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United States Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

EPA

#22760441

Final
Environmental Impact Statement
Canaveral Harbor, Florida
Ocean Dredged Material Disposal
Site Designation

A Supplement to the Jacksonville Harbor
Dredged Material Disposal
Final Environmental Impact Statement

August 1990

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

SEP 4 1990

TO ALL INTERESTED PARTIES:

Enclosed for your information and examination is the Final Environmental Impact Statement for the Designation of the Canaveral Harbor, Florida, Ocean Dredged Material Disposal Site. Any comments should be furnished within 30 days from the date of publication of the Notice of Availability in the Federal Register.

Wesley R. Crum

Wesley B. Crum, Chief
Wetlands and Coastal Programs Section
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345 Courtland Street
Atlanta, Georgia 30365

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FINAL
ENVIRONMENTAL IMPACT STATEMENT
CANAVERAL HARBOR, FLORIDA
OCEAN DREDGED MATERIAL DISPOSAL
SITE DESIGNATION

A Supplement to the Jacksonville Harbor
Dredged Material Disposal Site
Final Environmental Impact Statement

Cooperating Agency

U.S. Army Corps of Engineers
Jacksonville District

Comments or inquiries should be directed to:

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September 5, 1990

Date

SUMMARY SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR
DESIGNATION OF A
CANAVERAL HARBOR, FLORIDA
OCEAN DREDGED MATERIAL DISPOSAL SITE

A Supplement To The Jacksonville Harbor
Dredged Material Disposal Site
Final Environmental Impact Statement

( ) Draft
(X) Final
( ) Supplement to Draft
( ) Supplement to Final

1. Type of Action.

(x) Administrative/Regulatory action
( ) Legislative action

2. Description of the Proposed Action. The proposed action is to designate an environmentally acceptable, adequately sized and economically feasible Ocean Dredged Material Disposal Site (ODMDS) for the Canaveral Harbor, Florida, area. This action complies with the Marine Protection, Research, and Sanctuaries Act (MPRSA) 1972, as amended by providing an environmentally acceptable ODMDS in compliance with the Ocean Dumping Regulations (40 CFR 220-229). The candidate ODMDS presented in the Draft Environmental Impact Statement (DEIS) as the preferred alternative has been re-configured in this FEIS to be consistent with 40 CFR 228.5(e). Maps and coordinates are based on the North American Datum of 1927 (NAD 27). The candidate site is larger than the interim site and encompasses it completely. EPA considers the re-configuration to be relatively minor, without apparent significant environmental impact. For this reason, no additional biological sampling was conducted to supplement the existing site characterization studies. Nor was a supplemental EIS were felt necessary. A Site Management and Monitoring Plan (SMMP) is being incorporated (Appendix H) into this FEIS to provide a mechanism to monitor for potential impacts and to provide management options in the event that such impacts are detected.

3. Environmental Effects of the Proposed Action. Use of the proposed site is expected to produce the following adverse environmental effects: (1) water quality perturbations (turbidity plumes, release of chemicals, lowering dissolved oxygen concentration); (2) smothering of the site's benthic biota; (e) changing the site bathymetry; and (4) altering the site's sediment composition. Generally the effects of water quality perturbations should be local and short-term and should have minimal effect on the region. However, turbidity attributable to dumping activities and erosion of disposed dredged material is expected to contribute to the apparent naturally turbid conditions of the area of the candidate site. However, the management and monitoring plan should detect

potential concerns and aid in the prevention of any significant adverse effects.

4. Need for the Proposed Actions. Projected volumes of new and maintenance dredged material exceed the capacity of the existing Canaveral interim ODMDS and available land disposal sites. The designation of a larger ODMDS is needed if projected work in the Canaveral Harbor area is to proceed.

5. Alternatives to the Proposed Action. The alternatives to the proposed action are: (1) no action, i.e., the interim designation of the existing Canaveral Harbor ODMDS not achieve final designation and no new ODMDS would be designated; (2) final designation of the existing interim Canaveral Harbor ODMDS; (3) designation of another ODMDS for Canaveral Harbor, or (4) upland nearshore alternatives.

6. Federal, State, Public, and Private Organizations From Whom Comments Have Been Requested. See Section 7.04.

7. The oceanic areas over the continental shelf off Canaveral Harbor, Florida, are in the same Oceanic Province as the Jacksonville Harbor area, for which the ODMDS designation FEIS was filed on February 14, 1983. To avoid repetition of background environmental information, NEPA documentation for the designation of the Canaveral ODMDS is in the form of a supplement to the Jacksonville Harbor ODMDS Final Environmental Impact Statement.

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1.00 SUMMARY

1.01 Major Findings and Conclusions.

Need for a New Ocean Disposal Site - Canaveral Harbor is a man-made channel that has been widened, deepened and maintained numerous times in the past. Since 1974, an average of 1.1 million cubic yards have been removed annually, including an estimated 249,000 cubic yards in 1990. Estimated future annual average quantities are projected at around 800,000 cubic yards per year for the next five years. COE projected estimates of authorized new and maintenance material from the Canaveral region exceed the capacity of available land disposal sites and the existing interim designated Canaveral Harbor, Florida, Ocean Dredged Material Disposal Site (ODMDS). The present designation status of the interim site is "interim-indefinite", so that the interim status will continue indefinitely unless the site is de-designated or permanently designated by the U.S. Environmental Protection Agency (EPA). Based on this identified need, EPA proposes to designate the Canaveral Harbor candidate ODMDS, which encompasses the interim site, on a permanent basis.

Two Alternative Ocean Disposal Sites Were Evaluated as to Their Suitability for Designation Using EPA Guidelines - Two offshore locations were evaluated utilizing the existing literature base and site selection criteria promulgated in 40 CFR 228.5 and 228.6. The initial evaluation process eliminated the existing interim designated site because its size was not sufficient to accommodate the volume of material to be generated through dredging activities. The candidate site, larger than and encompassing the interim site, has attributes that show minimal if any conflicts with the EPA site selection criteria.

Upland and Nearshore Alternatives - COE estimates of dredged material volumes exceed the capacity of upland disposal sites presently available. Present indications are that easements for private land would not be available without extensive condemnation proceedings and considerable expense. There are three potential upland disposal sites in the Canaveral Harbor area. Two are adjacent to the Trident Basin. One is to the east and is owned by the U.S. Navy. A second is located to the west and is owned by the U.S. Air Force. Both organizations are reserving these sites for material to be dredged periodically from their respective berthing areas. Neither site is available for material from the deepening project or channel maintenance. A third potential site is located north of and adjacent to the channel. This area is under consideration for port expansion in the near future.

Dredged material unsuitable for construction would not be acceptable in this location. Other non-ocean disposal alternatives considered were beach disposal, nearshore disposal, or diked island creation. The fine-grained composition of the material expected to be dredged from the presently permitted sites precludes beach disposal and nearshore disposal.

Proposed Action - Designation of a New Ocean Dredged Material Disposal Site the Canaveral Harbor Area - The candidate site is centered at 28°18'44"N (28° 18.73'N) latitude and 80°31'00"W (80°31.00'W) longitude (NAD 27). Its boundary ranges between 3.5 and 7.0 nautical miles from shore and encloses an area of about four square nautical miles. Water depth within the site ranges from 45 ft (13.5 m) to 53 ft.(15.9 m). The candidate ODMDS presented in the Draft Environmental Impact Statement (DEIS) as the preferred alternative has been re-configured in this FEIS to be consistent with 40 CFR 228.5(e). Maps and coordinates in the text have been modified accordingly. All coordinates are based on the North American Datum of 1927 (NAD 27). The candidate site is larger than the interim site and encompasses it completely. Since EPA considers the re-configuration to be relatively minor, without apparent significant environmental impact, no field biological sampling to further characterize the site or a supplemental EIS were felt warranted.

1.02 Areas of Controversy. Utilizing the literature base and field data from a baseline survey, the site was selected with full cognizance of criteria set forth in 40 CFR 228.5 and 228.6. However, the State of Florida's decision regarding consistency with the State Coastal Zone Management Program has been an area of controversy. Concern was voiced by the Florida Department of Natural Resources that designation of this site was not consistent in that there is no specific ban on disposal of beach compatible material.

1.03 Unresolved Issues. As stated above, based on their comments to the DEIS the State of Florida does not believe the designation is consistent with the Florida CZM consistency program. There is general agreement that beach nourishment is not a viable alternative for disposal of the predominantly fine-grained material expected to be dredged from the sites presently permitted. Designation of this site does not rule out beach nourishment for suitable material that might be determined to exist at dredge sites permitted in the future. The decision on placement of any such material is properly made during the project permit process. EPA is in agreement that beach quality material should be used for nourishment to the maximum extent practical. Discussions are underway to resolve State of Florida questions regarding CZM consistency.

1.04 Relationship of Alternative Actions to Environmental Protection Statutes and Other Environmental Requirements. The relationship of the various alternative actions to environmental protection statutes and other environmental requirements is presented in Table 1.

TABLE 1
RELATIONSHIP OF ALTERNATIVE ACTIONS TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER REQUIREMENTS

Federal Policies	No Action	Interim Designated Site	Candidate Site
Preservation of Historical Archeological Data Act of 1974	In Compliance	In Compliance	In Compliance
National Historical Preservation Act of 1966, as amended	In Compliance	In Compliance	In Compliance
Clean Air Act, of 1955 as amended	In Compliance	In Compliance	In Compliance
Clean Water Act of 1977	In Compliance	In Compliance	In Compliance
Coastal Zone Management Act of 1972	In Compliance	In Compliance	In Compliance
Endangered Species Act of 1973, as amended	In Compliance	In Compliance	In Compliance
Federal Water Project Recreation Act of 1965	N/A	N/A	N/A
Fish and Wildlife Coordination Act of 1958	In Compliance	In Compliance	In Compliance
Land and Water Conservation Fund Act of 1965	N/A	N/A	N/A
Marine Protection, Research and Sanctuaries Act of 1972, as amended	In Compliance	In Compliance	In Compliance
National Environmental Policy Act (NEPA) of 1969	N/A	In Compliance	In Compliance
River and Harbor Act of 1899, as amended	N/A	N/A	N/A

TABLE 1 (CONTINUED)
RELATIONSHIP OF ALTERNATIVES TO ENVIRONMENTAL
PROTECTION STATUTES AND OTHER REQUIREMENTS

Federal Policies	No Action	Interim Designated Site	Candidate Site
Watershed Protection and Flood Prevention Act of 1954, as amended	N/A	N/A	N/A
Wild and Scenic Rivers Act of 1968, as amended	N/A	N/A	N/A
Executive Orders			
Floodplain Management (E.O. 11988) 24 May 1977	N/A	N/A	N/A
Protection of Wetlands (E.O. 11990) 24 May 1977	N/A	N/A	N/A
Environmental Effects Abroad of Major Federal Actions (E.O. 12114) 4 January 1977	N/A	N/A	N/A
Executive Memoranda			
Analysis of Impacts on Prime and Unique Agricultural Lands in Implementing NEPA (CEQ Memorandum, 11 August 1980)	N/A	N/A	N/A
Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory (CEQ Memorandum, 10 August 1980)	N/A	N/A	N/A
State Policies			
Florida Coastal Zone Management Program	N/A	In Compliance	In Compliance

2.00 PURPOSE AND NEED FOR ACTION

2.01 Marine Protection, Research, and Sanctuaries Act. Disposal of dredged material in the ocean is permitted by provisions of Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (MPRSA) (Pl 92-532). Section 103, however, requires that the dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. As authorized by Section 102 of MPRSA, EPA prepared and had promulgated the final revision of Regulations and Criteria for Ocean Dumping (40 CFR 220-229) which established criteria for reviewing and evaluating permits and criteria for site selection. The purpose of the present action is to fulfill the provisions of MPRSA and 40 CFR 220-229 by presenting information needed to evaluate the suitability of a proposed ODMDS for final designation for continuing use. The need for this proposed actions is also cited in 1.01 above.

2.02 National Environmental Policy Act. The National Environmental Policy Act (NEPA) of 1969, as amended, established the EIS process. EPA designates ODMDSs on a permanent basis through publication of a voluntary EIS and subsequent rulemaking in the Federal Register. The present FEIS in conjunction with the DEIS published on August 14, 1987 (52 FR 30429 [August 14, 1987]) fulfills the EIS portion of the designation process.

2.03 Canaveral Harbor, Florida. Although the site is classified as dispersive, COE projected volumes of new and maintenance dredged material exceed the capacity of the existing Canaveral interim ODMDS as well as capacity at available land disposal sites. COE estimates projected volumes and apparent dispersal rate are such that it was determined advisable to designate a site somewhat larger than that of the existing interim site. The designation of a larger ODMDS is needed if projected work in the Canaveral Harbor area is to proceed.

2.04 Purpose of the Proposed Action. The purpose of the proposed action is to provide an environmentally acceptable, adequately sized and economically feasible ODMDS for the ocean disposal of suitable dredged materials from the Canaveral Harbor area. As such, the ODMDS designation process makes available the option of an environmentally-acceptable site for ocean disposal of suitable dredged material. By itself, however, an EPA ODMDS designation neither authorizes any dredging project or ODMDS disposal of any dredged material.

3.00 ALTERNATIVES

3.01 Introduction. The action proposed in this document is the final designation of an environmentally and economically acceptable ODMDS site off Canaveral Harbor. Alternatives to the proposed action include no action, upland disposal, nearshore disposal, diked island creation, wetlands creation, and the designation of the interim ocean disposal site. The designation of an ODMDS does not preempt any other disposal option but does ensure that an ocean disposal option exists. Individual disposal actions will continue to be evaluated on a case-by-case basis and the disposal method that best suits public interest will be selected. The need for ocean disposal is determined on a case-by-case basis as part of the process of issuing permits for ocean disposal. This process often involves an alternatives analysis in a project-specific EIS (or other NEPA document) for proposed dredging projects. Both ocean and upland disposal alternatives, as appropriate, should be considered in these documents.

3.02 No Action. The no-action alternative would be to refrain from final designation of the proposed ODMDS or another local site. Selection of the no-action alternative would indicate that no disposal alternative was needed or that no environmentally or economically sound alternative existed.

3.03 Upland and Nearshore Disposal. Upland disposal alternatives are considered when evaluating need for ocean disposal. Upland disposal areas are used for some work in the area, but estimated new work and maintenance material from the greater Canaveral region for the future exceeds the existing capacity. In addition, these sites need to be retained for (although not restricted to) disposal of material with toxicity/bioaccumulation levels unsuitable for ocean disposal. Present indications are that easements for private land would not be available for use as disposal sites without extensive condemnation proceedings. Acquisition of easements for disposal of dredged material on private land would be costly and time consuming, in view of the projected annual quantity (800,000 cubic yards) to be dredged from the Canaveral Harbor area (Operations Division, Jacksonville Division, CE).

Other non-ocean alternatives include beach nourishment, nearshore disposal, diked island creation, and wetland creation. Beach nourishment is not a viable alternative for disposal of the material expected to be dredged from the sites presently permitted. Material dredged from these sites has been predominantly fine-grained and therefore not suitable for use in beach nourishment. Designation of this site does not rule out beach nourishment for suitable material which might be determined to exist at dredge sites permitted in the future. The decision on placement of any such material is properly made during the project permit process. Most of the material generated in the Canaveral Harbor area is unsuitable for dike construction based on analyses provided by the Navigation Section, Jacksonville District, CE. In addition, according to CE, "[N]earshore disposal and/or wetland creation has been associated with Canaveral Harbor and channel dredging projects as mitigating measures for adverse environmental impacts, but not as a practical alternative to offshore disposal because of the volume of the dredged material and its character".

3.04 Selection of a New Ocean Dredged Material Disposal Site. Selection of an appropriate ocean disposal site requires identification and evaluation of suitable areas for receiving the dredged sediments. Identification relies on available information from previous oceanographic studies (synoptic and site-specific) and recommendations from State and Federal agencies. Selection of a specific site requires a sustained effort involving collection and analysis of both historical information and field survey data. Results of this effort led to elimination of the interim designated site per se and the selection of the candidate site as the preferred alternative. Other new locations on the continental shelf off Canaveral Harbor did not provide environmental benefits which would compensate for greater transportation costs or for the disturbance of ocean bottom not previously used for disposal of dredged material.

3.05 Interim Designated Site. The area of this site, centered at 28°18'44"N and 80°31'00"W, is about 3.00 square nautical miles. Based on COE estimates, this site does not contain sufficient capacity to receive the COE projected quantities of dredged material from the Canaveral area without mounding and subsequent shoaling. Expansion of the site would alleviate the capacity problem, would satisfy 40 CFR 228.5(e) concerning sites of historical usage, and would be within economic constraints related to transport or dredged material. This proposed expansion of the interim ODMDS led to the configuration and location of the candidate disposal site (see Figure 1).

3.06 Preferred Alternative - Designation of the Candidate Site. Evaluation of this site involved the integration of new and existing data in determining its ability to meet all criteria related to final designation. The candidate site does meet the selection criteria; a comparison of its attributes with the criteria (40 CFR 228.5 and 228.6) is given in Section 5.0. It is large enough and sufficiently deep so that potential significant adverse impacts outside the site will be minimized. The fine grained substrate is compatible with the materials that are likely to be placed at this site. The candidate site is adequately removed from amenities (i.e., beaches and fish havens) to prevent these from being impacted, yet it is within an economically transportable distance.

The candidate ODMDS (See Figure 1) presented in the DEIS published August 14, 1987 has been re-configured in this FEIS. This re-configuration is consistent with 40 CFR 228.5(e) in encompassing all of the interim site. All coordinates in the text have been

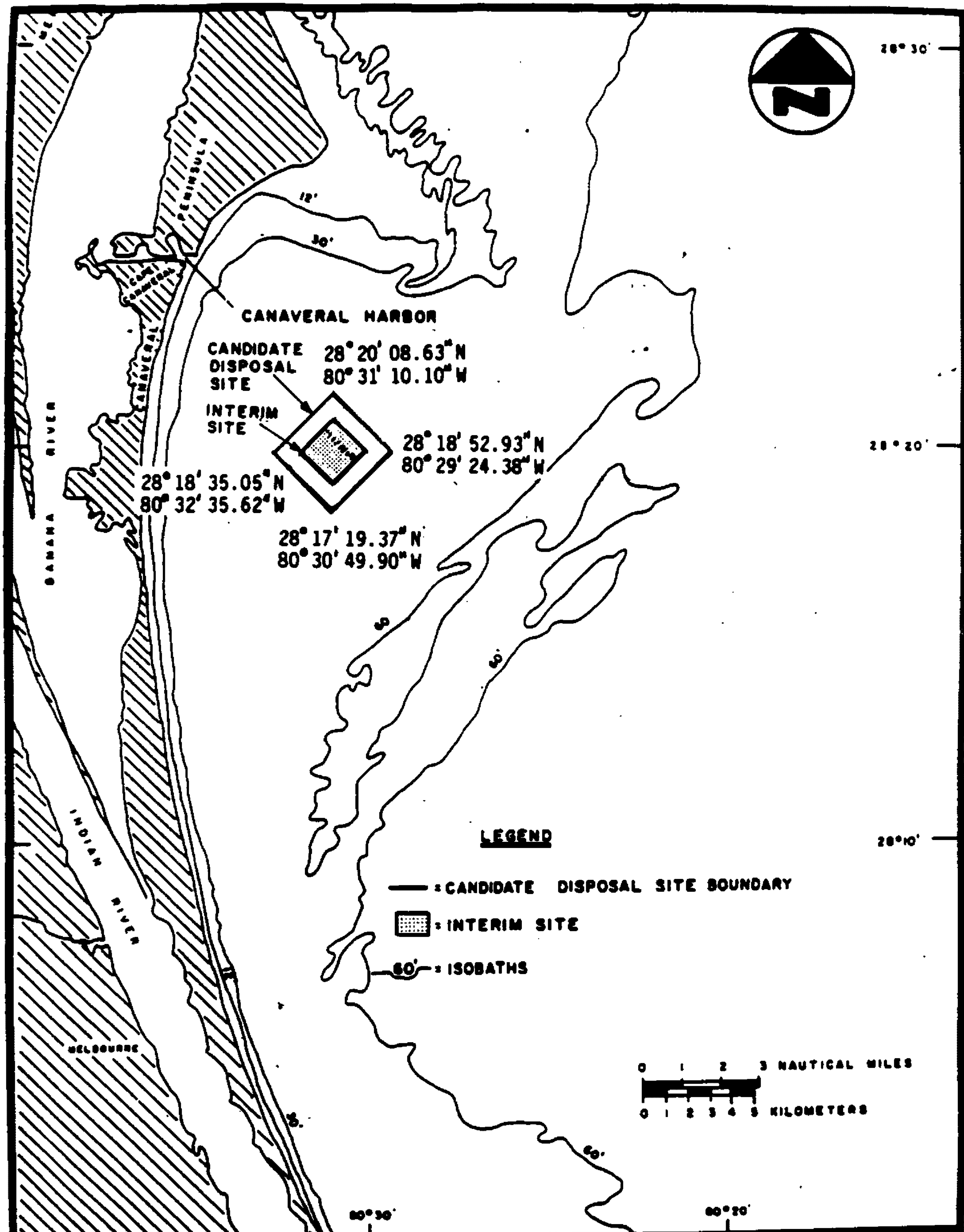

FIGURE 1. LOCATION OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE RELATIVE TO CANAVERAL HARBOR (ISOBATHS SHOWN IN FEET).

modified to reflect the re-configuration. Appendices consisting of contractor reports, including coordinates, have not been adjusted in any manner in order to maintain their integrity, as noted in preface pages for each of the relevant appendices. All coordinates are based on NAD 27. As the alteration to the site configuration is considered relatively minor, without apparent significant environmental impact, no additional field biological sampling to further characterize the site or supplemental EIS was performed.

The candidate ODMDS has an approximate 2.0 nautical mile x 2.0 nautical mile square configuration (an approximate 4.00 square nautical mile area). The center coordinates for the candidate Canaveral Harbor ODMDS are 28°18'44"N (28°18.73'N) latitude and 30°31'00"W (80°30.00'W) longitude, with corner coordinates as follows:

28°20'15"N, 80°31'11"W (28°20.25'N, 80°31.18'W);
28°18'51"N, 80°29'15"W (28°18.85'N, 80°29.25'W);
28°17'13"N, 80°30'53"W (28°17.22'N, 80°30.88'W);
28°18'36"N, 80°32'45"W (28°18.60'N, 80°32.75'W).

4.00 AFFECTED ENVIRONMENT

4.01 Introduction. This description of environmental characteristics in the general area of the candidate site was derived from information in available literature and from a baseline survey of the site conducted during late September and early October, 1985 (CSA, 1986). The site is greatly influenced by seasonal weather patterns and is characterized by a generally level, sand-bottom benthic environment where the benthos and nekton are typically diverse and seasonally variable.

4.02 Geology. The candidate site is located on the shallow continental shelf in the Canaveral Bight east of Cocoa Beach. The regional geology can be generalized as unconsolidated, fine marine sediments (Field and Duane, 1974) that were deposited under relatively low energy conditions created in the lee of the Cape (Meisburger and Duane, 1971). Ferland and Weishar (1984) show modern clays, silts, and fine sands in the area adjacent to Cocoa Beach which is in agreement with findings from the field survey (see CSA, 1986). Surficial sediment samples obtained from the candidate site had a sand-size texture in which fine-grained sand with varying percentages of silt and clay predominated. The sand-sized fraction was greater than 80% in all of the samples collected.

Bottom topography on the inner shelf is depicted by Ferland and Weishar (1984) as being irregular, with isolated ridges, shoals, and depressions. The candidate site, however, is generally smooth with depth gradually increasing from 45 ft (13.5 m) along the northwest boundary to 53 ft (15.9 m) in the southern corner. A small rise is located in the northwest portion of the proposed disposal site and is possibly a remnant of past dumping at the interim site (see Figure 2).

4.03 Physical Characteristics. The Canaveral Bight can be divided into three hydrographic regimes: coastal, shelf, and Gulf Stream. Being located in the coastal region, the candidate site is greatly influenced by local climatic conditions. The degree of mixing between the coastal and shelf regions is dependent on the intensity of horizontal and vertical density gradients, tidal currents, and wind-driven currents (Blanton and Atkinson, 1978). Currents in the region of the candidate site have been studied by Bumpus (1964, 1973), Carter and Okubo (1965), Leming (1979) and Kerr (1980), among others. Net movement is alongshore, in a general north-south orientation, and along bathymetric contours (Ferland and Weishar, 1984) at normal speeds of approximately 0.1 to 0.4 knot, with occasional increases up to 1.0 knot. Carter and Okubo (1965) found the direction of movements to be seasonal, sometimes heavily dependent on the wind. Measurements at the candidate site during the field survey showed the predominant currents to be moving to the north-northeast (approximately 45%) and the south-southwest (approximately 26%). Predominant current speeds measured were as follows: 41.4% of the measurements ranged from 0.1 to 0.2 knot whereas 29.6% of the currents were in the 0.2 to 0.3 knot range.

The water column at the candidate site was relatively isothermal during the field survey and showed a differential of only 1.3°C. Surface temperatures averaged about 27.5°C while near-bottom temperatures were rather constant (i.e., ranging from 26.5 to 26.8°C). Leming (1979) reported the entire shelf shoreward of the 50-m isobath to be essentially isothermal at 27°C during November along his Transect 3. This line is approximately 1/4 mile from the candidate site.

Salinity in the coastal region varies seasonally depending on the proximity to river discharge (Matthews and Pashuk, 1982). Within the water column at candidate site stations, salinities were found to be very homogeneous, with the majority being about 35.5 ppt (± 0.2ppt). This value is very similar to those reported by Atkinson et al. (1983) for the Canaveral region and indicates that the site is not readily influenced by riverine or estuarine waters.

4.04 Chemical Characteristics. Dissolved oxygen concentrations within the water column ranged from 4.8 to 8.1 ppm at the candidate site. These values are within the range reported by Matthews and Pashuk (1982) for the continental shelf off the southeastern United States. Oxygen minima were present in depths from 40 ft to the bottom and maxima were always located in the upper 20 ft of the water column.

Samples for total suspended solids were collected near bottom at the candidate site during the October, 1985 survey. Results of the analysis revealed concentrations ranging from 14 mg/l to 29 mg/l (CSA,

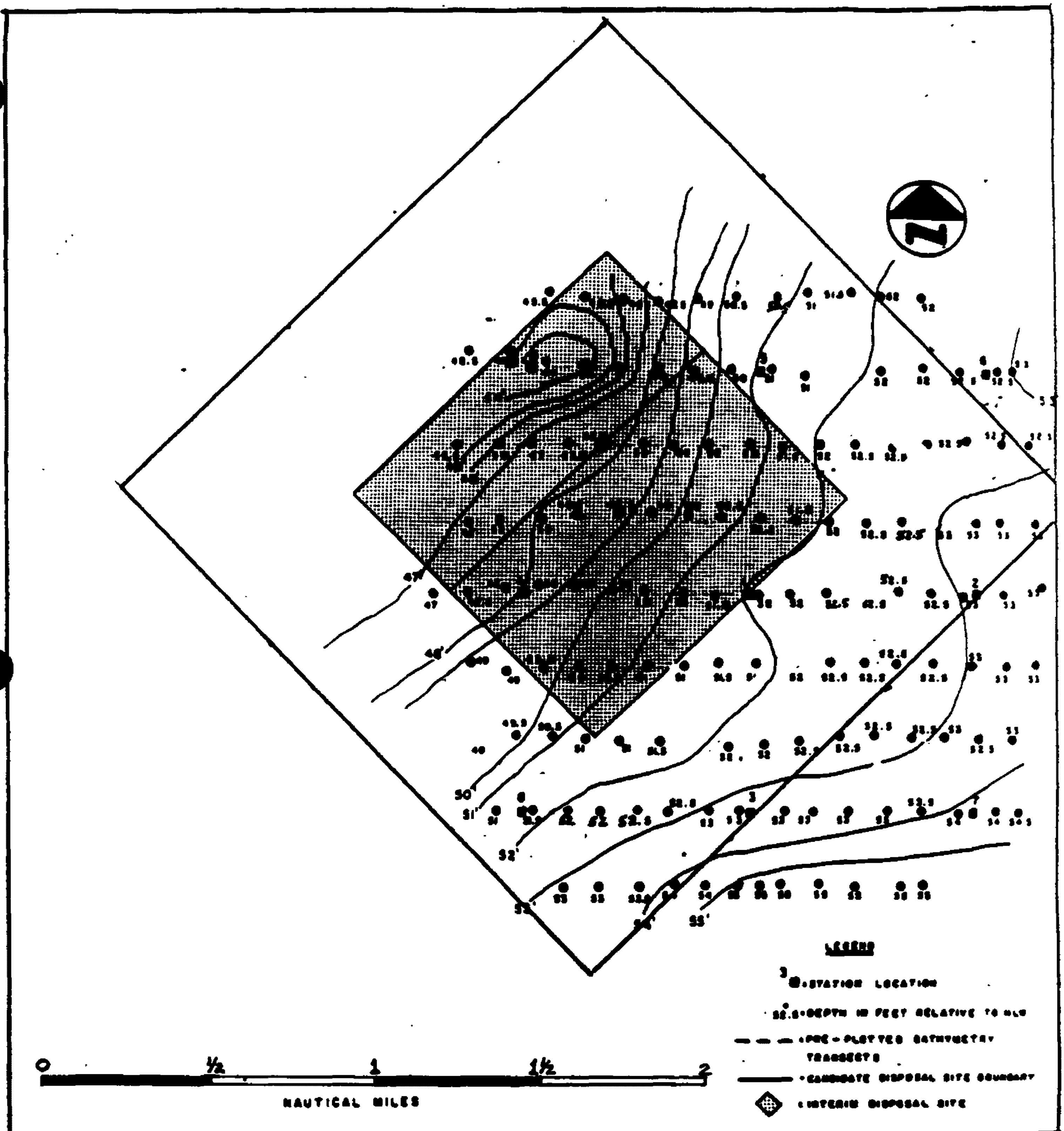

FIGURE 2 BATHYMETRY OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

1986). For comparison, total suspended solids under average oceanic conditions are in the range of 0.8-2.5 mg/l; whereas, suspended solid values in estuaries and rivers commonly exceed hundreds of mg/l (Horne 1969). Water at the site during the field survey (See Appendix A) was visibly turbid (CSA, 1986). Follow-up studies described in Appendix G also reported turbid conditions. Vertical profiles of transmissivity correlate well with video and diver observations and with data from samples of total suspended solids. Transmissivity in near surface waters ranged from approximately 7% to 19%. In general, near-bottom waters had zero transmissivity.

Analyses of water samples collected at the candidate site were made for trace metals (mercury, cadmium, and lead), high molecular weight hydrocarbons, chlorinated pesticides, and polychlorinated biphenols (PCBs). Results of these analyses showed all samples collected at the candidate site were below the limit of analytical detection. Limits of analytical detection were all below U.S. EPA (1976) water quality levels.

Sediment samples from the candidate site were analyzed for trace metals (cadmium, lead, and mercury), high molecular weight hydrocarbons, oil and grease, total organic carbon, chlorinated pesticides, and PCBs. Values for all of the above parameters were classified as below the detection limit or in very low concentration (CSA, 1986).

4.05 Biological Characteristics. The shelf phytoplankton of the South Atlantic Bight is a diverse assemblage (Marshall, 1982) with major components being diatoms, coccolithophores, and pyrrhophyceans (U.S. Department of the Interior, Minerals Management Service [USDOI, MMS], 1984). Diatoms dominate the nearshore waters, including the candidate site, but decrease in a seaward direction (Marshall, 1976). Dinoflagellates dominate the offshore waters and may become abundant during summer months (Hulbert, 1967; Roberts, 1974). The phytoplankton standing crop is higher in the nearshore region than on the outer shelf or in the oceanic region (Hulbert and MacKenzie, 1971).

Zooplankton populations in the region of the candidate site are mainly composed of holoplanktonic organisms (those spending the entire life cycle as plankton); however during the warmer months this dominance is reduced when large numbers of larval crustaceans (shrimp, crabs, and barnacles) and larval mollusks are present (USDOI, MMS, 1984). Bowman (1971) found that zooplankton standing stock decreased but species diversity increased in an offshore direction. He also recognized specific zooplankton associations for water masses associated with coastal, shelf, and oceanic regions. The coastal region is characterized by a general abundance of copepods belonging to the species *Acartia tonsa* and *Labidocera aestiva*.

Struhsaker (1969) divided the continental shelf of the South Atlantic into five regions: the coastal, open shelf, live-bottom, shelf-edge, and lower shelf habitats. The coastal habitat characterized as having a smooth, sandy-mud bottom out to depths of 14 to 18 meters (46 to 59 feet), is typified at the candidate site. This habitat is known for commercially important invertebrates and bottom fishes (USDOI, MMS, 1984) including penaeid shrimp, crab, croaker, flounder, sea trout, and drum. The coastal habitat is not a limited entity but rather occurs on most of the shelf region from Cape Hatteras to the Florida Keys and in the northern Gulf of Mexico. During the field survey of the candidate site, silver seatrout and silver perch dominated the fish catch while shrimp were most conspicuous among the crustaceans. Analyses of macroinfaunal data collected during the field survey of the candidate site revealed four macroinfaunal assemblages associated with four groups of stations. The distribution of these assemblages did not appear related to sediment grain size or water depth. Spatial proximity of the station appeared to be the only underlying factor accounting for the station groupings. Echinoderms, annelids, and mollusks dominated the biomass of the macroinfaunal assemblages.

The candidate site, whose average depth is around 50 feet, is at least one nautical mile from all known fish havens, artificial reefs, and fishing areas (e.g., hard banks) as reported by Moe (1963); Freeman and Walford (1976); USDOI, BLM (1979); Aska and Pybus (1983); USDOI, MMS (1984); and CSA (1985). In addition, the proposed site is at least 14 nautical miles shoreward of the economically important calico scallop beds (Taylor, 1967) located off Cape Canaveral in the open shelf habitat.

4.06 <u>Endangered Species</u>. The endangered species that may occur in the area of the candidate site include five whale species and four sea turtle species. Whale species include the finback whale (<u>Balaenoptera physalus</u>), humpback whale (<u>Megaptera novaeangliae</u>), right whale (<u>Eubalaena glacialis</u>), sei whale (<u>Balaenoptera borealis</u>), and sperm whale (<u>Physeter catodon</u>). The four endangered sea turtle species include the leatherback (<u>Dermochelys coriacea</u>), hawksbill (<u>Ertmochelys imbricata</u>), Kemp's Ridley (<u>Lepidochelys kempii</u>), and the green sea turtle (<u>Chelonia mydas</u>). The green sea turtle is considered endangered for Florida and east Pacific breeding populations, but threatened everywhere else. In addition, the loggerhead sea turtle (Caretta caretta), which is listed as a threatened species, may also occur in the region of the candidate site (George Duray, 1986, personal communication, Office of Endangered Species, Washington, D.C.).

The disposal of dredged materials at the proposed site is not expected to adversely affect these species because the area of the site is small in comparison to the total available ocean habitat and because of the wide-ranging habits of these species of concern.

The EPA has conferred with the National Marine Fisheries Service (NMFS) and with the U.S. Fish and Wildlife Service (FWS) to obtain assurance from these agencies that populations of threatened and endangered species under their purview will not be adversely affected by the proposed action (See Appendix J).

4.07 <u>Fish Havens, Wrecks, and Sport Fishing Grounds</u>. All known fish havens, wrecks, and fishing areas near the candidate site are shown in Figure 3. Location of these sport fishing areas was derived from Moe (1963); Freeman and Walford (1976); USDOI, BLM (1979); Aska and Pybas (1983); and USDOI, MMS (1984). EPA conducted field investigations of

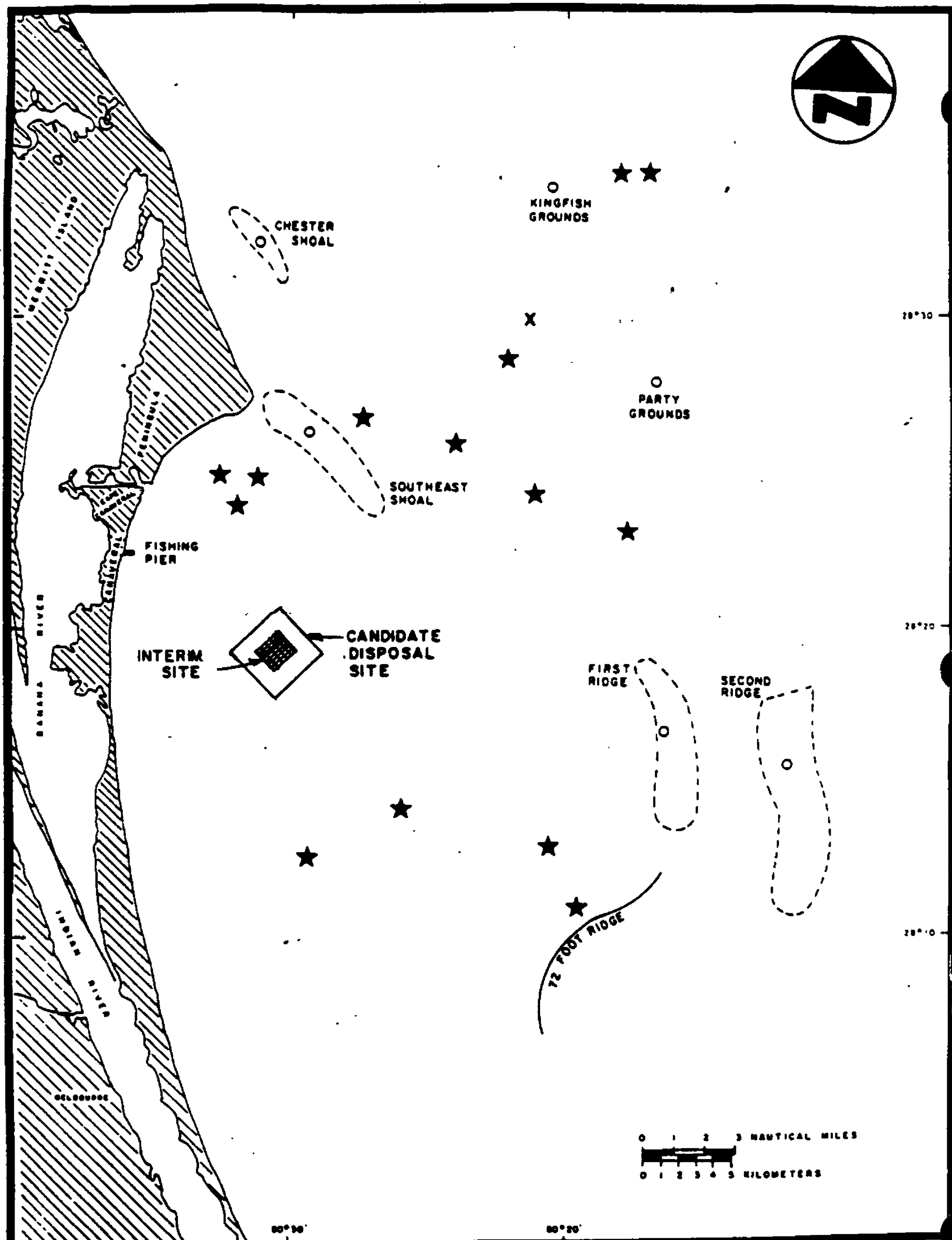

FIGURE 3 LOCATION OF CANDIDATE SITE RELATIVE TO FISH HAVENS (X), WRECKS (★) AND SPORT FISHING GROUNDS (o).

the fish haven west of the Canaveral Harbor ODMDS, depicted in Figure 3, and did not find it to be a significant resource with only remnants of its orginal condition(see Appendix G).

4.08 Coastal Amenities. The region's shore-related amenities, which include the Kennedy Space Center, refuges, aquatic preserves, and national seashores are shown in Figure 4.

4.09 Commercial Fisheries. Commercial fisheries in the Georgia Bight represented 10% (by weight) and 5.9% (in value) of the total United States landings in 1981 (USDOI, MMS, 1984). Florida east coast landings in the same year represented 14% (by weight) and 39% (in value) of the Georgia Bight landings. Ranked according to value, the 10 top commercial fisheries along Florida east coast in 1981 were: (1) calico scallop, (2) shrimp, (3) various fish, (4) swordfish, (5) king mackerel, (6) spiny lobster, (7) groupers, (8) spanish mackerel, (9) blue crab, (10) tilefish (USDOI, MMS, 1984). Shrimp and fish occur in the area of the candidate site. The calico scallop beds lie seaward of the site at a distance of at least 14 nautical miles.

5.00 ENVIRONMENTAL EFFECTS

5.01 Introduction. An assessment of environmental impacts at the candidate site was performed based on criteria promulgated in 40 CFR, Section 228.5 "General Criteria for the Selection of Sites", and Section 228.6 "Specific Criteria for Site Selection". These criteria deal with site evaluation in terms of requirements for effective ODMDS management to prevent unreasonable degradation of the marine environment. Site evaluation utilized a literature base and baseline data collected at the site (CSA, 1986). Each criterion is addressed in the following sections as it relates to the site's suitability as a disposal site and/or its capacity or ability to receive dredged material. Table 2 summarizes the application of the eleven specific criteria for site selection as required by 40 CFR 228.5. Paragraphs 5.02-5.12 address compliance with those specific criteria. Paragraphs 5.3-5.17 address compliance with the general criteria as required by 40 CFR 228.6.

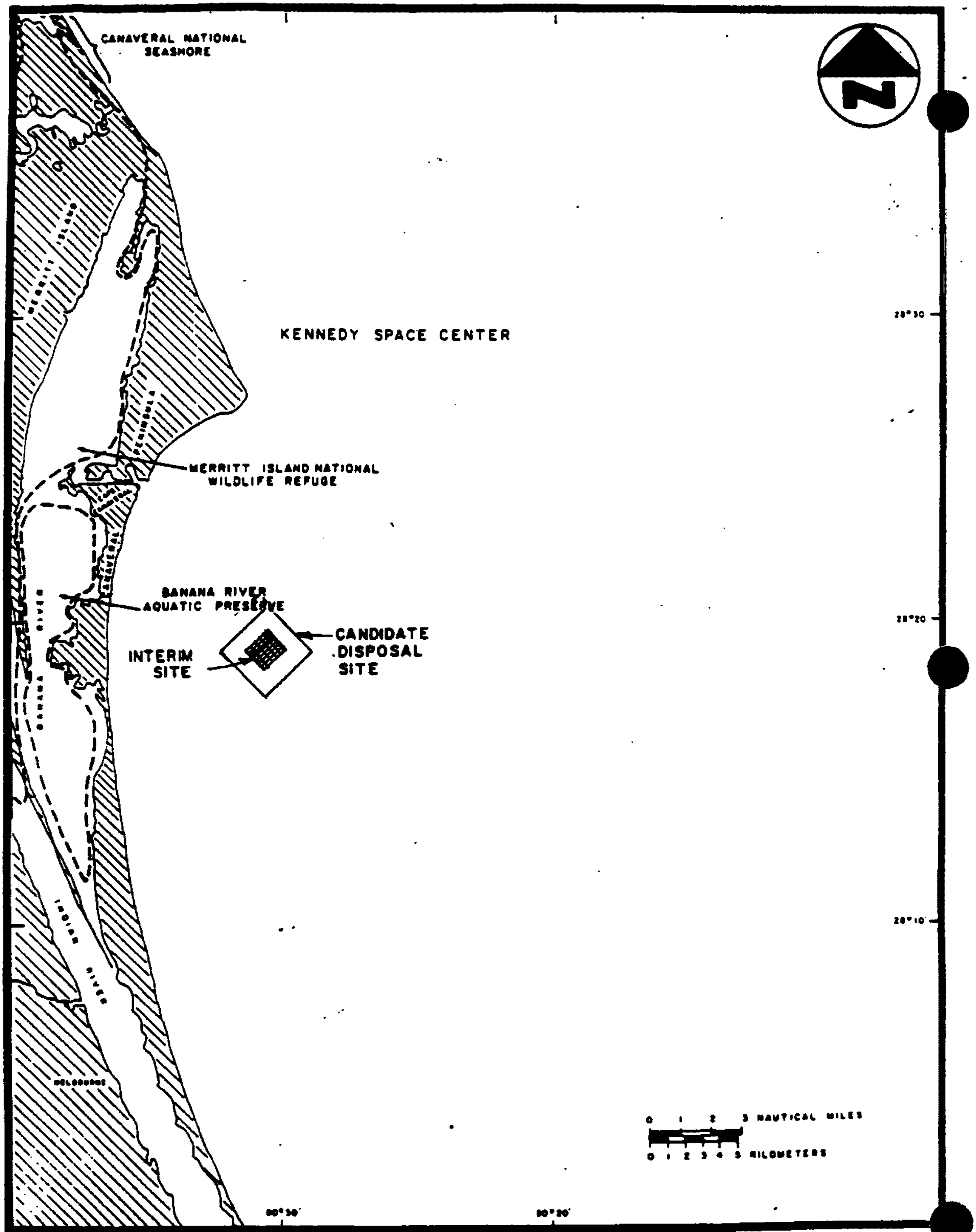

FIGURE 4 LOCATION OF CANDIDATE SITE RELATIVE TO SHORE-RELATED AMENITIES.

TABLE 2

SUMMARY OF THE SPECIFIC CRITERIA AS APPLIED TO THE CANDIDATE SITE

Criteria as Listed in 40 CFR S 228.6	Candidate Site
1. Geographical position, depth of water, bottom topography and distance from coast.	See Figures 1,2 and 3; 45-53-foot depth with flat clay, silt, and fine sand bottom; centered 4.5 nautical miles offshore. Area of approximately 4.0 square nautical miles centered on coordinates 28°18'44" and 80°31'00" (NAD27).
2. Location in relation to breeding, spawning, nursery, feeding, or passage of living resource in adult or juvenile phases.	No breeding, spawning or nursery areas within 1 nautical mile. Approximately 6 nautical miles from nearest estuary.
3. Location in relation beaches and other fishing amenity areas.	Approximately 3.5 nautical miles from to nearest beach. At least 1 nautical mile from any fishing area. The fish haven depicted in Figure 3 is no longer considered to be a significant resource.
4. Types and quantities of wastes proposed to be disposed of, and proposed methods on release including methods of packing the waste, if any.	An average of approximately 800,000 cy maintenance dredged material from Canaveral Harbor is proposed to be disposed by hopper dredge or dump scow.
5. Feasibility of surveillance and monitoring.	Surveillance possibly by boat or plane. See Appendix H.
6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Any movement would be along shore. Current velocities range from 0.1 to 0.4 knots, with movement to the NNE 45% of the time and to the SSW 26% of the time. Gulf stream frontal eddies are not a significant transport mechanisms for dredged material since the Gulf Stream mean axis is located at about 47 nautical miles from the proposed site.

Table 2
continued
SUMMARY OF THE SPECIFIC CRITERIA AS APPLIED TO
THE CANDIDATE SITE

Criteria as Listed in 40 CFR S 228.6	Candidate Site
7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects.)	Approximately 6.6 mcy have been disposed at the interim site since 1974. A small rise in the northwest portion of the candidate site may be mounding of material disposed in the past. (See Appendix F).
8. Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, area of special scientific importance, and other legitimate uses of the ocean.	No interference with these activities is expected.
9. The existing water quality and ecology of the site as determined by available data, and by baseline surveys.	Water quality approximates open ocean. Periodic turbulence caused by strong winds can greatly increase turbidity at the site. Bottom is typical shelf habitat covered by disposed material.
10. Potentiality for the development or recruitment of nuisance species in the disposal site.	Disposal of dredged material should not attract or promote the development of nuisance species. No nuisance species have developed due to past operations at the interim site.
11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	At least four nautical miles from any known features.

5.02 Geographic position, depth of water, bottom topography, and distance from coast [40 CFR 228.6(a)1]. The candidate site is located on the shallow continental shelf off east-central Florida. More specifically, it lies in the Canaveral Bight with its center about 4.5 nautical miles east of Cocoa Beach and with its western corner about 3.5 nautical miles east of Cocoa Beach (see Figure 4). Water depths within the site range from 45 ft (13.5 m) to 53 ft (15.9 m) from the northwest to the southeast. Figure 2 is a bathymetric map of the area of the proposed site showing the gradually sloping topography of the site which is typical of the shallow shelf region. The only break in topography is a small rise located in the northwest portion of the candidate site. This rise is postulated to possibly be the result of previous disposal of dredged material at the interim site. The rough topography of the continental shelf described by Moe (1963) for the Canaveral region lies seaward of the candidate site.

The center coordinates of the candidate Canaveral Harbor ODMDS are 28°18.72'N) latitude and 80°31'00"W (80°31.00'W) longitude, with corner coordinates as follows (NAD 27):

28°20'15"N, 80°31'11"W (28°20.25'N, 80°31.18'W);
28°18'51"N, 80°29'15"W (28°18.85'N, 80°29.25'W);
28°17'13"N, 80°30'53"W (28°17.22'N, 80°30.88'W);
28°18'36"N, 80°32'45"W (28°18.60'N, 80°32.75'W).

5.03 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]. Many of the area's species spend their adult lives in the offshore region but are estuary dependent because their juvenile stages must utilize a low salinity estuarine nursery region. Specific migration routes, from offshore to the estuaries and return to offshore areas, are unknown in the Canaveral area. The candidate site is not near the mouth of an estuary and thus should not encumber migratory passage. The site is not known to be located in any major breeding or spawning area, except for sea turtles which use the eastern Florida beaches as nesting habitat. Due to the motility of finfish, it is unlikely that dumping activities will have any significant impact on any of species found in the area.

5.04 Location in relation to beaches and other amenity areas [40 CFR 228.6(a)3]. The candidate site is located at least 3.5 nautical miles from the nearest beach and 1.0 nautical mile from any recognized amenity. Shore-related amenities include Canaveral National Seashore, Merritt Island National Wildlife Refuge, Banana River Aquatic Preserve, and the Kennedy Space Center (see Figure 4). Currents in the vicinity of the site trend alongshore, in a general north-south orientation. Therefore, it is unlikely that detectable quantities of dredged materials will be transported onto beaches. No adverse impacts to beaches have been associated with previous dredged material disposal at this site. Final designation of the candidate site should not adversely affect recreation, coastal development, or other uses of the beaches and other coastal amenity areas.

5.05 Types and quantities of wastes proposed to be disposed and proposed methods of release, including methods of packing the waste, if any [40 CFR 228.6(a)4]. It is anticipated that the candidate site will be used for disposal of maintenance dredged material from the Port Canaveral Channel and Turning Basins. An annual average of approximately 800,000 cubic yards of maintenance dredged material are projected for disposal in the candidate site after designation. The material is expected to be transported by means of hopper dredge and/or dump scow. In addition, about 1.2 million cubic yards of material dredged in planned expansion of the Port of Canaveral Harbor will require disposal, either in the candidate site or elsewhere, depending on the material. Dredging project projections for a five-year period are provided in the Site Management and Monitoring Plan (SMMP) for the Canaveral Harbor ODMDS (see Appendix H). All dredged materials deposited at ocean dumping sites must comply with EPA dredged material quality criteria for ocean dumping permits as specified in the Ocean Dumping Regulations (40 CFR, 227).

5.06 <u>Feasibility of surveillance and monitoring [40 CFR 228.6(a)5]</u>. The geographic and physical setting of the candidate site poses no special problems for monitoring or surveillance. Water depth at the site is suitable for diver collection or surface sampling and does not require use of a large, specialized surface vessel. The areal extent of the site allows use of towed devices for bottom and water column sampling. Baseline data collected at the site can serve as reference information for future monitoring and aid in assessing possible perturbations resulting from disposal at the site. The only foreseeable hindrance to surveillance and monitoring is that the site is often bathed by turbid waters. Photodocumentation of the bottom is not possible during these turbid water periods.

Several attempts at video surveys and/or diver observations (see Appendices A and G) have had limited success due to turbidity. However, side scan (see Appendix G) and sediment mapping (see Appendix F) surveys have been successful. In addition, the SMMP for the Canaveral Harbor ODMDS referenced in Section 5.05 provides the present management and monitoring approach for the site. EPA is also conducting a benthic monitoring study concurrent with the ODMDS designation process.

5.07 <u>Dispersal, horizontal transport, and vertical mixing characteristics of the area including prevailing current direction and velocity, if any [40 CFR 228.6(a)6]</u>. Currents in the Canaveral Project Area are mainly wind driven. Net current flow is alongshore with the direction of movement related to season (Carter and Okubo, 1965). Current speeds are normally in the range of 0.1 to 0.4 knot (Bumpus, 1973), with most in the 0.1 to 0.3 knot range. No conclusive statement, however, can be made about the region's sediment transport (Ferland and Weishar, 1984). Measurements at the candidate site during the field survey showed approximately 45% of the currents moving to the north-northeast and 26% trending south-southwest. Gulf Stream frontal eddies are not a significant transport mechanism of dredged material in the Canaveral area since the mean axis of the stream is located about 47 nautical miles offshore. A sediment transport study was conducted by the CE Waterways Experiment Station (WES) in 1986. Because of similarities between the proposed Ft. Pierce and Canaveral ODMDSs, the short- and long-term modeling results obtained for Ft. Pierce are considered applicable at the Canaveral site (Table 3). The short-term results indicate that the local ambient velocity fields are not adequate to transport significant amounts of sediment to the nearshore area. Results of long-term simulations indicate that some sediment might leave the site but should not affect the nearshore system.

Table 3

COMPARISON OF OCEAN CHARACTERISTICS RELATING TO THE PROBABLE FATE OF DREDGE MATERIAL TO BE DISCHARGED AT FT. PIERCE AND CANAVERAL CANDIDATE ODMDS SITES

	Water Depths	Distance from Shore	Prevailing Current Direction and Speed	Dredged Material Type
Canaveral Candidate ODMDS	43-55 ft.	3.5 nmi	Northerly at 0.1 to 0.4 knot	Fine-grained sand, silt, clay, sand/shell
Ft. Pierce Candidate ODMDS	40-54 ft.	4.5 nmi	Northerly at 0.06 to 0.3 knot	Fine-grained sand, silt, clay, sand/shell

5.08 <u>Existence and effects of current and previous discharge and jumping in the area (including cumulative effects) [40 CFR 228.6(a)7]</u>. The interim designated site is contained within the perimeter of the candidate site. Prior to 1974, dredged material was placed either in the disposal area located directly adjacent to the inner reach of the ship channel (Figure 5), or it was stockpiled on land for future use. During the years 1974-1988, approximately 5.7 million cubic yards of new material from the Trident Project and 10.9 million cubic yards of maintenance material composed of clay, silt, sand, and/or shell (McAdams, USACOE, personal communication) was placed in the site (Ferland and Weishar, 1984; and Farmer, 1988). The specific volumes of material disposed per year in the interim site are shown in Table 4. Sediment mapping surveys were conducted by EPA in July 1988 and April 1989. These studies, discussed in detail in Appendix F, were conducted to characterize distribution of dredged material and to

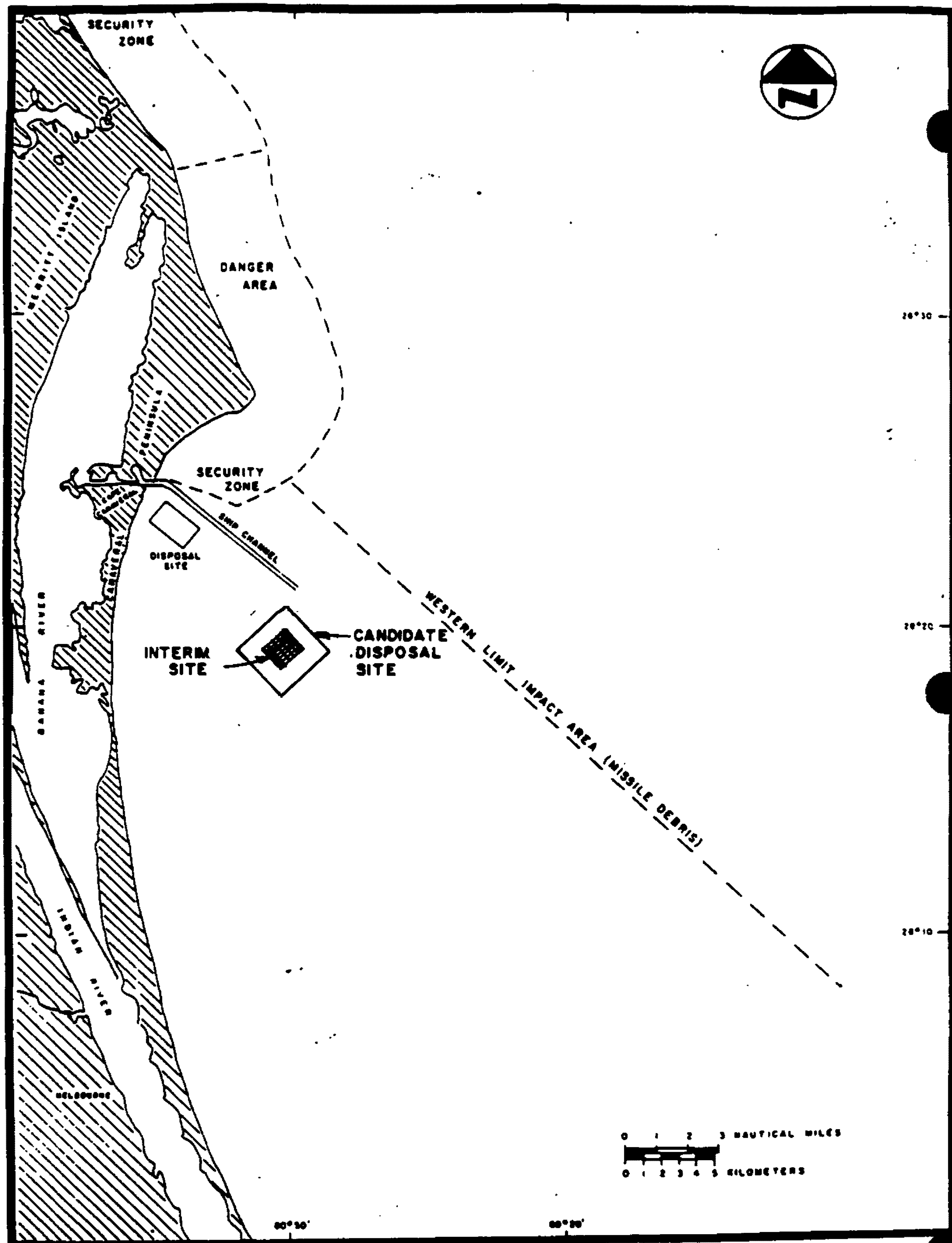

FIGURE 5. . HISTORICAL DISPOSAL SITES, SHIP CHANNELS, AND HAZARD AREAS IN THE VICINITY OF THE CANDIDATE SITE.

Table 4.
Summary of Dredged Material Disposal Volumes
at the Interim-Designated ODMDS, Canaveral Harbor*

Dredged Material in Cubic Yards

Date	New Work	Maintenance Work
1974	556,616	1,010,457
1975	2,762,100	312,771
1976	2,394,041	494,720
1977		40,593
1978		282,517
1980		1,402,547
1981		494,620
1983		930,000
1984-85		3,084,117
1986		351,535
1987		2,064,258
1988	(estimated)	385,000
Subtotals	5,712,757	10,853,135
Total	16,565,892	

*Len Farmer, USACOE, personal communication, July 1988.

determine the direction, extent and character of any migration of sediments after disposal. Some westward movement was indicated, with fine-grained sediments located outside the site to the west. The sediment mapping suggests that this material is of somewhat different composition and may not be from the same source. A follow-up survey conducted June 1990 is expected to provide additional information regarding sediment movement patterns.

5.09 Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean [40 CFR 228.6(a)8]. Shipping traffic is not heavy in the candidate site area and all anchorages are located inside the barrier island at Port Canaveral (Hunt, 1980). There are no designated Safety Fairways in the Georgia Bight or along the east coast of Florida (USDOI, MMS, 1984). Other than periodic use of designated ship channels by hopper dredges or towed barges on trips to and from the candidate disposal area, the site and its uses should not interfere with shipping activities.

Fishing and Recreation - The candidate site is located at least one nautical mile from any recognized sport fishing or recreational area, and thus should not appreciably interfere with activity in either area EPA has field-investigated the nearest charted fish haven west of the candidate Canaveral Harbor ODMDS depicted in Figure 3 and did not find it to be a significant resource. Only remnants of the fish haven remain (see Appendix G). Commercially important species occur in the area but not in sufficient quantity to make it a region of major commercial importance (Moe, 1963; Drummond, 1969; Struhsaker, 1969; USDOI, BLM, 1979; Gilmore et al., 1981; and USDOI, MMS, 1984). Even though shrimp, crab, kingfish, seatrout, spot, croaker, and red and black drum are found in the coastal habitat of the Canaveral Project Area, they are not limited to the region.

Mineral extraction, desalination, fish and shellfish culture, and areas of special scientific importance - No such activities are occurring at present in the area. Future exploration for oil and gas or sand extraction for beach nourishment projects should not be hindered by the candidate site or associated activities.

Other legitimate uses of the ocean - Two telecommunication cables have been identified in the Canaveral Project Area; however, the candidate site is located at least five nautical miles from the cables. No other legitimate uses have been identified in the general region of the candidate site.

