UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001
March 20, 2012

Mr. Miles Croom
Assistant Regional Administrator
for Habitat Conservation
NMFS Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SUBJECT: REQUEST TO INITATE ABBREVIATED ESSENTIAL FISH HABITAT CONSULTATION FOR PROPOSED EXTENDED POWER UPRATE AT ST. LUCIE PLANT, UNITS 1 AND 2 (TAC NO. ME5091)

Dear Mr. Croom:

The U.S. Nuclear Regulatory Commission (NRC) is currently reviewing a license amendment request to increase the licensed core power level at the St. Lucie Plant, Units 1 and 2 (St. Lucie). If granted, the increase in power (also called an "extended power uprate" or EPU) would increase the temperature of water discharged to the Atlantic Ocean. Because this change in effluent temperature has the potential to affect local essential fish habitat (EFH), the NRC has prepared the enclosed EFH Assessment. With this letter, the NRC staff requests to initiate abbreviated EFH consultation per 50 CFR 600.920(h)(2) for the proposed EPU at St. Lucie.

St. Lucie is located on Hutchinson Island in St. Lucie County, Florida. The island is a barrier island bounded by the Atlantic Ocean to the east and the Indian River Lagoon to the west. The cooling system withdraws water from the Atlantic Ocean to cool the condensers of the two operating reactors. The Atlantic Ocean provides cooling and receiving waters for both units' condensers and auxiliary cooling systems through common intake and discharge canals with ocean piping.

Florida Power & Light Company (FPL) submitted its license amendment request to the NRC for Unit 1 on March 31, 2010. The amendment request proposes an increase in Unit 1's licensed core power level from 2700 megawatts thermal (MW(t)) to 3020 MW(t). On February 25, 2011, FPL submitted a second license amendment request to increase the licensed core power level of Unit 2 from 2700 MW(t) to 3020 MW(t).

Per 50 CFR 600.920(a)(1), Federal agencies must consult with the National Marine Fisheries Service (NMFS) regarding EFH for actions that they authorize, fund, or undertake, or those actions that are proposed to be authorized, funded, or undertaken that may adversely affect EFH. In this case, the Federal action is NRC's decision to grant the license amendment request for an EPU at St. Lucie. Implementation of the EPU would cause the St. Lucie Plant to increase the temperature of its effluent to the Atlantic Ocean. The amount and rate of water withdrawn from the ocean would remain unchanged, as would entrapment, entrainment, impingement, and all other effects of the plant on the ocean environment.

In the enclosed EFH Assessment, the NRC considered the potential effects of the proposed EPU on 42 Federally managed species and their designated EFH near the site. The staff found

no adverse effects to EFH for 2 species and **minimal adverse effects** on EFH for the remaining 40 species. The NRC requests your concurrence with our EFH Assessment determination within 30 days per 50 CFR 600.920(h)(2). If you have any questions regarding this issue, please contact me at 301-415-2327 or by e-mail at Andy.Imboden@nrc.gov or Dennis Logan, Aquatic Biologist at 301-415-0490 or by e-mail at Dennis.Logan@nrc.gov.

Sincerely,

Andrew S. Imboden, Chief
Environmental Review and
Guidance Update Branch
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-335 and 50-389

Enclosure:
As stated

cc w/encl: Listserv

Jocelyn Karazsia
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Essential Fish Habitat Assessment

St. Lucie Plant, Units 1 and 2
Proposed Extended Power Uprate

February 2012

Docket Numbers 50-335 and 50-389

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Prepared by:

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Pacific Northwest National Laboratory

for
Division of License Renewal
Office of Nuclear Reactor Regulation

ENCLOSURE

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Abbreviations, Acronyms, and Symbols

°C	degrees Celsius
°F	degrees Fahrenheit
<	less than
>	greater than
CFR	*Code of Federal Regulations*
cm	centimeter(s)
EEZ	exclusive economic zone
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
EPU	extended power uprate
FDEP	Florida Department of Environmental Protection
FMP	fishery management plan
FPL	Florida Power & Light Co.
fps	feet per second
FR	*Federal Register*
ft	feet
ft^3	cubic feet
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
HAPC	habitat area of particular concern
in.	inch(es)
km	kilometer(s)
lbs	pounds
m	meter(s)
m^3	cubic meter(s)
m^3/d	cubic meters per day
MGD	million gallons per day
mi	mile(s)
m/s	meters per second
MSA	Magnuson-Stevens Fishery Conservation and Management Act, as amended
MW(t)	megawatts thermal
NEPA	National Environmental Policy Act of 1969, as amended
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
SEIS	Supplemental Environmental Impact Statement
St. Lucie	St. Lucie Plant, Units 1 and 2
U.S.C.	U.S. Code

Essential Fish Habitat Assessment for the Proposed Extended Power Uprate at St. Lucie Plant, Units 1 and 2

1.0 Introduction

In compliance with Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), the U.S. Nuclear Regulatory Commission (NRC; the staff) prepared this Essential Fish Habitat (EFH) Assessment for the proposed Federal action: NRC's decision whether or not to grant a license amendment for an extended power uprate (EPU) at St. Lucie Plant, Units 1 and 2 (St. Lucie), located on Hutchinson Island in St. Lucie County, Florida.

This EFH Assessment describes the proposed action, identifies relevant commercially, Federally-managed species within the vicinity of the proposed action site, assesses whether the proposed action may adversely affect any designated EFH, and describes potential measures to avoid, minimize, or offset potential adverse impacts to EFH as a result of the proposed action.

2.0 Description of the Proposed Action

The proposed Federal action is NRC's decision of whether or not to grant Florida Power and Light Co. (FPL) license amendments that would authorize FPL to increase the core power level from 2700 MW(t) to 3020 MW(t) for each of the two St. Lucie units.

FPL, which owns and operates St. Lucie, submitted two separate license amendment requests for EPUs on November 22, 2010, and February 25, 2011, for Unit 1 and Unit 2, respectively. If approved, these two amendment requests would increase the licensed core thermal power for each of the two St. Lucie units from 2700 MW(t) to 3020 MW(t), an increase of 11.85 percent.

If approved, the proposed EPU would not change the rate of water withdrawal or quantity of water withdrawn at St. Lucie. Additionally, FPL would not change any component of the cooling system design.

The proposed EPU would increase the temperature of discharged water. However, St. Lucie's Industrial Wastewater Facility Permit (FDEP 2011a) would continue to limit the maximum temperature of heated discharge water and the thermal mixing zone volume. The permit specifies the following limitations for water discharged from the diffusers into the Atlantic Ocean:

- Discharged water may not exceed a maximum of 115°F (46°C) or rise more than 30°F (16.7°C) above the ambient water temperature during normal operations.
- Discharged water may not cause the ocean surface temperature to exceed 97°F (36°C) as an instantaneous maximum.
- Discharged water may not be more than 17°F (11°C) above the ambient water temperature in the receiving body of water outside a thermal mixing zone of 466,092 ft^3 (13,198 m^3); and
- The total area of the mixing zone for St. Lucie may not exceed 511,804 ft^2 (47,548 m^2).

Note that the Industrial Wastewater Facility Permit, as in effect today, specifies that discharged water may not exceed a maximum of 113°F (45°C). However, the Florida Department of Environmental Protection revised FPL's permit to allow FPL to discharge water 2°F (1°C) higher—at a temperature 115°F (46°C)—upon NRC's approval of the proposed EPU.

The NRC issued operating licenses to FPL on March 1, 1976, and June 10, 1983, to operate Units 1 and 2, respectively. In 2001, FPL submitted applications to the NRC for renewed licenses. The NRC issued renewed licenses for St. Lucie on October 2, 2003. St. Lucie's current operating licenses expire on March 1, 2036 (Unit 1), and April 6, 2043 (Unit 2). If approved, the license amendment would authorize FPL to operate St. Lucie at a higher core power level for the remainder of the renewed license term.

2.1 Site Location and Description

St. Lucie lies on Hutchinson Island in St. Lucie County, Florida. The nearest municipalities to the north, west, and south are Fort Pierce, which is approximately 11 km (7 mi) northwest of the plant; Port St. Lucie, which is approximately 7 km (4.5 mi) to the west; and Stuart, which is approximately 13 km (8 mi) to the south. St. Lucie is located in a relatively flat, sheltered area of Hutchinson Island. Directly west of the facility, the land slopes downward, and mangroves cover the intertidal shoreline of the Indian River Lagoon. Dunes and ridges separate the facility from the Atlantic Ocean to the east (NRC 2003a). Figure 1 shows the location of St. Lucie in relation to the Atlantic Coast. Habitat potentially affected by the EPU is the nearshore and offshore Atlantic Ocean near St. Lucie.

The Atlantic nearshore and offshore marine communities in the vicinity of St. Lucie were studied in detail prior to the start of Unit 1 operation in 1976 (NRC 2003a). Three subtidal Atlantic microhabitats exist within the discharge pipeline and thermal plume area; shallow beach terrace, Pierce Shoal (approximately 2 mi (1.6 km) from shore), and a 30- to 40-ft (9- to 12-m) trough between the two areas. Each microhabitat differs by depth and sediment composition with the trough habitat area supporting the greatest diversity of macroinvertebrate species. The nearshore habitat intertidal worm reef communities support unique assemblages of macroalgae and macroinvertebrates (EAI 2001). No seagrass habitat exists in the vicinity, although intermittent hard bottom habitat now exists to the north of the discharge pipelines, which is likely due to recent hurricane activity in 2004 and 2005 (CSA 2009).

Fisheries assessments in association with startup and operations of St. Lucie provided information on offshore and transitional assemblages of marine organisms (FPL 1973). Bottom trawls and beach seines collected ichthyoplankton and fish at five offshore locations in the vicinity of the discharge and intake with the startup and operation of St. Lucie. Monitoring yielded 5,570 individuals distributed among 49 species. The five most abundant species accounted for nearly 70 percent of the catch (NRC 2003a):

- Atlantic bumper (*Chloroscombrus chrysurus*),
- Spanish mackerel (*Scomberomorus maculatus*),
- Atlantic croaker (*Micropogonias undulatus*),
- spot (*Leiostomus xanthurus*), and
- bluefish (*Pomatomus saltatrix*).

Following the commencement of Unit 2 operations, benthic studies in the vicinity of St. Lucie reported 934 macroinvertebrate taxa. The studies also revealed minimal change from baseline conditions to operational conditions in the immediate vicinity of the thermal discharge. Likewise, sampled fish assemblages did not change significantly between operation of only Unit 1 and operation of both Units 1 and 2 (EAI 2001).

Nearshore hydrology patterns include a tidal range of 0.8 m (3 ft) and a rotary tidal current that continuously changes direction during a 12.4-hour cycle at an average speed of 0.74 fps (0.23 m/s) near the surface. The prevailing northerly current flows parallel along the east Florida coast and the secondary current flows to the south (FPL 2001).

2.2 Cooling Water System Description and Operation

As discussed in Section 2.0, the EPU would not change the rate of water withdrawal or quantity of water withdrawn and would not change any component of the cooling system design. However, this section describes the cooling water intake system and FPL's compliance with Section 316(b) of the Clean Water Act for completeness. Unless otherwise noted, the description of the cooling system is summarized from NUREG-1437, Supplement 11, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding St. Lucie, Units 1 and 2" (NRC 2003a).

2.2.1 Cooling Water Intake and Discharge Systems

St. Lucie's once-through heat-dissipation system withdraws from and discharges water to the Atlantic Ocean. Approximately 1,200 ft (370 m) offshore, three cooling water intake structures take in water. The normal water depth is about 23 ft (7 m) at the intake. Each intake structure consists of a large concrete base with a vertical cylindrical opening in the center and a concrete velocity cap supported by columns that extends about 6 ft (1.8 m) from the base. The velocity cap reduces entrainment of marine organisms by eliminating vertical flow and limiting horizontal flow velocities. After entering the intake structures, water travels through separate buried pipes beneath the beach and dune system to the intake canal. Flow velocities vary within the intake system; Table 1 provides calculated flow velocities at four points along the intake path (Ecological Assoc. 2000 *in* NRC 2003a).

Table 1. Calculated Flow Velocities at Various Points in the St. Lucie Intake

	Velocity m/s (ft/s)	
Location	**3.7-m (12-ft) Diameter Intakes**	**4.9-m (16-ft) Diameter Intakes**
Velocity Cap Intake	0.11 to 0.12 (0.37 to 0.41)	0.27 to 0.30 (0.9 to 1.0)
Vertical Section	0.37 to 0.40 (1.2 to 1.3)	1.9 to 2.1 (6.2 to 6.8)
Intake Pipe	1.3 to 1.4 (4.2 to 4.7)	1.8 to 2.1 (5.9 to 6.8)
Intake Canal	0.30[a] (1.0)	

[a] Flow rate represents the combined flow from all intake pipes once merged in the intake canal.

