United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
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July 24, 2002

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U.S. Army Corps of Engineers
Jacksonville District
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Log No.: 4-01-F-765
Application No.: 200003733 (IP-MN)
Dated: February 2, 2001
Sponsor: Lee County Board of County Commissioners
County: Lee

Dear Colonel May:

This document is the Fish and Wildlife Service's (Service) Biological Opinion based on our review of the proposed Gasparilla Island Erosion Control Project located in Lee County, Florida. It describes the effects of the action on the federally-listed threatened loggerhead sea turtle (*Caretta caretta*), endangered green sea turtle (*Chelonia mydas*), endangered leatherback sea turtle (*Dermochelys coriacea*), and endangered hawksbill sea turtle (*Eretmochelys imbricata*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This Biological Opinion is based on information provided in the Public Notice, field investigations, meetings, letter correspondence, email correspondence, agency websites, and telephone conversations with the U.S. Army Corps of Engineers (Corps); Lee County and their consultants, Humiston and Moore Engineers (H&M); the Department of Environmental Protection (DEP); the Florida Fish and Wildlife Conservation Commission (FWC), Mote Marine Laboratory, and other sources of information. A complete administrative record of this consultation is on file at the South Florida Ecological Services Office in Vero Beach, Florida.

CONSULTATION HISTORY

April 29, 1999- In a letter and biological assessment, the Corps determined the implementation of the Lee County Shoreline Protection Project for Gasparilla and Estero Islands, as authorized in 1970, "will not affect" the federally listed West Indian manatee (*Trichechus manatus*), but "may affect" the listed loggerhead and green sea turtles. Consequently, the Corps requested initiation of formal consultation with the Service concerning these listed species.

September 1999- The Service concurred with the Corps determinations and submitted its Biological Opinion, FWS log number: 4-1-99-F-812, for the Lee County Shoreline Protection Project that included the portion of Gasparilla Island between DEP monuments R-10 and R-24.

March 2, 2000- The Service submitted a final Fish and Wildlife Coordination Act Report, in accordance with the provisions of the Fish and Wildlife Coordination Act of 1958 (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

February 2, 2001- The Public Notice states the applicant (Lee County) proposes to extend sand placement beyond the original federal project footprint and construct a segmented breakwater and two T-head groins between R-24 and R-26.5 through the Corps regulatory program. Based on this new information, the Corps requested reinitiation of formal consultation and determined the actions of the proposed modification will "not affect" the piping plover, but "may affect," loggerhead and green sea turtles and "may affect, but not likely to adversely affect" the West Indian manatee.

February and March, 2001- After several discussions by phone and email, the Service concurred with the Corps that reinitiation of consultation would be required since the project boundaries were expanded and the addition of erosion control structures in the project design constituted new information. Also, the Service concurred with the Corps that the project would not effect the piping plover since it is unlikely the species will be present during construction. Since the Corps has agreed to implement the *Standard Manatee Protection Construction Conditions,* the Service's 1999 Biological Opinion remains valid for the West Indian manatee.

July 18, 2001- The Service participated in a teleconference held by DEP with Lee County, H&M, and the FWC to discuss the status of the applicant's DEP Joint Coastal Permit Application and to identify outstanding fish and wildlife issues, including the Service's Biological Opinion.

August 14, 2001- As a result of the July 18, 2001 teleconference, the Service hosted a meeting with Lee County, Humiston and Moore, Taylor Engineering, FWC, and DEP to further discuss the possible adverse effects of the project on fish and wildlife resources, particularly listed sea turtles and their hatchlings, as a result of construction of the segmented breakwater and T-head groins. As a result of this discussion, it was decided to include additional monitoring elements to determine the extent of the effects of the structures on sea turtle hatchlings. Those participants in the meeting agreed to participate on the sea turtle Hatchling Monitoring Review Team (HMRT).

The Service has expressed concern regarding these potential adverse effects on sea turtles as a result of the shore-parallel and emergent design elements of the erosion control structures. We recommended that the maximum height of the structures should be limited to mean low water (MLW) versus the 2-3 feet above mean high water (MHW) as proposed to avoid possible adverse effects to adult and hatchling sea turtles. It was explained by H&M that submersion of the segmented breakwaters and the T-head portion of the groins would render the structures ineffective because they would not fully dissipate wave energy due to the shallow nature of the wave energy typically generated under normal conditions in the Gulf of Mexico.

Since the design of the erosion control structures was not modified, the Service is concerned that they may result in long-term adverse effects to listed sea turtles, especially hatchlings. Therefore, to determine and evaluate the possible long-term affects of the erosion control structures on sea turtle hatchlings, the applicant has agreed to include a three-year sea turtle hatchling monitoring plan to the post project monitoring.

September 2001- In an effort to design and develop a scientifically valid sea turtle hatchling monitoring plan, Mote Marine Laboratory, Sarasota, Florida agreed to assist with this process and provide a draft plan.

September 17, 2001- The Service provided a letter to the Corps that acknowledged receipt of all the information necessary to initiate formal consultation on the proposed action, as required in the regulations governing interagency consultations (50 CFR 402.14).

September 23, 2001- Service staff participated in a site visit with the applicant's consultant to Gasparilla Island to assess the project area.

September 24, 2001- Service staff conducted a site visit with the applicant to the 1998 Kohler property project site on North Captiva Island, Lee County, where T-groins were constructed in a design similar to those currently proposed.

December 2001-January 2002- The Service, FWC, and the applicant received and reviewed preliminary drafts of the hatchling monitoring plan provided by Mote Marine Laboratory. Comments were received by the Service from the team via phone, letter, and fax then provided to Mote Marine Laboratory for inclusion in the revised draft.

January 8, 2002- The Service contacted the NMFS to coordinate consultation regarding the segmented breakwater. Since the applicant has agreed to incorporate the sea turtle hatchling monitoring plan in the project description, NMFS believes the Service's BO will adequately address the possible adverse effects to swimming sea turtles. However, at the conclusion of the hatchling monitoring period, the NMFS' requested that the Corps reinitiate consultation based on this new information.

February 11, 2002- The HMRT received the revised draft of the hatchling monitoring plan.

March 7, 2002- A teleconference was initiated to resolve any outstanding questions and/or issues with the HMRT.

May 10, 2002- The Service received and distributed the final hatchling monitoring plan to the

HMRT. This plan is included as Appendix A in this Biological Opinion.

May 31, 2002- The Service received an email indicating that the Corps revised their determination regarding listed sea turtle species from "may affect, not likely to adversely affect" to "may effect."

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to construct a berm profile with a seaward slope of 1:10 and a berm width varying between 145 to 215 feet at elevations between five feet NGVD at the landward end of the berm and 4.2 feet at the seaward end of the berm along three miles of shoreline along the southern end of Gasparilla Island, Lee County, Florida between DEP monuments R-10 and R-26 (Figure 1). The varying berm width is designed to provide a wider beach in areas of high erosion potentials. An estimated 920,000 cubic yards of material will be obtained via a hydraulic dredge from an ebb shoal borrow site located approximately 4,000 feet northwest of Boca Grande Pass (Figure 2). The borrow material has a composite grain size of 0.38 mm with a 1.3 to four percent silt content. Sediment samples of the existing beach within the project area indicate an average grain size of 0.42 mm with a negligible silt content. The applicant has requested a mixing zone variance extending 0.62 mile parallel and 0.8 mile perpendicular to the shoreline. A seven-year renourishment interval is anticipated.

In addition to the placement of sand along the shoreline, the Corps proposes to construct erosion control structures that will be oriented parallel to the shoreline and remain emergent at mean high water MHW. The structures include an offshore segmented breakwater structure (segments 350 and 200 feet in length) and two T-head groins (235 feet body length, 200 foot head width) located in the vicinity of R-25, R-25.5, and R-26, respectively and are collectively referred to as "erosion control structures" in the remainder of this document. The segmented breakwater is proposed to be constructed of limestone boulders located approximately 325 feet off shore of the current shoreline, in 10-12 feet of water. The rubble-mound breakwater will maintain a crest elevation of approximately +3 NGVD. The T-head groins (T-groins) will be oriented closer to shore, in approximately six feet of water, and lie within the boundary of the Gasparilla Island State Recreation Area (SRA). The body and head of the T-groins will be constructed of sheet piling with limestone rip-rap placed on the water-ward side of the T-head. The T-heads of the groins will maintain a crest elevation of +2 NGVD above mean MHW (Figures 4 and 5).

The offshore segmented breakwater and T-groins are proposed to reduce incident wave energy along and downdrift of the Belcher Road seawall thus extending the renourishment interval and potentially minimizing the need for further shoreline armoring. Coastal engineers representing the applicant and DEP state that without the stabilizing influence of the proposed segmented breakwater, a beach could not be maintained in front of the Belcher Road seawall. Typically the DEP advises against the construction of permanent structures along the shoreline. However, in the case of Gasparilla Island where less invasive shoreline protection methods have been repeatedly attempted, DEP coastal engineers state that erosion control structure construction is appropriate in this area.

The Corps has incorporated the following sea turtle protection measures into the project design since construction may occur during the sea turtle nesting season (April 1-November 30):

1. Relocation of all detected sea turtle eggs 65 days prior to deposition of sand on the beach or by May 1, or which ever is later;
2. Measuring of compaction of the deposited fill with a cone penetrometer;
3. Tilling of the beach if the average cone penetrometer index exceeds 500 cone penetrometer units (cpu); and
4. Leveling of any escarpments which exceed 18 inches in height and extend more than 100 feet in length.

Figures 1 and 2: Project and borrow site location, Lee County, Florida (excerpted from DEP 2001).

Figure 1

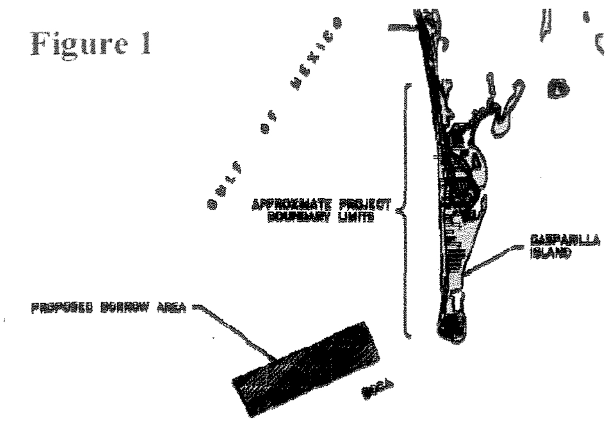


Figure 2

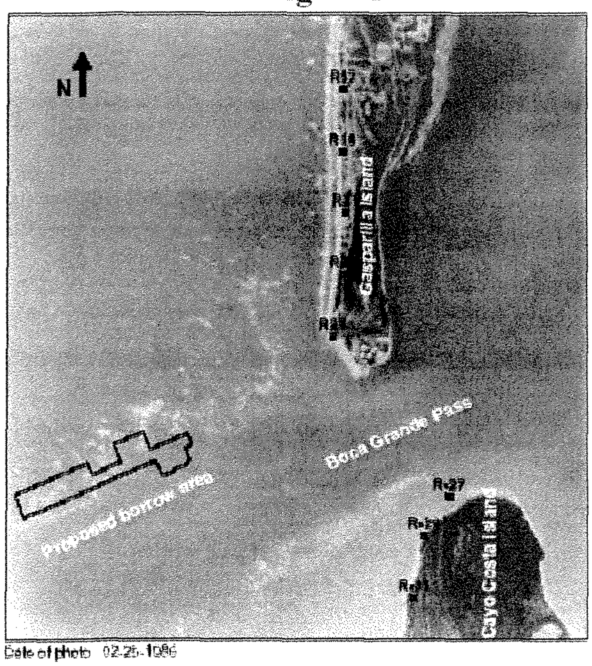


Figure: 3: Breakwater location offshore of the Belcher Road seawall at R-25 (excerpted from DEP 2001).

