3. rectifying the impacts by repairing, rehabilitating, or restoring the affected environment;

4. reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and

5. compensating for the impact by replacing or providing substitute resources or environments.

This definition recognizes mitigation as a step-wise process that incorporates both careful project planning and compensation for unavoidable losses and represents the desirable sequence of steps in the mitigation planning process. Initially, project planning should attempt to ensure that adverse effects to fish and wildlife resources are avoided or minimized as much as possible. In many cases, however, the prospect of unavoidable adverse effects will remain in spite of the best planning efforts. In those instances, compensation for unavoidable adverse effects is the last step to be considered and should be used only after the other steps have been exhausted.

The Service's Mitigation Policy focuses on the mitigation of fish and wildlife habitat values, and it recognizes that not all habitats are equal. Thus, four resource categories, denoting habitat type of varying importance from a fish and wildlife resource perspective, are used to ensure that the mitigation planning goal will be consistent with the importance of the fish and wildlife resources involved. These categories are based on the habitat's value for the fish and wildlife species in the project area (evaluation species) and the habitat's scarcity on a national, regional or local basis. Resource Category 1 is of the highest value and Resource Category 4, the lowest. Mitigation goals are established for habitats in each resource category.

The mitigation goal for Resource Category 1 habitats is no loss of habitat value since these unique areas cannot be replaced. The goal for Resource Category 2 habitats is no net loss of in-kind habitat value. Thus, a habitat in this category can be replaced only by the same type of habitat (i.e., in-kind mitigation). The mitigation goal for Resource Category 3 habitats is no net loss of overall habitat value. In-kind replacement of these habitats is preferred, but limited substitution of different types of habitat (out-of-kind mitigation) perceived to be of equal or greater value to replace the lost habitat value may be acceptable. The mitigation goal for Resource Category 4 habitats (considered to be of marginal value) is to avoid or minimize losses, and compensation is generally not required.

Priority habitats in the project area include offshore hardbottom reefs within the pipeline corridor and hardbottom reefs which may be present in the vicinity of the barge transfer/pump station. These habitats are considered by the Service to be in Resource Category 2, and no net loss of in-kind habitat value is recommended. However, we consider any significant colonies of hard (stony) coral in this area to be Resource Category 1. Research suggests that two species of brain and star coral grow at a rate of approximately 0.5 centimeters per year (Dodge 1987). Based on this information, we estimate it would take these corals, and likely other hard coral species, at least 100 years to reach 1 meter in diameter.

Existing Beach Composition

Miami-Dade County beaches have experienced several renourishment events since the 1970's which have altered the sand composition of these beaches (T. Rice, pers. com. 2001). Historically, the native beach sand was composed of approximately 70 percent quartz and 30 percent carbonate (T. Rice and L. Charles, pers. com. 2001). Currently, the sand composition is dominated by carbonate with very little quartz. As a result, several problems have been associated with this change, such as increased turbidity which affects reef communities and sand compaction which affects sea turtles. Recent sea turtle nesting data may suggest a trend toward an increase in false crawls which may be attributed to the quality of the sand deposited during the latest renourishment and/or other anthropogenic affects (S. MacPherson, pers. com. 2001).

Upper Beach Zone

The upper beach zone supports ghost crabs, which are common occupants of this zone and are at risk of burial. Limited information describes the crabs ability to "burrow up" to the surface if buried. If populations drop after nourishment takes place, it could be attributed to the emigration of crabs responding to a decreased food supply in the disturbed intertidal (surf) zone rather than from burial mortality (Nelson 1985). The upper beach zone also provides nesting habitat for federally listed sea turtles. Potential impacts to these species include loss of nest, reduced nesting activity, and reduced hatchling survival from sand placement, sand compaction, escarpment formation, and sand color and texture changes. The Biological Opinion dated October 24, 1996, for Region III of the Coast of Florida Erosion and Storm Effects Study includes the project area considered for the proposed renourishment. The "Reasonable and Prudent Measures" and "Terms and Conditions" listed in the Biological Opinion for Miami-Dade County (and revisions) are applicable to the project and the Corps plans to incorporate these requirements into the project plans, specifications, and any contracts, as appropriate.

Surf Zone

The surf zone of the beach supports a diversity of amphipods, polychaetes, gastropods, bivalves, and surf zone fishes. The sand flea or mole crab is one of the more common inhabitants. Many of the surf zone species, because of their weak swimming capabilities, burrowing and/or cryptic nature, will be negatively impacted by the beach nourishment from the sand "dump". New recruitment must come from juveniles or adults which migrate to the area. Increased sediment load may affect the respiration of some species, which could cause suffocation and the loss of these individuals to the system. Information on surf zone fishes is limited but generally states that most fish will flee and avoid the disturbed area and will return within a few months. Outside of lagoons, nearshore hardbottom areas are the primary natural structures in shallow waters of mainland Florida's east coast and were estimated to have nursery value for 34 species of fishes. (Lindeman and Snyder 1998). Nelson (1985) suggest that loss of habitat may be more harmful to fish than suspended sediment loading, which could clog their gills. Most surf zone fish may tolerate an elevated level of turbidity, but burrowing fish are at greater risk from burial.

In general, sandy beaches are populated by small, short-lived organisms with great reproductive potential. As a result, these communities tend to recover quickly from environmental disturbances. The effects of this beach nourishment project on the beach zone fauna will depend primarily on the quality of the nourishment material. If the sand selected to be used for this project meets Corps specifications with Service recommendations, recovery of the beach fauna should occur within one year.

Nearshore High Energy Reefs

Based on reef maps provided in the Coast of Florida Study (Continental Shelf Associates 1993), several small patches of nearshore reef were identified immediately off of the beach. Miami-Dade County plans to conduct visual nearshore surveys in the project area to determine presence and composition of nearshore hardbottom, if still exposed (B. Flynn, pers. com. 2001). Impacts to nearshore high energy reefs, when present, could include direct burial through sand placement and excessive turbidity from washing of the dredged sand. While the fishes, which inhabit these reefs, will avoid adverse effects by leaving the area, the epifauna, which grows on the rocky substrate, will be lost. The affected habitat would include nearly all of the epibenthic organisms (e.g., sponges, bryozoans and stony corals) within the renourishment area. This habitat is unique in that it is located in a dynamic, high energy area. Located in the surf zone, wave action seasonally and intermittently scours the rock, making it available for the settlement of pioneering sessile organisms. The presence of an abundance of these organisms in early life stages provides unique forage opportunities for fishes and invertebrates. Despite frequent scouring, this habitat should be recognized as a valuable fishery resource. The South Atlantic Fishery Management Council's Fishery Management Plan calls for avoiding impacts to this important resource. Where impacts cannot be avoided, the Service recommends mitigation through the creation of similar habitat to that which is lost. Mitigation offsets should, as a minimum, be a ratio of 1 to1 with the addition of a temporal lag multiplier, if appropriate.