5.10 <u>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]</u>. Water quality in the region of the candidate site is mostly under the influence of the open ocean and salinities seldom drop much below 34 ppt (Jacobson, 1974). Water clarity is normally good but periodic turbulence caused by strong winds can make the nearshore water quite turbid (Gilmore et al., 1981). Such an occurrence was encountered during a recent field survey (CSA, 1986: Appendix A). EPA video surveys of the bottom in 1988 and 1989 also observed turbid bottom waters. Narrative for the these surveys is provided in Appendix G. With the exception of suspended solids (i.e., a measure of turbidity), values for water quality parameters obtained from samples taken during this survey were well within the limits of applicable water quality standards. Dissolved oxygen concentrations at the site (4.8 to 8.1 ppm) during the field survey (CSA, 1986) are certainly sufficient maintain aquatic life (U.S. EPA, 1976).

The ecology of the candidate site is typical of the coastal habitat described by Struhsaker (1969). Bottom sediments at the site were predominantly fine sand with varying amounts of clay, silt, and medium to coarse sand (CSA, 1986). Commercially important species supported by the coastal habitat which were collected during the field survey include shrimp, crab, seatrout, silver perch, croaker, and drum.

No critical habitat or unique ecological communities have been identified at the candidate site. An EPA side scan sonar survey, as well as attempts at video surveys and diver observations (limited visibility), found no evidence of environmentally-sensitive features on or near the candidate site. The fish haven west of the site depicted in Figure 3 was not considered a significant resource since it is in poor condition, based on side scan information and local personal communication (see Appendix G). Buffer zone protection has been applied to fish havens, artificial reef communities, turtle nesting areas, and onshore amenities in the general region of the site (CSA, 1985).

5.11 Potentiality for the development or recruitment of nuisance species in the disposal site [40 CFR 228.6(a)10]. Disposal of dredged material should not attract or promote development of nuisance or undesirable species. No nuisance species have been reported in the previously utilized interim disposal site. New material would contain little or no fecal coliform bacteria, but such organisms may be present in maintenance dredged material.

5.12 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]. Features identified as possibly being relevant to this criterion are shown in Figures 3 and 4. The candidate site is at least 3.5 nautical miles from any identified feature on land and even further from identified wrecks-at-sea which may or may not be of historical importance.

5.13 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 outer 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 location of the candidate site in relation to the region's sport fishing and recreational areas is shown on Figure 3; the shipping channel is shown on Figure 5. As detailed under Section 5.09, the boundary of the candidate site is at least one nautical mile from any identified major fisheries, shellfisheries, or area of recreational use. The site is at least one nautical mile from any ship, channel or anchorage.

5.14 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)]. The boundary of the candidate site is at least 3.5 nautical miles from any beach. Shoreline, or marine sanctuary (see Figure 4). Temporary perturbations in water quality are expected to be reduced to ambient or undetectable levels within a short distance of the release point. Therefore, no adverse impact to any beach, shoreline, or marine sanctuary is expected due to use of the candidate disposal site. In addition, no known geographically limited fishery or shellfishery occurs in the Canaveral Project area. (Moe, 1963; Struhsaker, 1969; U.S. D.O.I., MMS, 1984).

5.15 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 228.5 and 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 site selection criteria in Section 228.5 and 228.6 of the Ocean Dumping Regulations were used as a basis for selecting the candidate site for final designation action. Based on present information, the candidate site meets all criteria. If, based on future monitoring survey information, the Canaveral ODMDS is found not to meet these criteria, the use of this site will be terminated as soon as an alternate disposal site is designated.

5.16 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-range 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)]. The size of the site is an approximate 2.0 x 2.0 nautical mile square (approximately four square nautical mile area). The size and location of the candidate site is amenable to ODMDS monitoring and surveillance programs. A Site Management and Monitoring Plan for the Canaveral Harbor ODMDS has been developed and is presented in Appendix H.

5.17 EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically used [40 CFR 228.5(e)]. The configuration of the Canaveral Harbor candidate ODMDS presented in the DEIS only partially overlapped the smaller historically-used interim site. The candidate ODMDS has been re-configured for this FEIS to completely encompass the interim site in partial fulfillment of 40 CFR 228.5(e) concerning sites of historical usage. To attempt to place the proposed ODMDS beyond the edge of the continental shelf, however, is not feasible. The continental shelf is wide (over 35 nmi) in the Canaveral area (Moe, 1963) and such a distance could not only be economically prohibitive, but would also place the site in water depths that would greatly limit benthic monitoring.

5.18 Relationship between short-term use and long-term productivity. Disposal operations should not significantly interfere with the long-term use of any resources at the candidate site. Commercial fishing and sport fishing at or near the candidate site should not be significantly affected because the site is not known to be located in a limited fishery area. The site constitutes only a very small part of the Georgia Bight inhabited by commercially important species. The short-term perturbations at the site will not significantly affect the long-term productivity of the region.

5.19 Irreversible or irretrievable commitments of resources. Resources irreversibly or irretrievably committed through use of the proposed site will include: (1) loss of fuel for the hopper dredges to transport the dredge material to the site: (2) loss of some potentially recyclable material (i.e., sediment for land fill); and (3) loss of some benthic organisms that will be smothered during disposal operations.

5.20 Unavoidable adverse environmental effects and mitigating measures. Use of the proposed site may produce the following adverse environmental effects: (1) temporary water column perturbations (turbidity plume, release of chemicals, lowering dissolved oxygen concentration); (2) smothering of some of the site's benthic biota; (3) changing the site bathymetry; and (4) altering the site's sediment composition.

In general, water quality perturbations should have only local and short-term effects and should have minimal regional effect. However, turbidity attributable to dumping activities and the erosion of disposed dredged material is expected to contribute to the apparent naturally turbid conditions of the area of the candidate ODMDS. Some adverse effects can be lessened through proper management of the disposal site. Disposal material that might migrate off site should cause only negligible effects since sediment grain sizes would principally be compatible with surrounding native sediments (fine grain on fine grain). Effects outside the candidate ODMDS boundaries should be minimized through the management and monitoring approach presented in the Canaveral Harbor SMMP (see Appendix H). This SMMP is intended to be flexible and can be changed for cause by the responsible agency for reasons such as results from monitoring surveys.

6.00 LIST OF PREPARERS The following people were primarily responsible for preparing this document:

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Dr. E. A. Kennedy Oceanographer 3 years, senior scientist scientist with TerEco Corp. with CSA; 8 years, senior	Introduction, interpretation of sediment and epifaunal data
Dr. Alan Hart Biostatistician, Oceanographer 4 years, senior scientist with CSA; 2 years,	Statistical analyses, meiofaunal research and macroinfaunal data analyses
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7.00 PUBLIC INVOLVEMENT

7.01 Section 7 coordination. By letter dated August 17, 1987, EPA contacted the National Marine Fisheries Service (NMFS) regarding coordination on Section 7, Endangered Species Act of 1973. By letter dated October 8, 1987, NMFS concurred that species of concern would not be affected by the proposed designation. Verification of concurrence with the reconfigured site was obtained through EPA telephone conversation with Dr. Terry Henwood of NMFS on February 15, 1990, an EPA follow-up letter to NMFS dated February 28, 1990, and a subsequent follow-up NMFS letter to EPA dated March 12, 1980. The U.S. Fish and Wildlife Service (FWS) was contacted by letter dated August 17, 1987. In the reply dated August 27, 1987, FWS stated that in this case "...consultation responsibility rests with the National Marine Fisheries Service." Based on these consultations, EPA considers designation of the ODMDS to be consistent with Section 7 of the Endangered Species Act of 1973. The three referenced concurrence letters are provided in Appendix J.

7.02 Coastal Zone Management Consistency. EPA prepared a CZM Consistency Evaluation for submission to the State of Florida in August 1987. EPA concluded that the designation is consistent with Florida's CZM plan. The Consistency Evaluation is provided in Appendix I with a new preface. EPA's 1987 evaluation was based on the site configuration used in the DEIS. The reconfiguration used in this FEIS does not alter EPA's conclusion. Because of the reconfiguration, the sentence in the introduction stating, "[t]he proposed site contains over half the area of the interim site and an adjacent area seaward..." should be revised to read: "The proposed site encompasses the entire area of the interim site and a portion of the surrounding area on all sides." In addition, reference to the site's distance from Cocoa Beach, Florida, should be updated to read: "Site boundaries are located 3.5 nmi east of Cocoa Beach, Florida, in the Atlantic Ocean." In review of the draft consistency evaluation in 1987, the State of Florida did not concur. Comment letters regarding the consistency evaluation are provided with EPA responses in Appendix J.

7.03 Comments on and responses to the DEIS. Public comment letters received during the 45-day NEPA review period and responses are provided in Appendix J.

7.04 Public coordination. The FEIS has been circulated to the following Federal, State, and local agencies and groups:

Federal

National Marine Fisheries Service
U.S. Fish and Wildlife Service
U.S. Navy
Office of Coastal Zone Management, U.S. Department of Commerce
U.S. Army
U.S. Coast Guard
National Park Service
National Ocean Survey, U.S. Department of Commerce
Bureau of Land Management/Minerals Management Service

State

Office of the Governor - Florida
State of Florida A-95 Clearing House
Florida Department of Natural Resources
Florida Department of Environmental Regulation
Florida Marine Fisheries Commission
Florida Department of Community Affairs
Florida Office of Coastal Management

Local

Brevard County Board of Commissioners
Superintendent, Canaveral National Seashore
Manager, City of Cocoa Beach

Public
South Atlantic Fisheries Management Council
Florida Sierra Club
Florida Audubon
Florida Wildlife Federation
Northeast Florida Shrimpers Association
Florida Cooperative Extension Service
Marine Advisory Office - Marineland
Florida Boating Council
Florida League of Anglers
Organized Fishermen of Florida
Florida Sport Fisheries Association

8.00 REFERENCES

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APPENDIX A
FIELD SURVEY

PREFACE

The following section of the contractor site characterization report was completed before the Canaveral Harbor DEIS was published. As such, the reconfigured ODMDS was not depicted in the report. In order to maintain the integrity of the report, no revisions were made.

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SECTION A: INTRODUCTION

1. This report describes the field sampling activities and results of a survey at the Canaveral Harbor candidate ocean dredged material disposal site (ODMDS). This site was selected for sampling following a review of the existing literature and an information search to identify environmentally sensitive areas and nearby amenities used by man (Continental Shelf Associates, Inc., 1985a).

2. Following site selection, various data and samples were collected at the candidate site including bathymetry profile data, water column, sediment, and biological samples. Samples were collected by scientists and divers working aboard the 42-ft motor vessel AMITY. Five sampling stations were established within the perimeter of the 2 nmi square site and four additional sampling stations were located outside the site but within 1,000 m of the site boundaries. The latitude and longitude of each of the sampling stations and the four corners of the site are listed in Appendix C.

SECTION B: METHODS AND MATERIALS

3. This section describes the field and laboratory methods employed during the survey of the potential Canaveral Project Area disposal site and during subsequent analyses of the field samples and data. Included are descriptions of navigation, underwater video, and bathymetry systems, rationale for utilizing diver sample collection methods, sample collection techniques, laboratory analytical methods, data analyses methods, and quality control. Methods used during the surveys are based upon the Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites prepared by Pequegnat et al. (1981) for the U.S. Army Corps of Engineers.

Navigation

4. The location of the candidate Canaveral Harbor ODMDS was selected by the Jacksonville District. The latitude and longitude provided by the Corps were converted to Loran-C coordinates in the field using a navigation system which consisted of an EPSCO Model C-Nav XL Receiver, EPSCO Model C-Plot II 10-inch plotter, and a Digitec Alphanumeric Paper Roll Printer. Prior to the beginning of sampling at the Candidate Canaveral Harbor ODMDS, a navigation system calibration was performed at two Corps of Engineers benchmarks in Port Canaveral to determine Loran-C propagation error. Upon arrival at the potential ODMDS, the site boundaries were established on the EPSCO plotter along with survey station locations and underwater video and bathymetry survey transects. The survey vessel captain was then able to follow the boat's progress on the plotter and more accurately navigate to sampling stations and follow survey transects.

5. Five stations were established within the site boundaries and four stations were set up outside the site, one each to the northeast, southeast, southwest, and northwest (Figure B.1). Nine transects for the video and bathymetric survey were established in an east-west orientation through the site (Figure B.2).

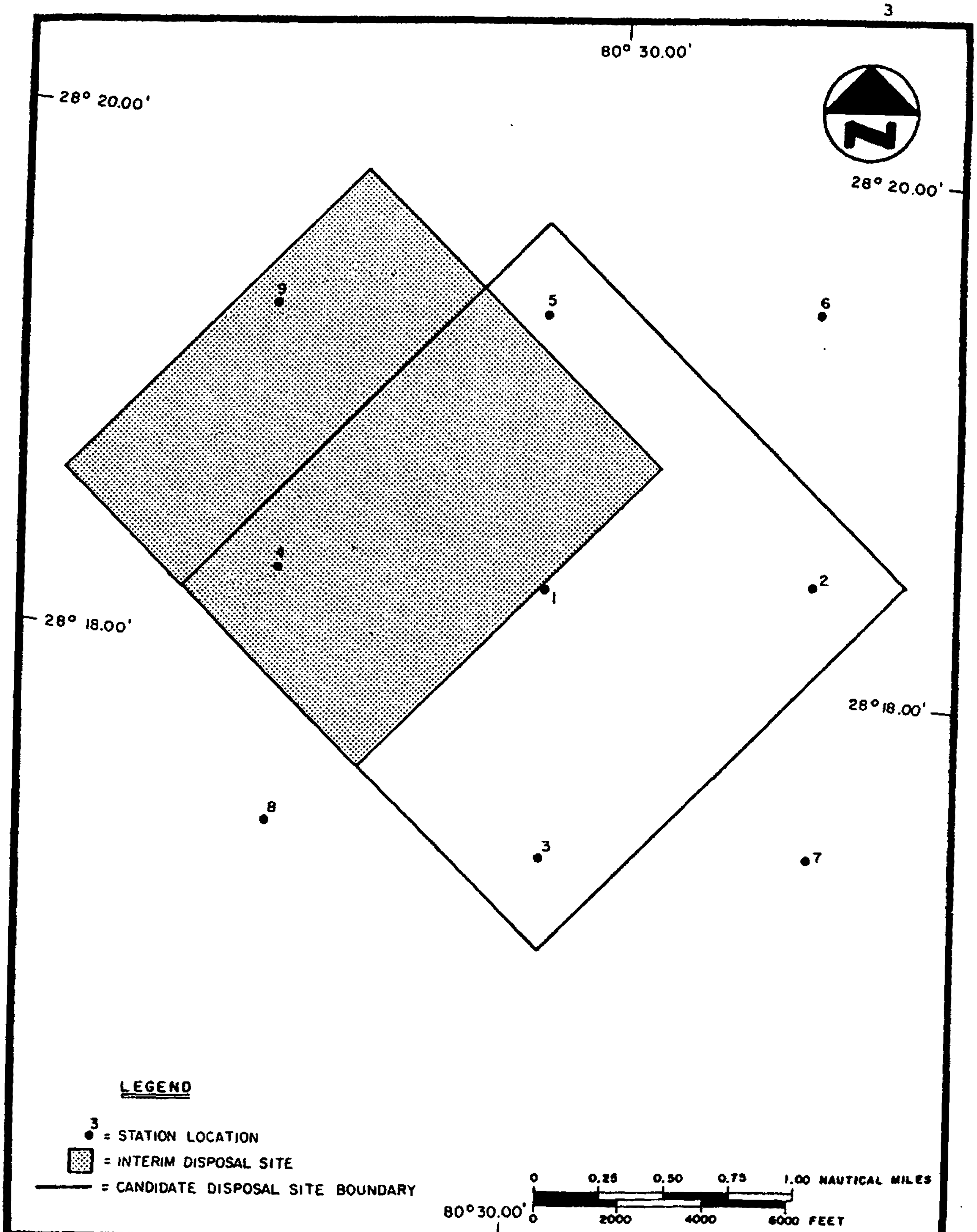


FIGURE B.1. STATION LOCATIONS WITHIN AND AROUND THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

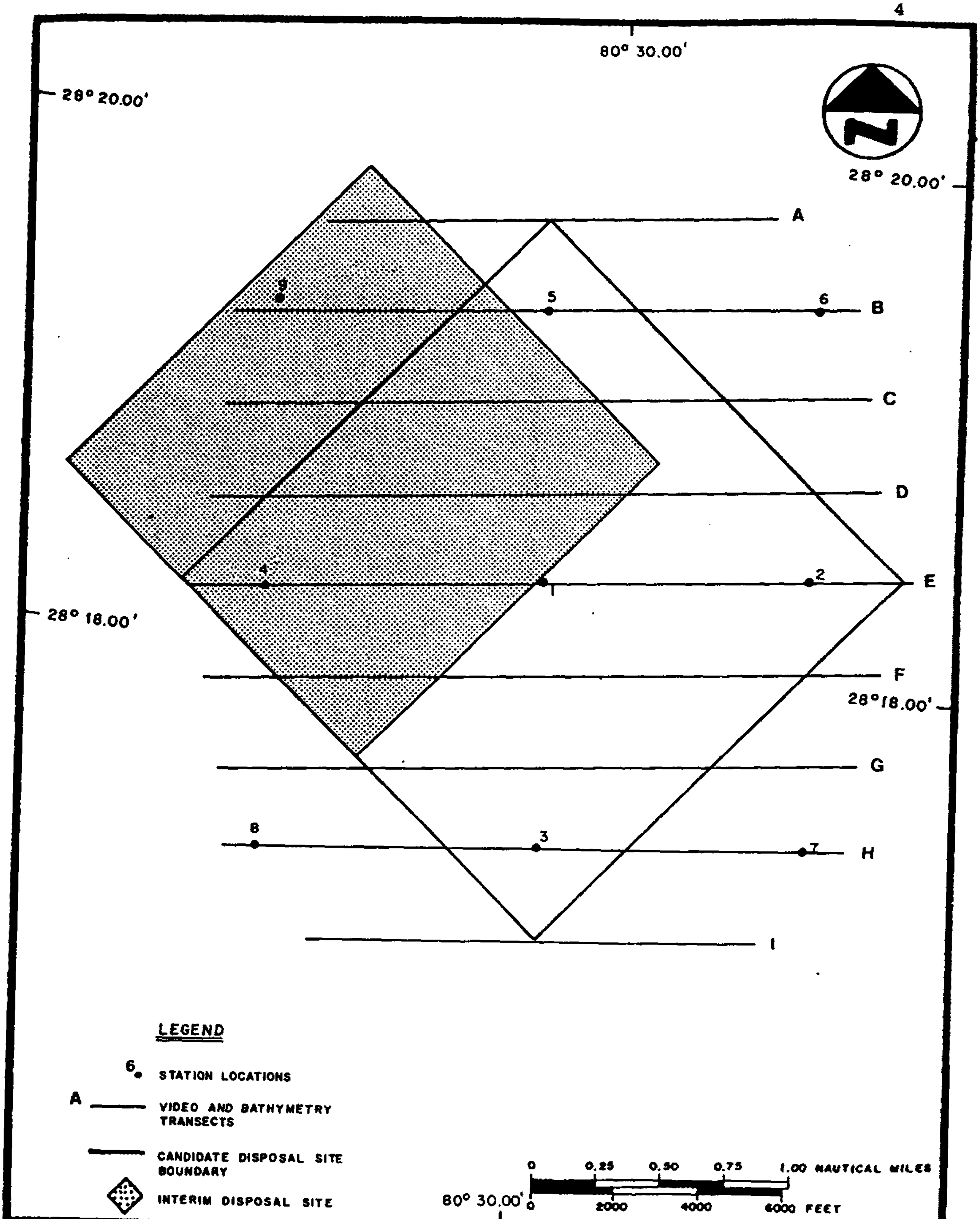


FIGURE B.2. PROPOSED VIDEO AND BATHYMETRY SURVEY TRANSECTS THROUGH THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

Video and Bathymetry

6. Acceptable video data were not collected at the candidate Canaveral Harbor ODMDS due to extremely low visibility at the site. A Ikugami video camera in a waterproof housing was mounted to a sled which was towed across the site. Underwater visibility was less than one foot along the entire tow track and it was not possible to tell when the camera actually touched the bottom. Because of this high turbidity (CSA, 1985b), the requirement for an underwater video survey at the tentative Canaveral Harbor ODMDS was dropped.

7. Bathymetry data were collected along the pre-plotted transects (Figure B.2) using a Raytheon DE-719 Recording Fathometer. The depths were recorded on continuous fathometer chart paper and navigation fixes were automatically marked on the chart paper by the navigation system. Navigation position fixes were plotted at 300-m (984-ft) intervals along survey transects. Water depths were checked using a measured weighted line at the beginning of every second survey transect to calibrate the fathometer and determine potential instrument drift.

Sample Collection Techniques

8. Divers were utilized during this survey to collect both water quality and sediment samples. Advantages of using divers over remote methods in shallow depths are numerous and include cost-effectiveness, higher quality samples, and elimination of many contamination problems.

9. Divers were able to collect all the water quality samples or sediment samples for a station on a single dive of under 15 minute duration. This is a much shorter period of time than would be required to obtain samples in water collection bottles or using box corers or sediment grabs, especially when sampling in areas of choppy or rough water where premature releases of sampling gear can be a common occurrence.

10. Divers are infinitely superior in collecting undisturbed sediment samples in areas of sand or rubble covered bottoms. Most remote coring devices are unable to collect an undisturbed sample in a sand or shell-covered bottom due to insufficient penetration. Divers are also able to carefully insert hand corers to standard depths in the sediments and take replicate samples in close proximity to each other.

11. Collecting samples by diving can also eliminate the problem of shipboard contamination because the actual collection corer or jar also serves as the storage vessel for the sample. The sample is collected underwater, the container is sealed, and the sample is not exposed to possible contamination until arriving at the laboratory.

Hydrographic data

12. Water column profile data (salinity, temperature, depth, dissolved oxygen, and transmissivity) were collected at each station using a Beckman RS5-3 Portable Salinometer, a YSI Model 54 Dissolved Oxygen Meter, and a Hydro Products Model 912S Transmissometer. Readings were taken at 0.5 m (1.5 ft) below the surface and at 3 m (10 ft) intervals through the water column down to approximately 0.5 m (1.5 ft) above the bottom.

13. Current measurements were made using an ENDECO Model 105 Recording Current Meter. The current meter was deployed at the candidate Canaveral Harbor ODMDS center at the beginning of the survey and recovered after sampling activities were completed. The current meter was attached to a taut-line mooring array and was positioned 1.5 m (5 ft) above the bottom. Current speed and direction measurements were recorded on film at 0.5-hr intervals for the entire time the current meter was deployed.

Water samples

14. Water quality samples for total suspended solids determination were collected by divers from near the bottom (1 m above bottom) where turbidity was highest at each of the nine sampling stations. Water quality samples for trace metals (cadmium, lead, and mercury), high molecular weight hydrocarbons, and chlorinated pesticides and PCBs were also collected by divers from near the bottom (1 m above bottom) at the five stations within the project area and at the proximal upcurrent station (Figure B.3).

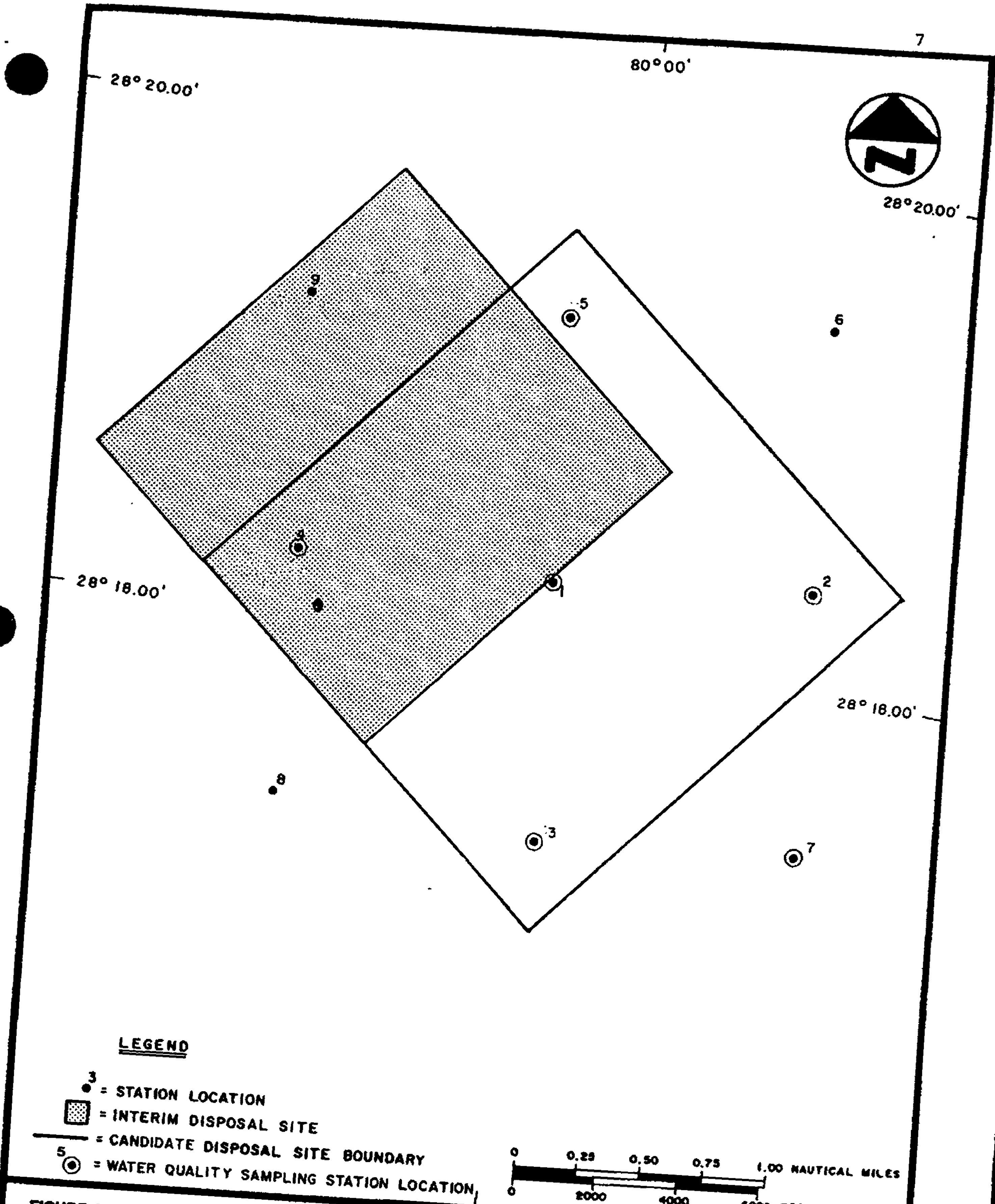


FIGURE B.3. WATER QUALITY SAMPLING STATION LOCATIONS AT THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

15. Total suspended solid samples were collected in 3.8-l polyethylene jars. The jars were washed with detergent and tap water, rinsed with distilled water, and then filled with distilled water and capped.

16. Water samples to be analyzed for cadmium and lead were collected in 0.5-l linear polyethylene jars. Mercury samples were collected in 0.5-l glass jars with a teflon-lined lid. Trace metal sample jars were precleaned by washing with detergent and tap water, rinsing with tap water, rinsing with 1:1 nitric acid and tap water, then rinsing with deionized water. The jars were then filled with deionized water and capped.

17. Water samples for high molecular weight hydrocarbons and chlorinated pesticides and PCBs were collected in 2-l glass jars with teflon-lined lids. The sample jars were cleaned by washing with detergent and tap water and then rinsing with pesticide-grade hexane. The jars were then filled with deionized water and capped.

18. Divers took the jars to the bottom, opened and purged them by filling them with air from their spare scuba regulators, filled them with water from a depth of 1 m above the bottom, and then recapped the jars. Upon reaching the surface, the sample jars were immediately stored on ice until delivery to the laboratory. Table B.1 shows the types of water quality samples collected, the containers used, the preservation techniques, and amount of sample collected.

Sediment samples

19. Sediment samples for granulometry, trace metals, high molecular weight hydrocarbons, chlorinated pesticides and PCBs, oil and grease, and total organic carbon were also collected by divers at each of the nine stations using precleaned sample jars and corers. Sediment sample jars were precleaned using the same methods employed for water quality samples. The jars were then filled with deionized water and capped. Table B.1 lists the types of sediment samples collected, the containers used, the preservation techniques, and amount of sample collected.

20. Sediment samples for granulometry were collected by inserting two coring tubes (3.18 cm inside diameter, 15.0 cm length) into the sediment to a depth of 10 cm, scooping sediment away from the sides

TABLE B.1. SAMPLE TYPE, CONTAINER, PRESERVATION TECHNIQUES, AND SAMPLE SIZE FOR WATER QUALITY, SEDIMENT, AND TISSUE ANALYSES SAMPLES.

Sample Type	Container	Preservation	Sample Size
Water Quality			
Total Suspended Solids	3.8 l plastic	Cool to 4°C	3.8 l
Cd, Pb	0.5 l polyethylene	Cool to 4°C	0.5 l
Hg	0.5 l glass	Cool to 4°C	0.5 l
High Molecular Weight Hydrocarbons	2.0 l glass	Cool to 4°C	2.0 l
Pesticides and PCBs	2.0 l glass	Cool to 4°C	2.0 l
Sediments			
Granulometry	0.25 l polyethylene	Cool	250 g
Cd, Pb	0.12 l glass	Freeze	200 g
Hg	0.12 l glass	Freeze	200 g
High Molecular Weight Hydrocarbons	0.5 l glass	Freeze	1000 g
Pesticides and PCBs	0.5 l glass	Freeze	1000 g
Oil and Grease, TOC	0.5 l glass	Freeze	1000 g
Meiofauna	0.5 l glass	Buffered formalin	120 cm^3
Macroinfauna	1.0 l polyethylene	Buffered formalin	Varied
Tissue			
Cd, Pb, Hg	Plastic bags	Freeze	>100 g
High Molecular Weight Hydrocarbons	Aluminum foil	Freeze	>100 g
Pesticides and PCBs	Aluminum foil	Freeze	>30 g

of the tubes, carefully inserting rubber stoppers in the lower end of the coring tubes, inserting rubber stoppers in the upper end of the coring tubes, and then placing both capped tubes inside a ziploc bag. The remainder of the sediment samples were collected by gently scooping sediment into the predesignated containers which were then capped. The granulometry samples were stored on ice following collection. The rest of the sediment samples were transferred to larger precleaned jars upon reaching the surface, labeled, and frozen.

Benthic faunal samples

21. Two meiofaunal samples were collected at each station by divers using coring tubes (3.18 cm inside diameter, 20.0 cm length). Each corer was inserted 15 cm into the sediment. Sediment was then removed from around the base of the corer, rubber stoppers were inserted into first the bottom and then the top of the corer, and the corer and stoppers were placed into a large ziploc bag. Meiofaunal samples were narcotized in magnesium sulfate solution for 20 to 30 min after collection, preserved with buffered formalin in individually labeled jars, and stored at ambient temperature.

22. Five replicate macroinfaunal samples were obtained by divers at each station using stainless steel hand corers (12.5 cm x 12.5 cm x 15.0 cm high). The corers were inserted 15 cm into the sediment, then one side of the buried corer was exposed by digging away the sediment. The diver slipped a hand under the mouth of the corer to cover it, and the corer was lifted out of the sediment, inverted, and placed along with the sediment sample in a cotton bag which was securely tied shut. The bags were placed in magnesium sulfate for 20 minutes to narcotize the infaunal samples and the samples were then gently sieved on a 0.5 mm mesh sieve. All material not passing through the sieve was transferred to labeled containers and preserved with a rose bengal stained 10% buffered formalin solution.

23. Macroepifauna were collected using a 3-m beam trawl at two stations within the potential site, one station upcurrent of the site, and one station downcurrent of the site (Figure B.4). Two replicate tows of approximately 10-min duration at two knots were made at each station. Each trawl sample was brought aboard ship and weighed in a previously tared noncontaminating mesh bag on a calibrated balance.

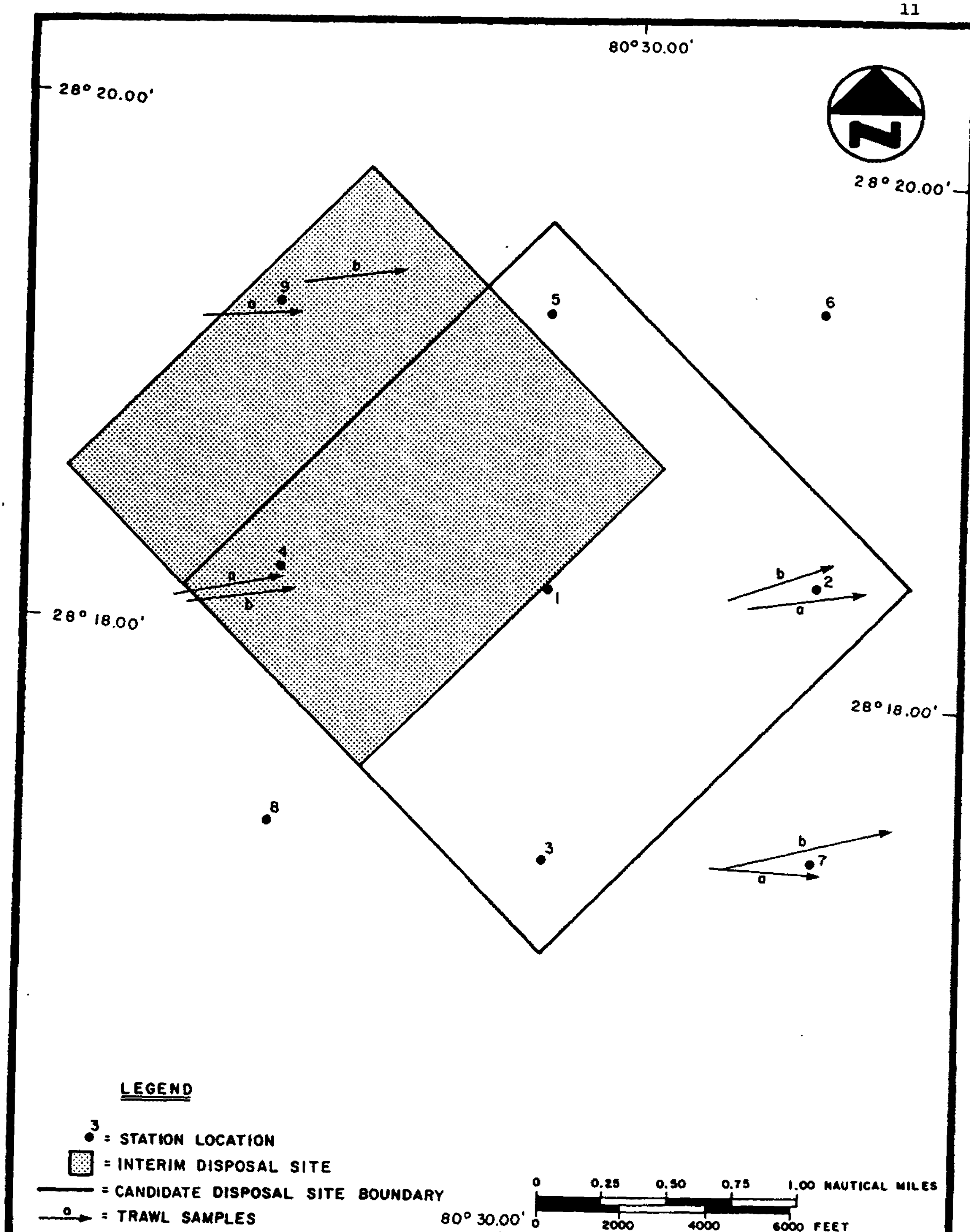


FIGURE B.4. TRAWL SAMPLE LOCATIONS AT THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

24. Organisms were then selected for tissue analyses for trace metals, high molecular weight hydrocarbons, and chlorinated pesticides and PCBs. Both a fish and a shellfish species were selected from the trawl samples at each station for tissue analyses. Specimens for trace metal analyses were removed from the trawl sample with precleaned, nonmetallic forceps and placed in separate ziploc plastic bags. Each bag was then placed into another plastic bag containing an identifying label and the samples were frozen. Fish and shellfish specimens for chlorinated pesticides and PCBs analyses were removed from the trawl sample with hexane-washed, stainless steel forceps and each set of specimens was then wrapped tightly in hexane-cleaned heavy duty aluminum foil, labeled, and frozen. Fish and shellfish specimens for analyses were field processed in the same manner as the high molecular weight hydrocarbon samples.

25. Following the removal of specimens for tissue analyses the remainder of the trawl sample was rough sorted. Specimens were preserved in buffered 10% formalin in labeled containers and stored at ambient temperature.

Bathymetric Data Analyses

26. Bathymetric profile data were transferred from the fathometer chart paper to bench sheets, and tide tables (NOAA, 1986) were used to determine the actual water depth relative to mean low water (MLW). The corrected water depths were plotted along the bathymetric survey transects and contours were drawn at 1-ft intervals.

Video Data Analyses

27. Due to conditions of high turbidity at the candidate Canaveral Harbor ODMDS no video data were collected or analyzed.

Hydrographic Data Analyses

28. Water column profile data were recorded in data logs in the field and transferred to bench sheets upon return to the laboratory.

Corrections were applied to the data sets to account for instrument drift recorded during post calibrations. The corrected data were utilized to prepare vertical water column profiles for the various parameters.

Water Quality Data Analyses

Total suspended solids

29. A known volume of water sample was filtered through a pre-weighed, 0.4-um pore size, 47-mm diameter polycarbonate filter. The filters were rinsed with deionized water to remove salts, vacuum dried, placed in a drying oven at 60°C for 24 hours, and then placed in a desiccator. Filters were weighed on a six-place balance and returned to the desiccator. Each filter was weighed on three successive days and the three weights were then averaged.

Trace metals

30. Cadmium and lead concentrations were determined by use of atomic absorption spectrophotometry (AAS) heated graphite furnace. Prior to analysis, the Cd and Pb had to be concentrated by extraction chelation due to their dissolved concentrations in seawater. This concentration method is presented in the U.S. EPA Methods for Chemical Analysis of Water and Wastes (1976) and is summarized by Pequegnat et al. (1981). The sample was then analyzed by AAS heated graphite furnace.

31. Levels of mercury in seawater samples were determined by cold vapor AAS. Bromide-bromate digestion procedures (Farey et al., 1978) were used to convert organically bound Hg to inorganic Hg. After the digestion process, the samples were analyzed using the EPA-approved cold vapor AAS method (U.S. EPA, 1976).

High molecular weight hydrocarbons

32. High molecular weight hydrocarbons were extracted from water by liquid-liquid partition. Extraction and concentration methodologies are explained in U.S. EPA (1977). Silica-alumina column chromatography was used to separate fractions and the extracts were analyzed using glass capillary gas chromatography with a flame ionization detector.

Chlorinated pesticides and PCBs

33. The water samples were extracted with two volumes of methylene chloride, dried with sodium sulfate, and concentrated over steam and under nitrogen. PCBs were separated from pesticides using a silicic acid column chromatographic separation detailed in the U.S. EPA Manual of Analytical Methods for the Analysis of Pesticide Residues in Human and Environmental Samples (U.S. EPA, 1977). Electron capture gas-liquid chromatography was used for chlorinated pesticides and PCBs analysis. Chlorinated pesticide levels were quantified by comparison to an EPA-type pesticide mixture. PCB quantities were determined by comparison to results of analyses of a known weight for Arochlor ^{R} 1254.

Sediment Sample Analyses

Granulometry

34. Grain size analyses were performed using methods outlined in Pequegnat et al. (1981). Sand fractions were separated from silt and clay fractions by wet sieving samples through a series of standard sieves. The percent of the total sample by weight retained on each sieve was recorded. The hydrometer method (Smith and Atkinson, 1975) was then utilized to determine silt and clay fractions.

Trace metals

35. Eighty percent of the sediment samples were treated by seawater elutriation and the remaining 20% by 0.1 N HCl partial extraction. Seawater elutriation liquid phase preparation is described in U.S. EPA/COE (1977) and the HCl partial extraction is outlined in Pequegnat et al. (1981). The sample aliquots to be analyzed for Cd and Pb were preserved by adding concentrated HNO_3 to a pH of less than 2.0. The Hg sample aliquots were preserved with the addition of a 1% aqueous solution of $KMnO_4$ and adjustment of pH to less than 2.0. The Cd and Pb samples were analyzed by AAS using a flameless graphite tube furnace attachment. The Hg samples were analyzed by the cold vapor AAS method given in U.S. EPA (1976).

High molecular weight hydrocarbons

36. Measurements of high molecular weight hydrocarbons in sediment samples (250 g) were made using the methods outlined by

Pequegnat et al. (1981). Following extraction of the aliphatics and aromatics by silica-alumina column chromatography, the fractions were analyzed by glass capillary gas chromatography with a flame ionization detector.

Chlorinated pesticides and PCBs

37. Chlorinated pesticides and PCBs were extracted from partially dried sediments (100 g) using methods described by U.S. EPA (1977) and Pequegnat et al. (1981). Separation of the chlorinated pesticides and PCBs was by silicic acid column chromatography and analyses were by electron capture gas-liquid chromatography.

Oil and Grease

38. Sediment oil and grease concentrations were determined by adding acid to a weighed sample, adding $MgSO_4 \cdot H_2O$ to remove water, grinding the sediment in a mortar, and extracting the oil and grease. Procedures followed those described in the EPA sediment analysis manual (U.S. EPA, 1969).

Total Organic Carbon

39. Sediment total organic carbon was determined using the dry combustion method which utilizes a high temperature induction furnace (Allison et al., 1965). The sediment sample was air dried and then ground with a mortar and pestle to pass through 100-mesh screen. A known weight of the sample was then combusted at a programmed rate of 300° to 650°C in 10 min and at 650°C for an additional 20 min. The CO_2 was trapped in ascarite and weight recorded as organic carbon. The organic carbon concentration (C_o) of the sample (in mg/g) was calculated as follows:

$$C_o = \frac{(X_o)\ (12/44)}{(g)}$$

where

X_o = weight of CO_2 evolved at 650°C, in mg

g = weight of sample combusted, in g

Benthic Faunal Samples Analyses

Meiofaunal sample analyses

40. Upon arrival at the laboratory, meiofaunal samples were washed through nested 500 um and 63 um sieves. The portion remaining on the 500 um sieve was discarded. The portion remaining on the 63 um sieve was washed thoroughly to remove as much sediment as possible. The samples contained very little sediment after washing. The 63 um samples were washed into a beaker, and water was added to bring the volume to a suitable level for subsampling (between 175 to 325 ml). The total sample was then stirred and aliquoted using a pipette. Several aliquots were taken to achieve a total subsample volume equal to 10% of the sample volume.

41. Aliquots were placed in a gridded counting dish and only nematodes and harpacticoid copepods were counted. These taxa were also removed and vouchered in labeled and stoppered vials. All counts were then extrapolated to represent total numbers expected in the sample volume. These numbers as well as the total sample volume and the total aliquot volume were then recorded on standard data entry sheets and entered into the computer data base.

Macroinfaunal sample analyses

42. Macroinfaunal samples were sieved on a 0.5 mm mesh screen for removal of fine particles before sorting. The organisms were sorted by major taxonomic group, (i.e., Annelida, Arthropoda, Mollusca, Echinodermata, and miscellaneous phyla) and then identified to species level. Meiofaunal groups (e.g., nematodes, copepods, etc.) retained on the 0.5 mm sieve were not sorted. Unidentifiable immature or damaged animals were taken to the lowest practical identification level (LPIL). A representative of each species identified was placed in a voucher collection designated for the respective survey sites. Wet weight biomass determinations were made of the major taxonomic groups by replicate. Samples were blot-dried and weighed to the nearest 0.1 mg on a Mettler AC100. The data were then recorded on standard data entry sheets and incorporated into the computer data base.

Macroepifaunal identifications

43. Macroepifaunal samples were returned to the laboratory, sorted, and then identified to the lowest practical taxonomic level. These data were then recorded on bench sheets and entered into the computer data base. Specimens retained for tissue analyses, which were listed in the survey logs, were also incorporated into the data base.

Tissue Sample Analyses

Trace metals

44. Specimens for tissue analyses for cadmium, lead, and mercury were thawed in a laminar flow clean hood and processed according to animal type. Only the edible tail section of shrimp was utilized following deheading, deveining, and removal of the exoskeleton. Fish were rinsed with deionized water, the skin laid back, and axial muscle tissue removed.

45. Tissue samples for the analysis of Cd and Pb were digested using a nitric acid reflux described by Pequegnat et al. (1981). The samples were then analyzed by flameless AAS.

46. Tissue samples for Hg analysis were digested separately from the other metal samples using methods described by Velghe et al. (1978) and summarized in Pequegnat et al. (1981). Analysis of the digestate for Hg was by the cold vapor method of AAS.

High molecular weight hydrocarbons

47. Approximately 100 g of tissue from the specimens was homogenized using the complete organism. Hydrocarbons were extracted using methods adapted from Smith et al. (1977) and described by Pequegnat et al. (1981). Silica-alumina column chromatography was performed on the extracts to separate fractions. The extracts were then analyzed using glass capillary gas chromatography with a flame ionization detector.

Chlorinated pesticides and PCBs

48. Tissue samples to be analyzed for chlorinated pesticides and PCBs were thawed in a laminar flow clean hood. A minimum of 10 g of

edible tissue was dissected from the animals and prepared as described by U.S. EPA (1977). Chlorinated pesticides and PCBs were recovered by silicic acid column chromatography. Analyses of the extracts was by electron capture detector gas-liquid chromatography, described in U.S. EPA (1977) and Pequegnat et al. (1981).

Data Analyses

Water

49. Hydrographic data (temperature, salinity, transmissivity, and dissolved oxygen concentration) at each station were reported on raw data sheets. Salinity data were corrected based on post calculations to correct for drift in the instrumentation. The data were plotted as vertical profiles for each of the nine stations.

50. Data film from the current meter was transmitted to the manufacturer for interpretation. Upon receipt of the printout of the current meter data, the data were summarized by frequency of current speed and direction. A current rose plot was generated from the summarized data.

51. Correlations among the chemical parameters measured from water samples were calculated using Pearson's product moment correlation (Steele and Torrie, 1960). The concentrations of many of the chemical parameters were below the limits of detection; hence, in such cases, the concentrations of these parameters were included in the correlation analysis as zero.

Sediment

52. Sediment grain size data were reported as the percentage of total weight of the sample which was finer than individual grain size categories. The grain size categories were: (1) 4.75 mm, (2) 2.00 mm, (3) 0.850 mm, (4) 0.425 mm, (5) 0.250 mm, (6) 0.150 mm, (7) 0.075 mm, (8) 0.062 mm, (9) 0.004 mm, and (10) 0.001 mm. Cumulative weight percentage curves were plotted on probability paper. Mean grain size, sorting coefficient, skewness, and kurtosis values were then calculated for each sample using the formulas presented by Pequegnat et al. (1981). Ternary diagrams were also prepared based on the weight percentages of sand, silt, and clay in each sample.

53. Principal components analysis (PCA), a statistical ordination technique, was used to order the stations with respect to the grain size distribution at the stations. Ordination consists of numerically positioning a set of samples (e.g., stations) into a space defined by measured characteristics of the samples, (e.g., weight percentages in different phi grain size categories). The locations of the samples in the space are determined by the magnitude of the characteristics for the respective samples. The axes of the ordination space are then numerically rotated to account for the maximum variance within the data set in the fewest possible dimensions. The first axis accounts for the greatest portion of the variability; the second axis is orthogonal to the first and accounts for the second greatest portion of the variability. The remaining axes account for progressively less variability and are mutually orthogonal to the previous axes. Each sample can be located in the space defined by the rotated axes as a linear combination of the original variates. After the ordination was performed, the stations were plotted in the plane defined by the first two principal components.

54. Correlation among the chemical parameters measured from sediment samples were calculated using Pearson's product moment correlation. The concentrations of many of the chemical parameters were below the limits of detection. In such cases, the concentrations of these parameters were included in the correlation analysis as zero.

Benthic fauna

55. Standardized abundances of nematodes and harpacticoid copepods were calculated for the meiofauna samples collected at the nine infaunal sampling sites. The harpacticoid to nematode ratio (Pequegnat et al., 1981) was calculated using these data. The relationships between the ratio and (1) the average of the mean phi of the sediment sample replicates, and (2) the average percentage of fine material in the sediment samples was examined using Spearman's Rho (Conover, 1971).

56. Standardized abundances of macroinfaunal taxa were calculated for the five replicate samples collected at each of the nine sampling sites. The Shannon-Wiener Diversity Index, Pielou's Evenness Index, and Margalef's Species Richness Index were determined for each station.

57. Clustering analysis was used to classify stations based on their macroinfaunal species composition (normal mode analysis) and to classify species based on their abundances at the stations (inverse mode analysis). A hierarchical agglomerative technique using the Bray-Curtis similarity index was used. Results of the analyses were presented as dendrograms. In the dendrogram for the normal analysis, the more similar stations were in terms of their infaunal species composition, the more closely these stations were grouped in the dendrogram. Species which were similar in terms of their abundances at stations were more closely grouped in the inverse mode dendrogram.

58. Correspondence analysis was used to ordinate the macroinfaunal stations based on their particular species composition. Correspondence analysis differs from PCA in that chi-square distances are used to determine the distances between pairs of stations. Use of this distance measure insures that the ordination is not dependent on the statistical distributions of the species among the stations, which sometimes affects other ordinations methodologies. Relationships among the stations based on their composition of infaunal samples were examined from the reduced space defined by the axes of correspondence.

Tissue

59. Concentrations of chemical parameters in the tissue of fish and crustacean specimens collected at four stations were reported. Correlations among these chemical parameters measured from sediment samples were calculated using Pearson's product moment correlation. The concentrations of many of the chemical parameters were below the limits of detection. In such cases, the concentrations of these parameters were included in the correlation analysis as zero.

Quality Control

Shipboard quality control

60. The survey Chief Scientist was responsible for ensuring the quality of the data and samples collected during the survey. His responsibilities included keeping a log detailing the breakdown of each field day, supervising the collection of hydrographic profile data, checking data recording logs, and ensuring that correct sample collection and preservation techniques were followed. A quality control notebook containing detailed descriptions of standard operating procedures for

collecting, handling, and preserving each type of data or sample was kept aboard the survey vessel and was available to all personnel. Manufacturers' operating manuals for all survey instrumentation were also included in the notebook.

61. All sample containers were precleaned as described in a previous section before being taken into the field. Sample collection information was recorded in data logs immediately following the processing and preservation of each sample. This information included sample type, time, date, location, preservation technique, and any additional comments. At the conclusion of each survey day, newly collected samples were checked against the daily data logs, sample custody sheets were filled out, and samples were stored pending delivery to the laboratory.

Laboratory quality control

62. Following completion of the survey, all raw field data were returned to the office for reduction. Data forms were photocopied and then transmitted to the proper individuals for data reduction.

63. Water quality, sediment, tissue, meiofaunal, and macroinfaunal samples were delivered to the propor laboratories immediately following survey completion. Sample custody sheets accompanied each set of samples to the laboratory. Upon arrival, the samples were checked against the custody sheets, which were then signed, photocopied, and returned to the Project Manager.

64. Analytical laboratory quality control was maintained in accordance with the program outlined in the Handbook for Analytical Quality Control in Water and Wastewater Laboratories (U.S. EPA, 1979) and the Association of Analytical Chemists' (AOAC) Quality Assurance Principles for Analytical Laboratories (AOAC, 1984). With each set of samples, the following quality control procedures were implemented:

1) reagent blanks were run;
2) standards were run to determine if the reagents and instruments were in control;
3) 10% of all samples were spiked with standards to obtain accuracy data;

4) duplicate analyses were made on 10% of all samples to obtain precision data; and
5) a minimum of one audit sample was analyzed.

65. A computerized system was utilized for calculating and updating precision and accuracy data. This system allowed easy evaluation of control data by the Chief Chemist or the Laboratory Director.

66. Quality control for meiofaunal and macroinfaunal analyses included resorting a minimum of 5% of all the samples sorted per person during each quality control period. If the number of animals left behind after the first sort was equal to 5% or more of the number of animals found in the entire sample, a quality control failure would be logged, and another sample (in addition to the mandatory 5%) worked by that sorter would be checked. If this was also a failure then all the samples previously sorted by that person would be resorted.

67. Quality control at the identification and enumeration levels of sample processing relied upon the following:

1) preparation of voucher material for each species identified;
2) preparation of consistency card files for each species identified;
3) in-house verification of identifications during sample processing;
4) in-house examination of sample data sheets for questionable identifications and enumeration of data;
5) in-house support for scientific research and publications;
6) close communication with recognized outside experts, including verification of identifications; and
7) constant update of taxonomic libraries.

In addition, at the Laboratory Manager's discretion, up to 10% of the samples worked by a given taxonomist would be reidentified if consistency, identifications, and/or enumeration problems were thought to exist. If quality control failures were found, all samples worked by that taxonomist since the last quality control check would be reidentified.

SECTION C: RESULTS AND DISCUSSION

Video and Bathymetry Data

Candidate Canaveral Harbor ODMDS Video Survey

68. An underwater video survey of the candidate Canaveral Harbor ODMDS was attempted on 2 July 1985. Water turbidity limited visibility to less than 1 ft which prevented collection of underwater video data. The site was reoccupied on 27-28 September and 2-4 October 1985, and underwater visibility had declined further with no apparent light penetration greater than approximately 30-35 ft depth. The high turbidity levels observed at the site may be predominantly due to resuspension of silt and clay particles from the interim disposal site immediately to the northwest of the candidate Canaveral Harbor ODMDS (see Figure C.1). Because of these conditions, underwater video data were not collected from the candidate Canaveral Harbor disposal site.

Candidate Canaveral Harbor ODMDS Bathymetry

69. Bathymetry data from the Canaveral Harbor candidate site show depths within the site ranging from 47 ft (14.3 m) to 55 ft (16.8 m) (Figure C.2). Water depths of 55 ft (16.8 m) were observed along the survey transects at the southern edge of the site. Depth generally decreased from southeast to northwest with the shallowest areas found in the vicinity of Station 9, to the northwest of the candidate site. A small rise occurred in this area with water depths of 44 ft (13.4 m). This rise was most likely the result of previous disposal of dredged material at the interim disposal site.

Hydrographic Conditions

Introduction

70. Hydrographic measurements for temperature, salinity, dissolved oxygen, and transmissivity were collected on 2 and 3 October 1985 during the baseline survey. Vertical profiles of these data are shown in Figures C.3 through C.11 for Stations 1 through 9, respectively. Stations were sampled in the following sequence: 9-1300 h; 5-1410 h; 6-1515 h; 2-1600 h; 1-1645 h EDT on 2 October, and 4-0945 h; 8-1045 h; 3-1145 h; 7-1235 h EDT on 3 October. Knowledge of sampling order is

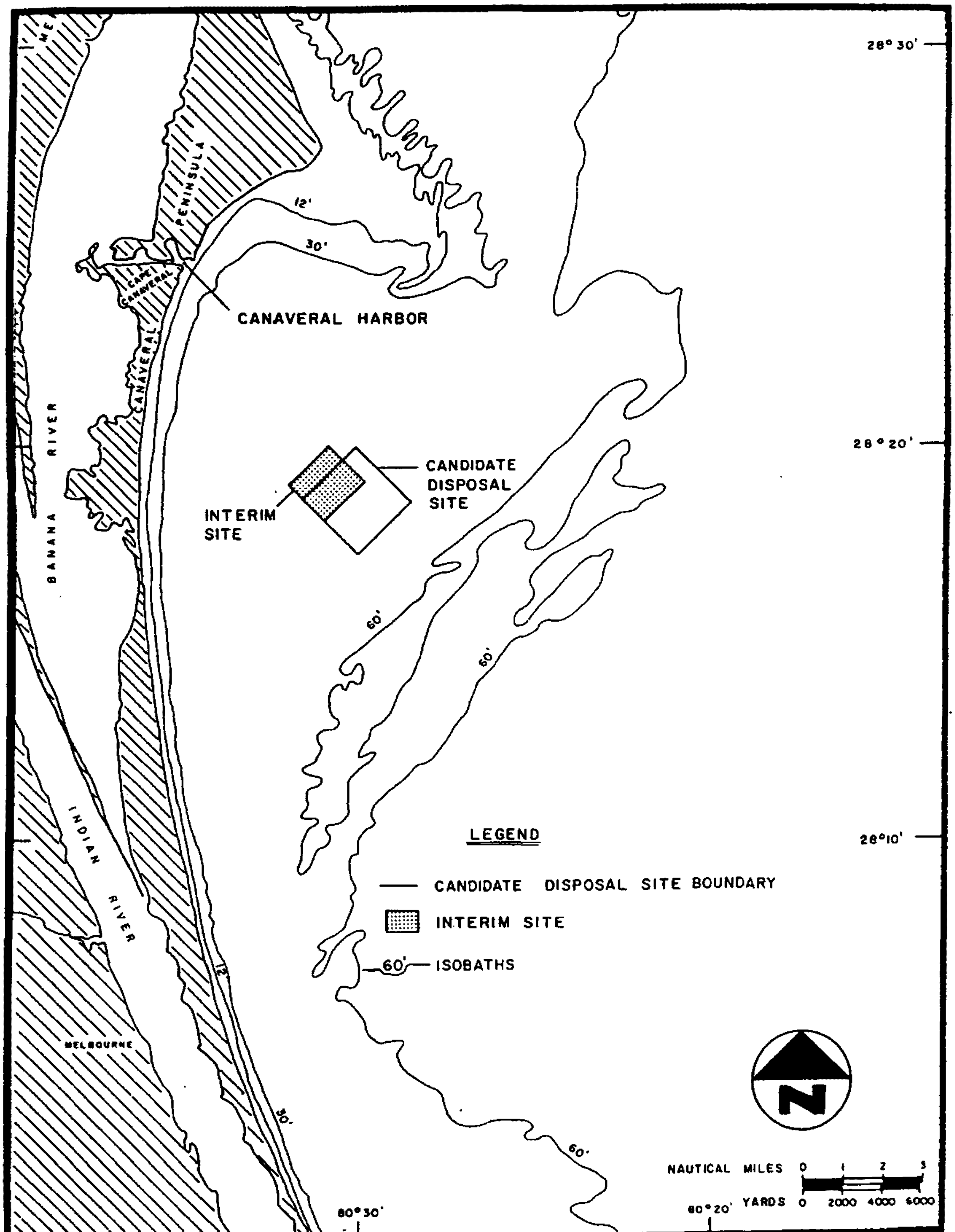


FIGURE C.1. LOCATION OF THE TENTATIVE CANAVERAL HARBOR DISPOSAL SITE RELATIVE TO CANAVERAL HARBOR.

