generally short-term and transient (Windom, 1976). Elevated turbidity levels occur during dredged material disposal, but decrease rapidly as suspended sediments settle or disperse. Some increases in turbidity could occur at the pycnocline.

Temporary decreases in DO may occur during disposal. Given the depth of the well-mixed portion of the water column at the proposed ODMDS, significant offsite impacts are not expected and any onsite impacts should be of short duration.

Nutrients bound in sediments would be released to the water column during disposal. Soluble phosphorous would be temporarily released but would be rapidly scavenged from the water column (Burks and Engler, 1978). Soluble nitrogen compounds, particularly ammonia, would also be released during disposal.

The potential for water quality impacts resulting from the release of trace metals is minor. Most heavy metals are poorly soluble and are readily sorbed by suspended matter and precipitated (Windom, 1976; Burks and Engler, 1978). Hydrocarbons, such as pesticides and PCBs, are generally poorly water-soluble. These substances generally remain sorbed on sediments and are not released during disposal (Windom, 1976; Burks and Engler, 1978).

The disposal of uncontaminated sediments in compliance with the EPA's Ocean Dumping Regulations and Criteria (40 CFR 220-229) would not be expected to result in sediment quality degradation. Periodic bioassay testing (toxicity/bioaccumulation) of proposed dredged material is required to ensure compliance.

Impacts of dredged material disposal on organisms in the water column are difficult to assess but are generally considered minimal and temporary (Pequegnat *et al.*, 1981). Most motile organisms (nekton) can avoid disposal operations and localized areas of poor water quality. Nonmotile (planktonic) organisms such as phytoplankton, zooplankton, and ichthyoplankton entrained within the disposal plume would be directly affected. The impacts of disposal on these organisms are difficult to assess in light of the high natural variability of planktonic communities. Significant long-term impacts are not anticipated.

Sedentary and slow-moving benthic and epibenthic biota could be impacted both directly and indirectly by dredged material disposal. Direct impacts would result from the smothering of bottom-dwelling organisms under varying depths of dredged material. These impacts would result in the loss of some of the disposal site biota and the resultant alteration of benthic community structure. The high reproductive potential of most benthic infaunal species is expected to re-establish pre-disposal conditions rapidly.

Direct impacts would occur at the specific sites of disposal. Recolonization from both the vertical migration of resident infaunal species and the recruitment of species from nearby areas would occur rapidly after completion of disposal operations.

Indirect impacts to biota could include the disruption of localized population dynamics of individual species. Indirect impacts would occur in and near the disposal sites.

4.7 Irreversible or Irrecoverable Commitment of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Non-renewable fossil energy (petroleum) used for fuel during project activities would be an irreversible loss.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Estimates for Port Everglades Harbor dredging indicate that the 7-mile candidate site would increase fuel consumption by 28 percent or 130 gallons per load over the 4-mile (preferred) site. This equates to approximately 9,100 gallons of fuel for a typical 50,000 cy project. For Palm Beach Harbor, estimates for dredging indicate that the 9-mile candidate site would increase fuel consumption by 40 percent or 192 gallons per load over the 4.5-mile (preferred) site. This equates to approximately 14,881 gallons of fuel for a typical 50,000 cy project (Fletcher, 2003).

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. Other than creating a potential for altering the structure of benthic communities by possibly changing the characteristics of the substrate, no irretrievable loss of resources is expected.

4.8 Relationship of the Proposed Action to Other Federal Projects

Palm Beach Harbor is located in Palm Beach County along the ICWW at the Lake Worth Inlet. Palm Beach Harbor is located approximately 4.5 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Palm Beach Harbor would utilize the proposed ODMDS for dredged material disposal. Disposal volumes of up to 50,000 cy (38,230 m³) of material annually may be placed at the site.

Port Everglades Harbor is located in Port Everglades County along the ICWW immediately south of Fort Lauderdale. Port Everglades Harbor is located approximately 7 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Port Everglades Harbor would utilize the proposed ODMDS for dredged material disposal. Disposal volumes of up to 50,000 cy (38,230 m³) of material annually may be placed at the site.

The ICWW provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW intersects Palm Beach and Port Everglades Harbors and is equidistant to the preferred ODMDS locations at these points relative to the harbors. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward Counties and is located a substantial distance from the continental shelf-slope break. No material from the ICWW is expected to be disposed at either of the proposed ODMDS locations.