Offshore Reefs

Potential impacts to these reefs include scarring damage from the slurry pipeline and burial and, although not anticipated in this project, sedimentation from turbidity generated from barge to the pumping station and pipeline. Little information is available for nourishment impacts in the offshore reef zone. Studies indicate that primary concerns in this zone are that of clogging the gills of resident fish by suspended solids, which may lead to suffocation (Nelson 1985) and the coating of the sessile reef dwelling species. Most mobile pelagic species of fish will leave the work area and return after the work is done. The hard bottom coraline community as a group is the most sensitive community to potential impacts from turbidity generated by the dredging operations and may suffer the greatest impacts from suspended sediments settling onto the reef. Past occurrences of sedimentation damage to reef communities have been documented for renourishment at Sunny Isles in 1988 and at Bal Harbour in 1990. Sediment impacts to the reef during the 1990 incident were though to be caused by the dredge spending a significant amount of time dredging in one confined area between reefs located immediately north and south of the area dredged. Turbidity generated from offshore operations is normally expected to occur at an offshore borrow site during sand collection. However, this project does not entail offshore material collection, and turbidity generated during barge transport and at the location of barge-to-pipe transfer is not expected to be significant (M. Dupes, pers. com. 2001).

As part of the current project, the Corps is proposing the incorporation of a turbidity monitoring program into the design and construction specifications for the project. The monitoring program should include a series of monitoring stations on appropriate hardbottom reefs and the beach fill sites. The monitoring program will require surveys to be conducted throughout the construction phase of the project to ensure levels of turbidity are maintained below State water quality standards. With the inclusion of this monitoring program in the Corps project design documents, the Service believes that suspended sediments will have minimal impact to natural resources in the project area.

Hardbottom impacts can also include reef scarring from the placement of the slurry pipe line. The pipeline corridor for this project will be the same corridor, and will include the same micro-siting procedures, as the 63rd Street renourishment project. Miami-Dade County conducted an extensive survey of the reef zones to identify the least damaging alignment for the slurry pipeline that would provide suitable access to the nourishment beach. The corridor that was identified produced the least amount of scarring to the offshore reefs (Miami-Dade County 2000). This recently completed alignment survey provided the proposed location of the 63rd Street slurry pipeline. The alignment assumes a pipeline footprint width of 0.25 meters (m) along the entire path over the reef. The estimated amount of reef damage is 311 m^2. The potential pipeline contact path is projected to include 532 hard corals, 2,637 soft corals, and 2,329 sponges. As past projects have shown, the pipeline will not be in contact with the reef along the entire path. Variability of bottom relief and permit required pipeline "collars" serve to support the pipeline for considerable distances, thus dramatically reducing the area of physical contact between the pipe and the reef. Actual impacts from several recent projects have been shown to be between 18% and 83% of full pathway projection. Therefore, mitigation will be calculated post-construction. Mitigation for pipeline damage from the initial placement for the 63rd street project will consist of artificial reef modules designed with concrete and limerock. The modules will be placed nearby at a 1:1 area of impact to base area of module ratio. With a 5 ft. by 9 ft. base area, one module per 5 m^2 of hardbottom impacts will be required. Due to the approximate 6:1 surface area to base area of these modules being substantially greater than impact surface area, we expect the actual mitigation habitat substrate ratio to be more akin to 2:1. Placement of the pipeline again (pipeline will not remain in place between projects) for the Alternate Test Beach project will likely incur some additional unavoidable reef impacts within the corridor, and mitigation proposed is expected to be similar in design.

The Service at present supports this mitigation scope and design, as exemplified by 63rd Street plans, but recommends that the Corps include a temporal lag factor in the mitigation ratio. The temporal lag factor accounts for the time lag in establishing a functional, viable hardbottom community that is comparable to the community impacted by the pipeline scarring. We recommend that the Corps research a temporal factor, incorporating a functional equivalency assessment, for insertion in mitigation calculations, for ratio/quantification evaluation here and in future projects. The Service recommends Habitat Equivalency Analysis: An Overview (NOAA, Damage Assessment and Restoration Program, 1995) as one reference. Another reference, based on this concept, is the Temporal Lag Table found in Section 5c of the Corps sponsored Joint State/Federal Mitigation Bank Review Team Process For Florida (October 1998).

Borrow Site: Upland Sand Specifications

The Corps proposes this project as a "test beach" to assess the feasibility, physically and fiscally, of obtaining beach compatible material from alternative sources, since offshore borrow sites are nearly exhausted. Initially, this included the use of aragonite obtained from the Bahamas and currently, obtaining sand from a domestic upland sand source. The Corps has generated generic sand specifications for contractors to use as a guide during the site selection and bid process. The contractor will be required to obtain the appropriate beach compatible material from an upland sand source, deliver, and place the material on the beach. As indicated in the sand specifications, the sand supplied will be natural; however, it may be processed or blended provided a blending plan is submitted/approved. Plans do not support manufactured sand (e.g. limestone quarried then crushed to meet specifications). Offshore material will not be accepted. Refer to the Corps' sand specifications in this FWCA Report appendix (Beach Fill). A summary of the physical specifications of material and borrow site requirements is as follows:

1. 99% of the material must pass through a # 3/8 sieve (9.51 mm) and shall contain no material larger than a # 3/4 sieve (19.00 mm).
2. The average mean grain size required is 0.30 mm, but not exceed 0.55 mm.
3. Sand will be composed of quartz and/or carbonate with no more than 20 percent sand of other mineralogical composition.
4. Silt content of less than 5 percent [passing #200 sieve (.074)].
5. Phi Standard Deviation values from 0.50 phi to 1.75 phi.
6. Free of debris, sharp rocks and pebbles, concrete rubble, clay, and organic material.
7. Sand color shall be similar to the existing beach and within the range on the Munsell Soil Color chart- Hue: 2.5 YR; 5 YR; 7.5 YR; 10 YR; 2.5 Y; 5 Y; Chroma: 1, 2, or 3; Value: 6, 7, or 8.
8. Phase 1 Hazardous Toxic and Radioactive Waste (HTRW) Evaluation will be conducted at the potential borrow sites to insure the material does not contain hazardous material. If acceptable, the material will be tested further for radioactive isotopes and various other environmental contaminants.