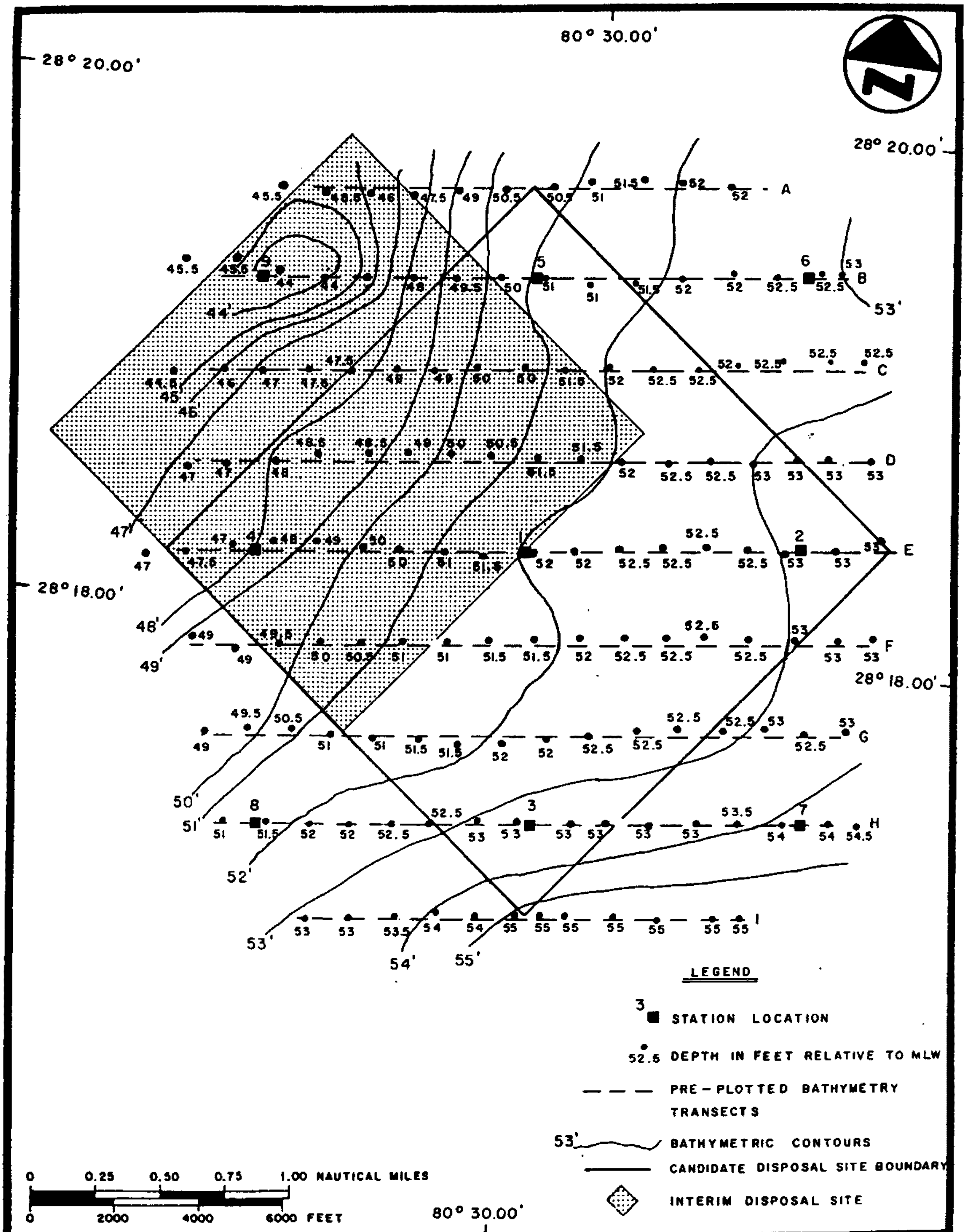


FIGURE C.2. BATHYMETRY OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

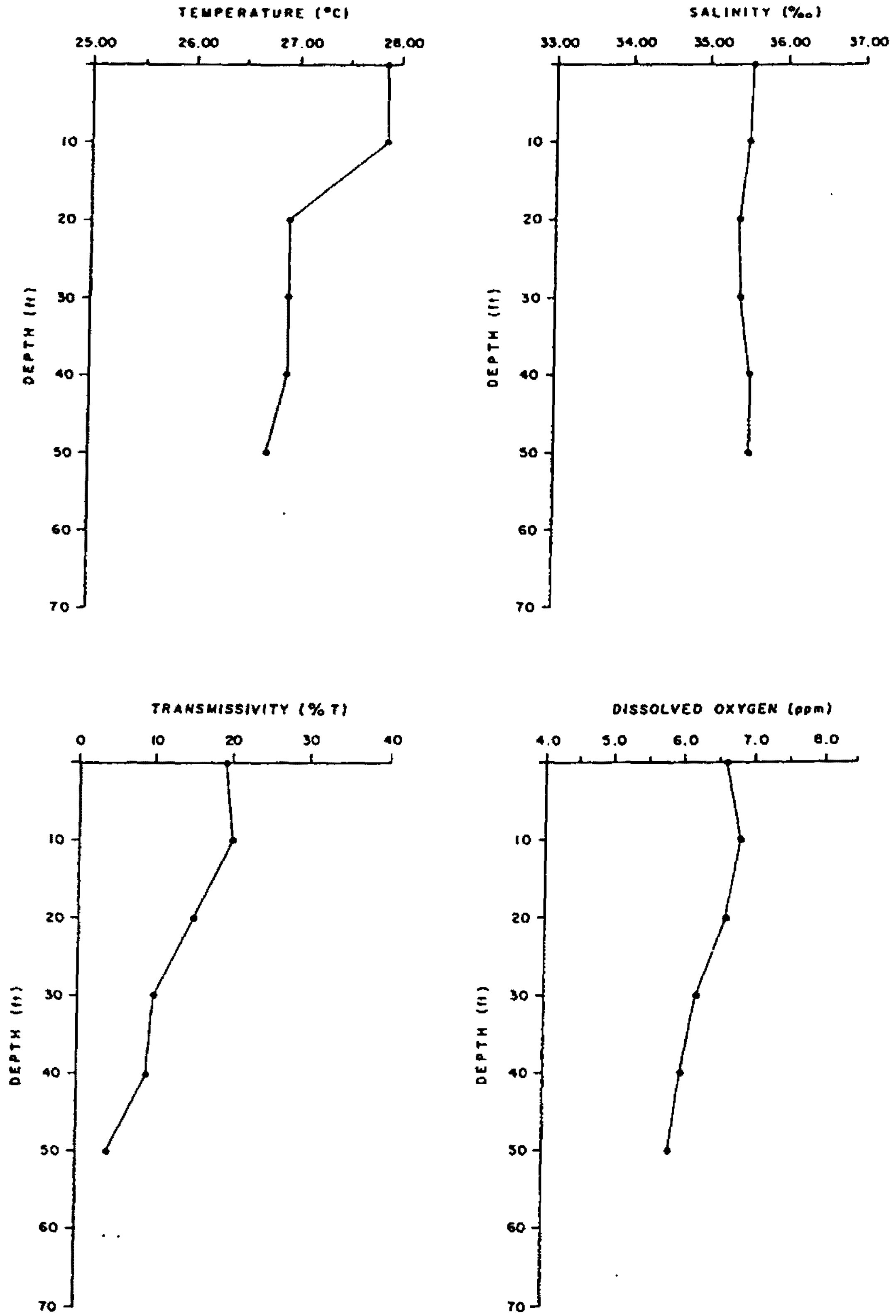


FIGURE C.3. HYDROGRAPHIC MEASUREMENTS AT STATION 1 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

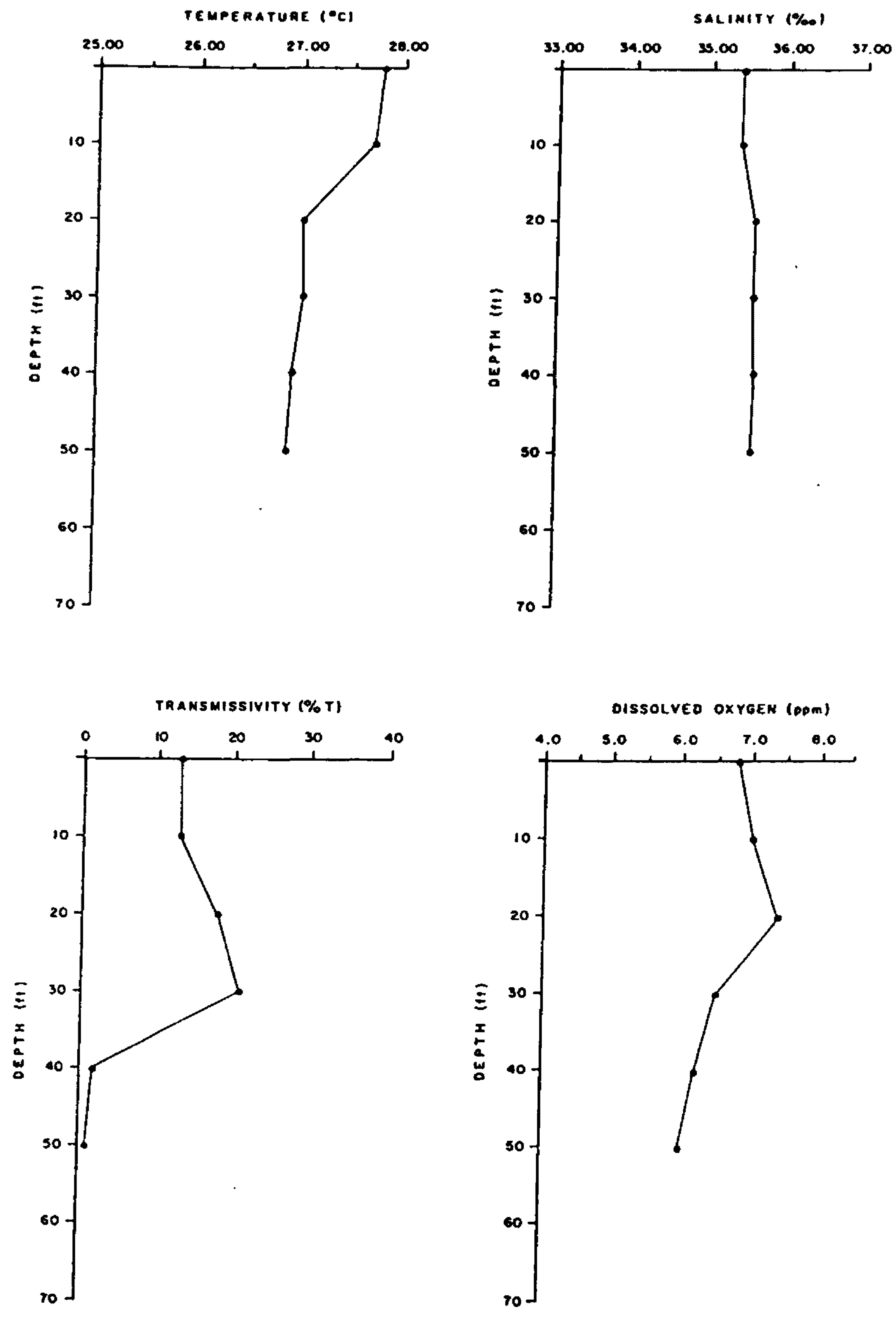


FIGURE C.4. HYDROGRAPHIC MEASUREMENTS AT STATION 2 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

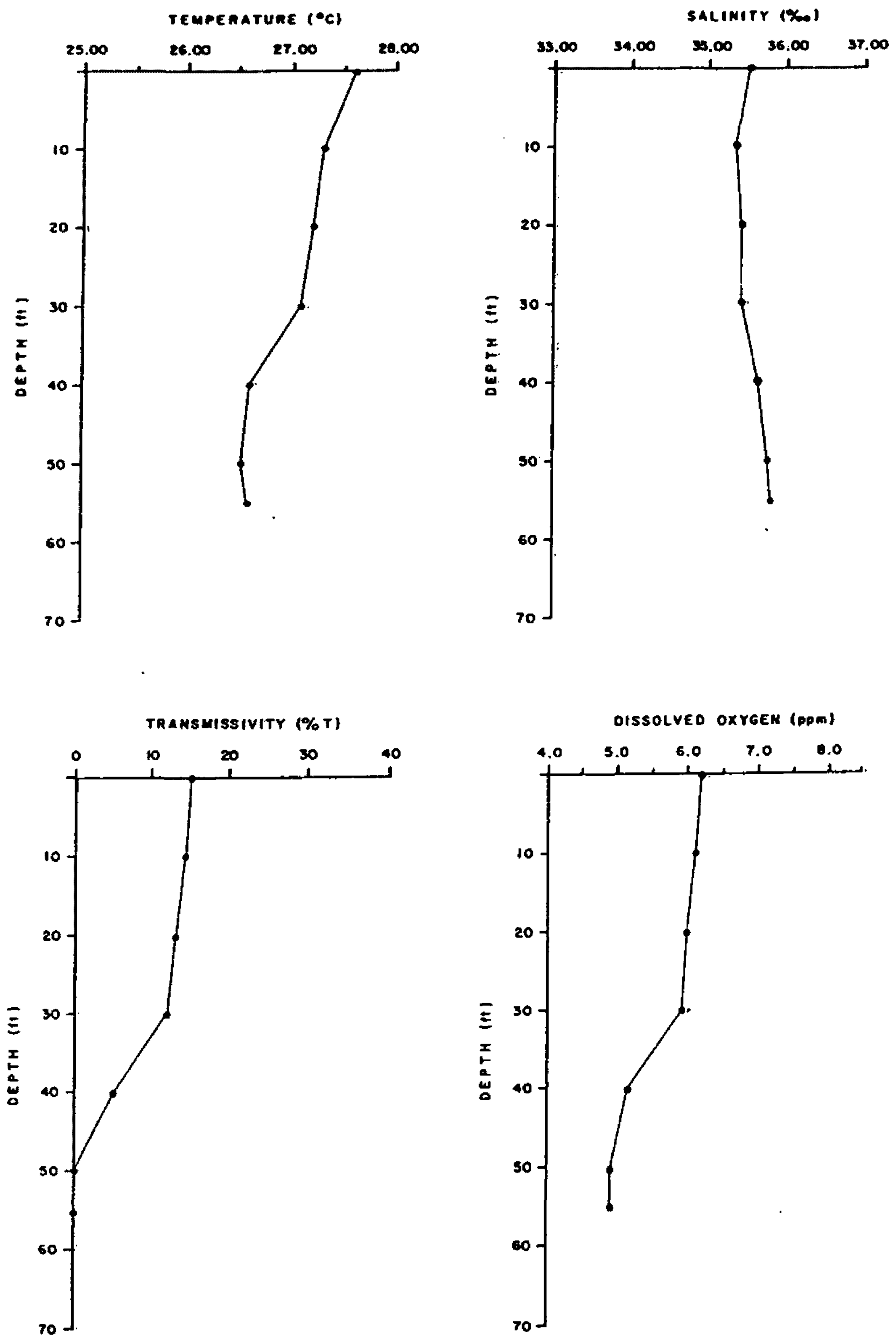


FIGURE C.5. HYDROGRAPHIC MEASUREMENTS AT STATION 3 OF THE CANDIDATE CANAVERAL DISPOSAL SITE.

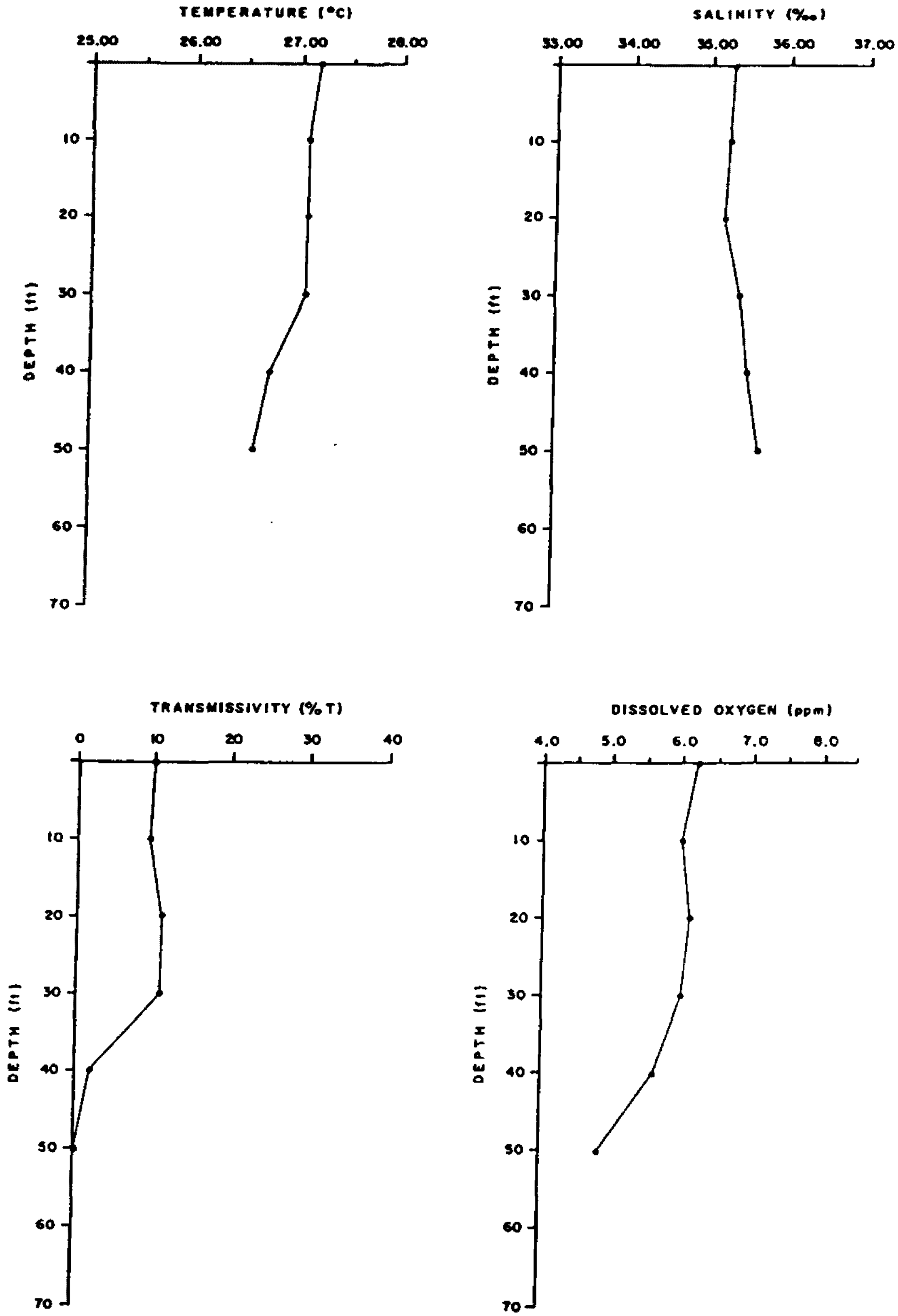


FIGURE C.6. HYDROGRAPHIC MEASUREMENTS AT STATION 4 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

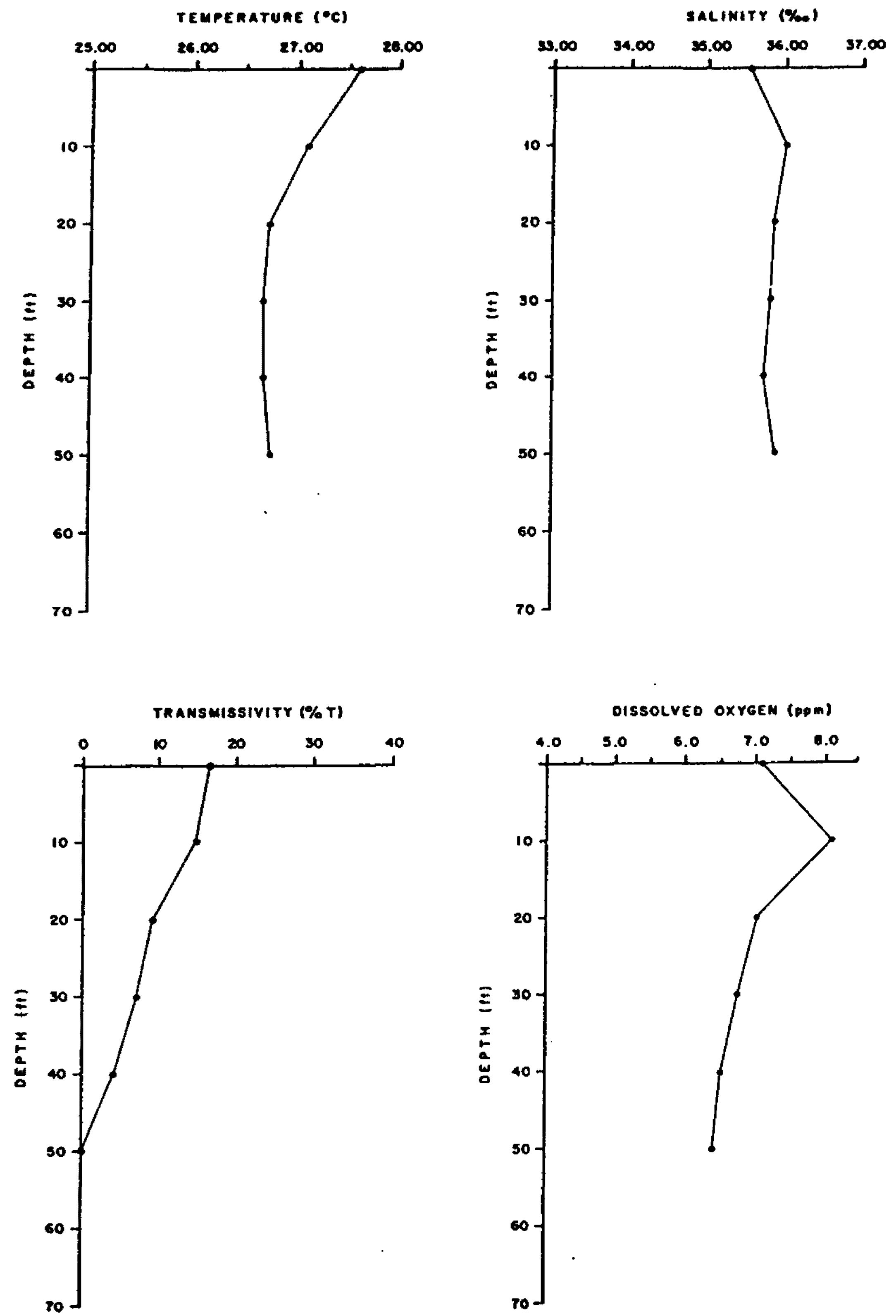


FIGURE C.7. HYDROGRAPHIC MEASUREMENTS AT STATION 5 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

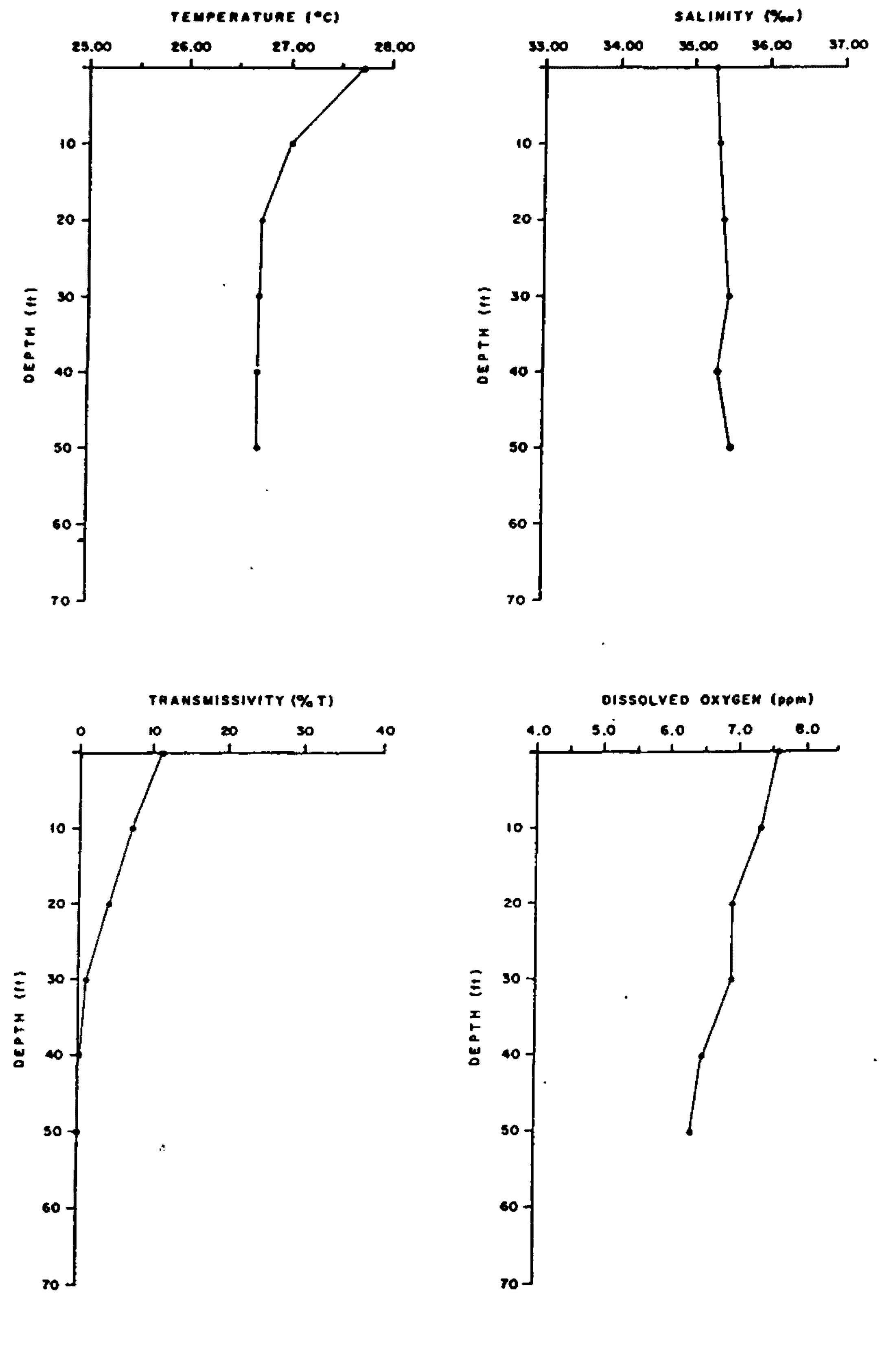


FIGURE C.8. HYDROGRAPHIC MEASUREMENTS AT STATION 6 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

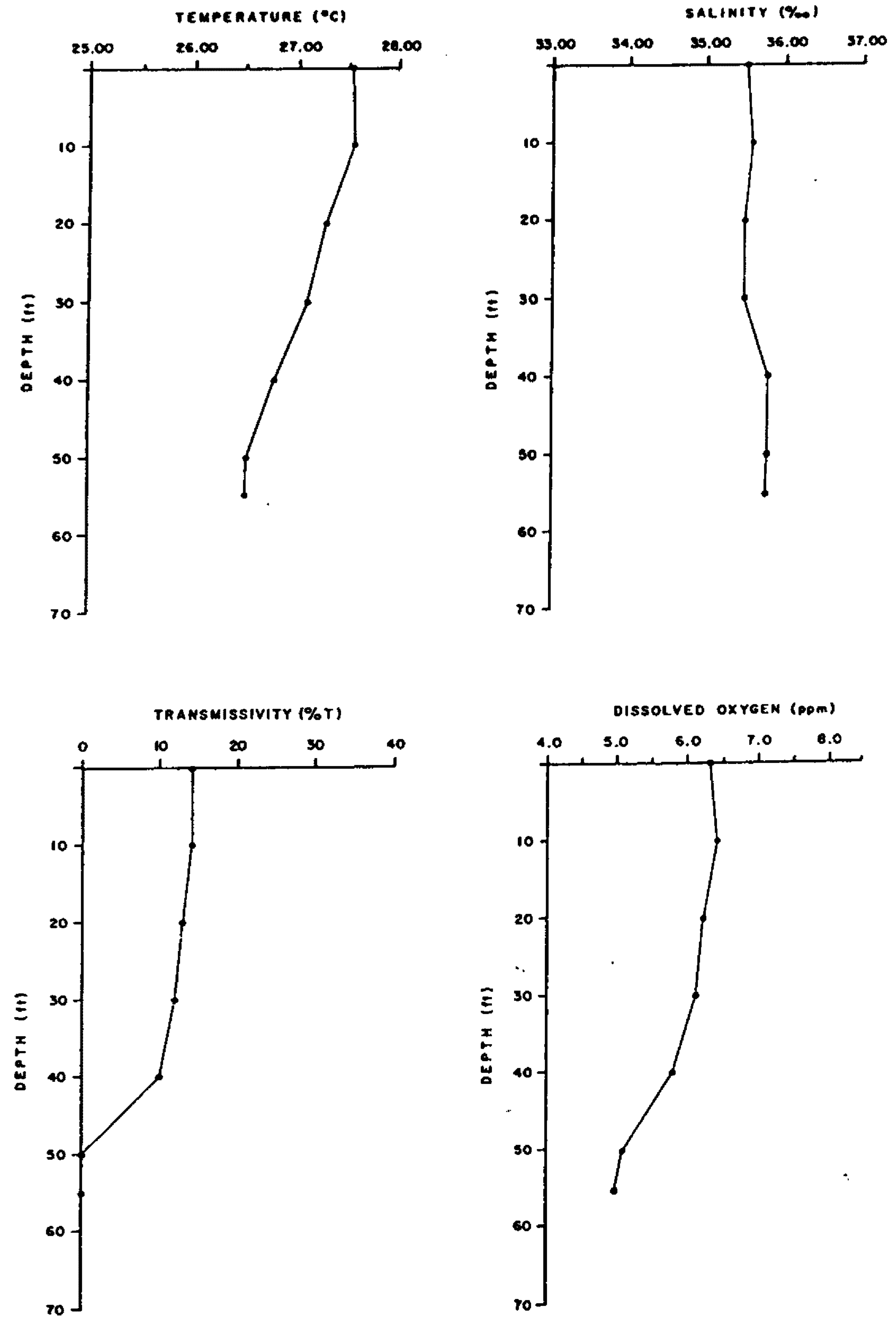


FIGURE C.9. HYDROGRAPHIC MEASUREMENTS AT STATION 7 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

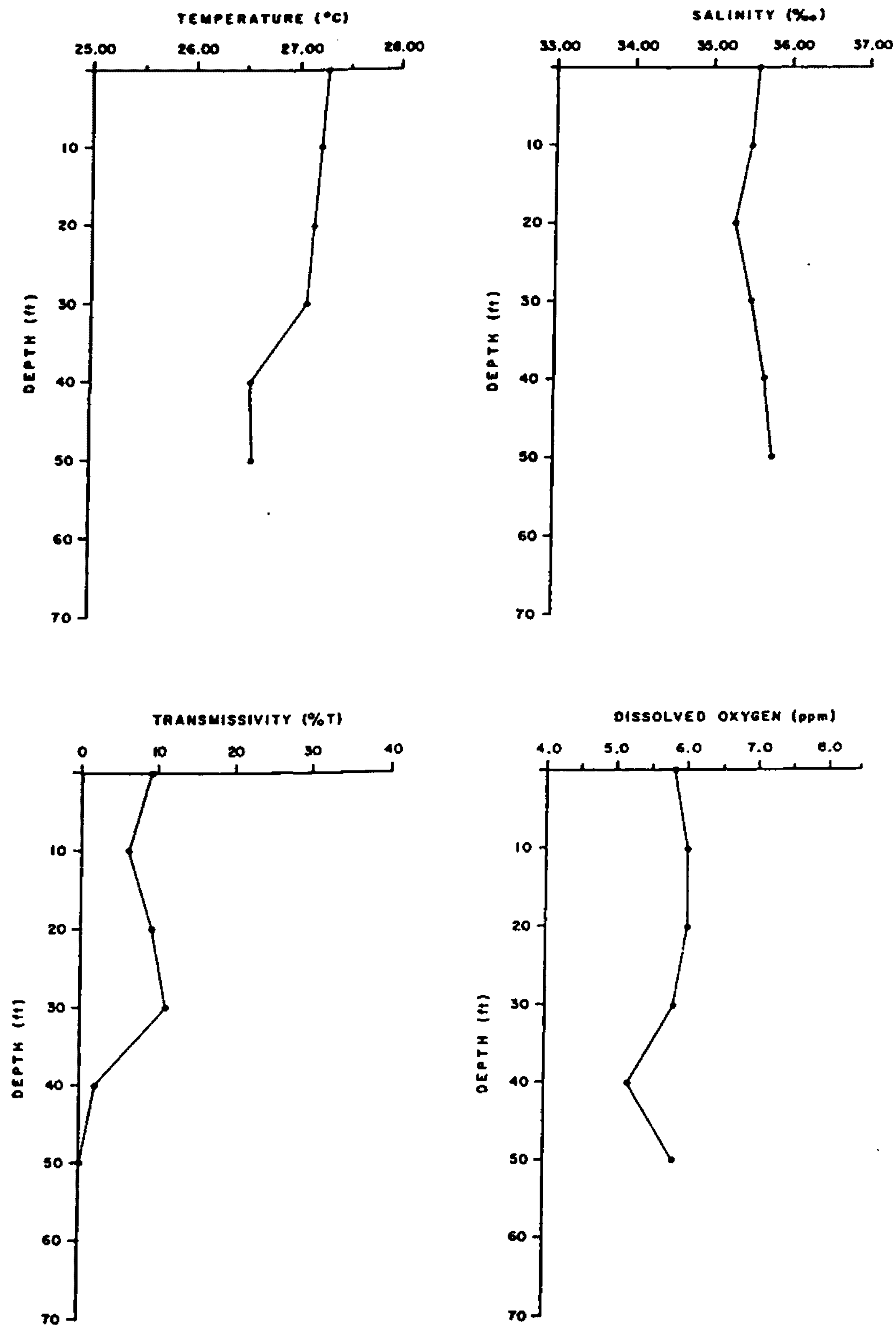


FIGURE C.10. HYDROGRAPHIC MEASUREMENTS AT STATION 8 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

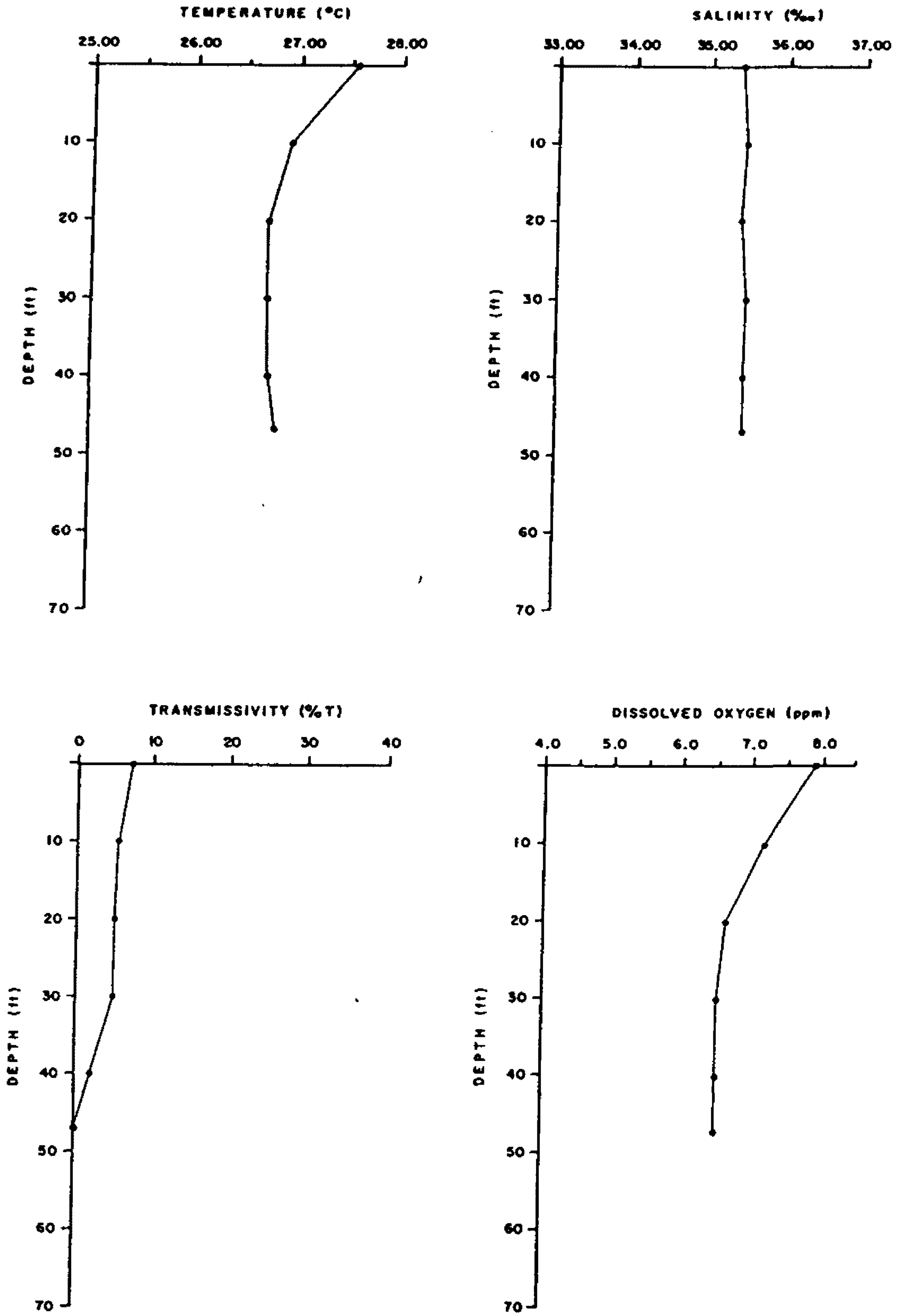


FIGURE C.11. HYDROGRAPHIC MEASUREMENTS AT STATION 9 OF THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

deemed important since temporal variations can be greater than spatial variation in nearshore waters.

71. A recording of near-bottom current speed and direction was obtained to document conditions existing at the candidate site and to aid in data interpretation. The current rose shown in Figure C.12 depicts percentages of speed and direction at the site during the period of 28 September through 4 October 1985.

Temperature

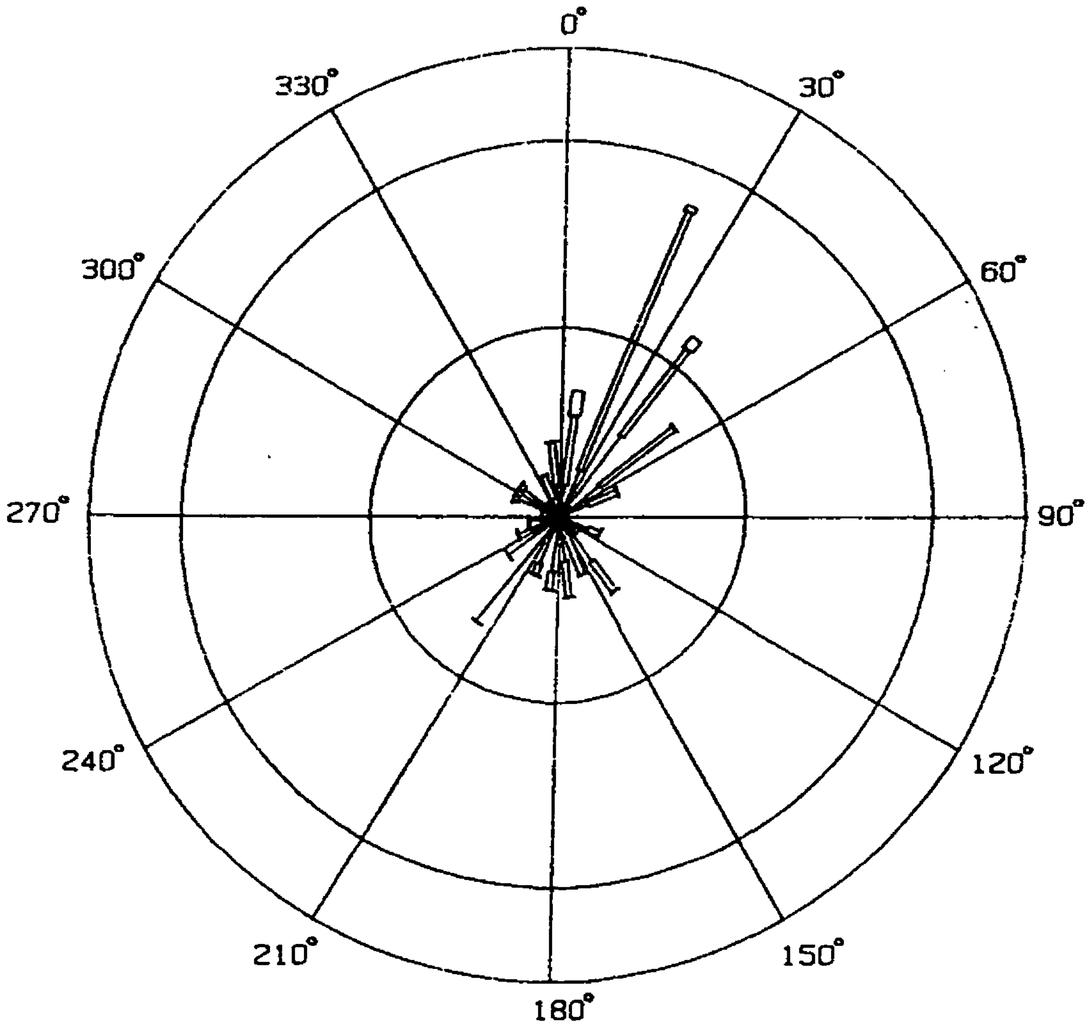
72. A temperature differential of only 1.3°C in the water column revealed that temperature structure is relatively isothermal at the candidate site. Surface temperature ranged from a low of 27.2°C at Station 4 to a high of 27.8°C at Stations 1 and 2. Station 4 was occupied at 0945 h in the morning and Stations 2 and 1 were sampled at 1600 and 1645 h, respectively, in the afternoon. These data show the effect of the upper layer diurnal temperature cycle on surface water temperature. Near-bottom temperatures were relatively constant, ranging from 26.5° to 26.8°C, at depths of 47 to 55 ft.

Salinity

73. Salinities within the water column at the candidate site ranged from 35.2 to 36.0 ppt with the majority being near 35.5 ppt (i.e.± 0.2 ppt). Station 5 revealed the maximum at a depth of 10 ft whereas the minimum occurred at Station 5's 20 ft reading. The homogeneity of salinities within the water column indicates that the site is not readily influenced by estuarine waters.

Transmissivity

74. Water at the site was visibly turbid with underwater visibility being less than 1 ft (CSA, 1985b). Transmissivity in near surface waters ranged between 7 and 19%. All stations had zero transmissivity in near-bottom waters except Station 1 (31%) and Station 2 (1%). Transmissivity exceeded 20% (i.e., 21%) only at Station 2's 30 ft measurement.



PERIOD: 28 SEP TO 4 OCT 1985

DATA SET: CANAVERAL

VALID READINGS: 100.0%

CURRENT SPEED ($cm\ s^{-1}$)

0–10
10–20
>20

SCALE 10%

FIGURE C.12. SUMMARY OF NEAR-BOTTOM CURRENT MEASUREMENTS TAKEN AT THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

Dissolved Oxygen

75. Dissolved oxygen concentrations within the water column ranged from 4.8 to 8.1 ppm at the candidate site. Oxygen maxima were always located in the upper 20 ft of the column and minima were present in depths from 40 ft to the bottom. Values for dissolved oxygen measured during the baseline survey are within the range reported by Mathews and Pashuk (1982).

Current Measurements

76. Near-bottom currents at the candidate site flowed predominantly in a north, northeast-south, southwest direction and generally followed the topography of the seafloor (see Figure C.2). Approximately 45% of the currents moved within the 0°-60° arc whereas 26% headed to the 150°-240° arc. Current speeds ranged from about 0 to >20 cm/s with 11.8% being in the range of 0-5 cm/s, 41.4% in the range of 6-10 cm/s, 29.6% in the range of 11-15 cm/s, 14.8% in the range of 16-20 cm/s, and 2.4% in the range of 21-25 cm/s. These speeds and the general net movement agree with CSA (1985a) who reported historical net movement alongshore at normal speeds of approximately 0.1 to 0.4 kn with occasional speeds up to 1.0 kn.

Water Quality Samples

Total Suspended Solids

77. Results of the total suspended solids analyses of near-bottom water were as follows (in mg/l): 19, 20, 26, 24, 23, 29, 32, 16, and 14 for Stations 1 through 9, respectively. These values are intermittent to those reported by Horne (1969) for oceanic water (i.e., 0.8-2.5 mg/l) and for rivers and estuaries which commonly exceed hundreds of milligrams per liter; however, the data agree very well with values reported by CSA (1986) for the coastal waters off Fernandina Harbor, Florida.

Trace Metals

78. Near-bottom water was collected at Stations 1, 2, 3, 4, 5, and 7 for mercury, cadmium, and lead analyses. Except for lead at

Stations 2, 3, and 4, trace metals were below the limit of detection. Lead values at the stations were also very near the limit of detection (see Table C.1 for results of trace metal analyses).

High Molecular Weight Hydrocarbons

79. Samples for high molecular weight hydrocarbons were collected from near-bottom water at Stations 1 through 5, and 7. Analyses of these samples showed that all parameters were below the limits of detection (Table C.2).

Chlorinated Pesticides and PCBs

80. Analyses of water samples for pesticides and PCBs yielded results that were also below the limits of detection. Values for these parameters are shown in Table C.3.

Sediment Samples

Granulometry

81. The Canaveral Project Area contains the sedimental transition zone between calcareous sands of the south and the quartzose sands of north Florida. Inner continental shelf sediments to the north have been described by Meisburger and Field (1975) as one of the most common lithologies off north Florida. It consists of a fine to medium, moderately well to well-sorted, quartz sand that contains only small amounts of calcareous material and displays little variation in textural and compositional characteristics. At Cape Canaveral, it becomes increasingly enriched in biogenic constituents and grades into medium to coarse, quartzose-calcareous sand. Field and Duane (1974) describe Canaveral sediment as a fine to coarse, moderately well sorted sand composed of nearly equal parts of terrigenous and biogenic material. Sediment patchiness is noted in transitional areas even though grain size is relatively uniform. Surficial sediment data obtained from the candidate Canaveral disposal site agree with the aforementioned observations.

82. Grain size analyses performed on sediments collected during the field survey revealed a sand-sized texture (Figure C.13) at all stations. Five stations were predominated by fine-grained sand, three

TABLE C.1. ANALYSES OF NEAR-BOTTOM WATER QUALITY TRACE METAL SAMPLES FROM THE CANDIDATE SITE.

Parameter	Station					
	1	2	3	4	5	7
Mercury, mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Cadmium, mg/l	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lead, mg/l	<0.0005	0.0005	0.0005	0.0006	<0.0005	<0.0005

TABLE C.2. ANALYSES OF NEAR-BOTTOM WATER QUALITY HIGH MOLECULAR WEIGHT HYDROCARBON SAMPLES FROM THE CANDIDATE SITE.

Parameter	Station 1	2	3	4	5	7
Wet weight of sample extracted	1500 ml	1500 ml	1500 ml	1500 ml	1500 ml	1500ml
Weight of extractables, mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Aliphatics and aromatics, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Resolved hydrocarbons, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Unresolved hydrocarbons, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Sum of n-alkanes, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Sum of even n-alkanes, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Sum of odd n-alkanes, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Unresolved hydrocarbons/ resolved hydrocarbons	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:odd n-alkanes/even n-alkanes	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:phythane/n-c18	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:n-alkanes/branched Hydrocarbons	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:pristane/n-c17	N/A	N/A	N/A	N/A	N/A	N/A

N/A - Not applicable, Ratio cannot be calculated.

TABLE C.3. ANALYSES OF NEAR-BOTTOM WATER QUALITY PESTICIDE AND PCB SAMPLES FROM THE CANDIDATE SITE.

Parameter	Station					
	1	2	3	4	5	7
Alpha-BHC, mg/l	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Gamma-BHC, mg/l	<0.000006	<0.000006	<0.000006	<0.000006	<0.000006	<0.000006
Heptachlor, mg/l	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Beta-BHC, mg/l	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Aldrin, mg/l	<0.000009	<0.000009	<0.000009	<0.000009	<0.000009	<0.000009
Heptachlor Epoxide, mg/l	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
4,4'-DDE, mg/l	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
o.p'-DDD, mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
o.p'-DDT, mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chlordane, mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin, mg/l	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003
Endrin, mg/l	<0.00006	<0.00006	<0.00006	<0.00006	<0.00006	<0.00006
4,4'-DDD, mg/l	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
4,4;-DDT, mg/l	<0.00006	<0.00006	<0.00006	<0.00006	<0.00006	<0.00006
Total PCBs as Archlor 1254, mg/l	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004

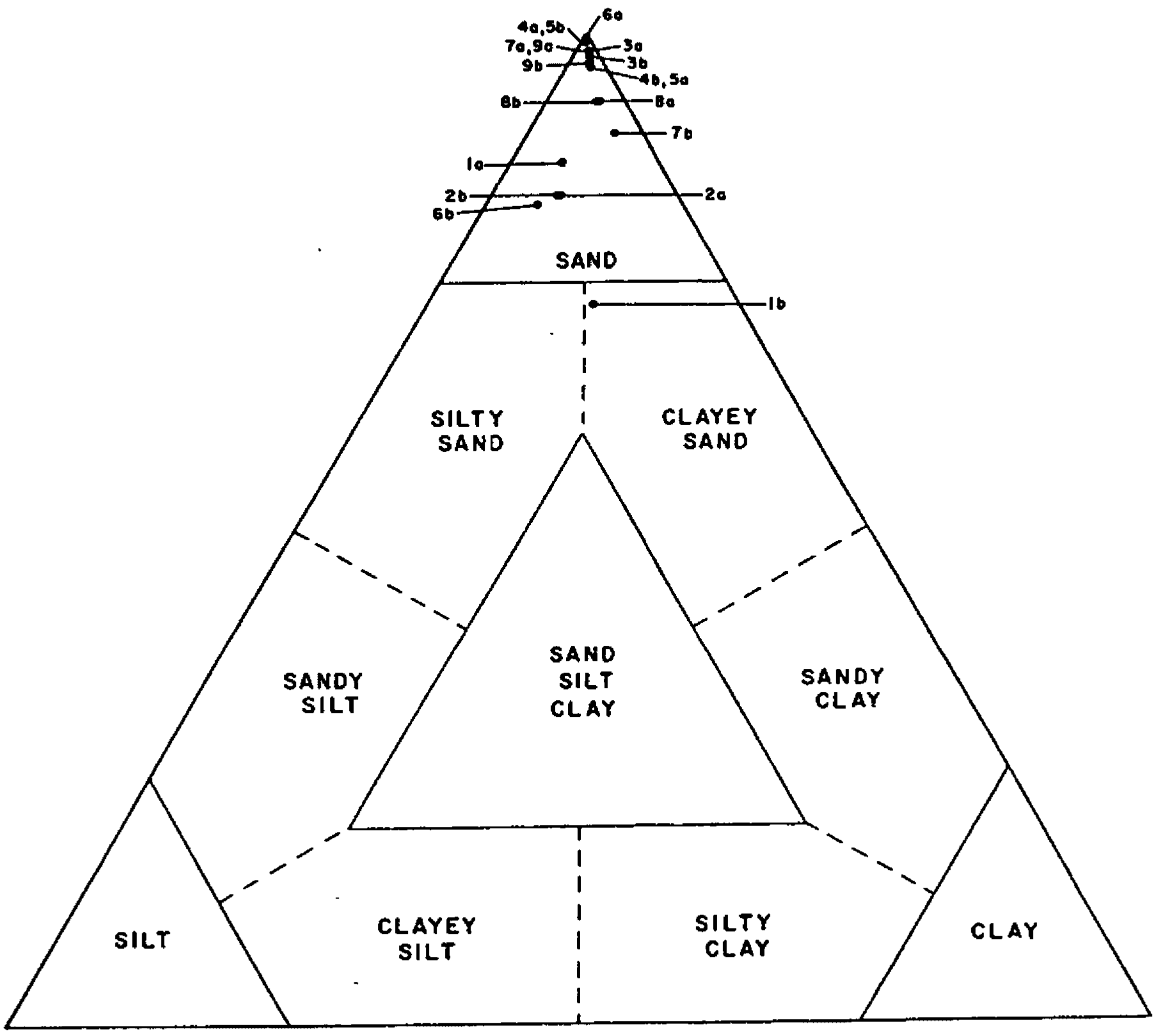


FIGURE C.13. TERNARY DIAGRAM FOR SEDIMENT SAMPLES FROM THE CANDIDATE CANAVERAL HARBOR DISPOSAL SITE.

stations were basically medium-grained sand, and the remaining station revealed a somewhat homogenous mixture of fine-and-medium-grained sand (see Table C.4 - a generalized listing of textural analyses results). Coarser grained sediments appeared in a shoreward direction. Only Stations 1 and 2 revealed significant quantities of fine material (i.e., >10% silt-clay fraction) and Station 3 had the highest percentage of coarse sand and gravel (see Table C.5). Information concerning mean sorting coefficient, skewness, and kurtosis of sediments from the grain size samples is listed in Table C.6.

83. Relationships among the nine stations with respect to the grain size distribution of the sediments, as investigated using principal components analysis, are presented in Figure C.14. The purpose of this analysis is to ordinate the stations based on their respective grain size distributions. The grain size distribution of each station was defined by the weight percentage in 11 phi size categories.

84. The first two principal components accounted for over 85% of the total variability in the grain size data set. The first component accounted for about 58% of the total variability. Because the first two principal components accounted for such a large portion of the total variability, a relatively strong gradient existed among the nine stations. If these principal components had accounted for a smaller portion of the variability, the analysis would have indicated a relatively more homogeneous distribution of grain size. The gradient of grain size distribution appeared related to neither the location of station nor the depth of the stations.

Trace Metals

85. Few trace metal values are reported in the literature for surficial sediments in the Canaveral Project Area. Kouadio (1984) analyzed sediments approximately 2 mi offshore the Port Canaveral jetty and found low concentrations of trace metals (i.e., mercury - 5 ppb, lead 13 ppm, cadmium - <0.1 ppm) when extracted by complete dissolution. These low values were attributed to the sandy, shell-hash nature of the sediment which contained a low percentage of the silt/clay fraction. Since trace metals are positively correlated with the silt/clay content of the sediment, the low percentage of such fine material in sediments at the candidate site (see Table C.5) probably accounts for the low values of the metals shown in Tables C.7 and C.8. Only the cadmium content at Station 2 and the mercury content at Station 9 were above detection

TABLE C.4. GRAIN SIZE PERCENT COMPOSITION OF SEDIMENT SAMPLES FROM THE CANAVERAL CANDIDATE SITE.

Station/ Replicate	Gravel	Sand			Silt	Clay
		Coarse	Medium	Fine		
1a	3	10	14	60.0	8.7	4.3
1b	0	5	5	63.0	13.0	14.0
2a	0	5	14	65.0	10.1	5.9
2b	0	8	17	59.0	10.3	5.7
3a	4	12	74	8.8	0.4	0.8
3b	2	11	50	34.975	0.675	1.35
4a	0	9	73	17.475	0.175	0.35
4b	1	12	62	21.85	1.05	2.1
5a	0	2	13	81.85	1.05	2.1
5b	2	10	29	58.475	0.175	0.35
6a	0	15	29	55.85	0.05	0.1
6b	0	1	19	63.0	12.8	4.2
7a	0	3	21	74.425	0.525	1.05
7b	0	8	20	62.0	2.4	7.6
8a	0	1	46	46.3	2.5	4.2
8b	0	2	30	61.3	2.7	4.0
9a	0	3	74	21.425	0.525	1.05
9b	0	0	73	24.6	0.8	1.6

TABLE C.5. PERCENTAGE FINER FROM THE GRAIN SIZE ANALYSES OF SEDIMENT SAMPLES COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Station	Replicate	Grain Size Category (mm) 4.75	2.00	0.850	0.425	0.250	0.150	0.075	0.062	0.004	0.001
1	a	97	96	87	84	73	62.0	23.0	13.0	4.3	2.1
	b	100	97	95	94	90	73.0	37.0	27.0	14.0	8.7
2	a	100	100	95	92	81	72.0	20.0	16.0	5.9	1.3
	b	100	100	92	86	75	64.0	17.0	16.0	5.7	1.0
3	a	96	93	84	29	10	2.0	1.6	<1.6	<1.6	<1.6
	b	98	92	87	69	37	4.8	2.7	<2.7	<2.7	<2.7
4	a	100	97	91	69	18	6.2	0.7	<0.7	<0.7	<0.7
	b	99	90	87	61	25	18.0	4.2	<4.2	<4.2	<4.2
5	a	100	100	98	97	85	76.0	4.2	<4.2	<4.2	<4.2
	b	98	95	88	82	59	11.0	0.7	<0.7	<0.7	<0.7
6	a	100	97	85	78	56	5.0	0.2	<0.2	<0.2	<0.2
	b	100	100	99	92	80	29.0	19.0	17.0	4.2	2.7
7	a	100	100	97	84	76	12.0	2.1	<2.1	<2.1	<2.1
	b	100	100	92	83	72	47.0	10.0	10.0	7.6	<1.0
8	a	100	100	99	89	53	27.0	7.2	6.7	4.2	<1.0
	b	100	100	98	92	68	43.0	9.7	6.7	4.0	<1.0
9	a	100	100	97	79	23	4.2	2.1	<2.1	<2.1	<2.1
	b	100	100	100	67	27	4.6	3.2	<3.2	<3.2	<3.2

TABLE C.6. MEAN, SORTING COEFFICIENT, SKEWNESS, AND KURTOSIS FOR THE GRAIN SIZE SAMPLES COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Station/ Replicate	Mean	Sorting Coefficient	Skewness	Kurtosis
1a	2.71	1.92	-0.13	1.87
1b	4.33	2.77	0.45	2.91
2a	3.00	1.75	0.03	2.95
2b	2.80	1.89	0.02	2.22
3a	0.94	0.99	-0.09	1.78
3b	1.48	1.13	-0.36	1.40
4a	1.41	0.87	-0.19	1.67
4b	1.56	1.39	0.00	1.70
5a	2.86	0.67	-0.39	1.66
5b	1.89	1.05	-0.45	1.79
6a	1.64	1.03	-0.60	1.40
6b	2.80	1.60	0.51	2.60
7a	2.06	0.78	-0.37	2.21
7b	2.42	1.89	0.04	2.46
8a	2.22	1.32	0.39	1.91
8b	2.51	1.33	0.20	1.90
9a	1.62	0.61	-0.02	1.37
9b	1.62	0.91	0.18	1.24

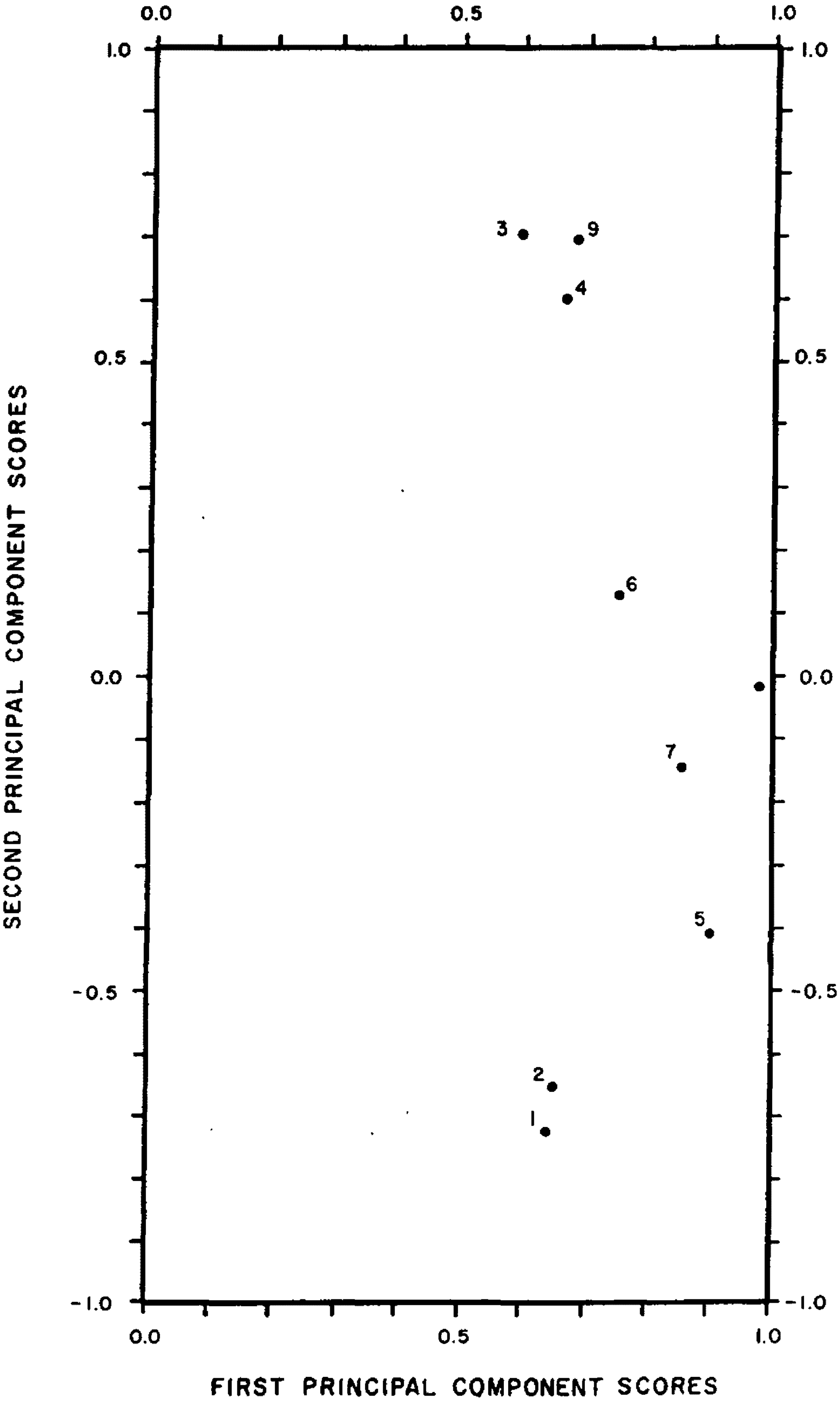


FIGURE C.14 . RESULTS OF THE PRINCIPLE COMPONENT ANALYSIS TO ORDINATE STATIONS BASED ON THEIR GRAIN SIZE DISTRIBUTIONS.

TABLE C.7. RESULTS OF TRACE METAL ANALYSIS (IN ELUTRIATE) OF SEDIMENTS FROM THE CANAVERAL CANDIDATE SITE.

Parameter	Station						
	1	2	3	5	6	8	9
Cadmium (mg/l)	<0.00005	<0.00008	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lead (mg/l)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Mercury (mg/l)	<0.0002	<0.0002	<0,0002	<0.0002	<0.0002	<0.0002	<0.0007

TABLE C.8. RESULTS OF TRACE METAL ANALYSIS (IN EXTRACTIONS) OF SEDIMENTS FROM THE CANAVERAL CANDIDATE SITE.

Parameter	Station	
	4	7
Cadmium (mg/kg)	0.036	0.075
Lead (mg/kg)	0.33	0.89
Mercury (mg/kg)	<0.03	<0.05

limits when subjected to seawater elutriate analysis. Values for cadmium and lead derived from partial extraction with weak acid are lower than those values reported by Kouadio (1984) and total extraction of mercury resulted in values below detection limits. In general, trace metals concentrations at the candidate site are comparable to those reported by Windom and Betzer (1979) for the nearshore shelf sediments off northeastern Florida, an area relatively free of trace metals.

High Molecular Weight Hydrocarbons

86. Values for high molecular weight hydrocarbons from sediment samples collected at the candidate site are indicative of a nonpolluted area. Data in Table C.9 show that only 22% of the samples had values above detection limits and these were very near the limit. Even those stations where samples contained the largest percentage of fines were essentially pristine with respect to hydrocarbon concentration.

Chlorinated Pesticides and PCBs

87. Pesticides and PCB constituents were not detected in sediments collected from the candidate site. Results of these analyses are shown in Table C.10 and are all below the limits of detection.