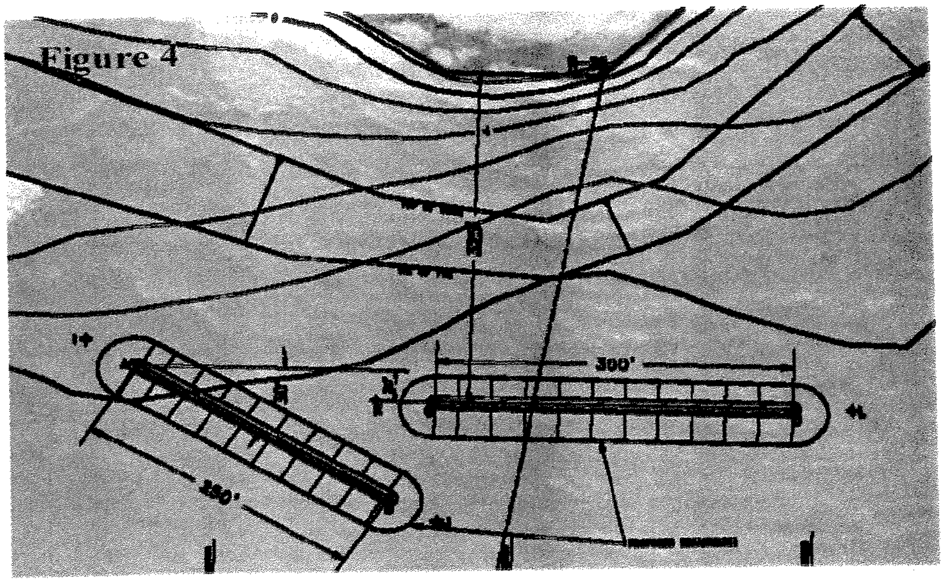
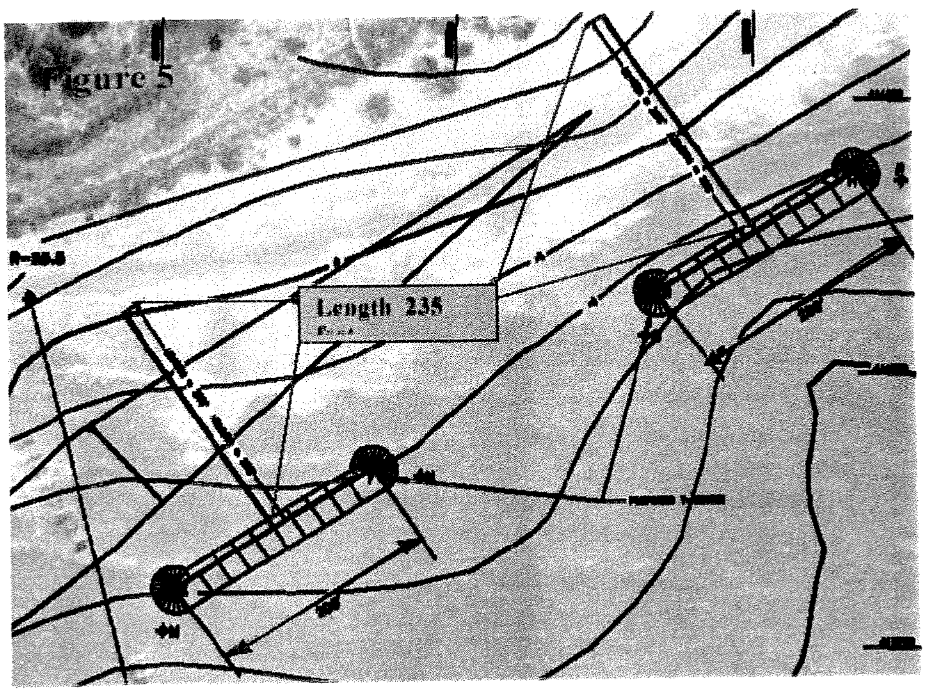


Figure 4: T-groin configuration and location within Gasparilla Island State Recreation Area in the vicinity of R-26 (excerpted from DEP 2001).



STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*), 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).

No critical habitat has been designated for the loggerhead sea turtle.

Green Sea Turtle

The green sea turtle (*Chelonia mydas*) was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green 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 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 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 (Florida Department of Environmental Protection, unpublished data). Green turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpublished data). The green turtle also nests sporadically in North Carolina and South Carolina (North Carolina Wildlife Resources Commission, unpublished data; South Carolina Department of Natural Resources, unpublished data). Unconfirmed nesting of green turtles in Alabama has also been reported (Bon Secour National Wildlife Refuge, unpublished data).

Critical habitat for the green sea turtle has been designated for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys.

Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*), listed as an endangered species on June 2, 1970 (35 FR 8491), nests on shores of the Atlantic, Pacific and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of

Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed worldwide, 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 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992, National Research Council 1990a).

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (Murphy 1996, Winn 1996, Boettcher 1998). Leatherback nesting also has been reported on the northwest coast of Florida (LeBuff 1990; Florida Department of Environmental Protection, unpublished data); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Marine and terrestrial critical habitat for the leatherback sea turtle has been designated at Sandy Point on the western end of the island of St. Croix, U.S. Virgin Islands.

Life history

Loggerhead Sea Turtle

Loggerheads are known to nest from one to seven times within a nesting season (Talbert *et al.* 1980, Richardson and Richardson 1982, Lenarz *et al.* 1981, among others); the mean is approximately 4.1 (Murphy and Hopkins 1984). The interval between nesting events within a season varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 along the southeastern United States coast (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). Nesting migration intervals of two to three years are most common in loggerheads, but the number can vary from one to seven years (Dodd 1988). Age at sexual maturity is believed to be about 20 to 30 years (Turtle Expert Working Group 1998).

Green Sea Turtle

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is about 3.3. The interval between nesting events within a season varies around a mean of about 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually two-four, or more years intervene between breeding seasons (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991a). Age at sexual maturity is believed to be 20 to 50 years (Hirth 1977).

Leatherback Sea Turtle

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1992). The interval between nesting events within a season is about 9 to 10 days. Clutch size averages 101 eggs on Hutchinson Island, Florida (Martin 1992). Nesting migration intervals of 2 to 3 years were observed in leatherbacks nesting on the Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996). Leatherbacks are believed to reach sexual maturity in 6 to 10 years (Zug and Parham 1996).

Population dynamics

Loggerhead Sea Turtle

Total estimated nesting in the Southeast is approximately 50,000 to 70,000 nests per year (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b). In 1998, there were over 80,000 nests in Florida alone. 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 that which nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989, National Marine Fisheries Service and U.S. Fish and Wildlife Service 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 (National Marine Fisheries Service and U.S. Fish and Wildlife Service 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 Counties) (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991b).

Green Sea Turtle

About 200 to 1,100 females are estimated to nest on beaches in the continental U.S. In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year. Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting aggregation in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season. In the Indian Ocean, major nesting beaches occur in Oman where 6,000 to 20,000 females are reported to nest annually.

Leatherback Sea Turtle

Recent estimates of global nesting populations indicate 26,000 to 43,000 nesting females annually (Spotila *et al.* 1996). The largest nesting populations at present occur in the western Atlantic in French Guiana (4,500 to 7,500 females nesting/year) and Colombia (estimated several thousand nests annually), and in the western Pacific in West Papua (formerly Irian Jaya) and Indonesia (about 600 to 650 females nesting/year). In the United States, small nesting populations occur on the Florida east coast (35 females/year), Sandy Point, U.S. Virgin Islands (50 to 100 females/year), and Puerto Rico (30 to 90 females/year).

Status and distribution

Loggerhead Sea Turtle

Genetic research (mtDNA) has identified four loggerhead nesting subpopulations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N.); (2) South Florida Subpopulation occurring from about 29° N. on Florida's east coast to Sarasota on Florida's west coast; (3) Northwest Florida Subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and (4) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico (Bowen 1994, 1995; Bowen *et al.* 1993; Encalada *et al.* 1998). These data indicate that gene flow between these four 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 subpopulation. The Northern Subpopulation has declined substantially since the early 1970's, but most of that decline occurred prior to 1979. No significant trend has been detected in recent years (Turtle Expert Working Group 1998, 2000). Adult loggerheads of the South Florida subpopulation have shown significant increases over the last 25 years, indicating that the population is recovering, although a trend could not be detected from the State of Florida's Index Nesting Beach Survey program from 1989 to 1998. Nesting surveys in the Northwest Florida and Yucatán Subpopulations have been too irregular to date to allow for a meaningful trend analysis (Turtle Expert Working Group 1998, 2000).

Threats include incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

Green Sea Turtle

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. For instance, in Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, estimates range from 200 to 1,100 females nesting annually. Populations in Surinam, and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

Leatherback Sea Turtle

Declines in leatherback nesting have occurred over the last two decades along the Pacific coasts of Mexico and Costa Rica. The Mexican leatherback nesting population, once considered to be the world's largest leatherback nesting population (65 percent of worldwide population), is now less than one percent of its estimated size in 1980. Spotila *et al.* (1996) recently estimated the number of leatherback sea turtles nesting on 28 beaches throughout the world from the literature and from communications with investigators studying those beaches. The estimated worldwide population of leatherbacks in 1995 was about 34,500 females on these beaches with a lower limit of about 26,200 and an upper limit of about 42,900. This is less than one third the 1980 estimate of 115,000. Leatherbacks are rare in the Indian Ocean and in very low numbers in the western Pacific Ocean. The largest population is in the western Atlantic. Using an age-based demographic model, Spotila *et al.* determined that leatherback populations in the Indian Ocean and western Pacific Ocean cannot withstand even moderate levels of adult mortality and that even the Atlantic populations are being exploited at a rate that cannot be sustained. They concluded that leatherbacks are on the road to extinction and further population declines can be expected unless we take action to reduce adult mortality and increase survival of eggs and hatchlings.

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific. Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; and watercraft strikes.

Analysis of the species/critical habitat likely to be affected

Listed species known to occur within the project area include the West Indian manatee, piping plover, and listed sea turtles such as the loggerhead, green, leatherback, Kemp's ridley (*Lepidochelys kempii*), and hawksbill sea turtle (*Eretmochelys imbricata*). Sea turtle nesting data collected along the Gulf of Mexico in the past nine years indicate that the loggerhead, green, and leatherback sea turtles are the only three species to nest in Lee County, but the loggerhead and green sea turtles dominate. The hawksbill sea turtle has not been documented as nesting in Lee County. Although the Kemp's ridley and leatherback sea turtles have been documented as nesting along the Florida's west coast and, in Lee County, one leatherback was documented as nesting in 1996, the likelihood that either species will nest within the project area is low. Critical habitat has not been designated in the continental United States for sea turtles; therefore, the proposed action would not result in an adverse modification.

Manatees consistently use Charlotte Harbor Sound, east of Gasparilla Island according to the FWC, Florida Marine Research Institute aerial survey data, 1985, 1987, and 1992. Since manatees may be present within the project vicinity particularly during the summer, the Corps has included the *Standard Manatee Protection Construction Conditions* in the project design to minimize possible adverse effects to the manatee. Therefore, the Service concurred with the Corps' determination. Manatee critical habitat has not been designated in the project area; therefore, the proposed action would not result in an adverse modification.

The piping plover has a broad distribution within North America. Nesting typically occurs in three geographic regions: the Northern Great Plains, the Great Lakes; and Atlantic coastal beaches from New Foundland to North Carolina; nesting does not occur in Florida. However in the winter, piping plovers are generally seen along Gulf of Mexico beaches, southern U.S. Atlantic beaches from North Carolina to Florida, in eastern Mexico, and numerous islands scattered throughout the Caribbean. The complete winter distribution of the piping plover remains to be determined, although specific Gulf and Atlantic coastal sites are becoming better recognized for their importance to wintering birds. Florida counties where wintering piping plovers are usually seen include Bay, Brevard, Collier, Miami-Dade, Duval, Escambia, Franklin, Gulf, Hillsborough, Lee, Martin, Monroe, Okaloosa, Palm Beach, Pasco, Pinellas, Santa Rosa, (possibly) Sarasota, St. Lucie, St. Johns, Taylor, Volusia, Wakulla, and Walton. Wintering piping plovers appear to prefer sites with the greatest extent of open water, such as sand spits and barrier islands where tidal flats are within close proximity (Service 1999). Based on these factors, the Service concurred with the Corps' determination. Critical habitat has not been designated in the project area for the piping plover; therefore, the proposed action would not result in an adverse modification.

This Biological Opinion pertains to the two sea turtle species, the loggerhead and green sea turtles, which predictably and regularly nest in Lee County and will be affected by the proposed action. Since the Service concurs with the Corps' determinations regarding the West Indian manatee and piping plover, these species will not be considered further in this consultation.

ENVIRONMENTAL BASELINE

Status of the species within the action area

The distribution of sea turtle nesting activity on Florida's Southwest Gulf Coast (Sarasota, Charlotte, Lee, and Collier counties) is understood less than that of the East Coast epicenter of sea turtle nesting between Brevard and Palm Beach counties (Addison *et al.* 2000). Ten to twelve percent of the total nesting activity on Florida's beaches occurs on Florida's Gulf Coast (Addison *et al.* 2000). During 1994 to1999 nesting seasons, Sarasota, Charlotte, Collier, and Lee counties have accounted for 41, 14, 15, and 8 percent of the overall nesting in the southern Gulf coast region, respectively. During the 2000 nesting season, of the 41.4 miles (69.9 km) of Lee County shoreline surveyed, data show a total of 1,968 sea turtle emergences (940 nests and 1028 false crawls) according to the FWC's Statewide Sea Turtle Nesting Survey Data, 2000 (Table 1).