Threatened and Endangered Species

The Service agrees that the project falls within the boundaries of the Coast of Florida Biological Opinion. However, due to unknown sand source and questionable sand specifications for this project, the Service, at this time, cannot assess potential effects on listed sea turtles. The upland sand source may not be in adherence with the Reasonable and Prudent Measure of the BO, which addresses beach quality sand and its suitability for sea turtles, from nesting to hatchling emergence. The Service has provided recommendations for revising the Corps' current sand specifications in order to ensure suitable beach material is utilized.

Continued consultation under section 7 is necessary to address sand suitability issues as they relate to sea turtles. Additionally, consultation should be initiated for possible effects to listed species which may be associated with the upland borrow site(s) and, depending on sand transportation routes, for the West Indian manatee. Areas identified as Alternative Sand Source Locations in the Coast of Florida Study EIS (Pg. EIS-25) indicate quarries may be located in environmentally sensitive areas, such as the Lake Wales Ridge.

VI. RECOMMENDATIONS

Sand Specifications

During review of the upland sand source specifications, the Service has identified several concerns and requests the following:

1. Upland material should be compared to the historic natural native beach, not the material currently existing on the beach which remains from previous nourishment activities;

2. Clarify mean grain size by including the sorting coefficient in the discussion;

3. Specify that quarried limestone crushed to meet grain size specifications is prohibited. The term "manufactured" is confusing;

4. Turbidity issues and concerns can be addressed by including the following:

   (a) Remove the words "whole or" in the shell fragments to describe acceptable shells. Whole shells that are sand-sized are very fragile, break down easily and produce mud. These "whole" shells are not durable, and the shells should be defined as fragments of mollusk shells, and excluding Halimeda, benthic foraminifera, etc. These quiet-environment "shells", break down very easily on a high energy beach.

   (b) Test carbonates for durability by requiring a tumbling barrel test with quartz included in the barrel, to simulate abrasion on the beach itself. Evaluate the remaining material.

   (c) Prior to transportation the material should be wet separated at the quarry site to wash out 90% of the fine material that are less than 200 microns in size. Utilization of on-site retention ponds should greatly reduce turbidity during and post-construction.

(d) Modify the sieving requirements to specify that they be wet sieved, with the tap water (not distilled water) retained, decanted, dried and weighed so there is an accurate percentage of muds calculated. Carbonate muds when dry will sieve as grains and not as mud.

(e) Require a settling tube analysis be conducted with the sieving analysis. This would show whether the non-quartz grains settle like quartz of the same size. The tube should be calibrated to quartz grains at 20 microns vs. the 62 micron standard. Sediments less than 20 microns are more likely to remain in suspension longer and are easily re-suspended.

(f) Require a final 0.5 or 1.0% silt content equal to or less than 20 microns as opposed to the 5% in the current specifications; this may be achieved if the above recommendations are implemented.

5. Restore a quartz dominated beach by limiting the percent carbonate to 30% to reflect the historic native beach composition.

6. Add the #35 sieve (0.50 mm) to the sediment sieve analysis to give more precise grain size distribution.

7. Prior to the final site selection of the upland sand source, the Service requests to review the sediment data obtained from the candidate sites. In addition, the Service requests the opportunity to provide our recommendations and site preference.

The Service also has concerns regarding possible contamination issues present at the borrow site. The Corps has required contractors to conduct a Phase 1 Hazardous Toxic and Radioactive Waste Evaluation at the potential borrow sites to insure the material does not contain radioactive materials or other environmental contaminants.

<u>Reduction of Adverse Effects</u>

The Corps has discussed with the Service specific measures in the specifications of the project that, if implemented, should reduce adverse environmental effects of the proposed project. These actions are as follows:

1. The Service has expressed concerns with the potential effects from turbidity on nearshore and off shore hardbottom reefs generated by the sediment transfer and by sediment placement on the beach. The Corps has proposed a turbidity monitoring program (Miami-Dade County 2000) that will monitor the levels of turbidity generated by the proposed nourishment and will provide corrective protocols to protect the nearshore and offshore reefs.

2. The Service has expressed concerns with the potential effects from the slurry pipeline placement across portions of the offshore reefs between the pumping station and the nourishment beach. The Corps has identified a preferred pipeline route for both 63rd Street and Alternate Test Beach projects, though a study prepared by Miami-Dade County (2000) that minimizes reef impacts and includes coral relocation and mitigation for post-construction verified impacts. The Service will need to evaluate mitigation specific to this project, which should be contained in the forthcoming Environmental Assessment. Assuming similar mitigation and monitoring plans, mitigation will include the nearby placement of concrete/limerock reef modules at the ratio of one module per 5 m^2. Miami-Dade County divers will micro-site actual pipeline placement. Hard corals should be avoided or relocated, especially those requiring 50 to 100 years to reach diameters of 0.5 to 1 meter. Tractor tires will be used as elevation collars. It is also our understanding that buoy cables, such as those responsible for reef damage in a previous area project, will be removed after pipeline placement in order to avoid this problem.

Nearshore Reef

A survey, as proposed by Miami-Dade County DERM and targeting characterization and extent of nearshore resources, including hardbottom, should be submitted to the Service. If resources are present, the Service recommends that the Corps provide plans for avoidance, minimization, and mitigation of impacts.

Mitigation

The Corps should research a temporal factor, incorporating a functional equivalency assessment, for insertion in mitigation calculations, for ratio/quantification evaluation here and in future projects. The Service recommends Habitat Equivalency Analysis: An Overview (NOAA, Damage Assessment and Restoration Program, 1995) as one reference. Another reference, based on this concept, is the Temporal Lag Table found in Section 5c of the Corps sponsored Joint State/Federal Mitigation Bank Review Team Process For Florida (October 1998). The Service will assist in this initiative.

Long-term Research Needs

1. Research is needed in addressing possible cumulative secondary environmental impacts from the repeated transfer of offshore silt to the nearshore benthic system along the coast of south Florida, for the evaluation of future projects and sand source selection.

2. Additional evaluations of the biological, physical, and chemical recovery of offshore sand borrow areas in general are needed for evaluation of future projects and sand source selection.

LITERATURE CITED

Blair, S., and Flynn. 1988. Sunny Isles Beach Restoration Project: Mechanical Damage to the Reefs Adjacent to the Borrow Area. Metro-Dade DERM Technical Report 88-14.

Blair, S. and B. Flynn. 1989. Biological Monitoring of Hardbottom Communities off Dade County, Florida: Community Description. In Diving for Science, 1989, Proceeding of the American Academy of Underwater Science, Ninth Annual Scientific Diving Symposium (Eds. Lang and Japp.) Costa Mesa, California.

Blair, S., B. Flynn, T. McIntosh, L. Hefty. 1990. Environmental Impacts of the 1990 Bal Harbor Beach Renourishment Project: Mechanical and Sediment Impact on Hard-Bottom Areas Adjacent to the Borrow Area. Metro-Dade DERM Technical Report 90-15.