Oil and Grease and Total Organic Carbon

88. Oil and grease concentrations ranged from 12.0 to 200.0 mg/kg at Stations 1 and 5, respectively. Total organic carbon values ranged from 1400 mg/kg at Station 8 to 16000 mg/kg at Station 3. Table C.11 shows values for these trace contaminants at all candidate site stations.

Benthic Fauna

Meiofauna

89. Meiofauna are those organisms which live within the interstitial spaces between sediment grains. Typically, the criteria for differentiating this group of organisms from the larger macroinfauna is size, a meiofauna being between 0.5 and 0.062 mm in length. Because this component of the benthic assemblage is generally dominated by nematodes and harpacticoid copepods, Pequegnat et al. (1981) suggested that the harpacticoid copepod to nematode ratio be used to trace dredged material.

TABLE C.9. HIGH MOLECULAR WEIGHT HYDROCARBON DISTRIBUTION IN SEDIMENTS FROM THE CANAVERAL CANDIDATE SITE.

Parameter	Station 1	2	3	4	5	6	7	8	9
Wet weight of sample extracted	250 g	250 g	250 g	250 g	250 g	250 g	250 g	250 g	250 g
Dry weight of sample extracted	165 g	190 g	190 g	205 g	205 g	145 g	178 g	185 g	190 g
Percent dry weight of wet weight	66%	70%	76%	82%	82%	58%	72%	74%	76%
Weight of extractables, mg/kg	14	17	27	97	176	59	27	20	94
Aliphatics and aromatics, mg/kg	<0.1	<0.1	<0.1	<0.1	0.21	0.11	<0.1	<0.1	<0.1
Resolved hydrocarbons, mg/kg	<0.1	<0.1	<0.1	<0.1	0.24	0.11	<0.1	<0.1	<0.1
Unresolved hydrocarbons, mg/kg	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Sum of n-alkanes, mg/kg	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Sum of even n-alkanes, mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sum of odd n-alkanes, mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Unresolved hydrocarbons/ resolved hydrocarbons	N/A	N/A	N/A	N/A	0.41	N/A	N/A	N/A	N/A
Ratio:odd n-alkanes/even n-alkanes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:phythane/n-c18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:n-alkanes/branched hydrocarbons	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio:pristane/n-c17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE C.10. RESULTS OF PESTICIDE AND PCB ANALYSES OF SEDIMENTS FROM THE CANAVERAL CANDIDATE SITE.

Parameter	Station 1	2	3	4	5	6	7	8	9
Alpha-BHC, mg/kg	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00004	<0.00003	<0.00004
Gamma-BHC, mg/kg	<0.00005	<0.00005	<0.00004	<0.00004	<0.00005	<0.00005	<0.00004	<0.00004	<0.00004
Heptachlor, mg/kg	<0.00009	<0.00009	<0.00008	<0.00007	<0.00009	<0.00009	<0.00008	<0.00007	<0.00008
Beta-BHC, mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Aldrin, mg/kg	<0.00007	<0.00007	<0.00006	<0.00006	<0.00007	<0.00007	<0.00006	<0.00006	<0.00006
Heptachlor Epoxide, mg/kg	<0.0001	<0.0001	<0.00009	<0.00008	<0.0001	<0.0001	<0.00009	<0.00008	<0.00009
4,4'-DDE, mg/kg	<0.0002	<0.0002	<0.0002	<0.0001	<0.0002	<0.0002	<0.0002	<0.0001	<0.0002
o.p'-DDD, mg/kg	<0.0007	<0.0007	<0.0006	<0.0005	<0.0007	<0.0007	<0.0006	<0.0005	<0.0006
o.p'-DDT, mg/kg	<0.0009	<0.0009	<0.0007	<0.0006	<0.0009	<0.0009	<0.0007	<0.0006	<0.0007
Chlordane, mg/kg	<0.0008	<0.0008	<0.0007	<0.0006	<0.0008	<0.0008	<0.0007	<0.0006	<0.0007
Dieldrin, mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Endrin, mg/kg	<0.0005	<0.0005	<0.0004	<0.0004	<0.0005	<0.0005	<0.0004	<0.0004	<0.0004
4,4'-DDD, mg/kg	<0.0004	<0.0004	<0.0003	<0.0003	<0.0004	<0.0004	<0.0003	<0.0003	<0.0003
4,4'-DDT, mg/kg	<0.0004	<0.0004	<0.0004	<0.0003	<0.0004	<0.0004	<0.0004	<0.0003	<0.0004
Total PCBs as Archlor 1254, mg/kg	<0.003	<0.003	<0.002	<0.002	<0.003	<0.003	<0.002	<0.002	<0.002

TABLE C.11. OIL AND GREASE AND TOTAL ORGANIC CARBON CONCENTRATIONS IN SEDIMENTS FROM THE CANAVERAL CANDIDATE SITE.

Station	Oil and Grease (mg/kg)	Total Organic Carbon (mg/kg)
1	12	6600
2	21	11000
3	22	16000
4	140	3200
5	200	11000
6	32	3600
7	23	8700
8	25	1400
9	110	9300

The abundance of nematodes was thought by these authors to be regulated by the quantity of sand in the sediment--increasingly large populations of nematodes are found as sand percentages approach and exceed 60%. The abundance of harpacticoid copepods was thought to be regulated by the concentration of biologically available organic matter in the sediments (Pequegnat et al., 1981). Shifts in the ratio at individual stations are thought to reflect the nature of the environmental change commensurate with the disposal of dredged material.

90. Standardized abundances of the nematodes and harpacticoid copepods collected at the nine stations in the Canaveral site are presented in Table C.12. In addition, the harpacticoid copepod to nematode ratio for each of the two replicates collected at each station are presented. This ratio was highest at Station 1. Stations 3, 5, and 7 had higher values ($\geq$ 0.17) for one replicate and lower values for the other. Values at Station 4 were 0.10; values at the remaining stations were less.

Macroinfauna

91. Five replicate 0.016-m^2 cores were collected to sample the macroinfaunal assemblage at each of the nine Canaveral stations. Specimens collected in these core samples were identified to the lowest practical identification level (LPIL). Phyletic listings of the results of these taxonomic analyses are presented in Appendix B.

92. The compositions of the macroinfaunal samples were dominated by annelids (polychaetes and oligochaetes) and mollusks (bivalves and gastropods) in terms of abundance (Table C.13). Contributions of annelids to total abundance ranged from 33.3% at Stations 1 to 59.4% at Station 9. The contribution of mollusks ranged from 13.5% at Station 8 to 44.2% at Station 1. With the exception of Station 8, the contribution of arthropods (crustaceans) to the total abundance, did not exceed 14%. Contribution of echinoderms did not exceed 13% at any stations. Echinoderms were not collected at Stations 4, 8, and 9.

93. The abundances of mollusks and echinoderms were strongly related to depth ($r = 0.72$, $p<0.05$ and $r = 0.66$, $p<0.05$, respectively), increasing as the water depth increased. Although the abundances of annelids and arthropods were positively related to depth ($r = 0.57$ and $r = 0.61$, respectively), these correlations were not statistically significant. Higher abundances of annelids and mollusks were observed at

TABLE C.12. ABUNDANCES (INDIVIDUAL PER 10 cm^2) OF NEMATODES AND HARPACTICOID COPEPODS AND THE HARPACTICOID COPEPOD TO NEMATODE RATIO FOR THE MEIOFAUNAL SAMPLES AT THE CANAVERAL SITE.

Station/ Replicate	Mean Nematode Abundance	Mean Harpacticoid Copepod Abundance	Harpacticoid Copepod to Nematode Ratio
1a	543.1	209.7	0.39
b	482.5	98.5	0.20
2a	1407.0	80.8	0.06
b	808.4	37.9	0.05
3a	1626.8	98.5	0.06
b	338.5	87.2	0.26
4a	250.1	25.3	0.10
b	265.2	25.3	0.10
5a	778.0	505.2	0.36
b	276.6	0.0	0.00
6a	1352.7	87.2	0.06
b	1654.6	101.0	0.06
7a	1313.6	37.9	0.03
b	1376.7	227.4	0.17
8a	973.8	10.1	0.01
b	1061.0	0.0	0.00
9a	429.4	12.6	0.03
b	237.5	0.0	0.00

TABLE C.13. ABUNDANCE OF MAJOR TAXONOMIC GROUPS (PERCENT CONTRIBUTION TO TOTAL ABUNDANCE) IN INDIVIDUALS PER SQUARE METER AT THE CANAVERAL MACROINFAUNAL STATIONS.

	Taxon					
Station	Annelida	Mollusca	Arthropoda	Echinodermata	Other	Total
1	1062.4 (33.3)	1408.0 (44.2)	51.2 (1.6)	192.0 (6.0)	473.6 (14.9)	3187.2
2	1587.2 (36.7)	1740.8 (40.2)	89.6 (2.1)	563.2 (13.0)	345.6 (8.0)	4326.4
3	1843.2 (41.1)	1561.6 (34.9)	166.4 (3.7)	448.0 (10.0)	460.8 (10.3)	4480.0
4	230.4 (40.0)	230.4 (40.0)	76.8 (13.3)	0.0 (0.0)	38.4 (6.7)	576.0
5	1062.4 (49.7)	640.0 (29.9)	153.6 (7.2)	76.8 (3.6)	204.8 (9.6)	2137.6
6	1228.8 (45.9)	704.0 (26.3)	307.2 (11.5)	89.6 (3.3)	345.6 (12.9)	2675.2
7	3840.0 (52.3)	2022.4 (27.5)	243.2 (3.3)	934.4 (12.7)	307.2 (4.2)	7347.2
8	243.2 (36.5)	89.6 (13.5)	217.6 (32.7)	0.0 (0.0)	115.2 (17.3)	665.6
9	729.6 (59.4)	281.6 (22.9)	64.0 (5.2)	0.0 (0.0)	153.6 (12.5)	1228.8
Mean	1314.1 (44.4)	964.3 (32.6)	152.2 (5.1)	256.0 (8.7)	271.6 (9.2)	2958.2

offshore stations compared to inshore stations. Higher abundances of arthropods occurred at the three southernmost stations and at the stations located in the northeast corner of the study area (Station 6). Echinoderms were not collected at the three inshore stations.

94. Annelids and mollusks were generally the predominant contributors to the total number of taxa at each station (Table C.14). From 30.8% (Station 3) to 50.0% (Station 9) of the macroinfaunal taxa were comprised by annelids. Mollusks contributed from 19.4% at Station 8 to 38.6% at Station 5 of the total number of taxa at each station. With the exception of Stations 6 (20.4%) and 8 (38.7%), the contributions of arthropods were less than 20%. Contributions of echinoderms were less than 8% at all stations.

95. The numbers of molluscan and echinoderm taxa present at each station were correlated with the depth of the stations ($r = 0.73$, $p<0.05$ and $r = 0.73$, $p<0.05$, respectively). Positive, but non-statistically significant, correlations were also observed for the numbers of annelid and arthropod taxa ($r = 0.52$ and $r = 0.52$, respectively). The numbers of taxa in each of these four phyletic groups were generally higher at the offshore stations and generally higher toward the southeast corner of the study area.

96. Mean abundances and standard deviations of the taxa collected at each station are presented in order of decreasing abundance in Appendix C. The mean abundances of the 20 most abundant taxa are presented in Table C.15. Eight of these taxa are polychaetes (Annelida). Molluscan taxa were comprised by six pelecypod taxa and one gastropod taxa. Three of these taxa were echinoderms. The two remaining taxa belong to Rhyncocoela and Phoronida.

97. Over the entire study area, biomasses were dominated by echinoderms based on the mean of the nine stations; however, the contribution of echinoderms to the total biomass at particular stations was variable (Table C.16). Little or no echinoderm biomass was collected at four of the nine stations. At four of the remaining five stations, the contribution of echinoderms exceeded 50%. Annelids and mollusks contributed considerably to the biomass at each of the nine stations compared to arthropods. Contributions of annelids and mollusks were generally greater than 10% at the stations while, with the exception of Station 8, the contribution of arthopods was less than 3%.

TABLE C.14. NUMBER OF TAXA (PERCENT CONTRIBUTION OF TOTAL TAXA) COLLECTED AT THE CANAVERAL MACROINFAUNAL SAMPLING STATIONS.

	Taxon					
Station	Annelida	Mollusca	Arthropoda	Echonodermata	Other	Total
1	22 (44.9)	16 (32.7)	4 (8.2)	3 (6.1)	4 (8.2)	49
2	18 (36.7)	18 (36.7)	6 (12.2)	2 (4.1)	5 (10.2)	49
3	16 (30.8)	17 (32.7)	9 (17.3)	4 (7.7)	6 (11.5)	52
4	11 (42.3)	8 (30.8)	5 (19.2)	0 (0.0)	2 (7.7)	26
5	18 (40.9)	17 (38.6)	5 (11.4)	1 (2.3)	3 (6.8)	44
6	19 (35.2)	14 (25.9)	11 (20.4)	4 (7.4)	6 (11.1)	54
7	30 (42.9)	18 (25.7)	13 (18.6)	4 (5.7)	5 (7.1)	70
8	11 (35.5)	6 (19.4)	12 (38.7)	0 (0.0)	2 (6.5)	31
9	15 (50.0)	7 (23.3)	5 (16.7)	0 (0.0)	3 (10.0)	30

TABLE C.15. TWENTY MOST ABUNDANT MACROINFAUNAL TAXA (INDIVIDUAL PER SQUARE METER) COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Taxon	Station 1	2	3	4	5	6	7	8	9	All Stations
Tellina probrina	729.6	857.6	435.2			25.6	780.8			314.3
Magelona sp. H.	294.4	345.6	332.8	25.6	358.4	435.2	345.6		192.0	258.8
Prionospio sp. E.	89.6	332.8	537.6	12.8	38.4	115.2	896.0	25.6	12.8	229.0
Micropholis gracillina	128.0	435.2	294.4			12.8	665.6			170.7
Rhynchocoela (LPIL)	294.4	179.2	345.6	25.6	128.0	192.0	204.8	76.8	89.6	170.7
Lumbrineris verrilli	115.2	140.8	204.8		115.2	76.8	716.8		115.2	165.0
Mediomastus (LPIL)	128.0	217.6	128.0	38.4	102.4	102.4	358.4	76.8	115.2	140.8
Pelecypoda (LPIL)	89.6	166.4	153.6	76.8	140.8	179.2	179.2		12.8	110.9
Tellina (LPIL)		179.2	460.8	38.4	102.4	102.4	38.4			102.4
Lucinidae (LPIL)	128.0	64.0	128.0	38.4	166.4	102.4	51.2	25.6	166.4	96.7
Paraprionospio pinnata	51.2	102.4	204.8		51.2	89.6	204.8		64.0	85.3
Gastropoda (LPIL)	140.8	153.6	128.0	12.8	38.4	76.8	166.4		38.4	83.9
Aglaophamns verrilli	128.0	64.0	128.0	12.8	51.2	76.8	166.4	25.6	51.2	78.2
Phoronis (LPIL)	128.0	128.0	51.2		64.0	89.6	64.0		51.2	64.0
Ophiuroidea (LPIL)	51.2	168.0			76.8	51.2	89.6			44.1
Sigambra tentaculata	25.6	64.0	64.0		38.4	25.6	153.6		25.6	44.1
Harmothoe (LPIL)		89.6	51.2				192.0			37.0
Tellina versicolor						76.8	243.2			35.6
Amphiuridae (LPIL)			128.0			12.8	153.6			32.7
Semelidae (LPIL)	76.8	38.4	12.8		12.8		153.6			32.7

TABLE C.16. BIOMASS OF MAJOR TAXONOMIC GROUPS (PERCENT CONTRIBUTION TO TOTAL BIOMASS) IN GRAMS PER SQUARE METER AT THE CANAVERAL MACROINFAUNAL SAMPLING STATIONS.

	Taxon					
Station	Annelida	Mollusca	Arthropoda	Echinodermata	Other	Total
1	4.75 (19.1)	4.74 (19.1)	0.02 (0.1)	14.26 (57.3)	1.10 (4.4)	24.87
2	4.39 (8.8)	9.32 (18.8)	0.10 (0.2)	34.46 (69.4)	1.36 (2.7)	49.63
3	10.64 (25.8)	2.48 (6.0)	0.81 (2.0)	26.62 (64.4)	0.77 (1.9)	41.32
4	0.58 (47.2)	0.59 (48.0)	0.03 (2.4)	0.00 (0.0)	0.03 (2.4)	1.23
5	2.39 (43.4)	1.64 (29.8)	0.11 (2.0)	<0.01 (0.0)	1.37 (24.9)	5.51
6	6.94 (41.6)	2.62 (15.7)	0.41 (2.5)	5.22 (31.3)	1.50 (9.0)	16.69
7	12.86 (16.6)	4.78 (6.2)	0.11 (0.1)	58.66 (75.7)	1.06 (1.4)	77.47
8	0.23 (20.5)	0.61 (54.5)	0.16 (14.3)	0.00 (0.0)	0.12 (10.7)	1.12
9	2.29 (68.8)	0.56 (16.8)	0.01 (0.3)	0.00 (0.0)	0.47 (14.1)	3.33
Mean	5.01 (20.4)	3.04 (12.4)	0.20 (0.8)	15.47 (63.0)	0.86 (3.5)	24.57

98. The biomasses of annelids were lower at Stations 4 and 8, two inshore stations; higher biomasses were observed at the two southern, offshore Stations 3 and 7. Annelid biomasses ranged from 2.29 to 4.75 g m^{-2} at the remaining five stations. Lower values for molluscan biomass were observed at the three inshore stations, ranging from 0.56 to 0.61 g m^{-2}. Biomasses of mollusks ranged from 1.64 to 9.32 g m^{-2} at the six stations located farther offshore. The biomass values of echinoderms were definitely higher offshore because echinoderms were not collected at the nearshore stations. The biomass at Station 5, in the center of the northern stations, was also negligible. Higher biomasses were observed in the southeastern quadrant of the study area.

99. Diversity, evenness, and species richness were calculated for the macroinfaunal samples collected at each of the nine stations. Values for these parameters are presented in Table C.17. The Shannon-Wiener Diversity Index incorporates the number of species and the distribution of individuals over species within each station. The values for this index ranged from 2.91 at Station 9 in the northwestern corner of the study area to 3.41 at Station 6 in the northeastern corner of the study area. No distinct pattern of values with respect to the spatial distribution was evident.

100. Evenness is the Shannon-Wiener Diversity Index scaled to the maximum diversity, i.e., each species is represented by equal numbers of individuals. The evenness values at all stations were relatively high, exceeding 0.79 in every case. In contrast to the lack of a discernible pattern of diversity values with respect to space, a pattern was evident for evenness values. The highest values were observed at the three westernmost (nearshore) stations. These values ranged from 0.86 to 0.95. Lower values (0.79 to 0.81) were observed in the southeastern quadrant of the study area (Stations 1, 2, 3, and 7).

101. Species richness is a measure of the total number of species present at a station. Lower values (6.4 to 7.6) were observed at the three westernmost stations. Values at the remaining six stations exceeded 8.2.

102. Clustering analysis was used to classify the stations (normal analysis) at the Canaveral site based upon their respective macroinfaunal assemblages. Taxa were also clustered (inverse analysis) based on their abundances at the nine stations. Only those taxa which

TABLE C.17. SHANNON WIENER DIVERSITY INDEX (H'), PIELOU'S EVENNESS INDEX (J), AND MARGALEF'S SPECIES RICHNESS INDEX (D) FOR THE MACROINFAUNAL SAMPLES COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Station	H'	J	D
1	3.08	0.79	8.7
2	3.08	0.79	8.2
3	3.18	0.81	8.7
4	3.09	0.95	6.6
5	3.19	0.84	8.4
6	3.41	0.85	9.9
7	3.38	0.79	10.9
8	3.22	0.94	7.6
9	2.91	0.86	6.4

were identified to a unique species level taxon were included in the analysis.

103. The results of the normal clustering analysis are presented as a dendrogram in Figure C.15. Station groups were delineated in the analysis based on their respective species composition. Four groups of stations are evident from this analysis. The first group is composed of Stations 1, 2, 3, and 7; the second group is composed of three stations--5, 6, and 9. The third and fourth groups each consists of a single station, 8 and 4, respectively.

104. These station groups do not appear to be related to the grain size distributions or the depths of the stations. Spatial proximity of the stations to each other seems to be the only underlying factor accounting for the station groupings that can be discerned from these data. The stations in Station Group 1 (1, 2, 3, and 7) were located in the southeastern quadrant of the study area. Station Group 2 (5, 6, and 9) were located along the northern boundary of the study area. The two remaining groups [Station Group 3 (Station 8) and Station Group 4 (Station 4)] were located along the southwestern boundary of the study area.

105. Inverse clustering analysis was performed to classify the species into groups based on their abundances at the nine stations in the Canaveral site. Four major species groups were delineated (Figure C.16). The fourth group was divided into three subgroups. The species level taxa and their respective occurrences at the nine stations are presented in Tables C.18 to C.23.

106. To delve deeper into the relationships among the station groups and the species groups, several presentations of nodal analysis (Boesch, 1977) are made which relate the results of the normal and inverse clustering analysis (Figures C.17 and C.18). In each of these figures, station groups are defined as follows:

Station Group	Stations
1:	1, 2, 3, and 7;
2:	5, 6, and 9;
3:	8; and
4:	4.

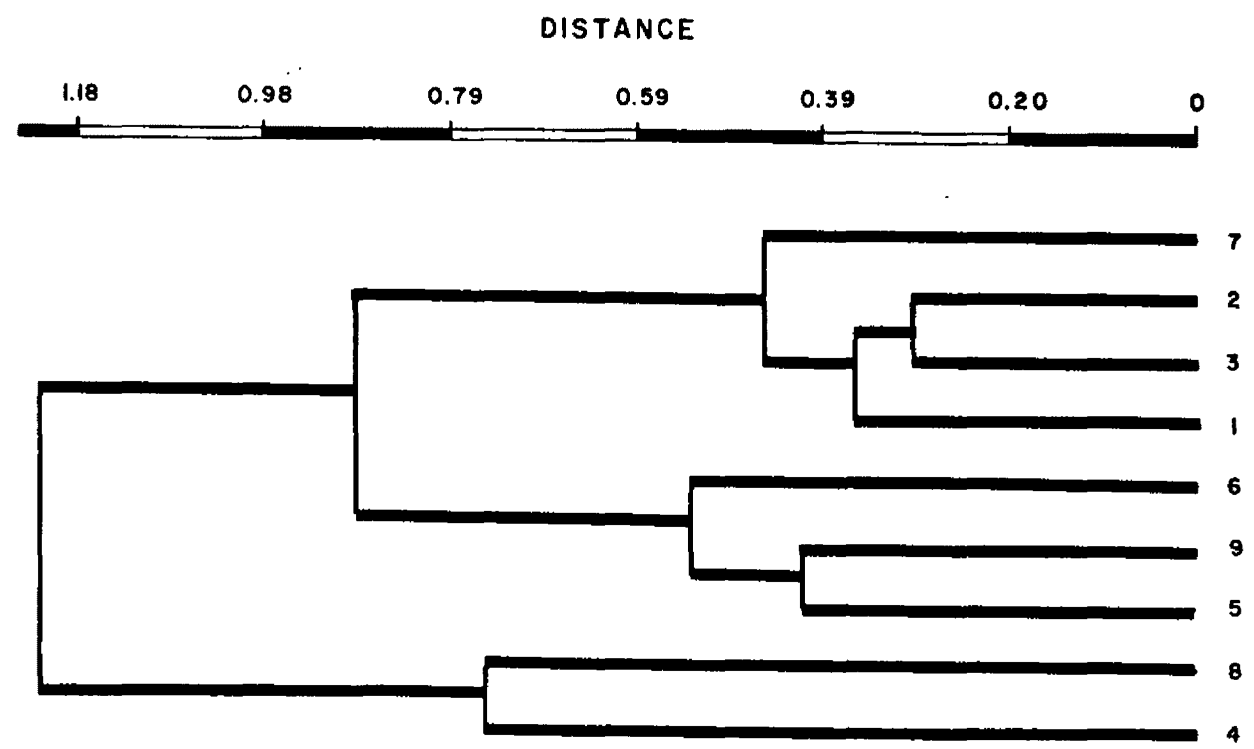


FIGURE C.15 . DENDROGRAM FOR THE NORMAL CLUSTERING ANALYSIS OF THE MACROINFAUNAL STATIONS.

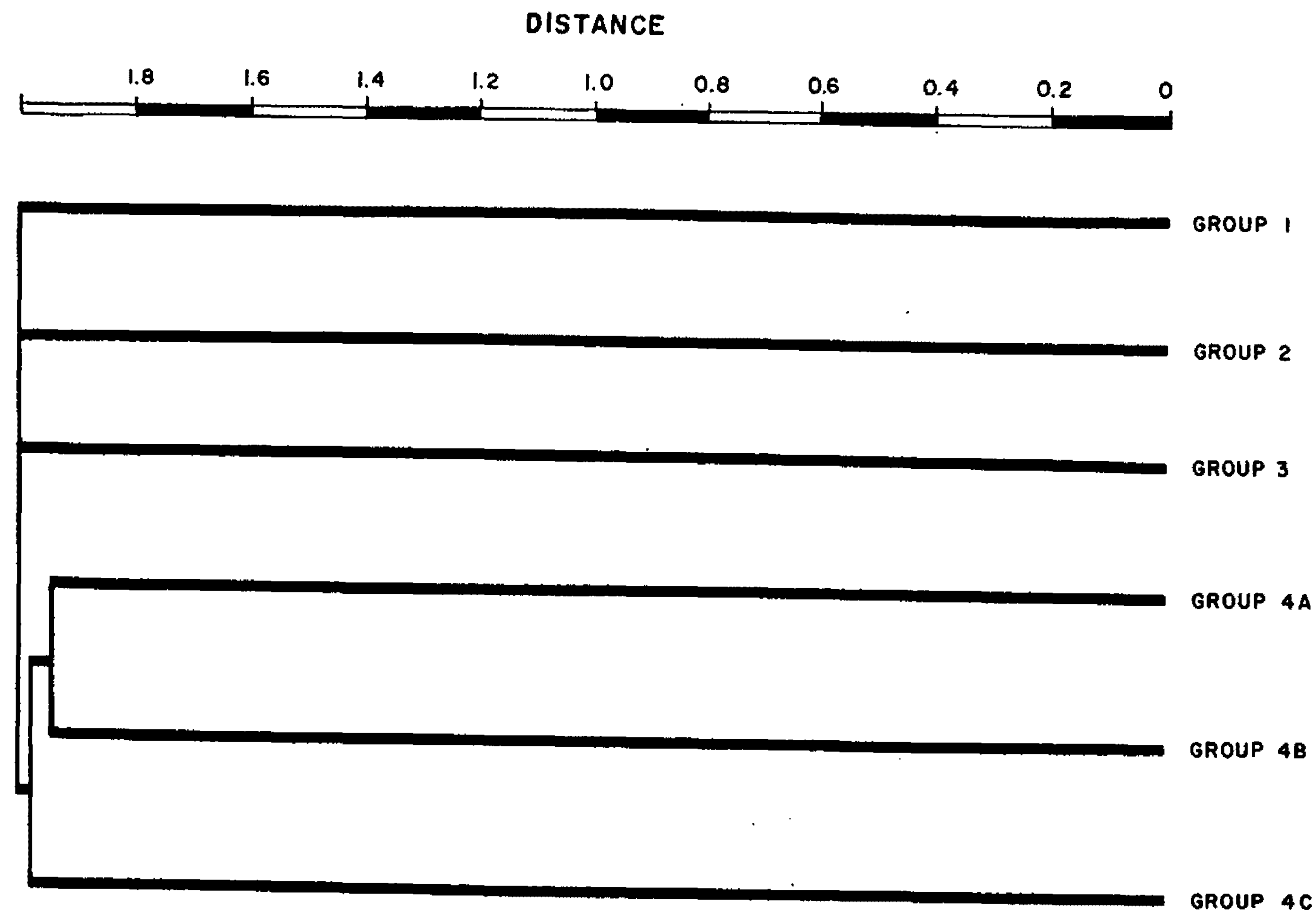


FIGURE C.16 . DENDROGRAM FOR THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SPECIES LEVEL TAXA.

TABLE C.18. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 1 OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Ceratocephale sp. B								*	
Bowmaniella brasiliensis								*	
Crassinella lunulata								*	
Megaluropus myersi								*	
Mooreonuphis cf. *nubulosa*								*	
Olivella dealbata								*	
Olivella nivea								*	
Scolelepis texana								*	
Strombiformis sp. D								*	
Tiron tropakis								*	
Tiron triocellatus								*	
Cyclaspis sp. Q								*	
Branchiostoma virginiae								*	*

TABLE C.19. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 2 OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Hauchiella sp. A									*
Batea catharinensis									*
Podarkeopsis levifuscina									*
Brasilomysis castroi						*			*
Mysidopsis sp. C									*
Paramphinome sp. B						*			
Lucifer faxoni						*			
Sigambra wassi						*			

TABLE C.20. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 3 OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Corophium acutum					*				
Anelassorhynchus sp. A					*				
Cyclaspis sp. P					*				
Diopatra neotridens					*				
Laonice cirrata					*				
Ogyrides alphaerostris		*			*				
Oxyurostylis sp. C		*		*	*				
Glycera americana				*	*				*

TABLE C.21. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 4A OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Metharpinia floridana			*					*	
Automate evermanni			*						
Ampelisca parapacifica			*						
Lumbrineris sp. Q			*						
Ophiactis sp. B			*						
Abra aequalis		*	*		*		*	*	*
Goniada littorea	*	*	*	*	*	*	*	*	*
Acteocina bidentata	*		*	*		*	*		*
Nannodiella cf. _vespuciana_			*						*
Apoprionospio pygmaea			*	*					
Notomastus lobatus							*		
Epitonium cf. _apiculatum_							*		
Odostomia weberi							*		
Acteon punctostriatus							*		
Parvilucina multilineata			*				*		
Onchnesoma squamatum	*		*				*		
Cryoturris fargoi				*			*		
Natica pusilla				*			*		
Sabellides sp. A				*					
Moira atropos				*					

TABLE C.22. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 4B OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Armandia agilis		*			*			*	
Exosphaeroma crenulata					*	*	*		
Sabellaria sp. A							*		
Magelona sp.H	*	*	*	*	*	*	*		*
Tellina probrina	*	*	*	*	*				
Prionospio sp. E	*	*	*	*	*	*	*	*	*
Micropholis gracillima	*	*	*	*	*				
Lumbrineris verrilli	*	*	*	*	*	*	*		
Aglaophamus verrilli	*	*	*	*	*	*	*	*	*
Paraprionospio pinnata	*	*	*	*	*	*	*		
Tellina versicolor	*				*				
Sigambra tentaculata	*	*	*	*	*	*	*		
Litocorsa sp. A	*			*	*		*		*
Solen viridis		*							
Bowmaniella portoricensis		*							
Hemipodus roseus		*					*		
Dentalium texasianum	*	*	*			*	*		
Nereis micromma	*	*		*			*		*
Naineris sp. A	*	*							*
Volvulella persimilis	*	*			*				
Spiochaetopterus oculatus	*	*				*	*		
Golfingia trichocephala		*	*	*	*	*			
Diplodonta sp. B		*	*	*	*				
Strombiformis bilineatus	*	*	*	*	*				
Loimia sp. A	*	*	*	*	*	*			
Corbula contracta	*	*		*	*				
Turbonilla hemphilli	*	*	*	*	*				
Dentalium pilsbryi	*	*	*	*					

TABLE C.23. OCCURRENCES OF THE SPECIES LEVEL TAXA IN GROUP 4C OF THE INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES FROM THE CANAVERAL SITE.

Species	Stations								
	7	2	3	1	6	9	5	8	4
Owenia sp. A	*		*	*	*			*	
Ancistrosyllis sp. B	*				*				
Hiatella artica	*								
Pinnixa chaetopterana	*		*		*				
Micropholis atra	*		*		*				
Promysis atlantica	*				*		*		
Aspidosiphon albus	*		*		*				
Apoprionospio dayi	*				*				
Apseudes sp. H	*				*				
Lepidasthenia varius	*								
Malmgreniella sp. A	*								
Ceratonereis irritabilis	*								
Nephtys sp. D	*								
Pinnixa sp. A	*							*	
Synchelidium americanum	*			*	*			*	
Listriella barnardi	*			*					
Armandia maculata	*			*					
Ptilanthura sp. A	*			*					
Spiophanes cf. *missionensis*	*			*					
Tharyx cf. *annulosus*	*	*							
Leptochela serratorbita	*	*							
Euceramus praelongus	*								
Ancistrosyllis jonesi	*								

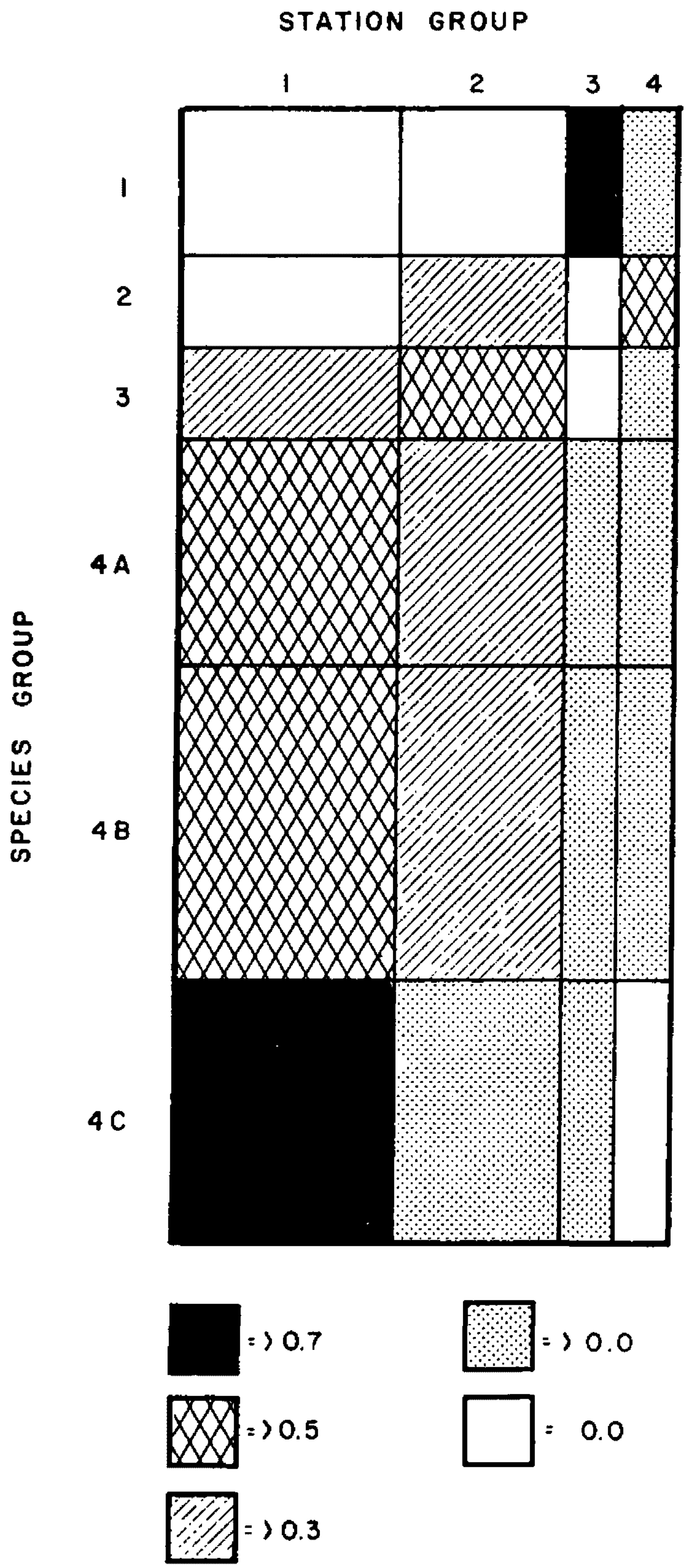
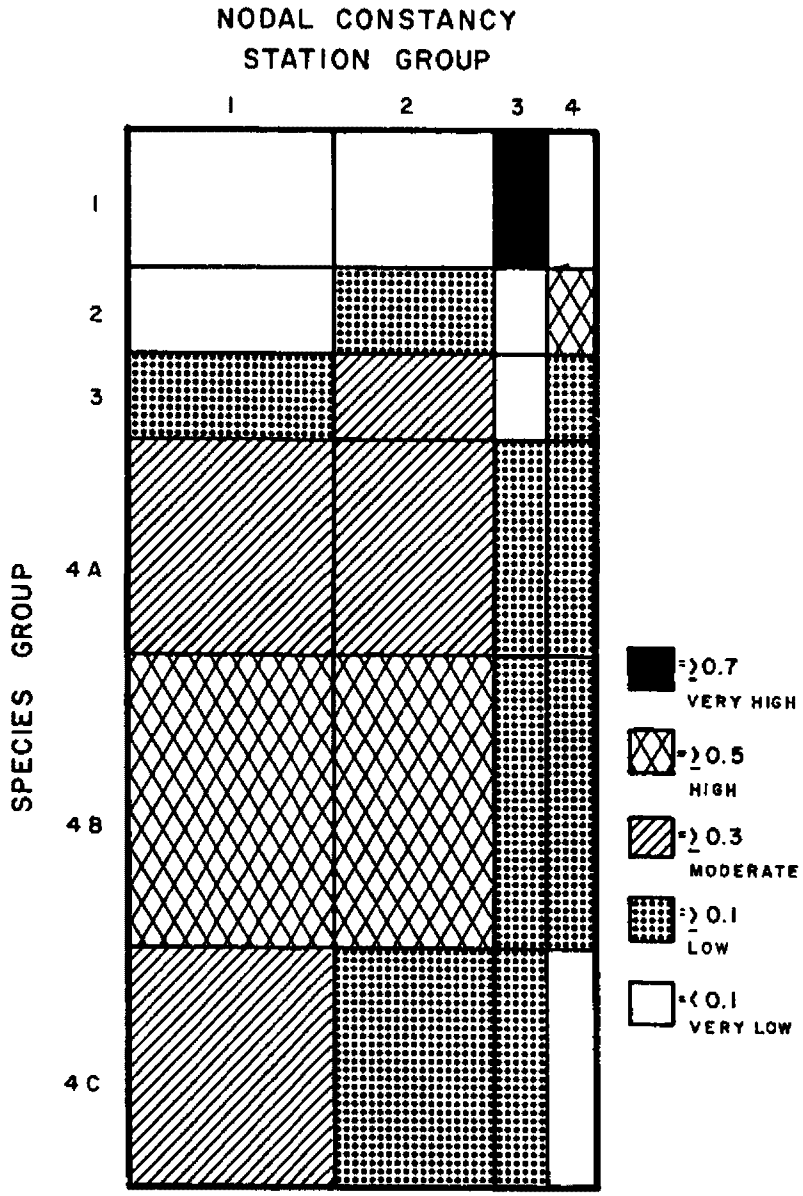


FIGURE C.17. AFFINITY OF SPECIES GROUPS FOR STATION GROUPS AS DEFINED BY NORMAL AND INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES.



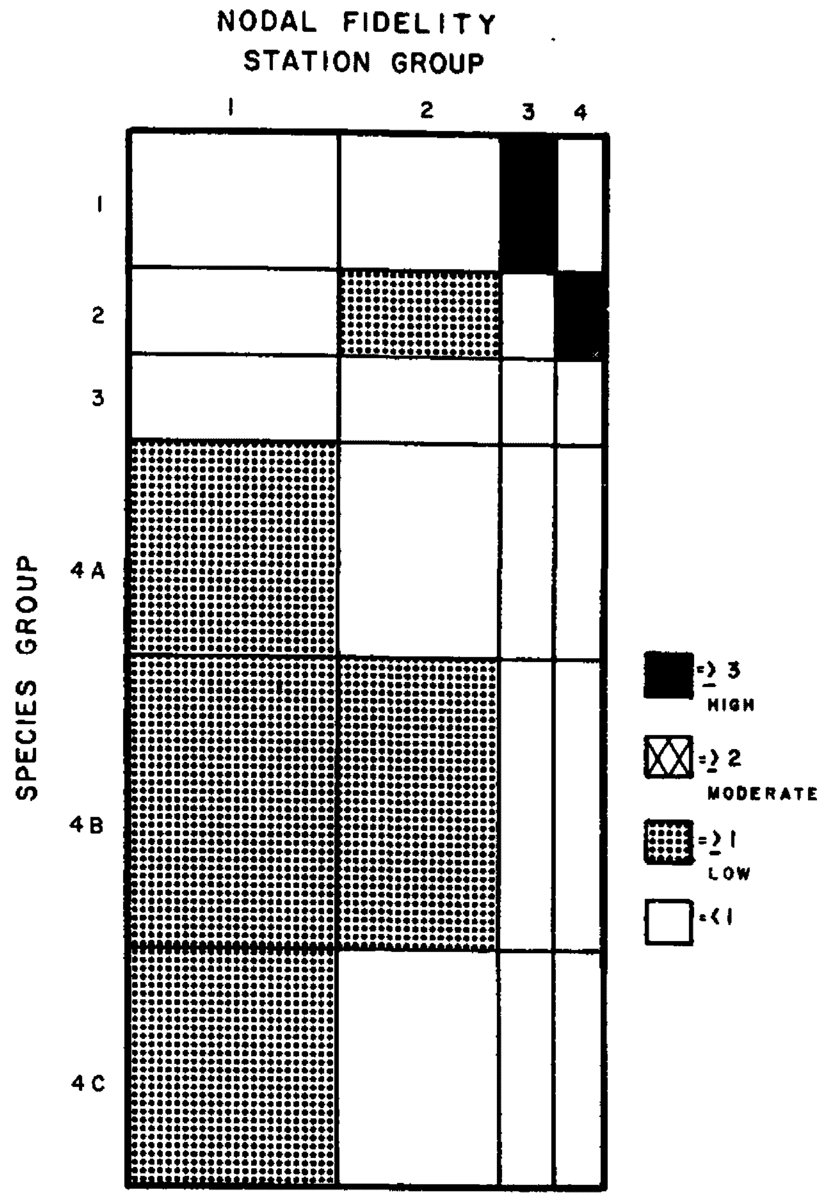


FIGURE C.18. NODAL CONSTANCY AND NODAL FIDELITY BASED ON NORMAL AND INVERSE CLUSTERING ANALYSIS OF THE MACROINFAUNAL SAMPLES.

The members of the six groups of species are specified in Tables C.18 to C.23.

107. The affinities of the members of particular species groups for the station groups are presented in Figure C.17. Affinity, in this case, is defined as the ratio of the number of occurrences of the species in a particular station group to the total number of occurrences of the species at all stations. Clearly, each of the four major species groups had a higher affinity with a particular station group. These affinities were as follows:

Species Group	Station Group
1	3
2	4
3	2
4	1

108. The major species groups were distinctly delineated by their occurrences at particular station groups. Because the station groupings were most related to the location of the stations (see above), the distribution of the species groups were likewise strongly related locations.

109. Nodal constancy of the species groups to the station groups followed a pattern similar to that described for the affinity of the species groups (Figure C.18). High constancy for Station Group 1 and 2 was observed for Species Group 4B. Moderate constancy was observed for species group 4A for Station group 2 while low constancy was observed for this station group by species group 4C. None of the species in groups 3 and 4 showed even moderate fidelity (see Boesch, 1977) to any station group; however, species groups 1 and 2 were highly faithful to Station groups 3 and 4, respectively (Figure C.18).

110. The macroinfaunal data (taxa identified to species level taxon) were also analyzed using correpondence analysis. The results of this analysis (Figure C.19) agreed well with those of the normal clustering analysis. Stations 1, 2, 3, and 7 formed a tight group of stations. Stations 5, 6, and 9 formed a somewhat less tightly clustered group of stations. Stations 4 and 8 were distinct from each other and from each of the other two groups. Comparison of Figure C.19 to the results of the principal components analysis of the grain size data (see

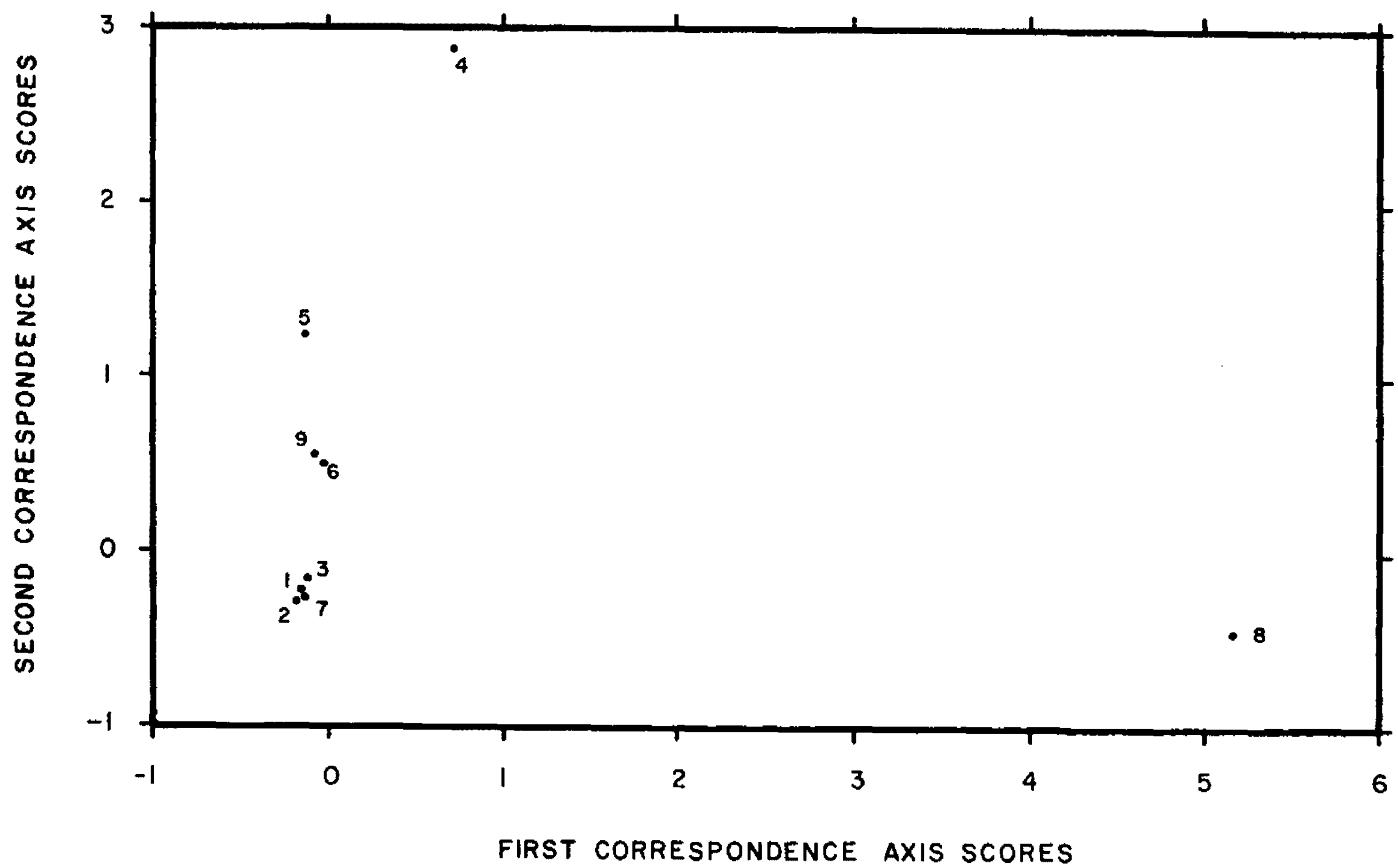


FIGURE C.19. RESULTS OF CORRESPONDENCE ANALYSIS TO ORDINATE STATIONS BASED ON THEIR MACROINFAUNAL ASSEMBLAGE COMPOSITIONS.

Figure C.14) revealed no evident relationship between the distribution of the macroinfauna and the sediment.

Macroepifauna

111. Replicate trawl samples were used to obtain data concerning the benthic biota at the candidate Canaveral disposal site. The entire trawl catch, comprised basically of fishes, crustaceans, echinoderms, mollusks, and cnidarians, for each station is detailed in Appendix D. Even though several of the species listed are not considered to be macroepifauna sensu stricto, no distinction was made between nektonic and benthic invertebrates and fishes since sampling bias (i.e., time of day, season of year, catch of opportunity, etc.) is a normal occurrence during field surveys. Differences in the catch among trawl samples are indicative of sampling bias since water depth and sediment type were very similar at all stations in the study area.

112. Sciaenids were the predominant demersal fishes collected in trawl samples at the candidate site. Species of the drum family accounted for 72.6% of the total fish catch with silver seatrout Cynoscion nothus (41.4%), and silver perch Bairdiella chrysoura (22.8%), contributing the largest numbers of specimens. The Atlantic cutlassfish Trichiurus lepturus (5.7%), and rock sea bass, Centropristis philadelphica (5.2%), were the next most abundant species collected. Other demersal fishes common in the trawl samples were banded drum (Larimus fasciatus), Atlantic croaker (Micropogonias undulatus), hardhead catfish (Arius felis), blackcheeked tonguefish (Symphurus plagiusa), fringed flounder (Etropus crossotus), Atlantic bumper (Chloroscombrus chrysurus), and smoothhead scorpionfish (Scorpaena calcarata). These fishes are common in the coastal habitat along the southeastern United States (Struhsaker, 1969).

113. The striped anchovy (Anchoa hepsetus), also occurred in relatively large numbers in the trawl samples. Although pelagic, anchovies are frequently taken in benthic trawls (i.e., captured as the trawl is moving through the water column). Presence of anchovy indicates that the candidate site is somewhat estuarine influenced; other common littoral species in the samples considered to be estuarine dependent include silver perch, banded drum, Atlantic croaker, spot (Leiostomus xanthurus), and blackcheeked tonguefish.

114. Fourteen species of decapod crustaceans were collected in the trawl samples. The sergestid shrimp Acetes americanus was

numerically predominant in all samples followed by the hardback shrimp (Trachypenaeus sp.) and the seabob (Xiphopenaeus kroyeri). The calico crab (Hepatus epheliticus) was the most abundant brachyuran collected and was captured at three of the four trawl stations (i.e., six of the eight samples). The mantis shrimp (Squilla empusa), a common inhabitant of nearshore and estuarine waters, was collected in only three of the eight trawls.

115. Echinoderms were represented by two species of starfish and one species each of echinoids and holothuroids. Only 24 specimens were collected, 13 of which were the sea star Luidia clathrata that was found at all stations except Station 9.

116. Only five species of shelled mollusks totaling 10 specimens were contained in the trawl catches. Four species of gastropods accounted for six specimens whereas the bivalves were represented by four specimens of the common jingle shell (Anomia simplex). The pelagic squid Lolliguncula brevis was collected in all trawl samples with the number of specimens ranging from 7-41 individuals per trawl.

117. It should be noted that the Calico scallop (Aequipecten gibbus) was not taken in any of the benthic trawls at the candidate site. This commercially important species is reported to occupy large areas farther offshore (seaward of the 120 ft isobath) in the Cape Canaveral area (Taylor, 1967).

Epibenthic Biomass

118. The benthic community in the Canaveral Project Area is close in comparison to that occupying the shallow shelf off the Fernandina-Jacksonville coast which is described as being diverse in species and low in overall abundance (CSA, 1986). Appendix D shows the numbers of species and specimens collected at the candidate site to be less than at the Fernandina candidate site. Even though the average biomass is a bit greater, it is not considered to be large in quantity. Average epifaunal biomass (wet weight) ranged from approximately 2.57 to 4.54 grams per square meter (see Table C.24) at the four trawl stations. Larger values were found at the seaward Stations 2 and 7 than at the landward Stations 4 and 9. A hard sand bottom in the northern Gulf of Mexico yielded similar biomass values (TerEco Corporation, 1981) and similar benthic communities (Barry A. Vittor and Associates, Inc., 1985).

TABLE C.24. WET WEIGHT BIOMASS OF TRAWL SAMPLES COLLECTED AT THE CANAVERAL HARBOR DISPOSAL SITE.

Station Replicate	Weight of Total Trawl Sample kg	(lbs)	Average Epifaunal Biomass (g/m^2)
2a	9.1	(20)	4.54
2b	7.7	(17)	
4a	4.5	(10)	2.57
4b	5.0	(11)	
7a	10.4	(23)	4.27
7b	5.4	(12)	
9a	6.8	(15)	3.19
9b	5.0	(11)	

Tissue Analyses

119. After the trawl samples had been weighed for wet weight biomass, fish and shrimp were removed for future tissue analyses. Trace contaminant values were determined for specified trace metals, high molecular weight hydrocarbons, and chlorinated pesticides and PCBs. Table C.25 lists those taxa that were selected for tissue analyses.

120. Trace metals values for specimens collected at the candidate site are given in Table C.26. Lead concentrations in all tissue samples were below detection limits and the cadmium levels were considered to be low when compared to specimens from the northeast Gulf (Dames and Moore, 1979). Mercury values ranged from 0.02 to 0.06 ppm which is the same range reported for the Fernandina specimens (CSA, 1986) and similar to background levels and concentrations reported for a relatively pristine area (TerEco Corporation, 1981).

121. High molecular weight hydrocarbon results are shown in Table C.27. Concentrations in all shrimp tissue were below the limits of detection and values in fish tissue are within acceptable ranges.

122. Concentrations of chlorinated pesticides in all tissue analyzed from the candidate site were below detection limits (see Table C.28). Very low values for total PCBs (<0.01 ppm) were detected in fish tissue only and no significant degree of contamination was indicated by such concentrations.

TABLE C.25. TAXA SELECTED FROM TRAWL SAMPLES FOR TISSUE ANALYSES AT THE CANAVERAL HARBOR DISPOSAL SITE.

Station Number	Taxa
2	*Micropogonias undulatus* (croaker) *Penaeus setiferus* (shrimp)
4	*Micropogonias undulatus* (croaker) *Penaeus setiferus* (shrimp)
7	*Micropogonias undulatus* (croaker) *Penaeus aztecus* (shrimp)
9	*Micropogonias undulatus* (croaker) *Xiphopenaeus kroyeri* (shrimp)

TABLE C.26. TRACE METAL ANALYSES RESULTS OF TISSUE FROM SPECIMENS COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Station-Specimen	Parameter Cadmium (ug/g)	Lead (ug/g)	Mercury (ug/g)
2-Fish	0.005	<0.03	0.03
2-Shrimp	0.024	<0.03	0.02
4-Fish	0.004	<0.03	0.04
4-Shrimp	0.017	<0.03	0.04
7-Fish	0.006	<0.03	0.03
7-Shrimp	0.012	<0.03	0.06
9-Fish	0.004	<0.03	0.04
9-Shrimp	0.012	<0.03	0.02

TABLE C.27. RESULTS OF HIGH MOLECULAR WEIGHT HYDROCARBON ANALYSIS OF TISSUE FROM SPECIMENS COLLECTED AT THE CANAVERAL CANDIDATE SITE.

Parameter	Station-Specimen							
	2-Fish	2-Shrimp	4-Fish	4-Shrimp	7-Fish	7-Shrimp	9-Fish	9-Shrimp
Wet weight of sample extracted	100 g	26 g	100 g	24 g	78 g	37 g	84 g	34 g
Dry weight of sample extracted	NA	NA	NA	NA	NA	NA	NA	NA
Percent dry weight of wet weight, ug/g	NA	NA	NA	NA	NA	NA	NA	NA
Weight of extractables, ug/g	ISS	ISS	ISS	ISS	ISS	ISS	ISS	ISS
Aliphatics and aromatics, ug/g	0.31	<0.4	0.17	<0.4	0.21	<0.3	0.33	<0.3
0 Resolved hydrocarbons, ug/g	0.58	<0.4	0.17	<0.4	0.39	<0.3	0.27	<0.3
Unresolved hydrocarbons, ug/g	0.17	<0.4	0.21	<0.4	0.13	<0.3	0.16	<0.3
Sum of n-alkanes, ug/g	<0.1	<0.4	0.14	<0.4	0.12	<0.3	0.13	<0.3
Sum of even n-alkanes, ug/g	<0.1	<0.4	<0.1	<0.4	<0.1	<0.3	<0.1	<0.3
Sum of odd n-alkanes, ug/g	0.29	NA	0.87	<0.4	<0.1	<0.3	<0.1	<0.3
Unresolved hydrocarbons/resolved hydrocarbons	NA	NA	1.3	NA	0.33	NA	0.59	NA
Ratio: odd n-alkanes/even n-alkanes, ug/g	NA	NA	1.3	NA	NA	NA	NA	NA
Ratio: phythane/n-c18	NA	NA	1.3	NA	NA	NA	NA	NA
Ratio: n-alkanes/branched hydrocarbons	NA	NA	1.3	NA	NA	NA	NA	NA
Ratio: pristane/n-c17	NA	NA	1.3	NA	NA	NA	NA	NA

*ISS- insufficient sample for gross metric analyses.

TABLE C.28. RESULTS OF PESTICIDE AND PCB ANALYSES OF TISSUE FROM SPECIMENS COLLECTED AT THE CANAVERAL CANDIDATE SITE.

	Station-Specimen							
Parameter	2-Fish	2-Shrimp	4-Fish	4-Shrimp	7-Fish	7-Shrimp	9-Fish	9-Shrimp
Alpha-BHC, ug/g	<0.00008	<0.00005	<0.00008	<0.00002	<0.00008	<0.00002	<0.00008	<0.00005
Gamma-BHC, ug/g	<0.0001	<0.00007	<0.0001	<0.00002	<0.0001	<0.00002	<0.0001	<0.00007
Heptachlor, ug/g	<0.0002	<0.0001	<0.0002	<0.00005	<0.0002	<0.00005	<0.0002	<0.0001
Beta-BHC, ug/g	<0.0003	<0.0002	<0.0003	<0.00009	<0.0003	<0.00009	<0.0003	<0.0002
Aldrin, ug/g	<0.0001	<0.0001	<0.0001	<0.00004	<0.0001	<0.00004	<0.0001	<0.0001
Heptachlor Epoxide, ug/g	<0.0002	<0.0001	<0.0002	<0.00006	<0.0002	<0.00006	<0.0002	<0.0001
4,4'-DDE, ug/g	<0.0003	<0.0002	<0.0003	<0.00008	<0.0003	<0.00008	<0.0003	<0.0002
o,p'-DDD, ug/g	<0.002	<0.001	<0.002	<0.0004	<0.002	<0.0004	<0.002	<0.001
o,p'-DDT, ug/g	<0.002	<0.001	<0.002	<0.0004	<0.002	<0.0004	<0.002	<0.001
Chlordane, ug/g	<0.002	<0.001	<0.002	<0.0004	<0.002	<0.0004	<0.002	<0.001
Dieldrin, ug/g	<0.0003	<0.0002	<0.0003	<0.00009	<0.0003	<0.00009	<0.0003	<0.0002
Endrin, ug/g	<0.0009	<0.0006	<0.0009	<0.0002	<0.0009	<0.0002	<0.0009	<0.0006
4,4'-DDD, ug/g	<0.0007	<0.0005	<0.0007	<0.0002	<0.0007	<0.0002	<0.0007	<0.0005
4,4'-DDT, ug/g	<0.0009	<0.0006	<0.0009	<0.0002	<0.0009	<0.0002	<0.0009	<0.0006
Total PCBs as Archlor 1254, ug/g	0.005	<0.004	0.007	<0.001	<0.005	<0.001	0.008	<0.004

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APPENDIX B

PHYLOGENETIC LISTING OF MACROINFAUNAL TAXA COLLECTED AT SAMPLING STATIONS AT THE CANAVERAL CANDIDATE SITE

PREFACE

The following section of a contractor site characterization report was completed before the Canaveral Harbor DEIS was published. As such, the reconfigured ODMDS was not depicted in the report. In order to maintain the integrity of the report, no revisions were made. Note that "LPIL" is defined as the "Lowest Practical Identification Level."