Table source: Ecological Assoc. 2000 *in* NRC 2003a

The intake canal is a 4920-ft (1500-m)-long, 180-ft (55-m)-wide, and 30-ft (9.1 m) deep L-shaped channel that carries water to the intake wells during normal operations. Three barriers within the canal reduce the impingement of marine biota. First, two sets of barrier nets (one with 5-in. [12.7-cm] and one with 8-in. [20.3-cm] openings) prevent sea turtles and large fish from entering the intake canal. These mesh barrier nets lie along the east-west arm of the intake canal. The third barrier is a rigid barrier that lies across the north-south arm of the canal. FPL regularly monitors the nets for sea turtles and other marine biota and inspects the mesh nets regularly for repair.

From the intake canal, water travels through a series of trash racks with vertical bars spaced 3 in. (7.6 cm) apart followed by 3/8-in. (1-cm)-mesh traveling screens, which are periodically backwashed. Water then enters one of eight separate intake wells (four per unit), at which point it is pumped through the main turbine condensers.

2.2.2 Cooling System Discharge and Heat Dissipation

Once cooling water circulates through the main turbine condensers for cooling, it returns to the Atlantic Ocean via a 2200-ft (670-ft)-long discharge canal. Water travels from the canal to two discharges pipes, which transport the water beneath the beach and dune system to the Atlantic Ocean. During normal operations, St. Lucie returns approximately 1,478 MGD (5.6 million m^3/day) of heated effluent water to the Atlantic Ocean.

The northernmost discharge pipe extends 460 m (1500 ft) offshore and delivers heated effluent to the Atlantic Ocean waters via a two-port "Y" diffuser. Water exists each port at a velocity of 13 fps (4 m/s), and the mixing zone extends 63 ft (19 m) horizontally and 0.8 ft (0.2 m) vertically from each port (FPL 2001). The southernmost discharge pipe extends 580 m (1900 ft) further out into the Atlantic Ocean than the northernmost pipe. This pipe discharges heated effluent through a multiport diffuser, which has a total of 58 diffuser ports. The exit velocity from each port is 11.5 fps (3.4 m/s) (FPL 2001). Under typical conditions, the 2°F (1.1°C) isotherm thermal plume is about 180 ac (73 ha) and 175 ac (71 ha) from the northernmost and southernmost discharge pipes, respectively.

Figure 2 shows current thermal plume extent for summer ambient water and extreme discharge temperature (119°F) is shown under southward current conditions. Figures 3 and 4 show the thermal plume under northward current conditions and slack water conditions, respectively. As modeled, the defined area of thermal plume influence for surface waters is beyond the 18-ft depth contour seaward, and is, therefore, exempt from coastal waters thermal limits (Golder Assoc 2010b). The northernmost extent of the thermal plume (defined by the 2°F isotherm) reaches the northern tip of Pierce Shoal under northward current conditions. To the east, the 2°F isotherm extends approximately two nautical miles to Pierce Shoal primarily during slack tide. The southernmost extent of the 2°F isotherm reaches approximately four nautical miles from the discharge pipelines to the south during southward current flow. Modeling of vertical mixing of heated effluent following uprate activities depicts no contact of the thermal plume with the sea bottom under maximum predicted warmer month operating conditions (Golder Assoc 2010a).

FPL performed modeling of thermal plume mixing under the proposed EPU conditions. The modeling predicts that the mixing zone will increase slightly due to the higher effluent temperature. Based on the modeling, FPL predicted the proposed EPU would add an additional total combined volume of 6,896 ft^3 (641 m^3) over the current thermal mixing zone area (Golder Assoc. 2010a). This is a small incremental increase over the existing mixing zone and is not a significant change with respect to the receiving water body.

2.2.3 St. Lucie NPDES Permit Limitations

Appendix B of the NRC license for St. Lucie contains the Environmental Protection Plan (NRC 2003b; 2003c), which states that the NRC relies on the Environmental Protection Agency (EPA) to resolve water quality monitoring and permitting issues. The EPA delegated authority to the Florida Department of Environmental Protection (FDEP) to administer the National Pollutant Discharge Elimination Discharge System (NPDES) permitting program in the State of Florida on May 1, 1995. The FDEP combined the Wastewater Permit with the NPDES permit, and the combined permit is referred to as the Industrial Wastewater Facility Permit. The FDEP most recently renewed St. Lucie's Industrial Wastewater Permit No. FL0002208 (FDEP 2011c) on September 29, 2011.

The permit specifies the following limitations for water discharged from the diffusers into the Atlantic Ocean:

- Discharged water may not exceed a maximum of 115°F (46°C) or rise more than 30°F (16.7°C) above the ambient water temperature during normal operations.
- Discharged water may not cause the ocean surface temperature to exceed 97°F (36°C) as an instantaneous maximum.
- Discharged water may not be more than 17°F (11°C) above the ambient water temperature in the receiving body of water outside a thermal mixing zone of 466,092 ft^3 (13,198 m^3); and
- The total area of the mixing zone for St. Lucie may not exceed 511,804 ft^2 (47,548 m^2).

Concerning impingement and entrainment of aquatic organisms, St. Lucie's Industrial Wastewater Facility Permit (FDEP 2011c) states that in order to maintain compliance with the Clean Water Act (CWA) 316(b) requirements, the permittee:

- "...shall maintain the current intake through-screen velocity such that the maximum velocity is not exceeded,
- ...shall maintain current traveling screen practices at Units 1 and 2 so as to assure that the screens are cycled twice during each 24 hours of continuous operation unless precluded by repair/maintenance requirements...
- ...shall develop a plan ....to help return live fish, shellfish and other aquatic organisms collected or trapped on the intake screens to their natural habitat....
- ...shall monitor aquatic organism entrapment in the intake canal and capture and return entrained organisms in the intake canal safely and as quick as possible when practical not cause harm. The permittee shall provide a summary of these efforts with the permit renewal application".

3.0 EFH Near the Site

The St. Lucie discharge affects the nearshore coastal waters of the Atlantic Ocean from the shoreline outward to Pierce Shoal to the north and east and to the minor shoals to the south of Pierce Shoal. Figure 5 depicts this area with a composite of the 2°F surface water isotherm under current summer month conditions.

During the NRC's development of this EFH Assessment, National Marine Fisheries Service (NMFS) provided a list of species managed by the South Atlantic Fishery Management Council (Table 2) (NMFS 2011a). During the initial review of life history and EFH requirements for each EFH species, the staff eliminated some species or life stages in Table 2 from further consideration if depth requirements or life history information suggested that the presence of those species or life stages is unlikely in nearshore Atlantic waters. Table 3 lists these eliminated species and life stages. The remaining species appear in Table 4, which indicates those species and life stages that NRC considers in more detail in this EFH Assessment.

Table 2. Species of Fish with Designated EFH in the Vicinity of St. Lucie

Fishery Management Plan	Common Name	Scientific Name
Coastal migratory pelagics[a]		
	cobia	*Rachycentron canadum*
	king mackerel	*Scomberomorus cavalla*
	Spanish mackerel	*Scomberomorus maculatus*

Fishery Management Plan	Common Name	Scientific Name
Coral[a]		
	black coral	*Order Antipatharia*
	octocorals	*Order Alcyonacea*
	sea pens/sea pansies	*Order Pennatulacea*
	stony coral	*Order Scleractinia*
Dolphin and wahoo[a]		
	common dolphin	*Coryphaena hippurus*
	pompano dolphin	*Coryphaena equiselis*
	wahoo	*Acanthocybium solandri*
Golden crab[a]		
	golden crab	*Chaeceon fenneri*
Highly migratory coastal pelagics[b]		
Tuna	Atlantic albacore tuna	*Thunnus alalunga*
	Atlantic bigeye tuna	*Thunnus obesus*
	Atlantic bluefin tuna	*Thunnus thynnus*
	Atlantic skipjack tuna	*Katsuwonus pelamis*
	Atlantic yellowfin tuna	*Thunnus albacares*
Swordfish	swordfish	*Xiphias gladius*
Billfish	blue marlin	*Makaira nigricans*
	longbill spearfish	*Tetrapturus pfluegeri*
	sailfish	*Istiophorus platypterus*
	white marlin	*Tetrapturus albidus*
Large coastal sharks	basking shark	*Cetorhinus maximus*
	bignose shark	*Carcharhinus altimus*
	blacktip shark	*Carcharhinus limbatus*
	bull shark	*Carcharhinus leucas*
	Caribbean reef shark	*Carcharhinus perezi*
	dusky shark	*Carcharhinus obscurus*
	great hammerhead shark	*Sphyrna mokarran*
	lemon shark	*Negaprion brevirostris*
	night shark	*Carcharhinus signatus*
	nurse shark	*Ginglymostoma cirratum*
	sand tiger shark	*Carcharias taurus*
	sandbar shark	*Carcharhinus plumbeus*
	scalloped hammerhead shark	*Sphyrna lewini*

Fishery Management Plan	Common Name	Scientific Name
	silky shark	*Carcharhinus falciformis*
	spinner shark	*Carcharhinus brevipinna*
	tiger shark	*Galeocerdo cuvier*
	whale shark	*Rhincodon typus*
	white shark	*Carcharodon carcharias*
Small coastal sharks	Atlantic angel shark	*Squatina dumeril*
	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*
	blacknose shark	*Carcharhinus acronotus*
	bonnethead shark	*Sphyrna tiburo*
	finetooth shark	*Carcharhinus isodon*
Pelagic sharks	bigeye thresher shark	*Alopias superciliosus*
	blue shark	*Prionace glauca*
	longfin mako shark	*Isurus paucus*
	oceanic whitetip shark	*Carcharhinus longimanus*
	porbeagle shark	*Lamna nasus*
	shortfin mako shark	*Isurus oxyrinchus*
	thresher shark	*Alopias vulpinus*
Sargassum[a]	**sargassum**	***Sargassum natans***
		Sargassum fluitans
Shrimp[a]	**brown shrimp**	***Farfantepenaeus aztecus***
	pink shrimp	*Farfantepenaeus duorarum*
	royal red shrimp	*Pleoticus robustus*
	rock shrimp	*Sicyonia brevirostris*
	white shrimp	*Litopenaeus setiferus*
Snapper and grouper[a]		
	blackfin snapper	*Lutjanus buccanella*
	blueline tilefish	*Caulolatilus microps*
	goliath grouper	*Epinephelus itajara*
	gray (mangrove) snapper	*Lutjanus griseus*
	greater amberjack	*Seriola dumerili*
	mutton snapper	*Lutjanus analis*
	red porgy	*Pagrus pagrus*
	red snapper	*Lutjanus campechanus*
	scamp	*Mycteroperca phenax*
	silk snapper	*Lutjanus vivanus*

Fishery Management Plan	Common Name	Scientific Name
	snowy grouper	*Epinephelus niveatus*
	speckled hind	*Epinephelus drummondhayi*
	vermilion snapper	*Rhomboplites aurorubens*
	Warsaw grouper	*Epinephelus nigritus*
	white grunt	*Haemulon plumieri*
	wreckfish	*Polyprion americanus*
	yellowedge grouper	*Epinephelus flavolimbatus*
Spiny lobster[a]		
	spiny lobster	*Panulirus argus*

[a] SAFMC 1998
[b] NMFS 2009

Table 3. EFH Species Excluded from EFH Assessment

Fishery Management Plan	Common Name	Rationale for Exclusion
Coastal Migratory Pelagics	cobia, Spanish mackerel, king mackerel	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant(a)
Coral and Live-Bottom Habitat	black coral (Antipatharia) and order Pennatulacea (sea fans)	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[a]
Dolphin-Wahoo	common dolphin Pompano dolphin wahoo	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[a]
Golden crab	golden crab	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[a]
Highly Migratory Coastal Pelagics	Atlantic albacore tuna Atlantic bigeye tuna Atlantic bluefin tuna Atlantic yellowfin tuna blue marlin white marlin basking shark bignose shark night shark sand tiger shark whale shark Atlantic angel shark longfin mako shark porbeagle shark shortfin mako shark blue shark oceanic whitetip shark bigeye thresher shark thresher shark	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[b]

Fishery Management Plan	Common Name	Rationale for Exclusion
Sargassum	Sargassum	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[(a)]
Shrimp	royal red shrimp	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[(a)]
Spiny lobster	spiny lobster	EFH not present in Atlantic nearshore open waters in the vicinity of the St. Lucie Plant[(a)]