Charles, L. Florida Department of Environmental Protection. 2001. Telephone conversation. 22 January 2001

Continental Shelf Associates, Inc. 1984. Environmental Assessment of the Palm Beach County Erosion Control Program: Phase I: Ocean Ridge. Final report for the Palm Beach County Board of County Commissioners. 110 pp.

Continental Shelf Associates, Inc. 1985. Environmental Assessment of the Palm Beach County Erosion Control Program: Phase II: North Boca Raton. Final report for the Palm Beach County Board of County Commissioners. 114 pp.

Continental Shelf Associates, Inc. 1987. Environmental Assessment of the Palm Beach County Erosion Control Program: Phase III: Jupiter/Tequesta. Final report for the Palm Beach County Board of County Commissioners. 50 pp.

Continental Shelf Associates, Inc. 1993. Coast of Florida Erosion and Storm Effects Study, Region III: Mapping and Classification of Hard Bottom Areas in Coastal Waters off Palm Beach, Broward, and Dade (Miami-Dade) Counties. Final report for the U.S. Army Corps of Engineers, Jacksonville District, Jacksonville, Florida.

Dupes, M. U.S. Army Corps of Engineers. 2001. Telephone conversation 13 February 2001.

Flynn, B. Miami-Dade DERM. 2001. Telephone conversation 20 February 2001.

Goldberg, W. M. 1973. "The Ecology of the Doral-Octocoral Communities off the Southeast Florida Coast: Geomorphology, Species Composition, and Zonation." Bulletin of Marine Science 23:465-488.

Goldberg, W. M. 1970. Some Aspects of the Ecology of the Reefs off Palm Beach County, Florida, with Emphasis on the Gorgonacea and Their Bathymetric Distribution. M.S. Thesis, Florida Atlantic University. 108 pp.

Lindeman, K.C., and D. Snyder. 1998. Nearshore Hardbottom Fishes of Southeast Florida and Effects of Habitat Burial Caused by Dredging. Fisheries Bulletin 97:508-525.

Lyons, W., D.G. Barber, S.M. Faster, F.S. Kennedy, Jr., and F.R. Milano. 1981. The Spiny Lobster, *Panulirus argus*, in the middle and upper Florida Keys: Population Structure, Seasonal Dynamics and Reproduction. Florida Department of Natural Resources, Publication No. 38. Marine Research Laboratory, St. Petersburg, Florida.

MacPherson, S. U.S. Fish and Wildlife Service. 2001. Telephone conversation. 19 January 2001

Marszalek, D. S., and D. L. Taylor. 1977. Professional Engineering Services for Surveying and Monitoring of Marine Hardground Communities in Dade County, Florida. Initial report for the USACE. Jacksonville District. Contract No DACW17-77-C-0036.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52. St. Petersburg, Florida.

Miami-Dade County. 2000. Physical and Biological Monitoring Program for Dade County, Florida: Sunny Isles Renourishment - Design Modifications. Dade County Erosion Control Project. Special Condition of Florida Department of Environmental Protection, Joint Coastal Permit #0126527-001-JC.

Miami-Dade County. 1999. Submerged Dredge Slurry Pipeline Impact Assessment. Miami-Dade County 2nd Renourishment Contract II. Report for the USACE. Jacksonville District. Contract No DACW17-98-C-0032.

Myers, Ronald L. and John J. Ewell, 1990. Ecosystems of Florida. University Press, Gainesville, Florida. 765 p.

Nelson, W. G. 1895. Guidelines for Beach Restoration Projects. Part i - Biological. Florida Sea Grant College. SGC-76. 66 pp.

Odum, W.E. 1969. The structure of detritus-based food chains in a South Florida mangrove system. Unpublished Ph.D. Dissertation. University of Miami, Miami, Florida.

Raymond, B., and A. Antonius. 1977. Biological Monitoring Project of the John U. Lloyd Beach Restoration Project. Final Report for Broward County Erosion Prevention District, Broward County, Florida.

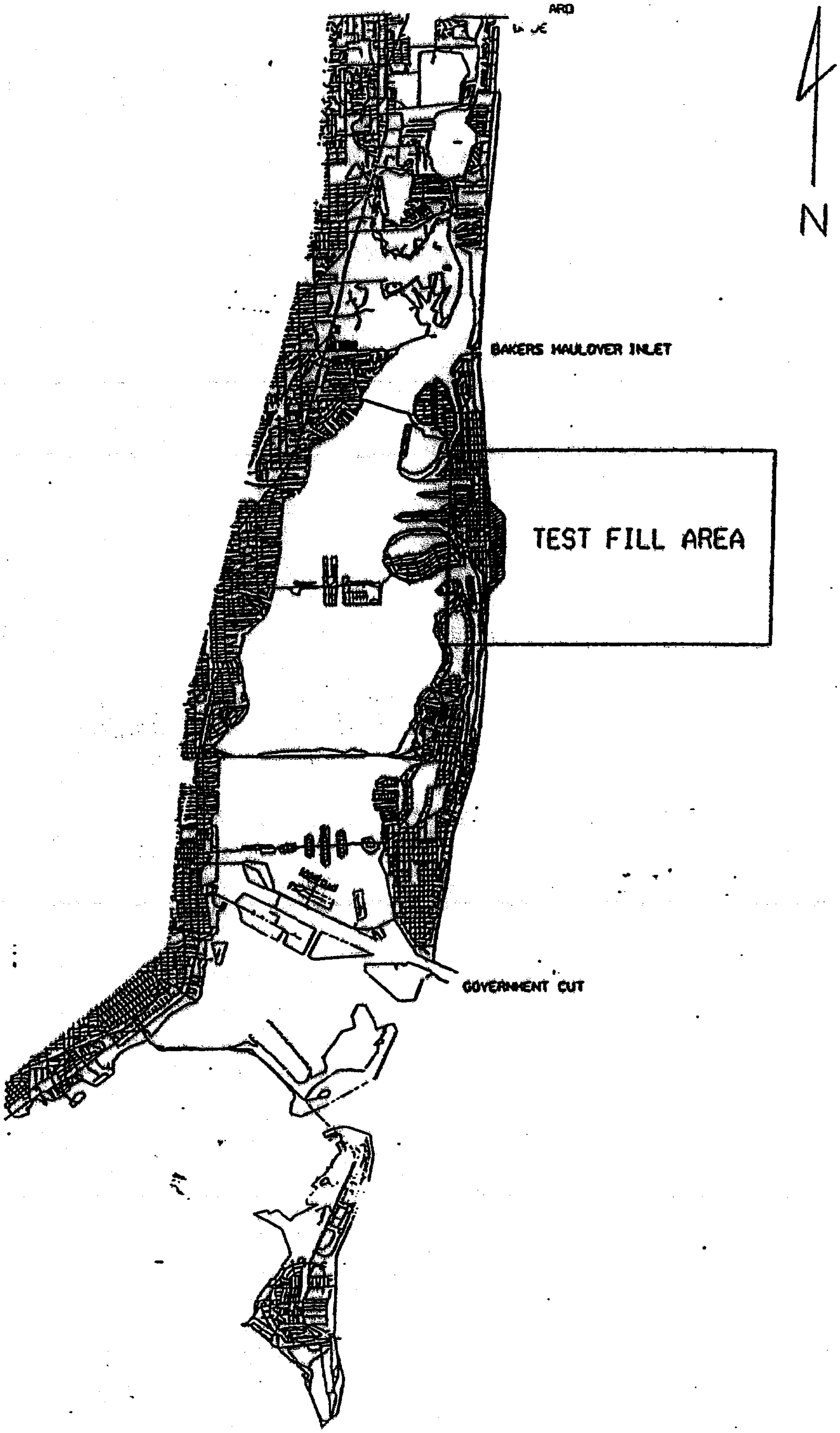
Rice, T. U.S. Fish and Wildlife Service, telephone conversation, 24 January 2001