APPENDIX B. TABLE 1. STATION 1.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	4	2	3	5	9	23
Phoronida						
Phoronis (LPIL)	0	0	3	5	2	10
Sipuncula						
Sipuncula (LPIL)	1	0	0	0	0	1
Golfingiidae						
Golfingia trichocephala	3	0	0	0	0	3
Annelida						
Polychaeta						
Ampharetidae						
Sabellides sp. A	0	0	1	0	0	1
Capitellidae						
Mediomastus (LPIL)	1	1	4	2	2	10
Glyceridae						
Glycera americana	1	0	0	0	0	1
Goniadidae						
Goniada littorea	1	0	0	0	0	1
Lumbrineridae						
Lumbrineridae (LPIL)	1	0	0	0	0	1
Lumbrineris verrilli	0	2	3	2	2	9
Magelonidae						
Magelona sp. H	1	3	5	7	7	23
Nephtyidae						
Aglaophamus verrilli	1	1	1	2	5	10
Nereidae						
Nereidae (LPIL)	0	0	1	0	0	1
Nereis micromma	0	0	0	0	2	2
Opheliidae						
Armandia maculata	0	0	1	0	0	1
Oweniidae						
Owenia sp. A	1	0	0	0	0	1
Pilargidae						
Sigambra tentaculata	0	0	2	0	0	2
Litocorsa sp. A	0	0	0	1	0	1
Polynoidae						
Polynoidae (LPIL)	1	0	0	0	0	1
Spionidae						
Spionidae (LPIL)	0	0	0	1	0	1
Apoprionospio pygmaea	1	0	0	0	0	1
Paraprionospio pinnata	0	1	0	2	1	4
Prionospio sp. E	0	2	0	0	5	7
Spiophanes cf. missionensis	0	1	0	0	0	1
Terebellidae						
Loimia sp. A	0	0	1	0	2	3
Oligochaeta						
Oligochaeta (LPIL)	0	0	0	1	0	1
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	2	0	3	1	1	7

APPENDIX B. TABLE 1. STATION 1. (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Ungulinidae						
Diplodonta sp. B	0	0	2	0	0	2
Semelidae						
Semelidae (LPIL)	2	2	1	0	1	6
Arcidae						
Barbatia (LPIL)	0	0	1	0	0	1
Lucinidae						
Lucinidae (LPIL)	0	1	1	2	6	10
Tellinidae						
Tellina probrina	15	6	11	5	20	57
Macoma (LPIL)	0	0	0	0	1	1
Corbulidae						
Corbula contracta	0	0	0	1	3	4
Nuculanidae						
Nuculanidae (LPIL)	0	0	0	0	1	1
Gastropoda						
Gastropoda (LPIL)	0	5	1	2	3	11
Naticidae						
Natica pusilla	0	0	1	0	0	1
Acteocinidae						
Acteocina bidentata	1	0	0	0	0	1
Pyramidellidae						
Turbonilla hemphilli	0	1	0	0	1	2
Turridae						
Cryoturris fargoi	0	1	1	0	0	2
Melanellidae						
Strombiformis bilineatus	1	0	0	2	0	3
Scaphopoda						
Dentaliidae						
Dentalium pilsbryi	0	0	0	0	1	1
Arthropoda (Crustacea)						
Isopoda						
Anthuidae						
Ptilanthura sp. A	0	1	0	0	0	1
Amphipoda						
Oedicerotidae						
Synchelidium americanum	0	0	1	0	0	1
Liljeborgiidae						
Listriella barnardi	0	1	0	0	0	1
Diastylidae						
Oxyurostylis sp. C	0	0	1	0	0	1
Echinodermata						
Ophiuroidea						
Ophiuroidea (LPIL)	0	0	0	0	4	4
Amphiuridae						
Micropholis gracillima	5	1	0	1	3	10
Echinoidea						
Schizasteridae						
Moira atropos	0	1	0	0	0	1

APPENDIX B. TABLE 2. STATION 2.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	2	4	4	2	2	14
Phoronida						
Phoronis (LPIL)	2	1	2	2	3	10
Sipuncula						
Sipuncula (LPIL)	0	1	0	0	0	1
Golfingiidae						
Golfingia trichocephala	1	0	0	0	0	1
Aspidosiphonidae						
Aspidosiphon (LPIL)	0	0	0	0	1	1
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	2	5	5	4	1	17
Chaetopteridae						
Spiochaetopterus oculatus	0	1	0	0	0	1
Cirratulidae						
Tharyx cf. *annulosus*	0	0	0	1	0	1
Glyceridae						
Hemipodus roseus	0	0	1	0	0	1
Goniadidae						
Goniada littorea	0	0	1	0	0	1
Lumbrineridae						
Lumbrineris verrilli	4	0	3	1	3	11
Magelonidae						
Magelona sp. H	5	7	2	8	5	27
Nephtyidae						
Aglaophamus verrilli	0	0	1	4	0	5
Nereidae						
Nereidae (LPIL)	0	1	0	0	0	1
Nereis micromma	2	0	1	0	2	5
Opheliidae						
Armandia agilis	0	1	0	0	0	1
Orbiniidae						
Naineris sp. A	3	0	0	2	0	5
Pilargidae						
Sigambra tentaculata	1	1	0	0	3	5
Polnoidae						
Harmothoe (LPIL)	1	0	0	2	4	7
Spionidae						
Spionidae (LPIL)	0	0	0	0	1	1
Paraprionospio pinnata	1	1	2	1	3	8
Prionospio sp. E	1	6	4	7	8	26
Terebellidae						
Loimia sp. A	0	0	0	0	1	1
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	2	3	5	0	3	13

APPENDIX B. TABLE 2. STATION 2 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Ungulinidae						
Diplodonta sp. B	0	2	1	0	0	3
Semelidae						
Semelidae (LPIL)	1	1	0	0	1	3
Abra aequalis	0	0	1	0	0	1
Solenidae						
Solen viridis	0	1	0	0	0	1
Arcidae						
Barbatia (LPIL)	0	0	0	0	1	1
Lucinidae						
Lucinidae (LPIL)	0	0	2	0	3	5
Tellinidae						
Tellina probrina	20	1	12	20	14	67
Tellina (LPIL)	0	0	0	2	12	14
Corbulidae						
Corbula contracta	0	0	1	0	0	1
Gastropoda						
Gastropoda (LPIL)	0	1	2	1	8	12
Pyramidellidae						
Turbonilla hemphilli	0	0	0	0	1	1
Vitrinellidae						
Vitrinellidae (LPIL)	0	0	1	0	0	1
Olividae						
Olividae (LPIL)	0	0	1	0	0	1
Melanellidae						
Strombiformis bilineatus	1	0	1	0	0	2
Retusidae						
Volvulella persimilis	1	0	0	1	1	3
Scaphopoda						
Dentaliidae						
Dentalium texasianum	1	0	2	0	2	5
Dentalium pilsbryi	0	0	0	0	2	2
Arthropoda (Crustacea)						
Amphipoda						
Melitidae						
Eriopisa (LPIL)	0	0	0	1	0	1
Cumacea						
Diastylidae						
Oxyurostylis sp. C	1	0	0	0	0	1
Mysidacea						
Mysidae						
Bowmaniella portoricensis	0	0	0	0	1	1
Decapoda (Natantia)						
Ogyridae						
Ogyrides alphaerostris	0	0	0	0	1	1
Pasiphaeidae						
Leptochela serratorbita	0	0	0	0	1	1
Decapoda (Reptantia)						
Decapoda Reptantia (LPIL)	0	2	0	0	0	2

APPENDIX B. TABLE 2. STATION 2 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Echinodermata						
Ophiuroidea						
Ophiuroidea (LPIL)	3	1	1	2	3	10
Amphiuridae						
Micropholis gracillima	7	3	2	11	11	34

APPENDIX B. TABLE 3. STATION 3.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	3	10	4	3	7	27
Phoronida						
Phoronis (LPIL)	1	0	1	0	2	4
Sipuncula						
Sipuncula (LPIL)	1	0	1	0	0	2
Golfingiidae						
Golfingia trichocephala	0	1	0	0	0	1
Onchnesoma squamatum	0	0	0	1	0	1
Aspidosiphonidae						
Aspidosiphon albus	0	1	0	0	0	1
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	0	4	0	2	4	10
Goniadidae						
Goniada littorea	0	0	0	0	1	1
Lumbrineridae						
Lumbrineris verrilli	4	4	2	5	1	16
Lumbrineris sp. G	0	0	0	1	0	1
Magelonidae						
Magelona sp. H	0	7	10	4	5	26
Nephtyidae						
Aglaophamus verrilli	3	1	2	3	1	10
Nereidae						
Nereidae (LPIL)	1	0	0	0	0	1
Oweniidae						
Owenia sp. A	0	1	2	0	1	4
Orbiniidae						
Orbiniidae (LPIL)	0	0	1	0	0	1
Pilargidae						
Sigambra tentaculata	4	0	0	1	0	5
Polynoidae						
Harmothoe (LPIL)	1	2	0	1	0	4
Spionidae						
Apoprionospio pygmaea	1	1	0	0	0	2
Paraprionospio pinnata	3	1	3	7	2	16
Prionospio sp. E	6	12	0	14	10	42
Terebellidae						
Loimia sp. A	1	0	0	2	0	3
Poecilochaetidae						
Poecilochaetus (LPIL)	0	0	0	1	1	2
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	0	2	2	2	6	12
Ungulinidae						

APPENDIX B. TABLE 3. STATION 3 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Diplodonta sp. B	2	0	0	0	0	2
Semelidae						
Semelidae (LPIL)	1	0	0	0	0	1
Abra aequalis	0	0	0	1	1	2
Lucinidae						
Lucinidae (LPIL)	0	1	6	0	3	10
Parvilucina multilineata	0	1	0	0	0	1
Tellinidae						
Tellina probrina	0	7	0	18	9	34
Tellina (LPIL)	7	6	9	5	9	36
Nuculanidae						
Nuculanidae (LPIL)	0	0	2	0	1	3
Gastropoda						
Gastropoda (LPIL)	2	1	1	5	1	10
Acteocinidae						
Acteocina bidentata	0	0	0	2	1	3
Pyramidellidae						
Turbonilla hemphilli	0	0	0	1	0	1
Turbonilla (LPIL)	1	0	0	0	0	1
Turridae						
Nannodiella cf. *vespuciana*	0	1	1	0	0	2
Melanellidae						
Strombiformis bilineatus	0	1	0	1	0	2
Scaphopoda						
Dentaliidae						
Dentalium texasianum	0	0	0	0	1	1
Dentalium pilsbryi	0	0	0	1	0	1
Arthropoda (Crustacea)						
Amphipoda						
Ampeliscidae						
Ampelisca parapacifica	1	0	0	0	0	1
Phoxocephalidae						
Metharpinia floridana	0	0	1	0	0	1
Mysidacea						
Mysidae						
Mysidae (LPIL)	0	1	0	0	0	1
Decapoda (Natantia)						
Alpheidae						
Automate evermanni	0	0	0	1	0	1
Decapoda (Reptantia)						
Decapoda Reptantia (LPIL)	1	0	0	0	0	1
Pinnotheridae						
Pinnixa chaetopterana	0	1	0	0	0	1
Pinnixa (LPIL)	0	1	0	3	0	4
Ostracoda						
Ostracoda Family A	1	0	0	1	0	2
Ostracoda Family B	0	1	0	0	0	1
Echinodermata						
Ophiuroidea						
Amphiuridae						
Amphiuridae (LPIL)	2	3	0	3	2	10

APPENDIX B. TABLE 3. STATION 3 (CONTINUED)

TAXON	Replicate 1	2	3	4	5	Total
Micropholis atra	0	1	0	0	0	1
Micropholis gracillima	3	6	1	7	6	23
Ophiactidae						
Ophiactis sp. B	0	0	0	0	1	1

APPENDIX B. TABLE 4. STATION 4.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	2	0	0	0	0	2
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	0	1	0	2	0	3
Glyceridae						
Glycera americana	0	0	0	1	0	1
Goniadidae						
Goniada littorea	1	1	0	0	1	3
Hesionidae						
Podarkeopsis levifuscina	0	0	0	0	1	1
Magelonidae						
Magelona sp. H	0	0	0	2	0	2
Nephtyidae						
Aglaophamus verrilli	0	0	1	0	0	1
Nereidae						
Nereis micromma	0	0	0	0	2	2
Orbiniidae						
Naineris sp. A	0	0	1	0	0	1
Pilargidae						
Litocorsa sp. A	0	0	1	0	1	2
Spionidae						
Prionospio sp. E	1	0	0	0	0	1
Terebellidae						
Hauchiella sp. A	0	0	0	0	1	1
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	1	1	0	2	2	6
Semelidae						
Abra aequalis	0	1	0	0	0	1
Arcidae						
Barbatia (LPIL)	0	1	0	0	0	1
Lucinidae						
Lucinidae (LPIL)	0	1	0	2	0	3
Tellinidae						
Tellina (LPIL)	0	0	3	0	0	3
Gastropoda						
Gastropoda (LPIL)	1	0	0	0	0	1
Acteocinidae						
Acteocina bidentata	0	1	0	1	0	2
Turridae						
Nannodiella cf. vespuciana	0	0	0	1	0	1
Arthropoda (Crustacea)						
Amphipoda						
Bateidae						
Batea catharinensis	0	0	1	0	0	1
Mysidacea						
Mysidae						

APPENDIX B. TABLE 4. STATION 4. (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Mysidae						
Mysidae (LPIL)	1	0	0	0	0	1
Mysidopsis sp. C	1	1	0	0	0	2
Brasilomysis castroi	0	1	0	0	0	1
Ostracoda						
Ostracoda Family C	0	0	0	1	0	1
Cephalochordata						
Leptocardii						
Branchiostomidae						
Branchiostoma virginiae	1	0	0	0	0	1

APPENDIX B. TABLE 5. STATION 5.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	2	0	2	4	2	10
Phoronida						
Phoronis (LPIL)	2	1	0	1	1	5
Sipunculida						
Golfingiidae						
Onchnesoma squamatum	0	1	0	0	0	1
Annelida						
Polychaeta						
Amphinomidae						
Amphinomidae (LPIL)	0	1	0	0	0	1
Capitellidae						
Capitellidae (LPIL)	0	1	0	0	0	1
Mediomastus (LPIL)	2	0	2	4	0	8
Notomastus lobatus	0	0	0	0	1	1
Chaetopteridae						
Spiochaetopterus oculatus	0	0	0	0	1	1
Glyceridae						
Hemipodus roseus	0	0	0	1	0	1
Goniadidae						
Goniada littorea	1	0	0	0	0	1
Lumbrineridae						
Lumbrineris verrilli	5	0	1	3	0	9
Magelonidae						
Magelona sp. H	9	8	2	2	7	28
Nephtyidae						
Aglaophamus verrilli	0	2	1	0	1	4
Nereidae						
Nereis micromma	0	0	0	1	0	1
Pilargidae						
Sigambra tentaculata	0	2	1	0	0	3
Litocorsa sp. A	0	2	0	0	0	2
Polynoidae						
Polynoidae (LPIL)	0	0	0	0	1	1
Spionidae						
Paraprionospio pinnata	1	1	2	0	0	4
Prionospio sp. E	1	0	0	1	1	3
Sabellariidae						
Sabellaria sp. A	0	13	0	0	0	13
Oligochaeta						
Oligochaeta (LPIL)	1	0	0	0	0	1
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	1	1	0	5	4	11
Semelidae						
Semelidae (LPIL)	0	0	1	0	0	1
Abra aequalis	0	1	0	0	0	1

APPENDIX B. TABLE 5. STATION 5 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Lucinidae						
Lucinidae (LPIL)	1	0	3	9	0	13
Parvilucina multilineata	0	1	0	0	0	1
Tellinidae						
Tellina (LPIL)	4	0	4	0	0	8
Nuculanidae						
Nuculanidae (LPIL)	1	0	0	0	0	1
Gastropoda						
Gastropoda (LPIL)	1	1	0	0	1	3
Epitoniidae						
Epitonium cf. apiculatum	0	1	0	0	0	1
Naticidae						
Natica pusilla	0	0	1	0	0	1
Natica (LPIL)	0	0	1	0	0	1
Acteocinidae						
Acteocina bidentata	0	1	0	1	0	2
Acteonidae						
Acteon punctostriatus	1	1	0	0	0	2
Pyramidellidae						
Turbonilla (LPIL)	0	0	1	0	0	1
Odostomia weberi	1	0	0	0	0	1
Turridae						
Cryoturris fargoi	0	1	0	0	0	1
Scaphopoda						
Dentaliidae						
Dentalium texasianum	0	0	1	0	0	1
Arthropoda (Crustacea)						
Isopoda						
Sphaeromidae						
Exosphaeroma crenulata	0	5	0	0	2	7
Amphipoda						
Amphipoda (LPIL)	0	0	0	0	1	1
Mysidacea						
Mysidae						
Promysis atlantica	0	1	0	1	0	2
Decapoda (Reptantia)						
Decapoda Reptantia (LPIL)	0	0	1	0	0	1
Pinnotheridae						
Pinnixa (LPIL)	0	1	0	0	0	1
Echinodermata						
Ophiuroidea						
Ophiuroidea (LPIL)	0	6	0	0	0	6

APPENDIX B. TABLE 6. STATION 6.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	2	3	7	1	2	15
Phoronida						
Phoronis (LPIL)	4	2	0	0	1	7
Sipuncula						
Sipuncula (LPIL)	0	0	1	0	0	1
Golfingiidae						
Golfingia trichocephala	0	0	1	0	0	1
Aspidosiphonidae						
Aspidosiphon albus	0	0	1	0	1	2
Echiura						
Echiuridae						
Anelassorhynchus sp. A	0	0	1	0	0	1
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	1	2	4	1	0	8
Cirratulidae						
Cirratulidae (LPIL)	1	0	0	0	0	1
Glyceridae						
Glycera americana	1	0	0	0	0	1
Goniadidae						
Goniada littorea	0	0	0	3	1	4
Lumgrineridae						
Lumbrineris verrilli	3	0	1	2	0	6
Magelonidae						
Magelona sp. H	4	4	10	13	3	34
Nephtyidae						
Aglaophamus verrilli	0	0	3	2	1	6
Opheliidae						
Armandia agilis	0	3	0	2	1	6
Onuphidae						
Diopatra neotridens	0	0	0	1	0	1
Oweniidae						
Owenia sp. A	0	0	0	0	1	1
Pilargidae						
Ancistrosyllis sp. B	0	0	2	0	0	2
Sigambra tentaculata	0	0	0	2	0	2
Litocorsa sp. A	0	2	0	0	0	2
Polynoidae						
Polynoidae (LPIL)	0	0	0	1	0	1
Spionidae						
Apoprionospio dayi	0	0	1	0	1	2
Paraprionospio pinnata	3	0	2	1	1	7
Prionospio sp. E	1	0	7	1	0	9
Laonice cirrata	0	0	1	0	0	1
Terebellidae						
Loimia sp. A	0	1	0	1	0	2

APPENDIX B. TABLE 6. STATION 6 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	0	1	7	4	2	14
Ungulinidae						
Diplodonta sp. B	0	0	0	1	0	1
Semelidae						
Abra aequalis	0	1	0	0	0	1
Lucinidae						
Lucinidae (LPIL)	0	3	1	4	0	8
Tellinidae						
Tellina versicolor	0	0	1	0	5	6
Tellina probrina	0	0	0	0	2	2
Tellina (LPIL)	2	6	0	0	0	8
Corbulidae						
Corbula contracta	0	0	3	0	0	3
Nuculanidae						
Nuculanidae (LPIL)	0	1	0	0	0	1
Gastropoda						
Gastropoda (LPIL)	1	2	1	1	1	6
Pyramidellidae						
Turbonilla hemphilli	0	1	0	0	1	2
Turbonilla (LPIL)	1	0	0	0	0	1
Melanellidae						
Strombiformis bilineatus	0	0	0	0	1	1
Retusidae						
Volvulella persimilis	0	1	0	0	0	1
Arthropoda (Crustacea)						
Isopoda						
Sphaeromidae						
Exosphaeroma crenulata	2	0	0	0	9	11
Amphipoda						
Corophiidae						
Corophium acutum	0	0	0	0	1	1
Oedicerotidae						
Synchelidium americanum	0	0	0	1	0	1
Cumacea						
Bodotriidae						
Cyclaspis sp. P	1	0	0	0	0	1
Diastylidae						
Oxyurostylis sp. C	0	0	0	1	0	1
Mysidacea						
Mysidae						
Promysis atlantica	2	1	0	0	0	3
Tanaidacea						
Apseudidae						
Apseudes sp. H	0	2	0	0	0	2

APPENDIX B. TABLE 6. STATION 6 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Decapoda (Natantia)						
Ogyriae						
Ogyrides alphaerostris	1	0	0	0	0	1
Decapoda (Reptantia)						
Decapoda Reptantia (LPIL)	1	0	0	0	0	1
Pinnotheridae						
Pinnixa chaetopterana	1	0	0	0	0	1
Pinnixa (LPIL)	0	1	0	0	0	1
Echinodermata						
Ophiuroidea						
Ophiuroidea (LPIL)	0	0	0	1	3	4
Amphiuridae						
Amphiuridae (LPIL)	0	1	0	0	0	1
Micropholis atra	0	0	0	1	0	1
Micropholis gracillima	0	0	0	0	1	1

APPENDIX B. TABLE 7. STATION 7.

TAXON	Replicate 1	2	3	4	5	Total
Cnidaria						
Actinaria						
Actiniaria (LPIL)	0	0	0	1	0	1
Rhynchocoeal						
Rhynchocoela (LPIL)	1	4	5	4	2	16
Phoronida						
Phoronis (LPIL)	2	1	0	0	2	5
Sipunculida						
Golfingiidae						
Onchnesoma squamatum	0	1	0	0	0	1
Aspidosiphonidae						
Aspidosiphon albus	0	0	1	0	0	1
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	3	10	3	6	6	28
Notomastus (LPIL)	0	0	0	1	2	3
Chaetopteridae						
Spiochaetopterus oculatus	1	0	1	0	0	2
Cirratulidae						
Tharyx cf. *annulosus*	0	1	0	0	0	1
Goniadidae						
Goniada littorea	0	0	1	0	0	1
Lumgrineridae						
Lumbrineris verrilli	9	20	4	13	10	56
Magelonidae						
Magelona sp. H	5	9	1	5	7	27
Nephtyidae						
Aglaophamus verrilli	2	6	3	0	2	13
Nephtys sp. D	2	0	0	0	0	2
Nereidae						
Ceratonereis irritabilis	0	0	0	1	1	2
Nereis micromma	0	1	1	0	1	3
Opheliidae						
Armandia maculata	0	0	0	1	0	1
Oweniidae						
Owenia sp. A	1	1	1	2	1	6
Orbiniidae						
Naineris sp. A	0	0	1	0	0	1
Pilargidae						
Ancistrosyllis jonesi	0	0	1	0	0	1
Ancistrosyllis sp. B	1	4	0	0	0	5
Sigambra tentaculata	1	6	1	1	3	12
Litocorsa sp. A	0	11	0	0	1	12
Polynoidae						
Lepidasthenia varius	1	1	0	0	1	3
Malmgreniella sp. A	0	0	0	0	2	2
Harmothoe (LPIL)	3	7	5	0	0	15

APPENDIX B. TABLE 7. STATION 7 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Sigalionidae						
Sigalionidae (LPIL)	0	0	0	0	1	1
Spionidae						
Spionidae (LPIL)	0	0	0	1	0	1
Apoprionospio dayi	1	0	0	1	0	2
Paraprionospio pinnata	2	2	3	3	6	16
Prionospio sp. E	14	23	19	6	8	70
Prionospio (LPIL)	0	4	1	2	0	7
Spiophanes cf. missionensis	0	0	0	1	0	1
Terebellidae						
Loimia sp. A	0	3	0	0	1	4
Poecilochaetidae						
Poecilochaetus (LPIL)	0	0	0	2	0	2
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	3	6	3	2	0	14
Semelidae						
Semelidae (LPIL)	1	3	6	0	2	12
Lucinidae						
Lucinidae (LPIL)	0	3	0	1	0	4
Tellinidae						
Tellinidae (LPIL)	2	4	0	0	0	6
Tellina versicolor	0	2	11	6	0	19
Tellina probrina	11	23	17	7	3	61
Tellina (LPIL)	1	0	0	0	2	3
Corbulidae						
Corbula contracta	0	5	0	0	0	5
Corbula (LPIL)	0	2	0	0	0	2
Hiatellidae						
Hiatella arctica	0	3	3	0	0	6
Lyonsiidae						
Lyonsia (LPIL)	0	0	0	0	1	1
Gastropoda						
Gastropoda (LPIL)	2	6	2	2	1	13
Acteocinidae						
Acteocina bidentata	1	0	0	0	0	1
Pyramidellidae						
Turbonilla hemphilli	0	0	2	0	0	2
Melanellidae						
Strombiformis bilineatus	0	0	0	0	2	2
Retusidae						
Volvulella persimilis	0	3	0	0	0	3
Scaphopoda						
Dentaliidae						
Dentalium texasianum	0	1	1	0	1	3
Dentalium pilsbryi	1	0	0	0	0	1

APPENDIX B. TABLE 7. STATION 7 (CONTINUED)

TAXON	Replicate 1	2	3	4	5	Total
Arthropoda (Crustacea)						
Isopoda						
Anthurdae						
Ptilanthura sp. A	0	0	1	0	0	1
Amphipoda						
Oedicerotidae						
Synchelidium americanum	0	0	1	0	0	1
Liljeborgiidae						
Listriella barnardi	0	1	0	0	0	1
Cumacea						
Bodotriidae						
Cyclaspis (LPIL)	0	0	0	0	1	1
Mysidacea						
Mysidae						
Promysis atlantica	1	0	0	1	0	2
Bowmaniella (LPIL)	0	0	0	0	1	1
Tanaidacea						
Apseudidae						
Apseudes sp. H	0	0	0	1	0	1
Decapoda (Natantia)						
Decapoda Natantia (LPIL)	1	0	0	0	0	1
Pasiphaeidae						
Leptochela serratorbita	0	0	0	1	0	1
Decapoda (Reptantia)						
Decapoda Reptantia (LPIL)	0	0	0	1	3	4
Pinnotheridae						
Pinnixa sp. A	1	0	0	0	0	1
Pinnixa chaetopterana	0	3	0	0	0	3
Porcellanidae						
Euceramus praelongus	1	0	0	0	0	1
Echinodermata						
Ophiuroidea						
Ophiuroidea (LPIL)	2	4	1	0	0	7
Amphiuridae						
Amphiuridae (LPIL)	4	1	5	2	0	12
Micropholis atra	0	0	1	0	1	2
Micropholis gracillima	9	18	16	4	5	52

APPENDIX B. TABLE 8. STATION 8.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	0	1	2	1	2	6
Annelida						
Polychaeta						
Capitellidae						
Mediomastus (LPIL)	1	1	0	1	3	6
Goniadidae						
Goniada littorea	0	1	1	0	0	2
Nephtyidae						
Nephtyidae (LPIL)	0	0	0	1	0	1
Aglaophamus verrilli	0	0	1	0	1	2
Nereidae						
Ceratocephale sp. B	0	0	1	0	0	1
Opheliidae						
Armandia agilis	0	0	1	0	0	1
Onuphidae						
Mooreonuphis cf. *nebulosa*	0	0	0	1	0	1
Oweniidae						
Owenia sp. A	0	0	1	0	0	1
Sigalionidae						
Sigalionidae (LPIL)	0	0	0	0	1	1
Spionidae						
Prionospio sp. E	1	0	0	0	1	2
Scolelepis texana	0	0	1	0	0	1
Mollusca						
Pelecypoda						
Semelidae						
Abra aequalis	0	1	0	0	0	1
Lucinidae						
Lucinidae (LPIL)	0	2	0	0	0	2
Crassatellidae						
Crassinella lunulata	0	1	0	0	0	1
Gastropoda						
Olividae						
Olivella dealbata	0	0	1	0	0	1
Olivella nivea	0	0	1	0	0	1
Melanellidae						
Strombiformis sp. D	0	0	1	0	0	1
Arthropoda (Crustacea)						
Amphipoda						
Oedicerotidae						
Synchelidium americanum	0	1	0	0	0	1
Gammaridae						
Megaluropus myersi	0	0	0	0	1	1
Phoxocephalidae						
Metharpinia floridana	0	1	0	0	0	1

APPENDIX B. TABLE 8. STATION 8 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Synopiidae						
Tiron triocellatus	0	0	0	2	0	2
Tiron tropakis	0	0	0	0	1	1
Cumacea						
Cumacea (LPIL)	0	1	0	0	0	1
Bodotriidae						
Cyclaspis sp. Q	0	2	1	0	0	3
Mysidacea						
Mysidae						
Bowmaniella brasiliensis	0	0	0	0	1	1
Bowmaniella (LPIL)	0	0	0	0	2	2
Decapoda (Reptantia)						
Pinnotheridae						
Pinnixa sp. A	1	0	0	0	0	1
Paguridae						
Paguridae (LPIL)	0	0	0	0	2	2
Ostracoda						
Ostracoda Family C	0	0	0	0	1	1
Cephalochordata						
Leptocardii						
Branchiostomidae						
Branchiostoma virginiae	0	0	2	1	0	3

APPENDIX B. TABLE 9. STATION 9.

TAXON	Replicate 1	2	3	4	5	Total
Rhynchocoela						
Rhynchocoela (LPIL)	1	0	3	1	2	7
Phoronida						
Phoronis (LPIL)	2	1	0	1	0	4
Sipuncula						
Golfingiidae						
Golfingia trichocephala	0	0	1	0	0	1
Annelida						
Polychaeta						
Amphinomidae						
Paramphinome sp. B	1	0	0	0	0	1
Capitellidae						
Mediomastus (LPIL)	1	0	5	1	2	9
Notomastus (LPIL)	0	0	0	0	1	1
Chaetopteridae						
Spiochaetopterus oculatus	0	0	1	0	1	2
Goniadidae						
Goniada littorea	1	0	0	1	0	2
Lumbrineridae						
Lumbrineris verrilli	1	3	3	0	2	9
Magelonidae						
Magelona sp. H	5	3	1	3	3	15
Nephtyidae						
Nephtyidae (LPIL)	2	0	1	0	0	3
Aglaophamus verrilli	0	2	0	0	2	4
Pilargidae						
Sigambra tentaculata	1	1	0	0	0	2
Sigambra wassi	1	0	0	0	0	1
Spionidae						
Paraprionospio pinnata	0	1	2	1	1	5
Prionospio sp. E	0	1	0	0	0	1
Terebellidae						
Loimia sp. A	0	0	1	0	0	1
Oligochaeta						
Oligochaeta (LPIL)	1	0	0	0	0	1
Mollusca						
Pelecypoda						
Pelecypoda (LPIL)	0	0	0	1	0	1
Lucinidae						
Lucinidae (LPIL)	3	3	3	1	3	13
Tellinidae						
Tellinidae (LPIL)	1	0	0	0	1	2
Gastropoda						
Gastropoda (LPIL)	0	1	2	0	0	3
Acteocinidae						
Acteocina bidentata	0	1	0	0	0	1
Cyclostrematidae						
Cyclostrematidae (LPIL)	1	0	0	0	0	1

APPENDIX B. TABLE 9. STATION 9 (CONTINUED).

TAXON	Replicate 1	2	3	4	5	Total
Scaphopoda						
Dentaliidae						
Dentalium texasianum	0	0	1	0	0	1
Arthropoda (Crustacea)						
Isopoda						
Sphaeroidae						
Exosphaeroma crenulata	0	1	0	0	0	1
Amphipoda						
Amphipoda (LPIL)	0	0	1	0	0	1
Mysidacea						
Mysidae						
Brasilomysis castroi	0	0	0	0	1	1
Decapoda (Natantia)						
Luciferidae						
Lucifer faxoni	0	1	0	0	0	1
Decapoda (Reptantia)						
Pinnotheridae						
Pinnixa (LPIL)	0	0	1	0	0	1

APPENDIX C

RANK ORDER OF ABUNDANCE OF MACROINFAUNAL TAXA COLLECTED AT SAMPLING STATIONS AT THE CANAVERAL CANDIDATE SITE

PREFACE

The following section of a contractor site characterization report was completed before the Canaveral Harbor DEIS was published. As such, the reconfigured ODMDS was not depicted in the report. In order to maintain the integrity of the report, no revisions were made. Note that "LPIL" is defined as the "Lowest Practical Identification Level."

APPENDIX C. TABLE 1. STATION 1.

TAXON	MEAN	STANDARD DEVIATION
Tellina probrina	11.4	6.27
Magelona sp. H	4.6	2.61
Rhynchocoela (LPIL)	4.6	2.70
Gastropoda (LPIL)	2.2	1.92
Aglaophamus verrilli	2.0	1.73
Mediomastus (LPIL)	2.0	1.22
Micropholis gracillima	2.0	2.00
Phoronis (LPIL)	2.0	2.12
Lucinidae (LPIL)	2.0	2.35
Lumbrineris verrilli	1.8	1.10
Prionospio sp. E	1.4	2.19
Pelecypoda (LPIL)	1.4	1.14
Semelidae (LPIL)	1.2	0.84
Corbula contracta	0.8	1.30
Paraprionospio pinnata	0.8	0.84
Ophiuroidea (LPIL)	0.8	1.79
Golfingia trichocephala	0.6	1.34
Loimia sp. A	0.6	0.89
Strombiformis bilineatus	0.6	0.89
Cryoturris fargoi	0.4	0.55
Diplodonta sp. B	0.4	0.89
Nereis micromma	0.4	0.89
Sigambra tentaculata	0.4	0.89
Turbonilla hemphilli	0.4	0.55
Acteocina bidentata	0.2	0.45
Apoprionospio pygmaea	0.2	0.45
Armandia maculata	0.2	0.45
Barbatia (LPIL)	0.2	0.45
Dentalium pilsbryi	0.2	0.45
Glycera americana	0.2	0.45
Goniada littorea	0.2	0.45
Listriella barnardi	0.2	0.45
Litocorsa sp. A	0.2	0.45
Macoma (LPIL)	0.2	0.45
Moira atropos	0.2	0.45
Natica pusilla	0.2	0.45
Owenia sp. A	0.2	0.45
Oxyurostylis sp. C	0.2	0.45
Ptilanthura sp. A	0.2	0.45
Sabellides sp. A	0.2	0.45
Spiophanes cf. missionensis	0.2	0.45
Synchelidium americanum	0.2	0.45
Lumbrineridae (LPIL)	0.2	0.45
Nereidae (LPIL)	0.2	0.45
Nuculanidae (LPIL)	0.2	0.45
Oligochaeta (LPIL)	0.2	0.45
Polynoidae (LPIL)	0.2	0.45
Sipuncula (LPIL)	0.2	0.45
Spionidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 2. STATION 2.

TAXON	MEAN	STANDARD DEVIATION
Tellina probrina	13.4	7.80
Micropholis gracillima	6.8	4.27
Magelona sp. H	5.4	2.30
Prionospio sp. E	5.2	2.77
Mediomastus (LPIL)	3.4	1.82
Tellina (LPIL)	2.8	5.22
Rhynchocoela (LPIL)	2.8	1.10
Pelecypoda (LPIL)	2.6	1.82
Gastropoda (LPIL)	2.4	3.21
Lumbrineris verrilli	2.2	1.64
Phoronis (LPIL)	2.0	0.71
Ophiuroidea (LPIL)	2.0	1.00
Paraprionospio pinnata	1.6	0.89
Harmothoe (LPIL)	1.4	1.67
Aglaophamus verrilli	1.0	1.73
Dentalium texasianum	1.0	1.00
Naineris sp. A	1.0	1.41
Nereis micromma	1.0	1.00
Sigambra tentaculata	1.0	1.22
Lucinidae (LPIL)	1.0	1.41
Diplodonta sp. B	0.6	0.89
Volvulella persimilis	0.6	0.55
Semelidae (LPIL)	0.6	0.55
Dentalium pilsbryi	0.4	0.89
Strombiformis bilineatus	0.4	0.55
Decapoda Reptantia (LPIL)	0.4	0.89
Abra aequalis	0.2	0.45
Armandia agilis	0.2	0.45
Aspidosiphon (LPIL)	0.2	0.45
Barbatia (LPIL)	0.2	0.45
Bowmaniella portoricensis	0.2	0.45
Corbula contracta	0.2	0.45
Eriopisa (LPIL)	0.2	0.45
Golfingia trichocephala	0.2	0.45
Goniada littorea	0.2	0.45
Hemipodus roseus	0.2	0.45
Leptochela serratorbita	0.2	0.45
Loimia sp. A	0.2	0.45
Ogyrides alphaerostris	0.2	0.45
Oxyurostylis sp. C	0.2	0.45
Solen viridis	0.2	0.45
Spiochaetopterus oculatus	0.2	0.45
Tharyx cf. annulosus	0.2	0.45
Turbonilla hemphilli	0.2	0.45
Nereidae (LPIL)	0.2	0.45
Olividae (LPIL)	0.2	0.45
Sipuncula (LPIL)	0.2	0.45
Spionidae (LPIL)	0.2	0.45
Vitrinellidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 3. STATION 3.

TAXON	MEAN	STANDARD DEVIATION
Prionospio sp. E	8.4	5.55
Tellina (LPIL)	7.2	1.79
Tellina probrina	6.8	7.46
Rhynchocoela (LPIL)	5.4	3.05
Magelona sp. H	5.2	3.70
Micropholis gracillima	4.6	2.51
Lumbrineris verrilli	3.2	1.64
Paraprionospio pinnata	3.2	2.28
Pelecypoda (LPIL)	2.4	2.19
Aglaophamus verrilli	2.0	1.00
Mediomastus (LPIL)	2.0	2.00
Amphiuridae (LPIL)	2.0	1.22
Gastropoda (LPIL)	2.0	1.73
Lucinidae (LPIL)	2.0	2.55
Sigambra tentaculata	1.0	1.73
Harmothoe (LPIL)	0.8	0.84
Owenia sp. A	0.8	0.84
Phoronis (LPIL)	0.8	0.84
Pinnixa (LPIL)	0.8	1.30
Acteocina bidentata	0.6	0.89
Loimia sp. A	0.6	0.89
Nuculanidae (LPIL)	0.6	0.89
Abra aequalis	0.4	0.55
Apoprionospio pygmaea	0.4	0.55
Diplodonta sp. B	0.4	0.89
Nannodiella cf. vespuciana	0.4	0.55
Poecilochaetus (LPIL)	0.4	0.55
Strombiformis bilineatus	0.4	0.55
Ostracoda Family A	0.4	0.55
Sipuncula (LPIL)	0.4	0.55
Ampelisca parapacifica	0.2	0.45
Aspidosiphon albus	0.2	0.45
Automate evermanni	0.2	0.45
Dentalium pilsbryi	0.2	0.45
Dentalium texasianum	0.2	0.45
Golfingia trichocephala	0.2	0.45
Goniada littorea	0.2	0.45
Lumbrineris sp. G	0.2	0.45
Metharpinia floridana	0.2	0.45
Micropholis atra	0.2	0.45
Onchnesoma squamatum	0.2	0.45
Ophiactis sp. B	0.2	0.45
Parvilucina multilineata	0.2	0.45
Pinnixa chaetopterana	0.2	0.45
Turbonilla (LPIL)	0.2	0.45
Turbonilla hemphilli	0.2	0.45

APPENDIX C. TABLE 3. STATION 3. (CONTINUED).

TAXON	MEAN	STANDARD DEVIATION
Decapoda Reptantia (LPIL)	0.2	0.45
Mysidae (LPIL)	0.2	0.45
Nereidae (LPIL)	0.2	0.45
Orbiniidae (LPIL)	0.2	0.45
Ostracoda Family B	0.2	0.45
Semelidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 4. STATION 4.

TAXON	MEAN	STANDARD DEVIATION
Pelecypoda (LPIL)	1.2	0.84
Goniada littorea	0.6	0.55
Mediomastus (LPIL)	0.6	0.89
Tellina (LPIL)	0.6	1.34
Lucinidae (LPIL)	0.6	0.89
Acteocina bidentata	0.4	0.55
Litocorsa sp. A	0.4	0.55
Magelona sp. H	0.4	0.89
Mysidopsis sp. C	0.4	0.55
Nereis micromma	0.4	0.89
Rhynchocoela (LPIL)	0.4	0.89
Abra aequalis	0.2	0.45
Aglaophamus verrilli	0.2	0.45
Barbatia (LPIL)	0.2	0.45
Batea catharinensis	0.2	0.45
Branchiostoma virginiae	0.2	0.45
Brasilomysis castroi	0.2	0.45
Glycera americana	0.2	0.45
Hauchiella sp. A	0.2	0.45
Naineris sp. A	0.2	0.45
Nannodiella cf. *vespuciana*	0.2	0.45
Podarkeopsis levifuscina	0.2	0.45
Prionospio sp. E	0.2	0.45
Gastropoda (LPIL)	0.2	0.45
Mysidae (LPIL)	0.2	0.45
Ostracoda Family C	0.2	0.45

APPENDIX C. TABLE 5. STATION 5.

TAXON	MEAN	STANDARD DEVIATION
Magelona sp. H	5.6	3.36
Sabellaria sp. A	2.6	5.81
Lucinidae (LPIL)	2.6	3.78
Pelecypoda (LPIL)	2.2	2.17
Rhynchocoela (LPIL)	2.0	1.41
Lumbrineris verrilli	1.8	2.17
Mediomastus (LPIL)	1.6	1.67
Tellina (LPIL)	1.6	2.19
Exosphaeroma crenulata	1.4	2.19
Ophiuroidea (LPIL)	1.2	2.68
Phoronis (LPIL)	1.0	0.71
Aglaophamus verrilli	0.8	0.84
Paraprionospio pinnata	0.8	0.84
Prionospio sp. E	0.6	0.55
Sigambra tentaculata	0.6	0.89
Gastropoda (LPIL)	0.6	0.55
Acteocina bidentata	0.4	0.55
Acteon punctostriatus	0.4	0.55
Litocorsa sp. A	0.4	0.89
Promysis atlantica	0.4	0.55
Abra aequalis	0.2	0.45
Cryoturris fargoi	0.2	0.45
Dentalium texasianum	0.2	0.45
Epitonium cf. *apiculatum*	0.2	0.45
Goniada littorea	0.2	0.45
Hemipodus roseus	0.2	0.45
Natica (LPIL)	0.2	0.45
Natica pusilla	0.2	0.45
Nereis micromma	0.2	0.45
Notomastus lobatus	0.2	0.45
Odostomia weberi	0.2	0.45
Onchnesoma squamatum	0.2	0.45
Parvilucina multilineata	0.2	0.45
Pinnixa (LPIL)	0.2	0.45
Spiochaetopterus oculatus	0.2	0.45
Turbonilla (LPIL)	0.2	0.45
Amphinomidae (LPIL)	0.2	0.45
Amphipoda (LPIL)	0.2	0.45
Capitellidae (LPIL)	0.2	0.45
Decapoda Reptantia (LPIL)	0.2	0.45
Nuculanidae (LPIL)	0.2	0.45
Oligochaeta (LPIL)	0.2	0.45
Polynoidae (LPIL)	0.2	0.45
Semelidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 6. STATION 6.

TAXON	MEAN	STANDARD DEVIATION
Magelona sp. H	6.8	4.44
Rhynchocoela (LPIL)	3.0	2.35
Pelecypoda (LPIL)	2.8	2.77
Exosphaeroma crenulata	2.2	3.90
Prionospio sp. E	1.8	2.95
Mediomastus (LPIL)	1.6	1.52
Tellina (LPIL)	1.6	2.61
Lucinidae (LPIL)	1.6	1.82
Paraprionospio pinnata	1.4	1.14
Phoronis (LPIL)	1.4	1.67
Aglaophamus verrilli	1.2	1.30
Armandia agilis	1.2	1.30
Lumbrineris verrilli	1.2	1.30
Tellina versicolor	1.2	2.17
Gastropoda (LPIL)	1.2	0.45
Goniada littorea	0.8	1.30
Ophiuroidea (LPIL)	0.8	1.30
Corbula contracta	0.6	1.34
Promysis atlantica	0.6	0.89
Ancistrosyllis sp. B	0.4	0.89
Apoprionospio dayi	0.4	0.55
Apseudes sp. H	0.4	0.89
Aspidosiphon albus	0.4	0.55
Litocorsa sp. A	0.4	0.89
Loimia sp. A	0.4	0.55
Sigambra tentaculata	0.4	0.89
Tellina probrina	0.4	0.89
Turbonilla hemphilli	0.4	0.55
Abra aequalis	0.2	0.45
Anelassorhynchus sp. A	0.2	0.45
Corophium acutum	0.2	0.45
Cyclaspis sp. P	0.2	0.45
Diopatra neotridens	0.2	0.45
Diplodonta sp. B	0.2	0.45
Glycera americana	0.2	0.45
Golfingia trichocephala	0.2	0.45
Laonice cirrata	0.2	0.45
Micropholis atra	0.2	0.45
Micropholis gracillima	0.2	0.45
Ogyrides alphaerostris	0.2	0.45
Owenia sp. A	0.2	0.45
Oxyurostylis sp. C	0.2	0.45
Pinnixa (LPIL)	0.2	0.45
Pinnixa chaetopterana	0.2	0.45
Strombiformis bilineatus	0.2	0.45
Synchelidium americanum	0.2	0.45

APPENDIX C. TABLE 6. STATION 6. (CONTINUED)

TAXON	MEAN	STANDARD DEVIATION
Turbonilla (LPIL)	0.2	0.45
Volvulella persimilis	0.2	0.45
Amphiuridae (LPIL)	0.2	0.45
Cirratulidae (LPIL)	0.2	0.45
Decapoda Reptantia (LPIL)	0.2	0.45
Nuculanidae (LPIL)	0.2	0.45
Polynoidae (LPIL)	0.2	0.45
Sipuncula (LPIL)	0.2	0.45

APPENDIX C. TABLE 7. STATION 7.

TAXON	MEAN	STANDARD DEVIATION
Prionospio sp. E	14.0	7.18
Tellina probrina	12.2	7.95
Lumbrineris verrilli	11.2	5.89
Micropholis gracillima	10.4	6.35
Mediomastus (LPIL)	5.6	2.88
Magelona sp. H	5.4	2.97
Tellina versicolor	3.8	4.71
Paraprionospio pinnata	3.2	1.64
Rhynchocoela (LPIL)	3.2	1.64
Harmothoe (LPIL)	3.0	3.08
Pelecypoda (LPIL)	2.8	2.17
Aglaophamus verrilli	2.6	2.19
Gastropoda (LPIL)	2.6	1.95
Litocorsa sp. A	2.4	4.83
Sigambra tentaculata	2.4	2.19
Amphiuridae (LPIL)	2.4	2.07
Semelidae (LPIL)	2.4	2.30
Prionospio (LPIL)	1.4	1.67
Ophiuroidea (LPIL)	1.4	1.67
Hiatella arctica	1.2	1.64
Owenia sp. A	1.2	0.45
Tellinidae (LPIL)	1.2	1.79
Ancistrosyllis sp. B	1.0	1.73
Corbula contracta	1.0	2.24
Phoronis (LPIL)	1.0	1.00
Loimia sp. A	0.8	1.30
Decapoda Reptantia (LPIL)	0.8	1.30
Lucinidae (LPIL)	0.8	1.30
Dentalium texasianum	0.6	0.55
Lepidasthenia varius	0.6	0.55
Nereis micromma	0.6	0.55
Notomastus (LPIL)	0.6	0.89
Pinnixa chaetopterana	0.6	1.34
Tellina (LPIL)	0.6	0.89
Volvulella persimilis	0.6	1.34
Apoprionospio dayi	0.4	0.55
Ceratonereis irritabilis	0.4	0.55
Corbula (LPIL)	0.4	0.89
Malmgreniella sp. A	0.4	0.89
Micropholis atra	0.4	0.55
Nephtys sp. D	0.4	0.89
Poecilochaetus (LPIL)	0.4	0.89
Promysis atlantica	0.4	0.55
Spiochaetopterus oculatus	0.4	0.55
Strombiformis bilineatus	0.4	0.89
Turbonilla hemphilli	0.4	0.89

APPENDIX C. TABLE 7. STATION 7 (CONTINUED).

TAXON	MEAN	STANDARD DEVIATION
Acteocina bidentata	0.2	0.45
Ancistrosyllis jonesi	0.2	0.45
Apseudes sp. H	0.2	0.45
Armandia maculata	0.2	0.45
Aspidosiphon albus	0.2	0.45
Bowmaniella (LPIL)	0.2	0.45
Cyclaspis (LPIL)	0.2	0.45
Dentalium pilsbryi	0.2	0.45
Euceramus praelongus	0.2	0.45
Goniada littorea	0.2	0.45
Leptochela serratorbita	0.2	0.45
Listriella barnardi	0.2	0.45
Lyonsia (LPIL)	0.2	0.45
Naineris sp. A	0.2	0.45
Onchnesoma squamatum	0.2	0.45
Pinnixa sp. A	0.2	0.45
Ptilanthura sp. A	0.2	0.45
Spiophanes cf. missionensis	0.2	0.45
Synchelidium americanum	0.2	0.45
Tharyx cf. annulosus	0.2	0.45
Actiniaria (LPIL)	0.2	0.45
Decapoda Natantia (LPIL)	0.2	0.45
Sigalionidae (LPIL)	0.2	0.45
Spionidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 8. STATION 8.

TAXON	MEAN	STANDARD DEVIATION
Mediomastus (LPIL)	1.2	1.10
Rhynchocoela (LPIL)	1.2	0.84
Branchiostoma virginiae	0.6	0.89
Cyclaspis sp. Q	0.6	0.89
Aglaophamus verrilli	0.4	0.55
Bowmaniella (LPIL)	0.4	0.89
Goniada littorea	0.4	0.55
Prionospio sp. E	0.4	0.55
Tiron triocellatus	0.4	0.89
Lucinidae (LPIL)	0.4	0.89
Paguridae (LPIL)	0.4	0.89
Abra aequalis	0.2	0.45
Armandia agilis	0.2	0.45
Bowmaniella brasiliensis	0.2	0.45
Ceratocephale sp. B	0.2	0.45
Crassinella lunulata	0.2	0.45
Megaluropus myersi	0.2	0.45
Metharpinia floridana	0.2	0.45
Mooreonuphis cf. *nebulosa*	0.2	0.45
Olivella dealbata	0.2	0.45
Olivella nivea	0.2	0.45
Owenia sp. A	0.2	0.45
Pinnixa sp. A	0.2	0.45
Scolelepis texana	0.2	0.45
Strombiformis sp. D	0.2	0.45
Synchelidium americanum	0.2	0.45
Tiron tropakis	0.2	0.45
Cumacea (LPIL)	0.2	0.45
Nephtyidae (LPIL)	0.2	0.45
Ostracoda Family C	0.2	0.45
Sigalionidae (LPIL)	0.2	0.45

APPENDIX C. TABLE 9. STATION 9.

TAXON	MEAN	STANDARD DEVIATION
Magelona sp. H	3.0	1.41
Lucinidae (LPIL)	2.6	0.89
Lumbrineris verrilli	1.8	1.30
Mediomastus (LPIL)	1.8	1.92
Rhynchocoela (LPIL)	1.4	1.14
Paraprionospio pinnata	1.0	0.71
Aglaophamus verrilli	0.8	1.10
Phoronis (LPIL)	0.8	0.84
Gastropoda (LPIL)	0.6	0.89
Nephtyidae (LPIL)	0.6	0.89
Goniada littorea	0.4	0.55
Sigambra tentaculata	0.4	0.55
Spiochaetopterus oculatus	0.4	0.55
Tellinidae (LPIL)	0.4	0.55
Acteocina bidentata	0.2	0.45
Brasilomysis castroi	0.2	0.45
Dentalium texasianum	0.2	0.45
Exosphaeroma crenulata	0.2	0.45
Golfingia trichocephala	0.2	0.45
Loimia sp. A	0.2	0.45
Lucifer faxoni	0.2	0.45
Notomastus (LPIL)	0.2	0.45
Paramphinome sp. B	0.2	0.45
Pinnixa (LPIL)	0.2	0.45
Prionospio sp. E	0.2	0.45
Sigambra wassi	0.2	0.45
Amphipoda (LPIL)	0.2	0.45
Cyclostrematidae (LPIL)	0.2	0.45
Oligochaeta (LPIL)	0.2	0.45
Pelecypoda (LPIL)	0.2	0.45

APPENDIX D

CANAVERAL CANDIDATE SITE TRAWL SAMPLE DATA

PREFACE

The following section of the contractor site characterization report was completed before the Canaveral Harbor DEIS was published. As such, the reconfigured ODMDS was not depicted in the report. In order to maintain the integrity of the report, no revisions were made.

APPENDIX D. CANAVERAL CANDIDATE SITE TRAWL SAMPLE DATA.

	Stations							
Taxa	2a	2b	4a	4b	7a	7b	9a	9b
Algae								
Phaeophycophyta								
Fucales								
Sargassaceae								
Sargassum sp.	X	X	X	X				
Anthophyta								
Angiospermae								
Hydrocharitaceae								
Thalassia sp.		X						
Cnidaria								
Hydrozoa								
Hydroida	X	X	X		X	X	X	
Campanulariidae								
Campanularia marginata	X	X	X		X	X	X	
Scyphozoa								
Semaeastomeae								
Ulmaridae								
Aurelia sp.					1			
unid. Scyphozoan	1		1		6	1	3	1
Anthozoa								
Octocorallia								
Gorgonacea								
unid. Gorgonacea			X	X				
Zoantharia								
Actinaria								
unid. Actinaria	2			3			6	
Mollusca								
Gastropoda								
Prosobranchia								
Mesogastropoda								
Crepidulidae								
Crepidula fornicata						2		1
Crepidula plana						1		
Muricidae								
Eupleura sp.						1		
Neogastropoda								
Olividae								
Oliva sayana							1	
Bivalvia								
Lamellibranchia								
Pterioida								
Anomiidae								
Anomia simplex								4

APPENDIX D. (CONTINUED).

Taxa	2a	2b	4a	4b	7a	7b	9a	9b
	Stations							
Cephalopoda								
Teuthoidea								
Myopsida								
Loliginidae								
Lolliguncula brevis	7	16	9	12	41	9	23	14
Arthropoda								
Crustacea								
Malacostraca - Decapoda								
Penaeidea								
Penaeidae								
Trachypenaeus sp.	19	20	21	23	13	35		
Penaeus aztecus					7	3		
Penaeus setiferus	2	2	3	1			2	
Xiphopenaeus kroyeri				7	1	5	N	N
Sergestoidea								
Sergestidae								
Acetes americanus	N	N	N	N	N	N	N	N
Caridea								
Hippolytidae								
Exhippolysmata oplophoroides							1	
Anomura - Paguridea								
Paguridae								
Petrochirus diogenes						1		
Pagurus pollicaris				1	1		1	3
Anomura - Galatheidea								
Porcellanidae								
Porcellana sayana						9		
Brachyura								
Calappidae								
Hepatus epheliticus			2	1	1	2	3	4
Leucosiidae								
Persephona mediterranea					1			
Portunidae								
Portunus gibbesii		2			3			
Portunus sp.	1							2
unid. Portunidae			1					
Malacostraca - Haplocarida								
Stomatopoda								
Squillidae								
Squilla empusa					4	3	2	

APPENDIX D. (CONTINUED).

Taxa	Stations 2a	2b	4a	4b	7a	7b	9a	9b
Ectoprocta								
Gymnolaemata								
Ctenostomata								
Vescicularidae								
unid. Vescicularidae	X	X				X		
Echinodermata								
Stelleroidea								
Asteroidea								
Platyasterida								
Luidiidae								
Luidia clathrata	2	4	4	1	1	1		
Spinulosida								
Echinasteridae								
Echinaster sp.	1	1				1		
Echinoidea								
Arbacioida								
Arbaciidae								
Arbacia punctulata			1		2			4
Holothuroidea								
Dendrochirotida								
Cucumariidae								
unid. Cucumariidae							1	
Chordata								
Osteichthyes								
Anguilliformes								
Ophichthidae								
Ophichthus gomesi							1	
Clupeiformes								
Clupeidae								
Harengula clupeola					4	1		2
Engraulidae								
Anchoa hepsetus	17	44		3	1	1	3	2
Anchoa mitchilli						5.		
Myctophiformes								
Synodontidae								
Synodus foetens						4		
Siluriformes								
Ariidae								
Arius felis		13	9	9	8		15	3
Gasterosteiformes								
Syngnathidae								
Hippocampus erectus				1				1

APPENDIX D. (CONTINUED).

Taxa	Stations 2a	2b	4a	4b	7a	7b	9a	9b
Perciformes								
Serranidae								
Centropristis philadelphica	15	9	13	5	36	20	6	
Carangidae								
Chloroscombrus chrysurus	1	2	5	7	1	2		11
Selene setapinnis	1					1		2
Selene vomer						1		1
Gerreidae								
Eucinostomus gula		1		1				
Sparidae								
Lagodon rhomboides								1
Haemulidae								
Orthopristis chrysoptera			3		2	1	1	4
Sciaenidae								
Bairdiella chrysoura			21	48	47	24	300	17
Cynoscion nothus	45	301	115	98	110	1	56	104
Cynoscion regalis								1
Larimus fasciatus	7	11	10	7	19	15		15
Leiostomus xanthurus		3		2	3		2	4
Menticirrhus americanus		2			2	1	3	4
Micropogonias undulatus	31	9	3	12	7		16	2
Ephippidae								
Chaetodipterus faber	2	1	5	1	1	1		4
Sphyraenidae								
Sphyraena borealis		2	2	2	2			1
Trichiuridae								
Trichiurus lepturus		1	25	20	33	1	18	17
Stromateidae								
Peprilus paru							1	
Scorpaenidae								
Scorpaena calcarta		1	2		4	2	4	6
Triglidae								
Prionotus martis							2	
Prionotus scitulus	1				2	2	3	
Prionotus sp.							1	1
Pleuronectiformes								
Bothidae								
Etropus crossotus	1	1	1	1	12	8	2	5
Cynoglossidae								
Symphurus plagiusa	8	6	3	3	12	5	4	3
Tetraodontiformes								
Balistidae								
Monacanthus hispidus							2	

N = Numerous, X = Present

APPENDIX E

LATITUDE AND LONGITUDE OF THE FOUR SITE CORNERS AND THE NINE SAMPLING STATIONS ASSOCIATED WITH THE POTENTIAL CANAVERAL HARBOR CANDIDATE OCEAN DREDGED MATERIAL DISPOSAL SITE

The following section of the consultant report was completed before the Canaveral Harbor DEIS was published. As such, the corner coordinates provided are of the original DEIS configuration as opposed to the reconfiguration presented in this FEIS. However, corner coordinates for the reconfiguration are referenced in the FEIS text. (The sampling station coordinates presented in this Appendix E did not change with a change in site configuration.) All coordinates are based on the North American Datum of 1927 (NAD 27) as opposed to the new NAD 83 measurements.

APPENDIX E. LATITUDE AND LONGITUDE OF THE FOUR SITE CORNERS AND THE NINE SAMPLING STATIONS ASSOCIATED WITH THE POTENTIAL CANAVERAL HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE.

Corner/Station	Latitude	Longitude
North Corner	28°19.73'	80°30.30'
East Corner	28°18.45'	80°28.54'
South Corner	28°16.92'	80°30.00'
West Corner	28°18.21'	80°31.74'
Station 1	28°18.33'	80°30.11'
Station 2	28°18.43'	80°28.92'
Station 3	28°17.28'	80°30.03'
Station 4	28°18.30'	80°31.30'
Station 5	28°19.37'	80°30.23'
Station 6	28°19.47'	80°28.99'
Station 7	28°17.37'	80°28.84'
Station 8	28°17.33'	80°31.25'
Station 9	28°19.32'	80°31.43'

APPENDIX F

SUMMARY OF SEDIMENT MAPPING SURVEYS

4.0 CANAVERAL ODMDS

4.1 OBJECTIVE

On the Canaveral I ODMDS Survey (July 1988), the results showed the possible presence of dredged disposal material to the west of the ODMDS. The primary purpose of the Canaveral II ODMDS Survey was to identify whether this material was natural or resulted from disposal activities. This identification was to be made from gamma radiation data and XRF elemental analyses of the seafloor sediments. With this data, site maps were to be prepared showing the distribution patterns of the sediments on the seafloor based on their natural radioactivity. Representative box cores were to be taken from the newly surveyed area to confirm the presence or absence of dredged material.

4.2 RESULTS

Immediately following the Fernandina Beach Survey, the OSV Anderson headed for Cape Canaveral while the EPA-CAIS crew traveled by land. The ship arrived at the city port at 0115 on April 25, 1989, and received the EPA-CAIS crew members for the Canaveral ODMDS survey. The ship departed port at 0145 and the gamma sled was deployed for preliminary testing at 0250. Station 001 (28°19.24'N and 80°31.92'W) was reached at 0354. The entire survey area was sampled and the survey concluded at Station 190 (28°19.27'N and 80°31.95'W) at 2143.

In Figure 18, the Canaveral ODMDS is shown in relation to the Canaveral shoreline. Figure 19 shows the ship's transects and gamma measurement stations in relation to the Canaveral ODMDS. Figures 20 through 27 show the Bi-214, Tl-208, K-40, and total absolute gamma activity maps generated for the survey area. Figures 28 and 29 show the depth contour and topographic profile of the seafloor. Appendix C lists the gamma data collected on the survey.