The proposed Port Everglades Harbor ODMDS is located approximately 1.5 miles north of the northern boundary of the Navy's SFTF. The SFTF is currently the centerpiece of the newly formed South Florida Ocean Measurement Center (SFOMC). The SFOMC offers a means to evaluate mine detection, countermeasures, and mine response; perform acoustic measurements; and acquire radar cross section and infrared signatures. The SFOMC is the only ship, submarine, and mine-effectiveness test range with simultaneous air, surface, and subsurface tracking capability. Some of the SFOMC's underwater detection and monitoring apparatus on the northern portion of the range may be adversely impacted by activities associated with the implementation of the proposed Port Everglades Harbor site. Passive monitoring equipment would likely experience the largest impacts.

Mr. William Baxley, Environmental Liaison for the SFOMC, was contacted regarding impacts to the SFOMC resulting from disposal of dredged material at the proposed ODMDS locations. Mr. Baxley agreed to provide a brief text description of potential impacts to the facility. At the time of the current submittal, this information remains outstanding.

4.9 Essential Fish Habitat

The Fishery Management Amendments of the South Atlantic Fishery Management Council identify a number of categories of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). Due to the offshore location of the proposed dredged material disposal sites, many of the areas listed as EFH and HAPC, were eliminated from consideration for this project. Estuarine areas such as estuarine emergent wetlands, intertidal flats, and estuarine scrub/shrub mangroves, are not present in the project area and therefore, are not discussed. All of the HAPC identified for the south Atlantic are also outside of the proposed project area. Impacts on EFH that are relevant to the proposed dredge material disposal sites are discussed in the following paragraphs.

4.9.1 Water Column

Dredged material disposal activities in both of the proposed sites are expected to cause increases in turbidity levels in the general vicinity of the proposed disposal areas. High levels of turbidity and suspended materials in the water column are expected to be short-term and minimal. Any modifications of the water quality resulting from the disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point by natural dispersion, mixing, and the eventual sinking of particles. Interim-designated disposal sites for both Palm Beach harbor and Port Everglades have shown no long-term or permanent adverse affects to the water column due to disposal activities.

4.9.2 Artificial/Man-Made Reefs

Artificial or man-made reefs do not occur within the confines of the project area. However, artificial reef sites are located near the project area, approximately 2 to 4 nmi west of the preferred site for Palm Beach Harbor. Other artificial reefs sites are located approximately 2 nmi west and northwest of the preferred disposal area for Port Everglades. Sediments similar to the dredged material are common and naturally occur in the proposed areas. Based on DIFID model results and NOAA/WES plume monitoring of the Miami ODMDS, transport of materials to any artificial reef site should not occur. No effects to these resources from using the proposed ODMDS for Palm Beach Harbor and Port Everglades are expected.

Amplifying information on artificial reefs in the vicinity of the project area is presented in tables 15 and 16 and figures 6 and 7.

4.9.3 Sargassum

Sargassum circulates between 20° and 40° N latitude and 30° W longitude and the western edge of the Florida Current/Gulf Stream. There is an apparent concentration in the North Atlantic Central Gyre between 28° and 34° N latitude. While smaller clumps of *Sargassum* may float into the proposed disposal areas, the vast majority of occurrence of this genus of brown algae remains much farther offshore. Also, due to its presence in the upper few feet of the water column, adverse impacts by ocean dredged material disposal activities are not expected.

4.10 Threatened and Endangered Species

Biological assessments of the impacts of the proposed site designation on currently listed threatened and endangered species have been prepared and coordinated with NMFS pursuant to Section 7 of the Endangered Species Act 1973, as amended. The Biological Assessment for the Palm Beach Harbor ODMDS is included as Appendix E and the Biological Assessment for the Port Everglades ODMDS is included as Appendix F.

Site designation of the Palm Beach Harbor ODMDS and Port Everglades ODMDS would not adversely affect or threatened the continued existence of any threatened or endangered species.

With the No-Action Alternative, threatened or endangered species would not be affected.

4.11 Hardbottoms

Several distribution surveys for hermatypic and ahermatypic corals have been conducted in the vicinity of the proposed ODMDSs from 1973 to 1987. No hermatypic corals were found in the vicinity of the project site, but ahermatypic corals were observed as scattered, isolated forms in the vicinity of the proposed ODMDS site for Palm Beach Harbor.

The proposed project will not have any effect on wormrock reefs because no known colonies exist within the proposed ODMDS project sites.

Under the No-Action Alternative, hardbottoms would not be affected.