Stark, W.A. and R.E. Schroeder. 1970. Investigations on the Gray Snapper, Lutjanus griseus. Pages 15-224 *in* C.R. Robins, W. H. Leigh, and D.P. de Sylva (eds.) Studies in Tropical Oceanography 10. University of Miami Press, Miami, Florida.

FIGURES

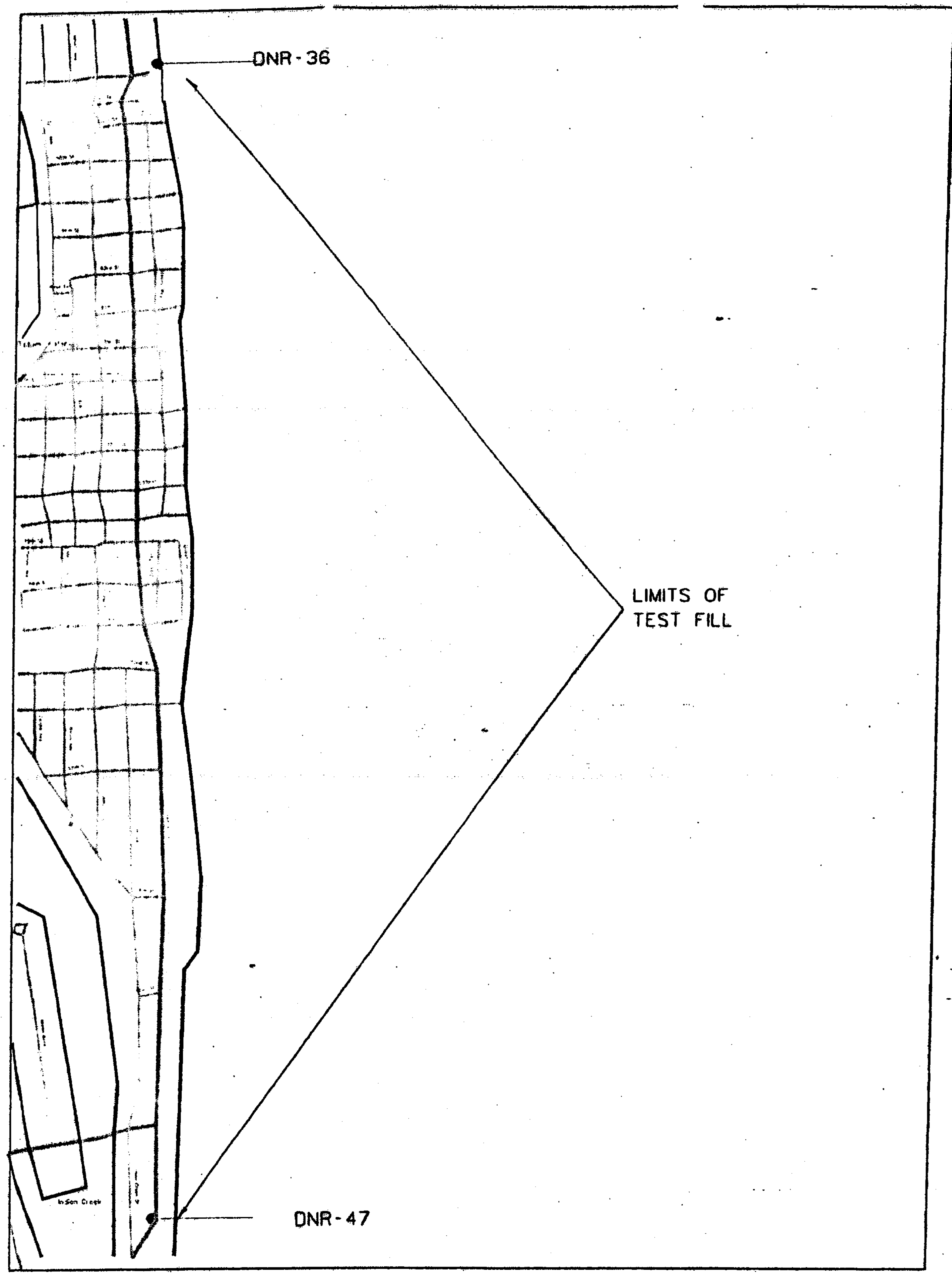
Figures

Figures 1a-1b	General Site Maps
Figure 2	Slurry Pipeline Corridor



DADE COUNTY TEST FILL SITE

FIGURE 1a



SUSTAINABILITY OF RENOURISHMENT
MIAMI BEACH TEST FILL

Figure [redacted]1b

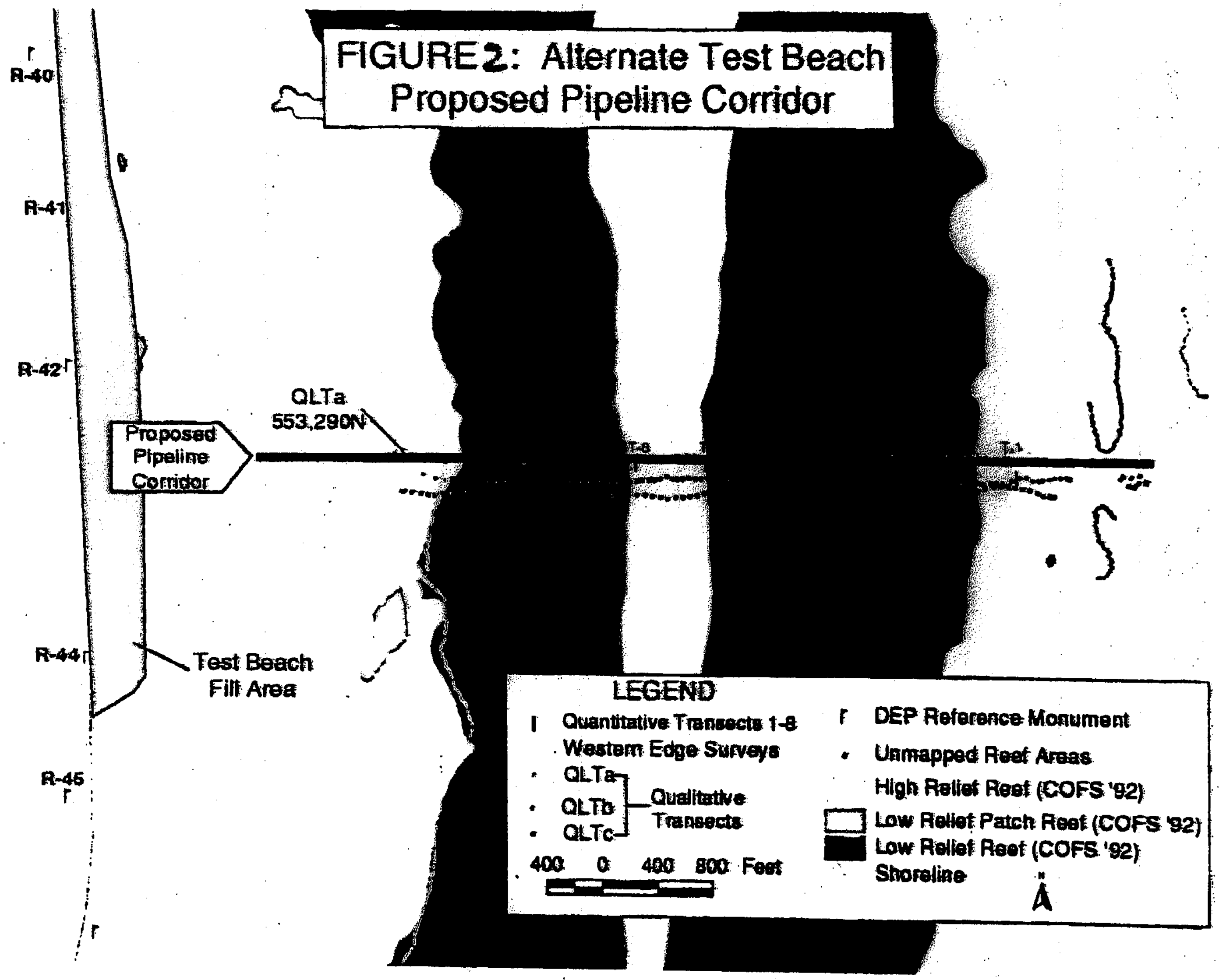


FIGURE 2: Alternate Test Beach
Proposed Pipeline Corridor
R-40
R-41
R-42
R-44
R-45
Proposed Pipeline Corridor
QLTa
553,290N
Test Beach Fill Area
LEGEND
Quantitative Transects 1-8
Western Edge Surveys
QLTa
QLTb
QLTc
Qualitative Transects
400 0 400 800 Feet
DEP Reference Monument
Unmapped Reef Areas
High Relief Reef (COFS '92)
Low Relief Patch Reef (COFS '92)
Low Relief Reef (COFS '92)
Shoreline
N

APPENDICES

Appendix

Appendix 1	Coast of Florida (COF) Biological Opinion
Appendix 2	COF addendum
Appendix 3	NMFS response to preliminary draft Fish and Wildlife Service Coordination Report
Appendix 4	FWC response to preliminary draft Fish and Wildlife Service Coordination Report
Appendix 5	Corps' Upland Sand Specifications (Beach Fill)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 2676
Vero Beach, Florida 32961-2676

October 24, 1996

IN REPLY REFER TO

Colonel Terry Rice
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attn: Planning Division

FWS Log No.: 4-1-96-F-268
Project: Coast of Florida Study, Region III

Dear Colonel Rice:

The U.S. Fish and Wildlife Service (FWS) has reviewed the draft Feasibility Report for the Coast of Florida Erosion and Storm Effects Study, Region III submitted by the U.S. Army Corps of Engineers (COE). This letter represents the FWS' biological opinion on the effects of the planned actions within this report in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). Effects of the planned actions on other resources such as nearshore reefs remain to be addressed in accordance with section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. *et seq.*).