The second part of the survey was to collect representative box cores from the newly surveyed area. The first sample collected was at Site 2A (28°19.62'N and 80°32.07'W) at 2223. The final box core was successfully obtained at Site 5 (28°21.55'N and 80°31.97'W) at 2329. A total of seven box cores were collected in the survey area. Figure 30A shows the location of the

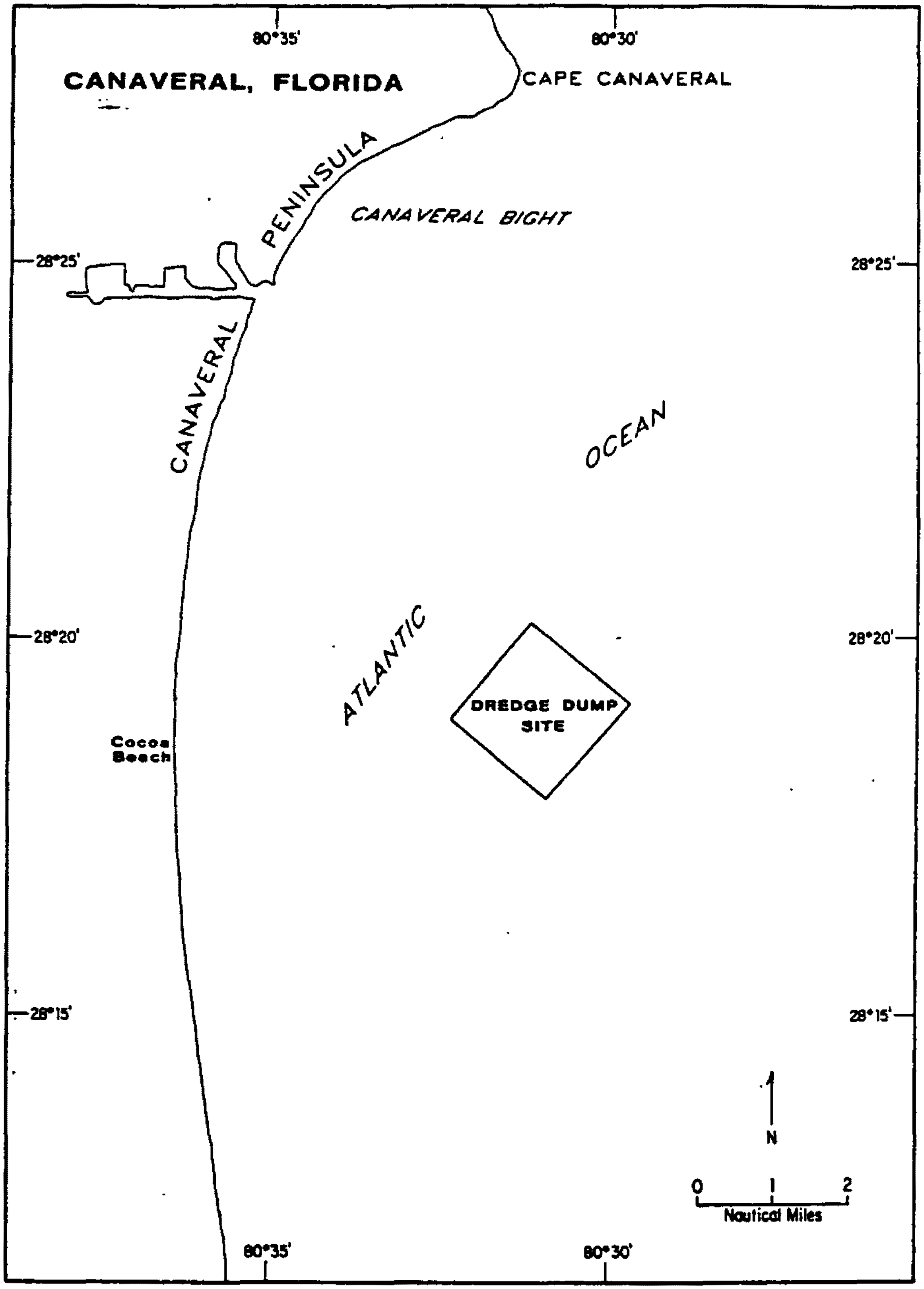


Figure 18. Canaveral Ocean Dredged Material Disposal Site.

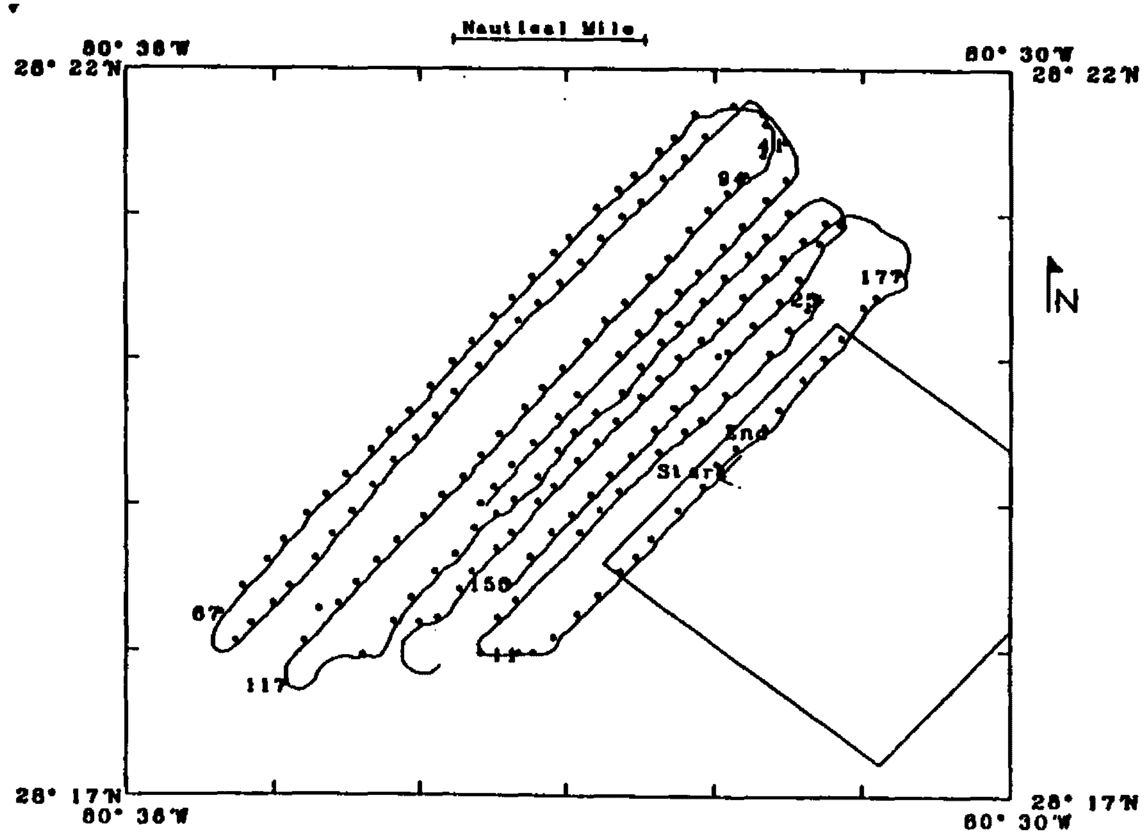


Figure 19. Ship's transects and gamma measurement stations for Canaveral ODMDS.

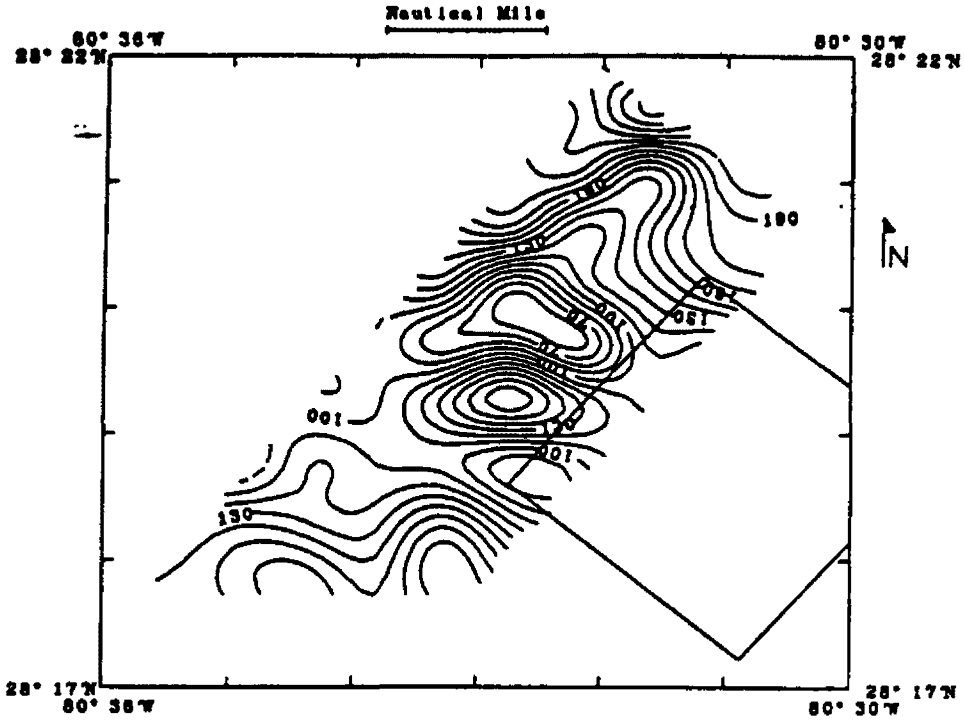


Figure 20. Contour map for Bi-214 absolute gamma activity for Canaveral ODMDS.

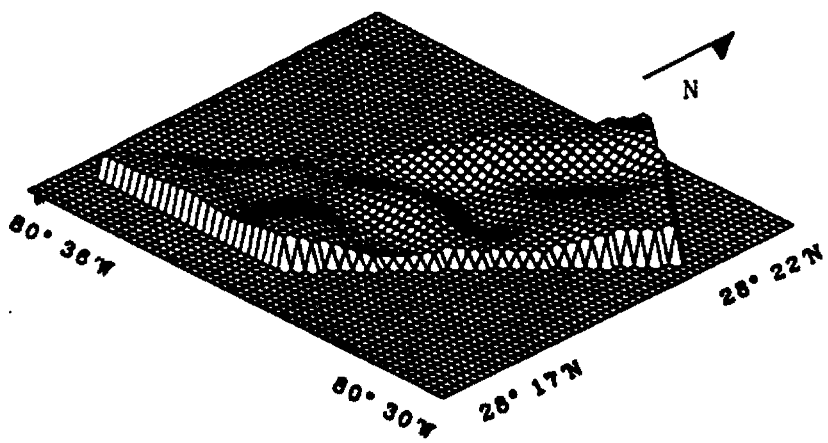


Figure 21. Topographic profile of Bi-214 absolute gamma activity for Canaveral ODMDS.

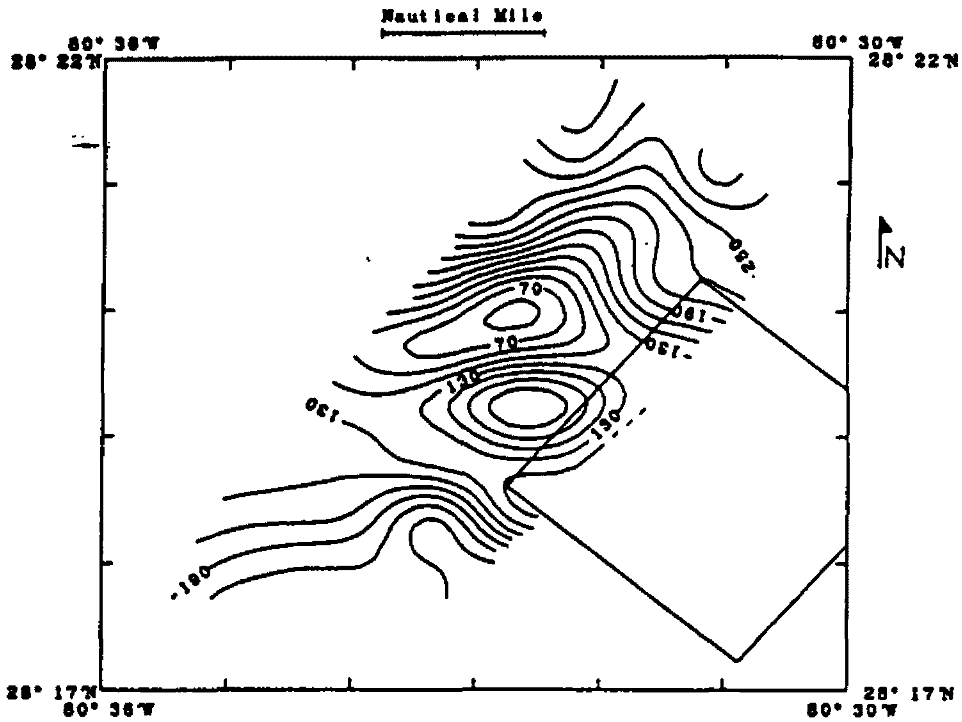


Figure 22. Contour map for Tl-208 absolute gamma activity for Canaveral ODMDS.

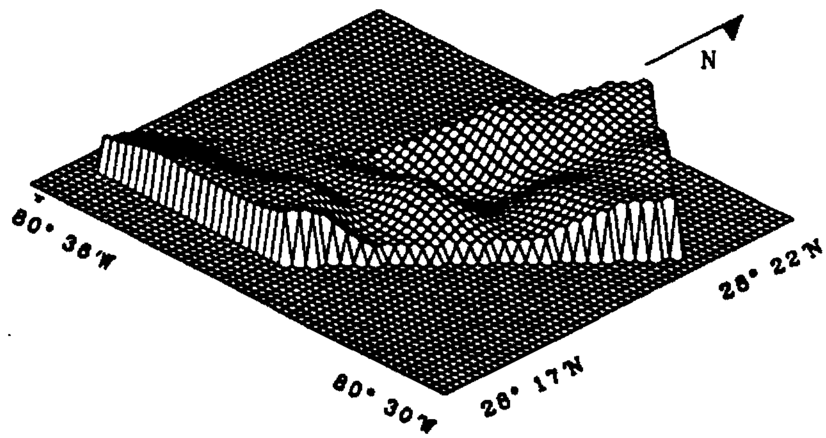


Figure 23. Topographic profile of Tl-208 absolute gamma activity for Canaveral ODMDS.

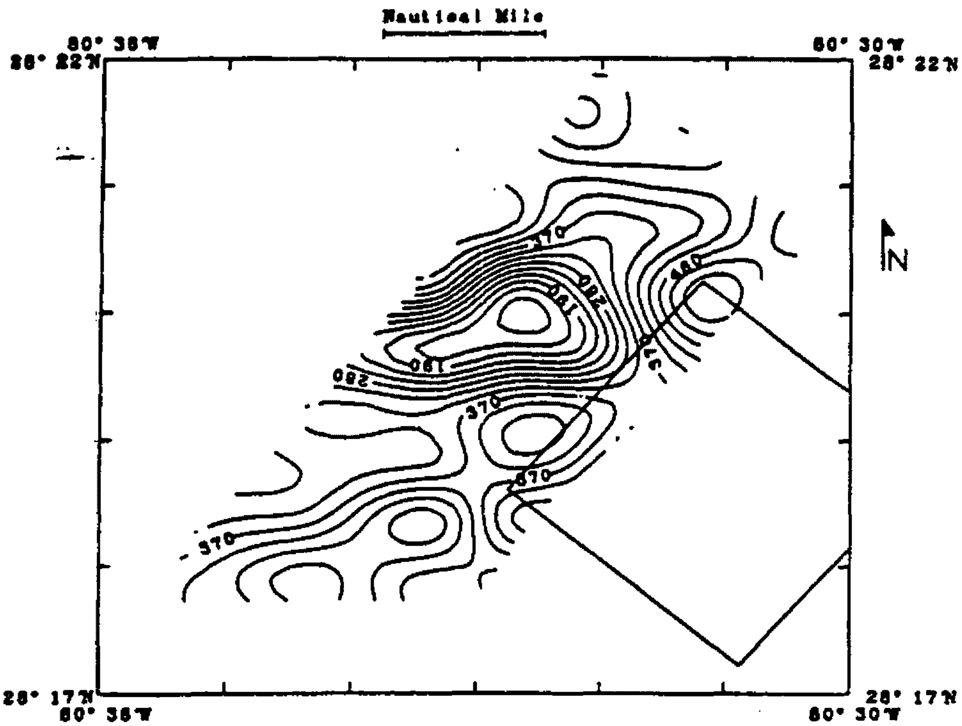


Figure 24. Contour map for K-40 absolute gamma activity for Canaveral ODMDS.

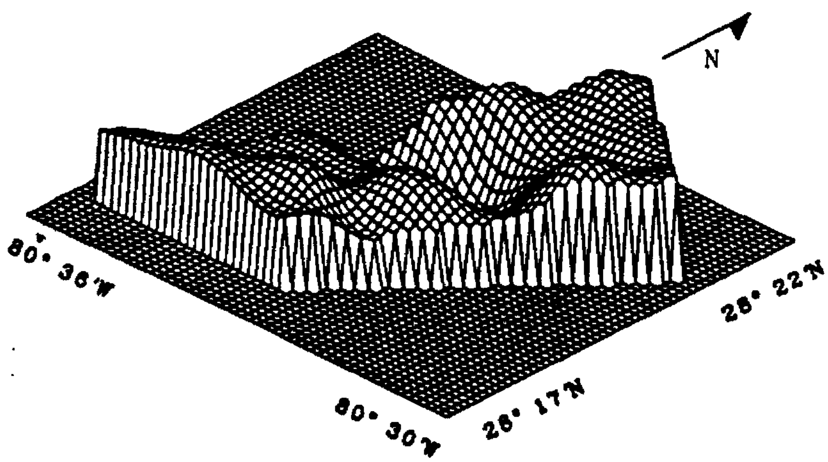


Figure 25. Topographic profile of K-40 absolute gamma activity for Canaveral ODMDS.

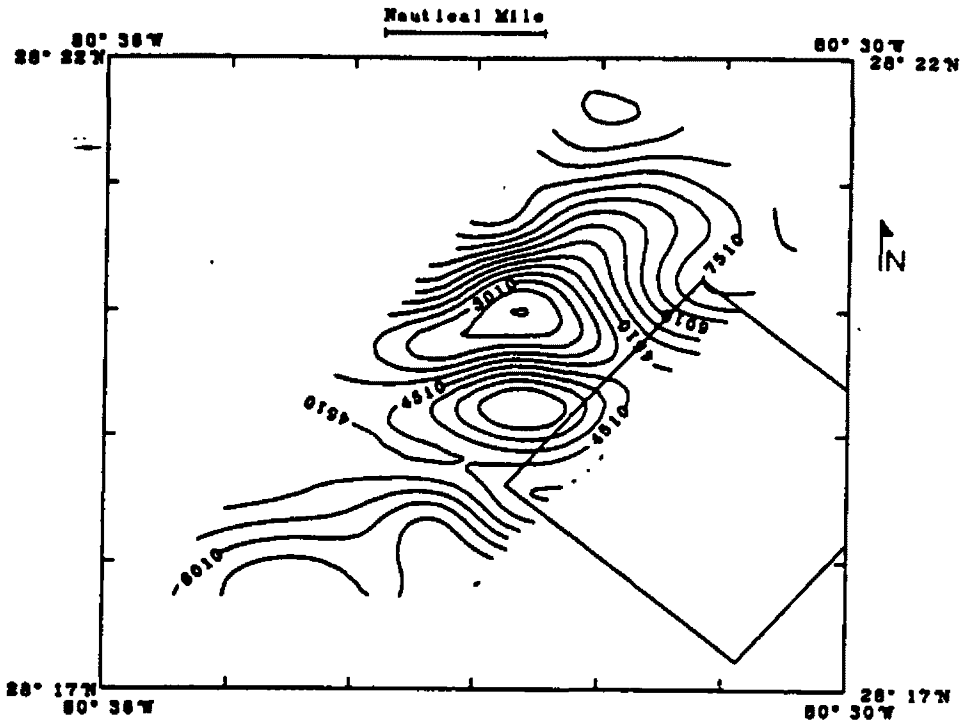


Figure 26. Contour map for total absolute gamma activity for Canaveral ODMDS.

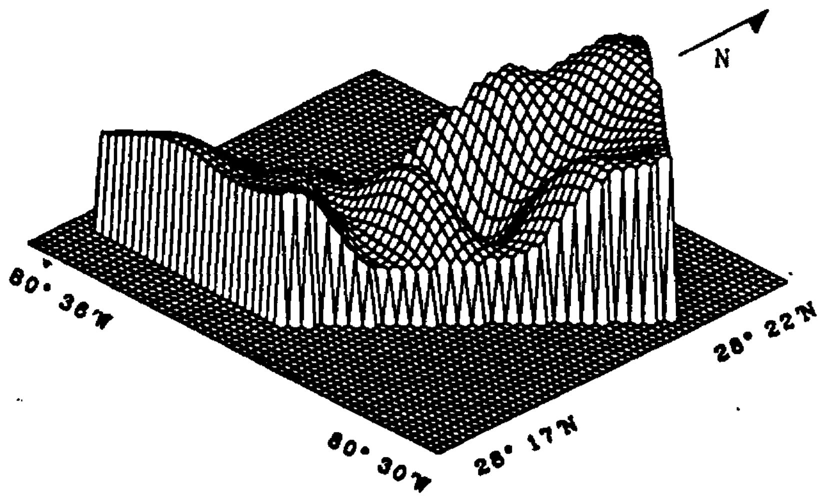


Figure 27. Topographic profile of total absolute gamma activity for Canaveral ODMDS.

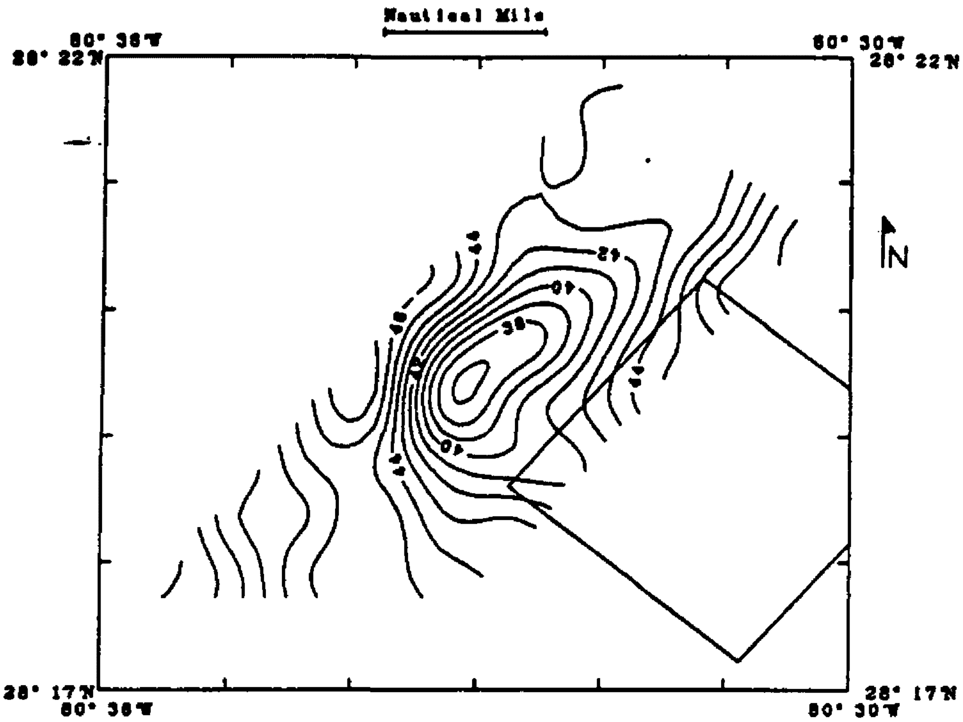


Figure 28.Contour map of depth for Canaveral ODMDS.

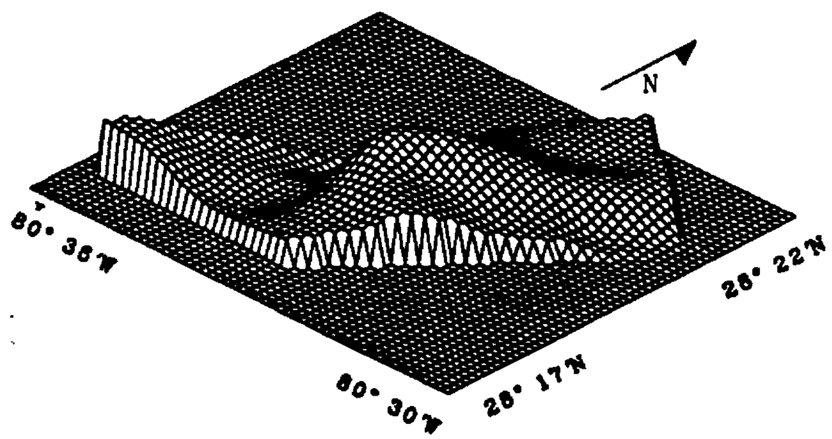


Figure 29. Topographic profile of the seafloor for Canaveral ODMDS.

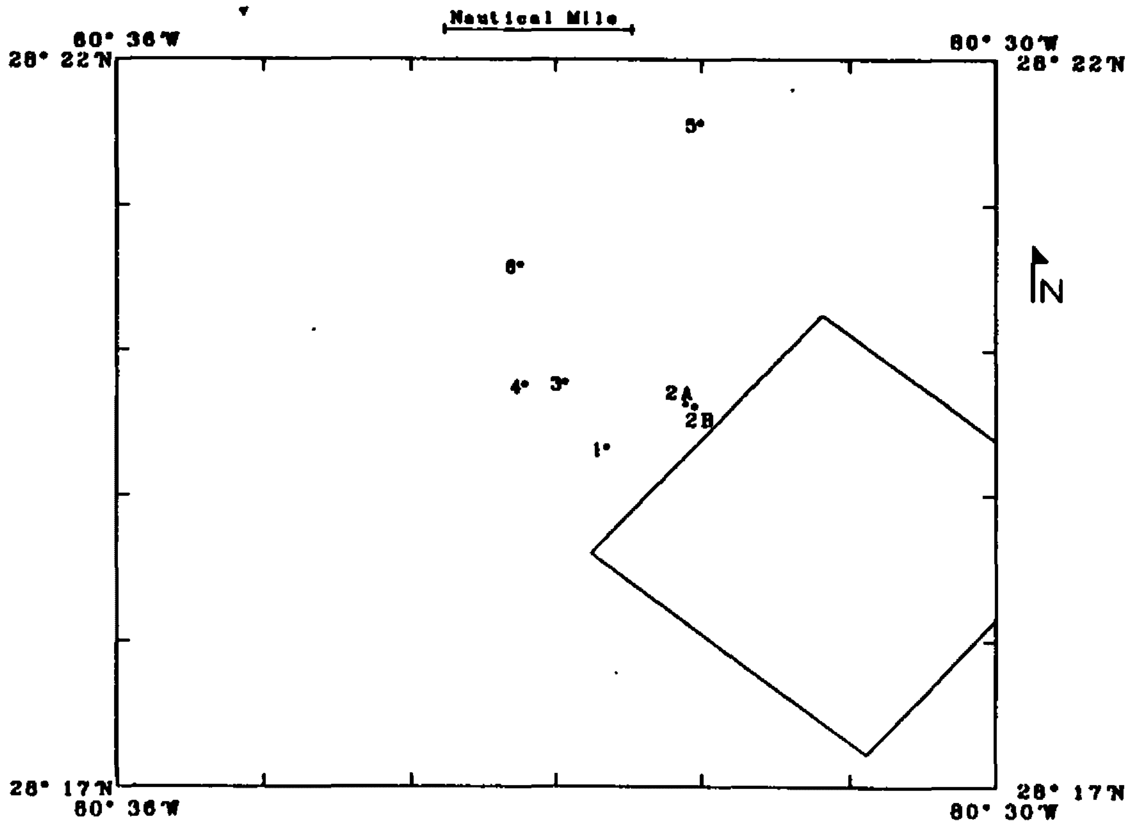


Figure 30A. Box core locations for Canaveral ODMDS.

BOX CORE COORDINATES

Box Core #1
28° 19.32'N
80° 32,61'W

Box Core #2A
28° 19.62'N
80° 32.07'W

Box Core #2B
28° 19.60'N
80° 32.01'W

Box Core #3
28° 19.77'N
80° 32.90'W

Box Core #4
28° 19.75'N
80° 33.18'W

Box Core #5
28° 21.55'N
80° 31.97'W

Box Core #6
28° 20.69'N
80° 33.21'W

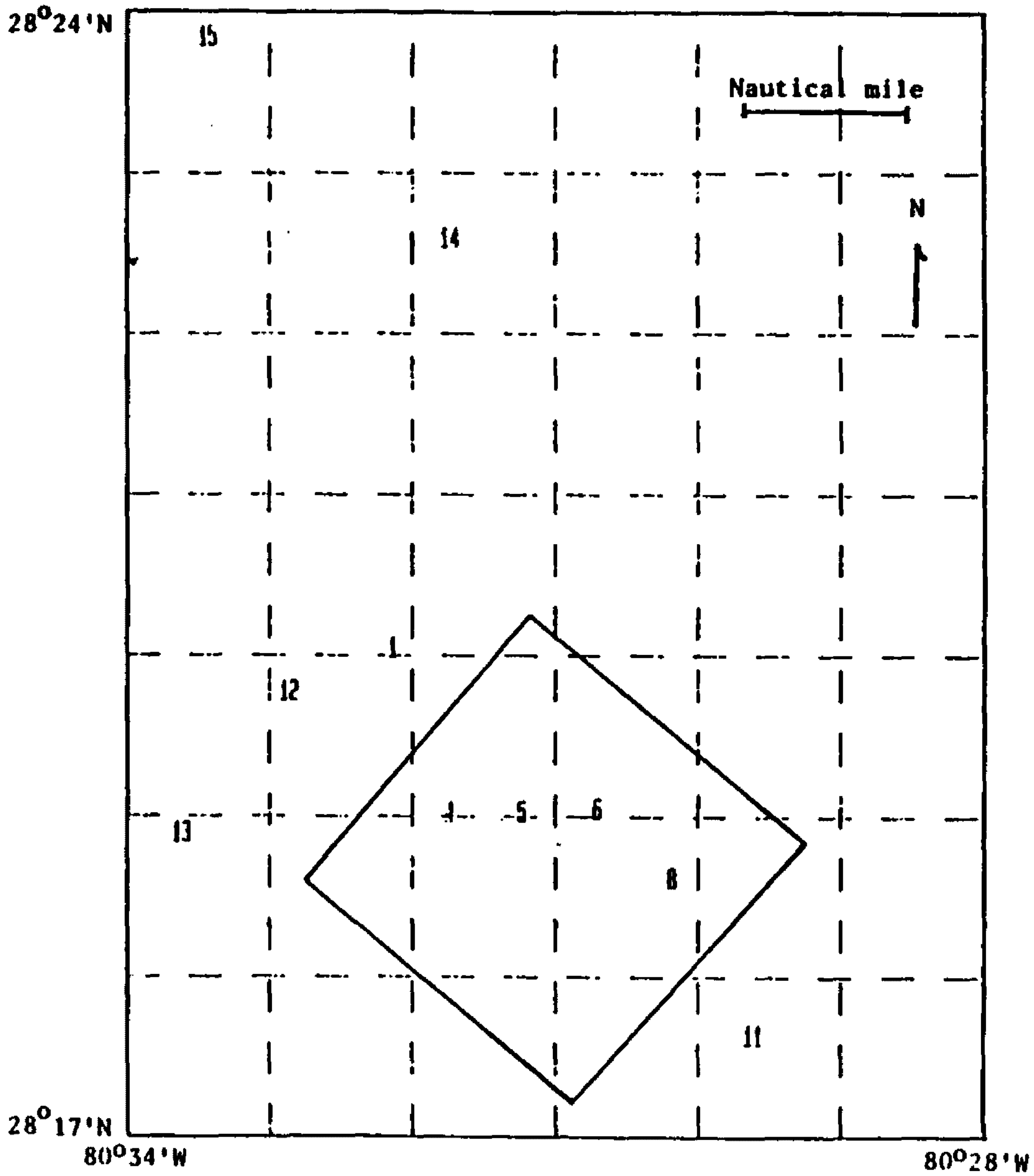
box cores in relation to the ODMDS boundaries. Figure 30B shows the box cores from the Canaveral I Survey (CAIS, 1989). Figure 31 shows the particle size analysis of the box cores. Table 3 shows the elemental and radiometric analyses of the seven box cores. Completion of the box core collection concluded the Canaveral II Survey and the ship headed for the city port. Survey equipment and EPA-CAIS crew were off-loaded at 0730 on April 26, 1989.

The gamma activity data was later used to generate composite site maps for the areas covered by Canaveral I and II Surveys. Figures 32 through 39 show the composite maps for Bi-214, Tl-208, K-40 and total absolute gamma activity. Figures 40 and 41 show the composite depth contour and topographic profile of the seafloor.

4.3 CONCLUSIONS

As a result of the Canaveral I ODMDS Survey (CAIS, 1989), the dredged material was identified as a circular mound within the ODMDS boundaries that had low gamma activity levels associated with the material. However, two possible western extensions of the dredged material were also suggested by the gamma maps. The first of these extensions was located near 28°20'N latitude and was directed westward. This area was shown as a depression of gamma activity similar to that of the area identified as the dredged material.

The Canaveral II Survey data determined this area to be separated from the spoil site by a zone of higher gamma activity. This higher gamma activity also coincided with a rise in the seafloor of approximately 1 meter just outside the northwestern boundary line. box core 2B was collected on the eastern edge of the depression, and 2A 108 meters to the west. The box core locations were chosen because of the rapid change of gamma activity between the two sites, higher for 2B and lower for 2A. Visual inspection of the core samples showed both to be sand overlaying a light colored compact clay. The particle size analysis compared closely, but sample 2A had a higher percentage of fine (0.063 mm) and medium (0.125 mm) size particles than 2B. box cores 3 and 4 showed medium particle size sand with no clay present. Particle size analysis for these cores indicate a higher percentage of particle size 0.250 mm than 2A or 2B. box cores 5 and 6 also showed a layer of sand over a similar clay that had a dominant percentage of 0.063 mm particle size.



Box core locations

Box core #1	28°19.99'N	80°32.16'W
Box core #4	28°18.97'N	80°31.77'W
Box core #5	28°18.97'N	80°31.26'W
Box core #6	28°18.99'N	80°30.73'W
Box core #8	28°18.56'N	80°30.21'W
Box core #11	28°17.58'N	80°29.67'W
Box core #13	28°19.72'N	80°32.92'W
Box core #13	28°18.84'N	80°33.67'W
Box core #14	28°22.54'N	80°31.80'W
Box core #15	28°23.79'N	80°33.49'W

Figure 30B. Location of box cores at Canaveral ODMDS taken from Canaveral I survey report (March 1989)

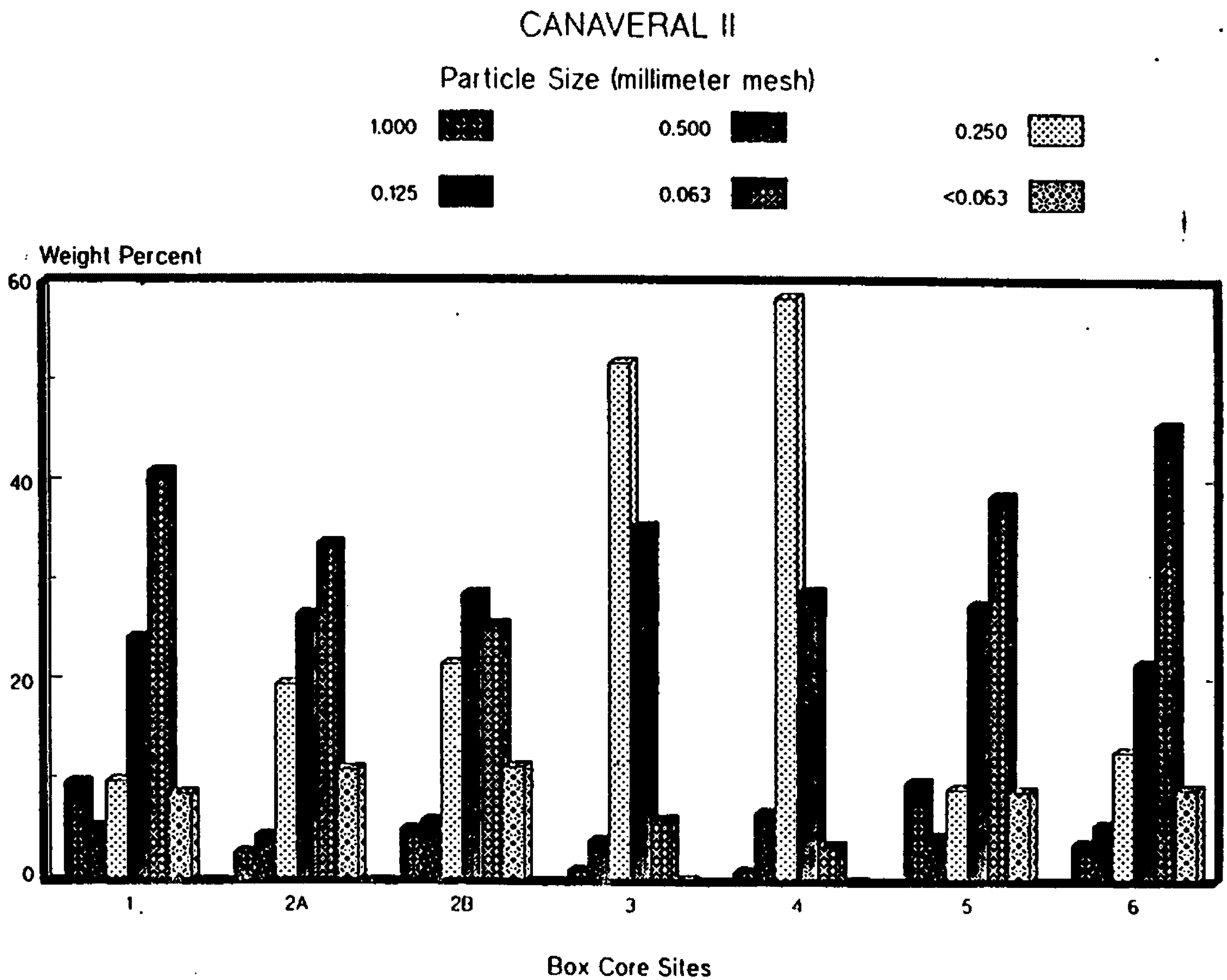


Figure 31. Histogram of box core sediments from Canaveral ODMDS.

TABLE 3. CANAVERAL II ODMDS SURVEY BOX CORE SEAFLOOR SEDIMENT SAMPLES

XRF Analyses

Boxcore:	1	2A	2B	3	4	5	6
Element				Percent			
Na	3.58	3.14	3.76	3.40	3.53	3.36	3.49
Mg	0.28	0.30	0.37	0.09	0.03	0.34	0.35
Al	1.77	1.88	2.16	0.72	0.63	1.95	2.20
Si	16.71	14.84	17.39	21.55	17.80	17.31	18.37
K	0.96	0.91	0.93	0.55	0.67	1.01	1.02
Ca	6.51	7.94	9.11	3.84	3.73	5.73	6.06
Ti	0.37	0.40	0.39	0.33	0.37	0.44	0.37
Fe	1.15	1.54	1.51	0.42	0.43	1.23	1.35
				ppm			
V	63.93	99.52	87.85	65.58	64.71	54.57	65.05
Cr	19.75	N.D.	N.D.	N.D.	N.D.	21.56	21.58
Mn	183.08	215.20	208.52	79.44	68.32	187.36	185.94
Co	3.22	0.56	4.28	1.11	0.61	N.D.	1.50
Ni	12.90	12.84	23.62	9.96	9.98	14.78	12.01
Cu	32.50	34.72	20.83	31.26	55.18	49.58	35.27
Zn	52.91	16.78	22.49	40.03	20.45	61.47	15.05
Rb	53.37	59.80	67.29	24.53	31.31	57.58	57.19
Sr	517.01	681.89	706.74	260.28	294.56	478.75	493.15
Zr	473.99	721.55	500.53	1000	1600	890.13	631.44
Ba	458.07	490.06	479.42	208.58	275.47	504.50	481.52
I	N.D.	497.11	N.D.	N.D.	N.D.	N.D.	N.D.

Radiometric Analyses

				(pCi/Kg)			
U	902	927	650	331	322	1327	982
Th	706	780	445	112	94	1246	778
K	5870	6070	5530	6200	570	6570	7100
CS-137	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	35

*N.D. = Not detected

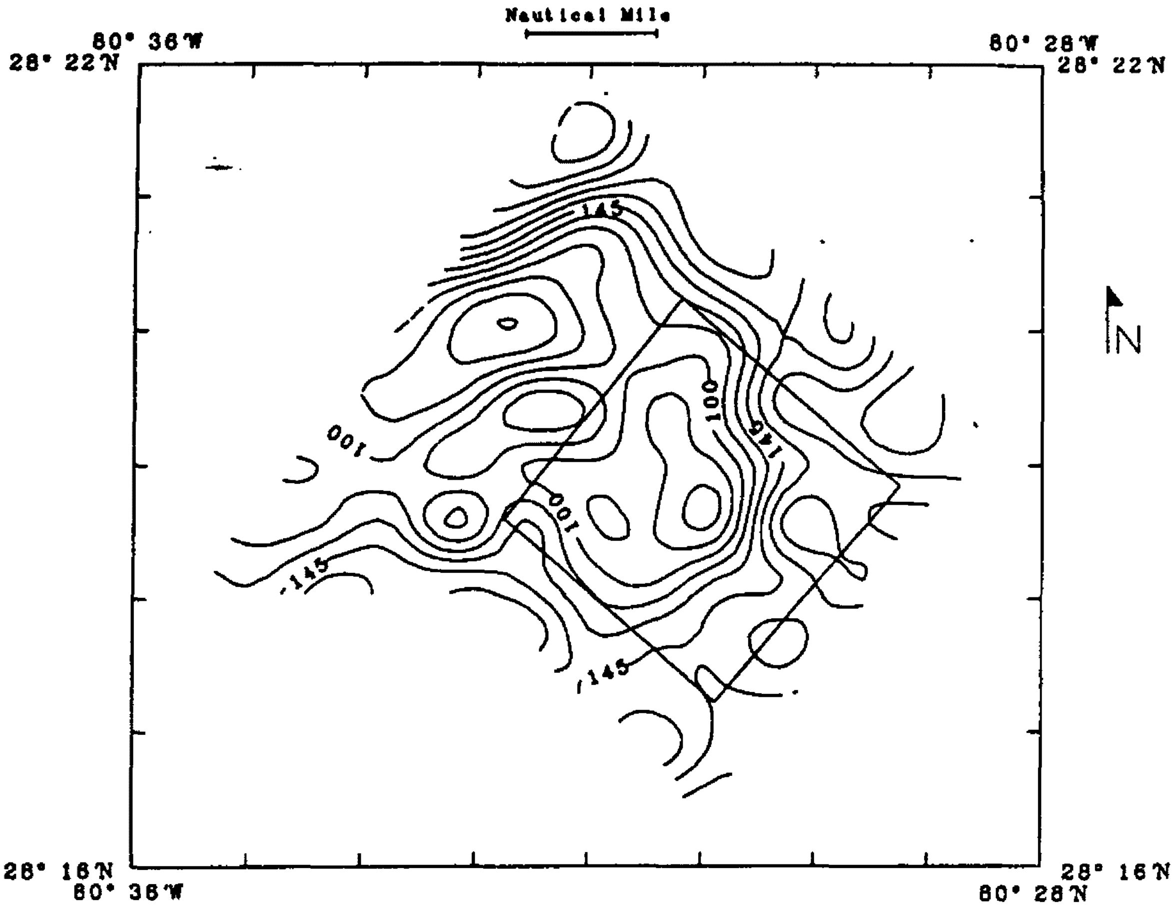


Figure 32. Contour map of Bi-214 absolute gamma activity for the combined survey regions of Canaveral I and II.

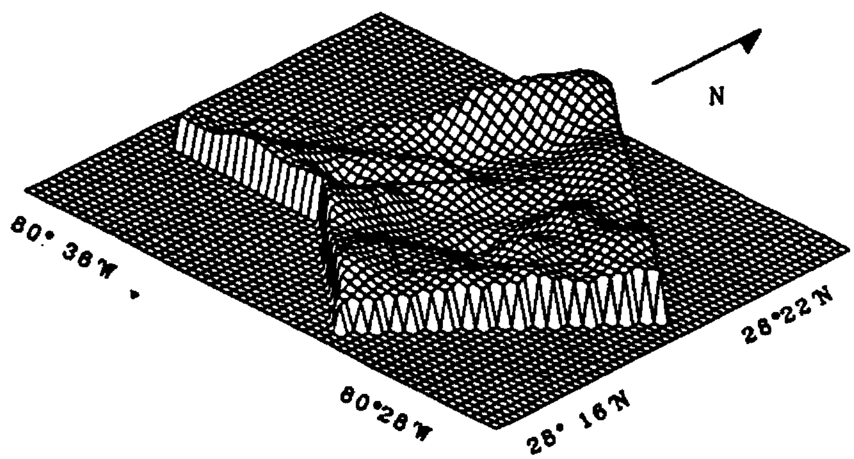


Figure 33. Topographic profile of Bi-214 absolute gamma activity for the combined survey regions of Canaveral I and II.

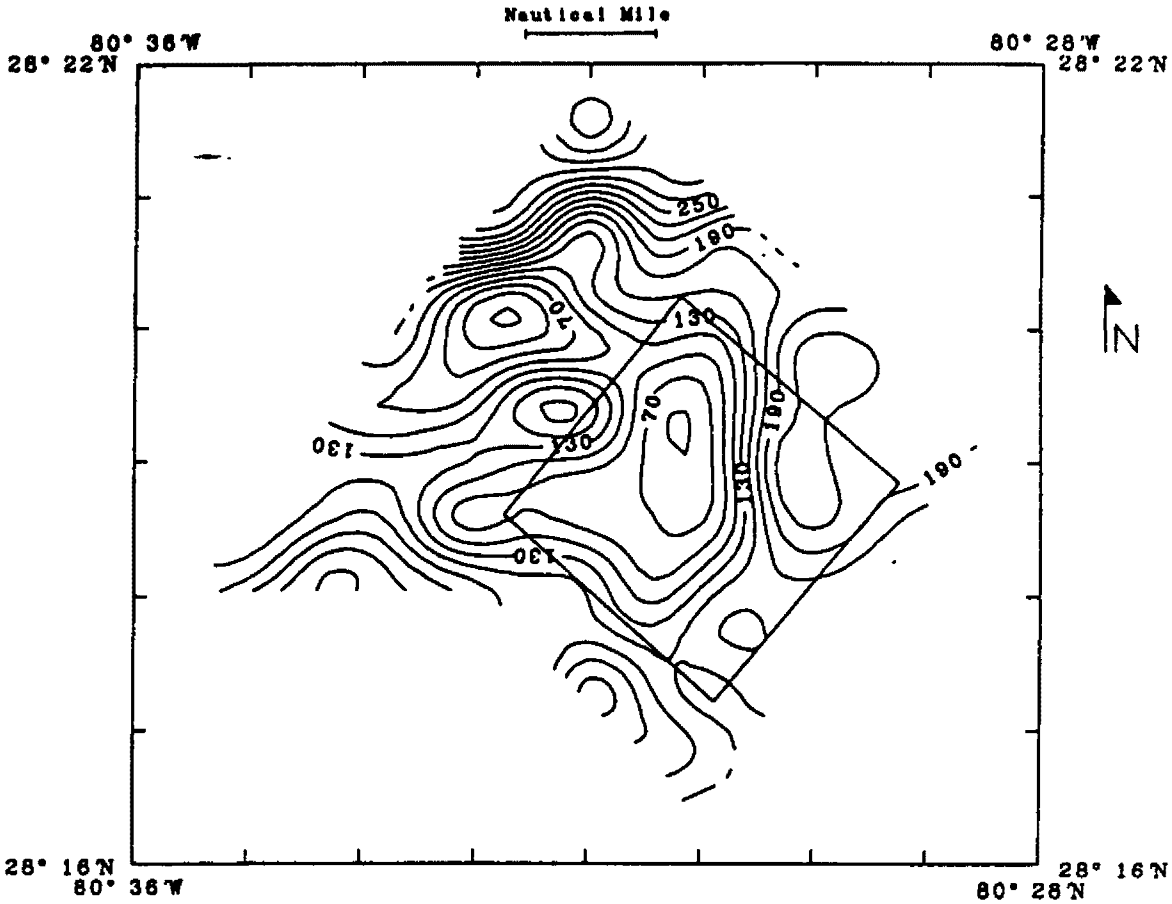


Figure 34. Contour map of Tl-208 absolute gamma activity for the combined survey regions of Canaveral I and II.

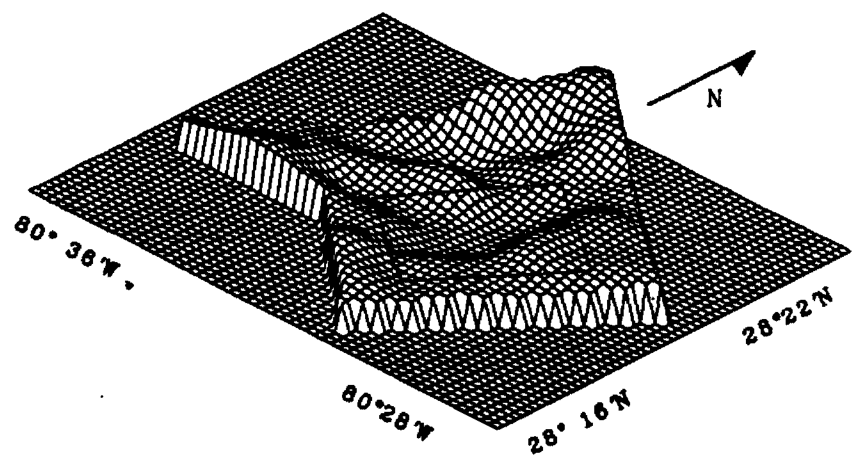


Figure 35. Topographic profile of Tl-208 absolute gamma activity for the combined survey regions of Canaveral I and II.

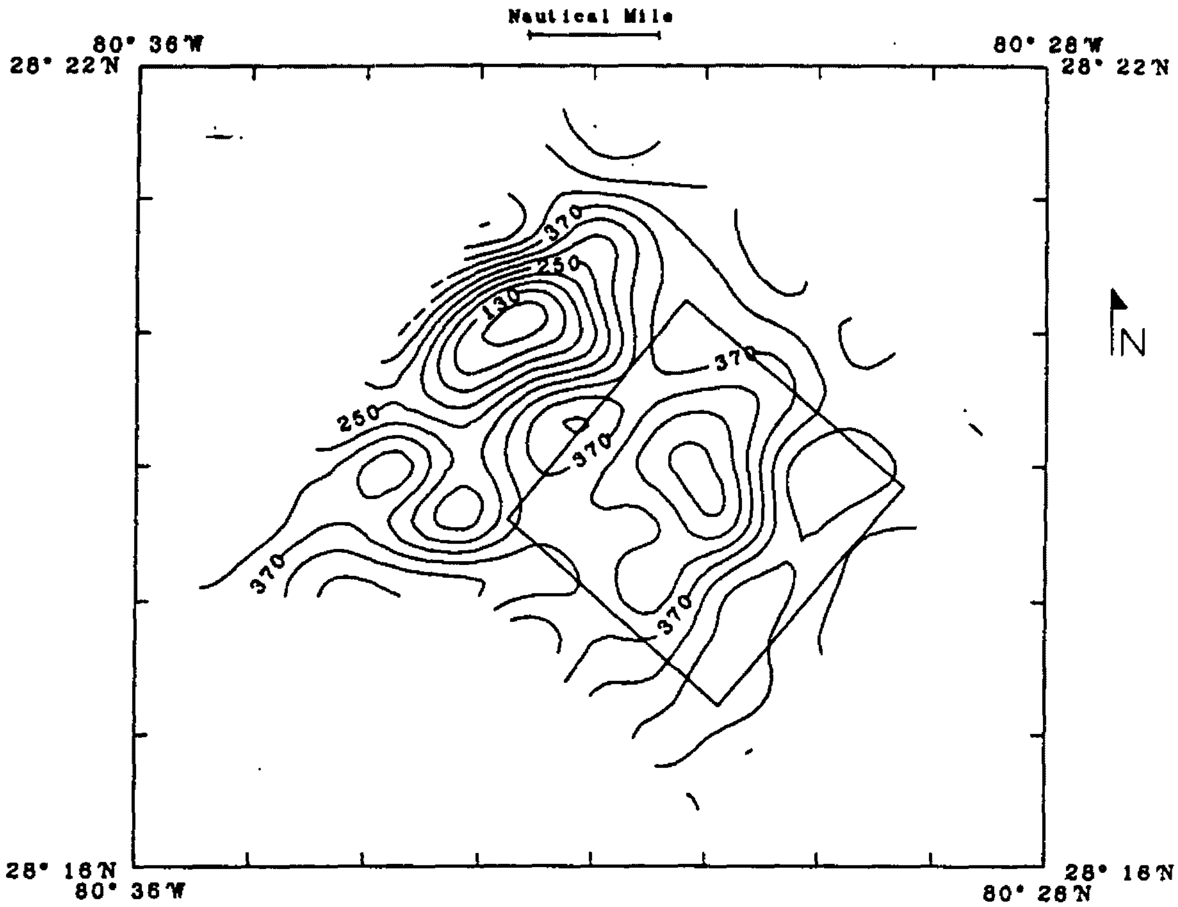


Figure 36. Contour map of K–40 absolute gamma activity for the combined survey regions of Canaveral I and II.

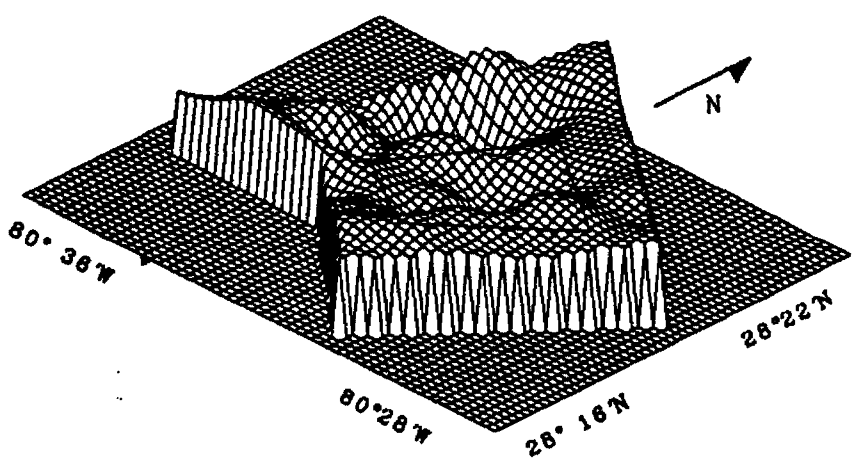


Figure 37. Topographic profile of K–40 absolute gamma activity for the combined survey regions of Canaveral I and II.

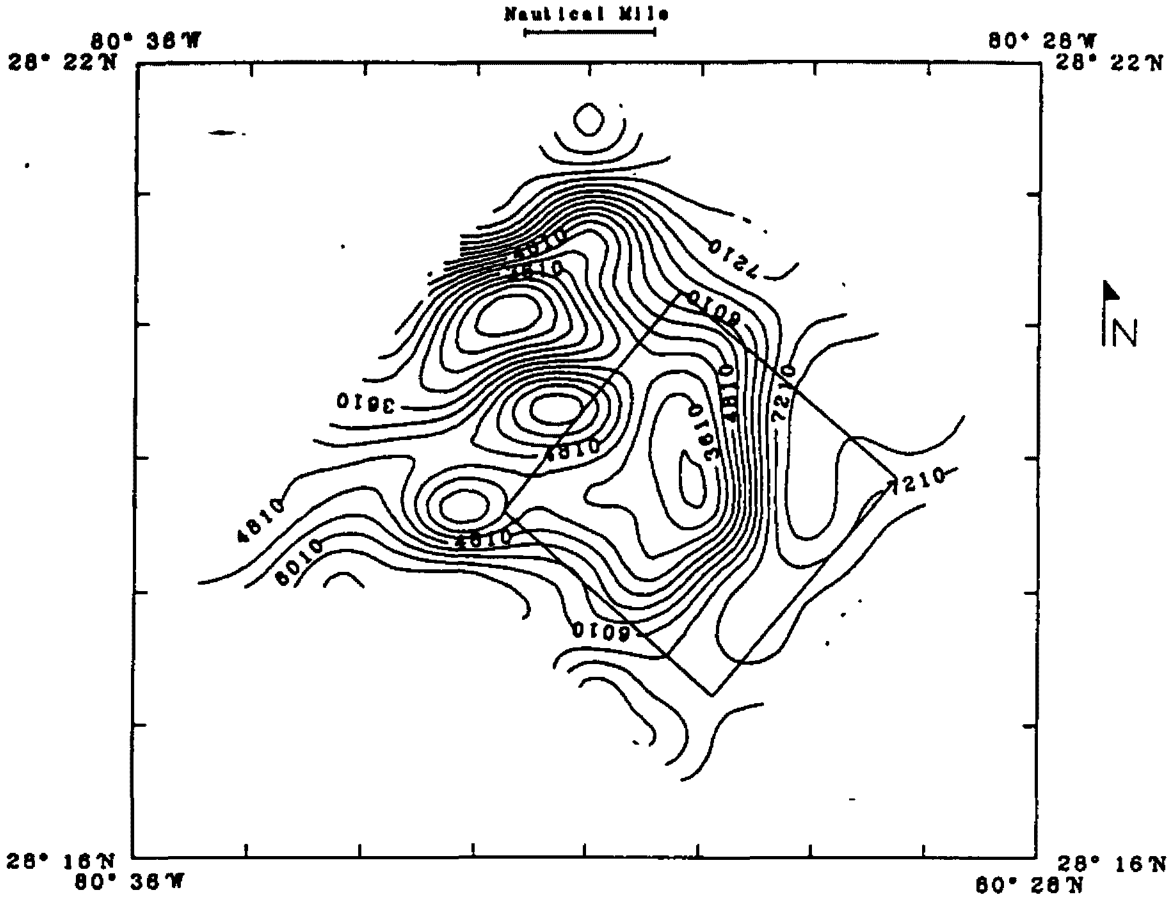


Figure 38. Contour map of total absolute gamma activity for the combined survey regions of Canaveral I and II.

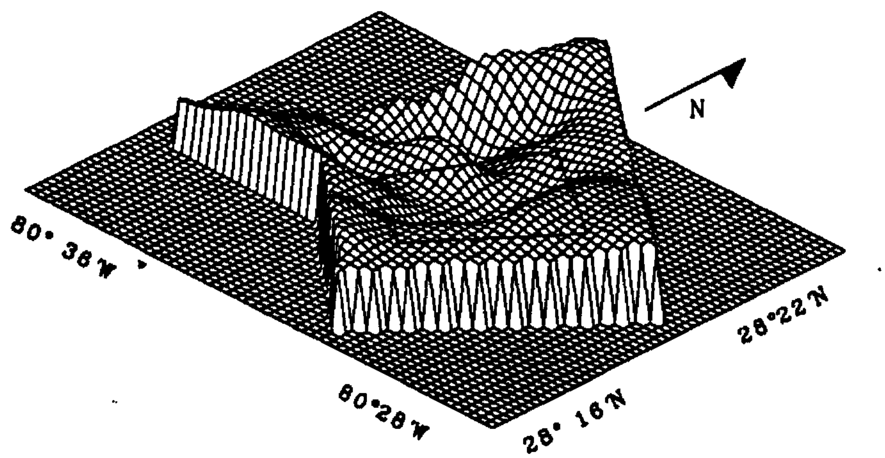


Figure 39. Topographic profile of total absolute gamma activity for the combined survey regions of Canaveral I and II.

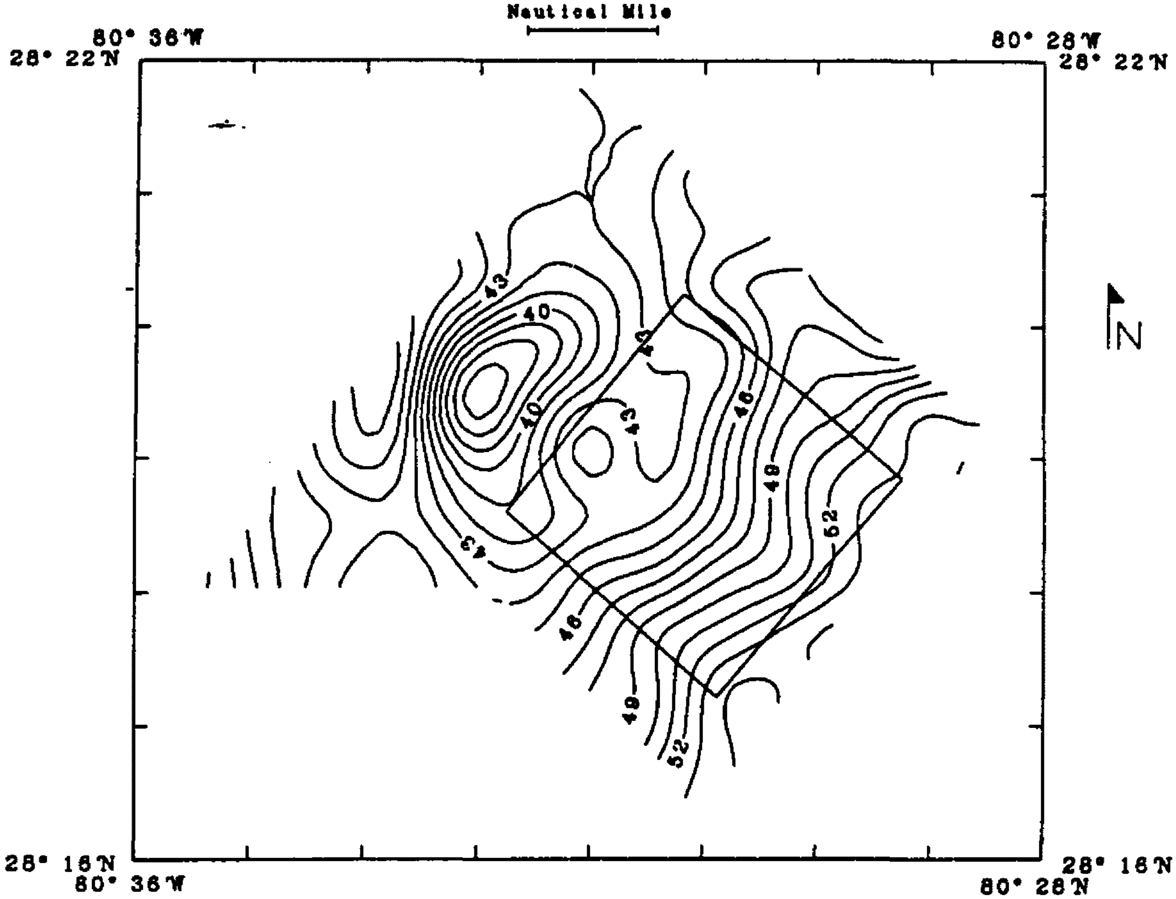


Figure 40. Contour map of depth for the combined survey regions of Canaveral I and II.