Table 1: Lee County Sea Turtle Nesting 1993-2001 (FWC Statewide Sea Turtle Nesting Survey Data, 2000)

Year	*Survey Length (km)*	*Loggerhead Nest*	*Loggerhead False Crawl*	*Green Nest*	*Green False Crawl*	*Kemps ridley Nest*	*Kemps ridley False Crawl*
2000	69.9	935	1026	5	2	0	0
1999	69.1	851	774	2	8	0	0
1998	65.5	865	931	1	0	0	0
1997	60.8	594	677	0	1	0	0
1996	63.9	686	899	0	1	1	0
1995	61.6	700	997	3	1	0	0
1994	68.4	691	656	4	1	0	0
1993	60.3	487	544	0	0	0	0

Loggerhead Sea Turtle

The loggerhead sea turtle nesting and hatching season for the southern Florida Gulf of Mexico beaches (Pinellas through Monroe Counties) extends from April 1 through November 30. Incubation ranges from about 45 to 95 days. The loggerhead sea turtle is the most abundant sea turtle species nesting in Lee County. The mean number of loggerhead sea turtles that nested in Lee County from 1994-2000 was 726 and ranged from 935 to 487 (Addison *et al.* 2000).

A daily sea turtle activity survey was conducted along 2.6 miles (4.2 km) of Gasparilla Island shoreline between monuments 13 and 26A by the Florida Department of Parks and Recreation in 1991-2000. During this time, sea turtle nests numbered from 11 to 152 and averaged 45 nests per year while false crawls numbered from 0 to 56 and averaged 34 per year. In total, there were 731 loggerhead emergences on southern Gasparilla Island (Table 2).

For the year 2000, 96 emergences of adult turtles (55 total nests, 41 false crawls) and a nesting success of 57 percent were documented for survey area along Gasparilla Island. Storms inundated 47 percent of the nests (26), 84 percent (22) nests were lost entirely primarily due to storm events on or about July 16, 2000.

Table 2: Loggerhead sea turtle nesting data from 1991 to 2000 for southern Gasparilla Island.

Year	Gasparilla Island SRA Loggerhead Nesting Data					
	Nests	False Crawls	Total Emergences	Nests Disturbance		
				Inundated	Predated	Total
1991	26	20	46	0	8	8
1992	38	14	52	3	7	10
1993	22	25	47	8	3	11
1994	64	20	84	10	5	15
1995	152	56	208	N/A	N/A	N/A
1996	11	13	24	N/A	N/A	N/A
1997	17	0	17	N/A	N/A	N/A
1998	20	36	56	N/A	N/A	N/A
1999	49	52	101	16	2	18
2000	55	41	96	26	N/A	26
Total	**454**	**277**	**731**	**63**	**25**	**88**

Green Sea Turtle

The green sea turtle nesting and hatching season for the southern Florida Gulf of Mexico beaches (includes Pinellas through Monroe Counties) extends from May 15 through October 31. Incubation ranges from about 45 to 75 days. According to Florida Statewide Nesting Survey data for 2000, Lee County recorded seven green turtle emergences resulting in five nests. This is an increase from 1999 where eight green turtle emergences resulted in two nests (Table 3). Green sea turtle nesting has not been documented in the project area. However, the potential for future nesting exists since nest site preferences are not documented by available data.

Table 3: Lee County green sea turtle nesting data from 1993 to 2000.

Year	*Survey Length (km)*	*Green Sea turtle Nests*	*Green Sea turtle False Crawls*	*Total Emergences*
2000	69.9	5	2	7
1999	69.1	2	8	10
1998	65.5	1	0	1
1997	60.8	0	1	1
1996	63.9	0	1	1
1995	61.6	3	1	4
1994	68.4	4	1	5
1993	60.3	0	0	0
Total	**n/a**	**15**	**14**	**29**

Factors affecting the species environment within the action area

Currently, approximately 77 percent of the properties upland of the MHW line along the Gasparilla Island project area are privately owned single-family residential lots and condominium complexes, and 23 percent of the project area borders lands owned by the State of Florida and is part of the Gasparilla Island SRA . Florida Power and Light, Inc., (FPL) owns an industrial facility east of Gasparilla Island SRA adjacent to the project area. Southern Gasparilla Island is separated from northern Cayo Costa Island by Boca Grande Pass. This pass is considered to be one of the prime fishing areas in the world for tarpon (*Megalops atlanticus*), a major predator of sea turtle hatchlings.

Historic dredge and fill records and sand transport modeling has identified the portion of Gasparilla Island corresponding to the project boundaries is as an area of critical erosion (DEP 2001). The Corps states that the coastline of Gasparilla Island has experienced significant erosion and shoreline recession over the past ten years, which has resulted in loss of sea turtle nesting habitat, a reduction of recreational opportunities, and a reduction of storm protection to oceanfront property. In the past, this area has been maintained through sand placement from navigation maintenance dredging projects associated with the operation of the Charlotte Harbor Entrance Channel and FPL facility, shoreline armoring, and the construction of two groins at the inlet. North of the Gasparilla SRA, a 1,000 foot seawall was constructed in the vicinity of Belcher Road (R-25). This seawall transferred the erosion problem to the downdrift beach where the lighthouse at Gasparilla Island SRA was subsequently undermined, resulting in armoring of the shoreline with a revetment. Eventually the area south of the Belcher Road seawall was restored and it has been maintained with subsequent placement of dredge spoil on several occasions (Figures 5 and 6). As a result of erosion sea turtle nests in the project area are frequently inundated or washed-out resulting in a reduction of nesting success.

Figure 5 (DEP Figure7). Historic shoreline changes and erosion control efforts south of the Belcher Road seawall (R-25) on southern Gasparilla Island (DEP 2001).

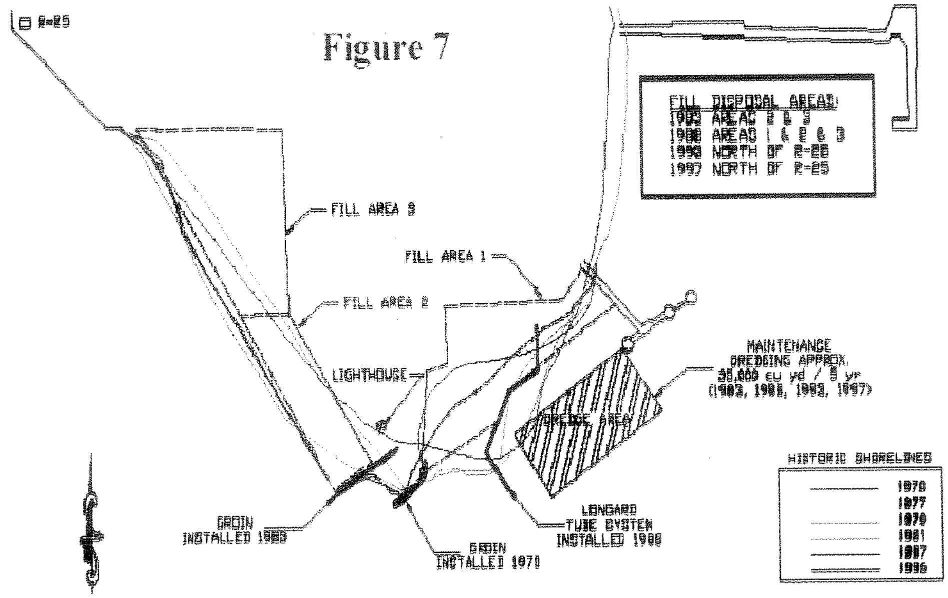
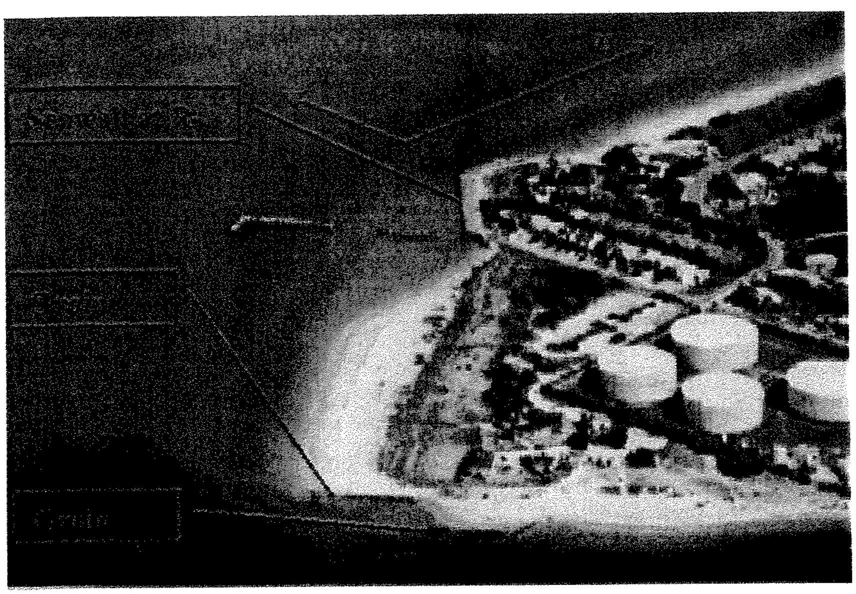


Figure 6: Existing structures at the southern end of Gasparilla Island specifically the Belcher Street seawall at R- 25 and two terminal groins within Gasparilla Island SRA.



Of the approximately 16,360 feet project length, about 8,050 feet (49%) are currently armored. As a result, most of the armored shoreline has little suitable nesting habitat. The Belcher Road seawall that armors approximately 1,000 feet of shoreline in the vicinity of R-25 is especially problematic. Despite multiple dredge spoil placement efforts in the area, sea turtle nesting habitat does not exist in front of the seawall. To compensate for scouring effects, periodic placement of material occurred within the boundaries of the Gasparilla Island SRA as a result of maintenance dredging activities of Boca Grande Pass for tanker access to the FPL facility. Since FPL has ceased operations, routine dredging of Boca Grande Pass and the beneficial placement of this material will cease to occur. The exposed seawall at Belcher Road is aso a significant source of eroin stress on adjacent beaches.

EFFECTS OF THE ACTION

The analysis of the direct and indirect effects of the proposed action on sea turtles and its interrelated and interdependent activities was based on the following factors.

Factors to be considered

The proposed action has the potential to adversely affect nesting females, nests, and hatchlings within the proposed project area during the renourishment activities (short-term effects) and through the establishment of erosion control structures (long term effects).

Analyses for effects of the action

Beneficial Effects

The placement of sand on a beach with reduced dry fore-dune habitat may increase sea turtle nesting habitat if the placed sand is highly compatible (i.e., grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project. In addition, a nourished beach that is designed and constructed to mimic a natural beach system may be more stable than the eroding one it replaces, thereby benefitting sea turtles.

Erosion control structures constructed in appropriate high erosional areas or to mitigate the effects of shoreline armoring, may benefit sea turtles in areas by reestablishing nesting habitat where none currently exists. However, caution should be exercised not to automatically assume that reestablishing nesting habitat will wholly benefit sea turtle populations without determining the extent emergent erosion control structures may affect hatchling behavior.

Direct Effects

Placement of sand on a beach alone may not provide suitable nesting habitat for sea turtles. Although beach nourishment may increase the potential nesting area, significant negative effects to sea turtles may result if protective measures are not incorporated during project construction.

Nourishment and/or erosion control structure construction during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of eggs and hatchlings and, along with other mortality sources, may significantly impact the long-term survival of the species. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtles through disruption of adult nesting activity and by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program or a nest mark and avoidance program would reduce these impacts, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Even under the best of conditions, about seven percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

Potential adverse effects during the project construction phase include disturbance of existing nests, which may have been missed, disturbance of females attempting to nest, and disorientation of emerging hatchlings. Heavy equipment will be required to install the T-groins, and this equipment will have to traverse the sandy beach to the project site, which could result in harm to nesting females, nests, and emerging hatchlings. Since a large trench will be excavated on the beach and be present during the night for some portion of the construction, a potential threat to nesting females and emerging hatchlings will exist.

Following construction, the presence of erosion control structures has the potential to adversely affect sea turtles. For instance, they may interfere with the egress and ingress of adult females at nesting sites; alter downdrift beach profiles through erosion, escarpment formation, and loss of sandy berms; trap and/or obstruct hatchlings during a critical life-history stage; increase hatchling and adult female energy expenditure in attempts to overcome the structures; and attract additional predatory fish or concentrate existing predatory fish, thereby increasing in the potential of hatchling predation.

1. Nest relocation

Project construction, including both sand placement and T-groin construction, is likely to occur during the sea turtle nesting season, therefore, sea turtle nest relocation is a possibility during the estimated four to five month project construction window. Besides the potential for missing nests during a nest relocation program, there is a potential for eggs to be damaged by their movement, particularly if eggs are not relocated within 12 hours of deposition (Limpus *et al.* 1979). Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Relocating nests into sands deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard *et al.* 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard *et al.* 1985), hatchling size (Packard *et al.* 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard *et al.* 1988), and locomotory ability of hatchlings (Miller *et al.* 1987).

Comparisons of hatching success between relocated and *in situ* nests have noted significant variation ranging from a 21 percent decrease to a nine percent increase for relocated nests (Florida Department of Environmental Protection, unpublished data). Comparisons of emergence success between relocated and *in situ* nests have also noted significant variation ranging from a 23 percent decrease to a five percent increase for relocated nests (DEP, unpublished data). A 1994 Florida Department of Environmental Protection study of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida found that hatching success was lower for relocated nests in five of seven cases with an average decrease for all seven sites of 5.01 percent (range = 7.19 percent increase to 16.31 percent decrease). Emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (range = 3.6 to 23.36 percent) (Meylan 1995).