This biological opinion programmatically addresses beach nourishment and renourishment in Region III. According to the COE's Biological Assessment (BA), separate biological opinions will be prepared for individual projects at a more advanced planning stage. This biological opinion is based on information provided from the following sources: the Feasibility Report, which includes a draft Environmental Impact Statement (DEIS), the BA for the Coast of Florida Study, Region III, from the Florida Department of Environmental Protection (FDEP), from Palm Beach, Broward, and Dade Counties, field investigations, previous biological opinions prepared for similar actions in the action area as well as other published and unpublished sources of information. A complete administrative record of this consultation is on file in the FWS' South Florida Ecosystem Office in Vero Beach, Florida.

CONSULTATION HISTORY

On October 5, 1995, the COE provided the FWS with a BA and a letter requesting formal consultation on threatened and endangered sea turtles as a result of the proposed actions associated with the Coast of Florida Study, Region III.

In a letter dated February 14, 1996, the FWS requested from the COE an estimate of the number of proposed projects which could be constructed within a single year. In this letter, the FWS notified the COE that formal consultation could not be initiated without this information.

In a letter dated March 28, 1996, the COE provided the FWS with the information requested above.

On July 9, 1996, the FWS notified the COE that the information provided is sufficient, formal consultation is initiated, and a biological opinion would be provided by August 23, 1996.

In August 1996, a revised DEIS for the Coast of Florida Study was received by the FWS.

BIOLOGICAL OPINION

Description of the proposed action

The Feasibility Report summarizes the COE's cooperative, cost-shared feasibility study on beach erosion and storm damage problems of the Atlantic Ocean shoreline along the southeast coast of Florida. The COE proposes to construct 27 shore protection projects consisting of beach nourishment, beach renourishment and sand transfer (See Table 1). These project segments span 93 kilometers of shoreline in Palm Beach, Broward and Dade Counties. Thirteen of these 27 projects have been previously authorized as Civil Works projects. Fourteen of the projects will require Congressional authorization.