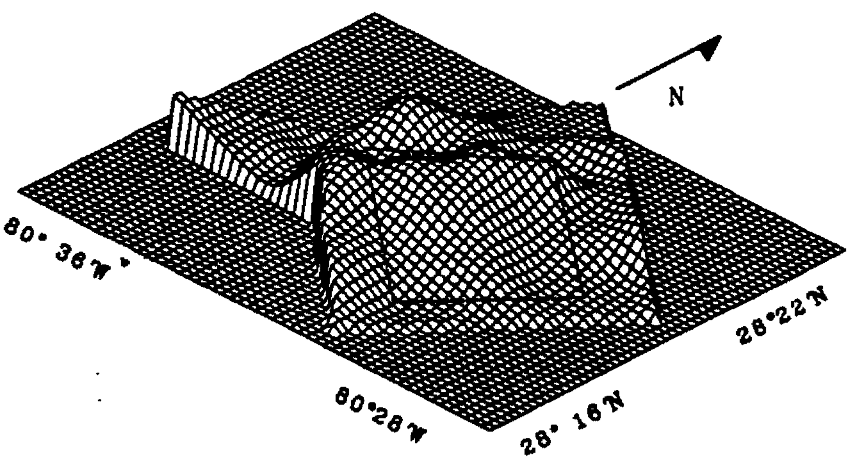


Figure 41. Topographic profile of the seafloor for the combined survey regions of Canaveral I and II.

In the Canaveral I Survey, box core 5 (location shown in Figure 30B) was collected in the suspected dredge disposal material, and Cores 14 and 15 from the channel for verification of the spoil sediments. The sediments found in both the dredge material disposal site and channel consisted of a dark, unconsolidated clay of fine (<0.062 mm) grain size.

The particle size analysis from the Canaveral I Survey for Core 5 from the dredged material sites, and 14 and 15 from the channel were highest in <0.062 particle size. box cores 2A and 2B from the second survey were found to have a broader distribution of particle sizes. The composite gamma activity maps, shown in Figure 32-39 and generated by the data from both surveys show, Bi-214, Tl-208, K-40 and total activity were found to be considerably lower in gamma activity in the area of Cores 2A and 2B than the area previously identified as dredged material. Finally, the visual inspection of Cores 2A and 2B showed a layer of light colored, compact clay with overlaying sand. The dredged material was identified in the first survey as a dark, unconsolidated clay without the presence of an overlaying layer of sand.

The second region of interest was an area of low gamma activity extending through the western corner of the ODMDS. The gamma activity level of this region rises continuously to the west until the gamma levels are similar to Cores 1, 2B, 5 and 6. Box core 13 from the previous survey (location shown in Figure 30B) was also of similar sand-over-clay composition. It was also noted in the seafloor topographic map that there was a rise in the seafloor of approximately 1 meter in this area.

The above gamma and box core data strongly infer that the sediments in this western corner of the ODMDS area are an extension of the dredge material sediments. The dark unconsolidated clay layer appears to thin to a surficial layer and ends approximately 3/4 nmi from the western corner of the ODMDS boundary. Box core 13 from the Canaveral I Survey identified the transition of this area to a sand with underlying consolidated clay. The gamma activity map also verified this transition of sediment types and clearly showed a termination of this extension.

5.0 REFERENCES

Center for Applied Isotope Studies. 1988a. Rapid surveillance of dredged material site sediments by continuous seafloor sampling and analysis. Completion report to Battelle Ocean Sciences, under Work Assignment 75, Contract No. 68-03-3319.

Center for Applied Isotope Studies. 1988b. Gamma radiation surveillance of dredged spoil site sediments at Fernandina Beach and Tampa Bay, Florida. Completion report to Battelle Ocean Sciences, under Work Assignment 1-103, Contract No. 68-03-3319.

Center for Applied Isotope Studies (March 1989). Sediment mapping at Charleston, South Carolina, and Canaveral, Florida. Completion report to Battelle Ocean Sciences, under Work Assignment 103, Amendment, contract 68-03-3319.

APPENDIX G

SIDE-SCAN SONAR AND CONTINUOUS VIDEO SURVEY NARRATIVE WITH ARITIFICAL REEF INVESTIGATION

SIDE SCAN SONAR

Immediately following the sediment mapping activities in July 1988, side scan sonar was used to survey the same transects traversed with the gamma sled. The primary purpose of the side scan activities was to use them as a basis for clearing the candidate disposal site respective to obstructions, outcrops (live bottom), and any other relief features that may warrant investigation by divers, ROV, or sled mounted video. Additionally, real time (ship board) mapping of the total gamma activity associated with the seafloor at the Canaveral site revealed a distinct pattern of signatures which likely represented disposed dredged material. Accordingly, it was believed that, in addition to serving as a site clearing tool, the side scan mapping might likewise reveal areas of deposited dredged material.

A total of 20 transects, each approximately 3 miles in length, were surveyed with side scan using a 100 KHz transponder. Transect spacing was at approximately 1000-feet intervals and side scan coverage was set at 100 meters. The towfish was deployed within a range of seven to twelve feet above the bottom. Ship positioning was controlled with a RAYNAV 750 Loran C receiver coupled with a NWU-51 navigational plotter. While traversing each transect, fixes of latitude and longitude were marked and recorded at 1000-feet intervals, generally corresponding to the sediment mapping records.

Figure 1 depicts the side scan transects. In Figure 2 the shaded area along certain transects represents areas at which side scan sonar return indicated targets different from the surrounding ambient material. Figure 3 represents an overlay of the gamma map constructed by Center for Applied Isotope Studies (CAIS) and the results of the side scan sonar mapping conducted by EPA. Obvious from this comparison is that the location of side scan targets (or areas of differing sediment character) compare very favorably with the transects and areas of depressed gamma activity verified by CAIS to have signatures coincident with those of material removed from the Canaveral channel. Figure 4 is a photomosaic of the side scan transects constructed from photographing all tracings assembled collectively. The rectangular distortion of the interim disposal site results from the slant range of the side scan being uncorrected.

CONTINUOUS VIDEO AND PHOTOGRAPHY

During May 1988 continuous video recordings were attempted at the interim Canaveral ODMDS but water clarity was not adequate and the mission was aborted. However, in July 1988 an additional attempt was made to obtain a video record of the site. The primary purpose of the video attempt was to reveal, pictorially, the nature of the sediment exhibiting unique gamma isotope signatures as well as differing sonar returns as discussed earlier in the side scan section.

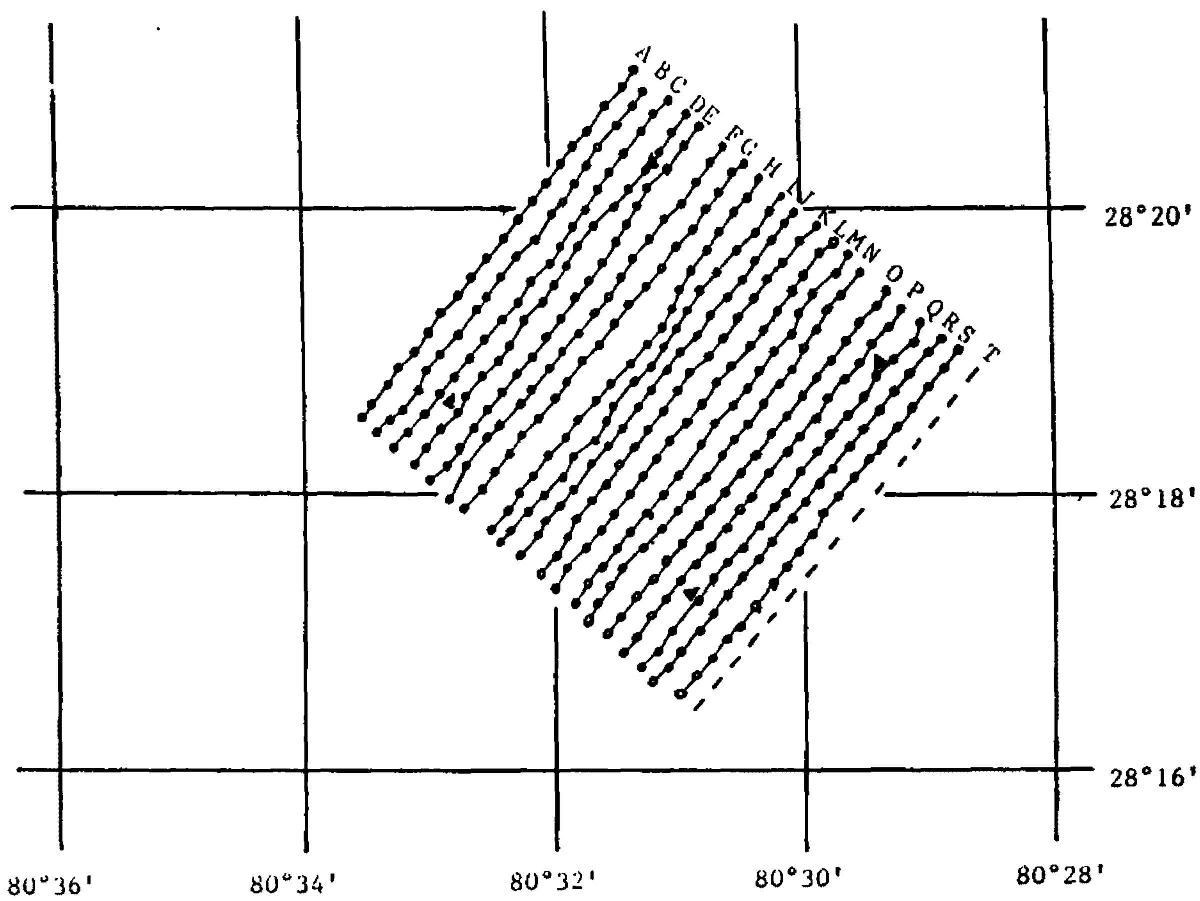
To obtain the video record, a sled mounted video camera was mounted to a towed sled and hard-wired to a monitor and video recorder located in the ships survey center. Also mounted to the rear of the sled was a 35mm still camera which could subsequently photograph any unique features revealed by the video camera as the sled passed over them. The sled was lowered to the bottom and towed via a cable through the ships U-frame. Towing speed was varied between 0.5 and 1.0 knots.

Upon deployment of the camera it was immediately obvious that visibility at the bottom showed little improvement from the earlier aborted attempt in May 1988. Accordingly, the original intent of obtaining a video record along each transect was abandoned, as it would have been unproductive, and the effort was reduced to an attempt at obtaining limited video and still photographs in areas representative of different gamma and side scan sonar signatures. Although the video picture of most of the area surveyed was of poor quality, a number of still photographs revealed the general character of the sediments associated with the suspected disposal zone as well as the unimpacted ambient sediments associated with the eastern area of the disposal site. As evident in the four sample photographs (Figure 5), in the area where gamma isotope mapping indicated dredged material, large slabs of eroding shell-imbedded clay appear to represent the material targeted by side scan sonar. Photographs of areas where side scan and gamma isotope mapping suggested ambient sediments, revealed the sediments to be predominately sand and shell.

CONCLUSION

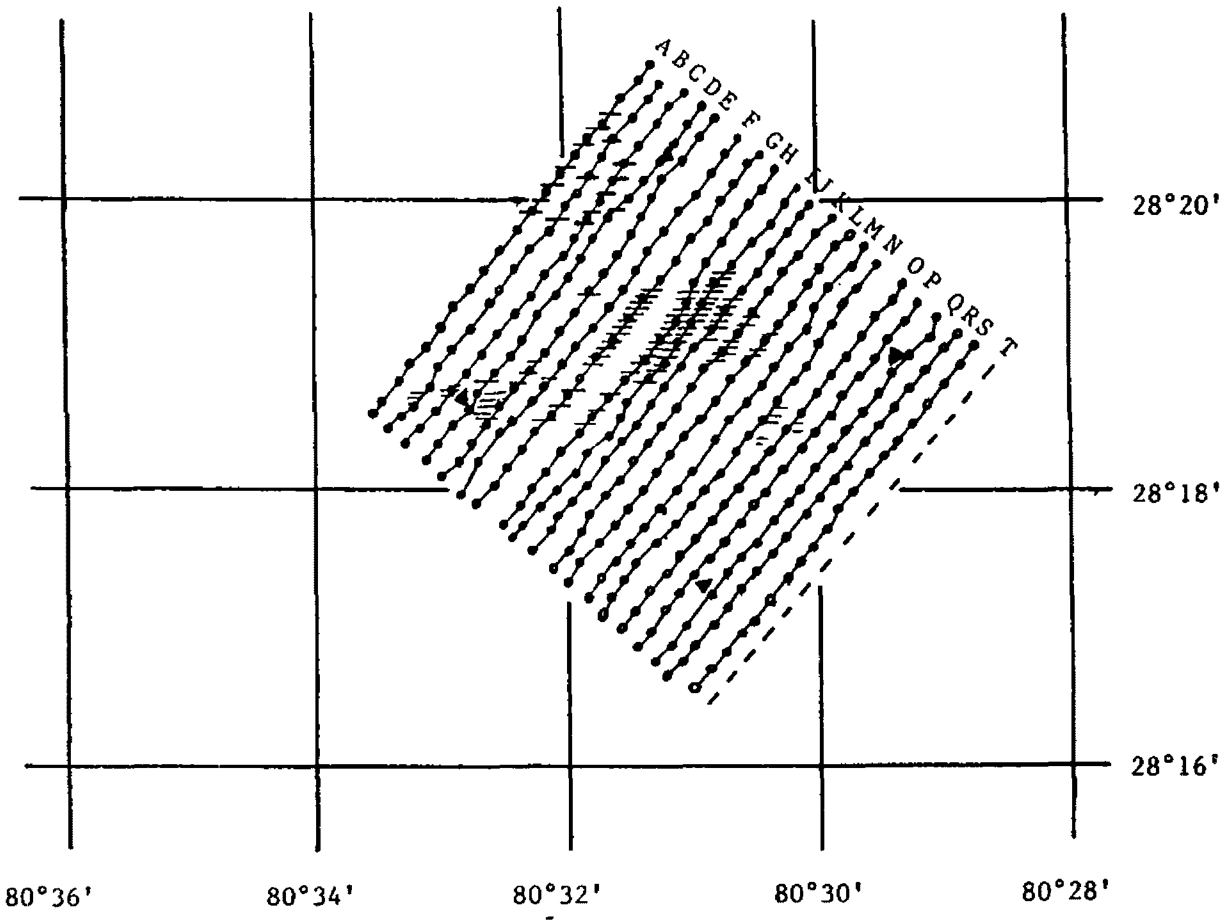
Results of the gamma isotope mapping, side scan sonar, and bottom photography compare quite favorably in depicting and defining the zone of disposed dredged material. Where the gamma isotope map depicted the dredged material to be predominately located in the western center of the site with a projection toward the western corner, the side scan sonar, likewise, confirmed striations of material in this same area with a different sonar return than surrounding areas. Follow-up photography at locations within this same zone revealed slabs of eroding, shell-imbedded clay. Beyond this zone, photographs revealed a predominately sand and shell bottom. Due to the longevity of disposal operations at the interim Canaveral site, and without a pre-disposal baseline, it can only be speculated whether the location of dredged material near and beyond the western boundary is a result of material movement or actual dumps at these locations due to positioning error or other reasons. However, since erosion and subsequent movement of material from the disposal site toward the western boundary would be suspected to occur in thin layers, and since the side scan sonar records suggest definite deposits of different material at the western

FIGURE 1. SIDE SCAN TRANSECTS, CANAVERAL CANDIDATE AND INTERIM ODMDS, JULY 1988.



▲ Corner of Interim Site

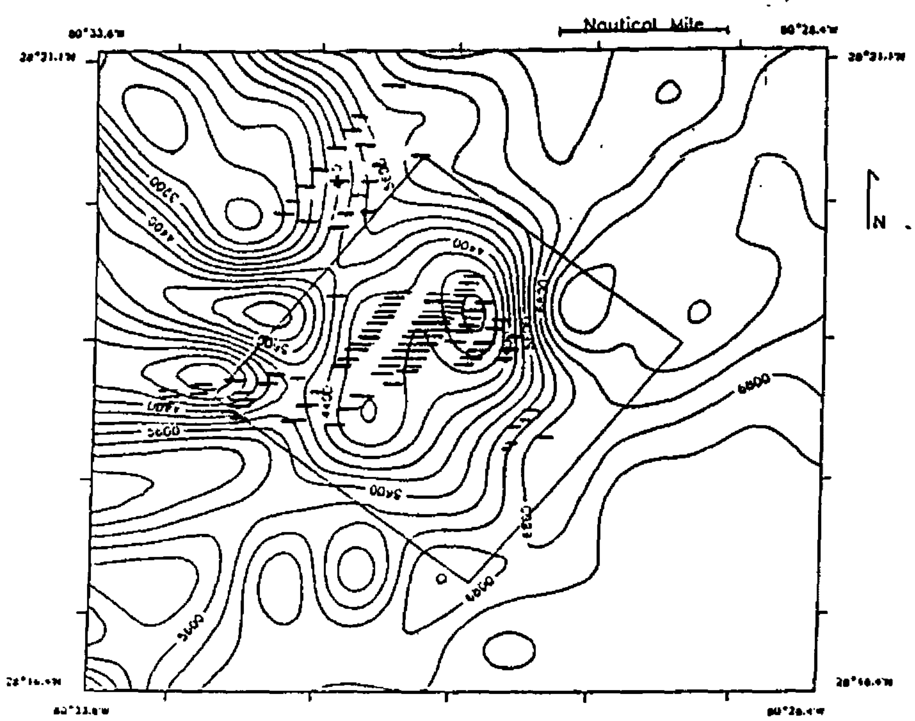
FIGURE 2. SIDE SCAN TRANSECTS WITH TARGET OVERLAY, CANAVERAL CANDICATE AND INTERIM ODMDS, JULY 1988.



Side scan sonar targets coinciding with gamma isotope signatures associated with disposed dredged material

▲ Interim Site Corners

FIGURE 3. GENERAL OVERLAY OF SIDE SCAN SONAR TARGETS AND GAMMA ISOTOPE SEDIMENT MAP, CANAVERAL INTERIM AND CANDIDATE ODMDS, JULY 1988.



Side Scan Sonar Targets

FIGURE 4. Photomosiac of side scan sonar transects

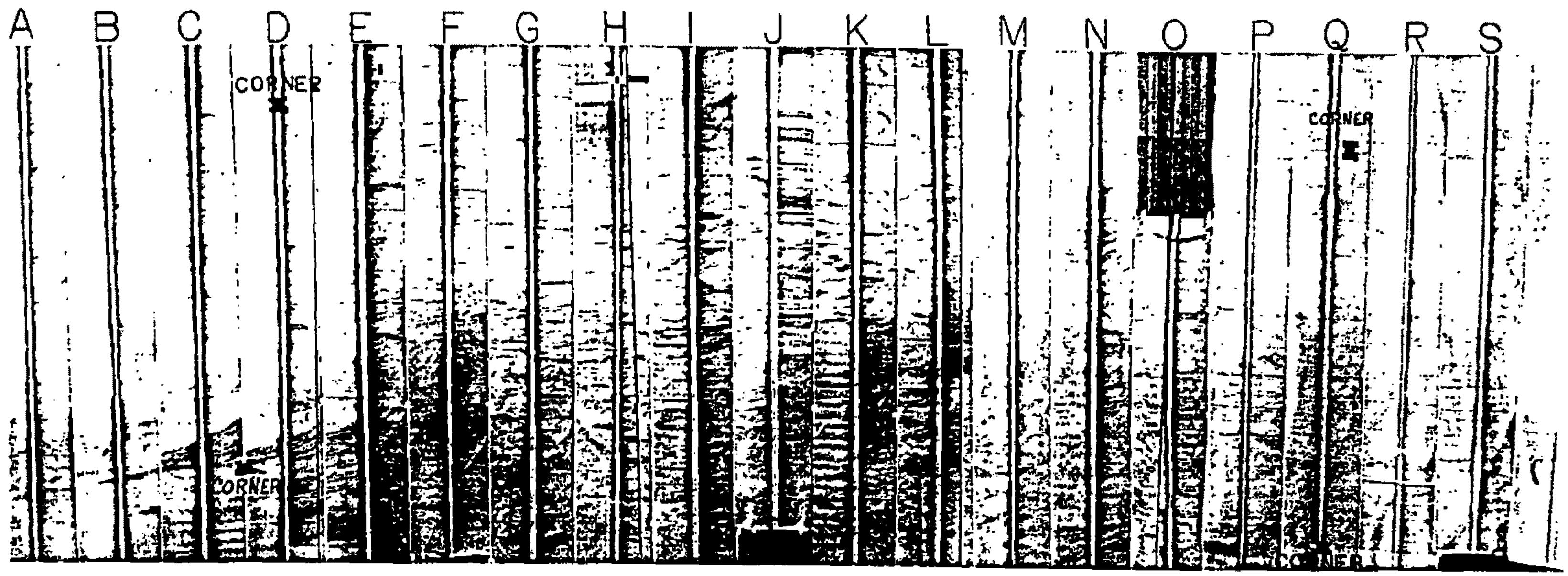
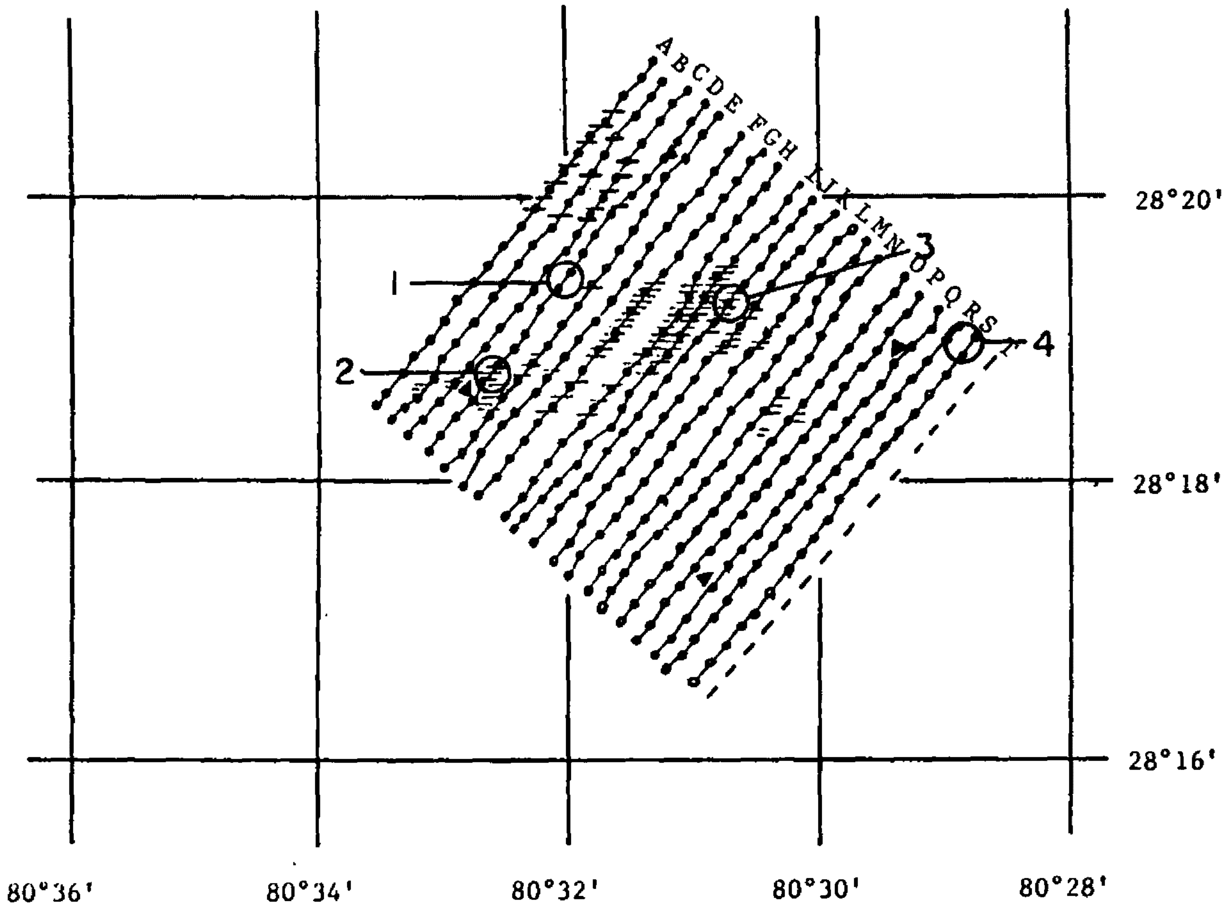


FIGURE 5. PHOTO LOCATIONS CORRESPONDING TO SIDE SCAN SONAR TARGETS AND GAMMA ISOTOPE MAPPING, CANAVERAL INTERIM AND CANDIDATE ODMDS, JULY 1988.



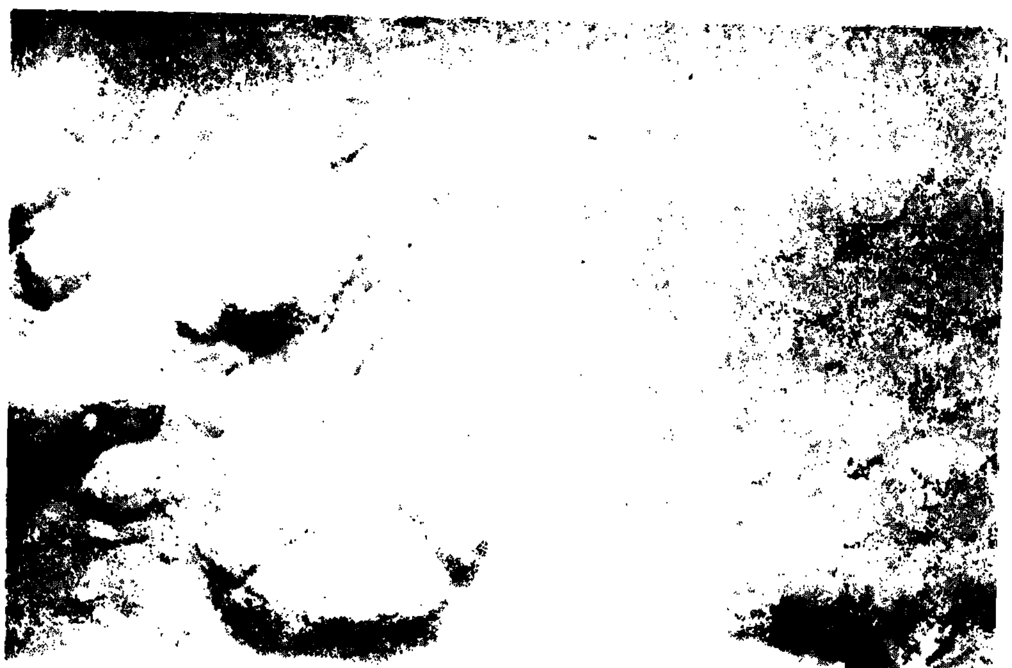
Side scan sonar targets coinciding with gamma isotope signatures associated with disposed dredged material corner of the site, these factors would certainly favor the location of the material as being a result of direct disposal.

Figure 5 (continued) Photographs of seafloor

Photograph 1 (refer to preceding map)

Photograph 2.

Photograph 3



Photograph 4

ARTIFICIAL REEF INVESTIGATION

During the July 1988 sediment mapping cruise it was necessary to terminate the western-most transect short of a charted artificial reef (Figure 6). The uncertainty of the composition proximate to the charted reef location due to the possibility of entanglement and subsequent damage or loss of the sled. After analysis of the results of the July 1988 gamma isotope mapping the necessity of extending the mapping effort further westward became apparent due to the possibility of dredged material outside the western boundary of the disposal site. Before this could be accomplished, the exact status and location of the artificial reef had to be determined.

Initial investigation of the artificial reef's status focused on contact of local individuals who had knowledge of the time of construction and composition of the reef. Through such contacts it was learned that the reef was originally constructed approximately twenty years ago and was formed by alternately placing two rows of 2-1/2' X 4' X 8' concrete slabs atop each other. The original permit called for the structure to be approximately 1200 feet in length but actually was not constructed to the permitted size. During the first year after construction, side scan sonar was conducted along with diver observations and revealed that the structure had been under-mined by wave and current action. This resulted in the toppling of the layers and subsequent covering of the slabs by sediment to a point that only remnants of the structure remained above the sediment surface.

As a follow-up to the communicated information, EPA conducted a side scan sonar survey to determine the location and general status of the reef structure to date. Six east/west transects slightly less than two miles in length located the structure at its charted position as depicted on Chart No. 11476 (NOAA Navigational Chart). Examination of the side scan information indicated a structure of little to no relief existing in a broken and irregular pattern. Remnants of the structure extended in a generally north to south direction for a distance of approximately 125 meters. Navigation fixes of the most distinct portion of the structure placed it at the coordinates of Latitude 28d19.49 and Longitude 80d33.73. Subsequent to locating the structure with side scan sonar, a diving effort to visually examine the remnants was unsuccessful due to zero visibility at the bottom caused by suspended sediments in the water.

APPENDIX H

SITE MANAGEMENT AND MONITORING PLAN

APPENDIX H:
Site Management and Monitoring Plan

Introduction. It is the responsibility of EPA under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 to manage and monitor each of the ODMDSs designated by the EPA pursuant to Section 102 of MPRSA. As part of this responsibility, a management and monitoring plan has been developed to specifically address the deposition of dredged material into the Canaveral ODMDS.

SITE MANAGEMENT

Section 228.3 of the Ocean Dumping Regulations (40 CFR 220 - 229) states: "Management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation." The plan may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process.

It is intended that the Canaveral ODMDS will be used for new work and maintenance material from the Canaveral Harbor navigation project and private entities such as the Port of Canaveral.

Management Objectives. There are three primary objectives in the management of each ODMDS. These are:

- o Protection of the marine environment;
- o Beneficial use of dredged material whenever practical; and
- o Documentation of disposal activities at the ODMDS.

The following sections provide the framework for meeting these objectives to the extent possible.

Dredged Material Volumes. During the years from 1974 to 1988, disposal volumes at the interim site ranged from a low of 40,593 cubic yards to 3,084,117 cubic yards. Future volumes and rates of disposal, either from Federal or private applicants, are expected to range around 800,000 cubic yards per year. Federal maintenance projects for Canaveral Harbor are anticipated to account for 95 to 99% of the total volume of material to be disposed at the ODMDS. A proposed deepening project at Canaveral Harbor, if approved, would add a one-time estimated contribution of 1.2 million cubic yards of new material.

TABLE: Volumes of Dredged Material Disposed at Canaveral Site 1986 -1990 and Estimated Average 1991 -1995.

Complete Date	Type of Action	Volume	Composition (cubic yards)
1986	Maintenance	351,535	silt/sand
1987	Maintenance	63,370	sand/silt
1988	New Work	2,000,888	sand/silt/clay
1988	Maintenance	1,873,9300	silt/sand/clay
1989	----		
1990	Maintenance	290,000	sand/silt/clay
1991	Maintenance	800,000	
1992	New Work	1,200,000	
1993	Maintenance	800,000	
1994	Maintenance	800,000	
1995	Maintenance	800,000	

Because the site is considered dispersive, no restrictions are presently placed on disposal volumes. Disposal of unrestricted volumes is dependent upon results from future monitoring surveys.

Material Suitability. Two basic sources of material are expected to be placed at the site, new work dredged material and maintenance material. These materials will consist of mixtures of silt, clay and sand in varying percentages.

There is no general restriction regarding the type of material that may be placed at the site. However, the suitability of dredged material for ocean disposal must be verified by the CE and agreed to by EPA prior to disposal. Verification will involve: 1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b), 2) a determination of the necessity for bioassay and bioaccumulation testing for non-excluded material based on the potential for contamination of the sediment since last tested, and 3) carrying out the testing and determining that the non-excluded tested material is suitable for ocean disposal.

Documentation of verification will be completed prior to use of the site. Documentation for material suitability for dredging events proposed for ocean disposal more than 5 years since last verified will be a new 103 evaluation and public notice. Documentation for material suitability for dredging events proposed for ocean disposal less than 5 years but more than 3 years since last verified will be an exchange of letters between the CE and EPA.

Should EPA conclude that reasonable potential exists for contamination to have occurred, acceptable testing will be completed prior to use of the site. Testing procedures to be used will be those delineated in the EPA/CE testing manual ("green book"). Only material determined to be suitable through the verification process by the CE and EPA will be placed at the designated ocean disposal site.

Time of Disposal. At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biota activity. As monitoring results are compiled, should any such restriction appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be imposed.

Placement of Disposal Material. No specific disposal technique is required for this site. However, there may be some environmental advantages to disposing suitable dredged material using the following procedures. These procedures will be followed to the extent practical.

Due to the predominant current regimes in the area, the site is considered to be dispersive. Scheduled monitoring surveys are intended to provide additional information regarding the dispersive or nondispersive nature of the site. Currents vary from north-northeast (45%) to south-southwest (26%). Sediment mapping surveys indicate that some degree of westerly movement of disposed material may have occurred. Based on the results of the sediment mapping study and current studies, it may be desirable to predetermine the disposal methodologies and locations within the ODMDS for disposal of dredged material, at least until sufficient monitoring information has been collected to provide assurance that dispersal does not result in adverse impacts. A primary purpose for the designation of a dredged material disposal site is, to the maximum extent feasible, to minimize impacts of disposal. If survey results support a need, the initial management strategy would be the placement of fine material in the easternmost portions of the selected site, to the extent practical, in order to assure that the material does not migrate off-site.

When no alternative exists to the placement of fine-grained material on sand, the disposal should be made in such a manner as to limit the geographic extent of the placement of this unlike material on the existing sediments. This should be accomplished through mounding of the disposed material to the extent practical.

It was agreed upon by EPA, COE and the State of Florida at a meeting held in Tallahassee, Florida, May 3, 1990, that the presently permitted dredging projects are not considered to be the sources of significant quantities of beach compatible sand. The disposition of any significant quantities of beach compatible sand from future projects will be determined during permitting activities for any such projects. It is expected that the State of Florida will exercise its authority and responsibility, regarding beach nourishment, to the full extent during any future permitting activities. Utilization of any significant quantities of beach compatible dredged material for beach nourishment is strongly encouraged and supported by EPA. Disposal of coarser material should be planned to allow the material to be placed so that it will be within or accessible to the sand-sharing system, to the maximum extent practical, and following the provisions of the Clean Water Act.

Multiple Use Management. The Canaveral ODMDS is intended for multiple use by a number of entities including the CE, U.S. Navy, Port of Canaveral, and private interests. Each of these users will have different needs relative to quantity, type of material, timing, etc., therefore partitioning of the site for specific users may be an appropriate management technique. This could facilitate monitoring and surveillance of individual disposal activities, however, it may not be the most appropriate management technique if the placement as described in the preceding section is desired.

SITE MONITORING

Part 228 of the Ocean Dumping Regulations establishes the need for evaluating the impacts of disposal on the marine environment. Section 228.9 indicates that the primary purpose of this monitoring program is to evaluate the impact of disposal on the marine environment by referencing the monitoring results to a set of baseline conditions. Section 228.10(b) states that in addition to other necessary or appropriate considerations, the following types of effects will be considered in determining to what extent the marine environment has been impacted by materials disposed at an ocean site (excerpted):

1. Movement of materials into estuaries or marine sanctuaries, or onto oceanfront beaches, or shorelines;

2. Movement of materials toward productive fishery and shellfishery areas;

3. Absence from the disposal site of pollution-sensitive biota characteristic of the general area;

4. Progressive, non-seasonal changes in water quality or sediment composition at the disposal site, when these changes are attributable to materials disposed of at the site;

5. Progressive, non-seasonal changes in composition or numbers of pelagic, demersal, or benthic biota at or near the disposal site, when these changes can be attributed to the effects of materials disposed at the site; and

6. Accumulation of material constituents (including without limitation, human pathogens) in marine biota at or near the site.

Part 228.10(c) states: "The determination of the overall severity of disposal at the site on the marine environment, including without limitation, the disposal site and adjacent areas, will be based on the evaluation of the entire body of pertinent data using appropriate methods of data analysis for the quantity and type of data available. Impacts will be classified according to the overall condition of the environment of the disposal site and adjacent areas based on the determination by the EPA management authority assessing the nature and extent of the effects identified in paragraph (b) of this section in addition to other necessary or appropriate considerations."

Surveys appropriate for monitoring at the Canaveral ODMDS are based on the attached flowchart. The predominant grain size of the disposal material is expected to be fine. Actual on-site monitoring, as opposed to extrapolation from data from other sites, is deemed necessary for this ODMDS. At this time, no higher trophic level studies are planned, but are conceivable, depending on future determination of need, available resources, and technology development.

Frequency of monitoring will be based on sufficiency of existing on-site and vicinity data, monitoring technique, volume and predominant grain size of the disposed material, and similarity to naturally occurring sediment.

<u>Baseline Monitoring</u>. The results of investigations presented in this EIS will serve as the main body of baseline data for the monitoring of the impacts associated with the use of the Canaveral ODMDS. The surveys conducted during the site characterization phase will serve as the main body of baseline data for the monitoring of the impacts associated with the initial disposal into the ODMDS (See FEIS Appendices A, B, C, D, F, and G). A bathymetric survey will be conducted by the COE or site user prior to each dredging cycle or project disposal. No additional pre-disposal monitoring at this site is proposed.

<u>Disposal Monitoring</u>. After the site designation, the initial disposal operation is expected to take about four months to complete. For this and subsequent disposal activities, the dredging contractor will be required to prepare and operate under an approved electronic verification plan for all disposal operations. As part of this plan, the contractor will provide an automated system that will continuously track the horizontal location and draft condition (vertical) of the disposal vessel from the point of dredging to the disposal area, and return to the point of dredging. Required digital data are as follows:

(a) Date;

(b) Time;

(c) Vessel name;

(d) Captain of vessel;

(e) Number of scows in tow and distance from vessel or other vessel used;

(f) Vessel position, at specified times (1) when within the channel limits, (2) between the dredging area and the disposal area, and (3) when within the disposal area limits, and at similar intervals during the return of vessel and scow(s) to the dredging area;

(g) Dredge scow or vessel draft, coincidental measurement with "f" above;

(h) Volume of material disposed; and

(i) Disposal technique used.

As a precaution to protect marine mammals as well as sea turtles during disposal operations, a bow observer will be stationed on vessels participating in disposal activities.

Post Discharge Monitoring. As a follow-up to the baseline bathymetric survey, the COE or other site user will conduct a bathymetric survey after disposal. The number of transects required will be dependent upon the length of the disposal operation and the quantity of material proposed for disposal. The surveys will be taken along lines so spaced and of sufficient length to adequately cover the disposal area. These surveys will be referenced to the appropriate datum and corrected for tide conditions at the time of survey.

The user will be required to prepare and submit to CE daily reports of operations and a monthly report of operations for each month or partial month's work

Material Tracking and Disposal Effects Monitoring. Based on the type and volume of material disposed, various monitoring surveys will be used to determine if and where the disposed material is moving, and what environmental effect the material is having on the site and adjacent area. A tiered approach will be used to determine the level of monitoring effort required following each disposal event. At a minimum, bathymetry and sediment mapping will follow disposal events on an annual basis, until deemed unnecessary. Bathymetric surveys will be the responsibility of the dredged material generator while EPA will be responsible for sediment mapping.

The rationale for a phased or tiered monitoring approach is based on that delineated in the EPA/CE Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters (1990). The basic philosophy is to provide for proper oversight of ocean placement activities at Canaveral ODMDS while properly managing personnel and fiscal resources. Because a major portion of the Canaveral site has been used historically without documented significant environmental impacts, we believe that the phased approach would provide the necessary information to determine the need for additional monitoring and be the most expeditious approach. This phased approach is especially appropriate for repeated disposal operations such as occur during maintenance of projects. For construction (new work) dredged material placement operations, which typically involve large quantities of material, variations of the phased approach may be appropriate.

With the phased approach, an interagency team, consisting of representatives of the state of Florida, U.S. Army Corps of Engineers, Environmental Protection Agency, National Marine Fisheries Service, and the user, would be established after designation. This team will determine suggestions for appropriate monitoring techniques and level of monitoring required for a specific action. This determination would be based on type of disposal activity (i.e. O&M vs. construction), type of material (i.e. sand vs. mud), location of placement activity within the ODMDS, or quantity of material.

As of June 1990, the monitoring program has been initiated at the Canaveral ODMDS. Benthic sampling by EPA is to be done for comparison against baseline information (See FEIS Appendix F). A REMOTS subbottom photography survey is to be completed for comparison with baseline sediment mapping as well as for comparison with results from the benthic sampling. Based on the results of these surveys, a decision will be made regarding the nature and extent of future monitoring activities based on the framework as described in this plan.

After completion of the present phase of monitoring, the interagency team would meet to review results of these efforts and determine suggestions for additional information collection. Should the results of these surveys conform with the expected scenario, no additional monitoring would be required for the disposal event. At the next event, the phased monitoring approach would be applied in a similar fashion. At some point in time, as suggested by the interagency team, a reassessment of the site would be undertaken. At a minimum, this reassessment would include benthic macroinfaunal and sediment chemistry surveys. Additional surveys for water quality or use of remote sensing equipment might also be required.

<u>Material Tracking</u>

<u>Discharged Material Geographic Extent, Thickness, and Movement</u>. Several methodologies can be used to characterize the extent of the discharged sediment. Precision bathymetry or the REMOTS subsurface prism camera can be utilized. Additionally, high resolution (shallow) acoustic subbottom profiling may be used to determine the vertical extent of the material. Side scan sonar and sediment mapping can be used to determine the geographic extent of the discharged material. A planned sequence of surveys may be necessary to determine whether or not movement is occurring, as well as the nature and extent of the movement.

Based on information collected, benthic sampling stations can then be located within the pathway of disposed material migration.

<u>Sediment Characterization</u>. One means of sediment characterization uses gamma spectrometry (sand size material) and x-ray fluorescence

(XRF) (fine material) analysis. An additional method to be considered is that using the REMOTS camera. An initial characterization is performed just prior to disposal to establish a baseline of elemental composition of the native sediment. Data obtained during this survey are used to construct computer generated maps showing isopleths of selected elements throughout the surveyed area. Upon completion of the disposal activity, a second survey is performed to obtain a new characterization of sediments with the dredged material in place. Comparison of pre-disposal and post-disposal elemental characterizations is used to determine the distribution of disposed dredged material.

Disposal Effects

Benthic Analysis. The number of replicates taken at each station will be determined based on the sampling technique employed i.e., box core, grab, or diver collected core samples, and on an evaluation of the species area curves from the site characterization studies. Diver collection is the preferred method for sample collection, with fifteen replicates required for evaluation of the species area curves from the site designation surveys. If diver collection proves not to be feasible, box core or grab sampling are alternatives. All samples will be sieved through 0.5 mm screen in the field, placed in appropriate containers, and immersed in 10% formalin/seawater solution with rose bengal stain for transport to the laboratory. Species identification will be to the lowest practicable level. Data analyses will include, at a minimum, species diversity, evenness, richness and Q- and R- mode cluster analyses.

Sediment Chemistry. Sediment should be collected from these same stations for sediment chemical analysis. All cores will be refrigerated and iced for return to the laboratory for analysis. Analyses shall include a metal scan, pesticides, chlorinated hydrocarbons, oil and grease, and nutrients (NH_3, NO_2+NO_3-N, TKN).

Sediment Particle Size. Samples should be collected for sediment particle size analyses simultaneously with and in the same manner as sediment chemistry sampling. All cores will be decanted and frozen aboard ship prior to shipment to the laboratory. The samples will be processed according to the wet sieve Modified Wentworth method.

Water Quality Sampling. Water quality may be sampled at each of the above stations. Dissolved oxygen, salinity and temperature measures will be taken at 5-foot intervals from surface to bottom.

Light extinction profiles will be conducted at 10-foot increments from surface to bottom. After determination of the 90, 50, and 10% light extinction levels, water samples will be collected, composited, and a sample extracted and filtered for chlorophyll-a analysis. Water samples for nutrient analysis will be taken at the surface, mid-depth, and bottom at each sampling station.

Demersal Fishes. Demersal fishes may be collected along transects established within the ODMDS and the area adjacent to the ODMDS using a 40-foot otter trawl equipped with a 0.25 inch mesh liner. A minimum of four transects should be established in each area. Trawl times should be standardized at 20 minutes. Trawl catches from each station should be placed in appropriate containers and fixed with 10% formalin. Fish specimens larger than four inches standard length should be slit to allow proper fixation.

Additional sampling techniques such as remote video, diver-operated photography, side scan sonar or vertical sediment profiling may be used as deemed necessary by EPA and the COE to determine the overall effects of disposal in the Canaveral ODMDS. Close coordination between EPA, COE, the State of Florida, and the user will be maintained during development of the detailed monitoring plan and evaluation of results. Should the initial disposal at the permanently designated ODMDS result in unacceptable adverse impacts, further studies may be required to determine the persistence of these impacts, the extent of the impacts within the marine system, and/or possible means of mitigation. In addition, the management plan presented may require revision based on the outcome of the monitoring program.

Reporting and Data Formatting. Any data collected will be provided to Federal and State agencies as appropriate. Data will be provided to other interested parties requesting such data to the extent possible. EPA requires data to be in the National Ocean Data Center (NODC) format, where appropriate. Data will be provided for all surveys in a report generated by the action agency. The report would indicate how the survey relates to the SMMP and list previous surveys at the Canaveral ODMDS. The report should provide data interpretations, conclusions, and recommendations, and should project the next phase of the SMMP. Appropriate reporting deadlines will be established for each monitoring activity.

Modification of ODMDS SMMP. A need for modification of the use of the Canaveral ODMDS because of unacceptable impacts is not anticipated. However, should the results of the monitoring surveys indicate that continuing use of the ODMDS would lead to unacceptable impacts, then either the ODMDS Management Plan will be modified to alleviate the impacts, or the location of the ODMDS would be modified.

APPENDIX I

FLORIDA COASTAL ZONE MANAGEMENT CONSISTENCY EVALUATION

PREFACE

EPA's 1987 evaluation was based on the site configuration used in the DEIS. The reconfiguration used in this FEIS does not alter EPA's conclusion. Because of the reconfiguration, the sentence in the introduction stating "[t]he proposed site contains over half the area of the interim site and an adjacent area seaward..." should be revised to read: "The proposed site encompasses the entire area of the interim site and a portion of the surrounding area on all sides." In addition, reference to the site's distance from Cocoa Beach, Florida, should be updated to read: "Site boundaries are located 3.5 nmi east of Cocoa Beach, Florida, in the Atlantic Ocean."

CANAVERAL HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM

CONSISTENCY EVALUATION

Submitted by:

U.S. Environmental Protection Agency

Region IV

I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Army Corps of Engineers (Corps), has prepared a draft environmental impact statement (DEIS) titled "Draft Environmental Impact Statement For Designation Of A Canaveral Harbor, Florida Ocean Dredged Material Disposal Site." This DEIS evaluates the environmental conditions relevant to the designation of an ocean disposal site offshore Canaveral Harbor, Florida. Additionally, the DEIS evaluates the proposed Canaveral Harbor site according to the eleven environmental criteria required for site designations under 40 CFR 228.6 (Ocean Dumping Regulations).

The site proposed for final designation is an extension of the Canaveral Harbor site that received an interim designation at 40 CFR 228.12 and has been used for dredged material disposal for many years. The proposed site contains over half the area of the interim site and an adjacent area seaward. The total area of the proposed site is approximately 4 square nautical miles (nmi). This site is located approximately 5.75 nmi east of Cocoa Beach, Florida in the Atlantic Ocean. Since 1974 approximately 10.3 million cubic yards of dredged material have been disposed of at the interim site with no evidence of adverse environmental impacts.

The site designation is needed in this area to provide an ocean disposal option for dredging projects in the area. Potential sources of the dredged material are the Port Canaveral Channel and Turning Basins. It should be emphasized that final designation of the interim Canaveral Harbor site does not imply EPA's approval of disposal of materials at the site. EPA and the Corps must conduct an environmental review of each proposed ocean disposal project. That review ensures that there is a demonstrated need for ocean disposal and that the material proposed for disposal meets the requirements for dredged materials given in the Ocean Dumping Regulations.

II. The Florida Coastal Zone Management Program (CZMP)

There are eight Florida statutes relating to ocean disposal site designations. This assessment discusses how the referenced DEIS for the Canaveral Harbor site designation and subsequent review, permitting and monitoring actions will meet the CZMP objectives to protect coastal resources while allowing multiple use of coastal areas. Consult the DEIS for further data and information.

A. Chapter 161: Beach and Shore Preservation

The intent of Chapter 161 is the protection of thousands of miles of Florida's coastline by regulating construction activities near and within these areas. The Canaveral Harbor site designation will require no new construction; and therefore no related support activities will be subject to the construction regulations in this chapter.

The Canaveral Harbor site is located 5.75 nmi from Cocoa Beach, the nearest beach and shore-related amenity. Sediment transport in the vicinity of the site is driven mainly by weather events. Because of this, dispersion of the material can be in any direction. However recent field surveys have shown that currents move primarily in the north/south direction. Surveys at the site have not detected the accumulation of material from past disposal toward the shore. A small mound is located northwest of the site but it has not been determined that this is from migration of dredged material. In short, the Canaveral Harbor site is dispersive and the sediments are transported and diluted in all directions by natural coastal processes. The distance of the site to the nearest beach is great enough so that impacts to the beach resulting from the use of the site are not reasonably anticipated. Past use of the site has not resulted in any interference with beach and shore activities in the vicinity. Monitoring surveys at the site will continue to evaluate the effects of disposal. In the event that significant accumulation of the dredged material towards any amenity is evident, use of the site can be modified or terminated.

B. Chapter 253: State Lands

This chapter addresses the responsibilities of the State Board of Trustees in managing the State sovereign lands by issuing leases, easements, rights of way, or other forms of consent for those wishing to use State lands, including State submerged lands.

Since the Canaveral Harbor site is not within State waters, Chapter 253 is not relevant.

C. Chapter 258: State Parks and Preserves

Figures 4.3 in the DEIS locate the Parks and Preserves in the vicinity of the proposed Canaveral Harbor site. As similarily discussed in Section A above, the distance of these areas to the proposed site should prevent any impacts to these areas from use of the site. Historical use of the site has not interfered with these areas.

D. Chapter 267: Historic Preservation

See figures 4.2 and 4.3 of the DEIS. The proposed site is located at least 4 nmi. from any known features, and therefore it is unlikely that the proposed site designation will result in any impact to these areas.

E. Chapter 288: Commercial Development and Capital Improvements; Industrial Siting Act

The final designation of the Canaveral Harbor site provides an environmentally acceptable ocean location for the disposal of dredged materials that meet the Ocean Dumping Criteria. If ocean disposal is selected as the most feasible option for a dredged material disposal project, this site designation ensures that an ocean disposal site is available in the area. Therefore the designation removes one barrier to free and advantageous flow of commerce in the area in that dredging projects and their associated navigational benefits cannot be halted due to the lack of an acceptable ocean disposal site.

The Industrial Siting Act is not applicable to this proposed site designation.

F. Chapter 370: Saltwater Fisheries

Chapter 370 ensures the preservation, management and protection of saltwater fisheries and other marine life. Most commercial and recreational fishing activity in the Canaveral Harbor vicinity is concentrated in inshore and nearshore waters. No natural hardbottom areas are known to occur in proximity to the proposed site. The nearest fish haven is located about 2 nmi from the site and past disposal operations at the site have not interfered with the use of this area as a fishery. In short, the Canaveral Harbor site does not represent a unique habitat for any of the important commercial or recreational fisheries. Use of the site will smother the non-motive or slow moving benthic organisms at the site. However the ability of these organisms to recolonize in similar sediments renders this impact short-term and insignificant. Evidence of this is found in surveys at the site which have detected no significant differences in the infaunal community between the site and control (not dumped on) areas. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have been contacted and asked to respond to EPA's conclusion ~~the~~ that the endangered or threatened species which could occur in this area should not be impacted by this site designation.

G. Chapter 376: Pollutant Discharge Prevention and Removal

Possible effects associated with the use of this site are local mounding, temporary increases in turbidity and the smothering of benthic organisms. The effect on the benthos should be minor as discussed in Section F above. Bathymetric monitoring will ensure that any mounding does not become a hazard to navigation. Turbidities resulting from use of the site will be temporary as the predominance of the dredged material will fall rapidly to the bottom. Any suspended sediments remaining in the water column will be diluted and dispersed so that the long term effect would not be greater than ambient suspended solids concentrations. This is supported by past experience with ocean disposal operations at the site and the results of recent monitoring surveys.

Any material proposed for ocean disposal must meet the criteria given in 40 CFR Part 227 (Ocean Dumping Criteria). EPA and the Corps will continue to monitor the site as long as it is used to detect movement of the material and any associated impacts.

H. Chapter 403: Environmental Control

The principle concerns raised in this chapter are similar to those addressed in many of the chapters discussed above: pollution control, waste disposal and dredging.

The Corps and EPA will evaluate all Federal dredged material disposal projects in accordance with the EPA criteria given in the Ocean Dumping Regulations (40 CFR Sections 220-229), the Corps regulations (33 CFR 209.120 and 209.145), and any state requirements. The Corps will also issue permits to private dredged material disposal projects after review under the same regulations. EPA has the right to dissaprove any ocean disposal project if it believes that the provisions of the Marine Protection Research and Sanctuaries Act of 1972 have not been met.

III. Conclusions

Based on the information presented in the DEIS, EPA concludes that the proposed Canaveral Harbor, Florida ocean dredged material disposal site designation is consistent with Florida's Coastal Zone Management Plan as summarized above.

APPENDIX J

COMMENTS ON AND RESPONSES TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

PREFACE

Comments were made on the DEIS and as such were made prior to the reconfiguration of the candidate site. EPA responses have been modified where necessary to take the reconfiguration into account.

Reg

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW
RICHARD B. RUSSELL FEDERAL BUILDING, SUITE ~~1034~~ 1320
75 SPRING STREET, S.W.
ATLANTA, GEORGIA 30303

TAKE PRIDE IN AMERICA

SEP - 9 1987

ER-87/982

Ms. Sally Turner, Chief
Marine Protection Section
U.S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Dear Ms. Turner:

The Department of the Interior has reviewed the Draft Environmental Impact Statement for the Canaveral Harbor, Ocean Dredged Material Disposal Site Designation, Brevard County, Florida, and has no comments to offer. 1

Sincerely yours,

James H. Lee

James H. Lee
Regional Environmental Officer

U.S. Departmr   of Housing and Urban Development
Atlanta Regional Office, Region IV
Richard B Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303-3388

August 17, 1987

Ms. Sally Turner, Chief
Marine Protection Section
US Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Ms. Turner:

This refers to your letter dated July 30, 1987, transmitting the Draft Environmental Impact Statement (DEIS) for the Canaveral Harbor, Florida ocean dredged material disposal site designation.

Our review indicates there will be no significant adverse impacts on any HUD programs as a result of this project in the Atlantic Ocean Offshore Canaveral Harbor. 1

Thank you for the opportunity to review and comment on your proposed project.

Sincerely,

Anthony A. Amato

for Ivar O. Iverson
Regional Environmental Officer

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333

September 4, 1987

Ms. Sally Turner, Chief
Marine Protection Section
U.S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Dear Ms. Turner:

Thank you for sending us a copy of the Canaveral Harbor, Florida Ocean Dredged Material Disposal Site Designation. We are responding on behalf of the U.S. Public Health Service.

We have reviewed the draft EIS for potential adverse human health effects and have no comments to offer at this time. 1

We appreciate the opportunity to review this EIS. Please send us a copy of the final document when it becomes available.

Sincerely yours,

Linda Anderson

Vernon N. Houk, M.D.
... stant Surgeon General
Director
Center for Environmental Health
and Injury Control

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

October 8, 1987   F/SER23:TAH/td

Ms. Sally S. Turner, Chief
Marine Protection Section
U.S. Environmental Protection Agency
345 Courtland Street
Atlanta, GA 30365

Dear Ms. Turner:

This responds to your letter of August 17, 1987, initiating informal consultation for the designation of an ocean dredged material disposal site offshore Canaveral Harbor, Florida. A draft environmental impact statement (DEIS) was transmitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA). 1

We have reviewed the DEIS and concur with your determination that populations of endangered/threatened species under our purview would not be affected by the proposed action. 1

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the proposed activity. If you have any new information or questions concerning this consultation, please contact Dr. Terry Henwood, Fishery Biologist, at FTS 826-3366. 1

Sincerely yours,

Charles A. Oravetz

Charles A. Oravetz, Chief
Protected Species Management
Branch

cc: F/PR2
F/SER1

Horberg

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

March 12, 1990 F/SER23:TLD

Mr. W. Bowman Crum, Chief
Wetlands & Coastal Program Section
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Crum:

This responds to your February 28, 1990 letter regarding modification of site location for designation of Canaveral Offshore Dredge Material Disposal Site. A Biological Assessment (BA) of the previous site was submitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA). (2)

We have reviewed the latest information provided and concur with your determinations that populations of endangered/threatened species under our purview would not be adversely affected by the proposed action. (2)

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the proposed activity. (2)

If you have any questions, please contact Dr. Terry Henwood, Fishery Biologist at 813/893-3366.

Sincerely yours,

Charles A. Oravetz

Charles A. Oravetz, Chief
Protected Species Management Branch

cc: F/SER1
F/PR2

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES FIELD STATION
2747 ART MUSEUM DRIVE
JACKSONVILLE, FLORIDA 32207

August 27, 1987

Ms. Sally S. Turner, Chief
Marine Protection Section
United States Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

Dear Ms. Turner:

This responds to your letter of August 17, 1987, in accordance with Section 7 of the Endangered Species Act of 1973, as amended, on the Environmental Protection Agency's proposal to designate an ocean dredged material disposal site offshore from Canaveral Harbor, Florida. You evaluated the impact this action would have on the following species, and determined a no effect: leatherback turtle, hawksbill turtle, Kemp's Ridley turtle, green turtle and loggerhead turtle. Since no activity is proposed for the nesting beaches that are found throughout the area, the consultation responsibility rests with the National Marine Fisheries Service. 1

We appreciate the opportunity to provide comments relative to federally listed species. If we can be of further assistance, please contact Don Palmer in this office. 1

Sincerely yours,

David J. Wesley

David J. Wesley
Field Supervisor

RESPONSES TO THE FEDERAL AGENCY COMMENT LETTERS

***

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF ENVIRONMENTAL PROJECT REVIEW
(September 9, 1987 Letter)

1. No response necessary. Thank you for your comments.

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
(August 17, 1987 Letter)

1. No response necessary. Thank you for your comments.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
(September 4, 1987 Letter)

1. No response necessary. Thank you for your comments.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
(October 8, 1987 Letter)

1. Thank you for providing National Marine Fisheries Service (NMFS) concurrence. The re-configuration of the Canaveral Harbor ODMDS since the DEIS stage (see this FEIS) to encompass the interim ODMDS does not alter EPA's determination on endangered/threatened species.

(March 12, 1990 Letter)

2. Thank you for providing verification of NMFS concurrence. Verification was provided in response to EPA's telphone conversation with Dr. Terry Henwood of the NMFS on February 15, 1990, during which EPA's plans to re-configure the ODMDS were indicated.

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
(August 27, 1987 Letter)

1. No response necessary. Thank you for your comments.

STATE OF FLORIDA
Office of the Governor
THE CAPITOL
TALLAHASSEE, FLORIDA 32399-0001

BOB MARTINEZ
GOVERNOR

October 6, 1987

Ms. Sally Turner, Chief
Marine Protection Section
U.S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Dear Ms. Turner:

In accordance with the National Environmental Policy Act (NEPA) and the Intergovernmental Cooperation Act of 1968, this office reviewed and coordinated a state agency review of your ~~draft Environmental Impact Statement~~ for Designation of a Canaveral Harbor, Florida, Ocean Dredged Material Disposal Site (ODMDS). 1
As part of our review process we requested and received comments from the departments of Commerce, Environmental Regulation, Natural Resources, and State and the Florida Game and Fresh Water Fish Commission. Their comments are enclosed, and reflect in greater detail the state's concerns. We request that you consider their comments as part of this letter and respond accordingly as provided in the NEPA Regulations, 40 C.F.R. 150.4(a).

This draft supplement to the Jacksonville Harbor Dredged Material Disposal Site Final EIS describes a proposal to designate a four mile square permanent dredged material disposal site approximately 4.5 miles offshore of Canaveral Harbor. A portion of the proposed site has been used as an interim disposal site since 1974. The document states that the 2
interim designation will expire in the near future but does not give a date. Approximately 10.3 million cubic yards of dredged material has been deposited at this location as a result of the Corps of Engineers' Canaveral Harbor channel maintenance activities. The channel has a 35 to 41 foot authorized depth that serves the expanding Port Canaveral and U.S. Navy Trident Submarine Basin.