2. Missed nests

Although a nesting survey and nest marking program would reduce the potential for nests to be impacted by construction activities, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. Even under the best of conditions, about seven percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

3. Equipment

The placement of pipelines and erosion control structure construction materials, as well as the use of heavy machinery or equipment on the beach during a construction project, may also have adverse effects on sea turtles. They can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure. The equipment can also create impediments to hatchling sea turtles as they crawl to the ocean.

4. Artificial lighting

Visual cues are the primary sea-finding mechanism for hatchling sea turtles (Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). When artificial lighting is present on or near the beach, it can misdirect hatchlings once they emerge from their nests and prevent them from reaching the ocean (Philbosian 1976; Mann 1977; DEP, unpublished data). In addition, a significant reduction in sea turtle nesting activity has been documented on beaches illuminated with artificial lights (Witherington 1992). Therefore, construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, misdirect females trying to return to the surf after a nesting event, and misdirect emergent hatchlings from adjacent non-project beaches. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to predatory fishes that are also attracted to the barge lights. This impact could be reduced by using the minimum amount of light necessary (may require shielding) or low pressure sodium lighting during project construction.

5. Entrapment/physical obstruction

The erosion control structures proposed for Gasparilla Island include the construction of two T-groins and an offshore segmented breakwater that are designed to remain emergent at MHW and oriented parallel to the shoreline. As such, these structures have the potential to interfere with the egress and/or ingress of adult females at nesting sites where they may proceed around them successfully, abort nesting for that night, or move to another section of beach to nest. This may cause an increase in energy expenditure, and, if the body of the T-groin is exposed, may act as barrier between beach segments and also prevent nesting on the T-groin alignment.

T-groins constructed in Palm Beach County, Florida were observed to serve as impediments to the offshore migration by hatchlings. Howard and Davis (1999) found that 13 percent of hatchlings emerging from nests laid near T-head groins encountered the groins on their trek to the ocean. However in this case, the project design for sand placement around the T-groins was not properly followed. The project was designed to have a narrower fill section in the vicinity of the groins so the shore parallel T-heads would be seaward of the high water line and hatchlings would be able to swim over them. However, the groin section received more fill than expected which caused the high water line to be further seaward than expected. As a result, hatchlings were trapped in the corner of the structure at the head and body joint intersection. This was attributed to the exposure of the T-head and body above the high water line and the presence of artificial lighting in the vicinity of the groins which caused them to disorient in the direction of the T-groins.

In contrast, the T-groins proposed for Gasparilla Island are designed with a weir in the center of the T-head and at the point where the body joins the head to allow wave energy to pass behind the t-head and facilitating littoral transport of material downdrift of the structures. Also, the body of the groin is designed to remain buried in the shoreline. However, the total length (250 feet) of the shore-parallel head portion of each of the proposed T-groins are designed to remain emergent (+2 NGVD). Likewise the segmented breakwater structure that will maintain a +3 NGVD along each of the 300 and 250 foot segments. Therefore, it is reasonable to hypothesize that the emergent, shore-parallel structures may obstruct sea turtle hatchlings.

Currently, there are few erosion control structures with similar designs as those proposed that exist along Florida's west coast. Those that do exist include T-groins constructed on Hideaway Beach, Marco Island, Collier County; North Captiva Island, Lee County; and South Naples Beach, Collier County in 1997, 1998, and 2000, respectively. Although limited nesting has occurred near the existing T-groin structures and performance results are encouraging, monitoring has not been implemented to evaluate the effects of the structures on sea turtles, particularly in relation to the offshore migration of hatchlings.

Typically, sea turtles emerge from the nest at night when lower sand temperatures elicit an increase in hatchling activity (Witherington 1990). After emergence, approximately 20-120 hatchlings crawl *en masse* immediately to the surf using predominately visual cues to orient themselves (Witherington and Salmon 1992, Lohmann *et al.* 1997). Upon reaching the water loggerhead and green turtle hatchlings orient themselves into the waves and begin a period of hyperactive swimming activity, or swim frenzy, which lasts for approximately 24 hours (Witherington 1991, Wyneken *et al.* 1990, Salmon and Wyneken 1987). The swim frenzy effectively moves the hatchling quickly away from shallow, predator rich, nearshore waters to the relative safety of deeper water (Wyneken *et al.* 2000, Gyuris 1994).

The first hour of a hatchling's life is precarious and predation is high, but threats decrease as hatchlings distance themselves from the natal beach (Stancyk 1995, Pilcher *et al.* 1999). Delays in hatchling migration (both on the beach and in the water) can cause added expenditures of energy and an increase of time spent in predator rich nearshore water.

Rarely will hatchlings encounter natural nearshore features that are similar to the emergent shore-parallel structures proposed for this project. However, observations of hatchling behavior during an encounter with a sand bar at low tide, a natural shore-parallel barrier, showed the hatchlings maintained their shore-perpendicular path seaward, by crawling over the sand bar versus deviating from this path to swim parallel around the sand bar through the trough, an easier alternative (Witherington, personal communication, 2001). Therefore, the T-groins and segmented breakwater may adversely effect sea turtle hatchlings by serving as a barrier or obstruction to sea turtle hatchlings delaying offshore migration; depleting or increasing expenditure of the "swim frenzy" energy critical to reach the relative safety of offshore development areas; and possibly entrapping hatchlings within the crevices of the structures or within eddies or other associated currents.

6. Predator concentration

The presence of T-groins and breakwaters has the potential to attract and concentrate predatory fishes and provide perching spots for predatory birds, resulting in higher probabilities of hatchling predation as hatchlings enter the ocean and attempt to reach offshore developmental habitat. The natural hardbottom habitat adjacent to Gasparilla Island is described as patchy, low to moderate relief (2-3 feet). The nearest natural hardbottom habitat to the project site is located between R-11 and R-12, approximately 12,000 feet to the north from the proposed structures. The introduction of high relief structures such as the breakwaters and T-groins are likely to attract and concentrate predatory fish to this area where similar habitat is not naturally present and the numbers of predatory fish, such as tarpon, are currently high. Boca Grande Pass is world-renown among sport fishermen for tarpon fishing. In addition, colonization of the structures by epibenthic macroalgae, invertebrates, and other organisms will change over time and will likely result in changes of fish assemblages as the structures mature and continue to concentrate predators in the future.

It is known that hatchling predation in nearshore waters is high (Stancyk 1982, Wyneken and Salmon 1996, Gyuris 1994). There are many documented occurrences of nearshore predators captured with hatchlings found in their digestive tracts. During hatchling predation studies in Broward County, Florida, it was documented that predatory fish species, such as tarpon and snappers (*Lutjanus sp.*), targeted sea turtle hatchlings and "learned" where to concentrate foraging efforts (Wyneken 1998). Therefore, a delay in the offshore migration can cause increased predation of sea turtle hatchlings (Glenn 1998, Gyuris 1994, Witherington and Salmon 1992).

Indirect Effects

Many of the direct effects of beach nourishment and groin construction may persist over time and become indirect impacts. These indirect effects include increased susceptibility of relocated nests to catastrophic events, the consequences of potential increased beachfront development, changes in the physical characteristics of the beach, the formation of escarpments, future sand migration, increased erosion downdrift of the erosion control structures, impacts of debris on the beach from erosion control structure breakdown, and increased erosion of shorelines adjacent to borrow site as a result of ebb shoal excavation.

1. Increased susceptibility to catastrophic events
Nest relocation may concentrate eggs in an area making them more susceptible to catastrophic events. Hatchlings released from concentrated areas also may be subject to greater predation rates from both land and marine predators, because the predators learn where to concentrate their efforts (Glenn 1998, Wyneken *et al.* 1998).

2. Increased beachfront development
Pilkey and Dixon (1996) state that beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also notes that the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism there (National Research Council 1995). Increased building density immediately adjacent to the beach often resulted as older buildings were replaced by much larger ones that accommodated more beach users. Overall, shoreline management creates an upward spiral of initial protective measures resulting in more expensive development which leads to the need for more and larger protective measures. Increased shoreline development may adversely affect sea turtle nesting success. Greater development may support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas (National Research Council 1990a), and can also result in greater adverse effects due to artificial lighting, as discussed above. Any new development or redevelopment should be reviewed for opportunities to reduce artificial light affects to the nesting beaches.

3. Changes in the physical environment
Beach nourishment may result in changes in sand density or compaction, beach shear resistance or hardness, beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand (Nelson and Dickerson 1988a). These changes could result in adverse impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987, Nelson 1988).

Beach compaction and unnatural beach profiles that may result from beach nourishment activities could negatively impact sea turtles regardless of the timing of projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988a). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Fletemeyer 1980, Raymond 1984, Nelson and Dickerson 1987, Nelson *et al.* 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests and also cause increased physiological stress to the animals (Nelson and Dickerson 1988c). Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

These impacts can be minimized by using suitable sand and by tilling compacted sand after project completion. The level of compaction of a beach can be assessed by measuring sand compaction using a cone penetrometer (Nelson 1987). Tilling of a nourished beach with a root rake may reduce the sand compaction to levels comparable to unnourished beaches. However, a pilot study by Nelson and Dickerson (1988c) showed that a tilled nourished beach will remain uncompacted for up to 1 year. Therefore, the Service requires multi-year beach compaction monitoring and, if necessary, tilling to ensure that project impacts on sea turtles are minimized.

A change in sediment color on a beach could change the natural incubation temperatures of nests in an area, which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments must resemble the natural beach sand in the area. Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the time-frame for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

For the proposed Gasparilla Island project, a compatibility analysis of the native beach sediment and the sediment at the proposed borrow area was conducted. A composite grain size distribution curve of each sediment core was compared to the composite grain size distribution curve of the existing beach sediment. Frequency distribution curves of the composite grain size distribution of each sediment core were compared to the frequency distribution curve of the composite grain size distribution of the existing beach. Inspection of these curves indicates that the borrow area sediments are more evenly distributed between coarse and fine material, whereas the existing beach sediment is sorted into predominately medium to fine grained material (DEP 2001).

A weighted average was used to estimate the composite grain size distribution and shell content of the native beach sediment and borrow area sediment, based on a zone of influence for each sediment sample across the beach profile or sediment core within the borrow area. The estimated composite median and mean grain size of the existing beach sediments (upland of MHW) is 0.295 mm and 0.320 mm, respectively, with a shell content of approximately 11 percent. The estimated composite median and mean grain size of the fill material from the borrow area is 0.388 mm and 0.526 mm, respectively, with a shell content of approximately 31 percent. The larger median and mean grain sizes is attributed to the higher percentage of shell found in the borrow area sediments as compared to the existing beach. The higher shell content also contributes a light gray tint to the color of the borrow area sediments (DEP 2001).

Based upon the information and analysis provided by the applicant, the beach fill material to be excavated from the proposed borrow area is expected to maintain the general character and functionality of the material occurring on the beach and in the adjacent dune and coastal system (DEP 2001).

4. Escarpment formation

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984, Nelson *et al.* 1987). In addition, escarpments may develop on the crenulate beaches located between groins as the beaches equilibrate to their final positions. These escarpments can hamper or prevent access to nesting sites (Nelson and Blihovde 1998). Researchers have shown that female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of the escarpments, which often results in failure of nests due to prolonged tidal inundation). This impact can be minimized by leveling any escarpments prior to the nesting season.

The relatively new T-groin design proposed for Gasparilla Island is a refinement of three recently constructed T-groin projects on Florida's west coast as follows: experimental T-groins were constructed using geotextile bags on Hideaway Beach, Marco Island, Collier County; rock T-groins were constructed on the Kohler property, North Captiva Island, Lee County; and modified rock T-groins were constructed on South Naples Beach, Collier County in 1997, 1998, and 2000, respectively. Monitoring results of the three projects has shown that the performance of the proposed design is significantly different from conventional terminal groin and T-groin designs, including the T-groins constructed in Palm Beach County (Humiston 2001), as described in the preceding "Direct Effects" section of this document.

All three projects using the proposed design demonstrate that this design may minimize erosion escarpments within the groin field, and may reduce escarpment formation on adjacent beaches. Monitoring data show that previously high downdrift erosion rates have been significantly reduced (Humiston and Moore Engineers 2000, Humiston and Moore Engineers 2001a, Humiston and Moore Engineers 2001b). For instance, downdrift erosion on North Captiva Island was reduced from an average of approximately 20 feet per-year during the year of T-groin construction, to approximately five feet per-year, three years later. Though preconstruction survey data from the downdrift shoreline on North Captiva Island do not exist, analysis of historical aerial photographs indicated pre-groin erosion rates of approximately 30 feet per-year (Humiston 2001).