Table 1. Project Plans Proposed in the Coast of Florida Study, Region III

Project Name	Project Type	Status
Bakers Haulover Inlet	0.1 Km Sand Transfer	New Project
Bal Harbour, Surfside, Miami Beach	14.3 Km Renourishment	Authorized Project
Boca Raton	2.3 Km Renourishment	Authorized Project
Dania Beach	1.0 Km Renourishment	New Project
Deerfield Beach	7.2 Km Renourishment	New Project
Delray Beach	4.3 Km Renourishment	Authorized Project
Fort Lauderdale	1.3 Km Renourishment	New Project
Golden Beach	1.8 Km Renourishment	New Project
Government Cut	0.3 Km Jetty Tightening	New Project
Highland Beach	5.1 Km Renourishment	New Project
Hillsboro Inlet	0.3 Km Sand Trap	New Project
Hollywood\Hallandale	8.5 Km Renourishment	Authorized
John U. Lloyd	3.7 Km Renourishment	Authorized
Jupiter\Juno Beach	4.8 Km Renourishment	Authorized Project
Key Biscayne	5.2 Km Renourishment	Authorized Project
Lake Worth Inlet	0.9 Km Sand Transfer	New Project
N. Palm Beach Island	3.0 Km Renourishment	Authorized Project
Ocean Ridge	2.4 Km Renourishment	Authorized Project
Palm Beach Island	4.3 Km Renourishment	Authorized Project
Pompano\Lauderdale by the Sea	8.5 Km Renourishment	Authorized
Port Everglades	.3 Km Sand Transfer	New Project
Port Everglades	Spur and Breakwater	New Project
Riviera Beach	1.7 Km Groin or Breakwater	New Project

Table 1. Project Plans Proposed in the Coast of Florida Study, Region III

Riviera Beach	2.7 Km Dune	New Project
S. Palm Beach Island	4.8 Km Renourishment	Authorized Project
So. Lake Worth Inlet	0.4 Km Sand Transfer	New Project
Sunny Isles (Haulover Beach)	4.0 Km Renourishment (2.5 miles	Authorized Project

Action Area

The action area for this Biological Opinion includes all shoreline where fill is proposed to be deposited or removed for transfer across an inlet, which amounts to 36 km of shoreline in Palm Beach County, 34 km in Broward County and 26.6 km in Dade County.

The COE has determined that the planned actions in the Coast of Florida Study, Region III may affect sea turtle nesting. Our records indicate that the threatened loggerhead sea turtle (*Caretta caretta*), as well as the endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*) and hawksbill sea turtle (*Eretmochelys imbricata*), nest on the beaches in Palm Beach, Broward, and Dade Counties.

Status of the species

The FWS has responsibility for protecting sea turtles when they come ashore to nest. The National Marine Fisheries Service (NMFS) has responsibility over sea turtles in the marine environment. In applying the jeopardy standard under the ESA, the FWS has determined that sea turtle species occurring in the U.S. represent populations that qualify for separate consideration under section 7 of the ESA. Therefore, even though sea turtles are wide-ranging and have distributions outside the U.S., the FWS only considers the U.S. populations of sea turtles when making jeopardy or no jeopardy determinations under section 7.

The reproductive strategy of sea turtles involves producing large numbers of offspring to compensate for the high natural mortality through their initial years of life. For at least two decades, several human-caused mortality factors have contributed to the decline of sea turtle populations along the Atlantic coast and in the Gulf of Mexico (National Research Council 1990a). These factors include commercial over-utilization of eggs and turtles, incidental catches in commercial fishing operations, degradation of nesting habitat by coastal development, and marine pollution and debris. Therefore, human activities that affect the behavior and/or survivability of turtles on the remaining nesting beaches, particularly the few high density nesting beaches, could seriously reduce our ability to protect sea turtles.

Loggerhead sea turtle

The loggerhead sea turtle, which was listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984). Total estimated nesting in the southeastern U.S. is approximately 50,000 to 70,000 nests per year (NMFS and FWS 1991b).

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to the population that nests on islands in the Arabian Sea off of Oman (Ross 1982, Ehrhart 1989, NMFS and FWS 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (NMFS and FWS 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward (NMFS and FWS 1991b).

Recent genetic analyses using restriction fragment analysis and direct sequencing of mitochondrial DNA have been employed to resolve management units among loggerhead nesting cohorts of the southeastern U.S. (Bowen *et al.* 1993; B.W. Bowen, University of Florida, Gainesville, in litt., November 17, 1994, and October 26, 1995). Assays of nest samples from North Carolina to the Florida Panhandle have identified three genetically distinct nesting populations: (1) northern nesting population - Hatteras, North Carolina, to Cape Canaveral, Florida; (2) South Florida nesting population - Cape Canaveral to Naples, Florida; and (3) Florida Panhandle nesting population - Eglin Air Force Base and the beaches around Panama City, Florida. These data indicate that gene flow between the three regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting population (Bowen *et al.* 1993, B.W. Bowen, University of Florida, Gainesville, in litt., October 26, 1995).

Green sea turtle

The green sea turtle, which was listed as an endangered species on July 28, 1978 (43 FR 32800), has a worldwide distribution in tropical and subtropical waters. Major green sea turtle nesting colonies in the Atlantic Ocean occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Breeding populations of the green sea turtle in Florida and along the Pacific coast of Mexico are listed as endangered; all other populations are listed as threatened.

Within the U.S., green sea turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and FWS 1991a). Nesting also has been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (FDEP, unpublished data).

Green sea turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpub. data) and they nest sporadically in North Carolina (North Carolina Wildlife Resources Commission, unpublished data). No green sea turtle nesting has been documented in South Carolina (S. Murphy, South Carolina Department of Natural Resources, in litt., November 8, 1995). Unconfirmed nesting of green sea turtles in Alabama has been reported (R. Dailey, Bon Secour National Wildlife Refuge, personal communication).

Leatherback sea turtle

The leatherback sea turtle, which was listed as an endangered species on June 2, 1970 (35 FR 8491), is found in the Atlantic, Pacific and Indian Oceans. Leatherback sea turtles have been recorded as far north as Labrador and Alaska and as far south as Chile and the Cape of Good Hope. Nesting grounds are distributed circumglobally, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (NMFS and FWS 1992, National Research Council 1990a).