The State of Florida has consistently supported economically sound port development when it is in the state's overall interest and adequate protection is given to environmental 3
resources. The state also recognizes that port development and maintenance activities can have long-term adverse impacts and

waste valuable resources. To reduce environmental risks and waste we have insisted that the selection of ocean disposal sites be based on acceptable scientific surveys and evaluations. Our cooperative efforts with EPA at Pensacola resulted in a systematic scientific site investigation program that we had expected would serve as a model for future site evaluations. That this site designation study plan was not used for the Canaveral Harbor site must be explained. A review of this draft raises questions on the adequacy of the scientific studies performed in support of the EIS. These issues are expressed in detail by the Department of Environmental Regulation and should be resolved before finalizing the EIS. 3

The disposal site as proposed will permit the disposal of beach quality sand material dredged from state sovereign lands. Removal of beach quality sand from the littoral system will exacerbate shoreline erosion problems. State policy and Florida Statutes provide that beach quality material should be placed on the downdrift beaches. Therefore, we find the proposed use of the site unacceptable. The EIS should acknowledge authority of the Board of Trustees of the Internal Improvement Trust Fund over dredged material removed from state soverign lands and prohibit the disposal of beach quality sand in the disposal site unless approved by the Trustees. 4

The State of Florida's review of this draft document finds scientific deficiencies and policy issues that must be corrected or receive further evaluation before proceeding to a final EIS. The draft EIS, in our judgement, does not satisfy the NEPA regulations and should not be considered an acceptable document unless the concerns raised in this letter and enclosures are satisfactorily answered. 5

We suggest that Florida's concerns be the subject of a interagency meeting. Such a meeting could be hosted by this office. Please contact Walt Kolb at (904) 488-8114 to make the necessary arrangements. Thank you for your cooperation. 6

Sincerely,

Glenn W. Robertson
Director of Policy and Finance

GWR/wkm
Attachments

cc: Florida Cabinet
Dale Twachtman
Sally Munroe
Colonel Robert L. Herndon

cc: Thomas G. Tomasello
James MacFarland
Jeremy Craft
Kirby Green
Bradley J. Hartman
George Percy
Andrew Grayson
Wynnelle Wilson
Dave Worley
Lynn F. Griffin
Mark Leadon
Dave Johnson
Clare Gray
Walt Kolb

STATE OF FLORIDA DEPARTMENT OF COMMERCE
Division of Economic Development

GOVERNOR'S OFFICE
Planning and Budgeting
Intergovernmental Coord.
AUG 31 1987
RECEIVED

August 25, 1987

Mr. Walt Kolb
Office of Planning and Budgeting
Executive Office of the Governor
The Capitol
Tallahassee, Florida 32399-1000

Dear Mr. Kolb:

We have reviewed the Draft Environmental Impact Statement (EIS) for Designation of a Canaveral Harbor, Florida Ocean Dredged Material Disposal Site. It is anticipated that this site will be used for disposal of maintenance dredged materials from the Port Canaveral channel and turning basins. 7

Port Canaveral handled 1.6 million tons of cargo valued at $13 million in 1985. The major import commodies were cement, citrus and petroleum products, asphalt and newsprint. The major export commodity was scrap iron. The port is also home for three cruise ships. 7

For Florida's seaports to remain competitive with ports in other states, it is important that they have EPA designated spoil disposal sites with enough capacity for long-term maintenance of their harbors. Designation of this spoil disposal site is consistent with the Department's goals and policies to promote international trade and the cruise industry. Thank you for the opportunity to comment on the Draft EIS. 7

Sincerely,

Wynnelle Wilson
Economist Supervisor

WW:bs:smj

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

September 25, 1987

Mr. Walt Kolb
Senior Governmental Analyst
Office of Planning and Budgeting
Office of the Governor
421 Carlton Building
Tallahassee, Florida 32301

Dear Walt:

Re: Draft Environmental Impact Statement, Canaveral Harbor ODMDS Designation

The Environmental Protection Agency proposes to designate a 4 nmi^2 permanent dumpsite 4.5 miles offshore of Cocoa Beach, 8
Brevard County. Approximately 1/4 of the proposed site has been used previously under an interim dumpsite designation. The site is proposed for the disposal of maintenance dredged material from the Port Canaveral entrance channel and turning basins.

The need for this site and the proposed expansion is not sufficiently addressed as required by Section 102(c) of the Marine, Protection, Research, and Sanctuaries Act. If the entrance channel material is beach quality, it is suitable for beach disposal. If interior material is construction grade, it 9
could be stored temporarily in available land disposal sites and sold for fill. This would allow a recycling of material, preclude unnecessary borrow pit construction, and be a more conservation oriented approach to the management of coastal land and water resources. We believe ocean dumping should only be considered as a last resort when material cannot be recycled for beneficial uses. Accordingly, we do not agree with designating ocean disposal sites or expanding existing ones if alternative disposal options are available.

The document does not include chemical analyses of dredged material sediment quality or detailed historical and projected quantities to be dumped. It is acknowledged that 10.3 million 10
cubic yards have been dumped at the interim site since 1974 and that in 1985 it was projected that 3.2 mcy will be disposed

during "the first year." What or when "the first year" is is not
explained nor how much material would be expected to be dumped,
and how often, in subsequent years. Also, quality and frequency 10
of material previously dumped should have been included to
qualify the assessment of impacts at the interim site.

As we have stated in previous comments, the scientific surveys
and evaluations are not complete and in concert with the protocol
developed for the Pensacola deep water site designation.
Although video work was attempted in the Canaveral surveys it was
not completed because of turbid conditions. Turbid water
conditions are described as occasional occurrences and possibly
due to the resuspension of nearby previously disposed material. 11
The video survey should have been attempted at other seasons or
times when turbid conditions were not present. If resuspended
material is causing turbid conditions, a survey with a wider
range could have been attempted to photodocument bottoms adjacent
to the site along the same contours. There is also no mention of
a side scan sonar survey which would have given preliminary
indications of the presence or absence of hard ground areas.

As with prior EISs for the Pensacola interim site and the
Fernandina and Charlotte Harbor sites, this DEIS does not include
a dispersion analysis of the probable footprint of dumped 12
material of a given quantity and type. At the least, a thorough
bathymetric and sediment examination around the interim site
might have provided some insight into the behavior of discharged
material in this location.

We continue to be concerned that site designation surveys are not
systematic and thorough, following the pattern of the Pensacola
deepwater survey protocol. We wish to be consulted on the plans 13
of study for the surveys and preview photographic records and
dispersion analyses prior to development of draft EISs.

We offer the following specific comments referenced to numbered
sections:

1.01: Why is it stated throughout the DEIS that the interim
site designation will soon expire? This site is listed 14
in 40 CFR Part 228.12(a)(3) as a dumpsite whose interim
designation has been indefinitely extended.

1.02: Had the state reviewed the field data from the baseline
survey its inadequacies could have been identified prior 15
to preparation of the technical report and the draft EIS.

2.02 and 2.04:

Which available land disposal sites were investigated? Was construction reuse of temporarily stored fill explored? 16

4.02: The affected environment should have been thoroughly documented by including the area surrounding the interim site in the survey. It would strengthen the evaluation of expected impacts to know how much area was affected by a certain quantity, quality and frequency of discharges over the last 15 years. 17

5.07: We disagree that conclusive statements about sediment transport cannot be made. If we know the dump stations, quantity and quality of material, and current speed and direction, a prediction of the areal extent and thickness of deposited material can be made. 18

5.08: What is the history of the dumping schedule between 1974 and 1983? When was the last dump and how much material was involved? What was its quality? Where was the dump station? How was it determined that no long-term effects on water quality or the physical and chemical composition of site sediments have resulted from these prior dumps? If monitoring surveys were done as required by the MPRSA, why weren't they included in this DEIS? 19

5.09: Something is missing in the second paragraph of this section. 20

5.20: How will the location of the dump station be determined to insure that effects outside the disposal site can be minimized? 21

'Judicious placement and movement of the dump buoy and periodically monitoring the site's bathymetry" is an insufficient description of site management. We need explicit descriptions of dump stations, quantities and rates of material to be disposed as well as the specific parameters, schedule and contingency measures of the monitoring program.

Appendix A

13 and 71:

To properly survey currents, an array should be deployed so that bottom, mid depth and surface (wind influenced) 22 currents are measured. Also, the results should be compared with whatever long-term data base is available in order to conclude that these measurements reflect typical conditions for the area. 22

Gulf Stream influences which are spurious, unpredictable and high speed can produce eddies and filaments which may disperse material in directions other than those dominating the current rose. A dispersion analysis needs to consider these anomalous, worst-case events as well as more normal forcing functions.

91: Were five macroinfaunal replicates determined through species saturation curve analyses? 23

We request a response to these comments by EPA prior to moving forward with finalization of this document. Since we consider the scientific studies presented in the DEIS to be inadequate we wish to meet with EPA to discuss an improved site survey. Such information will be needed to finalize our site designation recommendations. 24

We appreciate the opportunity to comment on this document.

Cordially,

Lynn

Lynn F. Griffin
Environmental Specialist
Intergovernmental Programs
Review Section

LFG/jb

cc: Dave Worley
Randy Armstrong
Dave Arnold
Andy Grayson

State of Florida
DEPARTMENT OF NATURAL RESOURCES

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399

TOM GARDNER
Executive Director

September 29, 1987

PLEASE ADDRESS REPLY TO:

Walt Kolb
Senior Governmental Analyst
Office of the Governor
421 Carlton Building
Tallahassee, Florida 32399

Re: Draft Environmental Impact Statement for Designation of a Canaveral Harbor, Florida Ocean Dredged Material Disposal Site

Dear Mr. Kolb:

The Department has reviewed the above-referenced draft Environmental Impact Statement (EIS) for designation of a permanent ocean dumping site proposed pursuant to 40 CFR Part 228. The following comments are offered for transmittal to the U. S. Environmental Protection Agency (EPA) on behalf of the Department, as well as the Board of Trustees of the Internal Improvement Trust Fund (Trustees). 25

Comments for the Division of Beaches and Shores are attached and incorporated hereto. Consistent with those comments, the Trustees object to the proposed permanent designation of this ocean dumping site. The site as proposed will permit the disposal of beach quality sand material dredged from state sovereign lands. Removal of such beach quality sand material from the littoral system will exacerbate the erosional problems of the downdrift shoreline. Such beach quality sand material should be disposed of on the downdrift beaches pursuant to the provisions of Section 161.142, Florida Statutes (1986). 26

The Trustees authority over such dredged material is provided as a mandatory enforceable provision of the Florida Coastal Management Program (FCMP), as approved pursuant to the Coastal Zone Management Act (42 U.S.C. 4321, et seq.). 27

The approved FCMP incorporates state legislative amendments through the 1984 Legislative session. Included 28 within the approved program are the following statutory provisions which constitute enforceable mandatory policy pursuant to the FCMP: Section 161.042, Florida Statutes, and Subsections 253.03(1) and 253.77(1), Florida Statutes (1984). 28

Subsection 161.042, Florida Statutes (1984), provides:

> The department is authorized to direct that any person, or any public body or agency, responsible for the excavation of sandy sediment as a result of any activity conducted to maintain navigable depths within or immediately adjacent to any coastal barrier beach inlet within sovereignty lands shall, after receipt of written authorization from the Department of Environmental Regulation relating to the deposition of spoil material from the excavation pursuant to chapters 253 and 403, use such sediment for beach nourishment as prescribed by the division. Requests for such authorization shall be made by the applicant to the Department of Environmental Regulation, and such authorization shall be granted upon issuance of water quality certification by the Department of Environmental Regulation. For any construction or excavation within or immediately contiguous to any coastal barrier beach inlet which has been permitted pursuant to s. 161.041, the department may require the permittee to supply beach profiles and conduct hydrographic monitoring of the impacted area. 28

Subsection 253.03(1), Fla. Stat. (1984), in pertinent part, provides:

> The Board of Trustees of the Internal Improvement Trust Fund of the state is vested and charged with the acquisition, administration, management, control, supervision, conservation, protection, and disposition of all lands owned by, or which may hereafter inure to, the state or any of its agencies, departments, boards, or commissions... 28

Subsection 253.77(1), Fla. Stat. (1984), provides:

> No person may commence any excavation, construction, or other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund or the Department of Natural Resources under this chapter, until such person has received from the Board of Trustees of the Internal Improvement Trust Fund the required lease, license, easement, or other form of consent authorizing the proposed use. (28)

In summary, the Department and the Trustees object to the permanent designation of an ocean dumping site offshore of Canaveral Harbor, unless such site designation specifically excludes its use for the disposal of beach quality sand material. (29)

Sincerely,

Thomas G. Tomasello

Thomas G. Tomasello
General Counsel

TGT/agj

cc: Andrew S. Grayson
James MacFarland
Casey Fitzgerald
Bob Palmer
Greg Diehl
Kirby Green
Ralph Clark
Brett Moore
Mark Leadon
Jack Woodard
Clare Gray
Doug MacLaughlin
David W. Arnold
Lynn Griffin
Bob Schutte

State of Florida

Department of Natural Resources Memorandum

September 23, 1987

TO: Andrew Grayson, Assistant General Counsel
Legal Office

FROM: Mark E. Leadon, P.E. Administrator
Bureau of Coastal Engineering & Regulation

SUBJECT: Draft Environmental Impact Statement, Canaveral Harbor ODMDS Designation

Evaluation of the above-referenced Draft EIS has been conducted by the Division and the following additional review comments are provided for your review. Comments regarding consistency of the proposed site designation with the Florida Coastal Zone Management Program will be provided separately although preliminary review is that the EIS does not 30
comply with the CZM Program. The EPA's consistency evaluation has been provided to me by DER and a copy is attached for your review. Table 1, p. 2, of the EIS lists the candidate ocean disposal site as being in compliance with the Florida CZM Program, as well as, a series of Federal laws and policies related to ocean dumping and environmental protection. The Division does not agree with these findings.

It is felt that the above-referenced Draft EIS does not adequately address alternative disposal site considerations. Land disposal alternatives are considered in Section 2.04, p. 4, but beach disposal alternatives are not considered. Section 3.00, p. 4, of the EIS further considers alternatives 31
but no beach disposal consideration is given. It is not evident that any alternative upland sites including beach disposal were considered as potentially acceptable in the ocean disposal site evaluation. The Division is concerned that no beach disposal sites are discussed and that final designation of the proposed ocean disposal site will promote future offshore disposal and loss of beach quality sand.

Department policy regarding use of beach quality sand from inlet maintenance dredging for beach nourishment has been well enunciated to the EPA and the Corps of Engineers over the years. Specific support from the Legislature in this regard is found in Section 161.042, F.S. which 32
states that the Department is authorized to direct that sandy sediment from navigational dredging be used for beach nourishment. This provision is contained within the Florida Coastal Zone Management Program. More recently Section 161.142, F.S., established Department policy that inlet dredged sand be placed on beaches.

An environmental assessment of potential impacts of the site designation based on criteria in the Federal Ocean Dumping Regulations, 40 CFR Parts 228.5 and 228.6, are provided on p. 15 of the EIS. In Section 33
5.02 impacts of placement of the dredged material in 47 to 55 foot water

depths are discussed. However, no consideration of the adverse impact
associated with removal of the material from the active sand transport
system is addressed. Section 5.04 of the EIS does state that "It is unlikely
that there will be any appreciable quantities of dredged material transported 33
onto beaches "and" No adverse impacts to these beaches has been associated
with previous dredged material disposal at this site." Section 5.15 of the
EIS establishes that "Resources irreversibly or irretreivably committed
through the use of the proposed site will include: (1) loss of some potentially
recyclable material (i.e., sand for landfill)."

The predominant and most expected source of dredged material
to be placed in the proposed ocean dump site is the Canaveral Harbor project
which includes a U.S. Navy Trident Submarine Basin. The Harbor and
entrance channel were constructed between 1950 and 1954. Following 34
construction of the Harbor project erosion rates sky-rocketed for the first
couple of miles south of the project. Although the Navy/Corps placed
about 2.3 million cubic yards from the Trident project on the beach in
1974-1975, the beach continues to experience erosion and is in need of
on-going renourishment. The Corps of Engineers has planned a fixed sand
bypassing plant north of the Canaveral Inlet to transfer sand to beaches
south of the inlet, but bypassed sand will only partially mitigate Inlet-induced
erosion. Additional bypassing from dredging operations is needed.

Provisions of Federal law, specifically PL 90-483, Section 111
(Title 33, Section 426(i), U.S. Code), allow the Corps of Engineers to prevent
or mitigate shore damages attributable to navigation projects. Construction
of the sand bypassing plant will partially mitigate erosion impacts from 35
the Harbor project. However, redistribution of sand dredged from the
Canaveral Harbor Project to beaches south of the project would substantially
offset any erosion on the beaches attributable to dredging of the project.
The Division's preliminary Beach Management Plan for restoration of the
State's beaches identifies the need for restoration of the beaches south
of Canaveral Inlet and recommends a restoration project for the area.

The Corps of Engineers, Jacksonville District, is in the process
of preparing an Environmental Impact Statement (EIS) for a Harbor expansion
project for Canaveral Harbor which will presumably utilize this proposed
ocean disposal site for material dredged in that project. The Division has 36
provided comments regarding placement of dredged sand on the beach
to the Corps in response to a request for comments to their EIS preparation.
The Division will likewise provide these comments to the Draft EIS for
the Harbor expansion when the Draft EIS is prepared and circulated for
comment.

Sediment analysis of the material presently existing in the
ODMDS is provided in Appendix A of the EIS. However, most importantly 37

to this Division is the nature of sediment to be dredged from the channel project. Core borings were taken in the Harbor in the past but grain size distribution analysis for that material is not provided in the EIS. Although the Harbor expansion project may produce high quantities of fine-grained silts and clays unsuitable for beach placement, the Division will insist on a comprehensive sediment analysis of proposed dredge material, particularly for the Harbor expansion or Inlet maintenance projects. There will presumably be substantial quantities of beach quality sand available for beach nourishment in future projects.

In summary, it is felt that the draft EIS does not adequately address environmental impacts as set forth in the Federal Ocean Dumping Regulations nor potential alternative disposal sites, does not comply with the State's policies and programs related to beach management, and is not consistent with Florida's federally approved Coastal Zone Management Program. The EIS is, further, in conflict with provisions of the Clean Water Act, PL95-217 (Title 33, Section 1344(t), U.S. Code) which calls for compliance with State requirements relating to discharge of dredge and fill material. 38

MEL/sp
Attachment
cc: Kirby Green
Jack Woodard
Lynn Griffin
Bureau Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

GOVERNOR'S OFFICE
Planning and Budgeting
Intergovernmental Coord.

AUG 27 1987

RECEIVED

REF: 4-WMD-ME/CP

Mr. Rick Smith
Federal Consistency Coordinator
State Planning and Development Clearinghouse
Office of Planning and Budget
Executive Office of the Governor
The Capitol
Tallahassee, Florida 32301

Enclosed are five (5) copies of the Environmental Protection Agency's evaluation of the consistency of the Canaveral Harbor ocean dredged material disposal site designation with the Florida Coastal Zone Management Plan. Information supporting this consistency evaluation may also be found in the draft environmental impact statement prepared for this site designation. We have enclosed three (3) copies of this document.

39

We are formally requesting your concurrence on our conclusion that the proposed designation of the Canaveral Harbor site is consistent with Florida's Coastal Zone Management Plan. If there are any questions, please call me or Mr. Reginald Rogers at 404-347-2126.

Sincerely yours,

Sally Turner

Sally Turner, Chief
Marine Protection Section

Enclosures

CANAVERAL HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

FLORIDA COASTAL ZONE MANAGEMENT PROGRAM

CONSISTENCY EVALUATION

Submitted by:

39

U.S. Environmental Protection Agency

Region IV

I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Army Corps of Engineers (Corps), has prepared a draft environmental impact statement (DEIS) titled "Draft Environmental Impact Statement For Designation Of A Canaveral Harbor, Florida Ocean Dredged Material Disposal Site." This DEIS evaluates the environmental conditions relevant to the designation of an ocean disposal site offshore Canaveral Harbor, Florida. Additionally, the DEIS evaluates the proposed Canaveral Harbor site according to the eleven environmental criteria required for site designations under 40 CFR 228.6 (Ocean Dumping Regulations).

The site proposed for final designation is an extension of the Canaveral Harbor site that received an interim designation at 40 CFR 228.12 and has been used for dredged material disposal for many years. The proposed site contains over half the area of the interim site and an adjacent area seaward. The total area of the proposed site is approximately 4 square nautical miles (nmi). This site is located approximately 5.75 nmi east of Cocoa Beach, Florida in the Atlantic Ocean. Since 1974 approximately 10.3 million cubic yards of dredged material have been disposed of at the interim site with no evidence of adverse environmental impacts.

The site designation is needed in this area to provide an ocean disposal option for dredging projects in the area. Potential sources of the dredged material are the Port Canaveral Channel and Turning Basins. It should be emphasized that final designation of the interim Canaveral Harbor site does not imply EPA's approval of disposal of materials at the site. EPA and the Corps must conduct an environmental review of each proposed ocean disposal project. That review ensures that there is a demonstrated need for ocean disposal and that the material proposed for disposal meets the requirements for dredged materials given in the Ocean Dumping Regulations.

II. The Florida Coastal Zone Management Program (CZMP)

There are eight Florida statutes relating to ocean disposal site designations. This assessment discusses how the referenced DEIS for the Canaveral Harbor site designation and subsequent review, permitting and monitoring actions will meet the CZMP objectives to protect coastal resources while allowing multiple use of coastal areas. Consult the DEIS for further data and information.

A. Chapter 161: Beach and Shore Preservation

The intent of Chapter 161 is the protection of thousands of miles of Florida's coastline by regulating construction activities near and within these areas. The Canaveral Harbor site designation will require no new construction; and therefore no related support activities will be subject to the construction regulations in this chapter.

The Canaveral Harbor site is located 5.75 nmi from Cocoa Beach, the nearest beach and shore-related amenity. Sediment transport in the vicinity of the site is driven mainly by weather events. Because of this, dispersion of the material can be in any direction. However recent field surveys have shown that currents move primarily in the north/south direction. Surveys at the site have not detected the accumulation of material from past disposal toward the shore. A small mound is located northwest of the site but it has not been determined that this is from migration of dredged material. In short, the Canaveral Harbor site is dispersive and the sediments are transported and diluted in all directions by natural coastal processes. The distance of the site to the nearest beach is great enough so that impacts to the beach resulting from the use of the site are not reasonably anticipated. Past use of the site has not resulted in any interference with beach and shore activities in the vicinity. Monitoring surveys at the site will continue to evaluate the effects of disposal. In the event that significant accumulation of the dredged material towards any amenity is evident, use of the site can be modified or terminated.

B. Chapter 253: State Lands

This chapter addresses the responsibilities of the State Board of Trustees in managing the State sovereign lands by issuing leases, easements, rights of way, or other forms of consent for those wishing to use State lands, including State submerged lands.

Since the Canaveral Harbor site is not within State waters, Chapter 253 is not relevant.

C. Chapter 258: State Parks and Preserves

Figures 4.3 in the DEIS locate the Parks and Preserves in the vicinity of the proposed Canaveral Harbor site. As similarily discussed in Section A above, the distance of these areas to the proposed site should prevent any impacts to these areas from use of the site. Historical use of the site has not interfered with these areas.

D. Chapter 267: Historic Preservation

See figures 4.2 and 4.3 of the DEIS. The proposed site is located at least 4 nmi. from any known features, and therefore it is unlikely that the proposed site designation will result in any impact to these areas.

E. Chapter 288: Commercial Development and Capital Improvements; Industrial Siting Act

The final designation of the Canaveral Harbor site provides an environmentally acceptable ocean location for the disposal of dredged materials that meet the Ocean Dumping Criteria. If ocean disposal is selected as the most feasible option for a dredged material disposal project, this site designation ensures that an ocean disposal site is available in the area. Therefore the designation removes one barrier to free and advantageous flow of commerce in the area in that dredging projects and their associated navigational benefits cannot be halted due to the lack of an acceptable ocean disposal site.

The Industrial Siting Act is not applicable to this proposed site designation.

F. Chapter 370: Saltwater Fisheries

Chapter 370 ensures the preservation, management and protection of saltwater fisheries and other marine life. Most commercial and recreational fishing activity in the Canaveral Harbor vicinity is concentrated in inshore and nearshore waters. No natural hardbottom areas are known to occur in proximity to the proposed site. The nearest fish haven is located about 2 nmi from the site and past disposal operations at the site have not interfered with the use of this area as a fishery. In short, the Canaveral Harbor site does not represent a unique habitat for any of the important commercial or recreational fisheries. Use of the site will smother the non-motive or slow moving benthic organisms at the site. However the ability of these organisms to recolonize in similar sediments renders this impact short-term and insignificant. Evidence of this is found in surveys at the site which have detected no significant differences in the infaunal community between the site and control (not dumped on) areas. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service have been contacted and asked to respond to EPA's conclusion ~~the~~ that the endangered or threatened species which could occur in this area should not be impacted by this site designation.

G. Chapter 376: Pollutant Discharge Prevention and Removal

Possible effects associated with the use of this site are local mounding, temporary increases in turbidity and the smothering of benthic organisms. The effect on the benthos should be minor as discussed in Section F above. Bathymetric monitoring will ensure that any mounding does not become a hazard to navigation. Turbidities resulting from use of the site will be temporary as the predominance of the dredged material will fall rapidly to the bottom. Any suspended sediments remaining in the water column will be diluted and dispersed so that the long term effect would not be greater than ambient suspended solids concentrations. This is supported by past experience with ocean disposal operations at the site and the results of recent monitoring surveys.

Any material proposed for ocean disposal must meet the criteria given in 40 CFR Part 227 (Ocean Dumping Criteria). EPA and the Corps will continue to monitor the site as long as it is used to detect movement of the material and any associated impacts.

H. Chapter 403: Environmental Control

The principle concerns raised in this chapter are similar to those addressed in many of the chapters discussed above: pollution control, waste disposal and dredging.

The Corps and EPA will evaluate all Federal dredged material disposal projects in accordance with the EPA criteria given in the Ocean Dumping Regulations (40 CFR Sections 220-229), the Corps regulations (33 CFR 209.120 and 209.145), and any state requirements. The Corps will also issue permits to private dredged material disposal projects after review under the same regulations. EPA has the right to dissaprove any ocean disposal project if it believes that the provisions of the Marine Protection Research and Sanctuaries Act of 1972 have not been met.

III. Conclusions

Based on the information presented in the DEIS, EPA concludes that the proposed Canaveral Harbor, Florida ocean dredged material disposal site designation is consistent with Florida's Coastal Zone Management Plan as summarized above.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

October 6, 1987

Mr. Walt Kolb
Senior Governmental Analyst
Office of Planning and Budgeting
Office of the Governor
421 Carlton Building
Tallahassee, Florida 32301

Dear Walt:

Re: [redacted] Harbor ODMDS Designation

We have previously reviewed the draft environmental impact statement for the referenced designation and wish to incorporate our September 25 comments as a part of this response. The following comments respond to the Environmental Protection Agency's federal consistency determination submitted under the requirements of the Coastal Zone Management Act.

Our DEIS comments identified deficiencies in the scientific surveys of the proposed site, specifically side scan sonar and photodocumentation. The impacts evaluations did not provide a dispersion analysis of the probable area of impact. Sediment quality data and information on historical and projected use are not provided. The DEIS also does not detail a site management plan.

Because of these deficiencies, EPA does not have sufficient data and information on which to base a sound designation decision. The conclusions summarized in its consistency determination should be based on scientific evidence rather than assumption. For instance, sections A and G do not reconcile the conclusion that the site is dispersive with the bathymetric evidence of a persistent mound in the interim site and with the speculation that resuspension of previously dumped material is responsible for locally turbid conditions. Similarly, the statement in section F that "no natural hardbottom areas are known to occur in proximity to the proposed site" is not based on side scan sonar and photographic surveys.

The consistency determination, section G, states that monitoring surveys have been conducted recently and will continue. If monitoring has been done in the past, particularly in conjunction with the most recent dump, these reports should be provided for review along with a thorough description of the site management plan.

We have requested a meeting with EPA to resolve these issues prior to finalization of the EIS. The data and information presented in the draft EIS are insufficient for an evaluation of the designation's consistency with Chapter 403, Florida Statutes. We reiterate our request that EPA provide complete survey information as discussed here and in our September 25 letter, as well as a thorough response to the questions and comments posed in those remarks. Upon receipt of the necessary information we will complete our federal consistency review. Failure to supply requested information can result in a finding of inconsistency as specified in 15 CFR 930.42(b).

Sincerely,

Randall L. Armstrong, Director
Division of Environmental
Permitting

RLA/lgb

cc: Lynn Griffin
Dave Worley

FLORIDA DEPARTMENT OF STATE
Jim Smith
Secretary of State
DIVISION OF HISTORICAL RESOURCES
R.A. Gray Building
Tallahassee, Florida 32399-0250
(904) 488-1480

GOVERNOR'S OFFICE
Planning and Budgeting
Intergovernmental Coord.
AUG 26 1987
RECEIVED

August 24, 1987

In Reply Refer to:

Louis D. Tesar
Historic Preservation Supv.
(904) 487-2333
Project File No. 870785

Mr. Walt Kolb
Office of the Governor
The Capitol
Tallahassee, Florida 32399-0001

RE: August 4, 1987 memorandum and attachments
Cultural Resource Assessment Request
SAI No. FL870731011147E, Draft Environmental Impact Statement for Designation of a Canaveral Harbor, Florida, Ocean Dredged Material Disposal Site, Brevard County, Florida

Dear Mr. Kolb:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites and properties listed, or eligible for listing in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment"). 40

The project location and nature of the materials to be disposed are such that it is the opinion of this agency that they will have no effect on any sites listed or eligible for listing in the National Register of Historic Places. The project is therefore consistent with the historic preservation aspects of Florida laws and regulations. 40

If you have any questions concerning our comments, please do not hesitate to contact us. Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated. 40

Sincerely,

Louis D. Tesar
fr George W. Percy
State Historic
Preservation Officer

GWP/efk

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

October 6, 1987

Mr. Walt Kolb
Senior Governmental Analyst
Office of Planning and Budgeting
Office of the Governor
421 Carlton Building
Tallahassee, Florida 32301

Dear Walt:

Re: Federal Consistency Determination, Canaveral Harbor ODMDS Designation

We have previously reviewed the draft environmental impact statement for the referenced designation and wish to incorporate our September 25 comments as a part of this response. The following comments respond to the Environmental Protection Agency's federal consistency determination submitted under the requirements of the Coastal Zone Management Act. 41

Our DEIS comments identified deficiencies in the scientific surveys of the proposed site, specifically side scan sonar and photodocumentation. The impacts evaluations did not provide a dispersion analysis of the probable area of impact. Sediment quality data and information on historical and projected use are not provided. The DEIS also does not detail a site management plan. 42

Because of these deficiencies, EPA does not have sufficient data and information on which to base a sound designation decision. The conclusions summarized in its consistency determination should be based on scientific evidence rather than assumption. For instance, sections A and G do not reconcile the conclusion that the site is dispersive with the bathymetric evidence of a persistent mound in the interim site and with the speculation that resuspension of previously dumped material is responsible for locally turbid conditions. Similarly, the statement in section F that "no natural hardbottom areas are known to occur in proximity to the proposed site" is not based on side scan sonar and photographic surveys. 43

Mr. Walt Kolb
Page Two
October 6, 1987

The consistency determination, section G, states that monitoring surveys have been conducted recently and will continue. If monitoring has been done in the past, particularly in conjunction with the most recent dump, these reports should be provided for review along with a thorough description of the site management plan. 44

We have requested a meeting with EPA to resolve these issues prior to finalization of the EIS. The data and information presented in the draft EIS are insufficient for an evaluation of the designation's consistency with Chapter 403, Florida Statutes. We reiterate our request that EPA provide complete survey information as discussed here and in our September 25 letter, as well as a thorough response to the questions and comments posed in those remarks. Upon receipt of the necessary information we will complete our federal consistency review. Failure to supply requested information can result in a finding of inconsistency as specified in 15 CFR 930.42(b). 45

Sincerely,

Randall L. Armstrong, Director
Division of Environmental
Permitting

RLA/lgb

cc: Lynn Griffin
Dave Worley

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

October 6, 1987

Sally Turner, Chief
Marine Protection Section
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Ms. Turner:

RE: Federal Consistency Determination; Canaveral Harbor ODMDS Designation

This department, functioning as the lead coastal management agency, pursuant to section 306(c)(5) of the Coastal Zone Management Act, (16 U.S.C. 1455(c)(5)), and section 380.22, Florida Statutes, hereby requests an extension of time within which to respond to the consistency determination for this project. According to the provisions of 15 C.F.R. 930.41(b), we are seeking to extend the state consistency review period deadline fifteen days, from October 11, 1987, to October 26, 1987. 46

Thank you for your assistance in this matter.

Sincerely,

Randall L. Armstrong, Director
Division of Environmental Permitting

RLA/cgm

cc: Walt Kolb
Lynn F. Griffin
Clare E. Gray
Thomas G. Tomasello

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

October 26, 1987

Sally Turner, Chief
Marine Protection Section
Environmental Protection Agency
Region IV
345 Courtland St, N.E.
Atlanta, Georgia 30365

Dear Ms. Turner:

RE: Federal Consistency Determination, Canaveral Harbor ODMDS Designation

The Department, functioning as Florida's lead coastal management agency pursuant to section 306(c)(5) of the Coastal Zone Management Act (16 U.S.C. 1455(c)(5)) and section 380.22, Florida Statutes, hereby notifies you that the above referenced project is not consistent with the Florida Coastal Management Program (FCMP) at this time. This determination of inconsistency is based on a review 47
of the NEPA documents and comments by both the Departments of Environmental Regulation (DER) and Natural Resources (DNR). The comments are enclosed for your information and are summarized below. The state position on consistency of the proposed site designation is based on analysis of the activity vis-a-vis enforceable state laws and rules included in the federally approved coastal management program.

The Environmental Protection Agency proposes to designate a 4 nmi^2 48
permanent dumpsite 5.5 miles east of Cocoa Beach, Brevard County. Approximately one-fourth of the proposed site has been used previously under an interim dumpsite designation. The site is

proposed for the disposal of mainenance dredged material from the Port Canaveral entrance channel and turning basins. The commenting agencies raise both general and specific issues concerning the consistency of this project with the FCMP. 48

The fundamental issue of need for an ocean disposal site is not addressed in the EIS. The Marine Protection, Research and Sanctuaries Act (MPRSA) states that the initial criterion to be considered in site designation is whether there is a need for dumping. Such an evaluation is critical to consideration of this site because of its location. Florida is clearly on record as opposed to disposal in shallow, nearshore waters of either inferior, contaminated material or of sand suitable for beach nourishment. 49

Ocean disposal, especially in nearshore areas, should be considered only when dredged material cannot be recycled or disposed of on land (beach nourishment). Instead, the DEIS states that land disposal is only considered for material unsuitable for ocean disposal. Florida's position has consistently been that if material is of beach quality, then it is suitable for beach nourishment. If inferior material is construction grade, it could be stored temporarily in available land disposal sites and sold for fill. This would allow for recycling of material, preclude unnecessary borrow pit construction and would be a more conservation oriented approach to management of coastal land and water resources. Florida believes that ocean disposal should be considered only as a last resort when material is unsuitable for recycling to other beneficial uses. Disposal sites, especially those close to shore, operate as disincentives to alternative disposal methods since ocean dumping is always easier and cheaper. Accordingly, the state does not agree with either designation of new or permanent ocean disposal sites or expansion of existing ones if more appropriate disposal options are available. Florida believes that it is critical to conserve its land and water resources and to manage them in consideration of the long term needs of the area's ecological system. 50

Scientific investigations of this site are inadequate in several respects, and are detailed in DER's comment letters dated September 25, and October 6, 1987, enclosed. The state is concerned that site designation surveys continue to lack careful, in-depth study sufficient to support designation decisions. In our coordination with EPA on the Pensacola deepwater site designation, an attempt was made to develop a systematic and thorough sampling protocol which we hoped would serve as a model for subsequent site evaluations. It is essential to standardize the design and implementation of candidate site surveys, and we request that EPA explain why this designation study did not follow the Pensacola model. The information not contained in the DEIS as noted in DER's letter should be furnished to the state as soon as practicable. 51

DNR indicates that the Board of Trustees of the Internal Improvement Trust Fund (Trustees) has authority over material dredged from sovereignty submerged lands which may be disposed of in this proposed site. Section 161.042, Florida Statutes, (F.S.) is a 52
mandatory and enforceable policy of Florida's federally approved coastal management program. That provision states that the Trustees, through DNR's Division of Beaches and Shores, are authorized to direct that sediment dredged from coastal barrier inlets be used for beach nourishment. This DNR policy has been well enunciated to both EPA and the Corps for many years.

Canaveral Harbor and the entrance channel were constructed between 1950 and 1954. Following construction of the project, erosion rates increased for the first couple of miles south of the area. In 1975, approximately 2.3 million cubic yards were placed on the beach by the Navy/Corps, but the beach continues to experience erosion and is in need of ongoing renourishment. The Corps plans to construct a fixed sand bypassing plant north of the Canaveral inlet to transfer 53
sand to beaches south of the inlet, but this will only partially mitigate inlet-induced erosion. As stated before, disposal sites, especially those close to shore, operate as disincentives to alternative disposal methods since ocean dumping is always easier and cheaper in the short term, but this is a waste of a valuable state resource which the state is attempting to prevent. Please refer to DNR's letter and attachments (enclosed) for specific references to inadequacies in the information provided for consistency review.

The consistency determination provided to the state for review analyzes the effect of the site designation on various statutes in the FCMP. Regarding Chapter 161, F.S., Beach and Shore Preservation, EPA states: "The distance of the site to the nearest beach is great enough so that impacts to the beach resulting from the use of the site are not anticipated." This completely misapprehends the purpose and intent of the chapter. EPA completely fails to consider the adverse impact to Florida's coastal zone 54
associated with removal of the material from the active sand transport system. Chapter 161, F.S., was enacted in part to prevent land-based construction from destroying the dune systems and the natural functions of sandy beaches. More importantly, the statute recognizes the dynamic character of sandy beaches and barrier islands and the importance of keeping beach sand in the littoral system by placing compatible material dredged from inlets on the downdrift beaches. We cannot continue to deal with coastal activities piecemeal. Designation of nearshore disposal sites discourages rational shoreline management, particularly when no consideration is given to alternatives such as upland disposal which keep the resource in the littoral transport system.

As to consistency with Chapters 370 and 403, F.S., the state finds
that the site study described in the EIS is inadequate and 55
insufficient to reach the conclusions drawn by EPA. Please refer
again to the specific comments in the enclosed letters, particularly
the letter from DER dated October 6, 1987.

In sum, the Florida DNR finds the proposed Canaveral Harbor ODMDS
designation inconsistent with its authorities in the FCMP, 56
specifically section 161.042, F.S.

Further, the DER has indicated that there is not adequate data or
information in either the consistency determination or the DEIS upon
which EPA can base a sound decision regarding designation.
Conclusions summarized in its consistency determination should be
based on scientific evidence rather than assumptions. Sections A
and G do not lead to the conclusion that the site is dispersive when 57
there is evidence of a persistent mound in the interim site, or that
resuspension of previously dumped material is responsible for
locally turbid conditions, for example. If monitoring has been done
in the past, particularly for the most recent dump, these reports
should be provided for review also. Finally, there should be a site
management plan and a thorough description of it.

In sum, DER does not have adequate information to enable it to make
a determination whether the designation is consistent with its
authorities in the FCMP. This letter should be considered as a 58
request for additional information. As you know, failure to provide
the state with adequate information upon which to base its
consistency decision may lead to a finding of inconsistency pursuant
to 15 C.F.R. 930.39(a).

Measures which may be taken to render this activity consistent with 59
the FCMP include consideration of alternatives to ocean dumping such
as upland disposal (beach nourishment) for suitable material.

Under the Coastal Zone Management Act, as amended, mediation (15
C.F.R. 930, subpart G) by the Secretary of Commerce may be sought
for serious disagreements between a state and a federal agency
taking direct action governed by 15 C.F.R. 930, subpart C. 60
We welcome the possibility of working further with EPA to resolve
these differences. The Governor's Office is available to mediate
the concerns of state agencies with the EPA. If you have questions
or wish consultation, please contact Clare E. Gray at (904)
488-8114. A copy of this letter has been provided to the Assistant

Administrator, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Sincerely,

Dale Twachtmann
Secretary

DT/ceg

Enclosures

cc:

Peter L. Tweedt, NOAA/OCRM
Ralph C. Schunk
Hon. Lawton Chiles
Hon. D. Robert Graham
Hon. Bill Nelson
Florida Cabinet
Tom Gardner
Thomas G. Tomasello
Kirby Green
Andrew S. Grayson
Mark Leadon
Lynn F. Griffin
Alex Alexander
Randall L. Armstrong
Dave Worley
Daniel H. Thompson
Clare E. Gray
Walt Kolb
David C. Slade
Dave Johnson

RESPONSES TO THE STATE OF FLORIDA COMMENT LETTERS

***

STATE COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

<u>Office of the Governor Letter (October 6, 1987) With Attachments</u>

1. No response necessary. Thank you for your timely and thorough comments. Your comments are addressed below.

2. The DEIS incorrectly indicates that the Canaveral Harbor Ocean Dredged Material Disposal Site (ODMDS) is approved on an interim basis and that such approval will expire. Instead, as corrected in Section 1.01 of the FEIS, the status of this disposal site is "interim-indefinite."

3. We commend the efforts of the State of Florida for their coordination with EPA and the U.S. Army Corps of Engineers (COE) regarding the Pensacola (offshore) ODMDS Environmental Impact Statement (EIS). This protocol was not totally applied to the Canaveral Harbor site since most field studies had already been completed and revisiting sites is difficult and expensive from a logistics and economics perspective. However, EPA agrees with several of the State's comments relative to site surveys and data interpretation. Survey methodologies are evolving for new sites and State suggestions/recommendations are being considered. Nevertheless, since the writing of the Draft EIS (DEIS), EPA has conducted several additional site surveys (sediment mapping, side scan sonar, investigation of the charted fish haven west of the site, and some bottom video photography; see Appendices F and G) and is conducting a benthic monitoring study concurrent with the ODMDS designation process.

4. EPA believes that the State's concern for loss of beach-compatible sand and use of the ODMDS should be addressed at the project-specific EIS or Environmental Assessment (EA) stage. EPA's designation of an ODMDS does not, by itself, authorize any dredging project or on-site ODMDS disposal. Such a designation also does not indicate EPA's approval of dredging projects that may use the ODMDS. It does, however, provide a potential option for suitable dredged material disposal. The COE and EPA evaluate all dredged material disposal projects in accordance with the EPA criteria (40 CFR 220-229), the COE regulations (33 CFR 209.120 and 209.145), and any State comments concerning consistency with a State Coastal Zone Management Program.

EPA understands the importance and value of utilizing beach-compatible material where feasible and appropriate, and supports (subject to EPA EIS review, i.e., per Section 309 of the Clean Air Act and per Section 102(2)(C) of NEPA) the examination of this alternative for disposal of appropriate sized sediments, when and where practical.

5. The State's comments attached to this October 6 letter are addressed herein. As stated in Response #3, additional studies have been conducted to further describe the ODMDS area.

6. On December 7-8, 1987, EPA, the Jacksonville District and the State of Florida (Department of Natural Resources, Department of Environmental Regulation and Office of the Governor) met in Tallahassee, Florida to update various ODMDS projects. The present Canaveral Harbor ODMDS was part of that discussion, which included a brief review of portions of the Florida Department of Environmental Regulation DEIS comment letter dated September 25, 1987. References to the Canaveral site were also made in a subsequent meeting on December 6, 1988. Additional coordination prior to FEIS publication was achieved through a meeting with the State in Tallahassee, Florida on May 3, 1990.

<u>Attachment 1: State of Florida Department of Commerce Letter (August 25,1987)</u>

7. No response necessary. However, it should be noted that disposal of dredged material is not limited to COE dredging since this ODMDS would also be available for other federal dredging projects and private projects if compliance with all appropriate regulations is achieved.

<u>Attachment 2: State of Florida Department of Environmental Regulation Letter (September 25, 1987)</u>

8. The western boundary of the re-configured Canaveral Harbor ODMDS is 3.5 nautical miles offshore Cocoa Beach, Florida.

9. Please refer to Response #4. An ODMDS provides an ocean disposal option. Other options such as beach nourishment or upland disposal may also be available in the area. Selection of the appropriate option for a given proposed project should

be addressed in the project-specific EIS or EA. EISs for dredging projects are reviewed by EPA so that disposal options are considered on a project-by-project basis. Even though this is the case, EPA agrees with the State of Florida that non-ocean alternatives (upland and nearshore options) should be addressed in the FEIS and revisions have been made in the FEIS (see Summary Sheet and Section 3.00). Reference to the beach nourishment option is also made in the Canaveral Harbor Site Management and Monitoring Plan (SMMP) presented in Appendix H.

10. A record of previous COE dredged material has been added to the Final EIS (FEIS) in Table 3. This table provides the date and volume of previous new work and maintenance work disposal actions. The sediment quality of such disposal was not readily accessible or available and was not included. However, all dredged material deposited at the ODMDS must comply with EPA quality criteria for ocean disposal permits. Present CE dredging projections call for approximately 4,000,000 cubic yards of material to be dredged over the five year period following designation. Included in this total is an estimated 1.2 million cubic yards of new work which the Port Authority proposes for 1992-93. It should be noted that disposal of dredged material is not limited to CE dredging since the ODMDS would also be available for other federal and private dredging projects if compliance with all appropriate regulations is achieved.

11. As indicated in Appendix A of the FEIS, a video survey was attempted on July 2, 1985 by a CE contractor. Visibility was less than one foot due to turbidity. Less visibility was realized on September 27-28 and October 2-4, 1985, when the site was revisited by the contractor. Consequently, no video surveys were recorded. EPA attempted a follow-up video survey from its OSV Peter W. Anderson vessel on May 24, 1988, and also encountered turbid conditions. A second attempt in mid-July 1988 was more successful and some video data were recorded. Because conditions remained generally turbid, however, a side scan sonar survey was conducted. In April 1989, an additional survey was conducted by EPA. Results are presented in Appendix G of the FEIS. A SCUBA investigation of a charted fish haven located west of the ODMDS was unsuccessful due to turbidity (see Appendix G). Based on the video and side scan information, however, EPA is now reasonably confident that no significant live/hard bottom areas exist in the ODMDS area surveyed and that site designation would not be precluded due to significant live/hard bottom areas. In addition, it would seem that such turbid conditions would limit the presence of many live/hard bottom species at the ODMDS.

12. COE bathymetry data of the ODMDS are provided in the DEIS and the FEIS (see Appendix A). Although no dispersion modelling was conducted for the Canaveral Harbor candidate ODMDS, EPA provided sediment mapping surveys (see Appendix F) to map the migration pattern of the disposed material.

13. Coordination between EPA and the State of Florida has increased significantly in recent years. The additional surveys at Canaveral were in part due to such coordination. However, coordination regarding ODMDS characterization is most productive for new sites (such as the mentioned Pensacola (offshore) ODMDS), as opposed to interim sites being permanently designated, since most field surveys have already been completed for interim ODMDSs. Nevertheless, since the writing of the DEIS, EPA has conducted several additional site surveys (sediment mapping, side scan sonar, investigation of the charted fish haven west of the site, and some bottom video photography; see Appendices F and G) and is also conducting a benthic study concurrent with the ODMDS designation process.

14. Please refer to Response #2.

15. Please refer to Response #13.

16. Please refer to Response #4 and 9. Specifically, the Summary Sheet and Section 3.00 of the FEIS has been revised since the DEIS to better address non-ocean (upland and nearshore) disposal alternatives.

17. As described in Appendix A, sampling stations were located both inside and outside of the DEIS configuration of the candidate ODMDS. This is still true after the candidate site was re-configured in the FEIS to completely encompass the interim site (as depicted in the FEIS). However, relative to the candidate site depicted in the DEIS, the northwestern outside station (#9) is now located within the re-configured candidate ODMDS and the two southeastern inside stations (#2 and #3) are now located outside the candidate site. In addition, EPA conducted sediment mapping in mid-July 1988 and April 1989 and also investigated the charted fish haven west of the ODMDS with side scan sonar (see Appendix F and G) and is also conducting a benthic monitoring study concurrent with the ODMDS designation process.

18. Sediment mapping information is presented in Appendix F of the FEIS.

19. Please refer to Response #10 relative to previous COE disposal actions at the interim ODMDS (see Table 3 and Appendix H of FEIS). With regard to monitoring surveys (other than COE bathymetry surveys), the sediment mapping conducted by EPA will serve as a baseline for potential future EPA monitoring surveys. The SMMP for the Canaveral Harbor ODMDS is also provided in Appendix H. This SMMP is intended to be flexible and may be changed for cause by the responsible agency due to factors such as the results of site monitoring. EPA monitoring surveys are dependent upon coordination between the COE, State of Florida, EPA and other potential users, as well as funding and EPA's

prioritizing of monitoring needs relative to all ODMDSs in the southeast (Region IV).

20. Corrections have been made in Section 5.09 of the FEIS.

21. Electronic verification of dump scow dumping locations by the dredging contractor is part of the Canaveral Harbor SMMP (see Appendix H). This will help ensure on-site disposal.

22. A detailed description of the field and laboratory methods used at the candidate Canaveral ODMDS are presented in Appendix A. Current measurements were taken at five feet above the bottom to establish the potential for movement of discharged material at or near the bottom. Comparison of measured currents with historic data is addressed in appendix A.

23. The fine macrofaunal replicates collected for analysis do not represent sampling to species saturation.

24. Please refer to Response #6.

<u>Attachment 3: State of Florida Department of Natural Resources Letter (September 29, 1987)</u>

25. No response necessary. Thank you for your comments.

26. Please refer to Response #4. EPA agrees that nourishment of beaches is an important consideration to be investigated in conjunction with dredging activities. Beach nourishment should be thoroughly evaluated as an alternative for the disposal of suitable dredged material. The State of Florida is free to pursue the beach nourishment option with the permitting agency despite the proposed permanent designation of the ODMDS. Site designation of an ODMDS does not preclude use of other disposal options feasible in the area.

27. EPA has determined that the designation of the Canaveral Harbor ODMDS on a permanent basis is consistent with the Florida Coastal Management Program to the maximum extent practicable. Per EPA/Region IV policy, we have prepared a CZM Consistency Evaluation and have provided it to the State (August of 1987). A copy with a (new) Preface is also presented in Appendix I of the FEIS.

28. Please refer to Responses #4, 9 and 26. Designation of an ODMDS does not abridge the statutory authorities referenced in the State of Florida letter.

29. Please refer to Responses #4, 9, 26 and 28. Since only one ODMDS is planned for the area, grain size was not restricted by EPA for ODMDS designation.

<u>Attachment 4: State of Florida Department of Natural Resources Memorandum (September 23, 1987)</u>

30. Please refer to Response #27.

31. Please refer to Responses #4, 9, 26, 28 and 29. Additional information summarizing upland and nearshore alternatives has been provided in the FEIS (see Summary Sheet and Section 3.00; Section 2.04 of the DEIS has been rewritten as Section 3.03 in the FEIS). Reference to beach nourishment is also made in the Canaveral Harbor SMMP (see Appendix H).

32. Please refer to Responses #4, 9, 26, 28, 29 and 31.

33. Please refer to Responses #4, 9, 26, 28, 29 and 31. The designation process applies only to the establishment of a viable offshore dredged material disposal site, not to specific dredging activities. The designation process designates an environmentally acceptable ocean site (ODMDS) for the disposal of suitable dredged material for which an ocean disposal need has been established. The State is free to pursue the use of potential beach-compatible dredged material from the greater Canaveral area with the permitting agency for use as beach nourishment material.

34. Please refer to Responses #4, 9, 26, 28, 29, 31 and 33 (Note: For general reference, EPA/Region IV would be interested in receiving detailed information regarding erosion causes and rates.).

35. Please refer to Responses #4, 9, 26, 28, 29, 31 and 33.

36. Please refer to Responses #4, 9, 26, 28, 29, 31 and 33.

37. In general, the grain sizes of the dredged material for potential disposal at the Canaveral Harbor candidate ODMDS are expected to be from, but not limited to, COE maintenance work which will primarily be fine-grained disposal material. Disposal of coarser material is also possible. The Canaveral Harbor SMMP presents a table for the projected disposals at the candidate site (see Appendix H).

38. Please refer to Responses #4, 9, and 26 through 37.

<u>Attachment 4a and 4b: EPA Cover Letter and Florida Coastal Management Program Consistency Evaluation (August 1987)</u>

39. No response necessary, i.e., the attachments are an EPA/Region IV letter and the EPA Florida Coastal Management Program (FCMP) Consistency Evaluation (see Appendix I for a new Preface to the Consistency Evaluation).

Attachment 5: Florida Department of State, Division of Historical Resources (August 24, 1987)

40. No response necessary. Thank you for your cultural resource assessment. EPA assumes that the slight re-configuration of the candidate ODMDS since the DEIS review will not alter this assessment.

STATE COMMENTS ON THE FEDERAL CONSISTENCY DETERMINATION

Florida Department of Environmental Regulation Comment Letter Dated October 6, 1987

41. The Department of Environmental Regulation (DER) comments dated September 25, 1987, which the State wishes to incorporate in the present letter, have been previously addressed (refer to Responses #8-24).

42. Additional studies have been conducted since the writing of the DEIS: side scan sonar, investigation of the charted fish haven west of the site, sediment mapping, and some ODMDS bottom video photography (also refer to Responses #3, 11, 13 and 17 and Appendices F and G). Also please refer to Response #10 and FEIS Table 3 for a record of previous COE disposals and the Canaveral Harbor SMMP (see Appendix H) for projected ODMDS use information. Response #19 provides comments on the SMMP.

43. Please refer to Responses #22 and #42. Also, relative to site dispersion, results of the EPA sediment surveys (see Appendix F) indicate a possible westward migration of disposal material. Additional sediment mapping activities conducted by EPA in June 1990 are expected to provide additional information regarding the parameters of sediment movement in the area of the candidate site.

44. The Canaveral Harbor SMMP is provided in Appendix H of this FEIS. Bathymetric monotoring procedures are also outlined in this Appendix. Also, refer to Appendices F and G describing recent EPA monitoring surveys and Appendix A for COE bathymetry data. In addition, EPA is conducting a benthic monitoring study concurrent with the ODMDS designation process.

45. The Canaveral Harbor ODMDS has been discussed at meetings attended by the State of Florida, COE and EPA (refer to Response #6).

46. No response necessary. Thank you for your comments.

47. As indicated in Response #27, EPA has determined that designation of the Canaveral Harbor ODMDS on a permanent basis is consistent with the Florida Coastal Management Program (FCMP) to the maximum extent practicable. EPA/Region IV has prepared a CZM Consistency Evaluation and has provided it to the State (August of 1987). A copy with a (new) Preface is also presented as Appendix I in this FEIS.

48. Please refer to Response #8.

49. Please refer to Response #4. EPA believes that the need for the ocean disposal option or another disposal option should be addressed at the dredging project EIA or EA stage. EPA also believes that the need for an ODMDS should be addressed in an ODMDS EIS. Need for a permanent ODMDS offshore Canaveral Harbor is addressed in the Summary Sheet and Sections 2.00 and 3.00 of the FEIS. EPA's proposed permanent designation of the Canaveral ODMDS would not preclude use of the beach nourishment option. The State of Florida is free to pursue such an option with the permitting agency.

50. Please refer to Response #49. Non-ocean and ocean disposal are both disposal alternative for dredged material. EPA believes that selection of the appropriate option should occur at the project EIS or EA stage, and that non-ocean alternatives should also be addressed in the ODMDS EIS. Section 3.00 on alternatives has been revised and broadened in the FEIS to include various non-ocean alternatives, including beach nourishment. EPA's proposed permanent designation of the Canaveral Harbor candidate ODMDS does not preclude the upland disposal option and selection of the upland disposal option for a given proposed dredging project does not preclude designation of the ODMDS, if a need for the ODMDS is justified by a previous dredging project. Also, the phrase "unsuitable ocean disposal" refers to unacceptable toxicity/bioaccumulation levels of dredged material that would make it unsuitable for ocean disposal (without restriction) but still potentially available for upland disposal.

51. The DER letters dated September 25, 1987 and October 6, 1987 referenced as being enclosed in the DER letter dated October 26, 1987, addressed in Responses #8-24 and 41-45. Please also refer to Response #3 and Appendices F and G regarding additional studies since the writing of the DEIS. Also, EPA is conducting a benthic monitoring study concurrent with the ODMDS designation process.

52. EPA's proposed permanent designation of the candidate ODMDS does not preclude other disposal options feasible in the area. Please refer to Responses #4, 9, 16, 26, 49 and 50.

53. It is unclear as to which Florida Department of Natural Resources (DNR) letter and attachments is referenced as being enclosed in the DER letter dated October 26, 1987. Such letters were not duplicated here. However, DNR letters dated September 23, 1987 (memorandum which enclosed a copy of the EPA CZM Consistency Evaluation and EPA cover letter) and a DNR letter dated September 29, 1987 were duplicated and responses provided as Responses #25-39. These DNR letters were enclosed in the letter from the Florida Office of the Governor dated October 6, 1987. Should these not be the letters referenced, reissuance of appropriate letters to EPA/Region IV in Atlanta, Georgia is requested. Please also refer to Response #52 relative to disposal options.

54. The statement referenced in the letter from Chapter 161 of the CZM Consistency Evaluation ("The distance of the site to the nearest beach is great enough so that impacts to the beach resulting from the use of the site are not anticipated") refers to impacts of site use. The source of the disposal material or alternative disposal options is a related but different issue. Again, EPA believes that selection of the appropriate disposal option should occur at the project-specific stage and be addressed in the ODMDS EIS. EPA's proposed permanent designation of the candidate ODMDS does not preclude other disposal options feasible in the area.

55. Please refer to Response #51.

56. Please refer to Responses #27 or 47.

57. Additional studies have been conducted since the writing of the DEIS. Please refer to Responses #3, 11, 13, 17, 42, 43 and 51. The CZM Consistency Evaluation should be reviewed in light of these studies (see new Preface to Appendix I).

58. Please refer to Responses #6 and 57.

59. Please refer to Responses #4, 9, 26, 31, 33, 49 and 50.

60. Please refer to Response #6.

BREVARD County
BOARD OF COUNTY COMMISSIONERS

OFFICE OF NATURAL RESOURCES MANAGEMENT, 2575 North Courtenay Parkway, Merritt Island, Florida 32953
Telephone: (305) 453-9515 Sun Com: 367-1515

SEAL OF BREVARD COUNTY FLORIDA

August 12, 1987

U.S. Army Engineer District
Jacksonville
P.O. Box 4970
Jacksonville, FL 32232-0019

Attention: CESAJ-PD-ES

Gentleman:

This office appreciates the opportunity to review the Draft Environmental Impact Statement for Designation of a Canaveral Harbor, Florida Ocean Dredged Material Disposal Site. At this point the only comments we have relate to commercial fisheries in the area.

Our office is working with the Organiz d Fishermen of Florida (OFF) on delineating important fishing areas off Brevard's coast. These may extend beyond the areas noted in Figure 4-2 of the DEIS. The Corps should perhaps solicit input from OFF to ensure completeness of the map. Also, this office is working with a number of interested part[illegible] on locating additional artifical reefs off the coast, however, it is not anticipated that the candidate site and disposal activities will interfere with these preliminary plans. 1

Finally, a point of curiosity. It is not noted in the DEIS or the attached letter as to the puropse of deepening the inner reach channel or middle basin to 42 feet. Surely maintenance dredging to the 35 foot depth is adequate to accommodate the shipping activity in the Port. Why is the additional depth required? 2

Thank you for the opportunity to comment on this DEIS.

Sincerely,

OFFICE OF NATURAL RESOURCES MANAGEMENT

Deborah L. Lugar

Deborah Lugar
Section Supervisor

DL/cb

cc: Sally Turner, Chief
Marine Protection Section, EPA

RESPONSES TO THE LOCAL AGENCY AND PUBLIC COMMENT LETTERS

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BREVARD COUNTY BOARD OF COMMISSIONERS
(August 12, 1987 Letter)

1. Thank you for your comments. EPA has included the Organized Fishermen of Florida (Bokeelia, FL) on its FEIS mailing list. We have also included the Florida Sport Fishing Association (Cape Canaveral, FL), the Southeastern Fisheries Association (Pensacola, FL), the International Women's Fishing Association (Palm Beach, FL), South Atlantic Fishery Management Council (Charleston, SC), Florida Marine Fisheries Commission (Tallahassee, FL), National Marine Fisheries Service (St. Petersburg and Miami, FL), the U.S. Fish and Wildlife Service (Vero Beach and Jacksonville, FL) and the Department of Interior (Washington, D.C.). Coordination concerning the completeness of Figure 4-2 of the DEIS has occurred.

2. The Jacksonville District COE has provided a response in a letter dated August 24, 1987. A more specific answer may be available from the project officer of the dredging project. The CE response is as follows:

   "The deepening of the inner reach channel or middle basin is not discussed in the Draft EIS, because as stated in paragraph 2.03 'The purpose of the proposed action is to provide an environmentally acceptable location for the disposal from the Canaveral Harbor area. The site designation process neither authorizes any dredging project nor permits disposal of any dredged material. The need for ocean disposal is determined on a case-by-case basis as a part of the process of issuing permits for ocean disposal.'"

   "The proposed increase in depths for the inner channel and middle basin for Canaveral Harbor were investigated by the Corps of Engineers at the request of the Canaveral Port Authority, the local sponsors of the proposed harbor deepening project, to increase navigational safety and promote port efficiency by allowing larger vessels with deeper drafts to safely negotiate the harbor."