[(a)] SAFMC 1998
[(b)] NMFS 2009

Table 4. Species of Fish Retained for In-Depth Analysis

Fishery Management Plan	Common Name	Scientific Name
Coral		
	octocorals	Order Alcyonacea
	stony coral	Order Scleractinia
Highly Migratory Coastal Pelagics		
Tuna	Atlantic skipjack tuna	*Katsuwonus pelamis*
Swordfish	swordfish	*Xiphias gladius*
Billfish	longbill spearfish	*Tetrapturus pfluegeri*
	sailfish	*Istiophorus platypterus*
Large Coastal Sharks	blacktip shark	*Carcharhinus limbatus*
	bull shark	*Carcharhinus leucas*
	Caribbean reef shark	*Carcharhinus perezi*
	dusky shark	*Carcharhinus obscurus*
	great hammerhead shark	*Sphyrna mokarran*
	lemon shark	*Negaprion brevirostris*
	nurse shark	*Ginglymostoma cirratum*
	sandbar shark	*Carcharhinus plumbeus*
	scalloped hammerhead shark	*Sphyrna lewini*
	silky shark	*Carcharhinus falciformis*
	spinner shark	*Carcharhinus brevipinna*
	tiger shark	*Galeocerdo cuvier*
	white shark	*Carcharodon carcharias*
Small Coastal Sharks	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*
	blacknose shark	*Carcharhinus acronotus*
	bonnethead shark	*Sphyrna tiburo*
	finetooth shark	*Carcharhinus isodon*
Shrimp		
	brown shrimp	*Farfantepenaeus aztecus*

	pink shrimp	*Farfantepenaeus duorarum*
	rock shrimp	*Sicyonia brevirostris*
	white shrimp	*Litopenaeus setiferus*
Snapper-Grouper		
	blackfin snapper	*Lutjanus buccanella*
	blueline tilefish	*Caulolatilus microps*
	goliath grouper	*Epinephelus itajara*
	gray (mangrove) snapper	*Lutjanus griseus*
	greater amberjack	*Seriola dumerili*
	mutton snapper	*Lutjanus analis*
	red porgy	*Pagrus pagrus*
	red snapper	*Lutjanus campechanus*
	scamp	*Mycteroperca phenax*
	silk snapper	*Lutjanus vivanus*
	snowy grouper	*Epinephelus niveatus*
	speckled hind	*Epinephelus drummondhayi*
	vermilion snapper	*Rhomboplites aurorubens*
	Warsaw grouper	*Epinephelus nigritus*
	white grunt	*Haemulon plumieri*
	wreckfish	*Polyprion americanus*
	yellowedge grouper	*Epinephelus flavolimbatus*

Habitat Areas of Particular Concern (HAPC) within designated EFH require special consideration. HAPC must meet one or more of the following criteria:

1) important for ecological functions,
2) sensitive to human degradation,
3) representative as rare habitat, or
4) has high probability of effects from development activities.

In addition to designated EFH for managed species, HAPC exist for coral and snapper-grouper in the nearshore (depths of 0 to 4m [0 to 12 ft]) hard bottom environments off the east coast of Florida from Cape Canaveral to Broward County, according to the Southeast Area Monitoring and Assessment Program. Offshore (depths of 5 to 30 m [15 to 90 ft]) HAPC for coral also exist in hard bottom environments off the east coast of Florida from northern Miami-Dade County to Palm Beach County (SAFMC 2009a) (Figure 6).

4.0 EFH Species Considered for In-Depth Analysis

4.1 Coral

Most corals consist of aggregations of individual polyps that independently respire, feed, and reproduce. Coral communities provide the structure for development of complex ecosystems as habitat and/or food for most of the other members of the ecosystem. Coral reproduce and generate larvae that are initially planktonic or benthic and ultimately settle to complete metamorphosis to juvenile, sessile coral. As coral are unable to actively migrate to avoid adverse conditions, all life stages are susceptible to water pollution, extreme temperatures, and sedimentation (SAFMC 2009a). Octocorals belonging to Order Alcyonacea include species such as soft corals and gorgonians. These coral species do not secrete a calcium carbonate skeleton and do not contribute to reef framework other than to increase reef diversity, complexity or as a food source. Stony corals include members of both the Class Hydrozoa (fire corals) and true stony corals (Order Scleractinia) and may or may not contain endosymbiotic algae (zooxanthellae). Habitats for coral colonization include hardbottom inshore and offshore environments or existing relief structures such as wrecks, existing coral reefs, or artificial reefs. Hardbottom reef communities found in nearshore waters establish ecosystems on limestone rock covered by a thin sandy layer. Hardbottom habitats provide important cover and feeding areas for many fish and invertebrates. EFH and coral HAPC exist in the coastal (nearshore and offshore) waters associated with the St. Lucie thermal plume.

4.2 Highly Migratory Coastal Pelagic Species

EFH definitions for the following highly migratory species rely on occurrence data of specific life stages and habitat characteristics such as temperature, salinity, and dissolved oxygen.

4.2.1 Atlantic Skipjack Tuna

Atlantic skipjack tuna (*Katsuwonus pelamis*), are pelagic and form schools associated with hydrographic fronts. Spawning occurs primarily in the warmer waters such as the Caribbean and Gulf of Mexico and currents carry larvae to inshore habitats such as off the east coast of Florida (NMFS 2009). Juveniles and adults feed opportunistically in surface waters on fishes, cephalopods, and crustaceans. EFH for juveniles and adults exists in the coastal waters associated with the St. Lucie thermal plume.

4.2.2 Swordfish

Swordfish (*Xiphias gladius)* reside in the upper pelagic zones in waters warmer than 13°C (55.4°F). Females spawn in waters less than 250 ft (75 m) deep, and spawning occurs year-round off the Florida coast (FMNH 2011a). Juveniles occur in coastal waters where they feed on squid, fishes, and pelagic crustaceans (NMFS 2009). EFH for juveniles exists in the coastal waters associated with the St. Lucie thermal plume.

4.2.3 Billfish

Longbill spearfish (*Tetrapturus pfluegeri*) and sailfish (*Istiophorus platypterus*) inhabit upper pelagic and oceanic waters above the 21°C (69.8°F) thermocline. While longbill spearfish primarily reside in offshore waters, juvenile and adult EFH exists for coastal waters associated with the St. Lucie thermal plume because adults and juveniles feed on fishes and squid that occur in nearshore waters. Sailfish school off the Florida and Caribbean coasts and known populations reside in east coast Florida waters (NMFS 2009). Juvenile and adult EFH for sailfish occur in coastal waters associated with the St. Lucie thermal plume.

4.2.4 Large Coastal Sharks

<u>Blacktip Shark</u>

The blacktip shark, (*Carcharhinus limbatus*) resides in shallow coastal and offshore surface waters. Blacktip sharks feed on schooling fish and occasionally crustaceans. Birth of live young occurs in estuarine habitats where neonates remain up to one year before moving to habitats that are more saline (FMNH 2011b). EFH for juvenile and adult blacktip sharks exists in coastal waters along the Atlantic east coast of Florida from West Palm Beach north for juveniles, and from southeast Florida north for adults (NMFS 2009). Therefore, EFH for blacktip shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Bull Shark

Primarily a shallow water shark, the bull shark (*Carcharhinus leucas*) resides from northern Cape Canaveral south to Jupiter Island in coastal waters of 3 to 11 m (9.8 to 36 ft) (NMFS 2009). According to Heuter and Tyminski (2002) bull sharks near Tampa Bay and Yankeetown, Florida became entrapped within power plant thermal plumes when the waters outside of the plumes dropped below the species' tolerance levels. However, juveniles have been documented in waters as low as 16.4°C (61.5°F) (Hueter and Tyminski 2002). Bull sharks prey on bony fishes and small sharks, although reports of sea turtles, crustaceans, and sea birds document opportunistic feeding. Live birth of pups occurs in coastal lagoons or other low-salinity estuarine habitats (FMNH 2011c). EFH for neonate and juvenile bull sharks occurs along the mid-east Florida coast northward, while adult EFH occurs throughout the east Florida coast (NMFS 2009). EFH for bull shark neonates, juveniles, and adults occur in coastal waters associated with the St. Lucie thermal plume.

Caribbean Reef Shark

The Caribbean reef shark (*Carcharhinus perezi*) inhabits seafloor bottom habitats near shallow coastal water reefs. Prey items include bony fishes (FMNH 2011d). Nursery locations in U.S. waters remain uncharacterized, although documentation of nursery habitat offshore of Brazil and Belize indicate requirements for warmer water conditions. All life stages have designated EFH for Atlantic coastal areas along the Florida coast (NMFS 2009). EFH for the Caribbean reef shark occur in coastal waters associated with the St. Lucie thermal plume.

Dusky Shark

The dusky shark (*Carcharhinus obscurus*) migrates north-south throughout the year. It is one of the larger, inshore shark species. Adult dusky sharks avoid estuarine waters although juveniles school in shallow, estuarine coastal waters. Dusky sharks feed on invertebrates and a variety of fishes (FMNH 2011e). All life stages have designated EFH for Atlantic coastal areas along the Florida coast (NMFS 2009). EFH for the dusky shark occur in coastal waters associated with the St. Lucie thermal plume.

Great Hammerhead Shark

The great hammerhead (*Sphyrna mokarran)* resides as a solitary fish in open ocean and shallow coastal waters. Great hammerheads feed on fish, crustaceans, and other elasmobranchs with a particular preference for stingrays. Reproducing biennially, great hammerheads move into shallower, warmer waters in the late spring to give birth to live pups (FMNH 2011f). Although nursery areas occur in coastal waters in the Gulf of Mexico, all life stages have designated EFH in Atlantic east coast waters (NOAA 2009). EFH for great hammerheads occur in coastal waters associated with the St. Lucie thermal plume.

Lemon Shark

Lemon sharks (*Negaprion brevirostris*) inhabit shallow coastal areas with coral reefs. Nearshore habitats dominated by shallow water mangrove islands serve as nursery areas (NMFS 2009). Lemon sharks mature slowly with juveniles remaining in nursery habitat for several years. Lemon sharks hunt over sandy or muddy bottom habitat for crustaceans and bony fishes (FMNH 2011g). EFH for juvenile and adult lemon sharks occurs in coastal areas along the Atlantic east coast of Florida (NMFS 2009). Therefore, EFH for lemon shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Nurse Shark

Nurse sharks (*Ginglymostoma cirratum*) reside near the sea floor in shallow coastal waters characterized by coral reefs or rocks. Shallow reef and turtle grass habitat serve as nursery areas, and juvenile nurse sharks inhabit shallow coastal waters 3 to 11 m (9.8 to 36 ft) deep from northern Cape Canaveral, Florida to Jupiter Island nearshore waters (NMFS 2009). Nurse sharks feed nocturnally on fish, crustaceans, stingrays, and molluscs. Females reproduce ovoviviparously, with fertilized eggs in egg cases developing and hatching within the female prior to birth (FMNH 2011h). EFH for juvenile and adult nurse sharks exists in coastal waters along the entire Atlantic east coast of Florida (NMFS 2009). Therefore, EFH for nurse shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Sandbar Shark

The sandbar shark (*Carcharhinus plumbeus*) resides in shallow coastal water as a bottom-dwelling species that avoids rough bottom or coral reef habitat. The sandbar shark is an opportunistic bottom-feeder and preys on fishes, molluscs, and crustaceans. Adults migrate as far north as Cape Cod in the summer months and return south during winter months. Males migrate in congregations while females migrate in solitary fashion (FMNH 2011i). Adults typically reside in waters deeper than 20 m (60 ft), although nursery habitat exists in shallow coastal waters. EFH for juvenile and adult sandbar sharks exists in localized coastal waters along the entire Atlantic coast of Florida (NMFS 2009). Therefore, EFH for sandbar shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Scalloped Hammerhead Shark

Scalloped hammerheads (*Sphyrna lewini*) form large schools in warm waters and range from nearshore coastal waters to offshore deeper waters. Like the congeneric great hammerhead, scalloped hammerheads feed on a variety of fish, crustaceans, smaller sharks, and stingrays, and move to warmer coastal waters to give birth (FMNH 2011j). Nursery habitat associated with Florida waters exists in waters adjacent and to the south of Cape Canaveral, Florida (NMFS 2009). EFH for scalloped hammerhead juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Silky Shark

The silky shark (*Carcharhinus falciformis*) resides in offshore, warm water habitats (23°C [74.1°F]), although juveniles frequent coastal inshore waters during summer months. Silky sharks prey on fishes, cephalopods, and crustaceans. Neonates spend the first months of life near reef habitats, primarily along the Caribbean islands in the western North Atlantic (FMNH 2011k). Designated EFH extends along the Atlantic coast from Florida to New Jersey for all life stages (NMFS 2009). Therefore, EFH for all silky shark life stages occur in coastal waters associated with the St. Lucie thermal plume.

Spinner Shark

Spinner sharks (*Carcharhinus brevipinna*) reside in inshore waters and school as adults. Spinner sharks prey on pelagic fishes, stingrays, and cephalopods (FMNH 2011l). Characterization of nursery areas for spinner sharks include sandy bottom, warm water habitats. EFH for neonate, juvenile, and adult spinner sharks exists in coastal waters along the entire Atlantic coast of Florida (NMFS 2009). Therefore, EFH for spinner shark neonates, juveniles, and adults occur in coastal waters associated with the St. Lucie thermal plume.