5. Downdrift erosion related to erosion control structures

Erosion control structures (e.g., terminal groins,T-head groins, and breakwaters), in conjunction with beach nourishment, can help stabilize U.S. East Coast barrier island beaches (Leonard *et al.* 1990). However, groins and breakwaters often result in accelerated beach erosion downdrift of the structures (Komar 1983, National Research Council 1987, U.S. Army Corps of Engineers 1992) and corresponding degradation of suitable sea turtle nesting habitat (National Marine

Fisheries Service and U.S. Fish and Wildlife Service 1991a, 1991b, 1992). Impacts first are noted and greatest changes are observed close to the structures, but effects eventually may extend great distances along the coast (Komar 1983). Beach nourishment only partly alleviates impacts of groin construction on downdrift beaches (Komar 1983).

Terminal groins operate by blocking the natural littoral drift of sand (Kaufman and Pilkey 1979, Komar 1983). Once sand fills the updrift groin area, some littoral drift and sand deposition on adjacent downdrift beaches occurs due to spillover. But, groins often force the river of sand into deeper offshore water, and sand that previously would have been deposited on downdrift beaches is lost from the system (Kaufman and Pilkey 1979). Conventional terminal rubble mound groins control erosion by trapping sand and dissipating some wave energy. In general, terminal groins are not considered a favorable erosion control alternative because they usually impart stability to the updrift beach and transfer erosion to the downdrift side of the structure. Additionally, they deflect longshore currents offshore, and excess sand built up on the updrift side of the structure may be carried offshore by those currents. This aggravates downdrift erosion and erosion escarpments are common on the downdrift side of terminal groins (Humiston 2001).

Likewise, conventional T-groins function in a manner similar to a regular conventional groin, except that the shore parallel section adds a breakwater-like feature which dissipates more wave energy than a shore-perpendicular groin. A conventional T-groin consists of a terminal groin with a shore parallel section connected to the seaward end. However, the conventional T-head groin may also act as a barrier to littoral transport and result in adverse downdrift impacts (Humiston 2001).

Unlike conventional T-groins, the T-groins proposed for the Gasparilla Island Project were designed specifically to minimize potential adverse effects downdrift of the structures. For instance, they have a low profile trunk section which is below mean low water (MLW) behind the T-section. This allows longshore current and sand transport to continue landward of the T-section. In addition, the T-head portion of the groin has low profile and a weir or gap in the center to allow the passage of wave energy to improve sand bypassing behind the structure (Humiston 2001).

Breakwaters are designed to attenuate wave energy which reduces the primary cause of erosion. Additionally, breakwaters modify wave patterns through diffraction. The combination of these factors on wave energy modifies the local littoral transport rates and may result in the accumulation of sand and minimization of erosion along the shoreline behind the breakwater. When properly designed, the shoreline forms a salient (sand accumulating prominently behind, but does not connect to the breakwater) which achieves a state of equilibrium, and once equilibrium is achieved, sand transport past the structure resumes thereby minimizing the potential of adverse downdrift effects. (Humiston and Moore 2001). The segmentation of the proposed segmented breakwater is designed to minimize this effect.

However, breakwaters may adversely affect the adjacent shoreline if they are not properly designed. They may form a tombolo (sand accumulating prominently behind and connecting to the breakwater). This creates a situation where the breakwater acts as a headland (a prominent land feature) rather than an offshore feature. The breakwater functions as a barrier to the longshore transport of material in a manner similar to a conventional terminal groin, resulting in offshore sand movement and downdrift erosion. Therefore, erosion may increase downdrift of the structure thus compromising suitable sea turtle nesting habitat.

6. Erosion control structure breakdown
If the structures fail and break apart, debris may spread upon on the beach, which may further impede nesting females from accessing suitable nesting sites (resulting in a higher incidence of false crawls) and trap hatchlings and nesting turtles (U.S. Fish and Wildlife Service 1991a, 1991b).

7. Erosion as a result of nearshore dredging activities
Future sand displacement on nesting beaches is a potential adverse effect of the nourishment project. Dredging of sand nearshore of the project area has the potential to cause erosion erosion of the newly created beach or other areas on the same adjacent beaches by creating a sand sink. The remainder of the system responds to this sand sink by providing sand from adjacent beaches in an attempt to reestablish equilibrium (National Research Council 1990b)

The borrow site includes a portion of the Boca Grande Pass ebb tidal shoal located on the north side of the inlet channel approximately two miles west of the inlet entrance. Coastal process numerical modeling and analysis were conducted to demonstrate the potential effects of the borrow area excavation on the coastal littoral system. The analysis indicated that the adjacent shores of Gasparilla and Cayo Costa Islands, and Johnson Shoals on the south side of the inlet in the nearshore area west of Cayo Costa Island may experience some adverse effects consisting of minor modification in the variability of shoreline position or patterns of erosion and accretion. The Corps anticipates that ebb shoal dredging will not have a significant adverse effect on the coastal system in a manner that may increase erosion or render the system unstable or vulnerable to the effects of storms or interfere with its ability to recover from storms. However, a monitoring program is proposed to assess the effects of the excavation of the ebb shoal borrow area. In addition, if the monitoring determines adverse effects have occurred, mitigation will be provided by the applicant for any erosion effects to the adjacent coastal system attributable to alteration of the inlet as described in the DEP Joint Coastal Permit number 0174403-001-JC, Gasparilla Island Beach Restoration. This requirement will also be incorporated into the Corps permit.

Species' response to the proposed action

Ernest and Martin (1999) conducted a comprehensive study to assess the effects of beach nourishment on loggerhead sea turtle nesting and reproductive success. The following findings illustrate sea turtle responses to and recovery from a nourishment project. A significantly larger proportion of turtles emerging on nourished beaches abandoned their nesting attempts than turtles emerging on Control or pre-nourished beaches. This reduction in nesting success was most pronounced during the first year following project construction and is most likely the result of changes in physical beach characteristics associated with the nourishment project (e.g., beach profile, sediment grain size, beach compaction, frequency and extent of escarpments). During the first post-construction year, the time required for turtles to excavate an egg chamber on the untilled, hard-packed sands of one treatment area increased significantly relative to Control and background conditions. However, in another treatment area, tilling was effective in reducing sediment compaction to levels that did not significantly prolong digging times. As natural processes reduced compaction levels on nourished beaches during the second post-construction year, digging times returned to background levels.

During the first post-construction year, nests on the nourished beaches were deposited significantly farther from both the toe of the dune and the tide line than nests on control beaches. Furthermore, nests were distributed throughout all available habitat and were not clustered near the dune as they were in the control. As the width of nourished beaches decreased during the second year, among-treatment differences in nest placement diminished. More nests were washed out on the wide, flat beaches of the nourished treatments than on the narrower steeply sloped beaches of the control. This phenomenon persisted through the second post-construction year monitoring and resulted from the placement of nests near the seaward edge of the beach berm where dramatic profile changes, caused by erosion and scarping, occurred as the beach equilibrated to a more natural contour.

As with other beach nourishment projects, Ernest and Martin (1999) found that the principal effect of nourishment on sea turtle reproduction was a reduction in nesting success during the first year following project construction. Although most studies have attributed this phenomenon to an increase in beach compaction and escarpment formation, Ernest and Martin indicate that changes in beach profile may be more important. Regardless, as a nourished beach is reworked by natural processes in subsequent years and adjusts from an unnatural construction profile to a more natural beach profile, beach compaction and the frequency of escarpment formation decline, and nesting and nesting success return to levels found on natural beaches.

Similar short-term effects to listed sea turtle species and their habitat are anticipated to occur as a result of construction activities related to the proposed project. Generally, these adverse effects are limited to the first year after construction. The Service believes there is a potential for long-term adverse effects on sea turtle hatchlings as a result of the introduction of the permanent shore-parallel, erosion control structures. However, the Service acknowledges the potential benefits of the erosion control structures since they may minimize the effects of erosion on sea turtle nesting habitat, provide habitat seaward of shoreline stabilization structures within the project area, and extend the renourishment interval, particularly in the vicinity of the Belcher Road seawall. Nonetheless, an increase in sandy beach may not necessarily equate to an increase in suitable sea turtle nesting habitat.

MONITORING

During meetings with the Service, Lee County and H&M, FWC, and DEP, it was agreed that including a sea turtle hatchling monitoring protocol in the project design was warranted. The goals and extent of the monitoring are to be clearly defined. The participants of the meetings agreed to serve as part of the sea turtle Hatchling Monitoring Review Team (HMRT) to help develop the plan and objectives.

Mote Marine Laboratory agreed to develop the hatchling monitoring plan. The draft monitoring design is included as Appendix A of this document. The goal of the monitoring plan is to address the following questions:

1. After emerging from the nest, do sea turtle hatchlings encounter the T-groins or segmented breakwater as they attempt their offshore migration to nursery grounds?
2. If they encounter a structure(s), how do the hatchlings interact with the structure(s)?
3. Can the hatchlings overcome the structure? If so, how?
4. If they can overcome the obstruction, how much time does it take for the hatchlings to overcome the obstruction?
5. If obstructed, does predation occur?

Lee County has offered to lead an advisory team comprised of the members of the HMRT as well as other invited members yet to be determined. Since its difficult to determine key elements (e.g.: control sites) of the monitoring plan prior to construction, the purpose of the team is to provide guidance to implement the hatchling monitoring plan in a manner consistent to its intent. If modifications of the draft monitoring plan are required, the advisory team will be consulted and a consensus will be reached prior to adoption of the modification.

After completion of the sea turtle hatchling monitoring, a final report will be generated which includes: an evaluation of the data and a determination of the effects of the erosion control structures on sea turtle hatchlings. This report may constitute new information pertaining to adverse impacts to sea turtles; therefore, reinitiation of consultation under the ESA may be necessary .

In addition, the Corps and DEP have required additional post-project monitoring as permit conditions ,to evaluate the effects of erosion control structure construction and ebb shoal excavation on shorelines downdrift and adjacent to the project area. If the results of the monitoring reveal a significant adverse effect on sea turtle nesting habitat, reinitiation of consultation with the Service may be necessary.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of any cumulative effects in the project area.

CONCLUSION

The proposed project will affect three miles of the approximately 1,400 miles of available sea turtle nesting habitat in the southeastern United States. Research has shown that the principal effect of beach nourishment on sea turtle reproduction is a reduction in nesting success, and this reduction is most often limited to the first year following the initial sand placement and subsequent renourishment events. Research has also shown that the impacts of a nourishment project on sea turtle nesting habitat are typically short-term because a nourished beach will be reworked by natural processes in subsequent years, and beach compaction and the frequency of escarpment formation will decline. However, long-term adverse effects to adult and hatchling sea turtles are anticipated as a result the erosion control structures. The principle long-term effects of the permanent placement of the structures are expected to affect hatchling success within 1.5 miles of the erosion control structures for the duration of the structures' existence. Although a variety of factors, including some that cannot be controlled, can influence how a beach renourishment and/or erosion control structure construction project will perform from an engineering perspective, measures can be implemented to minimize adverse impacts to sea turtles.

Therefore, after reviewing the current status of the loggerhead and green sea turtles, the environmental baseline for the action area, the short-term and long terms effects of the proposed project, and the cumulative effects, it is the Service's biological opinion that the construction project, as proposed, is not likely to jeopardize the continued existence of the loggerhead and green sea turtles and is not likely to destroy or adversely modify designated critical habitat. No critical habitat has been designated for the loggerhead and green sea turtles in the continental United States; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates three miles of nesting beach habitat could be taken as a result of the proposed action. The take is expected to be in the form of: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and marking program within the boundaries of the proposed project; (2) destruction of all nests deposited during the period when a nest survey and marking program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities and/or erosion control structure presence; (5) behavior modification of nesting females or hatchlings due to the presence of the erosion control structures, which may act as barriers to movement; (6) behavior modification of nesting females if they dig into shallowly buried T-groins, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; (7) misdirection of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (8) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (9) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service.

Incidental take is anticipated for the three miles of beach that have been identified for sand placement and erosion control structure construction. The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) the turtles nest primarily at night and all nests are not found because [a] natural factors, such as rainfall, wind, and tides may obscure crawls and [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) the total number of hatchlings per undiscovered nest is unknown; (3) the reduction in percent hatching and emerging success per relocated nest over the natural nest site is unknown; (4) an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area; (5) lights may misdirect an unknown number of hatchlings and cause death; (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site; (7) erosion control structures may obstruct or entrap an unknown number of adult and hatchling sea turtles during ingress or egress at nesting sites; and (8) an unknown number of hatchlings may be predated as a result of obstruction and/or increased predators at erosion control structures. However, the level of take of these species can be anticipated by the disturbance of project construction on suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) project construction will likely occur during a portion of the nesting season; (3) erosion control structures will modify beach profile and width and may increase the presence of escarpments; (4) beach renourishment will modify the incubation substrate, beach slope, and sand compaction; and (5) artificial lighting will deter and/or misdirect nesting females and hatchlings.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. Critical habitat has not been designated in the project area; therefore, the project will not result in destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of loggerhead and green sea turtles.

1. Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence must be used on the project site.

2. If the beach nourishment project will be conducted during the sea turtle nesting season, surveys for nesting sea turtles must be conducted. If nests are deposited in the project footprint and subject to potential construction related disturbance within 65 days, the eggs must be relocated.

3. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, beach compaction must be monitored and tilling must be conducted as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.

4. If the proposed project will be conducted during the sea turtle nesting season, sea turtle protection measures as detailed in the following Terms and Conditions sectionmust be employed to minimize the likelihood of take.

5. Immediately after completion of the project and prior to the next three nesting seasons, monitoring must be conducted to determine if escarpments are present and escarpments must be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.

6. For three years after construction, a sea turtle hatchling monitoring plan will be implemented to evaluate the extent of take as a result of the erosion control structures.

7. Contractors conducting the beach renourishment and groin construction work must fully understand the sea turtle protection measures detailed in this incidental take statement.

8. During the sea turtle nesting season, all construction equipment and materials must be stored in a manner that will minimize impacts to sea turtles to the maximum extent practicable.

9. During the sea turtle nesting season, lighting associated with the project must be minimized to reduce the possibility of disrupting and misdirecting nesting and/or hatchling sea turtles.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. In accordance with the 2001 rule change under subsection 62B-41.007, Florida Administrative Code, all fill material placed on the beach must be analogous to that which naturally occurs within the project location or vicinity in quartz to carbonate ratio, color, median grain size and median sorting. Specifically, such material shall be predominately of carbonate, quartz or similar material with a particle size distribution ranging between 0.62 mm and 4.76 mm (classified as sand by either the Unified Soil Classification System or the Wentworth classification). The material shall be similar in color and grain size distribution (sand grain frequency, mean and median grain size, and sorting coefficient) to the material in the existing coastal system at the disposal site and shall not contain:

1a. greater than five percent, by weight, silt, clay, or colloids passing the #230 sieve; greater than five percent, by weight, fine gravel retained on the #4 sieve;
1b. coarse gravel, cobbles, or material retained on the 3/4 inch sieve in a percentage or size greater than found on the native beach;
1c. construction debris, toxic material, or other foreign matter; and not result in cementation of the beach.

These standards must not be exceeded in any 1000 square foot section, extending through the depth of the renourished beach. If the natural beach exceeds any of the limiting parameters listed above, then the fill material must not exceed the naturally occurring level for that parameter.

2. Daily early morning surveys for sea turtle nests will be required if any portion of the beach nourishment project and/or groin construction project occurs during the period from April 1 through November 30. Nesting surveys must be initiated 65 days prior to nourishment and/or groin construction activities or by April 1, whichever is later. Nesting surveys must continue through the end of the project or through September 30, whichever is earlier. If nests are constructed in areas where they may be affected by beach nourishment activities, eggs must be relocated per the following requirements.

2a. Nesting surveys and egg relocations will only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. Surveyors must have a valid FWC permit. Nesting surveys must be conducted daily between sunrise and 9 a.m. Surveys must be performed in such a manner so as to ensure that beach nourishment activity does not occur in any location prior to completion of the necessary sea turtle protection measures.

2b. Only those nests that may be affected by beach nourishment activities will be relocated. Nests requiring relocation must be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with beach nourishment activities must cease when beach nourishment activities no longer threaten nests.

2c. Nests will not be relocated for T-groin construction purposes unless beach nourishment activities are in progress or will be starting within 65 days. Nests deposited within areas where beach nourishment activities have ceased or will not occur for 65 days must be marked and left in place unless other factors threaten the success of the nest. Any nests left in the T-groin construction area must be clearly marked. Nests will be marked and the actual location of the clutch determined. A circle with a radius of 10 feet, centered at the clutch, will be marked by stake and survey tape or string. No construction activities will enter this circle and no adjacent construction that might directly or indirectly disturb the area within the staked circle will be allowed.

3. Immediately after completion of the beach nourishment project and prior to April 1 for three subsequent years, sand compaction must be monitored in the area of restoration in accordance with a protocol agreed to by the Service, the State regulatory agency, and the applicant. At a minimum, the protocol provided under 3a and 3b below must be followed. If required, the area must be tilled to a depth of 24 inches. All tilling activity must be completed prior to April 1. If the project is completed during the nesting season, tilling will not be performed in areas where nests have been left in place or relocated. An annual summary of compaction surveys and the actions taken must be submitted to the Service. (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Also, out-year compaction monitoring and remediation are not required if placed material no longer remains on the dry beach.)

3a. Compaction sampling stations must be located at 500-foot intervals along the project area. One station must be at the seaward edge of the dune/bulkhead line (when material is placed in this area), and one station must be midway between the dune line and the high water line (normal wrack line).

At each station, the cone penetrometer will be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates will be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth will be averaged to produce final values for each depth at each station. Reports will include all 18 values for each transect line, and the final 6 averaged compaction values.

3b. If the average value for any depth exceeds 500 pounds per-square inch (psi) for any two or more adjacent stations, then that area must be tilled immediately prior to April 1. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the Service will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.

4. Visual surveys for escarpments along the project area must be made immediately after completion of the beach nourishment project and prior to April 1 for 3 subsequent years. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet must be leveled to the natural beach contour by April 1. If the project is completed during the sea turtle nesting and hatching season, escarpments may be required to be leveled immediately, while protecting nests that have been relocated or left in place. The Service must be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken must be submitted to the Service. (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the beach.)

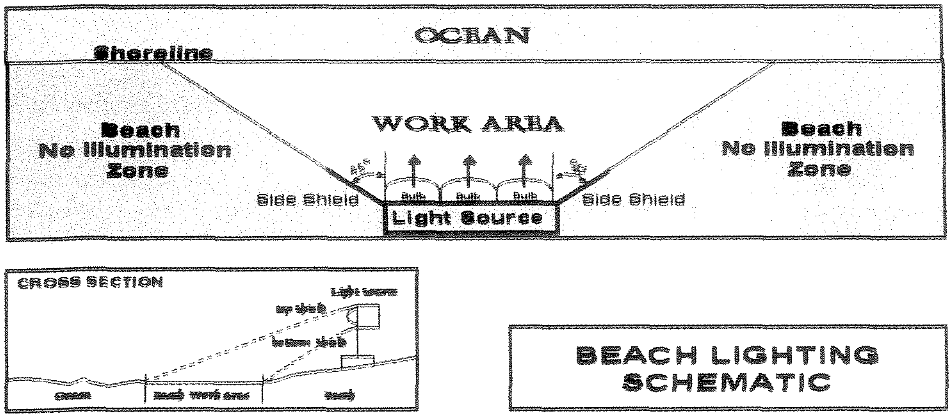
5. The applicant must arrange a meeting between representatives of the contractor, the Service, the FWC, and the permitted person responsible for nest marking and/or egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice must be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

6. From April 1 through November 30, staging areas for construction equipment must be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment and erosion control structure construction materials not in use must be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes and erosion control structure construction materials that are placed on the beach must be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes and groin construction materials must be off the beach to the maximum extent possible. Temporary storage of pipes on the beach must be in such a manner so as to impact the least amount of nesting habitat and must likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

7. During groin construction, no temporary lighting of the groin construction area is authorized at anytime during the sea turtle nesting season from April 1 through November 30 with the following exception. Lighting will be allowed if safety lighting is required at any excavated trenches that must remain on the beach at night. This lighting must be limited to the immediate construction area only and must be the minimal lighting necessary to comply with safety requirements.

8. During sand placement, from April 1 through November 30, direct lighting of the beach and nea shore waters must be limited to the immediate construction area and must comply with safety requirements. Lighting on offshore or onshore equipment must be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the waters surfac

and nesting beach while meeting all Coast Guard, EM 385-1-1, and OSHA requirements. Light intensity of lighting plants must be reduced to the minimum standard required by OSHA for General Construction areas, in order not to mis-direct sea turtles. Shields must be affixed to the light housing and be large enough to block light from all lamps from being transmitted outside the construction area (see figure below).



9. No permanent exterior lighting will be installed in association with this construction project.

10. In the event the erosion control structures fail or begin to disintegrate, all debris and structural material must be removed from the nesting beach area and deposited off-beach immediately. If maintenance of the erosion control structures is required during the period from April 1 to November 30, no work will be initiated without prior coordination with the South Florida Ecological Services Office.

11. The erosion control structures must be removed or modified if they are determined to not be effective or to be causing a significant adverse impact to the beach and dune system.

12. A report describing the actions taken to implement the terms and conditions of this incidental take statement must be submitted to the South Florida Ecological Services Office within 60 days of completion of the proposed work for each year when the activity has occurred. This report will include the dates of actual construction activities; names and qualifications of personnel involved in nest surveys, marking, and relocation activities; descriptions and locations of self-release beach sites; nest survey, marking, and relocation results; and hatching and emerging success of nests.

13. In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for nest marking and/or egg relocation for the project must be notified so the eggs can be moved to a suitable relocation site.

14. Upon locating a sea turtle adult, hatchling, or egg harmed or destroyed as a direct or indirect result of the project, notification must be made to the FWC, Bureau of Marine Enforcement (formerly the Florida Marine Patrol) at 800-342-5367. Care should be taken in handling injured

turtles or eggs to ensure effective treatment or disposition, and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

15. In accordance with the Sea Turtle Hatchling and Erosion Control Structure Interaction Monitoring Protocol as described in Appendix A, implement the monitoring after construction for three consecutive years as approved to by the Service, FWC, DEP and the applicant. However, the proposed monitoring plan protocol may be modified if post-project conditions or other factors warrant, provided the Service concurs with the modifications. Interim, annual, and final reports will be provided to the Service and the participating resource agencies as described in Appendix A.

The Service believes that incidental take will be limited to nests and hatchlings associated with the three miles of beach that have been identified as the project area which includes sand placement and erosion control structure construction. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes that no more than the following types of incidental take will result from the proposed action: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and marking program within the boundaries of the proposed project; (2) destruction of all nests deposited during the period when a nest survey and marking program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the location site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the project construction area or on adjacent beaches as a result of construction activities and/or erosion control structure presence; (5) behavior modification of nesting females or hatchlings due to the presence of the erosion control structures which may act as barriers to movement; (6) behavior modification of nesting females if they dig into shallowly buried T-groins, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; (7) misdirection of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (8) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; (9) behavior modifications of hatchlings if they encounter the erosion control structures, resulting in entrapment, obstruction, or predation; and (10) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Fish and Wildlife Service. The amount or extent of incidental take for sea turtles will be considered exceeded if the project results in more the placement of sand more than once on the three miles of beach proposed for construction. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Construction activities for this project and similar future projects should be planned to take place outside the sea turtle nesting and hatching season.

2. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The DEP, Office of Beaches and Coastal Systems can provide technical assistance on the specifications for design and implementation.

3. Surveys for nesting success of sea turtles should be continued for a minimum of three years following project construction to determine whether sea turtle nesting success has been adversely effected.

4. Extend the Sea Turtle Hatchling Monitoring activities beyond the three years required to assess the long term effects of erosion control structures on the migration of hatchlings from the nest to the ocean.

5. Educational signs should be placed at appropriate beach access points to explain the life history of sea turtle species that nest in the area.

6. In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

7. Evaluate compliance with the Lee County Lighting Ordinance pre- and post- construction in the project area, particularly within the vicinity of the erosion control structures and prior to implementation of the hatchling monitoring protocol.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; and (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Should you have additional questions or require additional clarification regarding this matter, please contact Trish Adams at (772) 562-3909, extension 232.

Sincerely yours,

Linda S. Ferrell for

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc.

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FWC, Office of Protected Species Management, Tallahassee, Florida (Robbin Trindell)
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NMFS, Habitat Conservation Division, St. Petersburg, Florida
NMFS, Protected Resources Division, St. Petersburg, Florida
EPA, West Palm Beach, Florida
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Appendix A

Gasparilla Island Beach Nourishment Project: Hatchling Marine Turtle Interaction with Erosion Control Structure Study.

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Introduction
The beaches along the central Gulf coast of Florida provide vital nesting habitat for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. In addition, these beaches have supported incidental nesting of the Kemp's ridley (*Lepidochelys kempi*) and the leatherback (*Dermochelys coriacea*) sea turtle. All four are listed as threatened or endangered, and are provided protection under the Federal Endangered Species Act of 1973, as well as the Marine Turtle Protection Act Chapter 370.12 (Florida Administrative Code).

Hatchling marine turtles emerge from eggs deposited in nests following an incubation period of 43 to 75 days (Mote Marine Laboratory, Sea Turtle Conservation & Research Program data). Typically, emergence from the nest occurs at night (Witherington, 1990) when lower sand temperatures elicit an increase in hatchling activity. Emergence occurs *en masse*, usually involving between 20 and 120 hatchlings (Lohmann et al., 1997). After emerging from the sand hatchlings crawl immediately to the surf using predominately visual cues to orient themselves (Witherington and Salmon, 1992, Lohmann et al., 1997). Upon reaching the water loggerhead and green sea turtle hatchlings orient themselves into waves (Witherington, 1991; Wyneken et al., 1990) and begin a period of hyperactive swimming activity, or swim frenzy, which lasts for approximately 24 hours (Salmon and Wyneken, 1987). The swim frenzy effectively moves the hatchling quickly away from shallow water, rich in predatory fish, and out to the relative safety of deeper water (Wyneken, 2000; Gyuris, 1994).