4.12 Fish and Wildlife Resources

Breeding, spawning, and feeding activities may occur near the proposed project areas; however, these activities are not believed to be confined to, or concentrated in, the proposed sites. The probability of significant impact from dredged material disposal to species found within the proposed sites is likely related to the motility of the species.

Both natural and artificial reef sites are found near the proposed ODMDSs. Natural hardbottom reefs occur primarily at depths of 20-100 ft (6-30 m). The seaward extent of the natural reef zone near the Palm Beach Harbor ODMDS is approximately 2.6 nmi (4.8 km) west of the western boundary of the proposed site. The seaward extent of the natural reef zone in the vicinity of the Port Everglades ODMDS is approximately 3.0 nmi (5.6 km) west of the western boundary of the proposed site. Colonies of the deepwater coral *Oculina varicosa* have been observed as scattered, isolated forms 1.7 nmi (3.2 km) west of the proposed Palm Beach Harbor ODMDS. Artificial reefs occur at a variety of depths, ranging from 10-440 ft (3-134 m). The seaward extent of documented artificial reef structures near the Palm Beach Harbor ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site. The seaward extent of documented artificial reef structures near the Port Everglades ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site.

4.13 Physical Oceanography

No significant impacts to tides or currents in the project areas are expected to occur.

4.14 Water Quality

The disposal of dredged material is not expected to significantly degrade water quality within disposal sites. The disposal will locally and temporarily increase water column turbidity and concentrations of dissolved and particulate constituents. Dissolved oxygen concentrations may decrease in the dump plume. Plumes of suspended sediments would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are also localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles. Based on dispersion modeling conducted for Palm Beach/Port Everglades ODMDSs, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (Section 4.3.3).

Only dredged material evaluated and found acceptable in accordance with the joint EPA/USACE guidance (EPA/USACE, 1991 and EPA/USACE, 1993) can be disposed in the ocean. The testing

evaluates the potential for unacceptable effects such as toxicity or bioaccumulation. These required tests reduce the possibilities of unacceptable water column and benthic effects caused by dredged material contaminants. Palm Beach and Port Everglades sediment characteristics reveal that the dredged material is acceptable for ocean disposal.

The No-Action Alternative is expected to have no impact on water quality of both ocean disposal sites.

4.15 Air Quality

The short-term impacts from increased barge or scow traffic associated with the project would not significantly impact air quality of the project sites. No air quality permits would be required for this project. Both Broward and Palm Beach Counties are designated as an attainment area for Federal air quality standards under the Clean Air Act. The offshore candidate sites for both Palm Beach Harbor and Port Everglades Harbor would result in higher overall air emissions than the preferred sites. Shown below are typical per load barge tug emissions based on emission factors reported by the Port of San Diego (2003) and an average barge speed of 4.3 knots.

Site	Emissions (Pounds/Load)			
	CO	NOx	SOx	PM ₁₀
Palm Beach 4.5-mile (preferred) site	5.0	33	4.7	1.9
Palm Beach 9-mile candidate site	10.0	69.1	9.8	4.0
Port Everglades 4-mile (preferred) site	4.5	30.7	4.4	1.8
Port Everglades 7-mile candidate site	7.8	53.7	7.7	3.1

CO=Carbon monoxide; Nox=Nitrogen oxides; Sox=Sulfur oxides; PM10=Inhalable particles

The No-Action Alternative is expected to have no impact on air quality.

4.16 Noise

The noise at any of the alternative ocean disposal sites would increase during disposal of dredged material. The duration of the noise increase would be greater for the offshore candidate sites. Surface noise for a tugboat is expected to be 82 dB at 50 feet (Port of Oakland and the USACE San Francisco District, 1998). Noise from the tugboats hauling barges or from hopper dredges to and from the ocean disposal sites would be too far from shore to have any meaningful noise impact on noise-sensitive land uses.