Tiger Shark

The tiger shark (*Galeocerdo cuvier*) prefer warm oceanic and shallow coastal waters. Although not well described, nursery areas for tiger sharks occur in offshore areas (NMFS 2009). Tiger sharks feed at night and move inshore to prey on a diversity of items such as sea turtles, sharks, rays, fishes, sea birds, marine mammals, cepahlopods, and crustaceans (FMNH 2011m). EFH for neonate, juvenile, and adult tiger sharks exists in coastal waters along the entire Atlantic coast of Florida (NMFS 2009). Therefore, EFH for tiger shark neonates, juveniles, and adults occur in coastal waters associated with the St. Lucie thermal plume.

White Shark

White sharks (*Carcharodon carcharias*) roam nearshore coastal and offshore surface waters throughout the western North Atlantic as the largest of the mackerel sharks. White sharks prefer cold to temperate waters (12 to 25°C [53.6 to 77°F]) and feed on a variety of prey items from fish to marine mammals (NMFS 2009). Sparse reproduction information assumes a biennial reproduction with live birth in temperate shelf waters (FMNH 2011n). NMFS has designated the mid- and northern east coast of Florida as EFH for all life stages (NMFS 2009). EFH for white sharks occur in coastal waters associated with the St. Lucie thermal plume.

4.2.5 Small Coastal Sharks

Atlantic Sharpnose Shark

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) resides year-round in the Gulf of Mexico and along the coasts of Florida and South Carolina. The Atlantic sharpnose schools in coastal waters and primarily exist in waters less than 10 m (32 ft) deep (FMNH 2011o). Prey items of the Atlantic sharpnose include bony fishes, crustaceans, and molluscs. Females stay offshore during gestation, but give birth to live young in nearshore habitats (FMNH 2011o). EFH for neonate, juvenile, and adult Atlantic sharpnose sharks exists in coastal waters along the mid-Florida coast (NMFS 2009). Therefore, EFH for Atlantic sharpnose shark neonates, juveniles, and adults occur in coastal waters associated with the St. Lucie thermal plume.

Blacknose Shark

Blacknose sharks (*Carcharhinus acronotus)*, range along the western North Atlantic from North Carolina to Brazil. The blacknose is common off Florida's east coast in the summer and fall (NMFS 2009). Blacknose sharks prefer coastal habitats in waters over sandy or coral bottoms, with juveniles residing in shallow waters and adults moving to deeper waters of over 9 m (30 ft). Primarily preying on small fishes, the blacknose shark forms large schools and reproduce biennially (FMNH 2011p). EFH for juvenile and adult blacknose sharks exists in coastal waters along the mid-Florida coast (NMFS 2009). Therefore, EFH for blacknose shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

Bonnethead Shark

The bonnethead shark (*Sphyrna tiburo*) resides in shallow coastal waters characterized by muddy or sandy bottoms. Bonnethead sharks travel long distances daily and form small schools. Bonnetheads feed during daylight hours on crustaceans, molluscs, and small fishes. Female bonnethead sharks move to shallow waters in the late summer to give birth following a 4- to 5-month gestation, the shortest among all sharks (FMNH 2011q). EFH for neonate, juvenile, and adult bonnethead sharks exists in coastal waters along the mid-Florida coast (NMFS 2009). Therefore, EFH for the bonnethead shark neonates, juveniles, and adults occur in coastal waters associated with the St. Lucie thermal plume.

Finetooth Shark

The finetooth shark (*Carcharhinus isodon*) resides in coastal waters up to 10 m (32 ft) in depth. Like other small coastal sharks, the finetooth shark forms large schools and prey on small fishes (FMNH 2011r). EFH for juvenile and adult finetooth sharks exists in coastal waters along the mid-Florida coast (NMFS 2009). Therefore, EFH for finetooth shark juveniles and adults occur in coastal waters associated with the St. Lucie thermal plume.

4.3 Shrimp Species

Brown shrimp (*Farfantepenaeus aztecus*) in the Atlantic Ocean occur primarily in offshore waters less than 55 m (180 ft) deep. Brown shrimp Spawn offshore, and eggs and larvae drift into shallower habitat under the influence of tides and currents. Pink shrimp (*Farfantepenaeus duorarum*) are common in shallower marine habitats with a range depth of 11 to 37 m (36 to 121 ft). Pink shrimp spawn off eastern Florida primarily in the summer months at depths of 3.7 to 15.8 m (12 to 52 ft). Rock shrimp (*Sicyonia brevirostris*) prefer sandy bottom habitat from a few meters to 183 m (600 ft) in depth. White shrimp (*Litopenaeus setiferus*) primarily aggregate in Atlantic Ocean waters of less than 27 m (89 ft). Rock shrimp spawn off Georgia and Florida when bottom water temperatures reach 22° and 29°C (71.6 and 84.2°F), usually in mid-spring. As juveniles and adults, brown, pink, rock, and white shrimp feed in benthic habitats at night and have an omnivorous diet. White, brown, and pink shrimp belong to the family Penaeidae. The SAFMC Fishery Management Plan for penaeid shrimp has designated the coastal waters off the east coast of Florida as EFH for juvenile and adult shrimp (SAFMC 2009b). EFH for shrimp occur in coastal waters associated with the St. Lucie thermal plume.

4.4 Snapper-Grouper Complex

Designated Snapper-grouper EFH exists in coastal habitats such as coral and artificial reefs, live/hard bottom, medium to high profile outcroppings, and submerged aquatic vegetation. Species in this group utilize these habitats for one or all life stages as well as spawning areas in the water column above adult habitat (SAFMC 1998).

4.4.1 Snapper Species

Snapper belonging to the species *Lutjanus* and *Rhomboplites* associated with the snapper-grouper Fishery Management Plan (FMP) include the blackfin snapper (*L. buccanella*), gray snapper (*L. griseus*), mutton snapper (*L. analis*), red snapper (*l. campechanus*), silk snapper (*L. vivanus*) and the vermilion snapper (*R. aurorubens*). The blackfin, silk, and vermilion snappers reside in waters deeper than 18 m (59 ft) as adults, spawn in deep, offshore waters, and produce eggs and larvae that are pelagic and drift with the currents in the South Atlantic Bight. As juveniles, these species occupy shallow reef habitat and tend to move offshore as they mature (FMNH 2011s; SAFMC 2009c). These species of snapper do not typically reside in shallow, inshore coastal waters, but may forage over shallow water reefs to prey on fishes, crustaceans, and benthic invertebrates. In contrast, gray, mutton, and red snapper occupy shallow reef or sandy bottom habitats as either juveniles, adults, or both and feed on fishes, crustaceans, and cephalopods (FMNH 2011t; 2011u; 2011v). EFH for all these snapper species occur in coastal waters associated with the St. Lucie thermal plume.

4.4.2 Grouper Species

Grouper species occupy a range of depths and display territorial preference for habitat with relief such as caves, wrecks, ledges, and reefs. The scamp (*Mycteroperca phenax*), snowy grouper (*E. niveatus*), speckled hind (*Epinephelus drummondhayi*), Warsaw grouper (*E. nigritus*) and yellowedge grouper (*E. flavolimbatus*) prefer habitats deeper than 25 m (82 ft), however, juveniles may occur in shallow coastal habitats (SAFMC 2009c). The goliath grouper (*E. itajara*) resides in inshore shallow waters up to 46 m (150 ft) and is one of the few grouper species that can tolerate brackish water conditions (FMNH 2011w). All grouper species listed here prey on fishes, cephalopods, and crustaceans (SAFMC 2009c). EFH for all these grouper species occurs in coastal waters associated with the St. Lucie thermal plume.

4.4.3 Blueline Tilefish

The blueline tilefish (*Caulolatilus microps*) resides in deep coastal waters along the continental shelf at depths of 30 to 236 m (98 to 774 ft). Blueline tilefish broadcast spawn from February to October, and eggs and developing larvae drift with shelf currents. Juveniles forage in nearshore habitats prior to migrating to offshore habitats characterized by irregular bottom relief structures (SAFMC 2009c). EFH for the blueline tilefish occurs in coastal waters associated with the St. Lucie thermal plume.

4.4.4 Greater Amberjack

The greater amberjack (*Seriola dumerili*) reside primarily in offshore deepwater habitats ranging from 18 to 360 m (60 to 1181 ft). However, eggs, larvae, and greater amberjack juveniles may drift into shallower marine habitats, and some populations migrate into inshore waters to forage (FMNH 2011x). Greater amberjack prey on benthic and pelagic fishes, crustaceans, and cephalopods (SAFMC 2009c). EFH for the greater amberjack occurs in coastal waters associated with the St. Lucie thermal plume.

4.4.5 Red Porgy

Red porgy (*Pagrus pagrus*) occur at depths of 25 to 90 m (82 to 295 ft) as adults and may reside in shallower waters as juveniles. Red porgy prey on crustaceans, molluscs and fishes near bottom relief structures (SAFMC 2009c). EFH for the red porgy occurs in coastal waters associated with the St. Lucie thermal plume.

4.4.6 White Grunt

White grunts (*Haemulon plumier)* inhabit nearshore live-bottom habitat of sponge-coral reefs between the shoreline and up to 35 m (118 ft) offshore. White grunts prey nocturnally over open sand or reefs on crustaceans, molluscs, benthic invertebrates and small fishes. Spawning occurs offshore, and pelagic eggs drift inshore with currents (FMNH 2011y). EFH for the white grunt occur in coastal waters associated with the St. Lucie thermal plume.

4.4.7 Wreckfish

The wreckfish (*Polyprion americanus*) occurs in deep water (over 400 m [1312 ft] in depth). Wreckfish eggs and larvae presumably drift with currents and encounter nearshore habitat for foraging as juveniles. Wreckfish prey on crustaceans, fishes, and cephalopods (SAFMC 2009c). EFH for the wreckfish occur in coastal waters associated with the St. Lucie thermal plume.

5.0 Potential Adverse Effects to EFH

The provisions of the MSA define an "adverse effect" to EFH as the following (50 CFR 600.810):

> *Adverse effect* means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

As previously discussed, under proposed EPU conditions, St. Lucie's Industrial Wastewater Facility Permit Discharged would limit the temperature of heated discharge water to a maximum of 115°F (46°C) or a rise no more than 30°F (16.7°C) above the ambient water temperature during normal operations. Therefore, in addition to entrainment, entrapment, and impingement, this EFH assessment includes the potential adverse effects of heat shock on EFH. Section 6 presents a discussion of potential cumulative impacts to EFH species or their habitat resulting from the past, present, and reasonably foreseeable future projects in the vicinity of St. Lucie.

5.1 Impingement and Entrainment

Entrainment and impingement affect EFH in two ways. First, by removing individuals of EFH species from the water volume entrained by the plant, entrainment and impingement change inhabited habitat to uninhabited habitat and decrease the size of EFH species populations. Second, impingement and entrainment remove potential prey and competitors of EFH species from the entrained volume of water and so change EFH.

In its *Final Environmental Statement Regarding the Operation of St. Lucie, Unit 1* (NRC 1982), the NRC estimated potential entrainment at St. Lucie based on monitoring data taken at six stations in the ocean near the intake and stations in the intake and discharge canals during preoperational and early operational monitoring for Unit 1. The most common larval fishes in the area of the intake were herrings and anchovies of the family Clupeidae. The staff estimated that under normal operating conditions, the two units would entrain 0.4 percent (on average) of the fish eggs and larvae passing the site. Under extreme conditions, entrainment would include less than 4 percent of the fish eggs and larvae passing the intake. Based on this assessment, the NRC concluded that entrainment losses under two-unit operation would not represent a significant impact to the local fisheries (NRC 1982).

In 2003, the NRC published a supplemental environmental impact statement (SEIS) to assess the environmental impacts of license renewal at St. Lucie (NRC 2003a). The SEIS also summarized impingement sampling carried out at St. Lucie, Unit 1, from 1976 through 1978. During this period, 226 24-hour collections were made of fish and shellfish trapped on the traveling intake screens. Assuming continuous operation, annual impingement rates were estimated at 34,000 (1978) to 131,000 (1976) finfish, and 26,000 (1976) to 37,000 (1978) shellfish. Over the course of the entire study, the mean numbers of finfish and shellfish impinged per 24-hour period were 222 and 82 individuals, respectively. Corresponding mean total weights per 24-hour period were 1.7 kg (3.7 lb) and 0.5 kg (1.1 lb), respectively. The most commonly impinged species groups were anchovy (*Anchoa* sp.), grunt (Haemulidae), jack (Carangidae), croaker (*Micropogonias* sp.), mojarro (Gerreidae), shrimp (Panaeidae, some of which are EFH species), and blue crab (*Callinectes sapidus*). The length of over 80 percent of the impinged fish was 8 cm (~6 in.) or less, and virtually all of the impinged shrimp were 4 cm

(~3 in.) or less in length. The NRC concluded in 1982 that impingement losses at Unit 1 were insignificant when compared to the fish populations in the site vicinity and (for shrimp) the number caught commercially off Florida's east coast. The NRC also acknowledged in 1982, that startup of Unit 2 would double the intake flow volume and increase impingement rates over those measured during Unit 1 operation. Doubling the weight of organisms impinged would be equivalent to less than one-half of one percent of the commercial catch of fish and shellfish in either St. Lucie or Martin County. Based on this, the NRC concluded that even the combined estimates of Unit 1 and Unit 2 impingement would be insignificant when compared to local commercial landings. Additional impingement monitoring for Unit 2 was not required. Today the FDEP and not the NRC regulates the design, operation, and any potential mitigation for the intake structure.