The first hour of a hatchling's life is precarious and predation is high but decreases as hatchlings distance themselves from the natal beach (Stancyk, 1982, Pilcher et al., 1999). Delays in hatchling migration (both on the beach and in the water) can cause added expenditures of energy and an increase of time spent in predator rich shallow water. Thus a delay in the offshore migration can cause increased predation of the hatchlings (Glenn, 1998; Gyuris, 1994; Witherington and Salmon, 1992) .

Objectives
The southern shoreline of Gasparilla Island in Lee County has been designated as critically eroded by the Florida Department of Environmental Protection (FDEP). The Lee County Board of County Commissioners petitioned the FDEP (File No. 0174403-001-JC) to conduct beach restoration/renourishment during the year 2002. The restoration project shoreline is located at the southern end of Gasparilla Island adjacent to Gasparilla Island Pass. Sand placement is to occur between FDEP reference monuments R-10 and R-26 (Figure 1 and 2 taken from above referenced file#).

Figure 1

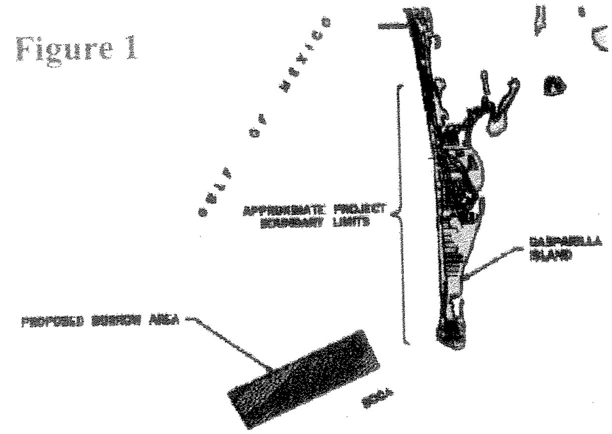
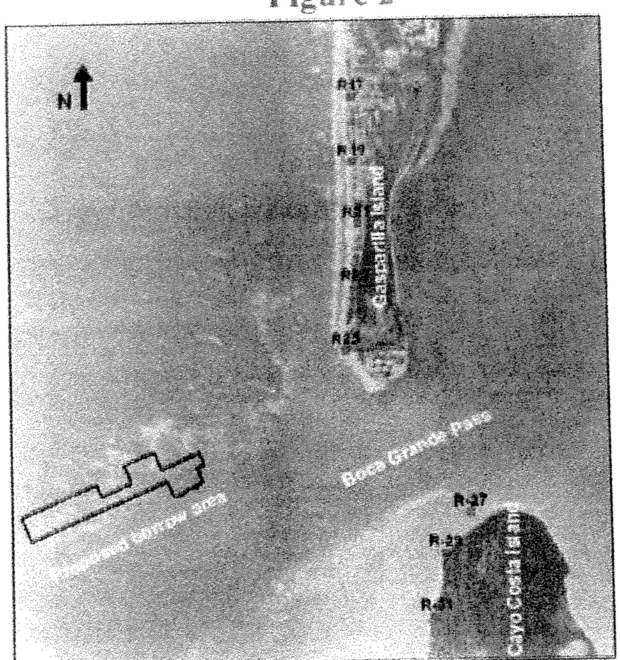


Figure 2



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In addition to the beach fill, a segmented emergent breakwater is to be constructed approximately 325 feet offshore from FDEP reference monument R-25 and two T-groins are to be constructed between R-25 and R-26.

Sea turtle nest monitoring, marking, protection and evaluation for the project shoreline is to be coordinated through a cooperative effort between the Florida Fish and Wildlife Conservation Commission (FWC), Lee County Natural Resources Department, Florida Park System and the Gasparilla Island Turtle Watch. Because sea turtles utilize the sandy beaches of Gasparilla Island for nesting and because no definitive studies have documented the effects that these structures have on sea turtle hatchlings, this scope of work is designed to 1) identify the behavior of sea turtle hatchlings upon encountering the structures, and 2) document incidents, if any, of predation from nearshore fish populations.

Erosion Control Structures

The offshore-segmented breakwater (emergent) to be constructed 325 feet offshore from FDEP reference monument R-25 consists of two segments with a small gap between. The breakwater is a rubble mound type structure with a total combined length of 550 feet and a crest elevation of +3 feet (NGVD). Two T-groins scheduled for the shoreline south of the breakwater are to be constructed of sheet piles with a rock apron in the seaward side of the T-groin segments. The length of the head of each T is to be 200 feet with a crest elevation of +2 feet (NGVD). The "T head" is shore parallel and the "body of the T" is shore perpendicular for a distance of 235 feet. Rocks averaging five tons each will form the breakwater armor and rocks averaging two tons each will form the T-groin aprons.

Problem Statement

Gasparilla Island provides vital nesting habitat for loggerhead (*Caretta caretta)* and green (*Chelonia mydas*) sea turtles both of which are protected under the U.S. Endangered Species Act of 1973 and the Marine Turtle Protection Act Chapter 370.12 (Florida Administrative Code). Florida Administrative Code includes in its definition of "take" significant habitat modification or degradation that kills or injures marine turtles by significantly impairing essential behavioral patterns. Under these regulations it is illegal for an unauthorized take of a sea turtle or any parts of a sea turtle, sea turtle eggs or hatchlings.

Historic data demonstrate a range of 76 to 289 loggerhead nests and 4 green turtle nests for the years 1997 through 2000 (FL FWC data for Lee County, Gasparilla Island; maps provided by Humiston & Moore Engineers). Although nest numbers within the erosion control project area (~R-23-R-6A) are few, 16 nests and 17 non-nesting emergences, or false crawls, were documented in 1999, and 19 nests and 12 non-nesting emergences were documented in 2000.

The erosion control structures are proposed to absorb wave energy and minimize sand scouring thus providing a sandy beach for humans, for property protection and for sea turtle nesting habitat. If the structures perform successfully and adequate sand remains within the project area it is probable that sea turtles will nest near the erosion control structures. To date there are few data available regarding sea turtle hatchling reactions/interactions with the offshore emergent breakwaters or shoreline T-groins. There are currently few similar structures along the West Florida shoreline. These Gulf coast structures can be found at 1) at Marco Island in Collier County, 2) in Naples, north of Gordon Pass, Collier County, and 3) at North Captiva Island, at the north side of Redfish Pass in Lee County. Monitoring has shown that the existing structures on the west coast have improved beach stability leading to additional nesting habitat (Ken Humiston, Humiston & Moore Engineers, personal communication). No adverse impacts have been documented although only limited nesting has occurred near the existing structures, additionally, there has been minimal monitoring effort to evaluate the failure or success of the hatchling migration from the shoreline to and/or beyond these structures. One T-groin of dissimilar design on the east Florida coast in Palm Beach County was found to cause a delay in the offshore migration of 13% of the hatchlings emerging from nests near the structures (Davis et al., 2000). It is currently unknown whether the emergent breakwater and/or the T-groins have potential for 1) obstructing the movement of sea turtles and/or hatchlings, or 2) causing increased predation of hatchlings as they swim near the structures.

Questions

7. How do hatchling sea turtles, after emerging from the nest, interact with T-groins and breakwater structures?
8. Can hatchlings get around/through the T-groins to achieve open Gulf waters?
9. Can hatchlings get past emergent, shore parallel breakwater structures?
10. Are hatchlings delayed in offshore migration by the structures, and if so, does the delay cause increased predation?
11. If there is a take, what are the possible predators?
12. If there is a take, what percentage is being taken? *(Or If there is a take is it significant?)*
13. Over time, the structures will be colonized by benthic, algal and fish species. Is there a possibility of increased predation near the structures in future years?
14. *If impacts from the structures are identified, do the benefits of restoring and stabilizing critically eroded shoreline outweigh the structure's impacts.*

Nearshore predation

Strong tidal currents along the south Gasparilla Island shoreline create hazardous conditions for navigation under present conditions. Although the shore protection design is intended to reduce currents in the vicinity of the structures, will this have an effect on the offshore navigation of the hatchlings? Predation on hatchlings in nearshore waters is high (Stancyk, 1982; Wyneken et al., 1996, Gyuris, 1994) There are many documented occurrences of nearshore predators captured with hatchlings found in their digestive tracts. Any impediment to sea turtle hatchlings rapid offshore migration could cause increased predation on the hatchlings and/or create a situation in which the swim frenzy is "used up" prior to the hatchlings getting away from the nearshore area.

During hatchling predation studies on the East Coast of Florida Jeanette Wyneken of Florida Atlantic University documented species of predatory fish targeting sea turtle hatchlings in nearshore habitat (Wyneken, 1996; Wyneken et al., 2000). The fish were captured and found to have hatchlings in their gastro-intestinal tract or they were observed eating hatchlings. The fish documented during these studies include: Tarpon (*Megalops atlanticus*), Mangrove Snapper (*Lutjanus griseus*), Great Barracuda (*Sphyraena barracuda*), Hardhead Catfish (*Arius felis*), Red

Grouper (*Epinephelus morio*), Crevalle Jack (*Caranx hippos*), Blue Runners (*Caranx crysos*) and Reef Squid (*Sepiateuthis sepiodea*). Small sharks were also observed feeding on hatchlings (Gyuris, 1994). Tarpon and Crevalle Jack are abundant in Charlotte Harbor (Williams et al., 1990) as well as bull (*Carcharhinus leucas*), great hammerhead (*Sphyrna mokarran*), nurse (*Ginglymostoma cirratum*), tiger (*Galeocerdo cuvier*), lemon (*Negaprion brevirostris*), blacktip (*Carcharhinus limbatus*), blacknose (*Carcharhinus acronotus*) and bonnethead (*Sphyrna tiburo*) sharks (Mote Marine Laboratory, Center for Shark Research data).

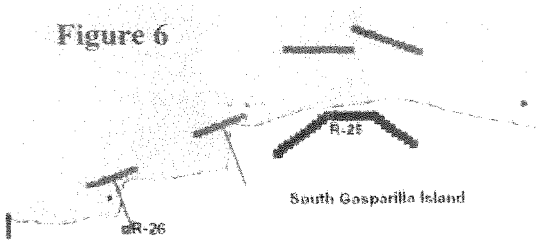
Exposed rock along beaches of Lee County provide substrate for the attachment of epibenthic macroalgae. The algae provide food for herbivorous fish, marine turtles, and invertebrates. In addition to the algal food, which grows on the reefs, fish and invertebrates are attracted to the basic structure of the reef and rapid rates of colonization occur. Because of the obvious potential for similar colonization of the submerged rocks on the breakwater and T-groin structures there is the potential for increased numbers of fish near the structures. Will hatchlings leaving the shoreline near the structures be slowed in their movement past or around the structures and thus be at increased risk of predation? Will the predation risk become higher as the colonization of the structures increases over time?

For comparative purposes, there are no naturally occurring habitats similar to these erosion control structures. Water at the breakwaters is projected to be approximately -14 feet for the entire 550 feet of breakwater structure and the base is wider than it is high. If predation does occur and there is evidence of increased predation at the structure as it is colonized, at what point does the loss of these animals create an overall disadvantage for the species? For example, the beach restoration and structures are engineered to build up sand where there currently is none. If the structures are successful and sand accumulates, there is a strong probability that turtles will begin nesting here thus increasing the number of hatchlings successfully entering the water. If hatchlings leaving the beach in the immediate vicinity of the structures are slowed by the structures in their offshore migration, there is a possibility that hatchling predation will increase over time. If this occurs, at what point might hatchling loss negate the positive aspects of the added shoreline habitat? When, instead of nesting habitat, the beach has receded to the point that the habitat is unsuitable for nesting, turtles would be unable to place nests and would nest elsewhere where there was adequate sandy habitat and no offshore structure. The actual hatchling survival rate could have the potential of being greater.

Materials and methods:

To assess the effects of the structures on hatchling orientation and behavior a series of trials is necessary for the project shoreline. The T-groins will be examined separately from the Breakwater with a control area for each. The approximate locations of the structures are observed in the figure below (Figure 6 from FDEP, File No. 0174403-001-JC).

Figure 6



It is proposed that there be an advisory committee for the project composed of representatives from U.S. Fish and Wildlife Service (FWS), the Florida Fish and Wildlife Conservation Commission (FWC), Mote Marine Laboratory (MML), Lee County Natural Resources Department, Humiston & Moore Engineers and the Gasparilla Island Sea Turtle Patrol. The advisory committee will decide the exact project parameters at the beginning of each season.

Background conditions at the proposed control and experimental sites are to be checked during field visits to ensure that there are no significant differences in the ambient lighting, current conditions, topography, human activity, and beach sediments at the selected locations prior to implementing the trials. A set of pre-project hatchling trials will be conducted at the project location during the 2002 marine turtle hatch season to obtain baseline data. The purpose of these trials will be to document marine turtle hatchling activity during offshore migrations prior to installation of the erosional control structures and sand placement. These trials will allow the Committee to determine the feasibility of this study in Boca Grand Pass, an area of strong tidal currents, and to clarify protocol based on the outcome of the pre-project trials. A minimum of 4 trials, utilizing 3 hatchlings each, will be completed during the summer of 2002.