Subsurface noise would increase during disposal and monitoring activities in the vicinity of the proposed disposal sites. According to the National Research Council (2003), vessel traffic is a major contributor to noise in the world's oceans especially at low frequencies between 5 and 500 kHz. Low-frequency ship noise sources include propeller noise, propulsion machinery and major auxiliaries such as diesel generators. Source spectral density levels for the types of vessels visiting

the proposed sites would likely range from more than 165 dB re 1 $\mu\text{Pa}^2/\text{Hz}$ at 1 meter around 25 Hz for larger vessels down to 140 dB re 1 $\mu\text{Pa}^2/\text{Hz}$ or less for smaller craft. During monitoring activities, the use of sonar systems for bathymetry measurements or sidescan imagery would also result in subsurface noise. (NRC, 2003)

This elevated noise level will be temporary and would not be expected to result in any significant adverse impacts to wildlife or aquatic organisms in the areas. Existing data are insufficient to predict accurately any but the grossest acoustic impacts on marine mammals. Marine mammals as a group have functional hearing ranges of 10 Hz to 200 kHz. Behavioral responses to noise range from subtle changes in surfacing and breathing patterns, to cessation of vocalizations, to active avoidance or escape from the region of the highest sound levels. For fish and elasmobranchs (sharks and rays), the functional hearing range is from well below 50 Hz to upward of 500-1,000 Hz. The hearing range for sea turtles has been measured in the 250-750 Hz range, with the most sensitive threshold recorded at the lowest frequency tested, 250 Hz. (NRC, 2003)

The No-Action Alternative would have no effect on the noise environment of the area.

4.17 Aesthetic Resources

No significant impacts on aesthetic resources would result from the proposed actions.

4.18 Recreation

The coastal waters of Broward and Palm Beach Counties are used for a variety of recreational activities including swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving. Few of these activities occur in, and none is restricted to, the proposed ODMDSs. No significant impacts to recreation are anticipated.

4.19 Public Safety

There should be no adverse impacts on public safety from the proposed actions.

4.20 Energy Requirements and Conservation

The energy requirements for this activity would be confined to fuel for the construction and transportation equipment. With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.21 Natural or Depletable Resources

In this case, the depletable resources would be the fuel for the construction and transportation equipment and human energy required for the project. The No-Action Alternative would eliminate these requirements, but would allow a continuation of and possible increase in navigational safety and economic problems.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.22 Scientific Resources

No scientific resources would be affected by the proposed actions.

4.23 Native Americans

Native Americans would not be adversely impacted by project activities.

4.24 Reuse and Conservation Potential

No adverse impacts are expected from the proposed project activities. The project does not lend itself to recycling or use of recycled or recyclable materials.

4.25 Urban Quality

No adverse impacts are expected. The project would benefit the local shipping industry and the economy.

4.26 Solid Waste

No solid waste is expected to be generated by project activities. Each site meets all evaluation criteria for use as an ODMDS.

4.27 Drinking Water

Drinking water would not be impacted by the project.

4.28 Indirect Effects

The proposed action may facilitate area dredging projects by providing a disposal option and thereby increase the associated environmental impacts of dredging (water quality degradation, wetland losses, pollution from increased shipping, etc.). The proposed action would benefit the shipping industry and economy. Furthermore, the indirect effect on the Federal standard could make beneficial use projects cost prohibitive by creating a lower cost option.

4.29 Compatibility with Federal, State, and Local Objectives

The proposed action is expected to be consistent with Federal, State and local plans and objectives.

4.30 Conflicts and Controversy

The areas of controversy are the proximity of the ODMDSs to nearshore reefs and the potential impacts of fine-grained material to these reefs. Other issues include: the scope, frequency, and costs of monitoring effects of disposal at the ODMDS sites.

4.31 Uncertain, Unique or Unknown Risks

No such risks are known or anticipated at this time. However, in the unlikely event of unacceptable impacts, corrective measures would be taken as required by permit, law, or otherwise as determined to be appropriate.

4.32 Precedent and Principle for Future Actions

The proposed actions would create two new ODMDS sites in the Atlantic Ocean to be used initially for the disposal of maintenance dredged material from the existing Palm Beach and Port Everglades Harbor Federal Navigation Projects, respectively.

4.33 Environmental Commitments

The USACE and contractors commit to avoiding, minimizing or mitigating for adverse effects during disposal activities by including appropriate measures in the contract specifications. Contract specifications implementing the requirements of the SMMPs are provided as an attachment to the SMMPs in Appendix J. For non-Federal users, an attachment to the SMMPs provides standard permit conditions for the sites. In addition, EPA and the USACE commit to environmental monitoring of the proposed ODMDSs dependent upon available funding (see Appendix J).

4.34 Compliance with Environmental Regulations

4.34.1 National Environmental Policy Act of 1969

Environmental information on this federal project has been compiled and the present Environmental Impact Statement is being prepared. The project complies with the National Environmental Policy Act.