5.2 Entrapment

Entrapment at St. Lucie affects mostly larger, adult individuals and has the potential to affect EFH in the same manner as entrainment and impingement. Between August 20 and 24, 2011, an exceedingly large number and volume of moon jellyfish (*Aurelia aurita*) were pulled into the St. Lucie Plant's intake cooling water canal. According to the Environmental Protection Plan Report (FPL 2011a):

> The St. Lucie Plant intake cooling water pipes are approximately 1,600 feet in length. As sea water traverses the intake pipes it becomes quite turbulent and reaches a flow rate of 6.8 feet/second. During that turbulent journey the jellyfishes' stinging nematocysts are broken off and are then released into the water column. The heavy concentration of moon jellyfish and corresponding nematocysts in the water column finally reached a lethal concentration on August 22, 2011. These conditions were responsible for the mortality of an estimated 10,000 pounds of fish in a 24-hour period.

The plant began to remove fish immediately after the jellyfish incursion began and continued until crews had to cease work due to the stinging effects of the nematocysts. In that time, the staff biologists rescued ten goliath groupers (*Epinephelus itajara*), one nurse shark (*Ginglymostoma cirraturm*), and eight snappers (Lutjanidae). The highest concentrations of moon jellyfish that caused the mortality lasted less than 24 hours (FPL 2011b).

Goliath grouper, nurse shark (a large, coastal shark), and some snappers are managed species under the South Atlantic Fishery Management Council and NMFS Designated Highly Migratory Species Management Plan and have designated EFH. FPL (2011a) reports that entrainment of moon jellyfish into the intake canal is a natural event that occurs yearly at the St. Lucie plant, although numbers high enough to cause such fish mortality are rare. FPL (2011b) performed a search on a utility database from 2006 through 2011 and found "five events similar to the circumstances of this jellyfish intrusion event." FPL's (2011a) mitigative action is "to minimize the high fish mortality by the St. Lucie Fish Removal campaign to keep the entrained fish population as low as possible." As part of an ongoing Endangered Species Act Section 7 consultation with NMFS for sea turtles, FPL is installing additional barriers that will limit future entrapment around the offshore intake structure.

5.3 Thermal Effects

Heat shock is acute thermal stress caused by exposure to a sudden elevation of water temperature that adversely affects the metabolism and behavior of fish and other aquatic organisms. In addition to heat shock, increased water temperatures in the thermal plume can cause chronic thermal effects by reducing the available habitat for aquatic organisms or if thermal plume temperatures are higher than the environmental preferences of a particular species (e.g., resulting in displacement of managed species or their forage species). Impacts to EFH species' food (forage species) occur in the form of displacement or loss of forage species and loss of forage species habitat.

Comparison of baseline aquatic monitoring of phytoplankton, zooplankton, macrophytes, benthic invertebrates, worm reefs, fish, and sea turtles with Unit 1 post-operational monitoring resulted in observations of no substantial or widespread effects on thermal effluents in coastal Atlantic waters (EAI 2001). Monitoring of offshore benthic macroinvertebrates and fish communities following commencement of Unit 2 operation showed no measurable effect on the abundance or diversity of benthic macroinvertebrates, nor any interference with movement or migration of pelagic fish communities (EAI 2001). The fish communities in coastal Atlantic waters are transitional assemblages of temperate and tropical forms. Since oceanic fishes are most diverse and abundant near reefs and other hardbottom areas, FPL sited intake and discharge structures for St. Lucie in areas devoid of these habitats (NRC 2003a). However, as discussed previously, the modeling conducted by FPL indicated that the increase in the thermal mixing zone following the initially requested EPU, increases the thermal load for a total combined volume of 6896 ft^3 (195.3 m^3) over current conditions. Coastal migratory species, sessile species, forage species, and planktonic life stages of marine organisms may still encounter the increased mixing zone area.

The staff determined that the potential for heat shock from the EPU is not likely because of the design, location, and operation of discharge for St. Lucie. In high-temperature plumes, mobile organisms generally avoid environmental conditions that compromise survival (Hall et al. 1978). The increase in thermal mixing zone by 6896 ft^3 (195.3 m^3) occurs over an area devoid of coral reefs and submerged aquatic vegetation, thus occurs in sub-optimal habitat. Therefore, the staff concludes that thermal impacts from Units 1 and 2 EPU would be minor.

5.4 Potential Impacts on Identified EFH

The following sections address potential adverse effect to the Federally managed species identified for in-depth analysis in Section 4.0. For each species and life stage, the NRC evaluated the effects of St. Lucie operating under EPU conditions to determine whether the proposed EPU would result in (1) no adverse impact, (2) minimal adverse impact, or (3) substantial adverse impact to EFH. The staff determined impact level through review of FPL monitoring data, scientific journal articles, NMFS publications, technical reports, and other relevant information. Section 6.0 addresses cumulative impacts.

5.4.1 Coral

As described in Section 4.1, habitats for coral colonization include hardbottom inshore and offshore environments and provide important cover and feeding areas for many fish and invertebrates. EFH and coral HAPC exist in the coastal (nearshore and offshore) waters associated with the far-field St. Lucie thermal plume. The increased thermal plume from the proposed EPU may affect an additional 6896 ft^3 (195.3 m^3)—of a total 9949 ft^3 (281.7 m^3)—of coastal Atlantic waters in the mixing zone, but will not change the existing far-field thermal plume which contains EFH and HAPC for coral. The proposed EPU would likely have a **minimal adverse effect** on coral EFH and HAPC.

5.4.2 Highly Migratory Coastal Pelagic Species

Section 4.2 describes the potential for neonates, juveniles, and adults of 19 highly migratory coastal fishes and sharks to inhabit coastal Atlantic waters associated with the far-field St. Lucie thermal plume, or feed on prey that reside in coastal areas associated with the St. Lucie thermal plume. Recreational fishery records for the east coast of Florida between 1981 and 2011 record landings of all coastal migratory pelagic species described in Section 4.2 (NMFW 2011b). The swordfish fishery represents a substantial commercial fishery off Florida's east coast with over 1.4 million lbs (635,000 km) caught in coastal St. Lucie waters alone between 2005 and 2010 (FWC 2011a-f). Commercial shark fishing regulations for sharks described in Section 4.2 allow for harvesting of blacktip, bull, lemon, nurse, spinner, silky, great hammerhead, scalloped hammerhead, tiger, Atlantic sharpnose, blacknose, bonnethead, and finetooth sharks (NMFS 2011b). Commercial fishing records for St. Lucie County record almost 600,000 lbs (272,000 kg) of unspecified shark landings between 2005 and 2010 (FWC 2011a-f). Recreational and commercial landing records confirm the presence of all species described in Section 4.2 in Atlantic coastal waters. However, highly migratory coastal pelagic species and their prey can avoid the thermal changes and increase in mixing zone for the nearshore Atlantic coastal waters. The increased thermal plume from the proposed EPU may affect an additional 6896 ft^3 (195.3 m^3)—of a total 9949 ft^3 (281.7 m^3)—of coastal Atlantic waters in the mixing zone, but will not change the existing far-field thermal plume which contains EFH for neonate, juvenile, and adult highly migratory coastal pelagic species. The proposed EPU would likely have a **minimal adverse effect** on highly migratory coastal pelagic species EFH.

5.4.3 Shrimp

Section 4.3 describes the potential for juvenile and adult penaeid shrimp to inhabit coastal Atlantic waters. The SAFMC Fishery Management Plan for penaeid shrimp designates the coastal waters off the east coast of Florida as EFH for juvenile and adult shrimp (NOAA 2009b), which includes coastal waters associated with the St. Lucie thermal plume. Commercial fishing record for shrimp species in St. Lucie coastal waters reports virtually no landings between 2005 and 2010, although 2,328 lbs (1,055 kg) of brown shrimp were harvested in 2007 (FWC 2011a-f). Prior to 1982, trawling and seine surveys in the vicinity of St. Lucie Plant intake and discharge reported limited numbers of brown, pink, and rock shrimp and were therefore discontinued (EAI 2001). No reports of white shrimp in the vicinity of St. Lucie coastal waters are available. The increased thermal plume from proposed EPU may affect an additional 6896 ft^3 (195.3 m^3)—of a total 9949 ft^3 (281.7 m^3)—of coastal Atlantic waters in the mixing zone, but will not change the existing far-field thermal plume which contains EFH for juvenile and adult penaeid and rock shrimp. The proposed EPU would likely **have minimal adverse effect** on penaeid and rock shrimp species EFH.

5.4.4 Snapper-Grouper Complex

Section 4.4 describes the potential for neonates, juveniles, and adults of 17 fishes of the snapper-grouper complex inhabit Atlantic waters associated with the St. Lucie thermal plume, or feed on prey that reside in coastal areas associated with the St. Lucie thermal plume. Of the species described in Section 4.4, only the goliath grouper and wreckfish did not specifically appear in records of Florida east coast recreational fishery landings between 1981 and 2011 and may be rare or uncommon in these waters (NMFS 2011c). Commercial catch records for St. Lucie County Atlantic waters report small takes (<6,000 lbs [2,700 kg]) between 2005 and 2010 with the exception of snowy grouper (>14,000 lbs [6,350 kg]) (FWC 2011a-f). Operational studies for St. Lucie, Unit 1, concluded that no significant variation in sport, commercial, and forage fish numbers and species occurred in nearshore waters adjacent to St. Lucie as a result of Unit 1 operations (EAI 2001). In spite of being rare in these waters, goliath grouper were entrapped, however, in St. Lucie's intake canal when an unusually large number of jellyfish were entrained into the canal in 2011 (event described in Section 5.2). The increased thermal plume from the proposed EPU may affect an additional 6896 ft^3 (195.3 m^3)—of a total 9949 ft^3 (281.7 m^3)—of coastal Atlantic waters in the mixing zone, but will not change the existing far-field thermal plume which contains EFH for egg, larvae, juvenile and adult snapper-grouper complex species. The proposed EPU would likely have **minimal adverse effect** on snapper-grouper complex EFH.

6.0 Cumulative Effects to EFH

This section addresses the direct and indirect effects of the proposed EPU on Federally managed species and their EFH when added to the aggregate effects of past, present, and reasonably foreseeable future actions. The primary effects on Federally managed species and their EFH and forage species as a result of the proposed EPU will occur as a result of the increased temperature of cooling water discharged to the Atlantic Ocean.

The geographic boundaries for assessing cumulative aquatic impacts are somewhat variable and depend on the specific aquatic resource. The mid-Florida Atlantic coastal waters between Cape Canaveral, Florida and Jupiter Inlet, including coastal waters for Brevard, Indian River, St. Lucie, Martin, and Palm Beach Counties, bound the potentially affected area as influenced by hydrological patterns driven by the Florida Current. Gilmore described this region as the most diverse continental shelf fish assemblage with a diversity of habitats for temperate and tropical species (Gilmore 2001).

The main stressors that can cause cumulative impacts on Federally managed species and their EFH and forage species within mid-Florida Atlantic coastal waters include:

- The continued operation of St. Lucie, including entrainment, impingement and thermal impacts under proposed EPU conditions;
- Fishing (commercial and recreational) and boating;
- Water quality and habitat degradation;
- Invasive species;
- Disease; and
- Climate change.

Each of these may influence the structure and function of mid-Florida Atlantic coastal waters in a way that could result in observable changes to Federally managed species and their EFH and forage species. The following is a brief discussion of how the stressors listed above could contribute to cumulative impacts on Federally managed species and their EFH and forage species in mid- to south-Florida Atlantic coastal waters.

6.1 Continued Operation of St. Lucie

As described in Section 2.1, St. Lucie marine monitoring surveys since operation began in the early 1980s record no significant variation in plankton, benthic macroinvertebrates, or fish species occurrences (EAI 2001). The NRC's SEIS for the St. Lucie license renewal in 2003 provides the most current review of operating impacts for aquatic resources. Assessments of impingement and entrainment of aquatic organisms in the cooling water intake canal concluded that losses would not represent a significant impact to local fisheries and that mitigation efforts to reduce any losses were sufficient (NRC 2003a). Discharge impact assessments, including thermal modeling for heat shock, also concluded that placement of discharge pipes and compliance with Industrial Wastewater Facility Permit No. FL0002208 would mitigate all impacts related to thermal stress (NRC 2003a). The NRC staff concludes that St. Lucie operation will continue to be a contributor to cumulative impacts on Federally managed species and their EFH and forage species.