Three trial areas (one control and two experimental sites) are identified for the T-groins and are listed below. These trial locations could be modified and/or located more precisely following the pre-trial field meeting by the project Advisory Committee. To insure that hatchlings will have a high probability of contact with the structures, hatchlings used in experimental trials will be released on the beach within close proximity to the structures. If a nest occurs naturally in the project area, it will be left in situ. Upon hatch the hatchlings will be monitored in their migration from the nest.

- T-groin (1) - located at the northern T-groin, at approximately R-25.5.
- T-groin (2) - located at the southern T-groin, at approximately R-26.
- Control - the control area will be selected following inspection of the shoreline and upland development, a possibility for the control is between R-26.5 and R-26A. This location is adjacent to the south and east of the southern most T-groin and is located at the mouth of Gasparilla Island Pass.

Three trial areas (one control and two experimental sites) are identified for the segmented breakwater located at R-25. Here also the exact hatchling release location at each segment of the breakwater will be determined by the Advisory Committee following site inspection.

1. North segment of breakwater.
2. South segment of breakwater.
3. Control - a site between R-23 and R-24.5 which is approximately 1,000 to 1,500 feet north of the T-groins and is located on the west facing beach south of Gasparilla Island Pass

Trials for the T-groins are to be conducted concurrently at the three locations: T-groin (1), T-groin (2) and control, followed by concurrent trials at the emergent offshore breakwaters: N breakwater, S breakwater and control if/when hatchlings are available. In the event that 18 hatchlings are not available in a single night, trials for the two experimental locations will be held on different nights.

A maximum of 260 loggerhead hatchlings will be used for trials, three at each of the three trial areas for the two treatments (T-groin and breakwater), or a maximum of 18 hatchlings per night. This number of hatchlings represents approximately162 hatchlings to be used in trials at the two treatment locations during 8 nights at each treatment location. From 18 to 36 hatchlings will be used during daytime trials (just before sunset or immediately following sunrise) in order video document the hatchlings and to check trial methodology. The extra hatchlings represent those obtained for the trials to be used in the event any of the original 18 were not active when released. The remaining hatchlings will be released immediately following completion of the trial experiments. Only loggerhead hatchlings will be utilized.

Statistical analysis for hatchling speed, direction and distance traveled will be calculated using methodology chosen by Blair Witherington during his studies of hatchling orientation (Witherington, 1991). A straightness index (Batschelet, 1981) will be calculated for hatchling paths and defined as the ratio of (1) the straight distance between the release point and the end point (the point where the hatchling is captured and the trial terminated), and (2) the actual distance traveled. The average swimming velocity for each hatchling will be calculated as the distance traveled between release and end points, divided by time. Average directions of swimming hatchlings will be compared using statistics for circular distributions (Batschelet, 1981). If applicable, the Kruskal-Wallis test and associated nonparametric multiple comparison test (Gibbins, 1985) will be used to compare straightness indices, average velocities and average directions among groups.

The percentage of hatchlings taken by predators will be calculated from the total number of hatchlings utilized for the trials at both treatment locations. The location of the take will be documented utilizing GPS along with visual descriptions of the location where the hatchling was taken. Because the trials will be conducted primarily at night when it will be difficult if not impossible to identify the predatory species, species of predatory fish will only be documented when known.

Trials will be completed consistently at low tide, or at various tidal conditions, during the months of July through October. The decision to conduct the trials at low tide or various tidal conditions will be decided upon by the Advisory Committee prior to commencement of the project. Environmental factors that could influence hatchling behavior will be documented, and if possible, controlled. Such factors include beach topography, ambient lighting conditions, background activity, and nearshore hydrographic conditions. At each trial location, both immediately before and after the trials are completed, surface current speed and bearing will be measured by tracking a lighted drogue at points perpendicular to the shore landward of the breakwater, beyond the groin and at the control area. At these same locations, the wave height / direction and wind speed /direction are to be recorded. A release location at each of the trial sites can be determined dependent upon outcome of the above to ensure that the hatchlings will not be swept out of the breakwater or T-groin locations.

Hatchling Collection

Members of the Advisory Committee will coordinate with the Florida Parks System and the Gasparilla Island Turtle Patrol to insure that a maximum of 40 nests are verified and marked along the Charlotte and Lee County, Gasparilla Island shoreline. Nest verification and marking will be conducted according to Florida FWC, Nest Productivity Protocol as follows. On the morning following egg deposition, the clutch site will be verified by carefully digging into the sand by hand. Following location of the uppermost eggs a temporary mark is to be placed at the sand surface to indicate the clutch location. Following the placement of several handfuls of moist sub-surface sand, the area is to be packed by applying steady pressure with the fist. The excavated sand is to be replaced to the original height. The nest will be marked with redundant location indicators so that monitoring personnel can locate the clutch in approximately two months. A sample method for marking the nests is to place one nest marking stake two feet landward, and one stake two feet seaward of the clutch location. An optional method is to bury a crushed aluminum can two feet north of the clutch and one foot deep into the sand.

The selected nests will be monitored throughout incubation. The incubation data for the Gasparilla Island shoreline will be utilized to determine the approximate date of hatch. Nests due to hatch will be checked at sunrise for evidence of eminent hatchling emergence. A depression or cone in the sand over the nest cavity indicates that the hatchlings have pipped out of their egg shells and may be near the surface. A temporary restraining cage, monitored during the evening that hatchlings are expected, may be placed over the nest to collect hatchlings when they emerge, or, by carefully probing with fingers, hatchlings that are within 10 cm of the surface may be removed from the sand on the same evening that the tracking trials are to be completed. Depending upon the availability of hatchlings, from 18 to 27 (the 9 extra hatchlings are being collected as a precautionary measure to ensure that at least 18 are vigorous) will be removed from either the nest or restraining cage and wil be placed immediately in a darkened container until released on the project or control beach. Any hatchlings not used during the evening trials will be released that same night. All efforts will be made to release hatchlings within one to three hours following emergence or removal from the nest All information, including the number of hatchlings removed, location of the nest(s), and date and time of removal will be forwarded the following morning to the appropriate Principal Permit Holder.

Trials are to be carried out at dark (2100-0500h) and a target number of 18 hatchlings will be tracked at each of the trial locations for both treatments (T-groins and breakwater) per night. In order to record hatching actions on video and to check trial methodology, at least one hatchling release at each treatment location (n=18 hatchlings) will occur prior to sunset or just after sunrise. In the event that storm or tidal activity destroy the marked nests, hatchlings can be obtained from nests located on the northern, Charlotte County shoreline of Gasparilla Island, or the Sarasota and/or Charlotte County shoreline of Manasota Key.

Hatchling Tracking Methodology

The tracking method to be utilized was developed by Blair Witherington of the Florida Marine Research Institute (Witherington, 1991). A 0.5 cm square, 10 cm long balsa wood float (no greater than 2 g) with a lead keel is to be fitted with a small chemical light stick (Cyalume) or light reflective vinyl. This balsa float will be towed by tethering it to the hatchling. The total mass of the float rig should be no greater than 1.9 g, <10% of the weight of a loggerhead hatchling. The average swimming velocity of hatchlings towing these floats was found to be comparable with or slightly lower than velocities recorded for a sample set of loggerhead hatchlings swimming without floats (Witherington, 1991). The hatchlings will be observed using night-vision goggles and an infrared light source if the vinyl is used. Infrared light has been documented to have no visible effect on hatchlings, even at close range (1 m). The Wyneken method of tethering hatchlings is to be utilized. Two other methods of tethering hatchlings have also been utilized successfully in the past and are discussed below as alternative methods in the event that problems arise with the Wyneken method.

The <u>Wyneken method</u> of tethering utilizes a 1.5 to 2.0 m long light cotton thread which is also attached to the balsa wood float (Wyneken and Salmon, 1996). A slip knot is made in the opposite end which is then placed just behind the front flippers, between the flippers and the carapace.

The <u>Witherington method</u> of tethering the float to the hatchling (Witherington, 1991) utilizes a 2.0 m long piece of monofilament line (1- 5 kg test strength) attached to the float at an eyelet on one end. The opposite end attaches to a small (#20) wire hook. The hook is inserted into the soft pygal scutes at the posterior edge of the carapace of each loggerhead hatchling. The barb on the hook is flattened to allow the hook to be removed following the end of the trials and the hook is to be notched with a metal file to ensure that it corrodes rapidly if retrieval is not possible.

The <u>Pilcher method</u> of tethering (Pilcher et al.. 1999) utilizes a Lycra harness with a velcro attachment placed around the hatchling. The monofilament line is sewn into the Lycra harness and attaches at the opposite end to the float.

At the trial location the hatchling which is going to be used is to be removed from the darkened container, measured, and fitted with a balsa wood float (see options for attachment above). If hatchlings are released for T-groin trials and the distance from the sandy beach to the "head" of the T is less than 3 m the line attaching the float to the hatchling will be shortened accordingly. The hatchling will be placed on the sand by monitoring personnel dressed in dark clothing. The monitoring personnel will hold the float in hand and remain behind the hatchling while it crawls down the beach. The hatchling crawl orientation is to be documented using a hand held GPS. When the hatchling enters the water, it is to be allowed to begin swimming at which time the monitoring personnel will release the balsa float into the water behind the hatchling and alert the in-water observer. The observer will follow the float and hatchling in a kayak, or if the distance is less than 3 m, the hatchling will be followed by one observer on shore and one observer on the structure (T-groin) or in a kayak. Observers will use night-vision goggles and an infrared light source to watch the swimming hatchling while a driver maintains and records the boat position. Hatchling positions are to be recorded as GPS waypoints at two to five minute intervals or when the hatchling makes an abrupt change in direction or is taken by a predator. A constant offset of the observer from the hatchling will allow a calculation of turtle position from the observer position. The boat is to remain approximately 5-30 m from the hatchling and lateral to its direction of movement. In a previous hatchling tracking study, the presence of a similar, human propelled boat did not cause swimming hatchlings to alter their path (Witherington, 1991.) Hatchlings are to be followed for 30 minutes or until beyond the structures, whichever is shorter. Any hatchling that encounters either the T-groin or breakwater will be followed to determine the complete effects of the structure on the hatchling migration or until the hatchling is taken by a predator. Following completion of the trial at the control, T-groin or breakwater locations, the hatchlings will be retrieved, the tethering and float will be removed, and the hatchling will be released. Retrieval will not be possible if the hatchling has been taken by a predator, but the location and time of predation will be documented. The average swimming velocity for each hatchling can be calculated as the distance traveled between release and end points, divided by time.

Anticipated Results:
When documenting the effects, if any, of erosion control structures on hatching activity, it is necessary to project a multi-year study due to the seasonal changes in the shoreline over time. A 3 to 5 year study will allow the documentation of colonization of the erosion control structures and will provide information on whether hatchlings are taken near the structures or whether the structures have an impact on hatchling migration. Following completion of the study, data will be published and made available to aid regulators and engineers in the accurate determination of the effects of these erosion control structures (offshore emergent breakwater and T- groins) on sea turtle hatchling survival and migratory activity.

Equipment

(Attached spreadsheet)

Time line:

Target Date for Completion:	Activity:
July - October, 2002	Hatchling release for baseline data prior to construction of erosions control structures and sand placement.
April 1 (week of), 2003-2005	Meet with the Advisory Committee (FWS, FWC, Humiston & Moore Engineers, Gasparilla Island Turtle Watch and Lee County Natural Resources Dept.) for an on-site field visit to define release and control locations and any other project parameters.
April 15 (week of)	Coordinate with Gasparilla Island Turtle Watch, Little Gasparilla Island Turtle Patrol, and Manasota Key Principle Permit Holders regarding nest verification, marking and procedures.
May 15	Names and Permit #'s for all personnel forwarded to FWS and FWC
May 31	Update FWS, FWC, Lee County, Humiston & Moore Engineers (referred to as "all parties") verbal or written.
June 1	Confirm that the 2 T- groins and the segmented breakwater are performing as designed.
June 10	Coordinate release location at Control with FWS and FWC
June 15	Trial run (without hatchling) during daylight and/or after sunset
June 28	Begin hatchling trials and update all parties (verbal or written)
July 15	Trial run (prior to sunset or just after sunrise) with hatchlings (date may change dependent upon availability of hatchlings)
July 15	Maximum of 40 nests verified and marked with redundant location indicators
July 31	Update all parties (verbal or written)
August 30	Update all parties (verbal or written)
September 27	Update all parties (verbal or written)
October 15	Target date for completion of trials at both treatment locations.
October 31	Copies of nest information including date, time and # of hatchlings removed, hatchling orientation maps submitted to FWS and FWC
December 15	Target date for final report to be submitted to FWS, FWC, Lee County Natural Resources Dept. and Humiston and Moore Engineers

Budget: Budget will include 3 sets of equipment and 3 teams. (See attached Budget Spreadsheet)

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