4.34.2 Endangered Species Act of 1973

In a letter dated November 19, 1986, the NMFS concurred with the BAs presented by the USACE to the NMFS regarding the impacts of the proposed project to populations of threatened and/or endangered species. However, in light of the date of preparation of the initial BAs, updated BAs have been prepared to reflect current conditions. The BAs for the proposed sites for Palm Beach and Port Everglades harbors will be submitted for concurrence with the NMFS. The updated BAs for Palm Beach and Port Everglades harbors are presented in appendices E and F, respectively.

4.34.3 Fish and Wildlife Coordination Act of 1958

No coordination has been attempted with the USFWS. Because only marine waters would be affected, no species under the jurisdiction of the USFWS would be affected.

4.34.4 Clean Water Act of 1972

The project would comply with this Act. A Section 404(b) evaluation is not applicable to this project and was not prepared.

4.34.5 Clean Air Act of 1972

The short-term impacts from transportation and construction equipment associated with the project would not significantly impact air quality. No air quality permits would be required for this project. Because both Broward and Palm Beach Counties are designated as attainment areas for Federal air quality standards under the Clean Air Act, a conformity determination is not required.

4.34.6 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix L.

4.34.7 Farmland Protection Policy Act of 1981

No prime or unique farmland would be impacted by this project. This act is not applicable.

4.34.8 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.34.9 Marine Mammal Protection Act of 1972

Incorporation of the safe guards used to protect threatened and endangered species during project activities would protect any marine mammals in the area, therefore, this project is in compliance with the Act.

4.34.10 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.34.11 Fishery Conservation and Management Act of 1976

The project has been coordinated with the National Marine Fisheries Service (NMFS) and is in compliance with the Act.

4.34.12 Submerged Lands Act of 1953

The project would not occur on submerged lands of the State of Florida. This project is in full compliance with this Act.

4.34.13 Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990

No coordination has been made with the USFWS.

4.34.14 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action has been subject to evaluations normally conducted for activities subject to the Act. The project is in full compliance.

4.34.15 Anadromous Fish Conservation Act

Anadromous fish species would not be affected. The project has been coordinated with the National Marine Fisheries Service.

4.34.16 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.34.17 Marine Protection, Research and Sanctuaries Act

The Marine Protection, Research, and Sanctuaries Act (MPRSA) regulates the transportation and subsequent dumping of materials, including dredged material, into ocean waters. Section 102 of the MPRSA requires EPA to designate ODMDs where needed. The proposed ODMDs are being designated pursuant to Section 102 of the MPRSA. The five general [40 CFR 228.5] and 11 specific [40 CFR 228.6] criteria for the selection of sites have been applied and satisfied (see sections 4.3.3 and 4.3.4).

4.34.18 Magnuson-Stevens Fishery Conservation and Management Act

The project activities would not have an adverse effect on the fish off the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the Continental Shelf appertaining to the United States, and the anadromous species which spawn in United States rivers or estuaries or their habitats.

4.34.19 E.O.11990, Protection of Wetlands

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

4.34.20 E.O. 11988, Flood Plain Management

This project does not occur in any floodplain, therefore, this Executive Order does not apply to project activities.

4.34.21 E.O. 12898, Environmental Justice

The proposed activity would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination because of their race, color, or natural origin, nor would the proposed action adversely impact "subsistence consumption of fish and wildlife." The proposed project complies with this Executive Order.

4.34.22 E. O. 13089, Coral Reef Protection

Executive Order 13089 (E.O. 13089) on Coral Reef Protection, signed by the President on June 11, 1998, recognizes the significant ecological, social, and economic values provided by the Nation's coral reefs and the critical need to ensure that Federal agencies are implementing their authorities to protect these valuable ecosystems. E.O. 13089 directs Federal agencies, including the EPA and the USACE whose actions may affect U.S. coral reef ecosystems, to take the following steps:

1. Identify their actions that may affect U.S. coral reef ecosystems;
2. Utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and
3. To the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

It is the policy of EPA and the USACE to apply their authorities under the MPRSA to avoid adverse impacts on coral reefs. Protection of coral reefs have been carefully addressed through the application the site designation criteria which require consideration of the potential site's location in relation to breeding, spawning, nursery, feeding, and passage areas of living marine resources and amenity areas [40 C.F.R. 228.6(a)(2) and (3)], interference with recreation and areas of special scientific importance [40 C.F. R. 228.6(a)(8)], and existence of any significant natural or cultural features at or in close proximity to the site [40 C.F.R. 228.6(a)(11)]. (See Section 4.3.4) Based on application of these criteria, the proposed disposal sites should not have adverse affects on coral reefs.