6.2 Fishing and Boating

Many fish and shellfish species in mid-Atlantic coastal waters, including Federally managed species, are harvested for recreational or commercial purpose. Federal or State agencies regulate commercial and recreational catches, but losses of some species (including Federally managed species) occur as the result of bycatch or illegal capture. Over-harvesting of prey species may degrade the habitat value of EFH for higher trophic level fish by depleting the food resources. The extent and magnitude of fishing pressure and its relationship to overall cumulative impacts to Federally managed species is difficult to determine. Normal use of fishing gear and discarded or lost fishing gear poses a threat to Federally managed species, but regulatory guidelines are established for SAFMC FMPs to limit impacts on EFH for these species and corresponding prey species (SAFMC 1998).

The 2010 commercial finfish and shellfish landings for Brevard, Indian River, St Lucie, Martin, and Palm Beach Counties recorded a total of 12,430,405 lbs (5,638,337 kg) of finfish, 1,486,248 lbs (674,151 kg) of invertebrates (excluding shrimp), and 1,104,087 lbs (500,805 kg) of shrimp (FWC 2011f). Specific descriptions of commercial and recreational fishery landings for the last six years for EFH managed species as described in Section 4 indicate that active fisheries for many of these species persist. Recreational and commercial boating adversely affects aquatic resources along the Atlantic coast through introduction of petroleum products at marinas and docks, improper navigation around shoal and shallow reef habitat, and through anchoring on reef habitat (FDEP 2011b). Because fishing and boating remain a concern, the NRC staff concludes that these stressors will continue to be an important contributor to cumulative impacts on Federally managed species and their EFH and forage species within the mid-Florida Atlantic coastal waters.

6.3 Water Quality and Habitat Degradation

Point-source chemical and thermal discharges can adversely affect EFH by reducing habitat functions, modifying community structure, bioaccumulation, and habitat modification (Hanson et al. 2004). No other industrial discharge to the Atlantic Ocean other than the St. Lucie discharge is known to occur in the immediate area. However, nonpoint sources such as urban and stormwater runoff, marine fuel spills, agricultural runoff and sewage disposal facilities may contribute impacts to mid-Florida Atlantic coastal waters. Management of water quality in these counties includes a number of conservation and restoration activities managed by the State to stabilize shorelines to reduce sedimentation, creation of water storage for reuse of agricultural runoff, and retrofits to hold and treat urban stormwater runoff (FDEP 2000b; FDEP 2008; SFWMD 2009).

Dredging activities and sand mining for beach restoration impacts nearshore inlet and shoal habitats. While these activities require approval by FDEP and other State and Federal agencies, impacts to the surrounding ecosystem may occur (Gilmore 2009; Martin County Board of County Commissioners 2011). The NRC staff concludes that water quality and degradation for the mid-Florida Atlantic coast will continue in the future and will be a potential contributor to cumulative impacts on Federally managed species and their EFH and forage species.

6.4 Invasive Species

The introduction of invasive species is often is a source of critical stress to endemic species or their habitats. Estuaries and sheltered coastal areas are among the most susceptible to invasive species, especially those that have suffered prior disturbance by navigation, industrial development, and urbanization. Most invasive species in marine systems result from transportation and introduction from ballast water or attachment to ship hull, or through live trade of exotic species or plants (Moser and Leffler 2010). Currently, one fish species in particular is of concern for the mid-Florida Atlantic coastal habitats. The lionfish (*Pterios volitans*) negatively affects reef communities through competition of resources and predation on various fish species. Local communities sponsor lionfish derbies throughout coastal Florida regions to help reduce numbers of lionfish (REEF 2010). The NRC staff concludes that invasive species will continue to be a concern and a potential contributor to cumulative impacts on Federally managed species and their EFH and forage species.

6.5 Disease

Aquatic biota may encounter a number of diseases-causing organisms. Among the most prevalent to all organisms is red tide, which is a toxic algal bloom. The marine algae *Karenia brevis*, produces a toxin in coastal Florida waters that can cause mortality to marine life, including Federally managed species (FWC 2011g). Red tide blooms typically initiate in nutrient-poor waters and migrate with ocean and wind currents (Alcock 2007). Red tide monitoring stations occur throughout the Gulf of Mexico coastal counties, and along the southern portion of Miami-Dade County. Red tide outbreaks primarily occur in these regions and no monitoring stations occur in the area described for cumulative impacts to EFH for St. Lucie Plant (FWC 2011h). However, red tide blooms may migrate up the south Florida coast with weather events.

Black band and white band diseases affect coral species when stressed by other environmental perturbations such as high water temperatures, sedimentation, and nutrient levels. Black band disease occurs when the filamentous bacteria *Phormidium corallyticum* destroys live coral and leaves behind the carbonate skeleton. Outbreaks of black band disease occur globally and occur more frequently in the summer months (FMNH 2011z). White band disease primarily affected branching corals such as staghorn or elkhorn and results in a similar result of dead coral as for black band disease. The cause of white band is currently unknown, but implications point to filamentous algae overgrowth (FMNH 2011aa).

Bleaching is another coral-related phenomenon believed to occur with stressful environmental conditions. In many species of coral, photosynthetic algae (zooxanthellae) live symbiotically within coral polyp tissue, provide a source of food and oxygen and assist with waste removal for the coral community. Zooxanthellae also give many corals their color. Loss of zooxanthellae in coral tissues, while not lethal, leaves behind a "bleached" coral structure, retards coral growth, and affects overall health of coral and coral communities with the loss of the photosynthetic algae (FMNH 2011ab).

The NRC staff concludes that red tide and coral disease remains a concern and a potential contributor to cumulative impacts on Federally managed species and their forage species.

6.6 Climate Change

Global climate change represents a potential stressor for the coastal Atlantic for Federally managed species that migrate throughout the Atlantic Ocean.

The potential cumulative effects of climate change on mid-Florida Atlantic coastal waters may arise from a number of environmental factors such as sea level rise, temperature increases, salinity changes, wind and water circulation changes, and ocean acidification (Florida Oceans and Coastal Council 2009; Raven et al. 2005). Changes in sea level could result in effects to nearshore communities, including the reduction or redistribution of optimal habitat and turbidity. Water temperature and salinity changes could affect habitat utilization by indigenous or invasive species, frequency of disease outbreaks, or spawning patterns and successful reproduction (Florida Oceans and Coastal Council 2009).

The NRC staff concludes that climate change impacts to Federally managed species and their EFH could be an important contributor to cumulative impacts for mid-Florida Atlantic coastal waters.

6.7 Total Cumulative Impacts

Based on the NRC staff review, multiple stressors affect the aquatic resources of mid-Florida Atlantic coastal waters. Management actions may address the impacts of some of the stressors (e.g., cooling system operations, fishing pressure, and water and habitat quality). Although the impacts associated with cumulative impacts cannot be quantified, cumulative impacts on aquatic resources have had or potentially will have destabilizing and adverse effects on at least some aquatic resources, including Federally managed species and their EFH and forage species.

7.0 EFH Conservation Measures and Conclusions

7.1 Conservation Measures

The intake of the St. Lucie cooling system consists of three intake structures with velocity caps, three buried pipelines, a common intake canal, and two intake well structures (one for each unit). St. Lucie already has a number of features that minimize impacts to aquatic biota, including Federally managed species:

- The velocity caps minimize entrainment of fish and other organisms by eliminating vertical flow and slowing horizontal flow.
- In the intake canal, a series of barriers prevents sea turtles and other biota from being impinged on the screens where the water enters the plant. Two of these barriers are mesh nets and the third is a rigid barrier.
- NRC is currently in consultation with NMFS under Section 7 of the Endangered Species Act. As part of this consultation, FPL is adding additional protective measures at the intake.

Thermal discharge impacts related to proposed EPU could influence Federally managed species, their EFH, or their prey species. The Industrial Wastewater Facility Permit revision for EPU requires submission of a biological plan of study to assess and describe representative and indigenous population diversity at all trophic levels, seasonal sustainability, surveys of food chain species, and presence of pollution-tolerant species. FPL submitted a biological plan of study to assess representative important species and water quality parameters. The baseline monitoring would begin following FDEP approval of the monitoring plan. It would continue until the Unit 1 EPU has been completed. Post-operational monitoring will begin once the Unit 2 EPU is completed and will continue for two years. Three study sites for sampling include areas associated with the discharge along the multi-port diffuser discharge line, and two reference areas to the north and south along the coast encompassing 2,224 ac (900 ha) each. Multiple habitat types exist within the sampling study areas, and one of the representative species groups assessed includes members of the snapper family. Comparisons between current condition monitoring and previous 316(a) studies will address the conditions of the Administrative Order (FPL 2011d). FDEP approved FPL's biological plan of study on August 18, 2011 (FPL 2011e). As a result of these studies, FDEP could impose additional requirements on FPL through the St. Lucie Industrial Wastewater Facility Permit process.

7.2 Conclusions

The NRC investigated the potential effects of the proposed EPU at St. Lucie Plant on 42 Federally managed species and their EFH near the site. The known distributions and records of the Federally managed species and the potential ecological impacts of operation on them, their habitat, and their prey base have been considered in this EFH Assessment. The NRC evaluated the proposed EPU operating conditions to determine whether the EPU would result in (1) no adverse effect, (2) minimal adverse effect, or (3) substantial adverse effect on Federally managed species and their EFH. Table 5 summarizes the expected impacts of the proposed EPU for each species. Many of the Federally managed species for the mid-Florida Atlantic coastal waters have been collected in the coastal waters near the St. Lucie Plant. However, the location of discharge diffusers paired with models of the thermal mixing zone under EPU conditions indicate change in far-field temperatures that would result in potential adverse effects on the various life stages of the Federally managed species, habitat, and forage species. The NRC staff concludes that the proposed EPU would result in no to minimal adverse effects on Federally managed species and their EFH in mid-Florida Atlantic coastal waters.

Table 5. Impacts on EFH Species from the Proposed St. Lucie EPU

FMP	Common Name (Species Name)	EFH Description [a,b]	Expected Effect of EPU on EFH
Coral			
	octocorals (Order Alcyonacea) stony corals (Order Scleractinia)	Hardbottom habitat in nearshore and offshore waters; HAPC within existing northward current thermal plume for St. Lucie	**Minimal Adverse Effect** HAPC within existing far-field thermal plume, and small portion may be influenced by increased mixing zone for EPU
Highly Migratory Coastal Pelagic Species			
Tuna	Atlantic skipjack tuna (*Katsuwonus pelamis*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
Swordfish	swordfish (*Xiphias gladius*)	Coastal waters for juveniles	**Minimal Adverse Effects** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
Billfish	longbill spearfish (*Tetrapturus pfluegeri*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	sailfish (*Istiophorus platypterus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
Large Coastal Sharks	blacktip shark (*Carcharhinus limbatus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species

FMP	Common Name (Species Name)	EFH Description [a,b]	Expected Effect of EPU on EFH
	bull shark (*Carcharhinus leucas*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	Caribbean reef shark (*Carcharhinus perezi*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	dusky shark (*Carcharhinus obscurus*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	great hammerhead shark (*Sphyrna mokarran*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	lemon shark (*Negaprion brevirostris*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	nurse shark (*Ginglymostoma cirratum*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	sandbar shark (*Carcharhinus plumbeus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	scalloped hammerhead shark (*Sphyrna lewini*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	silky shark (*Carcharhinus falciformis*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	spinner shark (*Carcharhinus brevipinna*)	Coastal waters for neonate, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	tiger shark (*Galeocerdo cuvier*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	white shark (*Carcharodon carcharias*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species

FMP	Common Name (Species Name)	EFH Description [a,b]	Expected Effect of EPU on EFH
Small Coastal Sharks	Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	blacknose shark (*Carcharhinus acronotus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	bonnethead shark (*Sphyrna tiburo*)	Coastal waters for neonates, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	finetooth shark (*Carcharhinus isodon*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
Shrimp			
	brown shrimp (*Farfantepenaeus aztecus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	pink shrimp (*Farfantepenaeus duorarum*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	rock shrimp (*Sicyonia brevirostris*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	white shrimp (*Litopenaeus setiferus*)	Coastal waters for juveniles and adults	**No Adverse Effect** Not common or limited distribution in mid-Florida coastal waters
Snapper-Grouper			
	Blackfin snapper (*Lutjanus buccanella*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	blueline tilefish (*Caulolatilus microps*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	goliath grouper (*Epinephelus itajara*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** Not common or limited distribution in mid-Florida coastal waters.