Leatherback sea turtles regularly nest in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (NMFS and FWS 1992). Leatherback turtles have been known to nest in Georgia and South Carolina, but only on rare occasions (Georgia and South Carolina Departments of Natural Resources, unpublished data). Leatherback nesting also has been reported on the west coast of Florida on St. Vincent National Wildlife Refuge (LeBuff 1990), St. Joseph Peninsula State Park (FDEP, unpublished data), and St. George Island (T. Lewis, St. Vincent National Wildlife Refuge, personal communication); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Hawksbill sea turtle

The hawksbill sea turtle, which was listed as an endangered species on June 2, 1970 (35 FR 8491), is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. Within the continental U.S., hawksbill sea turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys in Monroe County (Meylan 1992, Meylan *et al.* 1995). Hawksbill tracks are difficult to differentiate from those of loggerheads and may not be recognized by surveyors. Therefore, surveys in Florida probably underestimate actual hawksbill nesting numbers (Meylan *et al.* 1995). In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (NMFS and FWS 1993).

ENVIRONMENTAL BASELINE

Status of the species in the action area

A. Nesting within Region III compared to nesting statewide

The following discussion of sea turtle nesting within Palm Beach, Broward, and Dade Counties, as well as comparisons to statewide nesting trends, was derived from data provided by Meylan *et al.* (1995) and Meylan (unpublished data). Meylan *et al.* (1995) tabulates the results of nesting surveys throughout Florida between 1979 and 1992. Unpublished data are available for the 1993 and 1994 nesting seasons.

Approximately 25 percent of Florida's sea turtle nesting occurs annually in the tri-county area known as Region III. During the nesting seasons from 1979 to 1992, loggerhead sea turtles laid 21.8 percent of their nests within Region III: green sea turtles laid 28.4 percent; and leatherbacks laid 54.7 percent. Hawksbill sea turtles reportedly laid 64 percent of their nests on Region III beaches; however, total nesting activity was low (11 nests state-wide) and this high percentage could be due to factors other than regional nesting preference.

Statewide and within Region III of the Coast of Florida Study, loggerhead sea turtle nests account for the vast majority of reported nesting (97.9 and 95.1 percent, respectively, from 1979 to 1992). During this same period, green sea turtle nests amounted to 0.2 percent of nesting state-wide and 4.2 percent within Region III. Nesting totals for each species differ substantially. From 1988 to 1992, while survey efforts remained relatively constant, the total number of reported loggerhead nests state-wide fluctuated between

37,242 and 68,614. Green sea turtle nests were reported to fluctuate between 455 and 2,509 during the same period. While totals differ, the distributions of loggerhead and green sea turtle nests follow a similar pattern on the east coast of Florida.

The most nesting activity by both species occurred outside of the action area to the north in Brevard County. Loggerhead and green sea turtles laid 39.4 percent and 39.5 percent, respectively, of their nests in Brevard County. Palm Beach County supported the second highest percentage of nests for both species with 17.8 percent of loggerhead nests and 23.1 percent of green sea turtle nests.

Broward County was sixth in importance as a nesting location for both species. Loggerhead sea turtles laid 3.4 percent of their nests here between 1979 and 1982 and green sea turtles laid 5.0 percent of their nests in Broward County during the same period. Dade County had a small but significant proportion of nests (0.6 for loggerheads and 0.3 for greens) from 1979 to 1992.

Between 1988 and 1992, annual reported leatherback sea turtle nests varied between 98 and 188 state-wide. The distribution of these nests differs from the loggerhead and green sea turtle nests discussed above. Leatherback nests have a center of distribution at Palm Beach County which supports more than half (50.1 percent) of the total nests reported state-wide. To the north, Martin and St. Lucie County beaches have been the site of 27.7 percent and 13.2 percent of leatherback nests, respectively. South of Palm Beach County, the number of leatherback nests declines more sharply. Broward County supported 3.0 percent of leatherback nesting and Dade County supported 1.6 percent.

The hawksbill sea turtles nest so rarely in Florida (only 11 nests reported state-wide from 1979 to 1992) that no distinct pattern of distribution is apparent. However, the majority (7) of those reported nestings have occurred within the Region III area. One hawksbill nest was reported from Palm Beach County in 1985 and two in 1992, one in Broward County in 1986, and one in 1981 and two in 1990 in Dade County.

B. Nesting within Region III

The average number of nests annually of each species within each Region III county are shown in Table 2. These data show that Palm Beach County is clearly the most important nesting location within the region for the endangered leatherback and green sea turtles. Less evident from Table 2 is the fact that as the total number of nests for these species declines from north to south, so too does the percentage that these nests contribute to total nesting activity. Green sea turtles lay 4.3 percent of total nests in Palm Beach and Broward Counties. but only 0.5 percent of the total in Dade County. Similarly, leatherback nests constitute 0.8 percent of the total in Palm Beach County but only 0.4 and 0.5 percent in Broward and Dade Counties, respectively.

Table 2. Average annual number of nests by county from 1992 to 1994

	Loggerhead	Green	Leatherback	Hawksbill
Palm Beach	12,133	544	99	1
Broward	2,226	101	11	0
Dade	401	2	2	0

C. Nesting activity trends in Region III

Throughout the state, the number of sea turtle nests (all species) per kilometer surveyed from 1979 to 1992 appears to have increased slightly. Loggerhead nest numbers vary enough from year to year to prevent Meylan *et al.* (1995) from drawing a firm conclusion that loggerhead nesting is increasing (see Figure 1). Kilometers surveyed increased as the study progressed, thus, the figures become increasingly reliable. It appears that loggerhead nesting activity could be on a four year cycle. Figure 1 shows peaks in nesting density for 1982, 1986, and 1990. Similarly, green sea turtle nesting exhibits a two year cycle in activity.

A trend toward increasing loggerhead nesting within Region III appears more evident as seen in Figure 2. The contribution from each county to each year's loggerhead nesting activity can be approximated by reviewing Table 2. All counties have a similar trend.

Dissimilar trends in green sea turtle nesting among Palm Beach, Broward, and Dade Counties occurred from 1979 to 1994. Nesting activity for each year by county is shown in Figure 3.
The figure above shows a pronounced increase in green sea turtle nesting in Palm Beach County from 1990 to 1994. The phenomenon of higher nesting activity in alternating years can easily be seen in the years 1990, 1992, and 1994. This pattern can also be seen in the Broward County data. The trend toward increasing green sea turtle nesting activity over the long term is also clear from the figure. Dade County, however, shows a decrease in reported green sea turtle nesting per kilometer. Except in 1980, the number of nests per kilometer in Dade County is low, which could be due to random fluctuations in nesting activity. Meylan *et al.* (1995) report that an increase in green sea turtle nesting has been observed statewide. We do not know the reason for this increase is unknown and regard it with cautious optimism.

Figure 1: **Average number of loggerhead nests per kilometer surveyed in Florida from 1979 to 1992**