FMP	Common Name (Species Name)	EFH Description [a,b]	Expected Effect of EPU on EFH
	gray (mangrove) snapper (*Lutjanus griseus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	greater amberjack (*Seriola dumerili*)	Coastal waters for eggs, larvae, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	mutton snapper (*Lutjanus analis*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	red porgy (*Pagrus pagrus*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	red snapper (*Lutjanus campechanus*)	Coastal waters for juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	scamp (*Mycteroperca phenax*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	silk snapper (*Lutjanus vivanus*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	snowy grouper (*Epinephelus niveatus*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	speckled hind (*Epinephelus drummondhayi*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	vermilion snapper (*Rhomboplites aurorubens*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	Warsaw grouper (*Epinephelus nigritus*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species

FMP	Common Name (Species Name)	EFH Description [a,b]	Expected Effect of EPU on EFH
	white grunt (*Haemulon plumieri*)	Coastal waters for larvae, juveniles and adults	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species
	wreckfish (*Polyprion americanus*)	Coastal waters for larvae and juveniles	**No Adverse Effect** Not common or limited distribution in mid-Florida coastal waters.
	yellowedge grouper (*Epinephelus flavolimbatus*)	Coastal waters for juveniles	**Minimal Adverse Effect** EPU increased thermal mixing zone may affect small portion of coastal water habitat and forage species

[a] SAFMC 1998

[b] NMFS 2009

Figure 1. Geographic Location of St. Lucie Plant Along the Florida Atlantic Coast

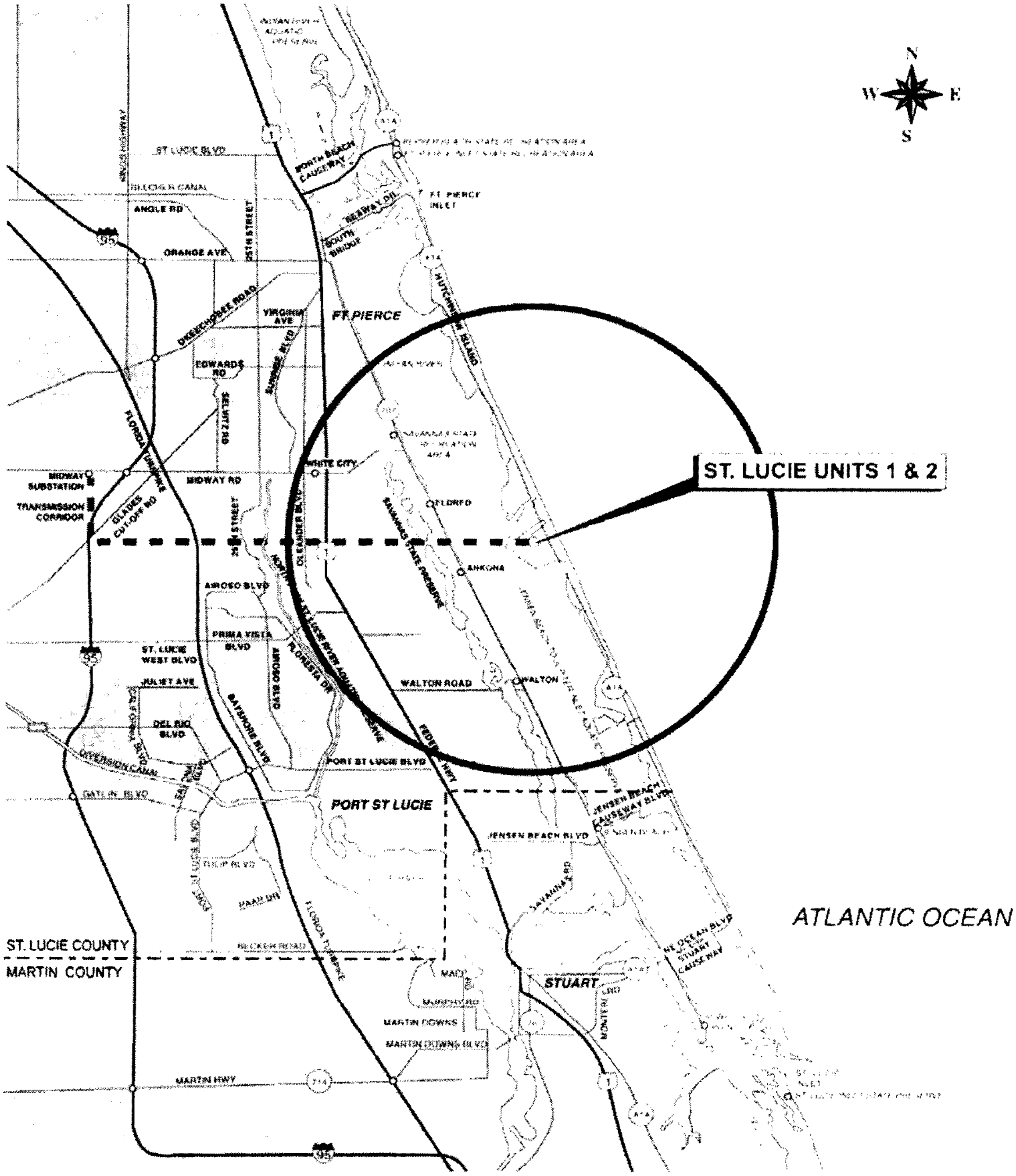
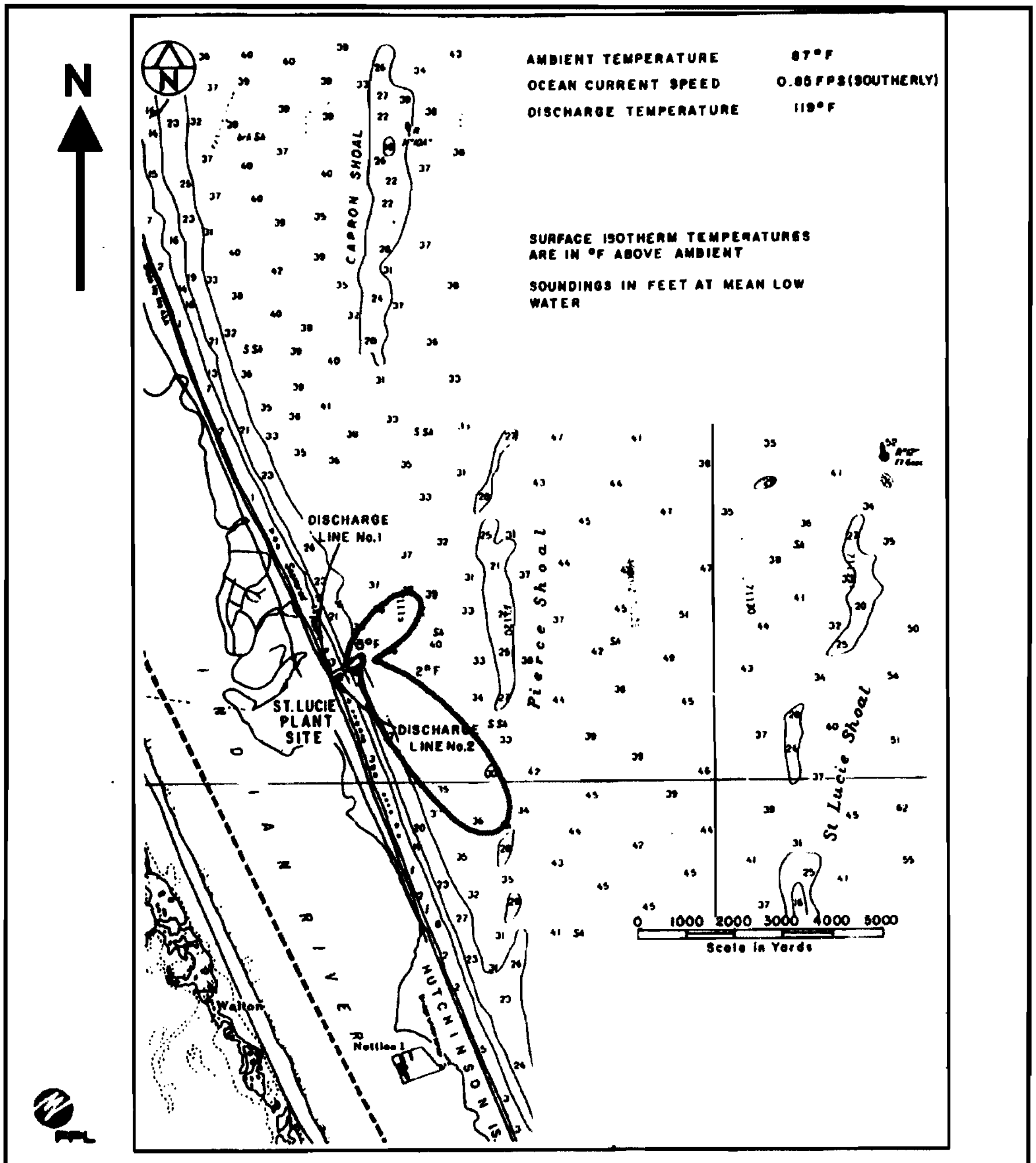


Figure Source: FPL 2011c

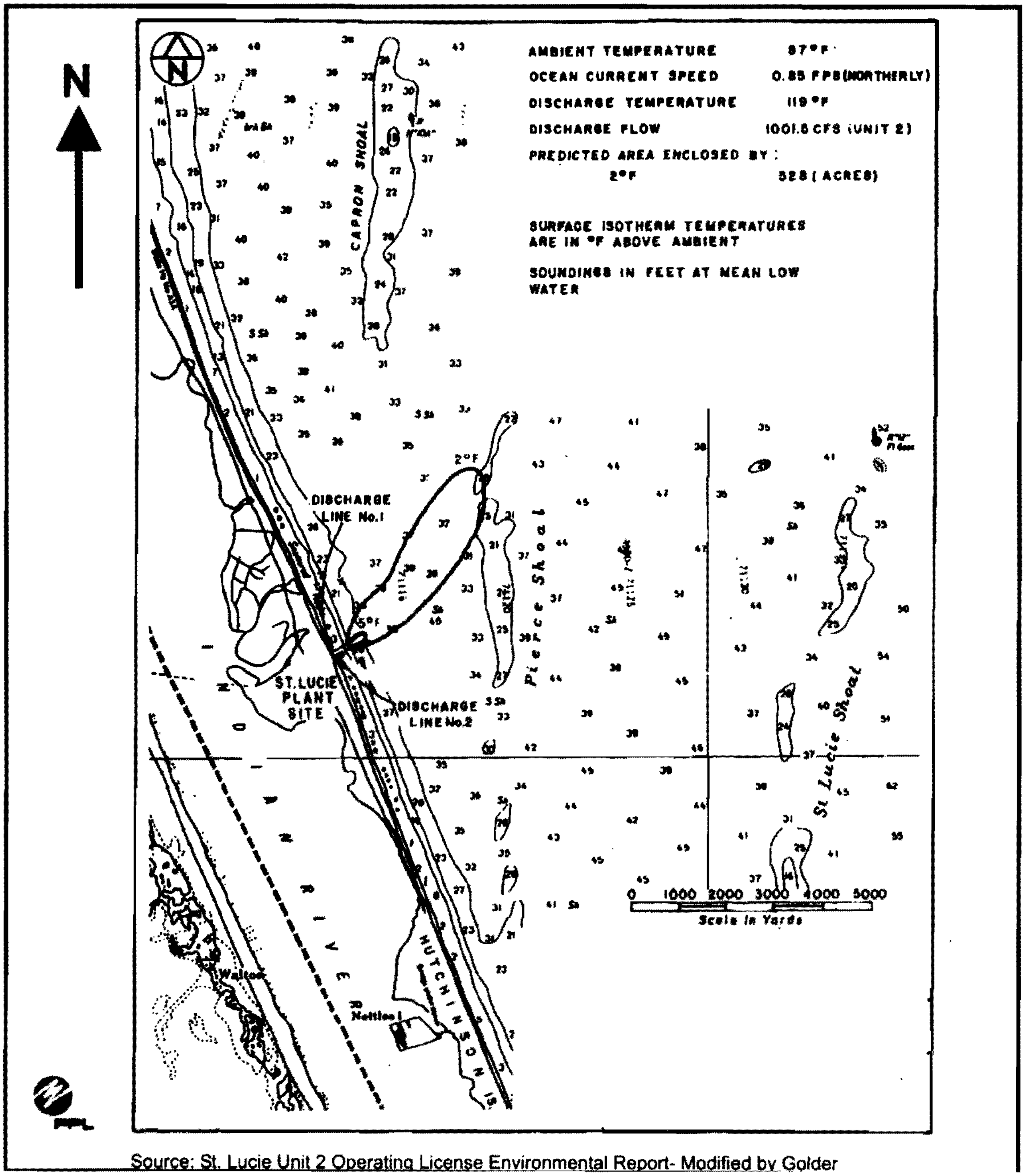
Figure 2. St. Lucie Discharge Surface Isotherms Under Southward Currents



Source: St. Lucie Unit 2 Operating License Environmental Report- Modified by Golder

Figure Source: Golder Assoc. 2010b

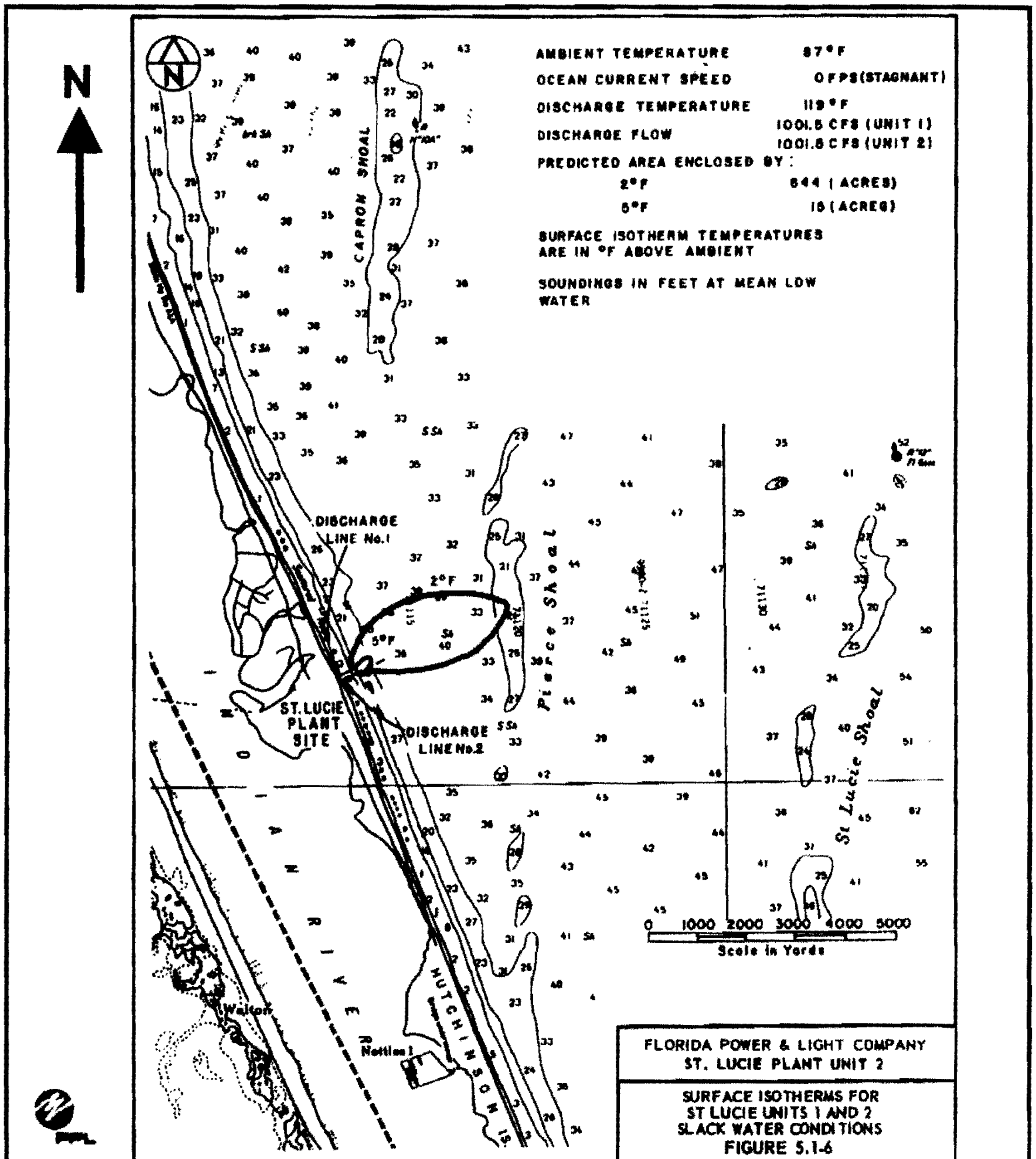
Figure 3. St. Lucie Discharge Surface Isotherms Under Northward Currents



Source: St. Lucie Unit 2 Operating License Environmental Report- Modified by Golder

Figure Source: Golder Assoc. 2010b

Figure 4. St. Lucie Discharge Surface Isotherms Under Slack Currents

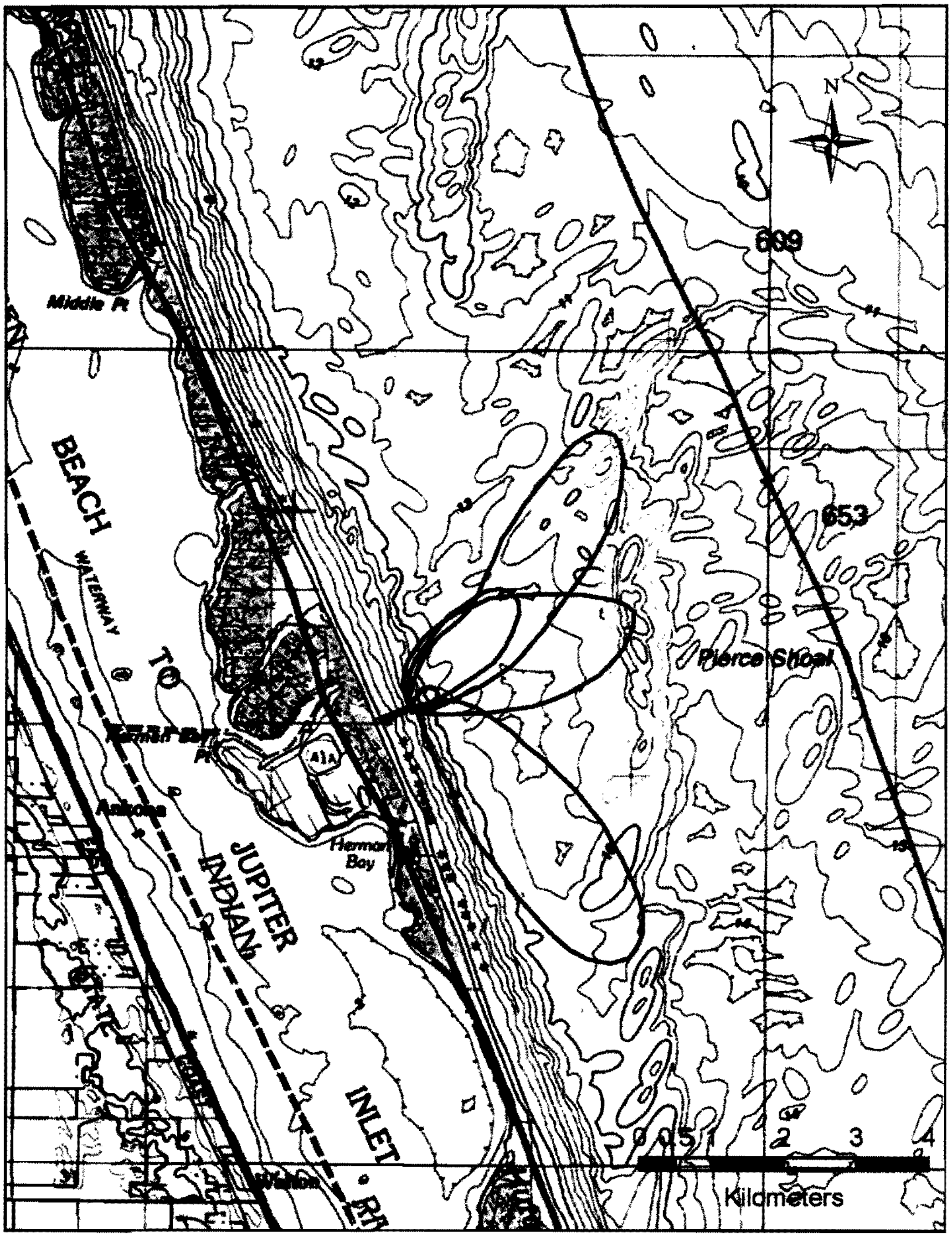


Source: St. Lucie Unit 2 Operating License Environmental Report- Modified by Golder

Figure Source: Golder Assoc. 2010b

Figure 5. Composite Map of St. Lucie Discharge Surface Isotherms at 119°F(48°C)

Discharge temperature under all conditions; Pierce Shoal outlined in yellow



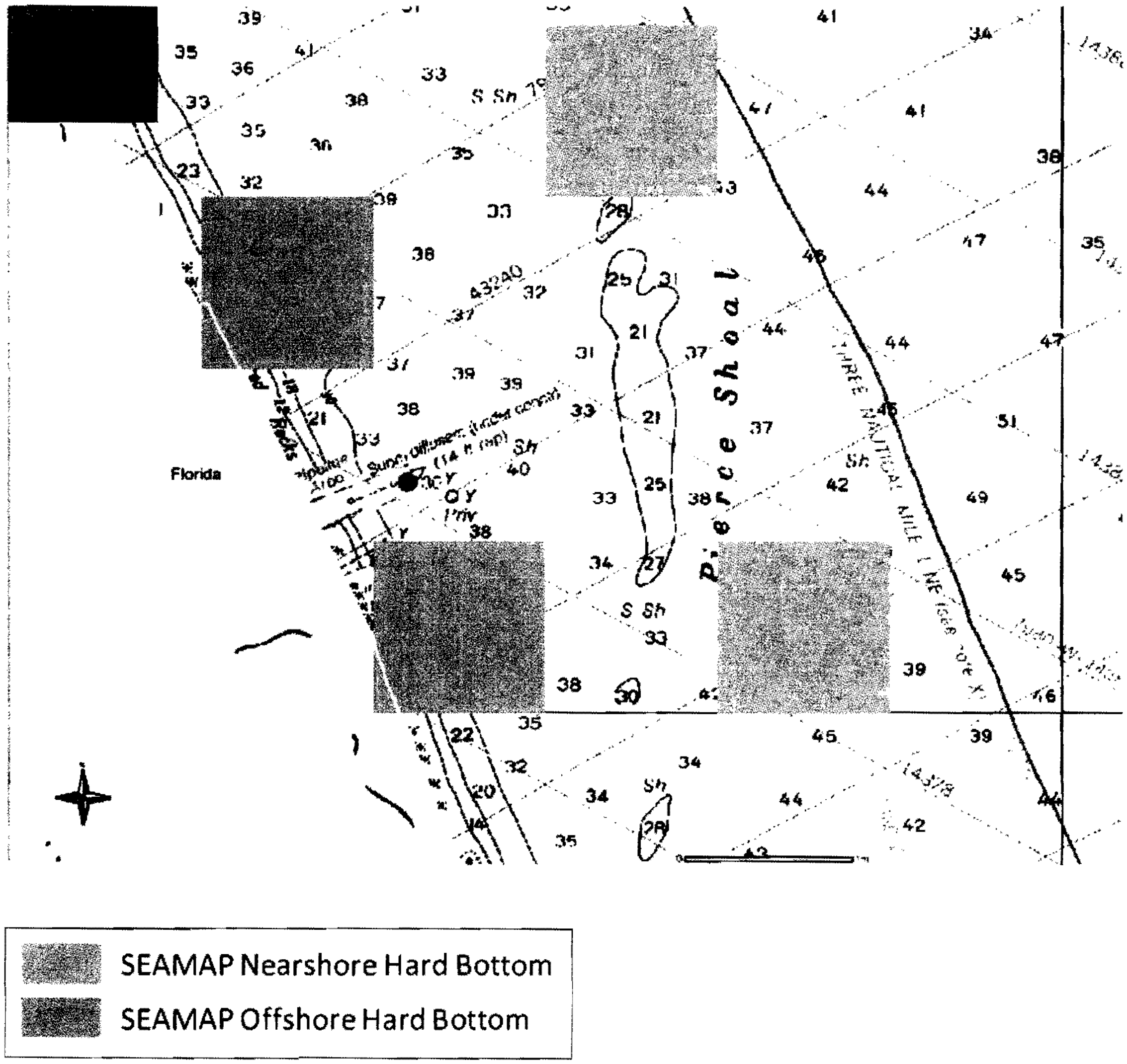
5-degree (F) above ambient

2-degree (F) above ambient

Ambient Temperature	87-degree (F)
Ocean Current Speed	0.85 FPS (northerly)
Discharge Temperature	119-degree (F)
Discharge Flow	1001.5 cfs

Figure Source: Golder Assoc. 2010b

Figure 6. Location of HAPC Hard Bottom Habitat Near St. Lucie Discharge



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no adverse effects to EFH for 2 species and **minimal adverse effects** on EFH for the remaining 40 species. The NRC requests your concurrence with our EFH Assessment determination within 30 days per 50 CFR 600.920(h)(2). If you have any questions regarding this issue, please contact me at 301-415-2327 or by e-mail at Andy.Imboden@nrc.gov or Dennis Logan, Aquatic Biologist at 301-415-0490 or by e-mail at Dennis.Logan@nrc.gov.

Sincerely,

/RA/

Andrew S. Imboden, Chief
Environmental Review and
Guidance Update Branch
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-335 and 50-389

Enclosure:
As stated

cc w/encl: Listserv

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